Sharing the Shuttle with America:

NASA and Public Engagement after Apollo

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Abstract

Historical accounts depict NASA's interactions with American citizens beyond government agencies and aerospace firms since the 1950s and 1960s as efforts to "sell" its human space flight initiatives and to position external publics as would-be observers, consumers, and supporters of such activities. Characterizing citizens solely as celebrants of NASA's successes, however, masks the myriad publics, engagement modes, and influences that comprised NASA's efforts to forge connections between human space flight and citizens after Apollo 11 culminated. While corroborating the premise that NASA constantly seeks public and political approval for its costly human space programs, I argue that maintaining legitimacy in light of shifting social attitudes, political priorities, and divided interest in space flight required NASA to reconsider how to serve and engage external publics vis-à-vis its next major human space program, the Space Shuttle. Adopting a sociotechnical imaginary featuring the Shuttle as a versatile technology that promised something for everyone, NASA sought to engage citizens with the Shuttle in ways appealing to their varied, expressed interests and became dependent on some publics' direct involvement to render the vehicle viable economically, socially, and politically. NASA's ability and willingness to democratize the Shuttle proved difficult to sustain, however, as concerns evolved following the *Challenger* accident among NASA personnel, political officials, and external publics about the Shuttle's purpose, value, safety, and propriety.

Mapping the publics and engagement modes NASA regarded as crucial to the Shuttle's legitimacy, this case study exposes the visions of public accountability and other influences – including changing perceptions of a technology – that can govern how technoscientific institutions perceive and engage various external publics. Doing so illuminates the prospects and challenges associated with

democratizing decisions and uses for space and, perhaps, other technologies managed by U.S. government agencies while suggesting a new pathway for scholarly inquiry regarding interactions between technoscientific institutions and external publics. Expanding NASA's historical narrative, this study demonstrates that entities not typically recognized as space program contributors played significant roles in shaping the Shuttle program, substantively and culturally. Conceptualizing and valuing external publics in these ways may prove key for NASA to sustain human space flight going forward.

Dedication

To Steve and Maya

To Mom and Dad

To Grandma and Grandpa B. and to Grandma and Grandpa S.

To Mrs. P.

Acknowledgements

This study is personally meaningful to me. I grew up with the dream of becoming a Space Shuttle astronaut. During my undergraduate years, however, I realized that my real passion entailed exploring not space *per se* but considering the social, political and cultural imperatives and possibilities for human ambitions to probe and navigate the cosmos. Why is it that certain nations choose to invest in sending human or robotic emissaries into space? What determines the destinations they decide to visit? Will private companies and individuals ever eclipse governments as leaders in using and exploring space? Although I abandoned my aspiration to fly to the stars, my commitment to making sense of this bold human endeavor has not ebbed. This study therefore signifies for me the melding of personal dreams past and present.

Like the pursuit of all dreams, a dissertation is as much a process as it is a product. Although its shelf life will far exceed the months and years spent creating it, a tremendous quantity of mental and physical energy and non-trivial amounts of elation, frustration, triumph, and sacrifice punctuate the experience. Fortunately, in my case, numerous caring and knowledgeable individuals eased my journey in the completion of this work and are the foundation from which this work could come to fruition. I am indebted to and forever grateful to all of those who supported me, whether by helping me work through intellectual complexities, holding out a light as I navigated the depths of various archives and research materials, providing gifts of time or financial resources, celebrating with me the achievement of milestones along the way, or commiserating when the going got tough.

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Introduction

It was a most unusual sight, surreal and sublime all at once. Two Space Shuttle orbiters faced one another, nose to nose, on a tarmac at the Smithsonian National Air and Space Museum's Steven F. Udvar-Hazy Center, adjacent to Dulles International Airport in Chantilly, Virginia. The vehicle on the viewer's left, *Enterprise*, was bright white against the nearby green foliage and the cloud-dotted, endless blue sky of that warm April day in 2012. After the National Aeronautics and Space Administration (NASA) had used the orbiter for atmospheric drop tests in the late 1970s, it had led a sheltered existence of being taken on tours for throngs to see and then found its way into its own wing at the Smithsonian facility. The spacecraft on the right, *Discovery*, looked much grayer and worn. Bearing the markings of having been NASA's most flown orbiter, it had completed its final of 39 missions to space just a year earlier as NASA closed down the Shuttle program to free up funds for new human space flight initiatives. For just a few hours, they stood in this unique configuration. *Enterprise* had been pulled from its place in the Udvar-Hazy Center and would soon journey, first strapped to the topside of a Boeing-747 and then by barge, to a new home in New York City's Intrepid Sea, Air & Space Museum. *Discovery* had been carried aboard the same 747 from Kennedy Space Center in Florida two days earlier and would retire by the day's end into the hangar *Enterprise* had occupied.

NASA and Smithsonian personnel, members of Congress, White House officials, astronauts, aerospace industry representatives, and interested individuals from the general public had flocked to witness this rare changing of the guard that was part of NASA's plan to allocate its four decommissioned Shuttle orbiters. A military band played patriotic tunes and bystanders waved American flags passed out for the occasion as *Discovery* rolled into its position facing *Enterprise*; a soprano led the crowd in a moving rendition of "The Star-Spangled Banner" before the ceremony began. Against this backdrop, dignitaries offered fond words about the Shuttle's accomplishments. NASA administrator Charlie Bolden, a former Shuttle commander, expressed that "the Space Shuttle program gave this country many

firsts and many proud moments."[1] Looking back over the Shuttle program's 40-year history, Bolden lauded the vehicle's instrumentality in deploying and repairing the Hubble Space Telescope, constructing the International Space Station, allowing people to learn to live and work in space, and motivating future generations of space explorers.

Jack Dailey, director of the National Air and Space Museum and once a NASA associate deputy administrator, offered a more curious statement in his brief speech honoring the Space Shuttle. Also connecting the Shuttle with the notion of national pride, Dailey focused momentarily not on the venerable spaceships behind him but on the enthusiastic crowd in his midst, noting: "For every major milestone in space history, Americans have participated in the excitement, pride, and optimism of the occasion."[2] Certainly the multitudes on hand that day to observe the ceremony welcoming *Discovery* lent validation to Dailey's claim, as did the millions who had set their sights on the skies to catch a glimpse of the orbiter riding atop the 747 when it approached and circled the Washington, DC, area before landing at Dulles. Since the start of Shuttle missions in 1981, American citizens had cheered on NASA and the astronaut crews at launches and homecomings of the magnificent flying machine that no other nation in the world could boast. And they had done the same with human space flight missions before the Shuttle debuted, enraptured by the landing of three of their countrymen on the surface of the Moon in 1969. Indeed, thanks to NASA's strong commitment to sending people on journeys beyond Earth and sharing these activities with ground-bound citizens, the agency's human space flight efforts have ranked among the most highly visible undertakings of the United States government. These sublime ventures into space

[1] NASA, "NASA Transfers Space Shuttle to NASM ([Smithsonian] National Air and Space Museum)" (video of ceremony transferring *Discovery* to National Air and Space Museum, Chantilly, VA, April 19, 2012), posted April 20, 2012, accessed February 22, 2015, https://www.youtube.com/watch?v=QSULwrdHF_g&index=21&list=PL9A08BBD2AAFC5681. Bolden's remarks begin at 36:05.

[2] Ibid. Dailey's remarks begin at 24:35.

have astounded people across the nation and the world over, taking their place as a widely recognized American cultural trope.[3]

Framing the Problem

Dailey's words acknowledged that even those who were not part of the circle of NASA and other government and industry entities who set goals to send humans on increasingly ambitious missions into space had a place in the storied history of the nation's human space flight program. Albeit, their role according to this characterization was a passive and reactive one: to observe these spectacles, celebrate them, and feel inspired by these achievements conducted on their behalf. Most historical accounts of the space agency have portrayed American citizens in similar fashion, instead identifying NASA officials, large aerospace firms, U.S. presidents and other White House officials, members of Congress, and foreign national space agencies as the entities responsible for shaping NASA and the U.S. civil space program. Walter McDougall's *…The Heavens and the Earth*, W. D. Kay's *Can Democracies Fly in Space?*, and many other works describe the geopolitical imperatives and discourses and the powerful state and industry actors that contributed to NASA's rise in the late 1950s and which helped to shape the agency's sense of identity, organizational culture, program choices, and external relationships – focused so centrally on human space flight – over its decades of existence.[4] The scholarly analysis concerning the

[3] The sublimity of space launches is explored more fully in David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

[4] Walter A. McDougall, *…The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1985); W. D. Kay, *Can Democracies Fly in Space? The Challenge of Revitalizing the U.S. Space Program* (Westport, CT: Praeger, 1995). See also, for example, Joan L. Bromberg, *NASA and the Space Industry* (Baltimore: Johns Hopkins University Press, 1999); William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York: Random House, 1998); Roger D. Launius and Howard E. McCurdy, eds., *Spaceflight and the Myth of Presidential Leadership* (Chicago: University of Illinois Press, 1997); Brian Woods, "Artifacts, Revolutionaries, and Bureaucrats: The Sociotechnical Shaping of NASA's Space Shuttle" (Ph.D. dissertation, University of Edinburgh,), WorldCat (45405214); T. A. Heppenheimer, *The Space Shuttle Decision: NASA's Search for a Reusable Space Vehicle*, NASA SP-4221 (Washington, DC: U.S. Government Printing Office, 1999); John M. Logsdon, *John F. Kennedy and the Race to the Moon* (New York: Palgrave Macmillan, 2010); John M. Logsdon, *The Decision to Go to the Moon: Project Apollo and the National Interest* (Cambridge, MA: MIT Press, 1970); John M. Logsdon, *After Apollo? Richard Nixon and the American Space Program* (New York: Palgrave Macmillan, 2015); Robert W. Smith, *The Space Telescope: A Study of NASA, Science, Technology, and Politics* (Cambridge:

nature of NASA's efforts to engage those outside of this set of actors has focused almost entirely on the agency's public affairs office's approaches to controlling the flow of information and conveying the spectacle of launch to the media and worldwide up through the first human lunar landing in 1969.[5] Numerous polls and surveys have sought to gauge public opinion about the space program, but only a few works, including Howard McCurdy's *Space and the American Imagination* and Michael A.G. Michaud's *Reaching for the High Frontier*, have suggested that citizens outside of the identified sphere of space program developers have played more active roles in the American space program.[6]

The historical claims and accounts of NASA's engagement of American citizens during the Mercury, Gemini, and Apollo human space flight programs comprise reasoned observations and meticulous research conducted by well-regarded scholars. All the same, several questions remain unanswered about the nature and bases of NASA's relationship – or relationships – with the citizens of the nation the space agency presumably serves. While various scholarly works have documented NASA's attempts and some of its rationales for engaging with American citizens during the Mercury, Gemini, and Apollo eras of human space flight, little work has been done to uncover whether, how, and why NASA's efforts to relate to citizens remained the same or varied after this celebrated period. Is it reasonable to assume NASA remained static in its motivations and approaches to engaging Americans as

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Cambridge University Press, 1989); and Howard E. McCurdy, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program* (Baltimore: Johns Hopkins University Press, 1993).

[5] See, for example, James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963* (Tuscaloosa, AL: University of Alabama Press, 1994); Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994); Kristen A. Starr, "NASA's Hidden Power: NACA/NASA Public Relations and the Cold War, 1945-1967" (Ph.D. dissertation, Auburn University, 2008), ProQuest (3348297); Bruce V. Lewenstein, "NASA and the Public Understanding of Space Science," *Journal of the British Interplanetary Society* 46 (1993): 251-254; Linda Billings, "Fifty Years of NASA and the Public: What NASA? What Publics?" in *NASA's First 50 Years: Historical Perspectives*, ed. Steven J. Dick, NASA SP-2010-4704 (Washington, DC: U.S. Government Printing Office, 2010), 151-181; and David Meerman Scott and Richard Jurek, *Marketing the Moon: The Selling of the Apollo Lunar Program* (Cambridge, MA: MIT Press, 2014).

[6] Howard E. McCurdy, *Space and the American Imagination* (Washington, DC: Smithsonian Institution Press, 1997); Michael A. G. Michaud, *Reaching for the High Frontier: The American Pro-Space Movement, 1972-1984* (New York: Praeger, 1986). See also Roger D. Launius, "Public Opinion Polls and Perceptions of U.S. Human Space Flight," *Space Policy* 19 (2003): 163-175.

it embarked on its next major human space flight initiative, the Space Shuttle? How has NASA conceptualized the American citizenry and defined various external publics – that is, those outside of the sphere of traditionally recognized space policy makers and influencers in NASA, the White House, the Congress, and the aerospace industry? What perceptions has NASA held of its responsibilities to them and of their relevance and roles vis-à-vis the human space flight program? What factors have shaped and constrained these visions? Have external publics mattered to NASA and the human space flight program beyond serving as passive observers?

Just ten years after Apollo 11 landed on the Moon, an article in the Sunday newspaper magazine *Parade* presented a vastly different relationship between NASA and the wide American citizenry in describing the agency's plans for the Space Shuttle than that described by historical analyses of Apollo-era NASA public relations. The article noted that the new space vehicle would provide "the first opportunity the public has had to get involved personally in a NASA project."[7] Ann Bradley, who served as NASA associate deputy administrator in the early years of Shuttle flights, echoed that claim in an internal NASA memorandum announcing plans to fly a schoolteacher as the first private citizen aboard the Shuttle. The vehicle's promise of providing routine and reliable access to space to reasonably healthy people with basic training, she averred, meant that "[n]o development has opened a greater prospect for direct citizen involvement in space flight than the Space Shuttle."[8] According to Hans Mark, NASA deputy administrator when the first Shuttle missions began, "the Shuttle opened the door for a vast broadening of the human experience in space."[9] Looking back on the Space Shuttle's legacy, former Shuttle manager Wayne Hale elegantly summarized: "If the intent was to transform space and the opening

[7] Richard C. Levy, "Everybody is Lining Up for Space," *Parade*, December 30, 1979, 4-5.

[8] Ann P. Bradley, "NASA's New Space Flight Participant Program," August 27, 1984, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[9] Hans Mark, *The Space Station, A Personal Journey* (Durham, NC: Duke University Press, 1987), 57-58.

of the frontier to more people, the shuttle accomplished this.…The shuttle truly became *the people's spaceship*."[10]

What a contrasting perspective these statements offer vis-à-vis characterizations of NASA's public engagement approaches during the Apollo era! While NASA never abandoned its determination to share the spectacle of human space flight with American citizens, the agency clearly considered external publics and approached public engagement with the Shuttle in some new and different ways. Looking beyond the well-researched NASA public relations efforts of the Apollo era, this work aims to cast a fresh light on NASA's ties with the citizenry of the United States by critically examining what came next in NASA's history of public engagement with human space flight. It tells the story of why and how NASA conceptualized and aimed to engage with a wide range of American citizens outside of the government-industrial complex in ways that evoked a commitment to the democratization and regularization of human space flight as the agency transitioned from the Apollo period of the 1960s and early 1970s to the Space Shuttle era that would span the next four decades.

Like other U.S. government agencies, NASA was charged from its inception with contributing to national goals and the general welfare. President Eisenhower and the Congress specifically directed NASA to advance understanding of the benefits and opportunities associated with space research.[11] Even so, the agency faced constant tensions in striving to present *human* space flight to American citizens and to the Congress as an activity worthy of federal funding; after all, rocketing people into space proved an extremely expensive and inherently esoteric effort that did not specifically constitute part of NASA's original mandate but nevertheless became the agency's primary focus. Beginning with Mercury, Gemini, and Apollo and continuing with the Shuttle, NASA's conceptualizations of external publics' relevance

[10] NASA, *Wings in Orbit: Scientific and Engineering Legacies of the Space Shuttle*, eds. Wayne Hale, Helen Lane, Gail Chapline, and Kamlesh Lula, NASA SP-2010-3409 (Washington, DC: U.S. Government Printing Office, 2010), 9. Emphasis added.

[11] National Aeronautics and Space Act of 1958, Public Law 85-568 (July 29, 1958).

and roles and its choices of public engagement approaches emerged from the agency's efforts to demonstrate the value of, and thereby to obtain and maintain legitimacy for, its human space flight programs. As this work shows, however, NASA's visions of how to serve and engage external publics with its human space flight enterprise changed to a notable degree in transitioning to the Shuttle era as shifting social attitudes and priorities and divided public interest in space flight became evident. NASA consequently promulgated the Shuttle as a versatile technology promising something for everyone and sought to engage citizens in ways appealing to their varied interests. Agency officials modulated how they perceived and sought to involve various external publics with the Shuttle throughout the course of the program. These changes took place as these officials negotiated the capabilities and challenges associated with flying the Shuttle in the face of disparate, evolving NASA, public, and political attitudes about this space technology's purpose, value, and safety; NASA's performance in managing the spacecraft; as well as NASA's program priorities.

In promulgating this thesis, I break with previous analyses and make a case that to accept a characterization of American citizens' participation in human space flight solely as celebrants of NASA's achievements does not account fully for the significance of external publics to the sustainability of the agency's first few decades of human space flight. Doing so leaves an impoverished picture of efforts within NASA, even if imperfect and not fully successful, to reconfigure the agency's relationships with the nation's citizens as it sought to move forward with the human space program after Apollo 11 landed astronauts on the Moon. Indeed, after the Apollo program, NASA saw as crucial to the legitimacy of human space flight the need to shift from recognizing a singular American citizenry of unquestioning supporters to one comprised of individuals and groups with distinct values, needs, interests, and capabilities and for whom the agency would strive to make the initiative accessible in myriad ways that satisfied them. I contend that the viability – and legacy – of the Space Shuttle in large part depended on NASA's willingness and ability to make such changes and to regard citizens as not just potential

advocates but as physical resources essential to the enterprise, even though the agency constantly struggled with preserving this stance.

Understanding how and why NASA's particular visions of public engagement developed in the post-Apollo era helps to elucidate key concerns for science and technology studies scholars, space historians, and NASA policymakers alike. Scholarly studies of public engagement with science and technology have tended to focus on questions of citizen benefits, equities, and justice in interacting with technoscientific experts. My approach to analyzing the case of the Space Shuttle brings symmetry to such inquiries, providing a glimpse into the visions of public accountability and legitimacy as well as the range of influences that can govern how a technoscientific government agency perceives and opts to engage with various external publics. In considering those influences, this work calls attention to the fact that internal and external perceptions of a technology have a particularly strong bearing on an agency's public engagement preferences at any given time. By carefully mapping these perceptions along with the publics and engagement modes that NASA regarded as crucial to the Shuttle's legitimacy over the technology's lifetime, I offer a new pathway for scholarly inquiry concerning interactions between technoscientific institutions and publics external to their traditional decision-making circles. In the process, this study illuminates the prospects, challenges, and limits associated with democratizing decisions about and uses of not just space but potentially a variety of technologies managed by U.S. government agencies.

My work also expands the historical narrative of the American space program by highlighting the various considerations NASA and other government space policymakers gave to the broad American citizenry in making choices about the Shuttle program and public participation therein. Accordingly, this study demonstrates that actors outside of those typically viewed as space program developers played significant roles in shaping the Shuttle program, both substantively and culturally, directly and indirectly, and not just as passive supporters and consumers, as many scholars and space program officials have surmised. Stirring questions about the assumption that elected representatives in democratic governments

make policy choices based on vocalized expressions of support or direction from their citizens, this work suggests that these alternative means of conceptualizing and valuing external publics – as contributors to future space program accomplishments – may in fact be the most important and meaningful way in which NASA can connect them with – and productively sustain – human space flight going forward.

Evolution of NASA's Public Engagement Approaches through the Shuttle Era

The commonly perceived connection between NASA and "ordinary" American citizens as witnesses to human space launches is, to be sure, deeply rooted in the agency's origins in the mid-20th century. During that time, many United States government leaders, technoscientific experts, and citizens alike subscribed to the belief advanced after World War II by President Roosevelt's science advisor, Vannevar Bush, that the results of government-funded scientific research and development activities would ultimately serve the nation's people.[12] Both in the United States and around the world, government institutions began to consider how their choices to pursue particular science and technology projects could help achieve their visions of desirable futures for their nations, adopting and promoting what scholars Sheila Jasanoff and Sang-Hyun Kim have called *sociotechnical imaginaries* to propagate their ideals.[13] The U.S. federal government created several new agencies focused on technoscientific advances, and the technocrats and experts who managed them and conducted research under their auspices aspired to attain

[12] Vannevar Bush, *Science: The Endless Frontier: A Report to the President* (Washington, DC: Government Printing Office, 1945).

[13] Sheila Jasanoff and Sang-Hyun Kim, "Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea," *Minerva* 47, no.2 (2009): 119-146. Scholars have proffered related terms to describe the melding of technoscience and visions of social good. George Marcus applies the term *technoscientific imaginaries* to describe scientists' inclusion of social concerns in their research and innovation activities in his edited work *Technoscientific Imaginaries: Conversations, Profiles, and Memoirs* (Chicago: University of Chicago Press, 1995). Gabrielle Hecht uses the term *technopolitics* to name the process by which government officials make technical decisions based on their visions of national futures in *The Radiance of France: Nuclear Power and National Identity after World War II* (Cambridge, MA: MIT Press), 2009. My interest herein is to examine how state-level actors' public engagement approaches are driven by how they blend visions of public good with technoscientific choices. As Jasanoff and Kim's definition of *sociotechnical imaginaries* refers to states' visions (versus Marcus' term's focus on scientists and Hecht's term's attention on describing a phenomenon), I believe this term best meets my aims and thus I favor using *sociotechnical imaginaries* throughout this narrative.

public appreciation of their research and development work via displays of their achievements and informing their citizenries about the value of their efforts.[14] According to political scientist Yaron Ezrahi, a commitment to conducting technoscientific activities in the open and with claimed commitments to serving the public interest allowed institutions within liberal democracies in particular to foster within their citizenries an *attestive public* that served to legitimize their actions and authority.[15]

NASA was very much founded and molded according to these principles. President Eisenhower responded to the perceived technological and ideological threats of the Soviet Union's deployment into Earth orbit of a basketball-sized sphere called *Sputnik* in 1957 by establishing NASA and authorizing the agency to embark on a program of space research. As Cold War tensions built, that initiative came to include a challenge issued by President John F. Kennedy to land American astronauts on the Moon within a decade in an effort to prove American supremacy to the Soviets' technology and way of life. Establishing NASA as an instrument of national security and foreign policy, the White House and Congressional drafters of the agency's founding legislation, the National Aeronautics and Space Act of 1958, recognized that attaining legitimacy of their vision of America made stronger via a national space program depended on ensuring both a global and national public awareness of the agency's activities. Accordingly, the legislation mandated that NASA "provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."[16]

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[14] See, for example, Sharon Macdonald, *The Politics of Display: Museums, Science, Culture* (New York: Routledge, 1998); Sonja D. Schmid, "Celebrating Tomorrow Today: The Peaceful Atom on Display in the Soviet Union," *Social Studies of Science* 36, no.3 (2006): 331-365; Daniel Sarewitz, *Frontiers of Illusion: Science, Technology, and the Politics of Progress* (Philadelphia: Temple University Press, 1996); Brian Wynne, "May the Sheep Safely Graze? A Reflexive View of the Expert-Lay Knowledge Divide," in *Risk, Environment and Modernity: Towards a New Ecology*, eds. Scott Lash, Bronislaw Szerszynski, and Brian Wynne (London: Sage Publications, 1996), 44-83; and Stephen Hilgartner, *Science on Stage: Expert Advice as Public Drama* (Stanford: Stanford University Press, 2000).

[15] Yaron Ezrahi, *The Descent of Icarus: Science and the Transformation of Contemporary Democracy* (Cambridge, MA: Harvard University Press, 1990).

[16] National Aeronautics and Space Act.

This seminal phrase served from the outset to guide and define NASA's relationship with those outside the government and the aerospace industry. NASA personnel committed to using all available communications modes to share openly with American and global citizens one successful advance in human space flight after another throughout the 1960s in the pursuit of an eventual Moon shot – the ultimate display of the nation's prowess. The agency developed positive images of space flight, forged strong relations with the news media, welcomed public visitors to NASA facilities and launches, and conducted extensive public outreach and education campaigns. As several scholars have suggested in documenting NASA's public relations efforts during this era, NASA made information about space flight widely available not only to enhance the United States' image abroad but also to garner American citizens' appreciation of NASA's activities and endorsement for continuing them.[17] Like those in the Congress who penned the Space Act, NASA officials were acutely aware of the agency's place within the American democratic system of government. They believed that by sharing the agency's achievements broadly they could eradicate any "deficit" in citizens' understanding of the space program. Such an approach, they reasoned, was appropriate and sufficient for serving and remaining accountable to those whose tax dollars financed the agency and whom elected the government officials who held the Treasury's purse strings.

During the 1960s and 1970s, it became clear to government institutions that many Americans would not accept unconditionally the legitimacy of a particular sociotechnical imaginary, policy, or program direction advanced by expert and elite decision-makers. By that time, the use of chemical weapons, nuclear reactors, pesticides, and other contentious creations of research and development activities revealed that science and technology did not *de facto* benefit all segments of society or the environment. Social activists and scholars consequently began to question the propriety of according

[17] Kauffman, *Selling Outer Space*; Byrnes, *Politics and Space*; Starr, "NASA's Hidden Power"; Lewenstein, "NASA and the Public Understanding of Space Science"; Billings, "Fifty Years of NASA and the Public: What NASA? What Publics?"

scientific experts and technocrats unchecked authority, with many demanding for citizens no longer to be viewed as passive consumers of these entities' actions but as participants in deciding the rightful place of science and technology within society. These entities turned on its head the "deficit model" of public engagement held by some technoscientific experts that citizens would support funding for scientific projects if experts provided them with information to address their seeming lack of understanding of science and technology. Instead, they maintained, perhaps the experts' work inadequately accounted for and served citizens' disparate needs and interests.[18] Many federal, state, and local government agencies within the United States and abroad responded to this resistance by rethinking their responsibilities to, and the appropriate and necessary roles of, citizens within democracies and by developing pathways to include citizens' input to and collaboration on technoscientific matters. Scholars have documented this "participatory turn" over the past few decades among regulatory and research agencies and institutions focused on public and environmental health and safety issues ranging from the use of genetically modified foods to the development of clinical trials for AIDS patients.[19]

Though having managed to hover above the fray of criticism for several years as it fulfilled a national imperative directed by President Kennedy, NASA found itself subjected to pressures similar to those faced by other technoscientific organizations at the end of the late 1960s and early 1970s. In

[18] See, for example, Don K. Price, *The Scientific Estate* (Cambridge, MA: Harvard University Press, 1967); Dorothy Nelkin, "The Political Impact of Technical Expertise," *Social Studies of Science* 5, no. 1 (1975): 35-54; Alan Irwin, "Constructing the Scientific Citizen: Science and Democracy in the Biosciences," *Public Understanding of Science* 10, no. 1 (2001): 1-18; Sheila Jasanoff, "Science and Citizenship: A New Synergy," *Science and Public Policy* 31, no. 2 (2004): 90-94; Martin Lengwiler, "Participatory Approaches in Science and Technology: Historical Origins and Current Practices in Critical Perspective," *Science, Technology, and Human Values* 33, no. 2 (2008): 186-200; Dominique Pestre, "Challenges for Democratic Management of Technoscience: Governance, Participation, and the Political Today," *Science as Culture* 17, no. 2 (2008): 101-119; and Alan Irwin and Bryan Wynne, eds. *Misunderstanding Science? The Public Reconstruction of Science and Technology* (Cambridge: Cambridge University Press, 1996).

[19] Michel Callon, Pierre Lascoumes, and Yannick Barthe, *Acting in an Uncertain World: An Essay on Technical Democracy*, trans. Graham Burchell (Cambridge, MA: MIT Press, 2009); Sheila Jasanoff, ed. *States of Knowledge: The Co-Production of Science and Social Order* (New York: Routledge, 2004); Sheila Jasanoff, *Designs on Nature: Science and Democracy in Europe and the United States* (Princeton, NJ: Princeton University Press, 2005); Steven Epstein, *Impure Science: AIDS, Activism, and the Politics of Knowledge* (Berkeley: University of California Press, 1996); Wynne, "May the Sheep Safely Graze?"

contrast to the claim that Americans have been cheerleaders to all that NASA has accomplished, public approval of government expenditures to send people into space was far from unanimous even at the zenith of the Apollo program.[20] For the millions of Americans who got caught up in the excitement of the space race and wrote "fan" letters to NASA's astronauts, lauding their heroism in tickertape parades following their safe returns to Earth, there were just as many who frowned on the nation's commitment to human space exploration. To the naysayers, the spacemen's socially homogeneous origins as white, male, military test pilots seemed unrepresentative of the diversity of the United States and out of touch with contemporary public pursuits of civil rights and equal opportunity.[21] Moreover, with social and economic turmoil at home and an unpopular war in East Asia taking a toll on American lives and finances, many citizens vocally opposed human space flight activity's seemingly militaristic quest to demonstrate technological and ideological superiority over the Soviet Union with no clear long-term benefits for individual American citizens. Staunch Democrats in the Congress echoed these concerns, and some vehemently called for an end to human space flight activities. Put simply, while the landing of Apollo 11's astronauts on the Moon had created a worldwide sensation, the technological triumph did not ensure widespread social acceptance at home. As NASA entered the 1970s, neither the Cold War-era sociotechnical imaginary for human space flight as a pursuit that would enhance the nation's global posture nor the idea of the citizenry as an attestive public seemed to hold.

NASA's top leadership was nonetheless determined to build on its legacy of human space flight. For one thing, many officials and engineers were personally enamored with the dream of space travel. Moreover, NASA had grown quickly over the years into an exceptional agency as perceived by many within and outside the agency due to these achievements, and those at NASA involved with the program viewed it as comprising the essence of the agency's identity and *raison d'être* regardless of the divide in

[20] Launius, "Public Opinion Polls and Perceptions of U.S. Human Space Flight."

[21] For more on the evolution of the astronaut profession, see Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012).

public and political opinion about the importance of human space missions.[22] Securing political approval for an Apollo follow-on program, however, required a wholesale change in NASA's expectations as the sociopolitical conditions of the times bore heavily on the initiative the Nixon administration and the Congress would support. While NASA urged President Nixon to undertake an ambitious post-Apollo human space flight program to include an Earth-orbiting space station and crewed trips to Mars, Nixon proved willing to endorse only a far more modest human space flight program for the indefinite future. As this fact became clear to NASA officials, they pressed for funds to develop just one element of their grand plan: the Space Shuttle. Originally having envisioned the Shuttle as a ferry service for astronauts, experiments, and supplies between the Earth and the space station, NASA set to building a case for the Shuttle as a standalone program deserving of support in its own right.

National security arguments had allowed President Kennedy and NASA to tap the resources needed to sustain the Apollo program, and to a significant degree NASA's willingness to accommodate Department of Defense payloads had much to do with the agency's success in garnering political support for the Shuttle. But legitimizing the Shuttle also entailed finding a completely different sociotechnical imaginary fitting of the new era. A substantial portion of the population questioned the value of federally funded space travel, instead preferring that the nation invest its precious financial resources in pursuits that would improve Americans' lives. At the same time, many citizens were eager to see the agency continue to send astronauts into space, and some aspired to be those very space travelers. NASA deftly negotiated these varied concerns by constructing the Shuttle as a utilitarian, democratized technology.[23]

[22] For more on this idea, see Roger D. Launius, "Imprisoned in a Tesseract: NASA's Human Spaceflight Effort and the Prestige Trap," *Astropolitics: The International Journal of Space Politics & Policy* 10, no. 2 (May-August 2012): 152-75.

[23] On the design and development of democratic technologies, see Langdon Winner, "Do Artifacts Have Politics?" *Daedalus* 109, no. 1 (1980): 121-136 and Richard E. Sclove, *Democracy and Technology* (New York: Guilford Press, 1995). While sometimes citizens evaluate choices about which technologies to develop and use, the Space Shuttle represents an instance in which a technoscientific institution, NASA, had an extant interest in developing a particular technology but recognized a need to articulate and extend uses of it – and advocated such uses – to various social groups to succeed.

NASA officials conceptualized the reusable new vehicle as a significant departure from the Mercury, Gemini, and Apollo space capsules of the past in both looks and purpose. With a cargo bay that could enclose a payload the size of a school bus and a cabin that could accommodate seven flyers, the winged vehicle would make space accessible for many uses and users, operating as a "space truck" that would carry a variety of experiments and satellites into space that would benefit people and businesses on Earth. A relatively benign acceleration at launch and an airliner-like landing would allow even those not in supreme physical condition to fly and work aboard the new spacecraft. In addition, the agency made an economic case for the new spacecraft, contending that the Shuttle's reusability and expected ability to launch several dozen times annually would save the nation billions of dollars in launch costs by no longer needing to rely on one-time-use, expendable rockets while still creating growth industries and millions of jobs.

These arguments helped NASA to secure Nixon's and, in turn, the Congress's approval of the Shuttle in 1972 and came to comprise NASA's guiding sociotechnical imaginary for the Shuttle's role and relationship with American citizens. They also signaled that NASA would need to reconsider not only the value of human space flight to citizens but also citizens' value to the human space flight effort and its modes of connecting with them. NASA continued to engage external publics through display as it did with its human program up through the early 1970s. The new vision for human space flight, however, prompted the agency's public affairs personnel aim to make its discourse about the Shuttle more relevant to citizens' daily lives and aspirations for the space program. Mark Byrnes' *Politics and Space* astutely argues that NASA officials used rhetoric conveying a pragmatic image of the Shuttle to secure funding and authority to continue the human space flight program.[24] Relatedly, Valerie Neal observes that NASA

[24] Byrnes, *Politics and Space*.

initially framed the Shuttle age as a "new era" in space transportation, marked by routineness and the delivery of practical benefits.[25]

NASA's efforts, I contend here, went deeper still. Building on these works, my study shows that the agency used a range of techniques to engage many publics with the program. In addition to appealing to skeptics, NASA also sought to appeal to space enthusiasts by sharing with them visions of how the Shuttle would broaden humanity's future in space and, tantalizingly, open space travel to them. Along these lines, the success of the Shuttle program depended on not just persuading audiences via the use of particular discourses to believe in the Shuttle's value in order to secure funding and authority to pursue the initiative – although this certainly was one element of NASA's strategy. Rather, success also would be measured by *realizing* the vision of a democratized human space flight program. NASA officials recognized that achieving this aim depended on making more Americans more active participants in Shuttle activities. NASA partnered with external entities and used new communications technologies to enhance the general public's insight into and sense of connection with the Shuttle program by increasing their access to the Shuttle in ways earlier human space flight programs never did. The agency aimed to involve Americans with the Shuttle in more substantive ways as well. NASA human space flight officials, once concerned only with training career astronauts and conducting missions, suddenly found themselves in the business of soliciting and serving satellite and experiment launch customers including major companies and individual citizens alike and recruiting and working with flyers from a variety of races and ethnic origins and ranging from corporate scientists to Congressmen to teachers. The Shuttle was not just a spacecraft to be displayed and talked about but became a physical site of public engagement, where the objectives of human space flight aficionados within NASA and an assortment of external interests met.

[25] Valerie Neal, "Framing the Meanings of Spaceflight in the Shuttle Era," in *Societal Impact of Spaceflight*, eds. Steven J. Dick and Roger D. Launius, NASA SP-2007-4801 (Washington, DC: U.S. Government Printing Office, 2007), 70-73.

Chapters 1 through 4 of this work tell the story of this shift in how NASA perceived the value of and manners of connecting with external publics and how these changes both helped to shape and were shaped by the transformation of NASA's vision for the human space flight program vis-à-vis the Shuttle. Chapter 1 opens by explaining the origins of NASA's commitment to human space flight and its original view of an attestive American public. After examining the challenges NASA faced in gaining support for a post-Apollo human program, I outline the process by which the agency secured approval for the Space Shuttle and built a new sociotechnical imaginary to legitimize the new human space flight project. Chapter 2 begins to delineate the myriad ways in which NASA sought to engage external publics with the Shuttle program. I show that while the quest for public and, in turn, political support to maintain financial backing and authority to continue with human space flight in large part motivated these efforts, NASA officials aimed to enroll specific publics as supporters by interacting directly with and serving disparate groups – from community business leaders to *Star Trek* fans – by tailoring messages and opportunities to satisfy their interests. The chapter shows how the agency advanced its sociotechnical imaginary for the Shuttle by marrying discourse, the Shuttle's unique physical attributes, and available communications technologies and hence allowing all Americans to feel like a part of the Shuttle program.

Chapter 3 shows the extent of NASA's commitment to realizing its democratized imaginary for the Shuttle by examining how the agency made decisions to open space to new uses and users via the spacecraft. NASA recognized that the success of the Shuttle rested on the ability of the agency to prove its utility and consequently sought to attract and negotiate its use with an eclectic set of publics. These publics ranged from space scientists who had opposed human space flight to corporations seeking solutions to manufacturing challenges to students with fresh ideas about the use of space to artists and others for whom the idea of flying experiments and objects aboard the Shuttle proved to be inspirational. Many of NASA's initiatives for involving these groups with the Shuttle followed after various publics petitioned to participate and particular offices and individuals within NASA decided to advocate for their involvement, thus exhibiting a new degree of responsiveness and accountability by the agency. Also

showing that NASA's vision for the Shuttle's role in society entailed engaging citizens in increasingly participatory ways, Chapter 4 explores how the agency worked to expand the human space flight ranks to include new groups of flyers aboard the new vehicle. From broadening the demographic and professional diversity of its astronaut corps to initiating a program to welcome flights by private citizens, NASA aimed to ensure that those who rode aboard the Shuttle resembled America more than the Mercury, Gemini, and Apollo astronauts did.

By the mid-1980s, a few years into the Shuttle's operational period, no one could deny that the program's relations with external publics were markedly different than those NASA had employed two decades prior. According to many indicators, NASA's approach bore fruit. Polling numbers suggested that more citizens supported the Shuttle than had the Apollo program. Primary and secondary school teachers and students came to view the Shuttle as an inspirational tool for studying science, math, and other subjects. Private companies and individuals alike were purchasing room on the Shuttle to carry payloads to space. Across the nation, the Shuttle instilled a sense of national pride and common ownership. The vehicle had arguably become America's most cherished technology.

Even so, democratizing the Shuttle and satisfying external publics' interests was not always easy for NASA. These chapters also reveal that enhancing the accessibility of human space flight required the agency to navigate a number of social, political, and technological challenges. NASA officials had to cope with critics in the media who questioned the genuineness of its intentions, particularly when the agency announced plans to fly private citizens aboard the Shuttle. They also had to ward off perceptions about the legitimacy of some of the payloads and people it proposed to fly aboard the Shuttle while finding ways to remain impartial in deciding who could participate and ensuring the safety of the Shuttle and all who flew aboard it even as it involved new players. At the same time, advocates for the development of a commercial launch industry objected to the Shuttle as a government threat to free enterprise. Much of the resistance to accommodating external publics in new ways came from various quarters within the agency. Scientists and astronauts within NASA sometimes opposed efforts to include

new publics in the Shuttle program out of concern about the impacts these decisions would have on their own ability to participate in Shuttle activities or on the time available for mission activities they deemed more important. Moreover, the Shuttle's complexity kept flight rates to just a fraction of what the vehicle's advocates had anticipated and thus limited opportunities and discouraged some private companies and entrepreneurs from using the Shuttle for experiments and manufacturing purposes.

As Chapter 5 shows, NASA's ability to sustain its commitment to opening the Shuttle to more public involvement encountered even greater difficulties beginning in 1986. That year, the Space Shuttle *Challenger* launch disaster killed seven astronauts, including NASA's first "citizen in space," teacher Christa McAuliffe. In so doing, the accident ripped asunder NASA's sociotechnical imaginary of a vehicle accessible to and capable of serving the daily lives of the nation's citizens. While some implored the agency to continue its commitment to expanding Shuttle flights to more people even in the wake of the disaster, the accident engendered among NASA officials and many within the Reagan administration, the Congress, and the news media a new perception of the Shuttle's associated risks and tarnished NASA's image of competently managing the human space flight program. The accident also prompted policy makers to reconsider the nation's future direction in human space flight, and several years later the agency received approval to build the space station it had long pursued, which would require the Shuttle's service and diminish its availability for other uses and users. At the same time, NASA grappled with increased resistance from the private sector entities that opposed the Shuttle as a competitor to their interests in commercializing space activities. These tensions and the preexisting challenges to NASA's ability to continue to democratize the Shuttle led the agency to refocus public engagement efforts on reestablishing credibility with external publics and, especially, officials in the White House and the Congress. While NASA officials had for years regarded direct involvement of broad segments of the public as crucial to ensuring the Shuttle's viability and legitimacy, they began to temper their priority on and enthusiasm for inviting new Shuttle users and flyers, instead focusing on less substantive approaches to keep connecting various publics with the vehicle and future human space flight endeavors.

After NASA endured a second Shuttle accident in 2003, the tragic loss of *Columbia*, the George W. Bush administration announced a plan to redirect human space exploration activities toward destinations beyond Earth orbit, and the Shuttles assumed a dedicated role as workhorses for International Space Station assembly. The latter part of the chapter reveals that while the agency had by then moved away from its sociotechnical imaginary of a democratized Shuttle program, NASA officials celebrated the Shuttle as the people's spaceship as the orbiters completed service and were sent to new homes in museums around the country. With the Shuttle program having ended, I take up in the conclusion of this work the question of whether and how NASA will consider and involve external publics as it seeks to legitimize and carry out new human space projects.

Practical and Conceptual Contributions

What insights does chronicling the story of public engagement with the Space Shuttle offer? On the broadest level, this dissertation offers an empirical case study to alert practitioners and scholars to the possibilities, prospects, and challenges for public engagement with space activities, and science and technology more generally. Scholars and practitioners alike use with increasing frequency the term "public engagement" in their efforts to signal commitments to two-way interaction with those outside of traditional decision-making and contributory circles. This study helps to elucidate what this popular modern term actually entails where technoscientific matters are concerned. Scholars interested in democratic theory and American history have examined and challenged the ontological existence of a unified, knowable mass public.[26] Even so, scholarship on the topic of pubic engagement has not yet come to terms with the complexity of "the public" – or, more appropriately, who "publics" are – while practitioners also often suffer from a failure to think through which publics they actually aim to serve and

[26] See, for example, Walter Lippmann, *The Phantom Public* (New York: Harcourt, Brace and Co., 1925); John Dewey, *The Public and Its Problems* (New York: Holt, 1927); and Sarah Igo, *The Averaged American: Surveys, Citizens, and the Making of a Mass Public* (Cambridge, MA: Harvard University Press, 2007).

engage. I approach the question of who publics are, at least in NASA's case, by examining carefully the actors with whom NASA interacted outside of its traditional space program development sphere. My examination of NASA's move from only imagining "the public" to recognizing the interests of multiple publics in entering the Shuttle era shows just how complex and varied are the many publics which confront a government agency. I reveal that publics can be important to technoscientific institutions not only as supporters to legitimize their activities but also as resources that can physically determine the viability of an enterprise.

There are still other limitations on current understanding of what public engagement is and what determines its potential forms. Many scholars, for their part, have adopted a normative stance that public involvement in technoscientific matters is crucial to ensuring that decisions and outcomes do not just serve the goals of the powerful but also satisfy broad human needs.[27] Some analysts have expressed concern, however, that such literature has not extended sufficiently beyond the "mere sloganizing" of a universal need for democratic engagement in technoscientific issues and an accounting for varieties of engagement mechanisms that institutions have employed.[28] Moreover, scholarship to date also tends to approach the question of public involvement in technoscientific issues from the single perspective of so-called "non-experts" or "lay citizens" and their efforts to modify the approaches used by credentialed

[27] See, for example, Andrew Feenberg, *Questioning Technology* (New York: Routledge, 1999); Myanna Lahsen, "Technocracy, Democracy, and U.S. Climate Politics: The Need for Demarcations," *Science, Technology, and Human Values* 30, no. 1 (2005): 137-169; Brian Martin, "Strategies for Alternative Science," in *The New Political Sociology of Science: Institutions, Networks, and Power*, eds. Scott Frickel and Kelly Moore (Madison: University of Wisconsin Press, 2006), 272-298; Philip Kitcher, *Science, Truth, and Democracy* (New York: Oxford University Press, 2001); Sclove, *Democracy and Technology*; Callon, Lascoumes, and Barthe, *Acting in an Uncertain World*; Sheila Jasanoff, "Technologies of Humility: Citizen Participation in Governing Science," *Minerva* 41 (2003): 223-244; Silvio O. Funtowicz and Jerome R. Ravetz, "Science for the Post-Normal Age," *Futures* 25, no. 7 (1993): 739-55; Ulrich Beck, *Risk Society: Towards a New Modernity*, trans. Mark Ritter (London: Sage, 1992); Brian Wynne, "Misunderstood Misunderstanding: Social Identities and Public Uptake of Science," *Public Understanding of Science* 1 (1992): 281-304; Epstein, *Impure Science*; Harry Collins and Robert Evans, "The Third Wave of Science Studies: Studies of Expertise and Experience," *Social Studies of Science* 32, no. 2 (2002): 235-296; and David H. Guston, "Forget Politicizing Science: Let's Democratize Science!" *Issues in Science and Technology* 21, no. 1 (2004): 25-28.

[28] See, for example, Irwin, "Constructing the Scientific Citizen" and Jasanoff, "Science and Citizenship."

experts to address a problem. Few works consider the matter of public engagement from the perspective of institutions charged with carrying out technoscientific work, or with respect to the sociotechnical imaginaries they proffer.

Understanding the concerns of citizens is, of course, vital to scholars' and practitioners' ability to determine what mechanisms might work best to engage such groups in matters that concern them. But making sense of *why* technoscientific experts and institutions support particular engagement approaches, if any, over others is imperative to understanding the prospects for future involvement of various citizen groups in collaborating on issues of interest with such organizations. How the nature and perceptions of a technology, including visions of its potential role in society and in attaining particular futures, can contribute to what public engagement options a technoscientific institution recognizes as possibilities also remains underexplored. This work examines these linkages, showing in particular that sociotechnical imaginaries can prove powerful in guiding institutions' technoscientific and public engagement choices while also proving frail and subject to resistance and change due to any number of social, political, and technological developments.

NASA never described its interactions with its various publics during the early era of the Shuttle as "public engagement," as this term entered popular and scholarly lexicon only later. Even so, this dissertation contributes to scholarship in this area by considering a case study that suggests that a wide range of factors drives and constrains the visions, abilities, and approaches of an agency, at least within a democratic government, to engage with various publics. Technoscientific agencies are established by democratic governments to contribute to national goals and the general welfare. While these agencies are chartered by government officials and laws to fulfill these purposes, agency leaders recognize the need to demonstrate value, accountability, and legitimacy to the publics that, at least indirectly, sustain and benefit from them. These aims are hardly easy for agencies to achieve, as they must constantly make decisions about the development, use, control, or stewardship of particular technologies in the face of limited budgets and disparate points of view.

Indeed, many NASA officials tried to make the Shuttle as open and inclusive as they could but ran into limits and perceptions of technology or opposing ideas or dominant actors in their pursuits. Analyzing NASA's approaches to public engagement throughout the Shuttle's history illuminates not only why publics were important to NASA but also the tensions that the agency faced, and others are likely to encounter, in democratizing their programs. State actors have often been accused of carrying out plans that fulfill their own visions of national or societal good without taking into account the values and objections of their citizenries, sometimes leading to calamitous results.[29] While sensitive to the interests of various publics vis-à-vis the Shuttle, this case study raises a key question for proponents of public engagement, democratic theorists, government officials, and scholars of government history: can democratic governments truly be expected to satisfy everyone or to pursue a consensus direction at a national level? In other words, is the "better" engagement champions of participatory democracy have often advocated even possible? After all, established constituencies are an undeniable reality, yet institutions are in principle obligated to "think" in the aggregate and serve millions of people, whose opinions are far from harmonious. Considering these challenges, I show that it is rather remarkable that government institutions in democracies are at all able to expand and maintain opportunities for more citizens to participate in different ways in their work as NASA did with the Shuttle, at least for a time.

This work also offers a new perspective on the development of the space program, seeking to rebalance historical understanding of NASA's public relations efforts with human space flight. Missing from most accounts of human space flight is adequate consideration of American citizens' actual and potential roles and significance to this enterprise, which has proven concomitantly awe-inspiring and esoteric. Mapping the evolution of public relations vis-à-vis the Shuttle reveals the internal and external vicissitudes that influenced NASA's strategies for engaging external publics for four decades. It shows who mattered throughout the program and why. This work helps to expand the narrative of American

[29] See, for example, James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1999).

space history by showing how complex NASA's relationships with various publics became as the Shuttle era began. NASA had operated for its first decade as if it had one big, attestive public. Agency officials had largely imagined the American people as an undifferentiated citizenry who, dazzled by the spectacle and patriotism of space flight, would come to support it. But when overwhelming support did not materialize even after NASA's greatest moment in 1969, the agency looked further to recognize the segments of society that could help to make the Shuttle a success; to that end, this study is a departure from histories that cast the American public in a passive, if not invisible, role.

While the agency was sometimes accused of trying to "sell" the Shuttle, build its "image," or pull off public relations "stunts," NASA's efforts, I argue, are better explained in less reductionist, one-sided terms; instead, they can be seen as attempts to engage external publics in ways meaningful and suited to the times – a means of remaining accountable to the American people. The theoretical developments of Bruno Latour, Sheila Jasanoff, and other scholars who have sought to understand relationships between science and technology and society underpin this view of NASA's connections with external publics. Latour and other proponents of "network" theories contend that the technoscientific and social worlds are intertwined. According to this concept, attempts to categorize technoscientific actors and external publics as such are artifices, as all actors and inanimate objects operate within networks that respond to the actions of others and seek to *enroll* one another in achieving particular aims.[30]

Invoking this perspective, NASA could only deliver on its sociotechnical vision and attain legitimacy for the Shuttle by enrolling Americans in the Shuttle program, and this required engaging and

[30] Michel Callon, "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fishermen of St. Brieuc Bay," in *Power, Action, and Belief: A New Sociology of Knowledge?*, ed. John Law (London: Routledge and Kegan Paul, 1986), 196-233; Bruno Latour, *Science in Action* (Cambridge, MA: Harvard University Press 1987); Bruno Latour, *We Have Never Been Modern*, trans. Catherine Porter (Cambridge, MA: Harvard University Press, 1993); Bruno Latour, "Give Me a Laboratory and I Will Raise the World," in *Science Observed*, eds. Karin D. Knorr-Cetina and Michael Mulkay (Beverly Hills: Sage, 1983), 141-169; and John Law, "Technology and Heterogeneous Engineering: The Case of Portuguese Expansion," in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, eds. Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Cambridge, MA: MIT Press, 1989), 111-134.

meeting the interests of more people in the many different ways they valued. NASA's external engagement approaches in the early Shuttle era thus clearly had not only self-serving but also strong public-serving components: the Shuttle was thus, in some senses, truly shared. Jasanoff has built on these network approaches by suggesting that technoscience shapes and is shaped by contingent interactions with social, economic, and political factors in a process of *co-production*.[31] The Apollo program and NASA's attestive public existed in such a symbiotic fashion, as did the Space Shuttle and NASA's various publics in the latter program's developmental and early operational years, and arguably somewhat longer. My work focuses primarily on how NASA envisioned and managed its engagement of various external publics rather than striving for a symmetrical analysis of mutual NASA-public shaping. I evince nonetheless that the Shuttle was also a product of publics outside of the domain of recognized space policy makers rather than being shaped solely by NASA and technoscientific experts as most histories have portrayed. One simply cannot consider the evolution of the Shuttle as separate from the agency's enrollment of external publics in this program.

From this point of view, this dissertation also offers an alternative history of the Space Shuttle. Focusing on the technological choices that NASA made, some pundits have considered the Shuttle to be a mistake for the American space program. Political scientist John Logsdon has called the Shuttle a policy failure, stating that budget constraints imposed by the Nixon administration pushed NASA down a path of making promises that the Shuttle would reduce the cost of space flight and become self-sustaining financially when the chances were stacked against the spacecraft. Former NASA administrator Michael Griffin, meanwhile, lamented shortly after taking office in 2005 that the Shuttle's design was "extremely aggressive and just barely possible" and consequently meant the nation had lived with a flawed human

[31] Jasanoff, *States of Knowledge*.

space flight system for decades.[32] While the Shuttle may appear imperfect from these perspectives, my account of the importance of broad public engagement to the Shuttle program brings in yet another figure of merit by which the program's evolution ought to be understood and its success judged. Appraising the program from this vantage point, one might ask to what extent NASA served its diverse publics vis-à-vis the Shuttle program.

Various individuals within NASA who saw the merits of pushing for a democratized Space Shuttle program overcame challenges to create participatory opportunities as best they could. Efforts to engage diverse publics in the Shuttle program were spread across NASA's public affairs, education, and human space flight organizations, with the agency's top leadership and the White House often pressing particular directions. No one had a master blueprint of these activities and the agency's publics as the Shuttle coursed through a 40-year swath of the agency's history. Looking in hindsight and deconstructing the agency's aims to engage disparate publics with the Shuttle in ways meaningful to them over this broad timespan, as this study does, can help NASA determine how best to and with what likelihood of success it can evolve its program plans, public engagement mechanisms, and performance measures to remain relevant. After all, chances are good that the public engagement issues encountered during the long Shuttle era are indicative of the sorts of challenges NASA will face as it aims to move forward with other human space flight initiatives.

Methods and Sources

This study offers insight into how and why one U.S. government agency, NASA, conceptualized and made choices about engaging with American citizens. As my principal aim is to provide a detailed account of this single institution's perceptions of external publics and their relevance and how this

[32] John M. Logsdon, "The Space Shuttle Program: A Policy Failure?" *Science* 232 (May 30, 1986): 1099-1105; Traci Watson, "NASA Administrator Says Space Shuttle Was a Mistake," *USA Today*, September 28, 2005, 1A, accessed February 22, 2015, LexisNexis Academic.

institution sought to relate to them over time, I have relied on qualitative research methods, primarily including archival research and interviewing individuals associated with the Shuttle program. I analyzed the discourse within relevant documents and oral history transcripts with the goal of "seeing" like NASA. Specifically, I take note of the various publics with which NASA officials either did or aspired to engage, assessing how and why NASA sought to connect with them. In some cases, NASA referred not to specific groups but to a general public or "the public," and I flag where the agency made these generalizations in its conceptualization of citizens. However, as many scholars have taken umbrage, quite rightfully, to the term "the public" because of its tendency to obfuscate the diversity of the people it is intended to encompass, I, too, avoid using the term as my own in this analysis. Still, when and where NASA did not call out specific groups, it is necessary to refer somehow to the entities en masse outside of NASA and the other government and industry scientists, engineers, and managers charged with making decisions about the space program's direction. Hence, and recognizing that some scholars will find even these terms imperfect, I rely herein on terms including "external publics" and "citizens" as ways of denoting without specificity individuals who fall outside of these "internal publics" of political stakeholders.

I have sought to understand how and why NASA, as an institutional actor, engaged with specific groups outside of the circle of designated space policy and program developers. What kinds of interactions did agency personnel have or strive to have with what groups? When did NASA officials seek particular sorts of relationships and why? How did the aspirations and visions of NASA personnel shape these choices? What other actors and circumstances had a role in defining them? Equally important to making sense of NASA's behaviors is recognizing where the agency limited its engagement with particular publics and what alternatives it did not pursue or adopt. Drawing on post-colonial and critical approaches to discourse analysis aided me in assessing what those rejections or silences meant vis-à-vis NASA's shaping of its relationship with American citizens.

Just as the American citizenry is not a homogeneous entity, NASA is not a monolithic institution, and I have attempted to avoid treating it as one in this work. The agency is comprised of tens of thousands of U.S. government civil servants and two to three times as many contractors spread over ten NASA field centers and myriad corporate installations throughout the country. Individuals ranging from the agency's administrator and senior leadership to the most junior employees across a range of offices – Shuttle management, public affairs, education, science, and safety and mission assurance, to name the key ones – along with U.S. presidents, members of Congress, and their staffs, and external consultants and advisors constructed views of external publics and brought these to bear in dealing with them. When talking about "NASA," I aim to be as explicit as possible about who participated, thought, and acted in what way.

Reviewing historical written records proved crucial to my ability to access the history of the Shuttle's first two decades in particular, which constitute the focal timeframe of this work. Records especially essential to my project include internal NASA memoranda capturing discussions of issues and decisions related to engaging various publics with the Shuttle, NASA public fact sheets and promotional materials about the Space Shuttle, speeches made by senior NASA officials to various external groups, and correspondence between NASA officials and citizens relating to the Shuttle program. Thanks to excellent recordkeeping by some of the individuals engaged in the initiatives discussed in this work, I was able to reconstruct many of the debates among actors involved to a highly detailed level. Most of the primary written records I examined came from the NASA Historical Reference Collection located at NASA Headquarters in Washington, DC. Several others came from the Johnson Space Center History Collection stored at the University of Houston-Clear Lake Archives in Texas. NASA's eight-volume special publication, *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space*

Program, produced under the general editorship of John Logsdon, contains reprints of several key documents from the space program's history that proved useful in my research.[33]

Many other types of written primary sources factored into this project. Presidential policy statements related to the Shuttle, reports by NASA advisory committees containing recommendations about the future of NASA and its human space flight programs, reports by the commissions established to investigate the Space Shuttle *Challenger* and *Columbia* accidents all proved key to understanding some of the external directives and pressures that drove NASA's decision-making about how to engage with various publics and how these choices changed over time. I also reviewed relevant legislation and records of Congressional hearings capturing debates about the post-Apollo human space flight program as well as the origins of NASA's mandate to disseminate information about its activities that proved so central to NASA's quest to engage with external publics. Equally important in understanding the outside views of the Shuttle program that both drove and reacted to NASA's choices concerning public engagement over the agency's history were my examination of public opinion polls as well as articles appearing in national and local news publications and magazine and newspaper advertisements with Shuttle-related themes.

Original interviews with individuals connected to the Shuttle program enhanced this project immensely by providing background, views, and anecdotes that documentation did not, and often could not, provide. I conducted more than two dozen interviews with individuals who interfaced with the Shuttle program from a variety of angles and over different points in the vehicle's history. Interviewees included Shuttle program officials, astronauts, NASA administrators, NASA public affairs officers, public outreach program specialists, Shuttle program managers, and a NASA visitor center director. I also talked with journalists, a teacher, and others who worked closely with NASA to advance the agency's

[33] John M. Logsdon, ed., *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program*, NASA SP-4407, 8 vols., Washington, DC: U.S. Government Printing Office, 1995-2008.

commitment to public interaction. Interviews proved particularly valuable to fill in details where written records do not exist. Talking directly with individuals inside and outside of NASA also provided candid perspectives on particular issues and challenges the agency faced in efforts to engage various publics with the Shuttle that the agency would not necessarily have captured, sometimes intentionally, in official agency documentation. I supplemented my original interviews by reviewing transcripts of interviews conducted by other researchers and historians with NASA officials involved in the Shuttle and earlier human space flight programs. These transcripts are accessible through the Kennedy Space Center Oral History Project and the Johnson Space Center Oral History Project.[34]

Various experiences I have had as a participant-observer in relation to the Shuttle program have aided me in contextualizing my research even if not serving directly as the basis of the history I share here. I had the good fortune to tour the Johnson Space Center and its visitor complex, Space Center Houston, as background for this study; this visit rounded out my familiarity with NASA's human space flight centers, as I had previously been to Kennedy Space Center in Florida and Marshall Space Flight Center in Alabama. I also had the privilege of witnessing firsthand the Shuttle *Discovery* flyover of Washington, DC, in April 2012 and attending the ceremony transferring *Discovery* to the Smithsonian. Perhaps most notably, as someone who has worked directly with and within NASA for many years, first as a White House Office of Management and Budget (OMB) space budget and policy analyst and then as a NASA employee, I cannot help but be influenced in my thinking about this research subject by my own observations as well as the tacit understanding of an institution's culture that one gains through personal immersion.

While one might argue that my affiliation with NASA, and in particular my involvement with some public engagement projects within the agency, has prevented me from being appropriately critical in these pages, I maintain to the contrary that these experiences, combined with my training in science and

[34] The Kennedy Space Center Oral History Project is accessible online at http://kscoralhistory.ksc.nasa.gov/; the Johnson Space Center Oral History Project is at http://www.jsc.nasa.gov/history/oral_histories/oral_histories.htm.

technology studies, have given me tools to enhance the insightfulness and practicality of my scholarship. My professional background provides me with a dose of realism and depth of understanding of the opportunities and challenges the agency faces that most scholars cannot claim. Moreover, if anything, I grew a highly critical skin at OMB that my reliance herein on network theories and methods, with their emphasis on symmetrical analysis, has helped to moderate and, in turn, has allowed me to conduct a comprehensive, balanced examination of NASA's historical engagement with American citizens.

Chapter 1: Bringing Human Space Flight Closer to Earth

If one thing was clear to the leadership and employees of NASA – and to so many people everywhere – after the Apollo 11 *Eagle*'s successful landing on the Moon on July 20, 1969, and the safe return of the mission's three astronauts four days later, it was that the space agency had created an incredible legacy on multiple fronts. The stuff of dreamers for centuries up until only a decade earlier, humans had visited another world for the first time. It showed the capability of the human mind to think up the seemingly unobtainable and craft a technological system to obtain it. The achievement proved a major display of American capability and showmanship, power, and prowess in the highly visible "space race" theater of the nation's Cold War with the Soviet Union. For the days running up to launch and through those following after splashdown, NASA basked in the perhaps the biggest public spotlight in human history. Millions had lined the beaches around Cape Kennedy for the moonshot. An estimated 600 million people around the globe, some 20 percent of the planet's population of the time, tuned in via television sets to witness Neil Armstrong and Edwin "Buzz" Aldrin take humanity's first steps on an alien world.

NASA's administrator, Tom Paine, was determined to capitalize on the awe of Apollo 11 and ask President Richard Nixon to authorize NASA to continue to press the boundaries of human space flight. Paine's predecessor, James Webb, who had served as NASA administrator throughout the Kennedy and Johnson administrations, had resigned from the administrator's post at the end of Johnson's term without having obtained an agreement between the White House and Congress on the future direction for the agency. Although both ends of Pennsylvania Avenue had maintained support for Apollo, NASA's budget began to decline after 1965 when the politically-savvy Webb refused to champion an Apollo follow-on given the priority of Johnson and the Congress to infuse increasing amounts of federal funds into "Great Society" programs and the Vietnam conflict. NASA consequently had begun in the late 1960s to shut down capabilities that had enabled the Apollo effort, including the Saturn booster's production line.

Two weeks after Apollo 11's successful return to Earth, Paine proposed a major post-Apollo human space flight program. In addition to extending the human lunar program with orbiting and surface bases and building a permanently occupied Earth-orbiting space station to be serviced by a reusable "space shuttle," the plan called for a 12-person expedition to the surface of Mars launching in 1981, for a cost of $4-8 billion annually. Paine might have advocated that NASA consider its human space flight work complete with the Apollo lunar landing and instead shift its emphasis. The National Aeronautics and Space Act of 1958 which gave birth to NASA, did not actually mandate that the agency pursue a program of human space flight; the legislation called only generally for NASA's "preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof."[1] It left to policy makers – Presidents and Congresses, informed by NASA administrators – decisions about how to fulfill its spirit. The agency had over the previous decade proven leadership in a number of other areas in space, having developed capabilities and made advancements in interplanetary exploration missions, weather probes, and satellite communications. Recognizing the enormous opportunity costs of human space flight and questioning the enterprise's scientific and societal value, huge swaths of the space science community and liberal members of Congress had begun to urge NASA to put more resources into these areas instead.

But Paine was a human space flight enthusiast – a "true believer," as one former NASA manager characterized the agency's legions of human space flight proponents who, with "almost a religious fervor," held to a conviction that the expansion of human presence into space was "the right thing" for the nation and the destiny of humanity.[2] As the leader of the government agency that had pulled off Apollo 11 and earned a reputation as a can-do organization, Paine could not envision the agency retreating from the this bold pursuit. Thus, he yearned to secure an opportunity for NASA to go further with the human

[1] National Aeronautics and Space Act of 1958, Public Law 85-568 (July 29, 1958).

[2] Wayne Hale, telephone interview by author, April 12, 2013.

program that formed the heart of NASA's internal culture and which had become virtually synonymous with the agency's name for so many outside of the organization. Paine also recognized, as sociologist Brian Woods puts it, that the Apollo-era "grand assemblage of scientists, engineers, bureaucrats and industrial might required a new goal if their interests were to continue to be served; and those interests were firmly centered on the development of advanced technology."[3]

While ego and self-interest were clearly at stake in Paine's bid for Mars, he and other NASA officials believed that the agency also had served the interests of the American people through the Apollo program and its human space flight program predecessors, Mercury and Gemini. Indeed, the national commitment had built up expertise and technical capabilities at NASA facilities and within the aerospace industry across the country that allowed the nation to enjoy newfound worldwide prestige while also boosting the American economy and education system. Through their experiences with these programs, NASA's leadership had embraced a vision, or *sociotechnical imaginary*, which framed human space flight as a crucial enterprise for the nation's place in the world.[4]

Paine and the elite group of NASA managers, policy makers, and aerospace companies that shaped the space program's direction predicated this imaginary on a belief that they served citizens by conducting the human program and engaging them through quasi-democratic approaches. Specifically, they surmised that by communicating openly about the results and value of their efforts and meeting the "demand" so many expressed for access to information about the astronauts and space, they created and sustained the appreciation of NASA's strides in human space flight activity. As political scientist Yaron Ezrahi has described, NASA officials engaged external publics in the space program through "the language and rhetoric of participation" but while casting them in passive roles, as consumers and

[3] Brian Woods, "Artifacts, Revolutionaries, and Bureaucrats: The Sociotechnical Shaping of NASA's Space Shuttle" (Ph.D. dissertation, University of Edinburgh,), WorldCat (45405214), 371.

[4] On sociotechnical imaginaries, see Sheila Jasanoff and Sang-Hyun Kim, "Containing the Atom: Sociotechnical Imaginaries and Nuclear Power in the United States and South Korea," *Minerva* 47, no.2 (2009): 119-146.

supporters of human space flight activity (or as future members of NASA's workforce, in the case of students); NASA leadership did not see them as entities seeking to engage in dialogue about their interests in the human space program or who might reject NASA's carefully laid plans.[5] In other words, American citizens outside of the circle of space program developers constituted for these players what Ezrahi calls an *attestive public* – a populace to affirm the legitimacy of a state (or in this case, an agency of the state) by witnessing or otherwise coming to identify with the political entity's technoscientific achievements.

This vision of the connection between human space flight endeavors, the strengthening of the nation, and American citizens helped to sustain NASA's achievements of the 1960s.[6] But contrary to Paine's aspirations, NASA faced considerable resistance in obtaining citizen and political support for a major human space flight initiative beyond Apollo. Belying NASA's view of an attestive American public, American interest in human space flight had actually not proven universal during the missions of the 1960s and became increasingly contentious as the decade wore on. Although NASA and national policymakers had stood behind Apollo as a means to preserve American democracy in the Cold War heat-up of the 1960s, a costly, elitist, prestige-driven, and spectacle-oriented human space flight program, no matter how successful technically, ran counter to the mood of the late 1960s and early 1970s, which emphasized pragmatism, attention to basic human needs, equal opportunities for all, and skepticism about state uses of technology. Given this sociopolitical environment, rather than receiving from President Nixon and the Congress the go-ahead to go to Mars, NASA ended up with a post-Apollo human space

[5] Yaron Ezrahi, *The Descent of Icarus: Science and the Transformation of Contemporary Democracy* (Cambridge, MA: Harvard University Press, 1990), 42. Ezrahi points to NASA as an example of a technoscientific authority seeking to create an attestive public. He explains that when visitors to Kennedy Space Center in the late 1970s and 1980s were taken to see the Saturn V rocket and heard from a NASA tour guide that it was built by companies in the many states from which they hailed, there was a "thunder of applause" from "proud citizens" who felt that they shared "a piece of the action." Through "the language and rhetoric of democratic participation," Ezrahi explains, the Saturn V "emerges suddenly as a monument to the ingenuity of an entire people, the creativity and contributions of many private American citizens and firms spread all over the United States."

[6] On the relationships between people, technology, and the sustainment of nations and nationalism, see Benedict Anderson, *Imagined Communities* (New York: Verso, 1983).

flight program – the Space Shuttle – that represented just one piece of the ambitious program Paine espoused.

The ensuing sections of this chapter trace the transition of NASA's human space flight program from Apollo to the Space Shuttle, highlighting how divided public attitudes helped to drive NASA's programmatic and public engagement choices following the first human lunar landing. I first outline NASA's adoption of human space flight as its principal mandate. Next, I show how the agency attempted to construct an attestive American public to legitimize this initiative. I go on to examine how post-Apollo public and political attitudes prompted Nixon and NASA to rethink the extent and shape of the human space flight program. Key to NASA's ability to continue to pursue its space flight aspirations was finding a human flight rationale and program which credibly fit with the countercultural social values of the era that railed against them. These pressures led NASA to abandon its push for an ambitious Apollo follow-on program and instead to put strategic emphasis on the Shuttle's affordability, capabilities, and ability to broaden access to space for a multiplicity of users and uses. In doing so, I argue, NASA adopted a fresh sociotechnical imaginary for human space flight. Conceptualizing the new vehicle as a democratically oriented space technology through which the agency would directly involve wide-ranging publics and serve their goals would hence guide NASA's efforts to engage citizens with human space flight as the Shuttle era began.

Imagining a National Imperative

A complex set of intertwined factors and events that took place in the several years following World War II shaped NASA into a bastion of human space flight expertise whose leaders and personnel would come to self-identify with and work to enroll citizens in recognizing the importance of this endeavor. NASA's pursuit of human space flight originated with an odd yet timely marriage between visionary rocket engineers and politicians in search of a technological answer to a vexing geopolitical

concern.[7] From there, it spiraled into a full-blown national commitment buoyed in part by the dedication of Administrations and Congresses and the expertise of tens of thousands of engineers and technicians in NASA and the aerospace industry, who grew dependent on the program's continued funding.

An aggressive American human space flight program certainly was not inevitable; indeed, it was hardly politically desirable by the occupant of the highest office of the U.S. government in the 1950s. President Eisenhower had desired a moderate approach to U.S. human space flight, preferring instead to concentrate U.S. space activity on satellite applications and international scientific cooperation to demonstrate the peaceful uses of outer space. Even a month following the Soviet Union's launch of *Sputnik*, the world's first artificial satellites, Eisenhower proclaimed: "What the world needs today even more than a giant leap into outer space, is a giant step toward peace."[8] He intensified the nation's space efforts when many American political leaders and journalists lamented that the communist nation had eclipsed the United States technologically and presented a threat to American security and democracy.[9] With Congress's approval, he also consolidated this activity into a single civilian agency, the National Aeronautics and Space Administration (NASA), which began to operate on October 1, 1958.[10] The

[7] The origins of America's pursuit of a human space program have been the subject of study by numerous scholars. While accounts have most frequently argued from a political angle that human space flight became a tool the U.S. government used instrumentally to best the Soviet Union, sociologist William Bainbridge has emphasized that space flight enthusiasts, talented rocket engineers among them, drew on cultural interest in space flight and exploited perceptions of geopolitical threats held by U.S. political leaders and citizens to realize their dreams of human space flight. See William S. Bainbridge, *The Spaceflight Revolution* (New York: Wiley, 1976). For a discussion that accepts both viewpoints and addresses the technological, political, and sociocultural origins of U.S. human space flight, see Roger D. Launius, "Prelude to the Space Age," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. I: Organizing for Exploration*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 1995), 1-21. This dissertation exposes another social component regarded by NASA and space policy makers as essential to the success of the U.S. human space flight program: the availability of attestive publics to bear witness to these feats.

[8] *Public Papers of the Presidents: Dwight D. Eisenhower, 1957* (Washington, DC: U.S. Government Printing Office, 1958), 799.

[9] For a discussion suggesting that *Sputnik* incited more worry among thought leaders and politicians than it did for most American citizens, see Kim McQuaid, "Sputnik Reconsidered: Image and Reality in the Early Space Age," *Canadian Review of American Studies* 37, no. 3 (2007): 371-401.

[10] While U.S. military organizations were also pursuing space activities at the time, Eisenhower had misgivings about military control of space activities and the impact it would have on worldwide opinion of the United States; he thus wanted the United States to carry out its space projects in an open, peaceful manner. He accepted his advisors'

program he advocated for NASA, however, was to be balanced, accruing not just international prestige but long-term value to the nation's citizens through a portfolio of scientific and applications research.[11] Indeed, a "blue ribbon" panel of academic social scientists assembled by NASA's first administrator, T. Keith Glennan, to help position and project the agency to American citizens in a socially palatable manner recommended emphasis on projects with practical applications. The NASA administrator along with leaders from the United States Information Agency, the State Department, and the National Security Council, however, urged Eisenhower to support also a human space flight program to create excitement and build national prestige.[12] Eisenhower supported Project Mercury as an initiative to demonstrate human space flight's feasibility. Still, the President foremost endorsed NASA's pursuit of unmanned projects as a means to fulfill another of the Space Act's directives: that NASA work "for the benefit of all mankind."[13]

The new agency thus built a long-range plan that included a host of unmanned meteorological, communications, and space science satellites and interplanetary probes that would advance scientific aims and contribute to numerous civilian and military applications along with the national economy.[14] But that plan also reflected the aspirations of a contingent of engineers who began advocating the possibility of human space travel following World War II. At that time, the United States had begun investing in developing rockets that would prove useful for military weaponry as well as scientific research on the upper atmosphere and space. Indeed, many of those involved had been led to pursue careers in

recommendation that the National Advisory Committee for Aeronautics would form the ideal basis for a civilian space agency, with personnel and facilities contributed by the Army and Navy.

[11] T. Keith Glennan, *The Diary of T. Keith Glennan*, ed. J. D. Hunley, NASA SP-4105 (Washington, DC: U.S. Government Printing Office, 1993), xxii.

[12] McQuaid, "Sputnik Reconsidered;" Glennan, *The Diary of T. Keith Glennan*, xxiv.

[13] National Aeronautics and Space Act of 1958.

[14] NASA, Office of Program Planning and Evaluation, "The Long Range Plan of the National Aeronautics and Space Administration," December 16, 1959, in *Exploring the Unknown, Vol. I*, 403-407.

aeronautics and rocketry by dreams and literature on human space voyages and considered how these technologies might send humans aloft. During the 1940s officials within the National Advisory Committee for Aeronautics (NACA), which would become the organizational nucleus of NASA, developed an interest in the prospects for human space flight to fulfill aims in space that artificial satellites could not achieve. Believing that human space travel could become reality by the early 1960s, NACA's director, Robert Gilruth, created an interagency organization aimed at attaining human space flight capabilities.[15]

Meanwhile, Wernher von Braun, the German V-2 rocket mastermind who surrendered to the United States after the war and continued to develop rockets in service to the U.S. Army, clung to his determination to see human space flight realized.[16] A respected rocket engineer in the United States by the 1950s, he deftly used his credibility, along with his gifts of charisma and eloquent speech, to promote the notion that human space travel was a serious possibility and a potential salve to America's Cold War fears of a menacing Soviet Union. As von Braun articulated this sociotechnical imaginary in one of a series of articles he and fellow space science and engineering experts published in *Collier's* in the early 1950s, mounting an aggressive, human-focused space program was instrumental for the United States, for a human presence in space "could be either the greatest force for peace ever devised, or one of the most terrible weapons of war – depending on who makes and controls it."[17] Von Braun envisioned artificial satellite launches followed by orbital flights of humans, the development of a manned space station tended by a reusable vehicle to transfer people to and from Earth, and ultimately human visits to the Moon and planets. The *Collier's* articles offered the impression that America's scientists and engineers

[15] H. J. E. Reid, Director, NACA, to NACA, "Research on Spaceflight and Associated Problems," August 5, 1952, Folder 18674, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[16] According to Launius, von Braun chose to submit to the Unites States because he reasoned that the former would provide stronger but less controlling support for his rocketry work than the Soviet Union would. See Launius, "Prelude to the Space Age," 13.

[17] Wernher von Braun, "Crossing the Last Frontier," *Collier's*, March 22, 1952, 25.

had thought through the technical details to make this vision a reality, should the nation wish to pursue it. Advocates within NASA of von Braun's human space flight paradigm incorporated it into the agency's long-range plan, targeting a manned circumnavigation of the Moon and the start of a space station after 1965 and manned lunar flights to the Moon beyond 1970.[18]

Like his presidential predecessor, John F. Kennedy, also was initially unconvinced that human space flight ought to be the focus of the United States' civilian space effort. At the start of his tenure in the White House, he, too, preferred a methodical and balanced approach to all that NASA did. Kennedy also desired to cooperate with the world's nations, including the Soviet Union, on an array of space activities. Less than three months after his inauguration, however, two global events prompted the new president to latch onto the sociotechnical imaginary that von Braun had posited and pursue a more aggressive, and ultimately competitive, human flight program. On April 12, 1961, the Soviet launch of Yuri Gagarin before the first Mercury flight propelled the Communist nation ahead of the United States in space feats; five days later, the failed Bay of Pigs invasion represented a deep blow to the Kennedy administration and to the United States' image abroad. Kennedy continued to prefer to pursue a cooperative space program with the Soviets but in reaction to these events asked Vice President Lyndon Johnson for options on how the nation could outdo the Soviets on the space front.

Johnson worked with the National Aeronautics and Space Council to consider alternatives and on April 28, 1961, delivered a report to the President.[19] Stating that countries around the world "increasingly identified" "dramatic accomplishments in space" as "a major indicator of world leadership," the report asserted that with a strong push, the United States "could conceivably be first" in a human

[18] NASA, Office of Program Planning and Evaluation, "The Long Range Plan of the National Aeronautics and Space Administration."

[19] The National Aeronautics and Space Council was established in the National Aeronautics and Space Act of 1958. At the time of Kennedy's administration, the council was chaired by the vice president and included the secretary of state, the secretary of defense, the NASA administrator, the chairman of the Atomic Energy Commission, and any additional members the president chose to appoint.

circumnavigation of the Moon or a human landing on the lunar surface by 1966 or 1967.[20] Kennedy's new NASA administrator, James Webb, and Defense Secretary Robert McNamara recommended to Johnson an across-the-board acceleration of the U.S. civil space program but highlighted the importance of sending humans to the Moon because "it is man, not merely machines, in space that captures the imagination of the world."[21] The national prestige accrued from such a success, they argued, would be substantial "even though the scientific, commercial or military value of the undertaking may by ordinary standards by marginal or economically unjustified."[22] Johnson sent the recommendation to Kennedy.

All the while, the Kennedy administration strived to engage the Soviet government of Nikita Khrushchev in cooperative space projects, including a joint lunar mission, but the Soviets rebuffed the suggestion without a U.S. commitment toward disarmament.[23] Kennedy pressed forward by accepting Johnson's advice and announced his intent before a joint session of Congress on May 25, 1961, for NASA to land humans on the Moon "before this decade is out."[24] Framing human space flight as a great adventure critical to winning "the battle that is now going on around the world between freedom and tyranny," Kennedy's appeal married a far-reaching technological goal with a vision of American leadership and exceptionalism among the world's nations and in so doing solidified NASA's guiding sociotechnical imaginary for the human space flight program. Kennedy's decision, which the Congress

[20] Lyndon B. Johnson to the President, memorandum, "Evaluation of Space Program," April 28, 1961, in *Exploring the Unknown, Vol. I*, 427-429.

[21] James E. Webb and Robert McNamara to the Vice President, May 8, 1961, with attachment, "Recommendations for Our National Space Program: Changes, Policies, Goals," 13, in *Exploring the Unknown, Vol. I*, 446.

[22] Ibid., 8.

[23] Kennedy continued to press unsuccessfully for U.S.-Soviet space cooperation even after his May 1961 speech. The details of Kennedy's desire to work jointly with the Soviets in space as a means of reducing tensions between the two nations are outlined in chapter 10 of John M. Logsdon, *John F. Kennedy and the Race to the Moon* (New York: Palgrave Macmillan, 2010).

[24] John F. Kennedy, "Special Message to the Congress on Urgent National Needs," May 25, 1961, John F. Kennedy Presidential Library and Museum, accessed December 4, 2014, http://www.jfklibrary.org/Research/Research-Aids/JFK-Speeches/United-States-Congress-Special-Message_19610525.aspx.

supported initially in the form of more than half a billion dollars to supplement NASA's FY 1961 budget, reversed Eisenhower's commitment to avoiding a space program focused on technological showmanship at the expense of other elements. As political scientist John Logsdon points out, "Project Apollo became the dominant feature of the U.S. quest for space leadership."[25] The resulting influx of resources for human space flight in turn helped to embed a dominant culture within NASA marked by zeal for ambitious engineering projects centered on the human program. As historian Howard McCurdy observes, "The paradigm of human exploration became part of NASA's organizational culture. People in NASA assumed that this was the way that space flight was done."[26]

Not all who were close to NASA favored the agency's adoption of this sociotechnical imaginary for space flight. While funding continued to flow throughout the 1960s to support NASA's nascent initiatives to explore the planets with robotic sentinels and place electronic eyes into orbit to observe the Sun and universe, these projects and the NASA centers that fostered them received far fewer resources than the Apollo flight systems projects based at the Manned Spacecraft Center in Houston and the Marshall Space Flight Center in Huntsville, Alabama. Many scientists protested NASA's choice of priorities and expressed concerns that Apollo project managers planned to focus on engineering goals and neglect scientific opportunities for the lunar missions – this, when the Space Act had called explicitly for NASA to arrange for the science community's participation in making observations and measurements using the agency's space vehicles.[27] The National Research Council's Space Science Board raised these

[25] John M. Logsdon, "The Evolution of U.S. Space Policy and Plans," in *Exploring the Unknown, Vol. I*, 381.

[26] Howard E. McCurdy, *Space and the American Imagination* (Washington, DC: Smithsonian Institution Press, 1997), 49. For an excellent discussion of the origins of NASA's technical culture, see Howard E. McCurdy, *Inside NASA: High Technology and Organizational Change in the U.S. Space Program* (Baltimore: Johns Hopkins University Press, 1993).

[27] The debate is nicely laid out in chapter 1 of William D. Compton, *Where No Man Has Gone Before: A History of Apollo Lunar Exploration Missions*, NASA SP-4214 (Washington, DC: Government Printing Office, 1989); National Aeronautics and Space Act of 1958.

concerns during its 1962 summer review of NASA's science programs.[28] The following year, Philip Abelson, editor of the journal *Science*, argued in an editorial and later before the Senate that unmanned probes would prove a far better way to obtain science than through human missions.[29] Statesman of science Vannevar Bush wrote to Webb about "the space program, as it has been built up," stating that it was "more expensive than the country can now afford" and that "its results, while interesting, are secondary to our national welfare."[30]

Nonetheless, even after, and perhaps because, Kennedy's presidency was snuffed prematurely by an assassin's bullet, the Johnson administration continued the nation's commitment to supporting the Apollo program, which at its funding peak in 1966 consumed almost $3 billion (1966 dollars), or nearly two-thirds of NASA's total budget and more than 2.5 percent of all U.S. federal spending for that year.[31] While academic space scientists expressed displeasure with the funding flow, others benefitted handsomely from the policy. Apollo facilitated a massive mobilization of aerospace industry contractor personnel dedicated to the lunar landing program as NASA sought to extend its capabilities and workforce through strategic partnerships with those who had expertise and experience with large defense systems.[32] Historian Sylvia Kraemer points out that contracting with industry also offered NASA the political advantage of spreading funds around the country with the prospect of building constituencies

[28] National Research Council, Space Science Board, *A Review of Space Research* (Washington, DC: National Academy Press, 1962).

[29] Philip H. Abelson, "Manned Lunar Landing," *Science* 140 (April 19, 1963): 267.

[30] Vannevar Bush to James E. Webb, April 11, 1963, in *Exploring the Unknown, Vol. I*, 614-616.

[31] Compton, *Where No Man Has Gone Before*, Appendix 2: Apollo Funding History, accessed December 4, 2014, http://www.hq.nasa.gov/pao/History/SP-4214/app2.html#1966.

[32] On the U.S. space industry's development and relationship with NASA, see Joan L. Bromberg, *NASA and the Space Industry* (Baltimore: Johns Hopkins University Press, 1999).

within the Congress.[33] Sure enough, members of Congress from states such as Texas and Alabama with strong space presences became staunch supporters of NASA and Apollo, particularly when expenditures were questioned by their colleagues. Eisenhower had fretted about the implications of technocracy and a powerful military-government-industrial complex, cautioning in his 1961 farewell address that "public policy could itself become the captive of a scientific-technological elite."[34] Even so, the exclusive nexus of NASA, the aerospace industry, and Apollo's supporters in the Kennedy and Johnson White Houses and in the Congress took responsibility throughout the 1960s for promulgating human space flight as a national imperative. As the next section shows, this elite group of players also conceptualized how to fit and enroll the American citizenry within that sociotechnical imaginary.

Seeking an Attestive American Public

Without question, NASA and other members of the space technocracy had specific goals and interests at stake in promoting human space flight during the enterprise's heyday in the 1960s and in contemplating post-Apollo initiatives. Approved and sustained via a sociotechnical imaginary that involved using homegrown space technology to eclipse the Soviet Union and accrue national prestige to the United States, the activity concomitantly realized the dreams of space visionaries at NASA. Over time, it also came to fuel the bottom lines of companies and to strengthen regional economies. For all of these reasons, Paine and others within NASA and the circle of the space program's supportive decision-makers were highly motivated to continue to urge the nation's investment in human space flight. These

[33] Sylvia K. Kraemer, "Organizing for Exploration," in *Exploring the Unknown, Vol. I*, 614-616. Kraemer also observes that NASA's partnerships with industry contractors helped to strengthen the contractors' abilities to develop and operate large technical systems and survive with just a few, large federal customers, including NASA.

[34] Dwight D. Eisenhower, "Farewell Address," January 17, 1961, Dwight D. Eisenhower Presidential Library, accessed December 4, 2014, http://www.eisenhower.archives.gov/research/online_documents/farewell_address/Reading_Copy.pdf. Walter McDougall spotlights the fact that the "technocratic model" came to dominate U.S. space flight activity in *…The Heavens and the Earth: A Political History of the Space Age* (Baltimore: Johns Hopkins University Press, 1985), 8.

players recognized, however, that within American democracy, the proposition to spend vast sums over several years required securing and maintaining the approval of members of Congress. That feat, they surmised, required convincing the electorate, the American citizenry, of the enterprise's value. Enrolling an attestive public, in other words, would be essential to legitimizing and continuing with this initiative.

The idea of space flight had been popularized by the 1950s by science-fiction writers such as Arthur C. Clarke, Isaac Asimov, and Robert Heinlein and thus was not new to Americans by the time Eisenhower created NASA; as historian Roger Launius points out, by the time of Sputnik's 1957 launch a majority of people believed that humans would set foot on the Moon within a quarter-century.[35] But while many people were willing to part with some pocket change to enjoy a space film or book and several hundred belonged to societies for space and rocketry enthusiasts, opinion research showed that no identifiable public constituency strongly supported a government-funded humans-in-space program in the earliest days of NASA. Analysis completed at NASA's request by social psychologist Donald Michael indicated that while the news media and several members of Congress had emphasized the severe implications *Sputnik* would have on the American way of life, "for many people everywhere, their own affairs, Little Rock, and the World Series took precedence over the Soviet leap into space."[36] Michael concluded in a separate study that "[t]here is no good reason to believe that there will be strong pressure from the public for effort and expenditures in this area, *unless very special efforts are made to elicit it*."[37]

While almost all agencies of the U.S. federal government have public information or consumer affairs offices to keep citizens apprised of their activities and services, most are banned by the 1919 Anti-Lobbying Act, and sometimes by agency-specific legislation, from using their budgets, furnished by

[35] Launius, "Prelude to the Space Age," 16.

[36] Donald N. Michael, "The Beginning of the Space Age and American Public Opinion," *Public Opinion Quarterly* 24 (1960): 575.

[37] Donald N. Michael, "Society and Space Exploration," *Astronautics* 31 (February 1958): 88-89. Emphasis in original.

taxpayers, to advertise themselves or to persuade citizens and members of Congress to support the programs they conduct.[38] A few agencies, though, are explicitly directed or authorized by legislation to communicate outward the results of their activities. The Atomic Energy Commission, for one, was "permitted and encouraged" by its originating legislation, the Atomic Energy Act of 1946, to disseminate scientific and technical information relating to atomic energy "so as to provide that free interchange of ideas and criticisms which is essential to scientific progress."[39] After the Atomic Energy Commission's General Advisory Committee in 1947 raised a concern, however, about the nation's willingness to accept the application of atomic energy for peaceful purposes, the Act was amended to include as additional justifications for dissemination of information "industrial progress," "public understanding," and "to enlarge the fund of technical information."[40]

NASA, too, received a legislative mandate to communicate publicly about its work. The National Aeronautics and Space Act of 1958 directed the agency "to provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof."[41] It also stated that "[i]nformation obtained or developed by the Administrator in the performance of his functions under this Act shall be made available for public inspection" except where classified or proprietary information is concerned.[42] The origins of these statements in the Space Act can be traced to Eisenhower's proposal to establish a civilian space agency. In a message to the Congress, Eisenhower expressed that any originating legislation should consider "[m]atters related to dissemination of the data collected" through

[38] Anti-Lobbying Act, *US Code* 18 (1919), § 1813.

[39] Atomic Energy Act of 1946, Public Law 585, 79th Cong., 2nd sess. (August 1, 1946), 12.

[40] Atomic Energy Act of 1954, Public Law 83-703, *US Code* 42 (1954), § 2161. Thank you to Bruce Lewenstein for making me aware of the Atomic Energy Commission's mandate to disseminate information. For a full discussion, see Bruce V. Lewenstein, "'Public Understanding of Science' in America, 1945-1965" (Ph.D. dissertation, University of Pennsylvania, 1987), 274-286.

[41] National Aeronautics and Space Act of 1958.

[42] Ibid.

space activities.[43] Calling for the open and free exchange of data was consistent with the President's interest in promoting cooperation in space among scientists domestically and internationally for the purpose of producing societal benefits and using space for peaceful purposes.

As the House and Senate heard the views of dozens of witnesses to prepare their respective versions of the legislation, members on both sides came to recognize that disseminating information about the nation's space activities was also warranted and would be beneficial for reasons other than scientific cooperation. While national security concerns would necessarily restrict the unbounded sharing of information, adopting a general practice of conducting space projects in the open and providing details about them would further the aims of Eisenhower and many in the Congress. Broad diffusion of information about American achievements in space would help to demonstrate U.S. leadership in space, promote democratic values abroad, and create an image of and national identity for the United States distinct from, and preferable to, the seemingly controlling political regime and socioeconomic system of the Soviet Union. The civilian space agency's ability to share news of its achievements to a mass global public that would bear witness to its gravity-defying feats would thus propagate this sociotechnical imaginary outward, creating what scholar Howard McCurdy calls the "aura of competence" of a nation committed in open fashion to sharing information and engaging them in the adventure of space flight.[44] Indeed, it was only if people could watch, learn about, and revere American space successes that the aim of affirming the United States as a technoscientific authority and the premier spacefaring nation would be fulfilled.[45] Through an "open program," the space agency would be able to, and did, work to make its

[43] Dwight D. Eisenhower to the Congress of the United States, April 2, 1958, in *Hearings before the Select Committee on Astronautics and Space Exploration*, HR 11881, day 1, 85th Cong., 2nd sess., April 15, 1958, 3-5.

[44] McCurdy, *Space and the American Imagination*, 83-107.

[45] The concept that technoscientific experts seek to attain credibility and legitimacy through "performances" is explored in Stephen Hilgartner, *Science on Stage: Expert Advice as Public Drama* (Stanford: Stanford University Press, 2000). Hilgartner expressly examines the matter in the case of scientific advisors and product regulators, but the idea applies to institutions carrying out technoscientific projects as well.

heroic astronauts, formidable rockets, and extraordinary achievements known to citizens around the world.

But the report accompanying the House's version of the bill indicated that providing for broad access to information about U.S. space activities also would be important for relating to the nation's own citizens. It stated that the House added language to promote greater dissemination of information "to let the people know all the facts."[46] It then went on to note that "only with thoroughgoing public understanding can the necessary support be marshaled to make it a success."[47] In other words, the report's authors assumed that the quasi-democratic tactic of making information available – and remedying the "deficit" in public understanding of the space program – was all that was needed or appropriate for citizens to buy into their imaginary of a nation made stronger and a world made safer by human space flight and give their approval of U.S. space activities. Whether or not NASA officials read closely the Congress's intents in including language for the space agency to share broadly information about its activities is unclear. Nonetheless, the agency's early leadership embraced the mandate, and this particular interpretation of it, as the basis for defining its relationships and obligations to the American people. Glennan established an Office of Public Information to communicate outward, an offshoot of the modest public relations office of the agency's predecessor, NACA. Glennan, and Webb after him, recognized that disseminating information about human space flight, the far-from-widely-accepted centerpiece of NASA's activities, would prove essential, not just for advancing U.S. foreign policy but for building public trust and creating an image of NASA and human space flight as legitimate endeavors worthy of American citizens' support.[48]

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[46] Select Committee on Astronautics and Space Exploration, HR 12575, Establishment of the National Space Program, 85th Cong., 2nd sess., May 24, 1958, H Rep. 1770, 8-9.

[47] Ibid., 36.

[48] For a detailed examination of the evolution from the NACA to the NASA public affairs program, see Kristen A. Starr, "NASA's Hidden Power: NACA/NASA Public Relations and the Cold War, 1945-1967" (Ph.D. dissertation, Auburn University, 2008), ProQuest (3348297).

Indeed, agency leadership and staff subscribed widely to the belief that the imperative to share information about NASA's activities was to enhance appreciation and garner constituencies for the agency and its human space flight program. After all, one month following Kennedy's appeal to Congress, only 42 percent of Americans favored the nation's commitment of tens of billions of dollars for Apollo.[49] A few years later, sociologist Amitai Etzioni would write *The Moondoggle: Domestic and International Implications of the Space Race*, a book blasting what Etzioni believed to be misplaced U.S. national priorities.[50] In 1963 NASA offered a grant to Columbia University's journalism school to "help improve news coverage – and hence public understanding – of what NASA is attempting to accomplish beyond the atmosphere."[51] While that interest might have seemed innocuous enough, several NASA's administrative and public affairs officials revealed these sentiments in interviews years after their tenures at NASA. Charles Biggs, a public affairs official at Johnson Space Center during the 1960s elaborated on the idea that the open program would serve NASA's quest for legitimization by an attestive public: "We never did anything improper or inappropriate or illegal, but we would bend every rule that we could to do something if we thought it was good for the agency, we thought it was good for the image, we thought it informed the public. That's what the Space Act is."[52]

Duff further explained that NASA made a point of sharing information not because the agency was trying to be "better public citizens" than any other federal agency but because the "space program,

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[49] Roger D. Launius, "Public Opinion Polls and Perceptions of U.S. Human Space Flight," *Space Policy* 19 (2003): 167.

[50] Amitai Etzioni, *The Moondoggle: Domestic and International Implications of the Space Race* (Garden City, NY: Doubleday, 1964).

[51] "NASA Pays to Find Out If It Is Doing Its Job," *New York Times*, July 12, 1963, 3, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times; "Public Be Dimmed," *Aviation Week*, September 23, 1963, 25; James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963* (Tuscaloosa, AL: University of Alabama Press, 1994), 18.

[52] Charles A. Biggs, interview by Rebecca Wright, August 1, 2002, transcript, NASA Johnson Space Center Oral History Project, Houston, TX, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/BiggsCA/BiggsCA_8-1-02.pdf.

that new invention, that incredible effort had to have public understanding and public support."[53] Duff stressed the importance of openness for NASA's technically risky line of work:

> It's good business sense to have an open program when you're running something as hard to control as the space program. … Machines can fail, people can fail, things can get totally out of control, the spacecraft can be hit by lightning. You are dealing with a situation in which the only possible way to succeed is to have as much understanding, as much education on the part of the people who are watching you as you can possible [sic] achieve so that you are being judged by people who have a basis to judge you.[54]

While being understood and judged by external publics could promote accountability or public debate about NASA's direction, James Webb, NASA's administrator under the Kennedy and Johnson administrations, made clear this was not the reason he valued informing citizens about NASA's work. Rather, he considered citizens' understanding to be critical to legitimizing NASA's activities as planned. As Duff recounts Webb's experience while in a review of NASA programs:

> Up came a slide about the public affairs program, and the officer said, in all innocence, because the [sic: he] thought it was true, "We have an open program because we respect the public's right to know." And Webb said, "Destroy that slide," and there was a crash from behind the screen. Webb said, "We have an open program because it is good public policy to have an open program. It's good for NASA and it's an effective NASA policy to have an open program. I'm not in the business of the public's right to know. There are others like the attorney general who will take care of that."[55]

Duff elaborated, revealing how intertwined external publics were for Webb with the agency's everyday actions:

> Webb had this great sense that we were a public activity that belonged to the citizens, the taxpayers. He really did, with no apology, think that ultimately our employers, or board of directors was the Congress, but our shareholders were the taxpayers. Ultimately, those were the people we had to answer to, and those were the people we were doing this for. … He [supported

[53] Brian Duff, interview by John Mauer, April 24, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC, accessed February 7, 2015, http://www.hq.nasa.gov/alsj//nasm_si__oral_history_project__duff_1.html.

[54] Ibid.

[55] Ibid.

> the open program] because he thought it was effective for getting the job done in the long run, and because it would build public support. We had to have public support, we had to have public sympathy, and we had to have public trust. … So we built each of those by making ourselves available.[56]

Indeed, Webb surmised a connection between getting people to understand and take interest in the space program and garnering the political support to keep fund NASA's programs. As Duff summarized Webb's sentiments about what public support via the open program would achieve for NASA:

> You can go back and say "Did it really matter that we had public support? Did it make any difference? Wouldn't the old style have worked just as well?" We had Lyndon Johnson, what do we need public support for? We had [Texas Congressman] George Mahon, we had two or three key people, why did we need public support? Webb would have said, "It's the public support that lets these other people give us what they want to give us. It's George Mahon knowing that back in Lubbock, his constituents are quasi-convinced that the space program is a good thing.[57]

As these statements show, the line between self-service and external accountability and service in sharing the human space flight program was certainly a blurred one for NASA officials. By operating in quasi-democratic fashion consistent with the Space Act provision for access to information – acting transparently, explaining human space flight's value, and responding to public information requests – agency officials anticipated that American citizens en masse would come to attest to human space flight as a legitimate enterprise and lend their support.

Occasionally NASA officials would express these sentiments publicly. Deputy Administrator Hugh Dryden's May 1961 testimony before the Senate Appropriations Committee evinced the official's persuasive intent. Dryden told the committee that NASA needed to help the public understand the Apollo project in order for them to accept it. "And we are naturally concerned here about that," Dryden stated.

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[56] Brian Duff, interview by John Mauer, May 24, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC, accessed June 20, 2013, http://airandspace.si.edu/research/dsh/TRANSCPT/DUFF4.HTM.

[57] Duff, interview, April 24, 1989.

"Now whether Americans want to accept that for scientific reasons, prestige reasons, propaganda reasons, or all three, is something we up here must decide."[58] For the most part, however, agency officials and documents denied any semblance of attempts at self-preservation, emphasizing instead that the agency was committed to serving American citizens through the human space flight program and its mandate to disseminate information widely. A 1966 document assembled by NASA's public affairs program stated in quite straightforward fashion: "We are not in an image-building business; we are trying to create a program that reflects what NASA is and what it is accomplishing. This is a distinction and a very important one…We feel that we have a service to offer."[59] Julian Scheer, NASA's public affairs chief from 1963 to 1971, pointed out that NASA did not "buy any meals or drinks" for journalists, nor did NASA's public affairs officers seek to filter information it shared with them – a situation Scheer considered the "healthiest thing you could have."[60] Scheer claimed this despite stating in an internal memo that he wanted the astronauts to exude an "image… of intelligent, hardworking individuals going about their tasks in a businesslike way" and "a completely disciplined outfit."[61] Paine, too, argued the neutrality of NASA's information sharing efforts, apprising the Congress that: "In NASA we do not translate interest in as support for. We only acknowledge the interest and try to supply goods and services on a reactive basis. And it is extremely important to appreciate the fact that these goods and services are factual, not self-serving and not message-bearing."[62]

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[58] *Hearing before the Senate Committee on Appropriations*, Independent Offices Appropriations, 1962, 87th Cong., 1st sess., May 21, 1961, 662. Dryden's views are also discussed by Kauffman, *Selling Outer Space*, 20.

[59] NASA, "Public Affairs Program Review Document," NASA Headquarters, April 19, 1966, 2, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[60] Caryl Rivers, "NASA: News Chief Respects Reporters," *Editor & Publisher*, April 4, 1964, 43.

[61] Scheer to Christopher Kraft, memorandum, "Astronaut Conversations with Wives," August 5, 1965, Folder 7638, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[62] Thomas O. Paine, "Public Interest in the Space Program: Appendix 5," Statement of Dr. Thomas O. Paine, Administrator, NASA, before the Committee on Aeronautical and Space Sciences, United States Senate, April 6, 1970, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Underlines in original.

Thus, under its mandate to share information broadly, NASA reached out to a wide variety of publics to convey the agency's commitment to serving the people of the United States. Collectively, the administrator, other officials, and astronauts gave speeches to hundreds of professional and civic societies each year. The agency also received thousands of public inquiries, some praising NASA but others critical in nature. In engaging with these audiences, NASA officials made a concerted effort to articulate the value of human space flight, imagining and framing it as a service, as progress, in the nation's interest. Consistent with the Cold War environment, many of the arguments swirled around the ideas of bolstering the nation's security, maintaining its influence in world affairs, enhancing U.S. prestige abroad, and advancing the cause of freedom over the perceived communist threat. As NASA deputy administrator Hugh Dryden conveyed in a 1962 speech to the United States Savings and Loan League entitled "The Citizen's Stake in Space Exploration," a human lunar landing would serve not just as "a spectacular achievement" but more importantly would "create for us a space capability second to none – the all-around power to exploit space fully in the national interest whatever that interest may require."[63] Only later in the 1960s, as criticism of expenditures on human space flight increased, did NASA focus arguments on societal welfare. In December 1967 Scheer conveyed to Mrs. Edward Levine of Los Angeles, California, that human space flight provided new scientific knowledge and advanced technology vital to the condition of life on Earth." He also noted that the space program "has given us competence in new techniques and technologies which will help us deal with the urgent social problems that confront a modern society."[64]

[63] Hugh L. Dryden, "The Citizen's Stake in Space Exploration," address at General Session of the United States Savings and Loan League, November 8, 1962, Washington, DC, NASA news release 62-236D, 2, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000039118.pdf.

[64] Scheer to Levine, December 18, 1967, Folder 1904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Webb's latter comment referred to his efforts to link NASA's "Space Age management" methods and its technology transfer program to the woes that President Johnson's "Great Society" programs were designed to address.

The speeches and letters NASA officials composed also attempted to enroll citizens as supporters of human space flight by casting the initiative as one resonant with traditional American and democratic values. Julian Scheer added to a list of explanations countering criticism by Mrs. E. G. Hunter of Massachusetts about the expenditures on space exploration a theme often invoked by President Kennedy: the inexorable myth of Americans' affinity for adventure. Scheer explained: "This move out into space is a tremendous human venture and adventure. It is a challenge to the spirit of man that our Nation, with its tradition of leadership and forward moving, cannot fail to accept."[65] Scheer noted in his letter to Mrs. Levine that the endeavor would allow the "people of the United States" to "carry on the best pioneering traditions of the American people."[66]

Moreover, NASA's rhetoric often suggested that human space flight was a choice that American citizens had consciously and actively made and sustained even when most had not directly been part of the decision-making process. As Scheer conveyed in a letter from Mr. Terrence O'Neill, who had asked about the rationale for a national space program, "The American people have made clear their desire to play a leading role in this exciting new field of human endeavor."[67] Scheer told Mr. Robert Berry of California that "There is every indication that the majority of Americans agree, and through their elected representatives, have consistently supported the National Space Program."[68] Implying an empowered role for citizens, Wernher von Braun delivered a public lecture in Lexington, Massachusetts, in 1959 in which he indicated that he was informing his audience about the tangible and intangible benefits of space exploration so that each individual could make "reasoned judgment" and "exercise his privileges as a

[65] Scheer to Hunter, September 10. 1965, Folder 1903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[66] Scheer to Levine.

[67] Scheer to O'Neill, September 18, 1964, Folder 1903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[68] Scheer to Berry, November 5, 1965, Folder 1903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

citizen to achieve objectives which he considers essential to the welfare of his country."[69] Dryden's "Citizen's Stake" speech noted that the masses would have a virtual role in the adventure of space flight: "The success of the National Space Program hinges on the ability of the American people, through their government, their industry, and their privately endowed institutions, to implement many difficult tasks. Not one or two men will make the landing on the moon, but, figuratively, the entire Nation."[70] While implying room for public debate and involvement, the desires of all of these elites to enroll citizens as attestive supporters of their aims, however, were quite evident.

NASA public affairs officials, meanwhile, aimed both to serve and enroll American citizens by providing access to information, people, and facilities associated with the human space flight endeavor and went to great lengths to achieve this. A great deal of that focus was on forming close connections with members of the news media who, in that era, served as the U.S. government's gateway to communicating with the mass American public. In an era marked by media skepticism of government activity, NASA charted new ground, building what former Kennedy Space Center public information chief Jack King called "adversarial" but "friendly" relationships with journalists.[71] NASA initially released information about launch plans only a short time prior to a launch and provided little status on vehicles in flight, embracing a policy to "do first and talk later" and averring that "our record should be

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[69] Wernher von Braun, "The Citizen in the Space Age," Carey Memorial Lecture, Lexington, MA, November 13, 1959, 3, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000041197.pdf. Von Braun was a master of invoking an imagined American public committed to space flight in speeches aimed at persuading others to believe the endeavor was widely supported. In a 1968 speech to employees at Marshall Space Flight Center, von Braun stated: "The confidence that the American people…have placed in us to perform our tasks during the critical months ahead is a trust that we cannot, and will not, betray." NASA, "Director Asks Employees to be Helpful, Flexible," *Marshall Star*, October 9, 1968, 8, Folder 18178, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. In 1960 von Braun informed a Senate committee that "[h]ere is the tomorrow which youth wants to embrace, and which we must not deny because of a waning of the frontier spirit which made American great." *Hearing before the Senate Committee on Aeronautical and Space Sciences, Subcommittee on NASA Authorization*, NASA Authorization for Fiscal Year 1961, part 1, 86th Cong., 2nd sess., March 29, 1960, 239.

[70] Dryden, "The Citizen's Stake in Space Exploration," 7.

[71] Jack King, interview by Patrick Moore, June 20, 2002, transcript, Kennedy Space Center History Project, Kennedy Space Center, FL.

built on the solid foundation of achievement."[72] Julian Scheer, however, greatly expanded NASA's accommodations for newsmen, arranging news centers and press sites for them at launches and granting them access on a pool basis to mission control rooms and astronaut recovery ships. Scheer also pressed Apollo's technical teams to include television cameras on the lunar landing missions – items not on the original mission requirements list – and to allow live media coverage of transmissions between mission control personnel and astronauts aboard spacecraft. Many astronauts and mission officials resisted the proposals on grounds that such openness might reflect poorly on NASA and the nation if, say, a problem arose during flight or an astronaut let foul language slip on live air. Top NASA officials including Manned Spacecraft Center director Bob Gilruth and Administrator Paine, however, almost always overruled the objections in favor of preserving the open program. The agency afforded similar access to artists, inviting them to capture launches and other aspects of the space program on canvas beginning in 1962. Communications scholar James Kauffman argues that the relationships between NASA, the astronauts, and *Life* magazine in particular grew so close at the start of the human space flight program that *Life* became "little more than an extension of NASA's public relations program."[73] Hugh Harris of Kennedy Space Center's public affairs bureau, however, contended that while the media were "ecstatic" about NASA's successes they were also "honest" in reporting the agency's failures during the 1960s.[74]

While the public affairs offices at NASA Headquarters in Washington and the NASA installations around the country tended to focus their energies on media relations, they also made provisions to showcase the human space flight program directly to the general public. Through pamphlets, films, traveling exhibits, a speakers bureau, and other outreach mechanisms, NASA aimed to

[72] "Apollo Information," May 18, 1967, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[73] Kauffman, *Selling Outer Space*, 10.

[74] Hugh Harris, interview by Roger Launius, Henry, Dethloff, Lee Snaples, and Lisa Malone, June 25, 2001, transcript, Kennedy Space Center History Project, Kennedy Space Center, FL.

educate and inform people about NASA's accomplishments and plans and enable them to "share freely in the excitement and adventure of this peaceful research and exploration into space."[75] NASA partnered with the Department of Defense to sponsor a large "Space Park" exhibit at the World's Fair in New York City in 1964, which Webb considered to be "one of our best opportunities to show manned space flight in its true relation to the other segments of our program and to the development of space pre-eminence for the United States."[76] In 1962 the agency took John Glenn's *Friendship 7* Mercury capsule to major cities as well as remote locales around the world.[77] During 1970-71 paraded the Apollo 11 capsule and Moon rock samples to all 50 U.S. state capitals. NASA noted that the nationwide tour would "enable the public to share the Apollo 11 adventure."

In addition, NASA's field centers, including the Johnson Space Center and what became known as the Kennedy Space Center in Florida, began tours so that the visiting public could see the hardware and facilities that supported the nation's space program. These tours were based on a tradition, as Kristen Starr has described in her research on NACA and NASA public affairs programs, that began at certain NACA installations to hold open houses; NACA's John Victory saw the open houses as an opportunity "to give our customers – the American public – a first-hand view of what we are doing, and to ask questions."[78] Scheer encouraged other NASA officials to invite individuals from outside of the sphere of traditional space program developers and influencers to the Apollo launches to "educate" and make those outside of the aerospace community "aware" of NASA's activities, stopping short of stating a goal of

[75] NASA, *Exploring Space…Project Mercury* (Washington, DC: Government Printing Office, 1961), back cover.

[76] James E. Webb to John A. Powers, August 9, 1963, Folder 1732, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[77] NASA, "Friendship 7 to Go on Tour," news release 62-100, April 19, 1962, Folder 18178, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[78] Starr, "NASA's Hidden Power," 115.

garnering appreciation and support.[79] Public affairs staffs also developed systems to handle and answer each of thousands of letters annually from people around the country and world.

The agency strived to serve and enroll citizens as supporters of human space flight in still other ways. The launch of *Sputnik* had galvanized science education within government and academic institutions throughout the country, including NASA, which recognized the importance of enrolling students as the nation's pool of future scientists and engineers. As Webb stated, "Among the major motivations of the space program is…the stimulating effects of this challenging national enterprise on all segments of American society, particularly the young."[80] NASA created an education office to develop materials for teachers to explain space concepts to their classes and sent NASA staff to visit schools and communities with "Spacemobile" vans filled with models and science demonstrations. The agency stood up a "University Program" to support higher education as well as efforts to attract early interest in space-related fields and careers among elementary and secondary students. NASA further aimed to educate students as well as adults to "achieve for our country a science-literate citizenry able to understand and act intelligently in the face of many problems emerging from an age of science and technology."[81] Among the agency's efforts was a pilot project with Howard University to "provide space-age understandings" for "culturally deprived adults" with limited reading ability. Offering a glimpse into the fine line NASA straddled between serving others and serving itself, a reviewer of the program noted that "it is a touchy business when you are trying to sell people on the social and economic impact in the space

[79] Scheer to distribution, memorandum, "Protocol Plans for Apollo Manned Missions," June 17, 1968, Folder 1904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Scheer to distribution, memorandum, "Invitations to View Launch of Apollo 5," December 18, 1967, Folder 1904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[80] NASA, *Space: The New Frontier* (Washington, DC: Government Printing Office, 1963), 2.

[81] James E. Webb and Hiden T. Cox, "Accelerated Space Exploration: An Imperative for Americans," remarks for delivery at the Annual Convention, American Association of School Administrators, Atlantic City, NJ, February 18, 1962, NASA news release 62-34, 17, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

program and you run into a lot of members of Congress who take exception to working with adults in this area."[82]

NASA officials nonetheless felt justified in maintaining relationships with external publics based on information and display in large part because of the strong positive feedback they received in the media and from enthusiasts for space flight. While agency officials would closely monitor polls and recognized dissension, they were energized and encouraged by the public interest in the astronauts and the spectacle of launch. Reporters, and then members of the general public, reacted to NASA's presentation of the Mercury astronauts in 1959 with what Roger Launius calls a "wave of excitement…like no one at NASA had ever seen before."[83] Hundreds of requests flooded in for astronaut appearances at a variety of events. Various media outlets heaped praise on the agency's approach to engagement. A 1965 article in *The Washington Post* noted that NASA's open information policy "has made every American a participant in its exciting conquests of space." The story carried a quote from a West German publication which said: "The Americans make it possible for the public around the world to participate without reservation in all phases of their exploration of space.… [T]he advantage is that the observer feels caught up in the adventure to a greater degree than if he were served up a success with victory fanfares in an all-inclusive communiqué."[84] In other words, NASA gathered that citizens of the United States and worldwide greatly desired to be made aware of, if not a part, of the agency's human space flight program, and NASA obliged to fulfill this "demand."

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[82] NASA, "Public Affairs Program Review Document," 29-30.

[83] Roger D. Launius, "First Steps into Space: Projects Mercury and Gemini," in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program: Vol. VII: Human Space Flight: Projects Mercury, Gemini, and Apollo*, ed. John M. Logsdon, NASA SP-2008-4407 (Washington, DC: U.S. Government Printing Office, 2008), 18.

[84] "Secrecy in Space," *Washington Post*, August 27, 1965, Folder 18178, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Contributing to agency officials' belief that its quasi-democratic approach to public engagement of open communications was the right one was the heady volume of requests NASA received from members of the public for information from the agency. By 1966, NASA was receiving more mail from the public than any other government agency.[85] By the time the Apollo 11 astronauts reached the Moon in 1969, more than 60,000 letters per month flowed into the agency's mail rooms, with huge numbers of those letters addressed to the astronauts.[86] Every day, in NASA's estimation, 50,000 people viewed NASA exhibits, 9,500 requested NASA publications, 10,000 schoolchildren enjoyed Spacemobile demonstrations, and 16,000 watched a NASA-produced film.[87] Demand for Spacemobile visits far exceeded NASA's ability to fulfill all requests. In 1969, 2.6 million people combined toured NASA facilities.[88] Comment cards collected from Kennedy Space Center tour participants indicated that less than 1 percent of respondents were critical of the space program, with many visitors expressing that the tour made feel "grateful" or "proud" or showed them the "necessity" of the space program.[89]

Taking stock of the positive interest and feedback, Scheer's successor, John Donnelly, would maintain in 1971: "Thanks to the candid, responsive public affairs posture it has maintained, particularly with respect to manned space flight, NASA has earned an excellent credibility rating with the press and the public."[90] As the 1960s wore on, however, opinion polls and other developments belied that claim and cast doubt on NASA's sociotechnical imaginary for space flight. Despite the enthusiasm NASA witnessed, more than half of American citizens believed the government should stop funding Apollo as

[85] NASA, "Public Affairs Program Review Document," 3.

[86] Duff, interview, April 24, 1989.

[87] NASA, "Public Affairs Program Review Document," 3.

[88] Thomas O. Paine, "Public Interest in the Space Program: Appendix 5," 4.

[89] "Comment Cards," news release NT-369, TWA-NASA Tours press packet, July 11, 1969, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[90] John P. Donnelly to Fletcher, memorandum (draft), October 28, 1971, Folder 7638, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

they trained their attention on addressing domestic needs and civil unrest and questioned the tragic deaths of three Apollo astronauts who perished in a fire during a training accident on the launch pad in January 1967.[91] Representative William Fitts Ryan of New York took particular umbrage to NASA's handling of the Apollo fire and expressed his conviction that "the public which, at a tremendous cost, is financing NASA's efforts in space, has a right to know how its money is being spent…the public has not been allowed to review [NASA's future] plans and to approve of future expenditures."[92]

NASA remained committed to diffusing information about human space flight, but not for the normative ends the congressman advocated. NASA's aims for doing so were certainly couched in charitable terms but also were highly instrumental: to fuel and fulfill public interest in the endeavor with the aim of gaining widespread support of an attestive public, including propagation of the enterprise through the grooming of future generations of its workforce. The agency had claimed its service to external publics through quasi-democratic approaches but was not willing to recognize them as anything more than "armchair" participants in and accepting fans of human space flight. As the next section shows, however, the concerns of human space flight skeptics would become too pronounced for NASA to brush aside and would factor into choices about human space initiatives in the post-Apollo era.

Facing Challenges to Human Space Flight's Legitimacy

When Nixon entered office in the months leading up to the Apollo 11 launch, he recognized that the nation would need to decide on a direction for the U.S. civil space program following Apollo. His transition task force on space had weighed in with its own recommendations, but Nixon's advisor, economist Arthur Burns, proposed that Nixon form an interagency committee to sift through the options

[91] Louis Harris, "Space Programs Losing Support," *Washington Post*, July 31, 1967, Folder 6620, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[92] *Cong. Rec.*, 90th Cong., 1st sess., April 26, 1967, vol. 113: H4733.

and provide recommendations to the President on the course the nation should take.[93] In February 1969 Nixon tasked Vice President Spiro Agnew, also chair of the National Aeronautics and Space Council, with spearheading a Space Task Group to fulfill this function. The Space Task Group included NASA Administrator Paine, Defense Secretary Melvin Laird (represented by Secretary of the Air Force Robert Seamans), and Nixon's science adviser, Lee DuBridge. Bureau of the Budget director Robert Mayo, Atomic Energy Commission chairman Glenn Seaborg, and Undersecretary of State U. Alexis Johnson participated as observers.

Paine initially aimed to circumvent the Space Task Group and ask Nixon directly to support a robust post-Apollo human space flight program. Nixon's advisors, however, directed him to work within the confines of the group.[94] Just two weeks after the Apollo 11 *Eagle* touched down on the lunar surface, on August 4, 1969, Paine presented NASA's ambitious human space flight proposal to the Space Task Group, hoping the agency's recent success without parallel would boost the Space Task Group members' endorsement of a follow-on. Paine told the Space Task Group members that "Apollo 11 started a movement that will never end, a new outward movement in which man will go to the planets, first to explore, and then to occupy and utilize them."[95] He then handed the floor to Wernher von Braun, on whom he had relied to orchestrate NASA's plan to send humans to Mars before the mid-1980s. Von Braun explained to the principals the details of an expedition that would take a dozen astronauts to the Martian surface and back to Earth. The journey would begin in late 1981 and return to Earth orbit in the summer of 1983.

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[93] T. A. Heppenheimer, *The Space Shuttle Decision: NASA's Search for a Reusable Space Vehicle*, NASA SP-4221 (Washington, DC: U.S. Government Printing Office, 1999), 123.

[94] Thomas O. Paine to the President, memorandum, "Problems and Opportunities in Manned Space Flight," February 26, 1969, in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. I: Organizing for Exploration*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 1995), 513-519.

[95] Heppenheimer, *The Space Shuttle Decision*, 148.

But even working within the glow of the historical Apollo 11 achievement, the members of Nixon's Space Task Group tasked with recommending future directions for NASA were not universally won over by NASA's advocacy for another costly crash program, this time to send humans to Mars. Vice President Agnew proved a staunch supporter for an ambitious human program to rival Apollo, having asked the Space Task Group to consider options for an Apollo follow-up program and expressing at the time of the Apollo 11 launch his "individual feeling that we should articulate a simple, ambitious, optimistic goal of a manned flight to Mars by the end of the century."[96] Even so, a quest to explore and exploit the planets seemed to other Space Task Group participants to be unanchored to any national priority. Sensitive to the social turmoil and budget pressures of the era, Secretary of the Air Force Robert Seamans argued that NASA might make a more politically acceptable contribution if the agency were to apply its capabilities to "solution of the problems directly affecting men here on earth."[97] Director of the Bureau of the Budget Robert Mayo, who served as an observer to the Space Task Group deliberations, opposed based on the President's commitment to submitting a balanced budget for FY 1971 in an era plagued by reduced revenues, inflation, and the financial burdens of U.S. participation in the Vietnam conflict and social programs' needs.

With Paine and Agnew, however, remaining determined to raise the possibility of sending humans to Mars to the President, the Space Task Group members decided, rather than to convey a consensus recommendation to Nixon, to present options for the President's consideration. On September 15, 1969, the Space Task Group submitted its report to Nixon. The report recognized the space program as a "national resource" and acknowledged that Apollo 11 marked "only a beginning to the long-term

[96] Richard Witkin, "Agnew Proposes a Mars Landing," *New York Times*, July 17, 1969, 1, 22, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

[97] Robert C. Seamans Jr. to Spiro T. Agnew, August 4, 1969, in *Exploring the Unknown, Vol I.*, 522.

exploration and use of space by man."[98] Emphasizing program balance, the report reflected the disparity in the Space Task Group members' policy preferences. While the opening summary's second paragraph noted the members' conclusion "that the space program for the future must include increased emphasis upon space applications" in areas including Earth resources and communications, the next paragraph stated: "We have also found strong and wide-spread personal identification with the manned flight program, and with the outstanding men who have participated as astronauts in this program. We have concluded that a forward-looking space program for the future for this Nation should include continuation of manned space flight activity."[99] The report outlined five program objectives that would balance human and robotic projects: an expanded space applications program; the use of space to accomplish defense missions; a program of robotic missions to study the Earth, Moon, planets, universe, and phenomena therein; opportunities for international participation and cooperation; and the development of space systems, beginning with a "new space transportation capability" and space station modules, focused on the principles of commonality, reusability, and economy.[100]

While articulating an awareness of external constraints on NASA's budget in the coming years and the value of balancing human space flight with other potential directions for the space program, the Space Task Group report nonetheless made clear the possibilities for achieving the sorts of human-tended projects that Paine advocated.[101] Nixon's domestic policy advisor, John Erlichman, had discouraged the group from including an option as ambitious and costly as Paine's proposal but did not object to the Space Task Group raising the possibility of a long-range goal of a human mission to Mars along with

[98] Space Task Group, *The Post-Apollo Space Program: Directions for the Future*, September 1969, in *Exploring the Unknown, Vol. I*, 523.

[99] Ibid., 523.

[100] Ibid., 524.

[101] The final Space Task Group report, however, also indicated that "a decision to phase out manned space flight operations, although painful, is the only way to achieve significant reductions in NASA budgets over the long term." Ibid., 540.

other human space flight objectives.[102] The Space Task Group thus included a carefully crafted statement in the report that "a manned Mars mission should be accepted as a long-range goal for the space program" and listed three pathways that would lead to the achievement of this goal before the end of the century. The most aggressive, costly option, peaking at $8-10 billion by 1980, entailed a modest Earth-orbiting station by 1976, a 50-man Earth-orbiting station and a lunar surface base being completed in 1980, and a human flight to Mars in 1983. The least ambitious option, needing half the amount of funding, would develop the modest station by 1977 and the larger station and lunar base before the mid-1980s but defer the Mars mission to an undetermined date. All of the options included as foundational elements the development of a reusable, chemically-fueled "shuttle" operating between Earth's surface and low-Earth orbit in an "airline-type mode" as well as chemically- and nuclear-propelled systems to move humans and equipment between orbits, to lunar orbit, and to the lunar surface.

Sensitive to how the President might react to the high price tags of any of these options, the Space Task Group members did not advocate within the report any timescales for accomplishing these milestones or landing humans on Mars. In the course of transmitting the report to Nixon, however, Agnew urged the President to support the middle option, which called for the development of a modest space station and an Earth-to-orbit shuttle by 1977 and a human Mars mission by 1986. A few days after the meeting with Nixon, Paine wrote to the President with an endorsement of this option as well, expressing his hope that as the nation progressed toward meeting its other needs, "we might be able to reexamine this and move closer to Option I."[103]

With the Space Task Group's report in hand, Nixon had to determine what sort of future to champion for the nation's space program, and to what extent human ventures off the planet should be a

[102] For more on this encounter, see John Erlichman, *Witness to Power: The Nixon Years* (New York: Simon and Schuster, 1982), 144-145.

[103] John M. Logsdon, *After Apollo? Richard Nixon and the American Space Program* (New York: Palgrave Macmillan, 2015), 80.

part of that vision. On one hand, Nixon's previous stance on space and his actions in the days surrounding the Apollo 11 mission suggested that the President might have been willing to embrace the challenge of sending humans to Mars. A space enthusiast at heart, he had played a key role as Eisenhower's vice president in establishing a civilian space program for the nation. During his 1968 campaign for the presidency, Nixon had expressed in a speech at the Manned Space Center in Houston his determination to keep the United States as the world's leader in space, implying that human space flight would play an important part of the solution.[104]

Moreover, like so many Americans and others around the world who got caught up in the ecstasy of Apollo 11, President Nixon lauded the significance of the lunar landing for the nation and for humanity more generally. Over the course of the Apollo 11 mission, he talked with the mission's astronauts three times: just prior to launch, while they were on the Moon, and following splashdown. During that third exchange he noted that the week of Apollo 11's journey had been "the greatest week in the history of the world since the Creation." Seeing fit to celebrate the accomplishment on a countrywide scale, Nixon designated just after Apollo's launch that the day following the lunar landing, Monday, July 21, would be a "National Day of Participation." He directed that American flags be flown on all government buildings and that non-security-related federal agencies close and encouraged state and local governments, private employers, and school systems to do the same so that American citizens could "share in the significant events" of that day. Noting that television "makes all of us participants" in space flight, Nixon emphasized in his proclamation that the enterprise was commonly owned and unifying: "The adventure is not theirs alone, but everyone's; the history they are making is not only scientific history, but human

[104] "A Troubled NASA Begins another Decade, Impasse for Air Defense," *Space/Aeronautics*, October 1968, 27.

history. That moment when man first sets foot on a body other than earth will stand through the centuries as one supreme in human experience, and profound in its meaning for generations to come."[105]

At the same time, Nixon was a very astute politician who paid close attention to opinion polls, the media, the sentiments of Congress, and other sources of information that revealed the attitudes of various segments of the public as he contemplated policy alternatives in all areas. Space was no exception, and the President was determined to forge a path that fit best within the interests of various constituencies. Nixon would spend the several months following the Space Task Group report's release monitoring reactions to it in order to determine what sort of budget – and what sort of vision for space flight – to include for NASA within his administration's FY 1971 federal government funding request to Congress, which would roll out in early 1970.

Even in establishing the Space Task Group, Nixon had expressed that "in developing your proposed plans, you may wish to seek advice from the scientific, engineering, and industrial communities, from The Congress and the public."[106] The request to include "the public," rather than only NASA's political and financial stakeholders, was a choice that broke with NASA's tendency not to solicit directly the views of the broad citizenry. The Space Task Group fulfilled Nixon's recommendation by proxy, however, inviting a group of 31 intellectual, industrial, civic, and political leaders to advise the committee on directions for the space program. Agnew said to the group,

> [I]t would be ludicrous to say that you are the man in the street and that this is participatory democracy. Your profile is clearly that of America's intellectual, industrial, civic, and political leadership. But it is accurate to say that you are here to represent the man in the street and your participation reflects the finest tradition of participatory democracy. We are asking you to advise

[105] Richard Nixon, Proclamation 3919, "National Day of Participation Honoring the Apollo 11 Mission," July 16, 1969, in *The American Presidency Project*, eds. Gerhard Peters and John T. Woolley, accessed December 8, 2014, http://www.presidency.ucsb.edu/ws/?pid=2128.

[106] Richard Nixon to the Vice President, the Secretary of Defense, the Acting Administrator, NASA, and the Science Adviser, memorandum, February 13, 1969, in *Exploring the Unknown, Vol. I*, 513.

us on policy decisions that we hope the man in the street will be happy to live with for the next decade.[107]

After receiving briefings on the Space Task Group's plans, several of the invitees questioned the necessity of creating a major new goal for NASA, doubting its potential impact on public interest in the space program. In addition, several industry and scientific stakeholder organizations provided views to the Space Task Group. Like the Space Task Group's invited contributors, the nation's premier aerospace professional society, the American Institute for Aeronautics and Astronautics, rejected the wisdom of pursuing a single, major space objective, albeit out of concern that doing so would restrict other space pursuits, including the society's preference for emphasis on activities in Earth orbit including a "partially reusable space transportation system" to deliver payloads to orbit.[108] The National Academy of Science's Space Science Board, meanwhile, took the opportunity to express again its skepticism about a long-term human space flight program. The Space Science Board's input to the Space Task Group acknowledged "possible roles for man" in scientific activities in the future but advocated in the near term for scientific studies of the solar system and universe using robotic probes and telescopes and applications of space technology for "the economic and social uses of mankind."[109] For both of these groups, a major human space flight initiative would have only marginal benefit to them, instead tying up funding that they could use to advance their goals more directly.

It is unclear whether these inputs ever reached Nixon; the publicly released Space Task Group report did not acknowledge them or how they were considered. What is notable about them, however, is that neither the space-related professional organizations nor those intended to represent the views of "average" citizens advocated for the sort of spectacular human space flight program Paine and Agnew

[107] Remarks of Vice President Agnew, July 7, 1969, attached to memorandum, Russell Drew to Members and Observers of the Space Task Group, July 29, 1969, quoted in Logsdon, *After Apollo?*, 60.

[108] American Institute for Aeronautics and Astronautics, "The Post-Apollo Space Program: An AIAA View," May 20, 1969, quoted in ibid.

[109] Harry Hess to Lee DuBridge, June 23, 1969, quoted in ibid., 60-61.

envisioned. Moreover, these perspectives reflected broader trends manifested elsewhere in the months leading up to and following Apollo 11 and the Space Task Group report's release concerning what many Americans believed about the importance and prudence of undertaking another large-scale human space flight effort as a national endeavor. The trends indicated that while Apollo 11's epic achievement undeniably ignited and unleashed widespread public and media reactions of euphoria, national unity, and pride in humankind's capabilities, those sentiments did not resonate with all Americans and proved ephemeral for many. Nixon would have to determine how to relate any human space flight program to a citizenry that was not attestive but in fact divided concerning this initiative.

To be sure, there were still many who subscribed to NASA's Apollo-era imaginary and believed in maintaining a strong national space program. But polls revealed that far fewer people than the Apollo hype suggested believed the result had been worth the nation's resource commitment.[110] Even in 1969, at the time of the lunar landing, only 53 percent of those surveyed believed the mission justified the investment.[111] Another July 1969 poll showed that only 39 percent of respondents favored a government funded mission to Mars while 53 percent opposed.[112] A July 27, 1969, *New York Times* editorial echoed these themes, stating: "This is not, in our opinion, a time to commit the nation to any hard timetable for

[110] For trends in public opinions about Apollo spending, see Herbert E. Krugman, "Public Attitudes toward the Apollo Space Program, 1965-1975," *Journal of Communication* 27 (1977): 87-93. It should be noted that polls over the years have variously asked respondents to indicate their support for "NASA," "the space program," "space exploration," "human space flight" and specific programs, such as Apollo or the Space Shuttle. These terms, of course, are not synonymous. It is unclear whether pollsters recognized the difference or whether they came to see these terms as being one and the same because of the emphasis NASA put on its human space flight programs. In any case, the terminology and other question wording differences often make it difficult to compare and identify trends in responses.

[111] Louis Harris, "Americans Still Question Space Budget," *Washington Post*, August 25, 1969, A2, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[112] "A Poll Finds Public Lukewarm on Mars," *New York Times*, August 7, 1969, 20, accessed February 22, 2015, ProQuest Historical Databases: The new York Times. Agnew and Paine were already publicly floating the idea of a human mission to Mars before the Space Task Group report's September 1969 release.

another space spectacular, or to launch a crash program for Martian landing comparable to the convulsive effort that has put us on the moon."[113]

Indeed, the questions many had raised about the value of the space program relative to other national needs throughout the course of the 1960s, but which NASA had attempted to placate by contending that human space flight served the American public, persisted in 1969, perhaps becoming even more poignant as three men bounced around on the Moon's surface at a cost to taxpayers of tens of billions of dollars. Many liberal intellectuals, disadvantaged groups, and sympathetic Americans rejected both of the justifications Kennedy and NASA had offered for the human space flight program: that it was a geopolitical necessity and an opportunity to pioneer a new frontier. Instead, they maintained that the nation had misplaced national priorities in supporting the space program, with many asking: "If we can put a man on the Moon, why can't we [solve any number of problems on Earth]?" Physicist Ralph Lapp observed that "Our astronauts glide through space at 25,000 m.p.h. while our streets are choked with bumper-to-bumper traffic…Space men nibble on expensively developed diets while Biafran children die from malnutrition."[114] Reverend Ralph Abernathy, president of the Southern Christian Leadership Conference, aimed to make this point in a visceral way when he brought dozens of poor southern families via mules and wagons to Kennedy Space Center to protest in the days leading to the Apollo 11 launch. Abernathy remarked on the "bizarre social values" of an American society which "though it has the capacity to meet extraordinary challenges, it has failed to use it ability to rid itself of the scourges of racism, poverty, and war, all of which were brutally scarring the nation even as it mobilized for the assault on the solar system."[115] That many black Americans felt antipathy toward the Apollo program

[113] Walter Sullivan, "Next: On to Mars?" *New York Times*, July 27, 1969, E1, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

[114] Ralph E. Lapp, "Send Computers, Not Men, Into Deep Space," *New York Times*, February 2, 1969, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

[115] NASA, *Astronautics and Aeronautics, 1969: Chronology on Science, Technology, and Policy*, NASA SP-4014 (Washington, DC: U.S. Government Printing Office, 1970), 201.

while they endured life in inner city slums was further brought to light by Gil Scott-Heron's 1970 song, "Whitey on the Moon":

A rat done bit my sister Nell.
(with Whitey on the moon)
Her face and arms began to swell.
(and Whitey's on the moon)
I can't pay no doctor bill.
(but Whitey's on the moon)
Ten years from now I'll be paying still.
(while Whitey's on the moon)
The man just upped my rent last night.
('cause Whitey's on the moon)…[116]

A number of members of Congress representing concerned constituents also chimed in with doubts about NASA's contributions to meeting society's most dire needs. Responding to Paine's testimony on the future of human space flight at an August 1969 Senate Space Committee hearing, Republican Senator Mark Hatfield of Oregon remarked that while he did not want the nation to abandon the space program, the decision to send humans to the Moon "showed a distorted sense of values in this country. I think a lot of people are thinking this every day: 'We have unmet needs elsewhere – in education, housing, and so forth.' They began to see the space program as the detractor…"[117] Joseph Karth, representative from Minnesota, argued that any mandate to put humans on Mars would indicate that NASA showed a "complete lack of respect for the taxpayer."[118] Even Senator Edward Kennedy, brother of the late President John F. Kennedy who spurred the Apollo program, called just prior to the first Moon landing for a deceleration of the program once the goal was achieved and to divert a

[116] Gil Scott-Heron, "Whitey on the Moon," *A New Black Poet - Small Talk at 125th and Lenox*, Flying Dutchman Records, 1970.

[117] *Hearing before the Senate Committee on Aeronautical and Space Sciences*, Future NASA Space Programs, 91st Cong., 1st sess., August 5, 1969, 47.

[118] William J. Normyle, "Manned Mission to Mars Opposed," *Aviation Week & Space Technology* 91 (August 18, 1969): 16.

"substantial portion" of NASA's budget "to the pressing issues here at home."[119] Some criticized Apollo as a welfare program and a playground for the aerospace industry.

In a similar vein, doubts about human space flight emerged from those who had grown skeptical about the intentions and priorities of political authorities and technoscientific experts. Americans living in the late 1960s had enjoyed some of the most remarkable advances that science and technology had to offer: vaccines that eradicated deadly diseases, oral contraceptives that opened new career opportunities to women, and conveniences like hand-held calculators and countertop microwave ovens that were enabled by advances in electronics. But they had also seen some of technoscience's most devastating effects on human life: the atomic bomb, synthetic pesticides that degraded the environment and posed hazards to human and animal health, and the weaponry and chemical agents used to wage an unpopular war in Vietnam. Vannevar Bush's post-World War II social contract model of technoscientific governance – that if scientists were given funding and left to their own devices, then society would be rewarded with untold benefits – had not quite held up as far as many were concerned. Despite many scientists' and engineers' claims, technoscientific advances did not necessarily equate with "progress" as measured by various social standards. The intentions of government, especially military, officials in using the tools of science and technology were equally suspect, and the space program, with its conceptualization as an instrument for "fighting" the cold war, was subject to criticism by anti-technocrats. On the eve of the Apollo 11 launch, Joseph Morgenstern questioned the wisdom behind the initiative in a *Newsweek* piece:

> We want desperately to believe it when our political and scientific leaders assure us with such calm rationality that they know precisely what they're doing. Yet our confidence wanes as our thoughts wander, willy-nilly, to the calm rationality of the people who got us into Vietnam, the calm rationality of the factory builders who despoiled our water and air, the calm rationality of all

[119] "Kennedy Asks Space Slowdown," *Washington Post*, May 20, 1969, A13, Folder 1171, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

> the decades of technologists who've calmly welshed on their promises of health and happiness for all.[120]

Further, comments like that one U.S. senator made upon the *Eagle*'s landing on the Moon – that humans had become "masters of the universe" – seemed incredibly anachronistic as many people's faith in technology projects' ability to solve social problems dried out.[121] While the Apollo astronauts' iconic photographs of planet Earth suspended in the blackness of space did wonders for the environmental movement, many environmentalists and others who felt the shift from technological optimism to disillusionment railed nonetheless against human arrogance that "man could still do anything he wants as long as he has the will to do it and the money to spend."[122] Many argued for democratic control over technology and investments in sciences that could help address growing health, environment, and energy crises.

Questions about the propriety of human space flight as NASA had conducted it, however, were not limited to those who opposed big government-funded science and technology projects. Space scientists echoed the Space Science Board's input to the Space Task Group that, like human space flight advocates, they were also eager to access space but for different purposes and via different means. The concerns echoed those the community had offered earlier in the decade when the human program got underway. As Ralph Lapp wrote in 1969, "the heroic aspect of manned spaceflights has tended to obscure the fundamental values of space science," which prized the acquisition of knowledge via unmanned probes and telescopes over extending human presence into space for its own sake.[123] Space scientist A. J. Dessler of Rice University expressed that members of his community were not properly

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[120] Joseph Morgenstern, "What's It to Us?" *Newsweek*, July 7, 1969, 68.

[121] Loren Eiseley, *The Invisible Pyramid* (New York: Charles Scribner's Sons, 1970), 32.

[122] John O'Connor, "TV: CBS Special on Space Tonight," *New York Times*, July 22, 1974, 56, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

[123] Erlend A. Kennan and Edmund H Harvey, Jr., *Mission to the Moon* (New York: Morrow, 1969), xiv.

represented in NASA's decision-making processes and thus were unable to optimize space systems for their needs: "They feel that the engineers are in such a strong position within NASA that they can generate a transportation system and then turn to the scientists and say: 'Here it is. What do you want to do with it?'"[124]

In addition, even some human space flight enthusiasts had become disillusioned with NASA's approach to the endeavor. The Apollo 1 fire, which had killed three astronauts during a training exercise while in a capsule on the launch pad, had since the 1967 event destroyed the idealized perceptions of NASA that many had held. Some experienced what Michael A. G. Michaud called "a sense of frustrated hope" because of the program's seemingly elitist nature.[125] NASA's space flight imaginary, in other words, had not included a meaningful role for them. Impressive as it was to behold the view of the astronauts who took humanity's first steps on another world on television and then later as they were regaled in tickertape parades, the fact that so few were chosen – and from a similar mold of white, male test pilots – alienated many "ordinary people" who could not relate to the astronauts and were disappointed in NASA's approach to connecting them to the space program.[126] In March 1971 NASA deputy administrator George Low was told by editors at *Life* magazine, which had once thrilled at holding exclusive rights to the astronauts' personal stories, that astronauts would no longer "sell" because people could not relate to them.[127]

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[124] A. J. Dessler, "Discontent of Space-Science Community," October 30, 1969, 3, in Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[125] Michael A. G. Michaud, *Reaching for the High Frontier: The American Pro-Space Movement, 1972-1984* (New York: Praeger, 1986).

[126] See, for example, "People Needed in Picture," *Sentinel Star* (Orlando, FL), September 16, 1973, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[127] Kim McQuaid, "Selling the Space Age: NASA and Earth's Environment, 1958-1990," *Environment and History* 12, no. 2 (2006): 140.

Still others who did not necessarily reject the commitment of massive resources to human space flight during the 1960 felt increasingly that NASA's human space flight imaginary no longer served the nation effectively. That NASA, many policymakers, and the media had so strongly linked NASA's human space flight program with establishing America's technological and ideological supremacy over the Soviet Union created a sense for many Americans that NASA and the human space flight program had only this single raison d'être. By the time of the lunar landings, NASA and the media had emphasized the Apollo initiative and this imaginary so heavily that, as one *New York Times* article put it, "the public was left with the misleading impression that Apollo *was* the space program."[128] For those who had come to recognize NASA and human space flight in these heroic, nationalistic terms, the Apollo 11 astronauts' arrival on the Moon and their safe return to Earth signaled the end of the space race, with the United States its prestigious winner, and human space flight – and perhaps NASA – no longer needed. Now the nation could cease spending on the space front and turn its attention to diplomatic efforts aimed at détente. As public opinion researcher Herbert Krugman put it, "[P]ublic support for the Apollo program had been designed to self-destruct on the initial achievement of the program's major objective."[129] John Noble Wilford of the *New York Times* similarly maintained that NASA failed to hold public interest in human space flight because both the agency and the media had conditioned people to regard the lunar landing as "the grand climax of the space program, a geopolitical horse race and extraterrestrial entertainment – not as a dramatic means to the greater end of developing a far-ranging spacefaring capability."[130]

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[128] John Noble Wilford, "Few Ask the Old Question: Is Space Worth the Trip?" *New York Times*, December 2, 1973, 6, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

[129] Krugman, "Public Attitudes toward the Apollo Space Program, 1965-1975," 93.

[130] John Noble Wilford, "A Spacefaring People: Keynote Address," in *A Spacefaring People: Perspectives on Early Spaceflight*, ed. Alex Roland, NASA SP-4405 (Washington, DC: U.S. Government Printing Office, 1985), 71.

Ultimately, doubts about the value of space spending after Apollo 11's culmination emanated from across the political spectrum. An October 1969 *Newsweek* poll of Americans with annual household incomes ranging from $5,000 to $15,000 revealed that 56 percent of the 1,321 respondents believed the government should be spending less money on space exploration while only 10 percent thought the government should be spending more. As Nixon's assistant and liaison to NASA, Peter Flanigan, pointed out to the President: "This represents 61% of the white population and is obviously the heart of your constituency."[131] In other words, while liberals and minorities may have been most vocal in their opposition to a major government-supported space program, even some within Nixon's "silent majority" of middle-class Americans – those to whom the President most appealed for his political strength – were likely questioning space.

NASA had worked throughout the 1960s to satiate space flight enthusiasts and to placate those who questioned the value of human space flight with its education and messaging efforts in an attempt to construct a single, attestive public of supporters. It became clear to Nixon, however, that Americans hardly constituted a single public that did or would support the initiation of another major human space flight program: their demands were too disparate and to a large extent ran contrary to the aims of a human program, at least as such a program had been framed in the 1960s. Broadly speaking, there was clearly a chasm between people's enthusiasm for the spectacle and sense of national pride that Apollo 11 conjured – where such interest had existed – and their convictions about whether the nation should be investing its limited financial resources in human space flight spectaculars. These citizens, for Nixon, were also the nation's electorate. Space was clearly not their highest priority, and if Nixon did not tailor the space program and NASA's budget in a way that would appease them and reduce federal spending as he had pledged, they might well take that into consideration in the 1972 election.

[131] Peter M. Flanigan to the President, memorandum, December 6, 1969, in *Exploring the Unknown, Vol. I*, 546.

Under these constraints, Nixon felt he could not accept even the least ambitious of the three options the Space Task Group put forward, let alone the recommendation by Agnew and Paine to commit the resources required to send humans to Mars by the early 1980s. Indeed, given the social milieu, it was unclear into what sort of sociotechnical imaginary a government-led Mars mission would fit. Following considerable back-and-forth between NASA and administration officials about the latter's plans for a Space Task Group report response and the agency's FY 1971 budget, Nixon proposed for FY 1971 a reduction of more than $400 million from NASA's FY 1970 budget. Those cuts would require NASA to cancel the last scheduled Apollo mission (Apollo 20), defer Apollo missions 18 and 19 until 1974. Paine and Nixon discussed the decision at a meeting in January 1970, as final budget decisions were being announced publicly. Paine sensed from the conversation with Nixon that the President "honestly would like to support a more vigorous space program" but that "[t]he polls and the people to whom he talked indicated to him that the mood of the people was for cuts in space and defense."[132] Believing strongly in the space program's long-term future, the President encouraged Paine to try and engender public interest in the human program in much the way NASA often had, by having "subsequent crews of astronauts visit the smaller cities of America like Rochester or Syracuse."[133] At the same time, Paine took direction from Nixon that:

> …it is very important when we [NASA] prepare his space speech that it be written in such a way that the opposition cannot invidiously compare his positive statements on space to problems in poverty and social programs here on earth. We cannot put the President in a position where it appears that he is taking money away from social programs and the needs of people here to fund spectacular crash programs out in space. I assured him that we could show that his support of advanced aerospace science and technology were [sic] of vital importance to the nation's future.[134]

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[132] Thomas Paine, memorandum for the record, "Meeting with The President," January 22, 1970, 1, Folder 12578, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The quoted phrases are Paine's summary of Nixon's comments.

[133] Ibid.

[134] Ibid., 4.

Nixon released his official response to the Space Task Group recommendations in a public statement in Key Biscayne, Florida, on March 7, 1970. What he embraced from the report was the concept of balance in the space program. Indeed, the carefully crafted speech reflected Nixon's determination not to be the President to terminate the human space program while defining "new goals which make sense for the seventies" and making sure that "space expenditures…take their proper place within a rigorous system of national priorities."[135] He suggested that "what we do in space from here on in must become a normal and regular part of our national life" but cautioned that these activities "must be planned in conjunction with all of the other undertakings which are also important to us."[136] Declaring that "space activities will be part of our lives for the rest of time," Nixon concurrently expressed that the space program he would support would "put our new learning to work for the immediate benefit of all people."[137] The speech offered three general purposes to guide the space program: exploration, scientific knowledge, and practical applications of knowledge gains to benefit life on Earth. All at once, the statement seemed to promise that NASA would realize the myriad of dreams, expectations, and limitations that its disparate publics demanded of it.

In making these overtures to appeal to space supporters and detractors alike, Nixon's speech proved almost completely noncommittal to NASA's human space flight program. The President stated that "the most important thing about man's first footsteps of [sic] the moon is what they promise for the future."[138] But the speech was silent on details, project plans, and timelines. He expressed that "we look forward to the day" when NASA would work with the space agencies of other nations to internationalize

[135] Richard M. Nixon, "Statement on Space," Key Biscayne, FL, March 7, 1970, 2, Folder 4702, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[136] Ibid.

[137] Ibid., 4.

[138] Ibid., 2.

the U.S. space program's astronaut crews.[139] He noted that decisions about lunar voyages beyond the remaining Apollo missions would be based on the program's results. In addition, he asserted that the nation "will eventually send men to explore the planet Mars" as part of a "bold" program to explore the planets and universe using robotic spacecraft but gave no target dates. Nor did the speech mention plans for a major orbiting space station; the President only specified that NASA would use systems developed for the Apollo program to build an "experimental space station" to prepare humans to live and work in space for long periods of time. This project, which became known as Skylab, would fly three crews of three American astronauts each to the orbiting workshop to conduct a variety of scientific experiments; the project would, however, last only for one year.

Indeed, the President made no pledge to the sort of major post-Apollo human space flight initiative that Paine and Agnew had desired. Aside from the remaining Apollo missions and Skylab, the only other element of Nixon's speech that resembled any of the options the Space Task Group report had offered was a declaration to examine the feasibility of reusable space shuttles to reduce the cost of transporting payloads into space. Here, the President picked up on the Space Task Group's point that "Much of the negative reaction to manned space flight" by scientists and members of the public "will diminish if costs for placing and maintaining man in space are reduced and opportunities for challenging new missions with greater emphasis on science return are provided."[140] Nixon thus averred in his speech that "Such a capability – designed so that it will be suitable for a wide range of scientific, defense and commercial uses – can help us realize important economies in all aspects of our space program."[141] The President requested $110 million in his FY 1971 budget to conduct studies of such a transportation

[139] Ibid., 4. As Nixon noted in this statement, he had given a speech at the United Nations in September 1969 entitled "Toward Internationalizing Man's Epic Venture into Space – An Adventure that Belongs not to One Nation but to All Mankind," in which he advocated international cooperation in space.

[140] Space Task Group, *The Post-Apollo Space Program: Directions for the Future*, 5.

[141] Nixon, "Statement on Space," 3.

system and the space stations the system might one day serve but offered no guarantee of a long-term funding commitment. Through his speech and budget plan, Nixon defined the possibilities for a new sociotechnical imaginary involving human space flight. As the next section shows, over the next two years, NASA and the Nixon administration would work to craft a new program and vision that would resonate with external publics.

Moving Toward a Democratized Human Space Flight Program

Even with, or perhaps because of, the President's demotion of the human space flight program, Paine did all he could in the ensuing months to keep alive his human space flight dreams. He courted Western European and Japanese officials to obtain international agreements to help show the White House and Congress worldwide interest in participating in human flight and other projects and also worked closely with NASA senior leaders to consider how lunar bases, Mars missions, and space stations could fit within NASA's future through the year 2000.[142] Nonetheless, Paine resigned from NASA in September 1970 and took an upper management position at General Electric, his previous employer. As a "buccaneer" who truly believed in humanity's future among the stars, it was difficult for him to remain the head of an agency which had built its identity on doing the impossible at a time when it seemed impossible "to get public support for the space program, to get public support for any program except sewers."[143] The message Nixon had sent NASA, contrary to the belief of Paine and so many who proudly worked there, was that the agency was *not* exceptional; rather, it would be judged and resources meted to it based on the priority that the President and members of Congress, in service to their electorates, deemed it to have for the nation and its citizens. As of then, with the urgency of competition with the Soviets

[142] Clare F. Farley, Executive Officer, memorandum for the record, May 5, 1970, Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[143] Thomas O. Paine, interview by E.M. Emme, July 9, 1970, transcript, NASA Oral History Interview, Washington, DC, Folder 4186, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

receding as a justification, the priority for NASA, let alone human space flight, was not very high. Any hope of garnering sufficient support for a human flight initiative would depend on a shift in NASA's imaginary for human space flight and how it framed the initiative's benefits and costs to the nation.

Paine's successor, Deputy-turned-Acting Administrator George Low, was a respected NASA career civil servant who shared Paine's passion for human space flight. He was determined to work to keep the agency on a path toward extending humanity's presence in space but was prepared to move away from NASA's Apollo-era philosophy of achieving success at any price to a more cost-conscious way of doing things, just like other federal agencies often had to do. During internal NASA discussions to prepare for the agency's FY 1972 budget request, Low asserted that NASA needed to shift from Apollo's global focus to an inward national focus, noting that the space program had to be "useful to the people here on Earth" and that NASA needed to be sure not to exempt human space flight from that requirement.[144] Over the next 18 months, Low, resuming his role as deputy administrator, and NASA's newly named administrator, James Fletcher, a physicist who had made his career in the space industry and academia and came to NASA from serving as president of the University of Utah, would address this issue. Specifically, they worked to make cost reduction and broader relevance central tenets of their efforts to demonstrate the feasibility, value, and appropriateness for the budgetary times of a reusable space transportation system and a station. But as cost and political realities set in, they would direct all of their labors, and their hopes, toward only one project: the Space Shuttle.

Fortunately, Fletcher and Low had a good foundation to leverage in their quest. Credited with having started NASA down the Shuttle path, George Mueller, head of NASA's Office of Manned Space Flight, recognized in 1967 that reducing the cost of space access would be crucial to the viability and legitimacy of any post-Apollo space station initiative. With budgets on the decline, NASA would need to figure out how to stretch its resources to continue to press the boundaries of human activity in space. The

[144] McQuaid, "Selling the Space Age," 138.

Saturn V rockets provided tremendous capability for the sorts of lunar and space station activities Mueller, Paine, von Braun, and others had envisioned but they were also extremely costly, requiring the production of a new booster for each launch. What NASA needed, Mueller surmised, was a reusable space transportation system – one that would undoubtedly require a considerable upfront investment for design, development, and construction but then would reduce the costs associated with each flight, as an airliner achieved. Such a system would even resemble an airplane: after taking off vertically like a rocket it would depend on wings to glide back to Earth horizontally and land on a runway.[145] In 1968, Mueller delivered a speech to the British Interplanetary Society in which he predicted that "the next major thrust in space will be the development of an economical launch vehicle for shutting between Earth and the…orbiting space stations which will soon be operating in space." Like his visionary counterparts at NASA, Mueller viewed this new craft as an essential, enabling element in humanity's movement into space: "The Space Shuttle is another step toward our destiny, another hand-hold on our future. We will go where we choose – on our earth – throughout our solar system and through our galaxy – eventually to live on other worlds of our universe. Man will never be satisfied with less than that."[146]

Mueller was as strategic as he was pragmatic and visionary. In addition to recognizing the need to bring down the costs of space flight to have any chance at gaining public and political support for major space projects, Mueller also foresaw the importance of broadening the shuttle's utility. He thus encouraged an internal task group established to lay out basic Shuttle requirements to think in these terms. In the summer of 1969, the task group issued a report that continued to identify station servicing as the

[145] The idea of a spaceplane had circulated for quite some time among space aficionados. See Roger D. Launius, "The Strange Career of the American Spaceplane: The Long History of Wings and Wheels in Human Space Operations," *Centaurus: An International Journal of the History of Science and its Cultural Aspects* 55, no. 4 (2013): 412-442.

[146] George Mueller, "Address before the British Interplanetary Society," University College London, August 10, 1968, quoted in T. A. Heppenheimer, *The Space Shuttle Decision*, 94. Muller was joined by others in the aerospace industry in sharing this vision for a Space Shuttle: as Bell Aerosystems vice president for research Walter Dornberger put it, the Shuttle would be capable of "putting a fresh egg, each morning, on the table of every crew member of a space station circling the globe." Walter R. Dornberger, "The Recoverable, Reusable Space Shuttle," *Astronautics and Aeronautics*, November 1965, 86.

Shuttle's primary rationale but broadened its possible contributions to include several types of missions, from deploying satellites to multiple orbits to on-orbit satellite check-out, repair, and retrieval to orbital delivery of propellant to carrying a station-like research module in its payload bay.[147] Mueller thus directed NASA's Shuttle study contractors to be sure their designs could support not only station logistics but also the launch and deployment of large satellites. A two stage fully reusable system, with a liquid flyback booster, emerged as NASA's favored choice. As historian T. A. Heppenheimer expressed it,

> Here was a new form of boldness: not a warmed-over version of the *Collier's* agenda, but a well-grounded concept of a completely new approach to the space activities that were already under way or approved…[I]ts breadth of rationale for the first time raised the possibility that a Shuttle might take on a life of its own, serving the nation even in the complete absence of a station. On these terms, the shuttle could indeed go forward.[148]

Mueller's strategy worked for gaining a foothold in the Space Task Group deliberations: the Air Force's Seamans, the American Institute for Aeronautics and Astronautics, and the President's Science Advisory Council all opposed NASA's arguments for a major space station but endorsed the promise that a reusable space transport system would have for lowering space operations costs and providing versatile capabilities.

NASA nonetheless had succeeded at getting the Nixon administration to include in its FY 1971 request funding for feasibility studies for *both* a Shuttle and a station and was prepared to defend that request. While agency officials pointed out the Shuttle's value to science and applications in testifying before the Congress, they continued to link the Shuttle to the station and the future possibility of a human Mars mission. Some members of Congress were unfazed by the linkages. Richard Roudebush of Indiana stated during House floor debate about the nation's need for the Shuttle, "I am puzzled by the statement that the Shuttle is in some way mixed up with the Mars landing, when nothing is further from the

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[147] NASA, Space Shuttle Task Group Report, "Volume II" Desired System Characteristics," revised, June 12, 1969, in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. IV: Accessing Space*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 1999), 206-210.

[148] Heppenheimer, *The Space Shuttle Decision*, 135-136.

truth…the purpose of the Space Shuttle is simply this: to go out and work on satellites to refurbish them, and to take men to and from a space station in earth orbit."[149] Members such as Olin Teague of Texas, chair of the House Committee on Science and Astronautics' Subcommittee on Manned Space Flight, welcomed the proposal; Teague even proposed adding $80 million for Shuttle and station studies to the House's authorization bill for NASA.

But the study funding incensed a number of members of Congress who regarded another large-scale technological program as an anathema in an environment in which their constituents and a variety of lobbies were pressing them to support social programs.[150] Joseph Karth, Teague's counterpart as the chair of the House Committee on Space and Astronautics' Subcommittee on Space Science and Applications, decried human space flight initiatives' impact on funding availability for unmanned science programs. Concerned that the Shuttle would lead to an eventual commitment to a human Mars mission, Karth proposed an amendment to the House bill to eliminate all funding for the Shuttle and station projects. It failed on a tie vote of 53-53. Liberal senators then took up the charge against the Shuttle and station. Those such as William Proxmire of Wisconsin and Walter Mondale of Minnesota, who felt NASA had lied to Congress during hearings following the 1967 Apollo 1 fire, were more than dubious of another human space flight effort's value. Proxmire, who the following year would go on to spearhead with success the elimination of funding for a national supersonic transport, regarded the Shuttle as a similarly wasteful use of taxpayer resources.[151] Mondale led a charge to eliminate the Shuttle and station study funding in both the Senate NASA authorization vote and then in the Senate's appropriations vote; neither passed, but the latter vote saved the funding by only a small margin: 28-32. House and Senate conferees

[149] *Cong. Rec.*, 91st Cong., 2nd sess., April 23, 1970, vol. 113: 12867.

[150] That NASA was considered in the same appropriations committee as the Department of Housing and Urban Development and the Veterans Administration added to the tensions members of Congress faced in allocating funds to these disparate programs.

[151] Proxmire and others also criticized the supersonic transport for its noisiness and exhaust impacts on the ozone layer. While NASA would later complete an environmental impact study of the Shuttle, it is not clear that Proxmire also criticized the Shuttle on these grounds.

passed a NASA budget of $3.3 billion, including the original $110 million for Shuttle and station studies. The funding level, however, still required NASA to make reductions to its human program and so the agency cancelled two more Apollo missions, 18 and 19.[152]

Still lacking Nixon's approval to request funds for the development of either program by the end of 1970, however, Fletcher and Low were ready to do what it took to get that approval in the following year. As John Logsdon observes, "Fletcher and Low believed that NASA had to get a go-ahead for the shuttle in 1971 if NASA were to maintain its identity as a large development organization with human spaceflight as its central activity."[153] Recognizing, however, that the House and Senate only narrowly passed NASA's FY 1971 request and that the Nixon administration had not yet indicated a willingness to support both a station and a Shuttle, agency officials decided moving forward to play down the station and any aspirations to go to Mars in an effort to at least get approval for the Shuttle, which they saw as necessary to enable the station. As Dale Myers, who headed NASA's manned space flight office, explained, "The only logical thing out of those three was the Shuttle. Couldn't build a space station because you couldn't go support it. They were canceling the Saturn V, and the S1B and all that stuff were [sic] gone, so you had to have a launch vehicle. So the Shuttle was the only choice we had."[154]

NASA thus aimed to sever the connection between the Shuttle and the station or human Mars missions in its public discourse. In doing so, it rebranded the Shuttle from being a workhorse to support a space station to providing economic and frequent access to space for satellites that would serve a variety of purposes and provide benefits to their owners, direct users, and society more broadly.[155] By January

[152] The near loss of Apollo 13 a few months earlier also played into this decision, as agency officials worried that losing a crew on another Apollo mission could jeopardize support for a post-Apollo human program.

[153] Logsdon, "The Evolution of U.S. Space Policy and Plans," 386.

[154] Dale Myers, interview by Carol Butler, August 26, 1998, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/MyersDD/DDM_8-26-98.pdf.

[155] Woods, "Artifacts, Revolutionaries, and Bureaucrats," 69.

1971 Low averred that NASA had "no plans at this time for manned Mars landing missions."[156] Carl Dry, another NASA official working in the Shuttle program office, noted that "Initially, we thought of the Shuttle only in terms of the station; now the Shuttle is to the fore alone."[157] NASA retrofitted its originally intended use of the Shuttle to suit the mood of the times, appearing not just to serve NASA and the aerospace industry's interests but common interests; rather than serving the interests of extending human presence in space it would serve the aims of Earth orbit's exploitation.[158] Far less costly and complex than lunar bases or a Mars mission, the Shuttle would offer something practical to the nation, while allowing the agency to develop and evolve capabilities for living and working in space. As Brian Woods has explained, "The means were transformed into the ends. Rather than a method to achieve a particular goal, new capabilities and the possibility of economic and routine access to space were turned into objectives in themselves."[159] NASA's desire to continue with human space flight mingled with public and political constraints for this activity to begin to forge a new sociotechnical imaginary for human space flight.

Of course, branding the Shuttle as a versatile, capable vehicle meant NASA would need to court customers to use the system – and reimagine its relations to external publics. As political scientist W. D. Kay has observed, "NASA was forced to piece together a coalition of supporters by promising to provide

[156] George Low, January 28, 1971, quoted in Scott Pace, "Engineering Design and Political Choice: the Space Shuttle, 1969-1972" (master's thesis, Massachusetts Institute of Technology, 1982), 26.

[157] Claude E. Barfield, "Space Report: NASA Gambles Its Funds, Future on Reusable Space Shuttle Program," *National Journal*, March 13, 1971, 541.

[158] Political scientist Roger Pielke, however, avers that NASA did not go as far in serving the "common interest," or using resources to attain a publicly recognized national goal, as it might have; rather, the agency, along with its contractors and politicians, had a vested interest in limiting the scope of alternatives to those that served their own interests. Roger A. Pielke, Jr., "A Reappraisal of the Space Shuttle Programme," *Space Policy* 9, no. 2 (May 1993): 149.

[159] Woods, "Artifacts, Revolutionaries, and Bureaucrats," 376.

a (very) broadly based service."[160] But no one outside of NASA had expressed a serious desire to use such a vehicle. While NASA would undertake a concerted outreach effort to drum up business from commercial satellite owners and experimenters and garner academic scientists' support once the Shuttle was approved, it was essential to the agency to secure the Air Force's full support for the project to get Nixon's and Congress's blessing. The Department of Defense had hitherto been content to continue to launch its payloads using expendable vehicles. Perhaps recognizing that NASA needed the Air Force's support to keep human space flight alive more than the Air Force needed the Shuttle, the Air Force demanded that the Shuttle including three parameters to meet its requirements. These included a 65,000-pound lifting capability and a 15-by-60-foot payload bay, which would make the Shuttle heavier and larger than NASA had been planning. The Air Force also desired a 1,500-mile "cross-range" capability to allow the crewed vehicle to land anywhere within a 3000-mile span along its return trajectory. While the changes would add more than 20 percent to the Shuttle's development and operations costs, NASA agreed to pursue them, seeing the need to secure the Air Force's payloads and support as necessary to get political approval. Former astronaut Joe Allen has called the move a "pact with the devil."[161] Dale Myers nonetheless conceded:

> Fact is, we wouldn't have a shuttle if we hadn't gone to the cross range. I had to have Air Force support, and I had to get Congress to support the idea that this thing would carry other military payloads. We couldn't prove enough payloads in NASA to defend building it, so that's where we came down. George Low and Jim Fletcher and I all agreed that we had to go to the cross range requirement and the big payload. So it got big and it got cross range. I think it was exactly the right thing to do, because we wouldn't have had a shuttle otherwise.[162]

[160] W. D. Kay, *Defining NASA: The Historical Debate over the Agency's Mission* (Albany: State University of New York Press, 2005), 113.

[161] Joseph P. Allen, interview by author, Washington, DC, April 2, 2013.

[162] Myers, interview.

Following the arrival at that agreement, Seamans indicated before Senate space committee in March 1971 that the Air Force intended to give "strong recommendation" for the Shuttle to be authorized and to phase out use of expendable launch vehicles.

The other element to NASA's practical argument for the Shuttle, which heated up as an issue in 1971, was the system's ability to launch frequently and in so doing reduce the costs of space operations, long a bane to both NASA and the Air Force. The White House Office of Management and Budget (OMB) was the President's budget watchdog, representing his fiscal policy and presumably the interests of the nation's taxpayers. OMB staff members were skeptical of the merits of the Shuttle and in 1970 required the agency to have an independent contractor assess the Shuttle's cost-effectiveness in comparison to expendable launch vehicles. Would the Shuttle realize the promise of cost savings, and if so, would it save enough to warrant the investment? According to Hans Mark, who would become director of the NASA Ames Research Center and then NASA deputy administrator in the early 1980s, "Fletcher and his staff were driven to make economic justification – something that was new to NASA since these were not necessary during the Apollo program."[163]

Fletcher tasked Mathematica, an economic consultancy in Princeton, New Jersey, to conduct a study. Mathematica drew on estimated costs of launch vehicle and payload designs and upcoming federal and private space transportation needs provided by NASA, the Department of Defense, the Aerospace Corporation, and Lockheed.[164] In May 1971, Mathematica concluded that a fully reusable shuttle would be marginally cost-effective, with a fully reusable Shuttle breaking even by flying about 600 missions in the 1978-1990 timeframe and costing $12.9 billion to develop.[165] The actual savings would depend on the Shuttle's flight rate, which in turn depended on the actual demand of payloads for launch. Most of the

[163] Hans Mark, *The Space Station, A Personal Journey* (Durham, NC: Duke University Press, 1987), 49.

[164] Jerry Grey, *Enterprise* (New York: William Morrow, 1979), 71-72.

[165] Pace, "Engineering Design and Political Choice," 30-31.

savings, Mathematica estimated, would come from the Shuttle's ability to accommodate payloads with less stringent construction requirements and to repair them on orbit or by returning them to Earth, thus cutting down on payload expenditures.[166]

Mathematica's analysis did not help NASA's cause with OMB. The budgeteers retained their doubts about the Shuttle given the study's tenuous results and informed NASA in May 1971 that the administration would cap the agency's annual budget at roughly $3 billion for the rest of Nixon's presidency – a huge drop from the $5-6 billion budget NASA had enjoyed at Apollo's peak. Moreover, they specified that the Shuttle development could cost no more than $5 billion and would need to demonstrate a 10 percent return on investment. With Mathematica's cost estimate for development of the fully reusable Shuttle far exceeding that amount, the agency would need to look to alternatives that would involve some expendable elements. Fletcher tasked NASA's Shuttle study contractors with examining options and also asked Mathematica to conduct a second study to calculate the circumstances under which the Shuttle would prove less costly than conventional launch vehicles. As historian Joan Bromberg observes, the Shuttle's design "became encumbered by NASA's need to fend off opponents and rally supporters."[167]

Human space flight detractors in the Congress also continued their crusade against the Shuttle throughout 1971. Proxmire said before the Senate that NASA had only averred in response to his repeated queries that "first, the shuttle would enable us to continue to have an active space program, and second, it would reduce the costs of the space program. But why do we actually need it? What would it help us accomplish that we could not otherwise accomplish? NASA seemingly has no answers to these questions."[168] Mondale, for one, held up an Air Force-commissioned RAND report that refuted NASA's

[166] Grey, *Enterprise*, 73.

[167] Bromberg, *NASA and the Space Industry*, 14-15.

[168] *Cong. Rec.*, 92nd Cong., 1st sess., May 26, 1971, vol. 117: S7811-7812.

ability to justify the Shuttle on economic grounds, claiming the Shuttle would not prove more cost effective than continued use of expendable launchers and would end up costing taxpayers even more.[169] Media outfits also chimed in, with the *Christian Science Monitor*, for one, calling the Shuttle "a first-rate concept in search of specific uses."[170] An *Innovation* article accused NASA of attempting self-preservation without a clear rationale for its existence.[171]

Mondale was further fueled in his anti-Shuttle stance by members of the scientific community who opposed NASA's claims of the Shuttle's utility and cost effectiveness. Substantiating Mondale's view was a recommendation by the Federation of American Scientists against FY 1972 funding for the program.[172] Moreover, several prominent scientists had written letters to Mondale and other members of Congress expressing their own doubts about the Shuttle. James Van Allen of the University of Iowa wrote to Mondale in May 1971 that Shuttle advocates seemed to believe "with religious fervor" that technology should be pursued for its own sake and that whatever outcomes resulted would justify it. "Responsible public policy," Van Allen said, "requires the demonstration of specific human benefits." Van Allen added that the Shuttle was "cut from same cloth" as the recently cancelled SST and ought to be subject to the same cost-benefit considerations.[173] Astrophysicist Thomas Gold of Cornell doubted NASA's ability to justify the Shuttle economically while reiterating the somewhat self-serving concern

[169] "Mondale: Shuttle Budget Unjustified," *Spartanburg Herald*, May 27, 1971, B3, accessed December 13, 2014, http://news.google.com/newspapers?nid=1876&dat=19710527&id=Uj0sAAAAIBAJ&sjid=MswEAAAAIBAJ&pg=7279,4998072.

[170] Robert C. Cowen, "U.S. Space Shuttle: Plan in Search of Goal," *Christian Science Monitor*, July 2, 1971, 1.

[171] Englebert Kirchner, "Sorry Virginia, There is No Space Program," *Innovation*, April 1971, 2, 4-5, 8-9.

[172] "Mondale Will Try for Shuttle Again Next Year," *Space Business Daily*, July 26, 1971, 108, Folder 7931, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[173] J.A. Van Allen to Walter F. Mondale, May 31, 1971, Folder 8271, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

previously expressed by space scientists that unmanned scientific exploration of space and applications activities would be a better use of federal resources than human flight projects.[174]

But the Shuttle also had advocates and sympathizers in these quarters that championed the vehicle's cause and ultimately paved the way for its acceptance and the new sociotechnical imaginary for space flight that it would herald. Countering the opposition of their colleagues, equally esteemed space scientists lauded the Shuttle's potential to buoy and advance their fields. Fred Whipple of the Harvard College Observatory revered the Shuttle for its ability to launch large scientific payloads and to enable humans to repair and perhaps operate major telescopes, such as the Large Space Telescope then under consideration by the astronomy community.[175] Berkeley Space Sciences Laboratory director Kinsey Anderson saw value in the Shuttle's ability to support scientists in many fields and to lower costs to make the deployment of space science spacecraft more economical.[176] Leo Goldberg of Harvard argued that the Shuttle held "great promise for the future advancement of space science" and at least "deserves continuing study."[177]

Meanwhile, several members of Congress delivered speeches and wrote articles for trade publications conveying their support for the Shuttle. Nebraska Senator Carl T. Curtis spoke in his statement "Space Shuttle – The Key to Our Future" of the Shuttle's promise "to open the space frontier in the way the railroads opened the west, or in the way the DC 3 airplane began the great expansion of commercial aviation." The vehicle, he added, would provide "a new capability that is needed" for

[174] Thomas Gold to Walter F. Mondale, June 5, 1971, Folder 8271, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[175] Fred L. Whipple to Clinton P. Anderson, June 15, 1971, Folder 8271, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The Large Space Telescope was eventually renamed the Hubble Space Telescope.

[176] Whipple to Anderson, June 15, 1971; Kinsey A. Anderson to Alan Cranston, June 25, 1971, Folder 8271, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[177] Leo Goldberg to Clinton P. Anderson, June 23, 1971, Folder 8271, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

national security, science, and practical applications and "to give new opportunities to use space to serve mankind."[178] Taking on those who preferred to see NASA funding diverted to address social needs, Senator Howard W. Cannon argued in the Aerospace Industries Association's newsletter that investments made in space technology like the Shuttle "create the strong economic base that will be necessary if we hope to solve *any* of our problems in the future."[179] Even Representative Karth backed down from his anti-Shuttle stance. Although still believing that the American people would not support the Shuttle, he indicated that he was willing to back the program based on NASA's commitment to separating the Shuttle from the station project and to finding a cost-effective design.[180] Members supportive of the Shuttle trumped the opposition. An amendment offered by Mondale, Proxmire, and other senators to eliminate the Shuttle in NASA's FY 1972 authorization bill was defeated 64-22, and the Congress approved $118.5 for continuing Shuttle studies in FY 1972.[181]

Attitudes in the Nixon administration were also turning in favor of building the Shuttle. Holding a different view than OMB staff members who analyzed and made recommendations concerning NASA's budget, OMB deputy director Caspar "Cap" Weinberger worried that the staff's proposed budget cuts for the space agency were too extreme; in addition to not approving the Shuttle, OMB had also been considering cancelling the last two Apollo missions. He wrote in an August 1971 memo to Nixon with concern that these cuts would suggest to the world that America was "turning inward" and "voluntarily

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[178] Carl T. Curtis, "Space Shuttle: The Key to Our Future in Space," attachment to Alfred P. Alibrando, NASA News, July 19, 1971, Folder 7931, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[179] Howard W. Cannon, "Liftoff to Economy: The Space Shuttle," *Aerospace*, July 1971, 7.

[180] "Karth Says Public Would Not Support Shuttle," *Space Business Daily*, May 19, 1971, 98, Folder 1159, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Karth nonetheless asserted a few weeks earlier that "no one in the space program seems concerned with the broader public interest" and believed NASA should do more than make advances to benefit the space industry. According to Karth, "NASA must go beyond that to assist in solving vast social problems that besiege our society" and called on the agency to establish an office to study ways for "meeting pressing national problems." See "Karth Says Space Leaders Lack 'Public Interest'," *Space Business Daily*, April 1, 1971, 161, Folder 1159, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[181] "Mondale Will Try for Shuttle Again Next Year," 108.

starting to give up our super-power status" and "should be able to afford something besides increased welfare, programs to repair our cities, or Appalachian relief or the like."[182] Weinberger argued that programs including the Shuttle ought to be funded. Still a space supporter at the core, Nixon endorsed the sentiment in a handwritten note on the memo stating "I agree with Cap."[183]

Over the course of the fall budget development season, NASA continued to stress the value of the new space transportation system to the nation to solidify Nixon's support for the Shuttle. That October, Mathematica shared with NASA and those involved in the Shuttle decision the preliminary results of its follow-on study to identify a cost-saving Shuttle configuration. Mathematica argued in a 15-page memorandum that a "reusable space transportation system is economically feasible" and that a particular concept, a "Thrust Assisted Orbiter Space Shuttle System" (TAOS), would yield the greatest savings; the system would include a reusable space plane, or "orbiter," an expendable external fuel tank, and two expendable booster rockets mounted on opposite sides of the tank. While acknowledging the need to continue to examine user demand, Mathematica maintained that "*it is our strong belief that the major portion of space transportation demand in the 1980's [sic] will come from economic applications of space technology to meet the growing needs of the U.S. and other developed and developing countries*."[184] The memo acknowledged that NASA and the Department of Defense would comprise a large share of the total demand but that commercial and international users would also serve to justify the Shuttle. Noting that "in the present mood and the present state of the economy a program like the shuttle and its decision has to be *user* oriented," Mathematica argued that "there appear" to be "major needs" in

[182] Caspar W. Weinberger, via George Shultz, to the President, memorandum, "Future of NASA," August 12, 1971, in *Exploring the Unknown, Vol. I*, 547.

[183] Ibid.

[184] Klaus P. Heiss and Oskar Morgenstern to James C. Fletcher, memorandum, "Factors for a Decision on a New Reusable Space Transportation System," October 28, 1971, in *Exploring the Unknown, Vol. I*, 553. Emphasis in original.

the areas of military, scientific, communications, Earth observations, navigation, and other applications such as space-based production processes and energy generation and transmission.[185]

Fletcher, meanwhile, continued to aim to appeal to Nixon on grounds beyond the economic justification. In a November 1971 paper, NASA argued five points for proceeding with the Shuttle that the agency believed would resonate with Nixon. Very aware of the President's reverence for Apollo, NASA contended first that the nation could not forego human space flight, claiming a "responsibility – to itself and to the free world" to continue this enterprise. Second, the paper pointed out that the Shuttle was the "only meaningful" new human flight program that NASA could accomplish at current budget levels. Third, NASA averred that the Shuttle was "essential for all the dramatic and practical future programs we can conceive." NASA argued that the Shuttle would satisfy the range of applications the Mathematica memo stressed while intimating that it could one day provide crew transportation and logistical support for more visionary aspects of human space flight including a station in Earth orbit and orbital assembly of systems needed for lunar bases. Fourth, NASA indicated that it had done due diligence and met the Nixon administration's challenge by finding a Shuttle solution costing half that of a fully reusable system. Finally, NASA pointed out that Shuttle development in the near term would help the aerospace industry, whose employment numbers had fallen by nearly one-third, from 1.43 million to 931,000,in just four years.[186] While most of the reductions followed from cuts in military spending for new aircraft, the Apollo wind-down also contributed to the decline. NASA maintained that the Shuttle would enable the "direct employment of 8,800 by the end of 1972, and 24,000 by the end of 1973."[187] With the following year, 1972, being an election year and the aerospace industry employing thousands of people in key states

[185] Ibid., 554. Emphasis in original.

[186] "Shuttle to Employ Fifty Thousand," *Space Business Daily*, January 7, 1972, 23.

[187] James C. Fletcher, "The Space Shuttle," November 22, 1971, in *Exploring the Unknown, Vol. I*, 558.

for Nixon, including his home state of California, announcing the approval of a Shuttle program could boost Nixon's bid for reelection.

The arguments were sufficient to win Nixon's support for the Shuttle as NASA's next major human space flight initiative. On January 5, 1972, Fletcher and Low met with Nixon in San Clemente, California, to discuss the project after receiving word from the White House that the President had approved NASA's development of a partially reusable Shuttle. During the 35-minute meeting, the NASA officials informed Nixon that the agency would be able to develop a Shuttle costing $5.15 billion, with a $1 billion and 18-month contingency, to be ready by September 1979. Nixon relayed to Fletcher and Low his particular interests in the Shuttle. He was intrigued by the Shuttle's potential to fly routinely and on short notice to support civilian applications including natural disaster response as well as more prospective uses such as for collecting solar power in orbit and beaming it to Earth as well as for nuclear waste disposal. Nixon noted that "even though we know now of many things that the shuttle will be able to do, we should realize that it will open up entirely new fields when we actually have the capability that the shuttle will provide." Recognizing that the Shuttle would offer a completely different flight environment than that of the Apollo capsules, the President also expressed that he "liked the fact that ordinary people would be able to fly in the shuttle, and that the only requirement for a flight would be that there is a mission to be performed." He also expressed interest in various forms of "meaningful participation" in the Shuttle program by foreign nations, including flights of international astronauts, experiments, and hardware. At the same time, Nixon hinted at his commitment to maintaining national prestige through human space flight, indicating that "even if [the Shuttle] were not a good investment, we would have to do it anyway, because space flight is here to stay. Men are flying in space now and will continue to fly in space, and we'd best be part of it."[188]

[188] George M. Low, memorandum for the record, "Meeting with the President on January 5, 1972," January 12, 1972, in *Exploring the Unknown, Vol. I*, 558-559. All quotations are Low's account of Nixon's reactions and direction to NASA during the conversation.

That same day, Nixon issued a statement announcing that the United States would pursue the Space Shuttle as "the right next step for America to take, in moving out from our present beach head in the sky to achieve a real working presence in space."[189] While Nixon's March 1970 speech about the future of NASA had been light on program specifics, the new speech made clear the President's choice of direction for the human space flight program. But as he had done in his speech nearly two years earlier, he cast his decision to invest in the Shuttle in a way that would appeal to everyone and alienate no one. As historian Matthew Hersch puts it, "Nixon pandered to every community Project Apollo had neglected, claiming that the same vehicle that would reduce the cost of spaceflight could satisfy the nation's diverse space enthusiasts while simultaneously satisfying environmentalists, and peace activists, and civil rights advocates."[190] Nixon, at least as much as NASA, recognized the need to establish a new sociotechnical imaginary for human space flight and the need to focus not just on the new vehicle but on how various groups of citizens would aid in legitimizing it and making it viable.

The President achieved this by proffering a vision of the Shuttle that tied the dreams of space flight aficionados together with the expectations of those who had long felt human space flight to be at best esoteric and at worst a waste, claiming that the Shuttle would "help transform the space frontier of the 1970s into familiar territory, easily accessible for human endeavor in the 1980s and '90s." The Shuttle as Nixon constructed it would be relevant to everyone, "delivering the rich benefits of practical space utilization and the valuable spinoffs from space efforts into the daily lives of Americans and all people."[191] The very name, Space Shuttle, which Nixon preferred over the mythology-derived names of NASA's previous human programs, conveyed the President's conviction that the new space vehicle

[189] Richard Nixon, "Statement Announcing Decision to Proceed with Development of the Space Shuttle," January 5, 1972, in *The American Presidency Project*, eds. Gerhard Peters and John T. Woolley, accessed December 13, 2014, http://www.presidency.ucsb.edu/ws/index.php?pid=3574.

[190] Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012), 144.

[191] Nixon, "Statement Announcing Decision to Proceed with Development of the Space Shuttle."

would belie any pretenses: it would exist not for the purpose of conducting space spectaculars but because it had an important job to do in providing people, experiments, and hardware with access to Earth orbit.[192]

As Nixon characterized it, the Shuttle would be the people's spaceship. It would represent a completely different sort of approach to human space flight than Apollo, based on a new rationale and sociotechnical imaginary for the human program. That vision was built on the idea that the Shuttle would democratize and make space flight more accessible and relevant to citizens in terms of providing them with tangible benefits and enabling their participation in the space program. Indeed, the new program would support the specific aims and interests of groups as diverse as environmentalists, international aspirants to space flight, and other would-be users of the Shuttle, as it "will give more people more access to the liberating perspectives of space, even as it extends our ability to cope with physical challenges of Earth and broadens our opportunities for international cooperation in low-cost, multi-purpose space missions." Nixon's words suggested that the Shuttle would open the possibility that many more sorts of people could become astronauts and abandon Apollo's gender homogeneity, which no longer suited America: "The resulting changes in modes of flight and re-entry will make the ride safer, and less demanding for the passengers, so that men and women with work to do in space can 'commute' aloft, without having to spend years in training for the skills and rigors of old-style space flight." Scientists and others who questioned why NASA sent humans into space rather than relying solely on robotic vehicles could take comfort in the fact that the Shuttle's capabilities to deploy, repair, and retrieve satellites would mean that the "limiting boundaries between our manned and unmanned space programs will disappear." Finally, the aerospace industry could rest easy because the effort would "engage the best efforts of thousands of highly skilled workers and hundreds of contractor firms over the next several years."[193]

[192] Even though the moniker "Space Shuttle" prevailed, NASA and government officials nonetheless often would refer to it more formally as the (National) Space Transportation System.

[193] Nixon, "Statement Announcing Decision to Proceed with Development of the Space Shuttle."

Despite Nixon's words, the Shuttle continued to endure its share of criticism from members of Congress, scientists, and dozens of newspaper editors and writers as the decision to approve the President's proposal for $228 million to begin Shuttle development moved to Capitol Hill. Many in Congress continued to question the Shuttle's value. Representative Bella Abzug of New York, for one, decried the Shuttle's impact on social needs. Journalists and pundits such as Daniel Greenberg contended that the Shuttle "can be likened to a gold-plated limousine to deliver small bundles: once built, its existence becomes the justification for delivering lots of bundles."[194] Bob Cromie of the *Chicago Tribune* similarly argued against investing billions in a spaceship that would soon enough become obsolete.[195] A March 1972 *New Leader* article explained:

> Spokesmen for science and technology have always contended that 'progress' must be allowed to continue unimpeded, lest our spirit as a people stagnate. Yet the critical issue, it would seem, is to channel the drive for progress toward solving the specific, urgent problems impairing the quality of life in the country. This is the issue that shot down the SST [supersonic transport] – and that not only the shuttle but the entire space program now faces.[196]

Brian O'Leary, a planetary scientist whom NASA had accepted as an astronaut in 1967 but then resigned in 1968 because he was dismayed at his chances of ever flying, raised questions about the Shuttle's goals, seeing them as unsteady, unclear, and out of touch with "human values."[197]

Strong advocacy and arguments for the Shuttle, however, persisted. Like Nixon, Senator Henry Jackson of Washington lauded its benefits "as a good investment which will return its costs to the people

[194] Daniel S. Greenberg, *Science and Government Report*, June 1, 1972, 1, quoted in Pielke, "A Reappraisal of the Space Shuttle Programme," 147.

[195] Bob Cromie, "Just What We Need: Another Spaceship," *Chicago Tribune*, January 8, 1972, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[196] Norman F. Smith, "Do We Need the Space Shuttle?" *New Leader*, March 24, 1972, 8.

[197] Brian O'Leary, "Do We Really Want a Space Shuttle?" *New York Times*, February 16, 1972, 39, accessed February 22, 2015, ProQuest Historical Newspapers: The New York Times.

many times over."[198] The AFL-CIO latched onto the employment benefits NASA forecasted, and urged the Congress to fund the Shuttle on the premise that it would provide some 50,000 American jobs.[199] Newspaper editors from regions of the country likely to benefit economically from the Shuttle expressed strong support for the program. The editorial staff at the *Miami Herald* lauded the Shuttle's promise to give Brevard County, home of Kennedy Space Center, "a welcome lift out of the doldrums" brought on by recent cutbacks in space spending, while the *Times-Picayune* cheered the fact that the program would lead to the reactivation of the Michoud rocket construction facility near New Orleans.[200] Many news publications without a major space industry presence also asserted their belief in the Shuttle's value for the nation scientifically, economically, as well as geopolitically.[201] Perhaps most significantly, Mathematica released its final assessment a few months after Nixon's announcement, indicating that the Shuttle would be economically justified in the TAOS configuration if it flew between 300 and 360 Shuttle flights in the 1979-1990 period, or about 25 to 30 flights per year. The consultancy maintained that with NASA and the Department of Defense alone projecting more than 600 payloads during this timeframe, the Shuttle would save the nation an average of $13.9 billion in 1970 dollars; even reducing the forecast by at least 100 payloads would result in a savings of approximately $10 billion.[202]

Mathematica did not make very clear that the payload demand figures its analysts had used were exceedingly optimistic: they were best-case scenarios provided that NASA and Department of Defense

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[198] Henry M. Jackson, "Why the Space Shuttle Is Important to You," *Machinist*, February 17, 1972, quoted in *Cong. Rec.*, 92nd Cong., 2nd sess., March 13, 1972, vol. 118: S3872.

[199] Ibid.

[200] "A Shuttle Boost for Florida," *Miami Herald*, January 7, 1972, Folder 8249, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; "Space Shuttle 'Go' Right Decision," *Times-Picayune*, January 7, 1972, Folder 8249, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[201] "Space Shuttle Can Be a Scientific Bridge to the Future," *Kansas City Star*, January 7, 1972, Folder 8249, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; "U.S. Stays in the Space Race," *Detroit News*, January 8, 1972, Folder 8249, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[202] Klaus P. Heiss and Oskar Morgenstern, *Mathematica Economic Analysis of the Space Shuttle System* (Princeton, NJ: Mathematica, 1972).

were able to gain funding for their shares of the payloads and could develop them according to their goal schedules. Moreover, lost in the hype over the Shuttle and not taken into account by the consultants was that the Manned Spacecraft Center's Shuttle program engineers did not believe the Shuttle's turnaround requirements would realistically be able to support anywhere close to 60 flights per year.[203] Nonetheless, the arguments for continuing the nation's human space flight program and doing so via a new space transportation system prevailed, and the Congress ultimately came down in favor of initiating development of the Shuttle program.

Chapter Synthesis

Once the Apollo 11 astronauts touched down on the Moon, it was no longer tenable for NASA to continue to conduct human space flight activities for the sake of pushing the boundaries of the possible with a small group of space travelers at a cost of billions of dollars to taxpayers only to tell them all about the journey. There were enthusiasts for space spectaculars, to be sure, but there was no single, attestive American public for human space flight as NASA was conducting it. The consumer-product model of public engagement alone did not fit adequately, nor did a program justified solely by geopolitical competition. Any hope NASA had for a reprise after Apollo would need to reimagine and reframe the purpose and value of human activity in space in a way that would appeal to a broad range of external publics. Consequently, NASA deferred its aspirations to go to Mars and to build space stations and instead constructed the Space Shuttle as a technological end in its own right which would serve a wide set of goals and users, bringing untold benefits to space enthusiasts and pragmatists alike through its promises of cost-effectiveness and versatility. Indeed, NASA's and Nixon's adoption of a democratic

[203] Robert F. Thompson, interview by author, Houston, TX, June 13, 2013.

sociotechnical imaginary for the Shuttle emerged as a means of making human space flight "fit" within the current social, political, economic, and cultural milieus.

With this new sociotechnical imaginary, NASA could definitively move forward with a new human space flight challenge in the post-Apollo era. Although the agency's human space flight visionaries would not lose sight of their long-range aspirations, they would tuck away blueprints for a station for the time being. Instead, they turned their attention to developing a Shuttle program under a new vision that would define how NASA interacted with external publics. While NASA's public engagement choices of the 1960s followed from a security-oriented vision, legitimizing human space flight and making it viable henceforth rested on NASA's commitment to considering citizens' diverse needs, values, and potential contributions and enrolling them in the Shuttle program in a much wider variety of ways than the agency previously had used to connect them with human space flight. The next three chapters explore those approaches in detail.

Chapter 2: Making Ground Connections

In 1971 space policy analyst Charles Lamb advised NASA not to worry about citizen views of its programs and instead to "push more vigorously for patrons from within the budgetary process" after finding little correlation between changes in public opinion as expressed in polls and changes in the agency's budget up through the early 1970s.[1] Lamb added that state authorities are often slow to change direction on major program commitments, particularly when powerful players keep pressure on government decision-makers to maintain funding for their preferred policies. This assertion certainly rang with truth: neither the Apollo program nor the decision to continue with human space flight vis-à-vis the Space Shuttle program was called for or strongly supported by the majority of American citizens; both choices were instead ultimately conceived and advocated by elites in government and industry. Further, once Shuttle development was underway, the fact that more than 50,000 NASA and aerospace industry contractor personnel supported the Shuttle in almost every state of the nation by 1977 proved instrumental to the program's political inertia, helping to maintain support and quell critics in Congress when technical challenges and hence cost and schedule impacts arose.[2]

NASA officials certainly had recognized the importance of working to gain the backing of the President and members of Congress for the activities it wished to pursue throughout the Apollo era. Nonetheless, as NASA entered the post-Apollo era of human space flight, the agency clung steadfastly to what Lamb had termed "the mythological power of public opinion."[3] Providing value to and enrolling external publics in the agency's continued human space flight effort as attestive supporters mattered deeply to NASA, as it did to Nixon and his presidential successors and members of Congress. It was in

[1] Charles M. Lamb, "NASA, National Priorities, and the Integration of Research (draft)," September 28, 1971, ii, Folder 6717, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[2] "Space Shuttle Press Briefing," Houston, TX, April 4, 1977, PC4B/1, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX; Roger A. Pielke, Jr., "A Reappraisal of the Space Shuttle Programme," *Space Policy* 9, no. 2 (May 1993): 151.

[3] Lamb, "NASA, National Priorities, and the Integration of Research (draft)," 83.

large part recognition of vocal citizen naysayers across the country that led these decision makers to select the Shuttle, as a purportedly affordable and broadly capable vehicle, as a tenable path forward for human space flight. Indeed, NASA, Nixon, and members of Congress subscribed to the belief that the American system of representative democracy provided a system of checks and balances requiring elected officials to prove their accountability and commitment to serving their constituents – or at least to not offending them – should they wish to be voted into office again. While the space program hardly ranked as a morally divisive domestic or foreign policy issue, it consumed considerable taxpayer resources with societal benefits unclear to many, and political officials determined to demonstrate fiscal responsibility could not overlook the backlash to the Apollo project and polling figures giving low priority to the space program in the midst of other national needs. As Representative Bob Casey of Texas, whose district housed the Manned Spacecraft Center, noted in House floor debate on NASA's FY 1972 budget, "nationwide, man-in-the-street type support" and the degree of general public enthusiasm about subjects including the space program influences Congress' funding decisions – at least to some extent.[4]

Consequently, key officials throughout NASA and the aerospace industry subscribed to the view that a causal link existed between external public support and political sustainment of the Shuttle and the space program more generally.[5] In 1971 Grumman Aerospace Corporation, one of NASA's Shuttle study contractors, produced a brochure about the nascent Shuttle concept which asserted: "To be truly effective, a continuing long-term space program needs the broad based support of the American people and their

[4] *Cong. Rec.*, 92nd Cong., 1st sess., March 25, 1971, vol. 117, pt. 6: 8151. In fact, many members of Congress, including Representative Olin Teague of Texas, conducted constituent surveys and generally paid close attention to public sentiment about a variety of political issues.

[5] There were exceptions at the time. Hans Mark, deputy administrator during the 1980s, believed public opinion was "too far down in the decision chain to have any immediate effect on specific political programs" and, like Lamb, maintained that the agency's relations with the White House and Congress mattered most for the sustainment of ongoing programs. See LF-6/Director of Public Affairs (Brian Duff) to AD/Deputy Administrator, "Public Relations Policies," January 9, 1982, 3, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

representatives in Congress."[6] Likewise, NASA public affairs chief John Donnelly stated in reference to promoting the Shuttle: "Obviously, it is in our interest to serve the needs of the broadest possible constituency."[7] Brian Duff, NASA's public affairs chief during the early 1980s, argued that broad public support made possible the things "we want to do."[8] Maintaining that a positive public experience with the Shuttle could smooth the way for political acceptance of a space station, Duff noted: "The continuing exposure of millions of Americans and foreigners to NASA's current successes is in itself helping to prepare an environment of acceptance for future programs."[9] Indeed, by then the Shuttle program was underway and the agency was pressing to gain the Reagan administration's approval of the Earth orbiting research platform it had long envisioned. Duff's boss, Administrator James Beggs, concurred. Beggs explained to the *Washington Times* in 1983: "We're in the business of producing shuttles, but if we are to keep producing them, we need the support of the American public."[10] Shuttle program manager Wayne Hale observed that the goal of those working on NASA's human space flight program "always, always was to get the permission and the resources. … That's the subtext to every media interaction, every congressional visit, everything that's done."[11] John F. Murphy, NASA assistant administrator for legislative affairs, expressed the idea succinctly in a 1983 letter responding to a request for information

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[6] Grumman Aerospace Corporation, *Space Shuttle: The Next Logical Step*, March 1971, 19, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[7] F/Assistant Administrator for Public Affairs (John P. Donnelly) to L/Associate Administrator for External Affairs, "Space Shuttle," November 13, 1975, Folder 8227, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[8] LF-6/Director of Public Affairs to AD/Deputy Administrator, "Public Relations Policies," 3.

[9] Ibid., 4-5.

[10] Jim Fraze, "Enterprise Wows Capital Citizenry," *Washington Times*, June 13, 1983, Folder 8008, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[11] Wayne Hale, telephone interview by author, April 12, 2013.

about the Shuttle from Mr. J. Scott Brownell of Branford, Connecticut: "It is through enthusiastic supporters of the space program, like you, that NASA makes new friends."[12]

But how would NASA go about building connections with the American people writ large for the Shuttle program and ultimately garner support for follow-on human space flight initiatives? What relationships would prove meaningful and appropriate to legitimize the Shuttle? By 1970, half of Americans believed the nation was spending too much on space, and that percentage began rising as the decade wore on.[13] Although space enthusiasts continued to write to NASA and manifest their excitement about space flight in other ways, the agency's attempts to garner even a bit of attention to, let alone endorsement of, the few human missions taking place in the early 1970s seemed to fall flat, with public and media excitement about NASA's launches clearly on the decline. While NASA's use of a color television camera and an electric rover on Apollo 15 garnered some renewed attention on lunar missions, media attention to Skylab and the 1975 Apollo-Soyuz cooperative mission between the two superpowers, the single NASA element of Nixon's détente plan with the Soviet Union, was minimal.[14] Gordon Harris, Kennedy Space Center's first public affairs chief, notes that television cartoons got better audiences.[15] Consequently, television networks broke with tradition and did not broadcast the splashdown return of the third and final crew of Skylab astronauts. According to longtime NASA staffer Josie Soper, NASA tried to make "a big deal" of Apollo-Soyuz when it was the only human mission flying until Shuttle came on

[12] John F. Murphy to J. Scott Brownell, January 31, 1983, Folder 801, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[13] Roger D. Launius, "Public Opinion Polls and Perceptions of U.S. Human Spaceflight," *Space Policy* 19 (2003): 167.

[14] NASA deputy administrator George M. Low had organized a "Think Group" in 1971 to suggest mission antics that might spur public interest in the Apollo 15, 16, and 17 flights. See Francis T. Hoban, *Where Do You Go after You've Been to the Moon?* (Malabar, FL: Krieger, 1997), 5-6.

[15] Gordon Harris, "Images of Space," *Spaceflight*, Aug.-Sep. 1979, 358.

line several years later.[16] But issuing numerous press releases, conducting status briefings throughout the mission, and sponsoring a movie about the mission narrated by Yul Brynner did not lead these initiatives to grab many headlines.[17]

NASA and President Nixon hoped to forge new connections with citizens by portraying the Shuttle as a space technology that would serve the space enthusiast as well as the person focused instead on earthly concerns, yielding and leading to both an exciting and purposeful future in space. Involving new space flight participants as users of and flyers aboard the Shuttle were central components of NASA's efforts to realize the initiative's viability, and I discuss these approaches in chapters 3 and 4. But NASA maintained that legitimizing the Shuttle also entailed garnering among external publics an appreciation of the new vehicle's value within society, just as it had aimed to do during the Apollo era. The present chapter shows how NASA strived to build on the vision Nixon had expounded, making the Shuttle accessible and meaningful to disparate publics. The chapter traces these efforts as they took place throughout the vehicle's development years during the 1970s and its first years of operations during the early to mid-1980s.

This chapter presents two interrelated approaches NASA used to engage, serve, and gain the support of a broad range of publics with the Shuttle program. The first section describes NASA's efforts to inform citizens of the Shuttle's projected and actual achievements. The latter section accounts for how the agency inspired them through visual and virtual access to the Shuttle. NASA used forms of each to satisfy human space flight enthusiasts as well as to counter critics. Originating in the Apollo era, both entailed consumer-product approaches to public engagement and a commitment to serving the American people through quasi-democratic tactics including articulating anticipated benefits, openly communicating

[16] Josie A. Soper, interview by Rebecca Wright, April 19, 2006, transcript, NASA Headquarters Administrator Project, NASA Headquarters, Washington, DC, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Administrators/SoperJA/SoperJA_4-19-06.htm.

[17] The movie Yul Brynner narrated is described in NASA, *"*Apollo Soyuz,*"* Folder 7462, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

and displaying achievements, and responding to public expressions of interest. NASA introduced changes, however, in the uses of each during the Shuttle era.

For one, while still desiring to attain broad support for human space flight, NASA began to deconstruct the American citizenry in an effort to identify, serve, and create constituencies for the Shuttle. Officials reached out to specific groups using targeted approaches, images, and messages about the Shuttle that were most relevant to them, emphasizing and expanding on various facets of the democratic imaginary for the Shuttle that Nixon had propagated.[18] Once the Shuttle was flying, NASA also sought to demonstrate the credibility of its claim that the vehicle would make space flight routine. Further, the agency capitalized on the features of the Shuttle that supported the sociotechnical imaginary – its relative roominess and ability to accommodate larger crew sizes and longer mission lengths, as well as the availability of new communications technologies – and offered opportunities to make citizens feel like participants in space flight. In doing so, NASA gave millions the chance to view and "experience" the Shuttle in more proximate ways than the agency made possible during the Apollo missions.

It is worth noting that the agency's employment of these approaches did not follow a master plan per se. The activities followed the common strategy of seeking to substantiate the Nixonian imaginary for the Shuttle, with the messages NASA used in its written materials stemming from the points Nixon and Fletcher had articulated to justify the Shuttle in the early 1970s. While considering some audiences early on, NASA officials, from the administrator to public affairs to other offices, often made decisions about whom to engage and how as ideas and opportunities arose and as challenges and critics became evident. Moreover, different organizations and individuals within NASA often held different opinions on what approaches and what audiences should be pursued, particularly concerning virtual interactions with the

[18] Throughout this chapter I refer to NASA's sociotechnical imaginary for the Shuttle with variable qualifiers that connote a technical system envisioned by NASA to provide open access to space and benefits to broad groups of citizens. While I vary these terms for stylistic purposes, the reader should be aware that I continue to invoke the concept of a sociotechnical imaginary, comprising a social vision for a technical program.

Shuttle orbiters. Consequently, officials had to convince one another of the merits and risks of various public engagement choices.

Through these public engagement efforts, NASA satiated and found allies who valued the Shuttle program, many of whom in turn became integral to NASA's efforts to further promote and sustain the Shuttle program. External publics and the Shuttle thus co-evolved, with these public engagement efforts helping to shape public perceptions of the Shuttle program as much as these offerings and public interest in them affirmed the Shuttle as a democratic technology, belonging to the nation.

Sharing the Shuttle through Discourse

Nixon had promulgated a sociotechnical imaginary depicting the Shuttle as a vehicle that would meet an assortment of public needs and involve a variety of participants. It would, however, be several years from the time of the Shuttle's 1972 approval until the new vehicle would begin missions and be able to deliver that vision. NASA officials thus spent the Shuttle's development and early years of flight promoting the new vehicle and its value to external publics through the use of discourse made up of rhetoric, messages, and images aimed at appealing to their assorted and collective interests. Continuing to embrace a consumer-product approach to engagement and public service, and standing by the Space Act's communications mandate, NASA officials regarded disseminating information about the Shuttle as vital to building the legitimacy of the human space flight program moving forward by enrolling external publics as attestive supporters of the new initiative.

NASA officials sometimes suggested publicly that the purpose of informing people was broader and multidirectional. Nominated NASA administrator Robert Frosch, for example, responded to an inquiry from Congress about NASA's public affairs program by stating that NASA sought public understanding of the space program so that citizens could "be better prepared to inform NASA of the

things that should be undertaken."[19] At the same time, Frosch informed the Carter administration that NASA did not need expanded authority or funding to enhance its public involvement efforts in support of an administration initiative to assist "consumers, workers, small businesses, and others" with participating in "agency proceedings" to improve agency decision-making.[20] Indeed, for the most part, NASA officials believed strongly that sharing the agency's accomplishments, goals, and plans for the Shuttle with external publics would serve the existing interest in NASA activities by space enthusiasts and, perhaps more importantly, provide skeptics with the knowledge they seemingly lacked in order to recognize the importance of NASA's work.

Officials made clear their commitment to this "deficit" view of public engagement on several occasions. As Administrator Tom Paine expressed to Senate Committee on Aeronautical and Space Sciences chairman Clinton Anderson concerning the expansion of Kennedy Space Center's visitor center in 1970: "Certainly, we believe that continued and improved exposure to the space program will provide a solid basis for stimulating an improved public understanding on the part of the public of our program and the benefits to be derived from them."[21] James Beggs, NASA administrator during the first few years of Shuttle operations, took to heart the advice of public opinion pollsters, who told him the way to get past the fact that "[NASA's] support in the general public is about a mile wide and an inch deep" was "to get more stuff out there."[22] Former Shuttle program manager and flight director Wayne Hale observed that the deficit model mentality has persisted across NASA: "There's this constant thought of 'Surely, if we

[19] "Answers of Robert A. Frosch, Nominee for the Post of Administrator, NASA, to Questions Posed by the Committee on Commerce, Science, and Transportation, United States Senate," June 2, 1977, Folder 4194, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[20] Robert A. Frosch to Esther Peterson, July 10, 1979, Code A Chron Files, July 2-19, 1979, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[21] Thomas O. Paine to Clinton P. Anderson, April 3, 1970, Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[22] James M. Beggs, interview by author, Chevy Chase, MD, April 8, 2013.

could just explain to people the importance of this, they would write their congressmen, stand up in town hall meetings and praise us, and the Congress would vote us the money."[23]

NASA was not alone in its commitment to keeping the nation's citizens informed about the Shuttle and other projects as a means to fill in their knowledge "gaps" and maintain the agency's viability. Many members of the House Science and Astronautics Committee and its Subcommittee on NASA Oversight were space enthusiasts who desired to see the program continue. Sharing NASA's conviction that many citizens were deficient in their understanding of the space program, they were determined to facilitate NASA's ability to disseminate information broadly and included an additional $4 million for NASA's public affairs office in the agency's FY 1972 authorization. In October 1971, the subcommittee issued a report which indicated that citizens often showed "a lack of understanding" about what it took for NASA to be successful. It noted that with the Shuttle and other new space and Earth science programs coming on line, "there is even more reason to present to the public the various aspects of NASA's work," as these programs "may have a profound effect on our future."[24] While Senators Mondale and Proxmire averred that the agency spent too much on "publicity," the House authorizers sided with NASA administrator Jim Fletcher in arguing that reductions in NASA's public affairs budget due to the agency's post-Apollo funding slump inhibited NASA from effectively fulfilling its Space Act mandate to inform the public about NASA's work.[25]

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[23] Wayne Hale, interview. Others at NASA have seen sharing information as a means of remaining transparent for accountability's sake but not for the purpose of selling the agency or its programs. According to former NASA manager Alan Ladwig, "Everybody will keep going back to the [National Aeronautics and] Space Act – "the widest practicable"…more sins have been committed based on that sentence than any other thing in the government! But I think the legitimate thing we should do is to disseminate information widely, as I think that is necessary. In terms of building public support for some grand next step, I'm not convinced that that's an appropriate role for us." Alan Ladwig, interview by author, Washington, DC, January 31, 2013. Similarly, NASA public affairs manager Bob Jacobs regarded his job as "cleaning the windows" to "give the American people a better view of the space program they are paying for." Robert N. Jacobs, interview by author, Washington DC, January 24, 2013.

[24] U.S. House of Representatives, Committee on Science and Astronautics, Subcommittee on NASA Oversight, NASA Visitor Information Facilities, 92nd Cong., 1st sess., October 1971, committee print, 1.

[25] Gordon L. Harris, *Selling Uncle Sam* (Hicksville, NY: Exposition, 1976), 33-34.

NASA had to decide how to go about sharing the Shuttle and other agency programs with external publics. The House Committee noted in an April 1971 report that "[g]eographical, societal and occupational divisions of public interest create demands for varying types of information" and urged NASA to study the interests of different segments of society.[26] NASA official William Gevarter argued in 1975 that NASA's public relations activities should "be geared to impact the basic value systems of the societal group at which the P.R. activity is directed."[27] Throughout the 1970s, NASA officials contemplated how a steady stream of publicity, including popular news summaries, expanded television and radio exposure, producing movies for commercial airliner flights, and creating distribution lists of opinion makers, educators, and others for NASA promotional materials, could help the agency boost its public image and general interest in the space program.[28] Late in the decade, NASA began to work with a political scientist from Northern Illinois University named Jon Miller, who studied public attitudes toward science and technology for the National Science Foundation. Carrying on through the mid-1990s, Miller conducted analyses on NASA's behalf that classified publics for the agency based on their levels of interest in the space program. Miller's thrust was that the agency had the potential to expand the ranks of those most supportive of the space program – whom Miller regarded as the most likely to foment political backing for NASA's programs – by gearing its information programs to satisfy the attitudes and

[26] House Committee on Science and Astronautics, Authorizing Appropriations to NASA, 92nd Cong., 1st sess., April 22, 1971, HR Rep. 92-143, accessed December 15, 2014, http://www.hq.nasa.gov/office/hqlibrary/documents/o45128943_1972.pdf.

[27] ADA-1/Office of Policy Analysis (William B. Gevarter) to ADA/Associate Deputy Administrator, "Perception of the Space Program by the Public – Its Implications for NASA, and Some Steps It Can Take," March 27, 1975, Folder 6714, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[28] AD/Deputy Administrator (George M. Low) to RPP/Manager, Solar and Chemical Power, "NASA Publicity," June 12, 1974, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; David Williamson, Jr., "Some Thoughts on the Accurate Projection of the NASA Image," November 1, 1974, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NS/Director, Information Systems Division (Louis N. Lushina), to LF/Director, Public Affairs Division, "Possibility of Showing NASA Movies on Airlines," March 28, 1979, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

behaviors of those less interested and knowledgeable about its activities.[29] Agency documents reveal that NASA's public affairs office often endeavored to apply Miller's thinking in planning how to engage various external publics.[30]

NASA's strategy included employing multiple images and messages in communicating with external publics about the Shuttle, consistent with Nixon's portrayed imaginary of the Shuttle as a spacecraft relevant and accessible to all. The agency centered its discourse around four major themes stemming from that imaginary in an effort to impress upon citizens the significance, value, and legitimacy of the new human space flight program during its development stage and early years of flight operations. NASA officials deployed certain themes broadly while targeting specific groups they aimed to enroll as constituencies with themes officials believed would resonate most. I describe each theme in turn.

Promising Practical Benefits

The public and political controversy surrounding the future of government-sponsored human space flight had made clear to NASA, Nixon, and members of Congress alike that above all, NASA would need to focus its information and education efforts about all of its programs, including the Shuttle, on how they would be relevant in a social milieu that seemed to have little tolerance for extravagance, elitism, and esoteric projects. NASA had proven itself a capable, can-do agency but one that, with its focus on sending humans into space given so many problems on Earth, seemed insular, out-of-touch, and

[29] Jon D. Miller, "Is There Public Support for Space Exploration?" *Environment*, June 1984, 30. Miller implicitly assumes that proponents of space activity would necessarily support any and all NASA-proposed initiatives. Even those interested in NASA activities, however, are often divided over what initiatives the agency should emphasize (e.g., human space flight versus robotic space exploration). Miller also assumes this public would become politically active on NASA's behalf based on survey responses about political behavior, not by examining actual precedent for citizen political action on space issues.

[30] See, for example, James W. McCulla, "Guest Activities in the Shuttle Era," March 31, 1982, attached to LFF 3/ Chief, Public Services Branch to distribution, "Revising NASA Guest Activities in the Shuttle Era," April 1, 1982, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

in pursuit of arcane goals in the minds of many. Articulated by many reacting to Apollo and Paine's ambitious humans-to-Mars proposal, these ideas were corroborated by studies NASA commissioned during the first part of the 1970s to better understand the political attitudes and social values of various sectors of the American public. A 1971 study by the Hudson Institute informed the agency that it had a disadvantage in competing for federal funding because it lacked a direct benefit to people's lives as a "helping"-type program and given that the military-industry complex was in disfavor with minorities, youth, and a new left counterculture.[31] A follow-on Hudson study concluded that Americans most valued national economic well-being, morality, and peace while acknowledging that industrial capabilities and scientific progress were instrumental in making the United States great in these respects.[32] It noted, however, that members of the general public did not associate NASA and the space program with their own problems or goals and that NASA needed to change public perceptions to attract popular support.[33]

Several NASA officials came to admit what these polls and other manifestations of public views on the space program had indicated: the agency's emphasis on the spectacle and adventure of space travel during the Mercury, Gemini, and Apollo programs had not won over a majority of Americans to the agency's cause. Instead, rational explanations and social context were the order of the day. Paine conceded as much, noting in 1970 that "our spectacular achievements in space have overshadowed the less dramatic but equally important story of the many benefits the nation is realizing from the space

[31] Anthony J. Wiener and B. Bruce-Briggs, *Contextual Planning for NASA: A Second Workbook of Alternative Future Environments for Mission Analysis*, Interim Report II, HI-1272/3-RR (Croton-on-Hudson, NY: Hudson Institute, 1971), Folder 16823, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[32] William Overholt, Anthony J. Wiener, and Doris Yokelson, *Implications of Public Opinion for Space Program Planning, 1980-2000*, draft final report, HI-2219/2-RR (Croton-on-Hudson, NY: Hudson Institute, 1975), Box 3, Space Flight Opinions and Justifications Subseries, General Reference Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[33] ADA-1/Office of Policy Analysis (William B. Gevarter) to ADA/Associate Deputy Administrator, "Perception of the Space Program by the Public."

program."[34] In succeeding Paine, Fletcher declared in 1973 that it was time for NASA "to move back from the spectacular" and "become more like one of the service agencies of government."[35] Apollo astronaut Harrison Schmitt, meanwhile, expressed that NASA public relations efforts had focused too much on events, spectaculars, and astronauts at the expense of providing an understanding of NASA's broad societal impact and significance to the future.[36] George Low recognized that philosophical arguments about the human desire to explore "may resonate with certain social circles" but that the "average American" was "more interested in what this means to them today than in broad promises of the fruits of future explorations."[37] A former aerospace industry employee likewise recognized a need to stress individual and collective benefits of the space program to Americans, noting that NASA and the industry needed to "sell the public on the desirability of aerospace, not more of this 'look how clever we are' pap that has been foisted off on the public."[38]

Even NASA's public affairs officials agreed. New public affairs chief during the 1970s, John Donnelly, suggested that NASA had overemphasized discrete projects and hardware instead of the reasons for those elements. Donnelly recommended to Fletcher in 1973 that NASA move away from communicating in "project-oriented mode" and employ a unifying rationale for space flight that would resonate with the "non-cognoscenti."[39] A few years into Shuttle development, Donnelly expressed that

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[34] "Benefits of the Nation's Space Program: Summary of a Statement by Dr. Thomas O. Paine, Administrator, NASA, April 6, 1970," NASA Facts, NASA Manned Spacecraft Center, Public Affairs Office, Houston, TX, Folder 4702, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[35] John Noble Wilford, "NASA, on 15th Birthday Today, Finds Itself in an Identity Crisis," *New York Times*, October 1, 1973, 70.

[36] J. Kelly Beatty, "The NASA Dilemma: What Price Space?" *Sky and Telescope*, January 1978, 27, Folder 6713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[37] George M. Low to David D. Ogilvie, July 22, 1975, Folder 6714, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[38] Stephen A. Kallis, Jr., "Aerospace Unrealities," *Aviation Week & Space Technology*, February 15, 1971, 54.

[39] Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012), 138.

NASA could not simply focus on "this new exciting piece of machinery" but instead needed to articulate its value proposition. NASA had to be able to answer "[w]hat good is it," Donnelly averred, "if continued public support is to be sustained, particularly after the first few flights."[40]

Perhaps the House Committee on Science and Astronautics put the issue best in its March 1971 report: "NASA has done a good job in bringing to the public the "what" of the space program, but has not been effective in explaining the "why" of the space program. The report noted that "the American public will support the space program, but only if the true story of space and its related benefits is more effectively brought home."[41] In 1974 Chairman Teague and the committee issued another report suggesting that "NASA should be doing much more in the area of disseminating space benefits information to the public."[42] Like Donnelly, the committee wanted NASA to focus less on reporting program status and more on explaining the benefits of its activities and sharing technology utilization data. During this timeframe, the House committee conducted several hearings reviewing the tangible benefits from the space program and published the proceedings in a series of reports that they distributed in response to citizen inquiries.[43]

Hence, NASA embraced throughout the 1970s a constant thematic emphasis on the pragmatic benefits to the nation and its citizens of the Shuttle and its other programs, redoubling the efforts it had made in the previous decade to articulate through speeches and letters responding to citizen inquiries how

[40] F/Assistant Administrator for Public Affairs (John P. Donnelly) to L/Associate Administrator for External Affairs, "Space Shuttle," November 13, 1975.

[41] House Committee on Science and Astronautics, Authorizing Appropriations to NASA.

[42] Quoted in Harris, *Selling Uncle Sam*, 32.

[43] See, for example, House Committee on Science and Astronautics, For the Benefit of All Humankind: A Survey of the Practical Returns from Space Investment, 91st Cong., 2nd sess., September 14, 1970, HR Rep. 91-1446. The House issued reports by the same name in December 1970, December 1971, October 1972, and April 1974.

investments in the space program served Americans.[44] Indeed, the tone and substance of speeches, fact sheets, pamphlets, and official reports coming out of NASA beginning in the late 1960s and into the new decade changed drastically to reflect the new focus. Fletcher conveyed the theme in a 1972 statement: "We now look ahead to several decades of a highly rational use of space. The focus will be on domestic needs, and the turning of our rapidly developing space capabilities to useful work. We have made our new program relevant to the needs of modern America."[45] A few years later, Fletcher told the *Salt Lake Tribune* that the "now" programs of the nation and world were shaping NASA's direction. "Congress, reflecting the wish of the people," said Fletcher, "wants it that way and that became the direction we (NASA) took."[46] Permeating the agency's internal culture, NASA's employee newsletter adopted the slogan "For the benefit of all…" on its footer and, referencing NASA's allocated percentage of each federal dollar, began a section called "Are you getting your 1 cent worth from NASA?"[47] Johnson Space Center's *Roundup* newsletter in 1971 advised employees to prepare to answer public questions about NASA's societal benefits.[48]

NASA stressed with even greater frequency in speeches and public relations materials the agency's role in developing communications and weather satellites as well as its contribution to technological innovation that led to the development of new, everyday applications useful in solving community, public, and industry problems. NASA began to tout these "spinoff" benefits of the space

[44] For more on NASA's embrace of pragmatism, see Chapter 5 of Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994).

[45] L. B. Taylor, Jr., *For All Mankind: America's Space Programs of the 1970s and Beyond* (New York: E. P. Dutton, 1974), 8.

[46] "'Now' Dictates Space Efforts, Dr. Fletcher Tells Session," *Salt Lake Tribune*, June 13, 1976, 125.

[47] *NASA Activities*, November 1976, 28, Folder 6903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[48] Johnson Space Center, "How to Answer Those Questions about Benefits of Space Research," *Roundup*, July 30, 1971, 3, Box 2, Space Flight Opinions and Justifications Subseries, General Reference Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

program as a way of demonstrating the agency's practical relevance and started producing an annual "Technology Utilization Program" report in 1973, followed by *Spinoff* in 1976, to send to citizens who asked about NASA's societal benefits. The agency, along with some of its aerospace industry partners, issued several socioeconomic impact studies during this timeframe.[49] While many of the benefits and applications highlighted had emerged from the agency's work on space science and Earth observing probes, NASA pointed out contributions from the human space flight program where feasible. The agency featured "down-to-Earth" benefits derived from the Apollo program including lightweight breathing gear for firemen, astronaut food delivery systems that could be adapted to assist the elderly, and onsite emergency diagnosis and treatment systems.[50] A Manned Spacecraft Center form letter to respond to public inquiries expressed that when NASA spent money on a project, "What we are really buying is the time and talents of thousands of Americans who work on the space program." To put the size of the Apollo investment into perspective, the letter pointed out that Americans spend more in a year on alcohol and tobacco than NASA spent in a decade to send humans to the Moon.[51] The *Aeronautics and Space Report of the President*, required annually by the Space Act and focusing primarily on NASA activities, included in 1974 a transmittal memo from President Nixon that linked the space program to "more

[49] See, for example, Midwest Research Institute, *Economic Impact of Stimulated Technological Activity*, MRI Project No. 3430-D, Final Report Summary (April 7, 1970 – October 15, 1971), "Economic Benefits" Folder, Box 18, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; McDonnell Douglas, *The Space Program and Its Economic Effect on the Nation*, n.d., Folder 5720, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Michael K. Evans, *The Economic Impact of NASA R&D Spending*, Final Report, Executive Summary (Bala Cynwyd, PA: Chase Economic Associates, 1976), "Economic Benefits" Folder, Box 18, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[50] NASA, "Benefits from NASA-Developed Technology," news release 72-132, July 4, 1972, Folder 6990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Down to Earth Space Benefits Result from Moon Missions," news release 74-161, June 18, 1974, Folder 6906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Houston Firemen Get NASA-Developed Lightweight Breathing Gear," news release 74-320, December 9, 1974, Folder 6906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Astronaut Food Technology Applied to Meals for Elderly," news release 76-02, January 18, 1976, Folder 6906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[51] Brian Duff, NASA Manned Spacecraft Center form letter response for public letters, Folder 4702, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

personal concerns" such as energy, the environment, and land use planning and emphasized the medical and economic benefits of human space flight.[52]

Both the *Aeronautics and Space Report of the President* and the agency's 1976 *Outlook for Space* strategic planning document featured sections on space applications and their earthly benefits ahead of descriptions of human space flight activities, suggesting a shift in NASA's programmatic emphasis.[53] NASA's leadership nonetheless continued to regard human space flight, and particularly the new Shuttle initiative, as its highest priority. But with the Shuttle, as political scientist Mark E. Byrnes observed, the agency would stress the pragmatic aspects of human space flight much more strongly than it did with its previous human initiatives.[54] Indeed, the Shuttle, portrayed as a far more democratic technology than the Saturn launch vehicles and capsules of NASA's initial human forays into space, would be a key representation of NASA's shift in commitment to a practical space program. Building on the imaginary that Nixon had promulgated for the Shuttle, the agency would aim to make the vehicle understandable and relevant to All Americans, including those who were unfamiliar with or uninterested in human space flight or did not readily recognize its connection to their lives.

Nixon had urged Fletcher and Low to emphasize in NASA's public communications the Shuttle's contributions to a breadth of near term and prospective civilian applications as well as its value as an investment that would lower the cost of space operations.[55] NASA, with the support of its aerospace

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[52] ADA-1/Office of Policy Analysis (William B. Gevarter) to ADA/Associate Deputy Administrator, "Perception of the Space Program by the Public."

[53] Ibid., 6-8; NASA Outlook for Space Study Group, *Outlook for Space: Report to the NASA Administrator* (Washington, DC: NASA, 1976), Box 17, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[54] See Chapter 6 of Byrnes, *Politics and Space*.

[55] George M. Low, memorandum for the record, "Meeting with the President on January 5, 1972," January 12, 1972, in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. I: Organizing for Exploration*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 1995), 558-559.

industry contractors, heavily promoted these concepts through speeches, Congressional testimony, brochures, and other publications. Indeed, these communications proved stylistically different than many that NASA produced in the 1960s. Whereas many previous publications focused on the agency's project plans and hardware without much explanation of their rationales, NASA began to couch the Shuttle and its other activities in the 1970s in terms of societal benefits. A 1972 NASA brochure about the Shuttle opened by making plain that "[a]fter a decade highlighted by driving effort and dramatic achievement, America's space program is shifting emphasis. Now the goal is practical benefits for people on Earth."[56] Jesco von Puttkamer, a NASA Headquarters program manager responsible for planning human missions beyond Earth orbit, acknowledged in a 1979 *Spaceflight* article that the Shuttle and its focus on commercial uses of space came "in direct response to the down-to-earth needs and demands of people everywhere."[57]

As portrayed by NASA and its industry contractors, the Shuttle provided a vital link unifying human space flight and space applications, rendering the human program instrumental in the pursuit of the invaluable applications that NASA hyped throughout the 1970s. NASA brochures indicated that the Shuttle, as a reusable system with a large carrying capacity and the ability for onboard astronauts to aid in tasks, would make carrying, deploying, and retrieving satellites in orbit simple and economical.[58] A Rockwell brochure from 1976 enumerated the many sorts of applications areas that satellites as well as laboratories carried into orbit by the Shuttle could benefit, including management of forests and croplands, exploration for new energy resources, communications, and detection and warning of natural

[56] NASA, *Space Shuttle: Emphasis for the 1970's* [sic], NASA EP-96 (Washington, DC: U.S. Government Printing Office, 1972), 1, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston TX.

[57] Jesco von Puttkamer, "The Last Day of the Old World," *Spaceflight*, November 1979, 445.

[58] NASA, *Space Shuttle: Emphasis for the 1970's* [sic], 1.

hazards.[59] Another emphasized the Shuttle's ability to be "sent off quickly on a special mission to gather information needed in an emergency on Earth, such as a flood or crop blight."[60] A 1971 Grumman brochure suggested the Shuttle's value in international relations as a platform for deploying military peacekeeping payloads, cooperating with other nations, and providing assistance to developing countries seeking to broaden their communications networks and services.[61] John Naugle, NASA associate administrator, expressed that the Shuttle would be "designed to meet the needs of all groups who will be using space in the 1980s and beyond."[62] This space technology would directly serve a multitude of user groups – scientists, the national security community, various agencies at all levels of government, and an assortment of industries ranging from fishing to pharmaceutical development – and, in so doing, would benefit all Americans. As a 1975 University of Alabama in Huntsville study for NASA put it: "Like most other Americans, your life will be profoundly affected by the Space Shuttle/Space Lab (SS/SL) program in the years that lie ahead."[63]

In an effort to resonate with the era's focus on environmental health and energy concerns, NASA sought to link the Shuttle to these particular issues. Donnelly had suggested as much to Fletcher in 1973, noting that showing the environmental benefits enabled by NASA's programs would connect NASA to a

[59] Rockwell International, *Space Shuttle Transportation System* (July 1976), 3, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston TX.

[60] NASA, *The Space Shuttle at Work*, by Howard Allaway, NASA EP-156 (Washington, DC: U.S. Government Printing Office, 1979), 23, quoted in Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994), 120.

[61] Grumman Aerospace Corporation, *Space Shuttle: The Next Logical Step*, 12-13.

[62] John E. Naugle, "Research with the Space Shuttle," *Physics Today*, November 1973, 31.

[63] Memorandum from the University of Alabama in Huntsville ED-PLUSS Study Team, attached to H. A. Engle and D. L. Christensen, *Educational Planning for Utilization of Space Shuttle (ED-PLUSS), Executive Summary: Identification and Evaluation of Educational Uses and Users for the STS* (Huntsville: University of Alabama in Huntsville, February 1975), Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

movement with high priority for the public and the Congress and make the agency "relevant."[64] Fletcher concurred. A 1975 NASA brochure consequently indicated: "When the Space Shuttle becomes operational in 1980, it will be an important tool to provide mankind with information to help in managing and preserving our crowded Earth… Payloads launched by the Space Shuttle will provide practical data that will affect both the daily lives of people and the long-term future of mankind."[65] Rockwell, the Shuttle orbiter's prime contractor, joined NASA in promoting this theme. In 1974 the company published a brochure entitled *Space Shuttle: For Down to Earth Benefits*, which noted that space is critical to humanity's ability to take care of Earth and manage "dwindling resources" and find new ones.[66] Two years later Rockwell made an even tighter, somewhat menacing link between the Shuttle and stewardship of the Earth's ecological system, stating: "The quality of life here – indeed, our very survival – depends on preservation of that system. And to preserve it, we must find ways to use it more wisely. In this context, the Space Shuttle may be the most important spacecraft ever developed."[67] Equally ominously, Rockwell averred in a 1982 publication that "With the world growing more complex almost daily and long-range projections painting a somber picture of the problems besetting mankind at the turn of the century, we will have to rely increasingly on space to meet our needs on earth. Shuttle missions will be directly related to those needs…"[68]

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[64] Hersch, *Inventing the American Astronaut*, 138.

[65] NASA, *Space Shuttle* (Houston: NASA Lyndon B. Johnson Space Center, February 1975), 29, Folder 7854, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[66] NASA/Rockwell, *Space Shuttle: For Down to Earth Benefits* (July 1974), Folder 6906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[67] Rockwell, *Space Shuttle Transportation System: A Promising New Era for Earth* (September 1976), 2, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston TX.

[68] Rockwell, *Shuttle* (July 1982), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston TX.

NASA, with the support of the Shuttle's contractors and Congressional proponents, also sought to counter those who doubted the new human space flight initiative from a cost and economic point of view. The agency presented the Shuttle as not only more capable but also more economical than the expendable launch systems used for its previous human flight programs. A 1972 NASA fact sheet about the Shuttle estimated the program's cost for development, the production of the orbiters, and other flight hardware, facilities, and investments required through 1990 at $8.3 billion. Assuming the Shuttle would fly some 500 missions for NASA, the Department of Defense, and other users during that period using orbiters that would each be used 100 times, NASA stated that the Shuttle would reduce launch and payload preparation costs and thus offer a savings of $12.4 billion over use of expendable vehicles and would more than pay for itself.[69] The new space transportation system would substantially reduce the cost of putting satellites in orbit over the existing Delta, Titan, and Atlas-Centaur launchers. The net result, according to a March 1972 NASA fact sheet, would lower launch expenses to $160 per pound to orbit, nearly an order of magnitude down from current costs.[70] Grumman's 1971 Shuttle brochure pointed out that NASA's FY 1971 budget of $3.4 billion – of which the Shuttle would require less than half, even over a five-year development period – represented just a small fraction of the $77.3 billion the nation would spend on social programs that year.[71] Arizona Senator Barry Goldwater remarked at the unveiling of NASA's first orbiter in 1976 that "the Space Shuttle is going to be a better deal for America than the purchase of Alaska, which was a very good bargain."[72]

The agency also emphasized that the Shuttle investment would ripple through the nation's economy. Fletcher conveyed to Congress that "for every $1 that you invest in a high technology program

[69] NASA, *Space Shuttle* (February 1972), 13, Folder 7905, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[70] NASA, "The Space Shuttle," fact sheet, revised March 15, 1972, 3, Folder 7924, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[71] Grumman Aerospace Corporation, *Space Shuttle: The Next Logical Step*, 14-15.

[72] *Cong. Rec.*, 94th Cong., 2nd sess., September 21, 1976, vol. 122: S16327.

like the Shuttle, or like Apollo, you receive $7 back."[73] The figure stemmed from a NASA-commissioned study to assess the agency's economic impact. A 1975 NASA brochure noted that the Shuttle would enhance the nation's trade posture by stimulating technology-intensive industries.[74] Shuttle contractors reminded citizens that while the Shuttle would have an unearthly destination, the funds spent building it would stay on Earth. McDonnell Douglas' July 1979 "Breadman" ad in *Forbes* indicated that as was the case for Apollo, dollars for the Shuttle would remain on our home planet and provide economic and social benefits.[75] Rockwell's 1976 Shuttle brochure, whose cover boasted an orbiter deploying a satellite against a background of waving stars and stripes, pointed out that the Shuttle was being constructed by companies in almost every U.S. state.[76] Grumman estimated in 1971 that the Shuttle would have an economic impact of $37 billion over 15 years, with the program especially boost the retail purchasing power of middle-class aerospace workers across the country.[77]

In addition, NASA frequently blended its pragmatic and economic arguments, contending that the investment in the Shuttle would be more than justified by the resulting benefits, even though the latter might not be knowable at the time. A 1972 Shuttle brochure claimed: "The Shuttle represents an investment in mankind's future. It can provide dividends that will continue for decades to come."[78] NASA made a similar argument in 1973, reporting to Congress: "We can say with confidence that the research and development expenditures for the Shuttle will provide a considerable number of new

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[73] *Hearing before the Senate Committee on Aeronautical and Space Sciences*, NASA Authorization for Fiscal Year 1974, pt. 1, 93rd Cong., 1st sess., February 28, 1973, 218.

[74] NASA, *Space Shuttle* (February 1975), 63.

[75] McDonnell Douglas, "Breadman…" (advertisement), *Forbes*, July 23, 1979, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[76] Rockwell, *Space Shuttle Transportation System: A Promising New Era for Earth*, 7.

[77] Grumman Aerospace Corporation, *Space Shuttle: The Next Logical Step*, 16-17.

[78] NASA, *Space Shuttle* (Washington, DC: U.S. Government Printing Office, 1972), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

procedures and products that will benefit all of our people in the coming decades – and all as bonuses of a transportation system that is planned to save us money directly in its application to space."[79] NASA's March 1972 Shuttle fact sheet couched the relationship in somewhat conditional terms: "If, as is likely, new useful and economically beneficial mission possibilities open up during the 1980's [sic] because of the routine and quick access to space the Shuttle provides, the investment will be returned many times over."[80]

Other communiqués asserted with greater conviction the reverse causal relationship: that the Shuttle's ability to reduce the costs of space operations would be the impetus for the surge of societal benefits the agency anticipated. A 1975 NASA publication noted that the Shuttle's lower costs of access to space "will enable new and unforeseen solutions of problems."[81] As costs declined and operations became simplified, a 1972 NASA brochure asserted, manufacturing of drugs and alloys and other uses of the Shuttle would emerge, and the economic advantages of the new space transportation system would become clear. That brochure further declared that "scientific leaders believe the most significant benefits to people on Earth will come from inventions not yet conceived, which will be stimulated when the Shuttle makes space flight simple, less time consuming and less expensive."[82] Rockwell joined NASA in attesting to the unspecified potential of the new system, with the company's president and chief executive officer Robert Anderson drawing an analogy between the Shuttle and the automobile, whose inventors could not "imagine all the wonders" the automobile produced. Going on to make a comparison to ships, trucks, and airliners, Anderson posited that the Shuttle would "be as vital to the nation's future in space as

[79] NASA Authorization for Fiscal Year 1974, *Hearing*, 216.

[80] NASA, "Appendix to Space Shuttle Fact Sheet," revised March 15, 1972, 5, attached to NASA, "The Space Shuttle," revised March 15, 1972, Folder 7924, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[81] NASA, *Space Shuttle* (February 1975), 7.

[82] NASA, *Space Shuttle: Emphasis for the 1970's* [sic], 8.

the more conventional carriers are to the country's economic life and well-being today."[83] NASA's George Low, meanwhile, testified before Congress in 1973 that spinoffs would "flow inevitably" from the Shuttle program.[84]

NASA officials thought strategically about how to convey to various external publics its messages about the Shuttle's societal and economic merits. Making these points in Congressional testimony and publications for a broad distribution, often teamed with aerospace industry contractors, was only part of the approach the agency used. Officials also identified and spoke to members of groups they believed would be influential in supporting and helpful in spreading word about the value of the Shuttle and the space program generally. Beginning in 1974, Fletcher and Low initiated a series of small-group meetings with non-aerospace industry and community leaders around the nation to communicate and convince them of "the current and potential benefits of the space program on society and the nation's economy."[85] Through these dialogues, the NASA officials strived to persuade these prominent individuals to appreciate NASA's value. Where Fletcher and Low felt they attracted backers, they forged relationships with participants to assist NASA in combating "the problem of gaining public support for space" by hosting community meetings to spread NASA's messages.[86] Fletcher and Low urged NASA's centers to conduct similar meetings in their regions.[87] Further, recognizing college students as a group on the whole to be "highly skeptical about the value of technological enterprises in general and the space

[83] Rockwell International, *Space Shuttle Transportation System* (July 1976), 12.

[84] *Hearing before the House Committee on Science and Astronautics*, 1974 NASA Authorization, part 1, 93rd Cong., 1st sess., March 20, 1973, 63.

[85] AD/Deputy Administrator (George M. Low) to distribution, "Meetings with Nonaerospace [sic] Business and Community Leaders," April 15, 1975, Folder 4159, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[86] George M. Low to Daniel J. Fink, December 31, 1974, Folder 6714, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[87] AD/Deputy Administrator (George M. Low) to distribution, "Meetings with Nonaerospace [sic] Business and Community Leaders."

program in particular," NASA officials embraced the opportunity to meet with student groups such as the Forum for the Advancement of Students in Science and Technology (FASST) with the aim of engaging and equipping students interested in science and technology to talk well of the Shuttle and the space program to their peers.[88]

Fletcher also saw fit to help establish a group of space boosters dedicated to promoting and working toward attaining broad public acceptance of the benefits of the Shuttle and all of NASA's programs. Fletcher and NASA's assistant administrator for industry affairs and technology utilization, Edward Z. Gray, worked with the National Space Club, a space community membership organization aimed at promoting excellence in the space program, to initiate such an association.[89] Gray maintained that the organization would benefit from "substantial but low profile" aerospace industry participation but needed to have a "strong grass roots character which would draw on a broad spectrum of society" for its leadership and membership.[90] Wernher von Braun, who had since left NASA, became the first president of the new association, called the National Space Institute (NSI). Careful not to suggest NASA's endorsement or influence of such an organization, Fletcher sent a letter to von Braun welcoming NSI's assistance in helping "the American public to know and understand the value and benefits" of the space

[88] George M. Low to Glenn S. Dumke, June 9, 1975, Folder 6714, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; "Naugle Speaks on Space Program at FASST/White House Youth Conference," *NASA Activities*, April 1975, 18, "FASST – publicity" folder, Box 7, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[89] K/Assistant Administrator for Industry Affairs and Technology Utilization (Edward Z. Gray) to A/Administrator, "Phone Call to Mr. Robert Anderson, Rockwell," December 30, 1974, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[90] K/Assistant Administrator for Industry Affairs and Technology Utilization (Edward Z. Gray) to A/Administrator and AD/Deputy Administrator, "Organization of a National Space Organization," October 30, 1973, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; K/Assistant Administrator for Industry Affairs and Technology Utilization (Edward Z. Gray) to A/Administrator, "Meeting with National Space Club Representatives – 10:00 A.M., Friday, December 7, 1973," December 5, 1973, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

program and indicating NASA's willingness to cooperate with NSI "wherever feasible."[91] NSI's first chairman, ABC news anchor Hugh Downs, noted at a September 1975 Senate hearing that NSI filled a "communications void" between NASA and the public – not just the "man in the street" but also the doctor, farmer, environmentalist, and many more.[92] According to an NSI pamphlet, the organization would tell the American public about the "practical uses of space by people on Earth" and how the "commitment that successfully put a man on the Moon" would help "to solve the problems of energy, inflation, and others."[93] Von Braun stated at the NSI's first annual meeting that the organization would serve as "a catalyst between the space technologist and the user," making citizens aware of "the new opportunities offered by advances made in space experiments and space techniques."[94]

Assuring an Exciting, Collective Future in Space

It was not lost on Nixon or NASA that not all Americans were skeptical of the value of human space flight. The space program had, beginning in the Mercury days, ignited the imaginations of countless citizens who followed NASA's astronauts and their missions with unabated excitement. In

[91] James C. Fletcher to Wernher von Braun, April 18, 1975, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Incorporated as the National Space Association in June 1974, the organization changed its name to the National Space Institute in April 1975.

[92] Hugh Downs, "Testimony of Mr. Hugh Downs, Vice President, National Space Institute, before the Subcommittee on Aerospace Technology and National Needs," Folder 498, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[93] National Space Institute, *The National Space Institute* (Arlington, VA: National Space Institute, n.d.), Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[94] Frederick I. Ordway III, "Wernher von Braun and the National Space Institute," *Ad Astra*, November/December 1994, 31. Von Braun noted elsewhere that as an association financed not just by special interests but also by individual citizen members, the NSI would offer the latter a voice in supporting and shaping future space policy; although not a lobbying organization, the NSI would invoke the sentiments of its membership of "ordinary citizens" in educating Congress through meetings and testimony. See Wernher von Braun, "For Space Buffs – National Space Institute: You Can Join," *Popular Science*, May 1976, 72; National Space Institute, "NSI's Executive Director Testifies before House Subcommittee on NASA Budget and the U.S. Space Program," news release, "Miscellaneous Space Surveys" folder, Box 16, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

addition to the astronauts and the engineers at NASA who labored to realize the feat of launching humans into space, many more had become armchair participants in the adventure of human space flight through the open information program the agency had established. Thanks to NASA's achievements, space flight also had entered American popular culture in force, keeping thousands if not millions of citizens engrossed in the dream of space travel through fictional television shows such as *Star Trek*, *I Dream of Jeannie*, and *The Jetsons* while hankering for more of the real thing. Tens of thousands had signed up with TWA and Eastern Air Lines to take trips to the Moon that these airlines planned to offer in the not-too-distant future. Many wrote to NASA asking how they could become astronauts. Beginning in the early 1970s, many space enthusiasts channeled their interests in space flight by joining with others of like mind in grassroots organizations dedicated to promoting and expanding humanity's future in space. Some became members of the NSI.

Space enthusiasts yearned for adventure and excitement in the far-flung reaches of the cosmos. Credentialed scientists and engineers were attracting attention to the prospect of space colonization. German-born rocket engineer Krafft Ehricke promoted his idea of "the Extraterrestrial Imperative" – that it was human destiny to move into and exploit the solar system – while Princeton physicist Gerard O'Neill advanced designs for space colonies that could create Earth-like environments for inhabitants.[95] Members of space advocacy groups such as the L5 Society, named for a gravitationally stable point along the Moon's orbit at which its founders envisioned placing an O'Neillian space colony, believed that at the rates of progress NASA had exhibited, they would get the chance to live in space in their lifetimes. They were also infatuated with concepts like the development of giant solar power stations in orbit capable of beaming energy to Earth via microwaves. Science fiction aficionados and *Star Trek* fans envisioned similar futures. So future-oriented were some space supporters that they expressed concern that NASA's Shuttle imaginary, which conceptualized the vehicle as capable of making space flight routine and

[95] Krafft A. Ehricke, "Extraterrestrial Imperative," *Bulletin of the Atomic Scientists*, November 1971, 18-26; Gerald K. O'Neill, "The Colonization of Space," *Physics Today*, September 1974, 32-40.

ordinary could have the collateral effect of creating a dull space program. As a *Boston Globe* guest writer averred: "The Space Shuttle will definitely not fill our hunger. In it, astronauts will just become another group of blue-collar workers" doing "tedious" work.[96]

NASA officials, while sensitive to the strong current of pragmatic sentiment across the country, thus saw fit to depict the Shuttle as a keystone to these developments when and where they believed the portrayal would be well-received. While they had throttled back on linking the Shuttle to a space station and almost never talked publicly about sending humans to Mars or other planets, neither had they stopped dreaming of these possibilities. Projects like those articulated by Ehricke and O'Neill certainly could serve as a means to build on the adventure begun with Apollo and expand human presence in space. In the mid-1970s NASA Ames Research Center director Hans Mark pointed out to Administrator Fletcher the burgeoning American interest in science fiction and suggested that the agency consider harnessing it "to advantage in developing new political support for NASA's programs."[97] Believing that science fiction buffs had helped to sell Apollo, Fletcher agreed it was worth discussing.[98] A few months later, NASA teamed with O'Neill to conduct the first of a series of studies at Ames on space settlements and industrialization. The participants considered, among other matters, how the Shuttle could be used to assemble colonies and transport inhabitants while refurbished Shuttle external fuel tanks could house workers in an orbiting manufacturing facility.[99] A 1977 NASA brochure about the Shuttle also took on

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[96] Daniel A. Petitpas, "Nation Needs Another Great Goal," *Boston Globe*, July 31, 1977, Folder 6713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[97] Hans (Mark) to Jim (Fletcher), May 9, 1976, Folder 4215, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[98] F/Acting Assistant Administrator for Public Affairs (Robert J. Shafer) to Ames Research Center/Hans Mark, "Science Fiction Audiences," May 17, 1976, Folder 4215, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Fletcher's sentiment appears as a handwritten note on the memorandum.

[99] Hersch, *Inventing the American Astronaut*, 139; NASA, "NASA Publishes Space Settlements Design Study," news release 77-118, June 8, 1977, NASA Historical Reference Collection online, accessed December 16, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/21729.pdf?w=NATIVE%28%27SERIES+ph+is+%27%27PRESS+RELEASES%27%27%27%29&rpp=100&r=1&m=44; NASA, *Space Resources and Space Settlement*,

these futuristic possibilities, noting that the new vehicle could transport modular units for "self-sustaining settlements" used to operate solar power stations or manufacturing of drugs, metals, or other products.[100] Rockwell aimed to suggest these futuristic and seemingly fantastical uses of the Shuttle would begin sooner than people imagined and thus had nearer-term relevance. The company's 1976 brochure stated that the Shuttle would "transport building blocks" to allow for space processing facilities, space hospitals, and space-based climate control applications that would, beginning with the Shuttle's launch, "be increasingly realized in our own lifetimes. "[101]

Officials made a point to reach out and convey to various interested audiences that the Shuttle would be useful in these longer-lead pursuits in addition to anticipated applications in the nearer term. One key community NASA identified was the legions of *Star Trek* fans, many of whom were youthful, idealistic individuals who convened regularly at dedicated conferences across the country. Jesco von Puttkamer, who spoke at multiple Star Trek conventions throughout the 1970s in an effort to engage with Trekkies, explained that some NASA officials initially "didn't see the connection between us and *Star Trek*." Von Puttkamer nonetheless conveyed to his colleagues that *Star Trek* could help communicate what the space program was all about, noting that Trekkies were "not just living in a fantasy world but were very inquisitive about the country's capabilities and future in space."[102] Eager to engage Trekkies in dialogue and cater to their interests, he informed attendees at a 1976 convention in Washington, DC, that

NASA SP-428 (Washington, DC: U.S. Government Printing Office, 1979), accessed December 16, 2014, http://settlement.arc.nasa.gov/spaceres/.

[100] NASA, *The Shuttle Era* (Houston: Lyndon B. Johnson Space Center, December 1977), 3, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[101] Rockwell, *Space Shuttle Transportation System: A Promising New Era for Earth*, 24.

[102] Peter Cobun, "NASA 'Old Guard' Bristling," *Birmingham News*, October 5, 1976, Folder 12726, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Italics added to *Star Trek* in von Puttkamer's quote.

NASA wanted to meet "humanistic as well as scientific needs" and "include a little of the dreams of young people" in the space program.[103]

Likewise, John Yardley, NASA's associate administrator for space flight, stated at a 1976 National Space Institute meeting that it would be a "cinch" to establish colonies on the Moon or at L5 "if there was appropriate public support."[104] Recognizing that the concept of space settlements also could appeal to environmentalists, utopians, pacifists, and others attracted to the ecological and apolitical havens they might offer, Fletcher publicly asserted his belief that space colonies would emerge, possibly before the end of the 1980.[105] Homer Newell, NASA's associate administrator under Fletcher, observed that Fletcher was able to discuss outwardly the sort of exciting human space flight adventures that had appealed to Paine because he tempered his statements to project an image of conservatism and public responsibility.[106] Specifically, Fletcher conceded that NASA had no current plans to establish space colonies because "People are not ready to bear the costs of developing the technology that would place humanity permanently into outer space."[107]

Indeed, NASA struggled with how best and how much to connect the Shuttle to the idea of a democratized space future. For instance, NASA associate administrator Homer Newell was pleased to provide the Committee for the Future (CFF), a grassroots group dedicated to seeing humanity leave Earth, with outreach materials when they expressed a desire to promote public awareness of space starting in the

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[103] "Star 'Trekkies' are Briefed on NASA Goals," *NASA Activities*, March 1976, 27; Folder 8935, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[104] David Brandt-Erichsen, "The L-5 Society," *Ad Astra*, November/December 1994, 35.

[105] Henry W. Pierce, "NASA Chief Predicts People Space Colonies," *Pittsburgh Post-Gazette*, September 28, 1974, Current News, September 30, 1974, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[106] Homer E. Newell, *Beyond the Atmosphere: Early Years of Space Science* (Washington, DC: U.S. Government Printing Office, 1980), 397.

[107] "'Now' Dictates Space Efforts."

late 1960s.[108] But NASA officials were leery when in 1971 CFF proposed helping the agency to generate public pressure for the Shuttle and other elements needed to take humans further into space by organizing a "citizens" mission to the Moon. According to CFF's vision, NASA would provide gratis unused Apollo hardware, and proceeds of sales to interested parties of scientific experiment space and lunar material and photographs made available from the mission would fund the operations.[109] Although several senior officials at NASA Headquarters and the Manned Spacecraft Center expressed great fascination with this strategy for creating a constituency for the space program, NASA acting administrator George Low rejected it, citing cost, safety, and other logistical concerns.[110] Associate Administrator for Manned Space Flight Dale Myers suggested the group instead participate as scientific users of the Shuttle when available.[111] When CFF later contacted NASA about holding a televised conference on humanity's future in space onsite at Kennedy Space Center near the Vehicle Assembly Building, where the Shuttle would be integrated, NASA deputy associate administrator John Naugle advised the group that conference discussions should avoid suggesting that NASA was planning to colonize space or send humans to the Moon and instead should focus on space activities' roles in solving global problems.[112] Clearly, the agency was hesitant to accept the assistance of even its most ardent supporters when it could not fully

[108] Barbara Hubbard to Thomas Paine, June 4, 1968, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Homer E. Newell to Waldo E. Smith, June 10, 1968, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[109] Hubbard to George Lowe [sic], March 25, 1971, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[110] Barbara Marx Hubbard, *The Hunger of Eve* (Harrisburg, PA: Stackpole, 1976), 143-149; George M. Low to Hubbard, April 5, 1971, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[111] Associate Administrator for Manned Space Flight (Dale D. Myers) to George M. Low, "Barbara Hubbard's Committee for the Future," July 20, 1972, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[112] John E. Naugle, "Meeting with Barbara Marx Hubbard (Chairman, The Committee for the Future, Inc.)," memorandum for file, January 24, 1975, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Fletcher ultimately denied the request because of security and logistical issues around the Shuttle's use of the facility. See Fletcher to Hubbard, May 29, 1975, Folder 15114, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

control messages about its activities and its credibility, legitimacy, and semblance of service to the nation could potentially be marred by critics in the Congress, media, or other external publics.

NASA also had to determine how to handle the impact of its hype of the Shuttle on space and science fiction enthusiasts, some of whom channeled their zeal into activist efforts that sometimes went against the agency's preferences. Months before the first Shuttle orbiter's 1976 debut, some *Star Trek* fans petitioned to name the new vehicle *Enterprise* in homage to the television show's famed starship. NASA had been planning to name the orbiter *Constitution* in honor of the nation's bicentennial. After tens of thousands of letters poured into the White House advocating the name change, President Gerald Ford acquiesced, informing Fletcher that he preferred the choice of *Enterprise*.[113] Obligated to honor the President's desire, Fletcher renamed the new orbiter accordingly. Agency officials felt mixed about the name. Some expressed concern about the implications of the new name; as one NASA official put it: "Here come the exploiters."[114] Others, many of whom were *Star Trek* fans or at least were understanding of the attention the new name would bring to NASA, embraced its ability to popularize the Shuttle.[115] NASA Shuttle program director Myron Malkin conceded to the *Washington Post* that "This way we get a ready-made public."[116]

Perhaps the largest issue NASA officials would confront concerning the involvement of broader groups of people in space was the question at the top of many, if not most, space enthusiasts' minds: when would they personally would get the chance to ride to space aboard the Shuttle? Even with their

[113] Associated Press, "And Now, a Real Space Shuttle Named 'Enterprise'," *Washington Post*, September 9, 1976, A2, Folder 12726, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[114] Jonathan Eberhart, "Space Shuttle: An Enterprising Debut," *Science News*, September 25, 1976, 199.

[115] The motivation for Ford's decision to side with the Trekkies and endorse the name *Enterprise* is ambiguous. Brian Woods posits that Ford may have surmised that this "populist maneuver" would help him in the upcoming presidential election. See Woods, "Artifacts, Revolutionaries, and Bureaucrats: The Sociotechnical Shaping of NASA's Space Shuttle" (Ph.D. dissertation, University of Edinburgh,), WorldCat (45405214), 223.

[116] Associated Press, "And Now, a Real Space Shuttle Named 'Enterprise'," A2.

enthusiasm for NASA's human flight programs, there was an underlying sense among many space fans that NASA had been somewhat elitist even in its purported quest to serve the nation through the Mercury, Gemini, and Apollo programs. NASA had certainly strived to make people feel like part of the endeavor through its open information approach, but it had not made promises to open space to all. Michael A. G. Michaud, who examined the rise of citizen space advocacy groups in the post-Apollo era, observes that "Even for space enthusiasts, the space adventure remained vicarious."[117] As the 1970s rolled around, achieving personal goals and relying on one's own experiences as a means of understanding became important to increasing numbers of Americans. Many citizens became frustrated and disillusioned with NASA's one-way, broadcast mode of engagement and lack of a significant role for themselves. As Ms. Mary Manning expressed:

> We, the public, simply got tired of the way in which we were treated by NASA and its military affiliates – with complete indifference most of the time, but with simple-minded, folksy, obviously fake and self-serving news media campaigns whenever it was time for either a launch or the annual congressional funding.…Give us something that offers a genuine sense of national effort and participation in a great enterprise, a real flow of information and involvement, and we all might again get interested.[118]

It is in part because of this frustration that many banded together into these groups to advocate for an exciting, participatory space program after Apollo.

As part of its effort to cultivate and enlarge this bastion of space supporters, NASA strived beginning with the Shuttle program to counter the belief that it had not done enough to open space flight as broadly as appropriate. As part of the imaginary of a broadly accessible and valuable Shuttle, NASA and Nixon had promoted the Shuttle's ability to expand participation in space flight. Thus, in addition to its pragmatic vision of the Shuttle through the mid-1980s, the agency carried forward the concomitantly

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[117] Michael A. G. Michaud, *Reaching for the High Frontier: The American Pro-Space Movement, 1972-1984* (New York: Praeger, 1986), 15.

[118] Mary Manning, letter to the editor, *Los Angeles Times*, January 20, 1973, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

utilitarian and romantic idea that the Shuttle would democratize space flyers. Officials worked to portray the Shuttle as a spacecraft capable of accommodating people for a variety of purposes and with relative ease, greatly contrasting with the rigors of space flight associated with the Mercury, Gemini, and Apollo capsules. According to a NASA publication released in 1971, when the agency still linked the Shuttle with a space station, "For passengers, a shuttle trip to or from space stations may be similar to a business trip by air to a distant city…While the astronauts pilot the craft, the passengers will relax in comfort comparable to flight in today's airliners." Shuttle flights would become so routine that these vehicles might "fly into space on timetables like those of buses, trains, ships and airliners."[119]

NASA highlighted that the Shuttle's reduced forces of acceleration during launch and reentry would mean many more people would physically qualify for space flight. "Space flight will no longer be limited to intensively trained, physically-perfect astronauts," stated a 1977 Johnson Space Center brochure, which noted that the more benign flight conditions "will welcome the nonastronaut space worker of the future."[120] A NASA fact sheet from 1985 claimed the acceleration forces were comparable to those experienced "on some carnival rides."[121] Many NASA publications described flying aboard the Shuttle as similar to riding on an airliner. Moreover, while NASA certainly expected many of the Shuttle's flyers to be scientists and engineers, the agency indicated an expectation to fly others as well. As the 1972 brochure stated, "They may be scientists, engineers, technicians, journalists, television crews or others whose business takes them into space. As experience increases the assurance of safety, men and women of many organizations and many countries will be among the passengers."[122] Administrator

[119] NASA, *Man in Space: Space in the Seventies*, by Walter Froehlich, NASA EP-81 (Washington, DC: U.S. Government Printing Office, 1971), 11, quoted in Byrnes, *Politics and Space*, 117.

[120] NASA, *The Shuttle Era*, 6.

[121] NASA, "Space Shuttle: NASA's Answer to Operations in Near-Earth Orbit," NASA Facts, NF-144, October 1985, 5, Folder 7905, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[122] NASA, *Space Shuttle: Emphasis for the 1970's* [sic], 6.

James Beggs asserted that "If this program is going to be what we hope it will be, we want a very broad spectrum of people involved in it. We don't want just scientists and engineers."[123]

Indeed, imaginative types at NASA were thinking about the prospect of the Shuttle opening space flight to ordinary citizens. In March 1970 NASA public affairs officers sent a sample article of a new NASA news subscription service to magazine editors which noted that "the fact remains that you and I, with no more qualifications than now required to fly on a passenger jet, will one day fly on a space shuttle – for a price of course." It quoted NASA deputy associate administrator for manned space flight Charles Matthews as saying: "We can expect average people to fly into space, to visit, to live and work" with the Shuttle operating akin to a commercial airline service for passengers and cargo. The article estimated that NASA would be able to offer 50 round trips per year costing passengers $5000 each.[124] The Shuttle would "operate as a common carrier," said a 1972 NASA brochure, serving essentially anyone who can buy a ticket or pay the freight cost."[125]

Several NASA officials touted the idea that the Shuttle would be able to provide access to space to almost anyone as the Shuttle neared flight status. Jim Bilodeau, director of Shuttle crew training at Johnson Space Center, told the *New York Times* that "[b]asically, we'll be able to take everybody but the walking wounded."[126] Astronaut Deke Slayton told a Florida newspaper that the Shuttle's flight similarities to a commercial jetliner meant it could be "possible" to fly anyone after the vehicle completed

[123] "Space Shuttle Good Business: NASA Chief," *Chicago Tribune*, March 28, 1982, Chicago Tribune archives online, accessed March 1, 2015, http://archives.chicagotribune.com/1982/03/28/page/23/article/space-shuttle-good-business-nasa-chief.

[124] "What? Space Shuttles!" attachment to O. B. Lloyd, Jr., "Dear editor" letter, March 30, 1970, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[125] NASA, *Space Shuttle: Emphasis for the 1970's* [sic], 6.

[126] William K. Stevens, "New Generation of Astronauts Poised for Shuttle Era," *New York Times*, April 6, 1981, A1, B10, accessed March 1, 2015, ProQuest Historical Newspapers: The New York Times.

its test flights and lofted priority payloads.[127] Various news outlets amplified the messages they heard from NASA officials. Advanced programs planner Robert Frietag conveyed to *National Geographic* his conviction that "by 1990 people will be going on the shuttle routinely – as on an airplane."[128]

It is perhaps unsurprising, then, that many journalists and citizens began to believe, as the *National Geographic* article authors did, that the Shuttle seemed to mark "the beginning of the people's space program."[129] NASA's effort to promote an exciting future for the Shuttle inspired external publics in ways for which the agency both was and was not prepared. As the Shuttle's operational phase approached, NASA began to receive letters from people all over the country and world asking about opportunities to fly aboard the Shuttle, with many having been led to believe by NASA and media rhetoric that NASA was taking reservations for Shuttle passengers.[130] After years of receiving public inquiries about personal flight, such letters were not new to NASA officials. As chapters 3 and 4 reveal, NASA officials, guided by the new sociotechnical imaginary for human space flight and a determination to legitimize and render it viable, would respond to the enthusiasm by establishing mechanisms for external publics to participate as users and flyers on the Shuttle.

Linking the Imaginary with Traditional American Themes

Human space flight began in the United States as a distinct quest to demonstrate the nation's technological and ideological superiority over the Soviet Union. The Shuttle represented a departure

[127] Dick Baumbach, "Get Away! Vacation in Space No Flight of Fancy," *Today*, February 17, 1980, 12D, Folder 8164, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[128] Jon Schneeberger, Ken Dallison, and Rick Gore, "When the Space Shuttle Finally Flies," *National Geographic Magazine*, March 1981, 317-347, accessed March 1, 2015, National Geographic Virtual Library.

[129] Ibid., 317.

[130] Pat Legan to Information Center, NASA, Johnson Space Center, January 4, 1979, Box 4, Public Affairs Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

from emphasis on a geopolitical race among elites in favor of a pursuit of benefits for and cooperation among many. Even so, NASA's original imaginary identifying human space flight as a symbol of American pride and strength ran deep for many American citizens. Therefore, just as they had done in the Mercury, Gemini, and Apollo eras, NASA along with other U.S. government officials associated the Shuttle with quintessentially American, forward-looking themes including new beginnings, the pioneering of new frontiers, social and technical progress, and a collective sense of American ingenuity and propensity to dream. The Shuttle, with its promise of a new, democratic approach to human space flight, certainly lent itself to such characterizations.

Settled by those seeking religious freedom, resources, and other forms of opportunity, America has historically self-identified with new starts. NASA and others invoked this ideal with great frequency in discourse about the Shuttle during its development and early operational phase, indicating that the new vehicle represented NASA's – and the nation's – transition to a "new era" in space flight. Americans have long been fascinated by their transportation systems, and NASA often applied the phrase to the Shuttle as the next stage in the evolution of the nation's technological conveyances. A 1975 NASA brochure stated that a "whole new era of transportation will come into being" with the Shuttle's advent.[131] A 1977 Johnson Space Center publication likewise asserted: "Building upon previous achievements, new plateaus in air and space transportation have been reached – military aviation, airmail, commercial passenger service, the jet age, and manned space flight. Now a new era nears. The beginning of regularly scheduled runs of NASA's Space Shuttle to and from Earth orbit in the 1980's [sic] marks the coming of age in space."[132] Merging the ideas that the Shuttle would be routine and exceptional all at once, a 1971 Grumman brochure referred to the Shuttle as a multipurpose "Space Truck" capable of carrying a variety

[131] NASA, *Space Shuttle* (February 1975), 1.

[132] NASA, *The Shuttle Era*, 3.

of payloads to orbit.[133] A Kennedy Space Center visitors brochure offered a similar juxtaposition of the ordinary and the extraordinary in stating that the Shuttle would "reenter the atmosphere regularly, landing like a sensational jetliner."[134] The agency backed up the image with colorful brochures, such as one illustrated by artist Robert McCall whose cover featured an animated Shuttle zooming through space, with painted stripes and a large number "3" on the tail and wing reminiscent of a race car.[135]

NASA and its counterparts applied the idea that the Shuttle heralded a new era in still other ways that enforced the imaginary of the Shuttle as a democratic technology. A 1977 Rockwell brochure focused not on the novelty of the Shuttle per se but on its benefits for Earth and its inhabitants. *Space Shuttle: A Promising New Era for Earth* enumerated the many ways in which space could be used to help solve problems on Earth. It then stated: "We long have had the technology with which to do this work; now we have the transportation system: Space Shuttle, a versatile vehicle that will permit us to carry out these and numerous other useful activities."[136] Fletcher, meanwhile, used the phrase on the day in 1976 when the orbiter *Enterprise* rolled out at Rockwell's Palmdale, California, facility to mark the societal changes the new vehicle would yield. "This day, we're about to enter a new era," Fletcher said, noting that the Shuttle would open space to "all people" and be "the beginning of a system of space transportation in which we will enter the environment of space permanently."[137] A Kennedy Space Center visitor brochure referred to STS (Space Transportation System)-1, the first Shuttle mission, as

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[133] Grumman Aerospace Corporation, *Space Shuttle: The Next Logical Step*. The term "Space Truck" would be used by various entities within and outside of NASA up through the first several years of the Shuttle's operations. Uses of the Shuttle are the subject of the next chapter.

[134] NASA/TWA, "Don't Miss the Excitement at Kennedy Space Center" (leaflet), [1975?], Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[135] NASA, *Space Shuttle: Emphasis for the 1970's* [sic].

[136] Rockwell, *Space Shuttle: A Promising New Era for Earth* (February 1977), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[137] "Fletcher Says Shuttle Marks New Era," *Defense/Space Business Daily*, September 21, 1976, 110, Folder 4215, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

marking "the dawning of a new era in the exploration and utilization of space;" it explained that "[u]nlike spacecraft of the past, the Space Shuttle qualifies as a true spaceship, a reusable vehicle affording routine access to space."[138] Upon the successful return of STS-1, the first Shuttle mission, President Reagan, too, declared that the flight marked "a new era in space travel."[139] Various news stories covering the mission also suggested the Shuttle had begun a new era.[140] In each of these usages, NASA and those promoting the Shuttle connoted that the new vehicle was distinct in intent from the agency's earlier human space flight endeavors but still of great importance for the nation. In doing so, they simultaneously framed the new vehicle in down-to-Earth, pragmatic terms and conveyed excitement and promising tomorrows by giving it a visionary and romantic quality in an effort to appeal to publics of each mind.

A related theme the agency invoked from the pages of Americana to legitimize the Shuttle was the idea that the new vehicle would help open the frontier of space, just as hardy souls had pioneered the American West. In doing so, NASA and the Shuttle would contribute to the nation's social and technological progress. The metaphor was certainly not an original one for American statesmen, nor was it new to NASA; President Kennedy and NASA officials had relied upon it in discussing the nation's move into space in the early 1960s. As a 1981 *New Yorker* piece expressed: "People at NASA love to draw analogies between the development of space and that of the American West; they say that the Shuttle is like the covered wagon, which started out hauling a few simple goods and wound up settling a whole country."[141] Again, comparisons to other modes of transportation emerged. Indeed, as early as

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[138] *America's Spaceport*, n.d., 22, Folder 4636, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[139] Joseph B. Treaster, "Nation Reacts with Cheers and 'We're No. 1 Again'," *New York Times*, April 15, 1981, A24, Folder 6713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[140] See, for example, Beau Cutts, "Shuttle Flight Marks Era," *Waco Tribune-Herald*, April 10, 1981, 7A, Folder 8313, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, and John Noble Wilford, "Shuttle Era Opens," *New York Times*, April 15, 1981, A1, Folder 8958, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[141] Henry S. F. Cooper, "Shuttle-I," *New Yorker*, February 9, 1981, 76.

1971, a Manned Spacecraft Center publication described the Shuttle as a vehicle that "will open the frontier of space as railroads opened the wild west a century ago." On the eve of the STS-1 launch, Jesco von Puttkamer likewise compared the Shuttle to the railroad's role in opening the western frontier of the United States, enabling economical and easy access to space to build large structures and eventual colonies.[142] Alan Ladwig, who held a variety of positions within NASA aiming to engage external publics with the Shuttle, recalls various individuals affiliated with the agency referring to the Shuttle as the "prairie schooner of the future."[143]

NASA would also publicly identify the Shuttle program with progress and forward movement by emblazoning a new logotype on the left wing of each Shuttle orbiter, the right breast of the astronauts' flight suits, and all NASA letterhead, publications, and other communications materials. The effort began with a directive from President Nixon and carried forward by President Gerald Ford for the National Endowment for the Arts to review graphics used across federal government agencies and improve their quality for more effective communication with citizens. The National Endowment for the Arts concluded that NASA's original "meatball" logo did not reflect "the most highly technological, exciting, and contemporary agency in the Federal Government."[144] NASA thus scrapped the logo which had been associated with its previous human space flight feats and adopted a new logotype: a stylized rendering of the letters "N-A-S-A" in bright red. Fletcher believed the new, warm and kinetic coloring of the logotype would counter the "cold, mechanized, technological image sometimes associated with NASA" while offering "a feeling of unity, technological precision, thrust and orientation toward the future."[145]

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[142] Ronald Kotulak and Jon Van, "Our Future Cities May Be 'Out of This World'," *Chicago Tribune*, April 9, 1981, Folder 2489, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[143] Ladwig, interview, January 31, 2013.

[144] James C. Fletcher to J. Carter Brown, October 3, 1975, Folder 4159, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[145] Ibid.

In addition, the idea that an indefatigable American spirit engendered the Shuttle appeared frequently in officials' public discourse, particularly when comparing American capabilities to those elsewhere in the world. Administrator James Beggs remarked in a 1983 speech welcoming *Enterprise* home after a multi-country tour that "the drive, the ingenuity, the determination, the imagination that has always characterized the American pioneer spirit is built into this craft and into all the Shuttle orbiters."[146] On some occasions, the sense of continued competition with the Soviet Union crept in, as officials harkened back to a sense that this unbridled perseverance stemmed from the nation's commitment to democracy. Upon the landing of STS-1, Reagan declared that "Today our friends and adversaries are reminded that we are a free people capable of great deeds. We are a free people in search of progress for mankind, and today we found a little more."[147] General James Abrahamson, associate administrator for space flight in the early 1980s, asserted that the Shuttle was "a fantastic comment on the American spirit" and symbolized that "drive which wells up in free people, in Americans, to win, to strive for victory over others or against our own goals, to be first, to be number one."[148]

Finally, NASA and President Reagan sought to accentuate the notion that the Shuttle was a democratic technology as they linked the vehicle with Americans' hopes and dreams and suggested those aspirations were shared by all of the nation's citizens. Abrahamson expressed in a speech to an association of journalists that the Shuttle was a "dream" for students, businessmen, scientists, and journalists alike – a dream that "belongs to every one of us." "In fact," he said, "what the Space Shuttle

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[146] James M. Beggs, "Suggested Remarks: SCA/Enterprise Ceremony," Dulles International Airport, June 12, 1983, NASA Historical Reference Collection online, accessed December 17, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/42241.pdf?w=NATIVE%28%27SERIES+ph+any+%27%27Beggs%27%27%27%29&upp=0&rpp=-10&m=81.

[147] Ronald Reagan, "Statement on the Landing of the Space Shuttle *Columbia* Following Its Inaugural Flight, April 14, 1981," *Public Papers of the Presidents: Ronald Reagan, 1981* (Washington, DC: U.S. Government Printing Office, 1982), 353.

[148] Jacquie Harbour, "Abrahamson Addresses Texas Newsmen Meeting," *Citizen*, March 28, 1982, Folder 11, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; "The Space Shuttle's Abrahamson: It's [sic] Potential Is Immense," *Government Executive*, July/August 1983, 11.

really is all about is a means of making the dreams of Americans come true."[149] STS-1 pilot John Young remarked, following his historic mission's landing, that "The dream is alive." Reagan told Congress that the start of the Shuttle program "did more than prove our technological abilities. It raised our expectations once more. It started us dreaming again."[150] The agency further strived to conjure a sense of unity and collective ownership of the Shuttle. A promotional brochure for Kennedy Space Center from the late 1970s was entitled *Welcome to Your Spaceport*.[151] Abrahamson told *USA Today* in 1984 that "The way I feel about it – and I think most people in the agency do – is that the Shuttle program really belongs to the American people. This is an important step in making them really understand and feel what that ownership is."[152] NASA's first African American astronaut, Guion Bluford, also suggested a widespread, common possession of the Shuttle, stating upon the return of his first mission, STS-8, in 1983: "I feel very proud to be a member of this crew, and I think we have a tremendous future with the space shuttle, I mean all of us."[153]

NASA's words resonated with many, as that sense of pride of ownership and desire to share in the dream of space flight came through in the actions and expressions of many American citizens. While doubters continued to question the Shuttle's value and the government's motives for funding it, NASA

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[149] James A. Abrahamson, "Can the Space Shuttle Compete?," remarks to the Aviation/Space Writers Association, April 12, 1983, 13-14, NASA Historical Reference Collection online, accessed December 17, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Record?w=NATIVE%28%27DESCRIPTION+ph+words+%27%27abrahamson%27%27%2C%27%27writers%27%27%27%29&rpp=20&order=native%28%27SERIES%27%29&r=1&m=7.

[150] Ronald Reagan, "Address Before a Joint Session of the Congress on the Program for Economic Recovery, April 28, 1981," *Public Papers of the Presidents: Ronald Reagan, 1981* (Washington, DC: U.S. Government Printing Office, 1982), 394.

[151] NASA John F. Kennedy Space Center, *Welcome to Your Spaceport* [1977?], Folder 4636, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[152] Michael Mecham, "Thousands Will Make Space Flight by 2000," *USA Today*, February 3, 1984, 10A, Folder 11, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[153] Thomas O'Toole, "Shuttle's 'Cleanest Mission' Ends with Night Landing," *Washington Post*, September 6, 1983, A3, Folder 11, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

construed from the positive messages the agency received from citizens that numerous Americans saw the Shuttle as belonging appropriately to the nation and its people. In addition to the many inquiries citizens made to NASA about becoming Shuttle passengers, many people were so moved by the first flight of *Columbia* that they sent letters and poems to NASA praising the mission's success. Others, feeling empowered to be helpful servants to the Shuttle's cause, wrote in with suggestions about how NASA could make the program more productive. People's pride in the Shuttle came through in their willingness to let NASA know their concerns about seemingly trivial points such as the Shuttle's aesthetics. When NASA decided to stop painting the external tank white after the first two missions to save on the cost and weight, leaving it in its natural rust-hued state, many wrote to express their displeasure. Shuttle official James Odom remarked, "You wouldn't believe the ugly letters I [received] when we took the paint off. 'That old ugly colored tank.' Most of them were from ladies that just thought it really looked good before." Odom added: "I wouldn't have thought the public would have paid [that] much attention to it."[154] These reactions helped to substantiate NASA's continued use of discourse characterizing the Shuttle as a novel, democratic, and future-oriented project.

Proving Capabilities, Competence, and Credibility

When NASA and the Nixon administration rolled out their plans to develop the Shuttle as the nation's next major human space flight initiative, they registered a very tall order technically speaking. While the agency and its aerospace industry partners had proven their ability to build systems capable to sending humans into deep space, the Shuttle represented an entirely new approach to space flight. The Shuttle orbiter would need to be able to accommodate and manipulate heavy, bulky payloads. It would need to sustain large crews. The orbiter would need to be outfitted for ground landings rather than the

[154] James B. Odom, interview by Rebecca Wright, July 20, 2010, Huntsville, AL, transcript, NASA STS Recordation Oral History Project, Houston, TX, accessed December 17, 2014, http://www.jsc.nasa.gov/history/oral_histories/STS-R/OdomJB/OdomJB_7-20-10.pdf.

ocean splashdowns of the past. Supporting the orbiter required a new propulsion system for launch and on-orbit maneuvering and thermal protection system to withstand atmospheric heating upon reentry. These requirements would need to be achieved for $7 billion and within six years.[155] And in order to meet the agency's promises that the Shuttle would enable routine, less costly access to orbit, NASA would need to prove it could service the orbiter rapidly for reuse and find customers to make the Shuttle economically viable.

Even if many people doubted human space flight's value, the agency had via its success with the Apollo program earned a reputation as a can-do organization, capable of tremendous technical achievements. NASA's experience with Skylab had demonstrated that humans could live and work for long periods in space, lending credibility to the idea that commercial and industrial applications in space were in the realm of possibility and that the Shuttle would be important in realizing that future. At the same time, the Skylab experiments had not succeeded at producing the perfect ball bearings or crystals that NASA had touted the microgravity environment would make possible and hence revolutionize manufacturing processes and the computer industry. Thus, despite NASA's claims that the Shuttle would make space flight routine and economical, NASA would need to *prove* the competence of the agency and the capabilities of the Shuttle in order to realize this vision and maintain its credibility and in turn, the agency believed, gain the support of external publics for the Shuttle. Preserving an image of credibility and competence would also be critical for NASA to gain support to build a space station, which was still part of officials' long-term aspirations. The agency would depend on openly sharing information combined with employing rhetoric suggesting the Shuttle's successfulness, targeting the news media but also making its achievements known directly to others, as a means to create external publics attestive to NASA's claim that the Shuttle was a worthwhile asset.

[155] NASA, *Space Shuttle* (February 1972), 13, Folder 7905, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. This total included $5.5 billion for development and $1.5 billion for procurement of flight hardware and facilities.

NASA's continued drumbeat of promises about the Shuttle's ability to deliver societal benefits and to create an exciting in future in space throughout the 1970s offered a convincing suggestion that the agency would be able to fulfill these plans, and the media helped by amplifying NASA's messages. But as NASA moved deep into developing the Shuttle system and producing the orbiters, technical challenges plagued the agency, thus challenging the credibility of the capable Shuttle NASA had touted. Most notably, the system's reusable main engines failed to meet certification standards when some exploded during testing. The impact of this and other difficulties slowed down development and impacted the Shuttle's cost posture. Redesigns of hardware and software systems, additional testing, and the need to increase the workforce constructing the first fully functional orbiter, *Columbia*, spent down the program's reserves and began to create pressures for the agency to look to its other programs for additional funds for the Shuttle. By early 1979, NASA officials requested supplemental funds to make a 1979 first-launch date. Recognizing the military need for the Shuttle, the Congress granted NASA the additional resources, but it soon became evident that the Shuttle still would not be ready to launch that year: technicians were behind in affixing *Columbia*'s protective ceramic heat tiles, many of which fell off when Rockwell transported the orbiter to Kennedy Space Center atop a Boeing-747. How, then, would the tiles fare on a flight to space? Although the Shuttle's promoters at the highest echelons of NASA had pledged that the Shuttle would make space flight routine, those working in the trenches of the Shuttle program realized operating the new vehicle was going to be, as sociologist Brian Woods put it, "anything but routine."[156] NASA's desire and reality were colliding.

Part of the reason for the technical challenges and cost overruns was that NASA had trimmed the Shuttle's development program and in turn invited a greater risk of technical hiccups when it accepted Nixon's condition that the Shuttle be developed for a fraction of NASA's initial projected cost. Some sympathetic citizens saw within the situation an agency determined to accomplish incredible feats but in

[156] Woods, "Artifacts, Revolutionaries, and Bureaucrats: The Sociotechnical Shaping of NASA's Space Shuttle," 388.

need of help. NASA received many well-intentioned letters from people across the country who offered ideas for solving the Shuttle's thermal protection system difficulties along with suggestions to maximize the cost-effectiveness, efficiency, and safety of Shuttle operations.[157] NASA officials, however, were unsettled by a preponderance of critical comments directed at the agency from a variety of sources. Members of the space science community denounced the impact of the Shuttle cost growth on funding prospects for their own programs, which became targets for solving the Shuttle's budget woes. The General Accounting Office blasted the Shuttle program in a 1977 report, questioning its technical integrity, environmental impact, and its ability to create the demand and lower launch costs that NASA had claimed.[158]

Many members of the media were particularly vocal in airing the issues besetting the Shuttle. Journalists derided the Shuttle, referring to it as "The Plane That Won't Fly," "America's Space Shuttle Lemon," "Aluminum Dumbo," and "The Spruce Goose of Outer Space."[159] Bob Thompson, manager of the Shuttle program at Johnson Space Program during the 1970s, recalls having to defend the Shuttle on a 1978 episode of *Nightline* against a very "antagonistic" Jules Bergman, who was, Thompson thought unfairly, lamenting the vehicle's cost growth using "raw numbers" from 1972.[160] Others took the opportunity to point out that, besides consuming vast amounts of taxpayer resources, the Shuttle delays had already had the negative effect of impelling NASA to allow the abandoned Skylab to fall,

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[157] See, for example, Peter J. Sacchetti to Sirs, February 23, 1980; Sam Huston to Christopher C. Kraft, Jr., March 12, 1981; and Daniel B. Littmann to Kraft, July 19, 1981. All of these letters located in Box 4, Public Affairs Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[158] Lee Hickling, "GAO Criticizes Shuttle – From Tires to Cost," *Today*, June 4, 1977, 8A, Folder 7958, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[159] See, for example, "The Plane That Won't Fly," *Newsweek*, May 5, 1980, 94-96; Arlen J. Large, "America's Space Shuttle Lemon," *Newsweek*, January 31, 1980, 14; Joel S. Hirschhorn, "Aluminum Dumbo," *Washington Post*, March 28, 1980, A19; and Gregg Easterbrook, "The Spruce Goose of Outer Space," *Washington Monthly*, April 1980. All articles located in Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[160] Robert F. Thompson, interview by author, Houston, TX, June 13, 2013.

uncontrolled, out of an unstable orbit to land wherever it might on Earth. Originally the agency had planned to have the Shuttle ready in time to boost the 80-ton laboratory into a stable orbit or deorbit it into the Pacific Ocean in a controlled manner.[161]

NASA regarded turning around the opinions of the news media, as influencers of the Congress and all American citizens, to be essential to enrolling external publics in perceiving the Shuttle as reliable, capable, and, ultimately, valuable. During the 1960s NASA had offered members of the news media open access to the agency to make them knowledgeable about the space program so as, the agency hoped, to report positively about it. That effort had fallen by the wayside during the middle of the 1970s with public affairs personnel changes. As the number of negative stories about the Shuttle rose, NASA leadership wanted to "bring public affairs back to how it was during the Apollo days," according to Brian Duff, who was appointed to do the job as NASA's new public affairs chief. Duff noted that "the attitude was basically that the best defense was a good offense, that you should always stay ahead of the problem instead of behind it. You should anticipate things and meet them, rather than having them catch you and having to react to them."[162] Duff's solution was to enhance NASA's transparency and outreach to the media. He told his staff, "You're going to see more newsmen in the next six weeks than you've seen in the last two years…you've got a story to tell, and we're going to make you so available the media is going to be tired of talking to you."[163]

Subscribing to the consumer-product and deficit models of engagement, Duff recommended to Administrator Robert Frosch in 1980 that the agency support an "STS Continuing Information Program"

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[161] "U.S. Picks a Name for Shuttle, Can't Predict Launch," *Wall Street Journal*, January 26, 1979, 1, Folder 8013, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Skylab fell to Earth on July 11, 1979, landing in Western Australia.

[162] Brian Duff, interview by John Mauer, May 24, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC.

[163] Brian Duff, interview by John Mauer, May 1, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC.

to "convey more adequately the breadth, the complexity and the long-term world significance of the Shuttle as a space transportation system." Duff wanted to make sure NASA remained in control as the authoritative source for information about the Shuttle and expand media coverage to a broad spectrum of subjects and not just development challenges. The idea, Duff expressed, is to "portray clearly, in understandable incremental segments to a variety of audiences, the story" of the Shuttle, which was "not the story of a single flight or a machine" but that of "a 'leapfrog' technology which promises a new Space Era." To do this, he said, NASA needed to confront reporters and others candidly about the issues it faced in developing the Shuttle along with its progress. He recognized the primary audience as the news media but envisioned public relations materials about the Shuttle being useful in dealing with any "external constituency," including officials in the White House and Congress as well as potential Shuttle users.[164]

The public affairs office under Duff thus began a proactive effort to influence the media and improve the Shuttle's image through an onslaught of accessible information. The agency started weekly press briefings, bringing in different NASA experts to cover various aspects of the program. NASA printed transcriptions of the briefings and made each one a "chapter" in what the agency dubbed the Shuttle Press Manual. By conveying to press members how complex the Shuttle program was and how NASA was working to address the technical challenges, NASA was, Duff explained, "trying to get the media to get over the idea that we were afraid of them, and that we were afraid of the program."[165] By educating journalists, many of whom were at that point new to covering the space program, NASA aimed to "dilute" the critical stories and effectively enlist the reporters in generating more stories that would reflect positively, or at least empathetically, on the Shuttle.

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[164] LF-6/Director of Public Affairs to A/Administrator and AD/Deputy Administrator, "Sustained Information/Education Program on the Shuttle Transportation System," June 23, 1980, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[165] Duff, interview, May 1, 1989.

Through this approach, the agency established a rapport with the extant crop of writers and helped to create a "Shuttle press corps" akin to the Apollo press corps of the 1960s.[166] And it seemed to work. All three major television networks and the Cable News Network planned live coverage of launch, reentry and landing of STS-1, whereas none had covered the return of the last Skylab crew.[167] As Lisa Malone, a public affairs official at Kennedy Space Center recalls, the Shuttle became the number one NASA program reporters wanted to follow, having "a thirst to know all of the technical details about it for many years."[168] In January 1982 Duff shared with Deputy Administrator Hans Mark his observation that the media tide had turned toward NASA's favor a few months before the STS-1 mission. The Shuttle dominated a number of magazine covers in 1981, he pointed out, and was "always" cast in the role of a "national triumph."[169] Coverage following STS-1's landing lauded the Shuttle's capabilities and NASA for remaining a "can-do" agency.[170] With coverage positive on the whole, NASA, Duff concluded, "enjoys a remarkable reputation for competency and credibility."[171]

Once Shuttle missions began, NASA's public affairs office continued to nurture its relationship with the news media in order to remain transparent and demonstrate the Shuttle's reliability and capabilities and the agency's competence and credibility. The public affairs office compiled a handbook advising journalists about how to cover the first Shuttle mission and informing them of what to expect.[172]

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[166] Ibid.

[167] Malcolm W. Browne, "News Media Swarm to Shuttle Site, Giving Launching a Carnival Air," *New York Times*, April 9, 1981, B17, Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[168] Lisa Malone, interview by author, Arlington, VA, April 17, 2013.

[169] LF-6/Director of Public Affairs (Brian Duff) to AD/Deputy Administrator, "Public Relations Policies," 2.

[170] See, for example, Lee Dembart, "Pulling Success Out of the Hat, NASA Remains a 'Can-Do' Government Agency," *Los Angeles Times*, April 22, 1984, and "Columbia Aloft," *Washington Star*, April 14, 1981. Both articles located in Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[171] LF-6/Director of Public Affairs (Brian Duff) to AD/Deputy Administrator, "Public Relations Policies," 2.

[172] NASA, *How to Cover the First Space Shuttle Mission*, Space Transportation System Briefing Series, Number 7 (January 12, 1981), Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

A general Shuttle news media handbook followed shortly thereafter.[173] NASA made press viewing accommodations at launches and landings and at mission control at the Johnson Space Center and also provided the news media with live audio and video feeds of the launches and missions as well as stock film footage. The agency welcomed foreign press agents. NASA initiated a service in which members of the media could dial a phone number to listen to communications between mission control and the Shuttle crews on orbit and began to conduct space-to-Earth press conferences beginning with STS-8 in 1983.[174] The agency occasionally permitted journalists to get even closer: the *New Yorker* writer Henry S. F. Cooper lived and worked with the STS 41-G crew before their October 1984 flight to capture the "human dimensions" of training.[175] The only exception to NASA's openness was on the occasion that a Shuttle mission was dedicated to a defense payload and the agency withheld information about the mission and payload per an agreement with the Department of Defense – a practice some journalists denounced as a compromise of the agency's open communications policy.

As a further means to prove the credibility of NASA's claim about the Shuttle's ability to make space flight routine and less costly and to suggest that the agency was achieving the sociotechnical imaginary it had set for the Shuttle, NASA declared the Shuttle "operational" in June 1982 after its first four missions, even though the agency had initially anticipated considering the first six to be flight tests. The agency still continued to work on known issues like the performance of the Shuttle's solid rocket motors but felt that demonstrating that it had financial and technical control of the Shuttle was paramount

[173] NASA, *Space Shuttle News Media Handbook* (February 1982), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[174] NASA, "Worldwide Telephone Service Set Up for STS-6 Mission," news release 83-41, March 28, 1983, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; John F. Murphy to George Carvalho, July 20, 1983, Folder 801, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[175] Henry S. F. Cooper, *Before Lift-Off: The Making of a Space Shuttle Crew* (Baltimore: Johns Hopkins University Press, 1987).

to attracting customers as well as garnering public and political validation of this major initiative.[176] NASA officials and their partners in industry took care to highlight victories in realizing the claims they had made. A 1982 Rockwell brochure asserted: "Space Shuttle is becoming more glamorous, and those who are building and operating it couldn't be more pleased. So successful are its orbital flights getting that they generate little suspense. The Shuttle orbiter is taking the risk out of space operations, as it was designed to do."[177] Astronauts endorsed the Shuttle's capabilities, with STS-3 commander Jack Lousma declaring that "*Columbia* performed magnificently" and pilot Gordon Fullerton calling the vehicle "an unbelievably beautiful flying machine."[178] Following the maiden flight of *Challenger* in 1983, General Abrahamson told the *Washington Post*: "It was a great mission, incredibly routine, which is what we want."[179] Abrahamson also did not hesitate to express that payload owners felt confident in NASA's performance, pointing out in Congressional testimony and speeches before groups of journalists and other professional groups the numbers of Shuttle customers NASA enrolled, including those they "stole" from the French rocket, Ariane, their major competitor for satellite payloads. Abrahamson also reported on a regular basis the agency's reductions over time of the number of anomalies encountered on each Shuttle mission.

NASA aimed to demonstrate accountability for delivering on its articulated promises concerning the Shuttle in still other ways. Through news releases and mission status briefings, NASA kept press members and others informed about plans for scheduled missions as well as the details of missions as they unfolded, including satellite deployments and retrievals as well as the achievement of other key

[176] James M. Beggs, interview by Kevin M. Rusnak, Bethesda, MD, March 7, 2002, transcript, NASA Oral History, NASA Historical Reference Collection, Washington, DC, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Administrators/BeggsJM/BeggsJM_3-7-02.pdf.

[177] Rockwell, *Shuttle*, 2.

[178] NASA, Lyndon B. Johnson Space Center, *The Shuttle Era*, JSC-12599 (Houston, TX: NASA, March 1983), 2.

[179] Thomas O'Toole, "Challenger Touches Down; Flight Is Called Best So Far," *Washington Post*, April 10, 1983, A7, Folder 11, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

mission objectives. Further, the agency aimed to engender public confidence in the Shuttle and NASA and the space program more generally by continuing to maintain an open and responsive program on many of its traditional fronts. NASA's public affairs offices busily fielded public inquiries, which seemed to surge around the time of Shuttle launches. Kennedy Space Center public affairs official Lisa Malone attested to the sheer amount of "fan mail" and other forms of contact NASA received during the early Shuttle era as well as the agency's commitment to responding to them. As she recalled, "we had so many phone calls I would go home and my ear was raw…Some public relations folks are always trying to throw the fishing line out and reel them in. [In NASA's case] the fish were jumping on us."[180] NASA would reply to citizens' queries about the Shuttle with fact sheets, lithographs of crews, and mission patch stickers. The agency satisfied the curious, skeptical, and uninformed alike by sharing with them publications about daily life and activities aboard the Shuttle, ranging from mission tasks to how what the astronauts ate and how they went to the bathroom in space.[181] NASA officials remained committed to keeping external publics informed and satisfied that the agency was responsive and fulfilling its obligations to them.

Even after declaring the Shuttle operational, NASA recognized it still had a way to go in fulfilling the agency's vision of a routine, broadly used vehicle. In 1983 Administrator Beggs acknowledged at a House appropriations hearing that the Shuttle was "pushing the state-of-the-art probably even harder" than the Apollo Saturn V had.[182] NASA leaders were aware, too, that the vehicle

[180] Lisa Malone, interview.

[181] See, for example, NASA, Division of Public Affairs, *Aboard the Space Shuttle*, by Florence S. Steinberg, EP-169 (Washington, DC: NASA, 1980), Folder 8163, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, and NASA, John F. Kennedy Space Center, *Spaceage* [sic] *Foods for Space Travelers*, KSC 85-80 (Kennedy Space Center, FL: NASA, July 1981), "Space Food" folder, Box 14, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[182] *Hearing before the House Committee on Appropriations, Subcommittee on HUD-Independent Agencies,* Department of Housing and Urban Development, and Certain Independent Agencies Appropriations for 1986, part 6, 98th Cong., 1st sess., March 22, 1983, 39.

remained experimental in many and was not yet on a trajectory to becoming cost effective.[183] Given the continued challenges, skepticism about whether the Shuttle would deliver all that NASA promoted never went away completely. Media critics and others unwilling to reduce their expectations for NASA continued to criticize the vehicle and the agency's performance.[184] Accordingly, NASA unceasingly kept up its efforts to demonstrate and promote through its open program its plans and successes, always working to ensure that the Shuttle's progress in fulfilling the vision NASA had set forth for it overshadowed its technical hitches and delays. The agency was determined to do all it could to enroll citizens in the belief that NASA would realize the imaginary it had promulgated for the Shuttle and legitimize this human space flight program.

Inviting Vicarious Participation in the Shuttle Program

That NASA could articulate the Shuttle's value to Americans and then offer proof once the vehicle was flying that it had built and was operating a highly capable space transportation system was a key piece of its strategy and ability to legitimize the new space transportation system to external publics. But the Shuttle in its physical form was a keystone to NASA's efforts to engage and enroll the American citizenry in many other respects as well. Opinion polls taken after the Apollo 11 mission indicated that the high level of public interest in viewing the launch and lunar landing had not equated to support for expenditures on the human flight program. Nonetheless, NASA personnel recognized that the agency's publicity and public attention during the Mercury, Gemini, and Apollo eras had come from having a visibly active flight program that offered visual and sensory experiences. Offering citizens opportunities

[183] Walter Pincus, "NASA's Push to Put Citizen in Space Overtook Fully 'Operational' Shuttle," *Washington Post*, March 5, 1986, A8, accessed March 1, 2015, LexisNexis Academic; Linda Billings, interview by author, Arlington, VA, June 26, 2014.

[184] See, for example, Frank S. Johnson, Jr., to Ben F. Phlegar, May 14, 1985, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, and William Boot, "NASA and the Spellbound Press," *Columbia Journalism Review*, July/August 1986, 23-29.

to learn about space flight missions directly from the astronauts, visit NASA's facilities to see firsthand the technology that made those journeys possible, and take in the spectacle of a launch during the 1960s allowed them to internalize and develop a different sort of appreciation for the space program than becoming familiar with NASA's progress and plans through the news media or NASA's publics permitted. A 1982 NASA paper outlining a plan to accommodate visitors at Shuttle launches revealed this strong conviction:

> [A] belief widely held in NASA that once exposed to the magnitude, excitement and sense of an adventure that comes with close-up observation of space exploration activities – especially the launch of a spacecraft – the individual, no matter what his station in life, has become involved. There is not only an emotional experience, but also an intellectual broadening that cannot be gained in the abstract. You cannot shuffle papers and read reports about all this and get a real grasp of it. That comes after you have seen the hardware, visited the sites, met the people, sensed the magnitude of it all, and participated in the action.[185]

Hence, in conjunction with its rational messages about the Shuttle's benefits, the agency aimed to realize Nixon's imaginary of a democratized space vehicle and make all Americans feel like participants in the Shuttle program by allowing them to directly witness and virtually engage with the new vehicle and its missions in a range of ways. Indeed, agency officials continued to subscribe to the idea that exposing people through visual and experiential means to its rockets and space travelers would satiate space enthusiasts and spark interest and support among others. Just as they hoped informing them through more pedagogical approaches would fill a deficit in their understanding and make them supporters, so too did they believe "experiencing" the Shuttle would help to serve, convey to, and generate new enthusiasm among all Americans the significance of the agency's new initiative, in turn making them proponents of human space flight.

The three sub-sections below describe three ways in which NASA aimed to make Americans feel connected to the Shuttle program once the Shuttle began flying: through tours and overflights of the

[185] McCulla, "Guest Activities in the Shuttle Era."

Shuttle test article *Enterprise*, via welcoming citizens to Shuttle launches and landings, and by harnessing communications technologies and offering other opportunities for individuals to experience the sights, sounds, and daily life aboard the Shuttle all while keeping their feet on the ground. All drew on the Shuttle's unique features and reinforced the notion of a spacecraft intended to serve all Americans.

Introducing Enterprise

Historian David Nye has noted that Americans have an affinity for "the technological sublime," or the association of machines they have developed to control their environments and destinies with a sense of awe, power, and national greatness.[186] It is this trait, he has argued, that has drawn citizens to witness and experience events ranging from World's Fairs to rocket launches. But more than just wanting to see any launch or any space vehicle, people seem to be drawn to seeing spaceships with the capacity to carry people. Public and media attendance at launches of NASA's scientific probes have always paled in comparison to the spectatorship garnered by human missions. As former NASA administrator James Beggs attests, "the plain facts are that when we are flying men and women in space, it has a huge impetus to the interest that the public has in the program."[187] Kennedy Space Center public affairs official Lisa Malone, who provided commentary for dozens of Shuttle launches, observes that human space flight has "a love potion – I don't know what you call it, but it's got a lure that is attractive to the public. It's magnetic in a way that you just can't describe."[188]

Millions had flocked to peer at the Mercury, Gemini, and Apollo capsules as the agency took them on national and international viewing tours. Likewise, even in the face of the zeitgeist of pragmatism, NASA found that many Americans were eager to at least catch a glimpse of this new

[186] David E. Nye, *American Technological Sublime* (Cambridge, MA: MIT Press, 1994).

[187] Beggs, interview, April 8, 2013.

[188] Lisa Malone, interview.

technological marvel, the Space Shuttle. This time the awe was somewhat differently placed. Then, people could behold in looking at NASA's space capsules the ingenuity that had enabled Americans to reach a new world. Now they could lay eyes on a space plane: a craft that, with the physique of an airplane, made the seemingly fantastical, abstract, and unobtainable appear to be suddenly familiar and within reach. It captured the imagination and suggested the real sense of service that NASA was promising all at once. James Hartsfield, a Johnson Space Center public affairs officer, noted that the Shuttle's technical attributes were practically "tailor-made" to intrigue citizens. "People love wings," he said. "Engagement with the Shuttle was easy in that respect. People liked it from the start. People wanted to see something fly home, and they wanted to dream about a way they could get on an airplane and fly to space."[189]

September 17, 1976, marked the start of NASA's effort to afford external publics visual and virtual access to the Shuttle as a high-priority component of its arsenal to enroll them in the new human space flight program. On that day, NASA debuted the first Shuttle orbiter *Enterprise* at Rockwell's assembly facility in Palmdale, California. The rollout ceremony itself was open to invited government leaders, aerospace and other business executives, media representatives, and other VIPs, including cast members of the original *Star Trek* television series after whose spaceship the new orbiter had been named.[190] An Air Force band played the *Star Trek* theme song as *Enterprise* emerged from her hangar. Finally able to point to the embodiment of a spaceship that had for several years been only a concept, Rockwell chairman Willard F. Rockwell, Jr., told the crowd that "those of little vision who accuse the space program and particularly the shuttle of being too far ahead of its time" could now be refuted.[191]

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[189] James Hartsfield, interview by author, Houston, TX, June 12, 2013.

[190] "Space Shuttle: A Monument to Minds," *Antelope Valley (CA) Press*, September 16, 1976, Folder 7952, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[191] Thomas O'Toole, "Space Shuttle Orbiter Shown for First Time in California," *Washington Post*, September 18, 1976, A2, Folder 7952, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

The next day, some 35,000 to 40,000 people showed up to an open house that Rockwell had been planned for Rockwell employees. The media had announced it as a public event, and Rockwell accommodated the enthusiastic and inquisitive hordes of visitors.[192] When NASA and Rockwell made arrangements to transport *Enterprise* from Palmdale to the agency's Dryden Flight Research Center in January 1977, citizens lined the roads along the 35-mile stretch to witness the spectacle.[193]

NASA provided numerous opportunities for the general public to see the new orbiter during the course of its testing program. Throughout 1977 the agency conducted approach and landing tests (ALT) at NASA's Dryden facility, located at Edwards Air Force Base in California's Mojave Desert, to evaluate *Enterprise*'s aerodynamic and flight control characteristics. *Enterprise* was mounted atop the modified Boeing 747 carrier aircraft that would be used to transport the orbiter across the country from landing to launch site. The ALT protocol included tests to appraise the flight worthiness of the combination, first in unpowered and unmanned form and then with astronauts powering the orbiter's systems. Starting in the summer *Enterprise* flew a series of five free flights, landing on the dry lake bed landing strips at Edwards, which was one of the Shuttle's designated landing sites. The agency planned carefully for invited special guests and members of the general public who requested vehicle passes to view these tests on site.[194] When in March 1978 the *Enterprise* and carrier aircraft pair flew to NASA's Marshall Space Flight Center in Huntsville, Alabama, for vibration tests and stopped along the way for refueling, enormous crowds again gathered to see the new spacecraft. Some 240,000 people came out to catch a glimpse of the Shuttle after NASA's Johnson Space Center issued a press release announcing the Shuttle's stopover

[192] Woods, "Artifacts, Revolutionaries, and Bureaucrats: The Sociotechnical Shaping of NASA's Space Shuttle," 222.

[193] Alan Brown and Richard Saltus, "Shuttle's First 'Flight' Draws Many Valleyites," *Daily Ledger-Gazette* (Lancaster, CA), January 31, 1977; Folder 7959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[194] NASA, "Public Affairs Plan: Approach and Landing Test, January 1977 through March 1978," January 26, 1977, Box 2, ALT Documents Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

at nearby Ellington Field.[195] Thousands more were on hand to greet the pair upon landing in Huntsville. Observing how the Shuttle and NASA's commitment to sharing it with citizens was attracting so many viewers, a NASA official who was on hand to show people *Enterprise* during its 1978 stop at Ellington Field near Houston expressed, "What I think is that this is different than Apollo and going to the Moon. I think the Shuttle is coming closer to the people. It is something they can relate to. They wanted to know when they can go on it."[196]

NASA had built *Enterprise* as a test article for the Shuttle program – the craft lacked engines or thermal protection – but had intended to refit it for space flight. When the orbiter's fuselage and wing designs changed during the construction of *Columbia*, however, the agency scrapped plans to make *Enterprise* functional, as the required overhaul would prove very costly. While *Enterprise* would remain an important reference asset for the Shuttle program, the agency recognized an opportunity to showcase the vehicle domestically and internationally. As early as 1978, NASA officials contemplated the prospect of taking *Enterprise* to the Paris Air Show, the world's foremost aviation and aerospace event. Although the feat was physically possible, NASA retrenched from pursuing it when Shuttle program director Myron Malkin balked that the potential for damage due to an accident or a terrorist attack to the Shuttle carrier aircraft or even *Enterprise* would be an unwise risk for what Malkin called a "clearly non-essential public relations gesture."[197] Administrator James Beggs rebuffed the idea as well when public affairs chief Brian Duff resurfaced the idea in the early 1980s, also fearful of the potential for damage to the 747. The Central Intelligence Agency, the Department of Defense, and the State Department also objected. Some members of Congress, meanwhile, favored the idea of promoting American technology in an

[195] NASA, *Astronautics and Aeronautics, 1978: A Chronology*, NASA SP-4023 (Washington, DC: U.S. Government Printing Office, 1986), 59-60.

[196] Ibid.

[197] MH-7/Director, Space Shuttle Program (Myron S. Malkin) to M/Associate Administrator for Space Transportation Systems, "Feasibility of Transporting OV-101 to the Paris Air Show," November 24, 1978, Folder 8009, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

increasingly competitive international aerospace and high technology market, and the pilots of the 747 believed that the flight would be easy enough. According to Duff, "Once Beggs' mind began to grasp what would happen if we did this successfully, he was all for it" and overrode the objections of the other agencies.[198] NASA made a plan to go to the 1983 Paris Air Show.

The agency had a difficult time, however, convincing French authorities to allow demonstration flights of the orbiter-747 pair: French aviation authorities attributed their hesitation due to some fatal accidents at the Air Show in recent years, but the idea of Americans touting their technology over Parisian skies when the French were heavily marketing their Ariane launch vehicle likely fueled the resistance.[199] But the mayor of Paris ultimately allowed NASA to fly *Enterprise* around the city's Boulevard Périphérique. Parisians were in awe of the spectacle. NASA associate administrator for space flight James Abrahamson recalls enthusiastic Parisians calling out "Navette! Navette!" ("Shuttle! Shuttle!") as *Enterprise* flew overhead.[200] Public affairs officer Louis Parker relayed: "The traffic in Paris is bad anyway, but every time the orbiter was flown around—and it would fly 1,000 feet, 1,500 feet, very visible—it just would create all sorts of havoc. As a matter of fact, that particular year, the French Open was happening at the same time as the Paris Air Show. John McEnroe was playing. He literally stopped a tennis match one day because it was flying across."[201]

The plan to attend the Paris Air Show ended up turning into a much broader, month-long domestic and multinational tour. When other European nations found out that the *Enterprise* would be

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[198] Duff, interview, May 24, 1989. See also James M. Beggs to Charles McC. Mathias, Jr., February 18, 1983, Folder 8009, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[199] Paul Lewis, "Paris Bars a Flight by Shuttle over Seine," *New York Times*, May 22, 1983, Folder 8009, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[200] James Abrahamson, interview by author, Washington, DC, June 19, 2013.

[201] Louis A. Parker, interview by Rebecca Wright, Houston, TX, December 6, 2001, transcript, NASA Johnson Space Center Oral History Project, Houston TX, February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/ParkerLA/ParkerLA_12-6-11.pdf.

nearby, they asked if the Shuttle could come to them. Parker recalled, "Everybody wanted to have it come to their airport. And…if it couldn't come to their airport, could they at least fly over our airspace and drop down so people could see it?"[202] The agency thus built a tour route that also took it to four other Western European countries and Canada. Everywhere, it was met with hundreds of thousands of enthusiastic viewers.[203] In addition, en route there and upon its return, it stopped in several American cities including Colorado Springs, Wichita, Dayton, New York City, and Washington, DC. In the nation's capital it flew low and majestically around the I-495 Beltway and up the Potomac River. As it flew, *Enterprise* commanded oohs, aahs, and applause from the hundreds of thousands who witnessed the spectacle. Tens of thousands more were present when the Shuttle landed at Dulles International Airport, and NASA outfitted them with small American flags and Shuttle lapel pins to accentuate the occasion's importance to the nation. "This stopover," Beggs told the *Washington Times*, "will allow the taxpayers to see what some of their money has gone for. We're very proud of the Enterprise and the whole shuttle flight system. We want the American public to be proud, too."[204] Based on some of the comments offered to the media, NASA curried just the sense of appreciation it had hoped the tour would elicit. "That's the most beautiful thing I've ever seen," remarked one local woman. A viewer who had come from Atlanta to see the Shuttle averred, "It's worth every penny even if it does nothing but raise the morale of the country."[205]

Just as soon as *Enterprise* returned from its world tour, NASA made plans to showcase it at the World's Fair in New Orleans the following year. As Beggs noted, "We at NASA are very much aware of the potential benefits for the agency, for the Space Program and for our nation which can result from

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[202] Ibid.

[203] Beggs, "Suggested Remarks: SCA/Enterprise Ceremony."

[204] Jim Fraze, "Enterprise Wows Capital Citizenry," *Washington Times*, June 13, 1983, Folder 8008, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[205] John Burgess, "Earthlings Applaud As Enterprise Makes Orbit above Beltway," *Washington Post*, June 13, 1983, B1, B6-B7, Folder 8008, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

exposure to an audience of the size and enthusiasm which the fair will provide."[206] The agency flew the Shuttle aboard the 747 to Mobile, Alabama, where the orbiter, too large to reach the fair site by rail or road, was loaded onto a barge for transport to New Orleans.[207] A multiday stopover in Mobile brought thousands of schoolchildren to see *Enterprise*, and the agency accommodated them with close-up encounters. Parker recalled: "The kids would literally walk by it. There was even a school for the handicapped that came; I think the kids were blind. They wanted them to literally be able to touch it. There was a picture of me that appeared in the Mobile newspaper, of [sic] holding up a little blind kid to touch the nose of the Enterprise. That was really kind of neat."[208] During *Enterprise*'s six-month stay in New Orleans, some 2.5 million fair visitors viewed the orbiter as well as a full-scale mock-up of the Shuttle orbiter flight deck and Spacelab laboratory module as well as a video production about Shuttle launches and missions.[209]

Extending Opportunities to Witness Launches and Landings

As the Shuttle program became the mainstay of human space flight in the 1980s, NASA continued to welcome hundreds of thousands of citizens annually to its visitor centers. Seen by the agency as a means of both "satisfying the public's interests in our programs" and "showing the taxpayer what we do with their [sic] tax dollars," visitor centers fulfilled the agency's aims of remaining

[206] NASA, "Shuttle Orbiter Enterprise to be Shown at New Orleans Exposition," news release 83-188, December 1, 1983, Folder 8011, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[207] Members of Congress from Tennessee had requested that NASA send *Enterprise* to the 1982 World's Fair in Knoxville but the plan was scuttled due to the high transportation costs and the inability of a barge carrying the orbiter to pass under several of the bridges spanning the Tennessee River route the orbiter would have to travel. Peter Adams, "Enterprise Won't Make World's Fair Date," *Today*, April 29, 1982, Folder 8009, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[208] Parker, interview.

[209] "Enterprise Popular Attraction at World's Fair," *NASA Activities*, February 1985, 13, Folder 8009, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

accountable to citizens while improving their understanding of its facilities and programs.[210] The visitor centers at Kennedy and Johnson featured exhibits on the Shuttle. Johnson changed its exhibit regularly to reflect cargo and experiments being flown on the latest Shuttle mission.[211] Kennedy added the Shuttle launch pads to its standard visitor tour, while Johnson allowed guests to view the Shuttle simulator astronauts used for training purposes. Attendance at both centers burgeoned with the Shuttle's arrival, bringing one million visitors annually to Johnson by the 1980s and pushing visitation to Kennedy to more than two million. Both visitor centers underwent major expansions during the 1980s and 1990s to accommodate the new wave of interest in NASA.

Once the Shuttle began its missions, NASA was able to introduce another means of engaging Americans tangibly with the Shuttle program: through the power of witnessing in person the launch of the new space transportation system. To a large degree, NASA did not need to persuade citizens to make the trek to see a launch. Millions of people who had witnessed the Mercury, Gemini, and Apollo take-offs were already aware that attending a launch was not just an act of observation: it was a dramatic multisensory experience whose magnificent complexity was like no other. David Nye has called it an occasion on which "the individual can be lifted out of quotidian experience in a fundamental rupture of the usual sensory impressions, to be overwhelmed by technological spectacle."[212] As an ad in the National Space Institute's *Space World* magazine promoting the organization's Shuttle launch tours noted: "You've seen it on TV, but nothing can compare to being right there – inside the Kennedy Space

[210] George M. Low (for James C. Fletcher) to Spiro T. Agnew, March 30, 1973, Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; James C. Fletcher to Olin E. Teague, September 25, 1974, Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[211] Gina Seay, "Tours Share Space with the World," *Houston Post*, May 30, 1986, 1E, 14E, Folder 14095, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[212] Nye, *American Technological Sublime*, 254.

Center gates – when six million pounds of thrust propel America's reusable spacecraft into orbit… and you feel the vibration… hear the roar… see the brilliance!"[213]

NASA began receiving requests from citizens to view STS-1 from onsite at Kennedy Space Center since the Shuttle's approach and landing tests.[214] As it had during the 1960s, NASA orchestrated a massive effort to accommodate the requests and visitors. NASA's "guest operations" arm of its public affairs office handled arrangements for distinguished guests from the White House, Congress, other federal agencies, foreign governments as well as the invited guests of high-ranking NASA officials, the mission astronauts, and Shuttle contractors and customers. NASA issued thousands of "car passes" to the general public which allowed holders to drive onsite and watch the launch from designated locations. Tour buses leaving from Kennedy Space Center's visitor center transported thousands of more people to viewing sites around the premises. The agency's public affairs officers broadcasted over loudspeakers and radio live commentary to explain the developments leading up to the launch and in the moments following it. Though required to remain neutral in tone, they aimed to put the engineering jargon of mission control into accessible terms.[215] The agency made special Shuttle souvenirs available for attendees to buy. Popular with stamp collectors and others looking for a unique memento by which to commemorate the day were envelopes bearing an image of the mission's patch with some information about the mission inside; purchasers could stamp and address the envelopes, which would be cancelled on the day of launch and mailed to the designated recipients.

Some 80,000 people from all walks of life assembled at Kennedy Space Center – the largest crowd ever gathered there to date – to view the launch of STS-1 on April 10, 1981. Included among them

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[213] National Space Institute, advertisement, *Space World*, February 1985, quoted in Nye, *American Technological Sublime*, 248.

[214] "Crowd of 80,000 to View Launch from KSC," *Spaceport News*, March 27, 1981, 3, Folder 8011, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[215] James Hartsfield, interview.

were nearly 3,500 reporters, photographers, and other members of the media.[216] Because the launch was scrubbed due to a computer malfunction and did not happen until the following day, the total crowd onsite to see the launch dropped to 45,000.[217] Another one million or so saw the launch from the vicinity of the space center. The agency basked in the reactions of those who witnessed the historical event, which seemed to erase all traces of doubt about NASA's capabilities. Attendees shrieked "Yeeeow!" and "All riiight!" at the sight of *Columbia*'s ascent, and many later remarked on the pride of country the launch engendered. Frank Gillespie, a retired train conductor from Pennsylvania averred that "It makes you believe in America." What emerged was, as the *New York Times* observed, a "collective feeling" by Americans of participating in this new space achievement.[218] The launch and the reactions it elicited gave NASA a tremendous boost of confidence in the Shuttle and signified for them the promise of external support for it. As NASA launch controllers at Kennedy exclaimed as *Columbia* left the ground, "We did it!" and "Where are the cynics now?"[219] Four days later, a crowd of 250,000 welcomed the ship back to Earth when it landed at Edwards Air Force Base.[220]

The agency believed strongly in the power of witnessing a launch and seeing the Shuttle in flight and wanted as many people as possible to have the experience – to be touched by the sublimity of it in a way rational explanations never quite could affect them. Bringing a wide range of external publics to

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[216] Browne, "News Media Swarm to Shuttle Site."

[217] McCulla, "Guest Activities in the Shuttle Era."

[218] "'Yeeeow!' and 'Doggone!' Are Shouted on Beaches as Crowds Watch Liftoff," *New York Times*, April 13, 1981, A17, Folder 8131, NASA Historical Reference Collection, Washington, DC.

[219] "Pool Status #2 (final)," April 12, 1981, Folder 8314, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[220] NASA, "'A Free People Capable of Great Deeds' – The Story of STS-1, the First Space Shuttle Mission," *Mission Report*, MR-001 (Houston, TX: Johnson Space Center, 1981), NASA Technical Reports Server, accessed December 19, 2014, http://ntrs.nasa.gov/search.jsp?R=19830001836&hterms=Free+People&qs=N%3D0%26Ntk%3DAll%26Ntt%3DA%2520Free%2520People%26Ntx%3Dmode%2520matchallpartial%26Nm%3D123|Collection|NASA%2520STI||17|Collection|NACA.

Shuttle launches and landings thus became a major element of NASA's strategy to broaden awareness of and heighten interest in the Shuttle as the program continued. The effort built on a tradition begun by public affairs chief Julian Scheer during the Apollo flights. Recognizing launches as an "opportunity to demonstrate dramatically and forcefully the impact and importance of the whole space program," Scheer had urged NASA's senior leadership to invite a "broad cross-section" of individuals unaffiliated with the aerospace industry to the Apollo launches.[221]

Given resource and capacity limitations, however, NASA officials had to be selective about whom they invited to Shuttle launches as special guests of the agency. Adopting a strategy Scheer had introduced with the February 1969 launch of Apollo 9 of giving highest priority to inviting "influential members of the general public" to launches, they were eager to have as wide a reach as possible and thus put considerable effort into identifying people outside of NASA circles whom they believed could, after witnessing a launch, go on to take actions to positively shape the nation's space program.[222] NASA envisioned that these individuals would be leaders in community governments, labor unions, the media, academia, or the business world.[223] NASA human space flight chief James Abrahamson, for one, invited Wall Street financiers to launches and landings to persuade them to underwrite potential Shuttle payloads and infrastructure.[224] The agency aimed to enhance these individuals' experiences at Kennedy Space Center with special tours and mission briefings. Memoranda circulated to NASA personnel up through the Shuttle's final launches solicited their recommendations for guests who would fit the profile of influencers. As former NASA official Alan Ladwig observed: "People that would go to a launch always

[221] Scheer to distribution, "Invitations to View Launch of Apollo 5," December 18, 1967; Scheer to distribution, "Protocol Plans for Apollo Manned Missions," June 17, 1968. Both memoranda located in Folder 1904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[222] NASA, "Public Affairs Plan, Apollo 9," February 1969, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[223] McCulla, "Guest Activities in the Shuttle Era."

[224] "The Space Shuttle's Abrahamson: It's [sic] Potential Is Immense," 11.

had a good time, they always enjoyed the experience, they always would write us nice notes afterward and I'm sure they probably told their friends about it." Whether or not these attendees went on to "go out and talk well" of the Shuttle as NASA had hoped, however, was not clear to Ladwig, who said the agency generally did not follow through to measure the impact of their guests' experiences.[225]

Two publics that NASA invited to launches as a means to legitimize the Shuttle program were women and racial minorities. Public opinion studies made clear to agency officials that NASA, the space program, human space flight, and the Shuttle had no constituency among these groups.[226] As Brian Duff expressed, human space flight "was seen by most women as a white enclave macho engineers playing with expensive toys, and the perception was that there was not [sic] real future for women in this area.…The same thing was true of minorities, particularly blacks. In the case of blacks, we didn't even have males on our side. The minorities, especially blacks thought it was a white man's area."[227] In response to public pressure to expand the social diversity of the astronaut corps in the 1970s, the agency had selected some astronauts that bucked the white male trends of its previous flight crews and linked their missions to invitations to these groups to attend launches. Longtime NASA staffer Josie Soper recalls that in the Shuttle's early days:

> There were a lot of firsts, first female [Sally Ride] and first African-American [Guion Bluford].... So with every first came more of an opportunity for the agency to market the audience differently. They would approach a different audience of people to come and be there and witness it firsthand, because the philosophy was this is how you're going to bring people on board and how you're going to get support for the program, is to show them what you're doing. Let them see it. Let them experience it and feel it firsthand.[228]

[225] Ladwig, interview, January 31, 2013.

[226] See, for example, Overholt, Wiener, and Yokelson, *Implications of Public Opinion for Space Program Planning, 1980-2000*, and Jon D. Miller, "The Information Needs of the Public Concerning Space Exploration: A Special Report for the National Aeronautics and Space Administration," July 20, 1982, Folder 6720, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[227] Duff, interview, May 24, 1989.

[228] Soper, interview.

NASA encouraged "prominent members" of each group to these historical launches. Hundreds of officials from the National Association for the Advancement of Colored People and the Urban League attended the launch of STS-8, Bluford's first mission, at NASA's invitation.[229] In preparation for Ride's launch in 1983, NASA invited women who the agency felt were most likely to have been critics of NASA, as well as women with access to the media, and those in senior positions in the government and private sector. According to Brian Duff, some 600 of NASA's targeted invitees accepted, including feminist activists Gloria Steinem and Betty Friedan.[230] NASA continued to aim to bring women and various minority groups to launches of missions with crewmembers with relevant tie-ins.[231]

The agency also saw launch attendance as instrumental to advancing its goal, held since the 1960s, of gaining appreciation of the space program by elementary and secondary school students. NASA officials regarded youth as a key constituency. Capturing the interest of children who might then attract the support of their parents for the space program was one aspect of why connecting with youth was important. More significant, however, was that youth comprised the available potential future workforce for NASA and the agency wanted to build the next generation of scientists and engineers who would carry on with the agency's work. Recognizing the critical role of educators in influencing students and making them aware of career choices and generally increasing their proficiency in science and mathematics, NASA assisted teachers with integrating the Shuttle in classroom curricula to "build a sound educational base for future STS missions, payload activities, and their scientific enhancement."[232] In addition to using the Spacemobile program and other existing channels, NASA officials believed inviting educators and students to launches and landings would help to inspire their commitment to the

[229] O'Toole, "Shuttle's 'Cleanest Mission' Ends with Night Landing."

[230] Duff, interview, May 24, 1989.

[231] Beth Beck, interview by author, Washington, DC, June 18, 2013.

[232] NASA, "Space Transportation System Public Affairs Plan: First Space Shuttle Mission, STS-1," September 1980, 5-1, accessed December 19, 2014, https://archive.org/details/nasa_techdoc_19900067371.

space program and science and technology in general. The agency would often plan conferences in conjunction with these events to inform them about the mission, NASA materials and resources available to the education community, as well as opportunities for students to engage in Shuttle-based research. In addition, they would reward science fair and other competition winners with trips to see Shuttle flights as prizes for their achievements.

Just as NASA welcomed the media and prominent members of society to launches so as to enlist their assistance in conveying the worthwhileness of the Shuttle program to others, so too did agency officials see merit in inviting artists to help tell NASA's story. They believed artists' creative capturing of Shuttle missions would humanize the program and make it more meaningful to citizens. Administrator James Webb had initiated the art program during the Apollo days, but a new program director, Robert Schulman, reinvigorated it in the Shuttle era after it had endured a lull correlating with the transition from Apollo to Shuttle. The program proved very popular among artists, with hundreds contacting NASA each year to participate. Beginning with STS-1, NASA selected a handful of artists to cover each mission's launch and landing, providing the artists what Bob Schulman, the program's director at the time, "access like they've never had before" and giving them special tours of the space center facilities.[233] Compensated with $1500 apiece, the artists converted the inspiration they drew from the events they witness into works on canvas in a variety of artistic styles, which NASA exhibited at the National Air and Space Museum and in traveling shows around the country for millions to see.[234] During the 1980s and

[233] Carla Hall, *Washington Post*, December 1, 1982, final edition, C7, accessed December 19, 2014, LexisNexis Academic.

[234] Smithsonian Institution, "Space Shuttle Art Exhibition to Go on View at the National Air and Space Museum," news release 398-82, November 12, 1982; NASA, *Artists and the Space Shuttle* (NASA, n.d.); and Owen McNally, "Depicting U.S. Push into Space," *Hartford (CT) Courant*, April 18, 1984. All documents located in Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

1990s, the agency expanded the program to include poets and musicians to help commemorate and convey the meaning of Shuttle flights in expressive, non-technical ways.[235]

Creating Virtual Mission Experiences

NASA's commitment to sharing Shuttle flights visually and palpably to serve the interest of enthusiasts and demonstrate broadly the Shuttle's utility and value extended further still. As a 1981 NASA publication conveyed, "In past exploration, a few hardy souls ventured out, while the rest waited for months or years to hear what they had found. In the Space Age, we are all explorers. Through the miracles of modern communications we have watched together as these new worlds have been revealed."[236] NASA officials harnessed a broad suite of available communications technologies to make the sights, sounds, and action of operating Shuttle missions even more accessible and concrete to all.

Physically equipping the Shuttle system itself for the purposes of giving external publics visibility into the program's activities was not a task to which everyone at NASA always readily agreed. The agency had demonstrated television as both an internal and public communications tool on Apollo 7, but the mission's engineers and astronauts regarded it as both a cost and safety distraction. As a result, Scheer faced difficulty persuading Apollo engineers to include video cameras as a "requirement" for the monumental Apollo 11 mission. While Scheer overcame their objections and proved the inordinate value of cameras in attracting media and public attention to major NASA achievements, resistant attitudes

[235] NASA, "Composer/Musician to Cover Shuttle Mission under NASA Art Program," news release 88-128, September 19, 1988, Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[236] NASA, *A Meeting with the Universe*, eds. Bevan M. French and Stephen P. Moran, EP-177 (Washington, DC: NASA, 1981), iv.

remained and seeped into the Shuttle era. Deputy Administrator Hans Mark, for one, thought providing live coverage of launches and activities could mar NASA's image in the event of a failure.[237]

At the same time, Shuttle program planners recognized the value of a video transmission system for monitoring and analyzing Shuttle launches, landings, and mission operations and thus established a system of video cameras, relay satellites, and transmission lines to support the new vehicle. In a coup for those eager to share facets of Shuttle missions with external publics, NASA public affairs staffers found an ally in Johnson Space Center director Christopher Kraft, who took a holistic view of what would define the Shuttle's success, and agreed to allow them access to the Shuttle television system for outreach purposes. The dozens of long-range cameras NASA had installed around its premises relayed, as best any technology could, the drama of these events for television viewing by millions without needing to travel to a launch or landing site, and NASA's public affairs office established a means to distribute the television feed to private and public broadcasters.[238] High-resolution cameras positioned in the orbiters and on the helmets of spacewalking astronauts did double duty for mission operations and public engagement, giving crewmembers and mission controllers views of hardware in the payload bay as well as viewers on Earth unprecedented looks at the work of astronauts in space.[239] Indeed, NASA public affairs officials saw early on that televising activities such as fixing and deploying satellites and astronauts conducting scientific experiments on orbit would offer external publics ringside seats to witness the accomplishment of the Shuttle's objectives, not only providing a spectacular view of space

[237] Brian Duff, interview by John Mauer, April 24, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC, accessed February 7, 2015, http://www.hq.nasa.gov/alsj//nasm_si__oral_history_project__duff_1.html.

[238] Bob Jacobs, e-mail message to the author, June 6, 2014.

[239] NASA, "Miniature TV Camera to Be Used on Fifth Shuttle Mission," news release 82-135, September 15, 1982, Folder 7038, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

activity but also serving as a key way to demonstrate the Shuttle's utility.[240] NASA's television system, for example, allowed millions to view the Hubble Space Telescope repair missions of the 1990s and 2000s.

Throughout the decades of Shuttle missions, public affairs officials and other NASA advocates of increased public visibility into Shuttle missions pressed to upgrade cameras with those of increasingly high resolution and introduce new viewing opportunities. With the 2002 launch of STS-112, the agency mounted cameras on the Shuttle's external tank that provided live video of the Shuttle's ascent after leaving the launch pad through the jettison of its solid rocket boosters. Bill Readdy, who oversaw NASA's human space flight program at the time, explains that NASA took the action to demystify and humanize space flight and make it more inclusive.[241] Bob Jacobs, NASA news chief since 2000, maintains it was one of the agency's most popular launches in years because "we did something different and we allowed [people] to experience space flight."[242] But as Jacobs expressed, proponents continually faced opposition from Shuttle program engineers who, concerned primarily with missions' technical success, did not consider the value of these cameras. In some cases they struggled to keep these assets in place, such as when in 1983 Johnson Space Center managers threatened to cease camera coverage of launches and landings from the agency's T-38 reconnaissance and chase planes.[243] Moreover, only after the 2003 *Columbia* accident did Shuttle program managers recognize value in viewing the outside of the orbiter during launch.

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[240] FD-1/Deputy Assistant Administrator for Television (Robert J. Shafer) to L/Associate Administrator for External Affairs, "Space Shuttle Television," December 15, 1975, Folder 8227, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[241] William Readdy, interview by author, Arlington, VA, June 27, 2014.

[242] Jacobs, interview.

[243] Frank S. Johnson, Jr., to James Abrahamson, December 20, 1983, with attachments, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

The agency also entered into partnerships with other entities to relay the experience of space flight to people in unprecedented ways. During the late 1960s, a new company that came to be known as IMAX Corporation burst onto the scene with its capability of shooting movies using 70-millimeter film for projection on oversized screens. Astronauts had until then recorded some of their mission activities using 16-millimeter cameras. The agency, however, recognized the availability of IMAX during the 1970s along with the possibility that the relatively spacious Shuttle could accommodate the bulky new camera, and aspired to make an IMAX film that would make viewers feel like virtual participants in Shuttle missions. As proponents within NASA struggled to find the funds and work through the logistics of how they would make an IMAX film, the IMAX Corporation independently made its own film, *Hail Columbia*, about the first Shuttle mission. Though it did not contain any footage shot aboard the Shuttle, the film captured the attention of NASA administrator James Beggs and NASA associate administrator for space flight James Abrahamson, who viewed the movie when it was screened at the National Air and Space Museum (NASM). Highly impressed by the film, they, along with astronauts who saw the film on trips to Washington, became advocates for flying an IMAX camera aboard the Shuttle.[244]

In pursuing participation in IMAX projects aboard the Shuttle, Duff said that "NASA was true to its philosophy that the people of the world should to the greatest extent share and have a sense of participation in the space program."[245] NASA could not give the IMAX Corporation preferential access to Shuttle missions over other media outlets, however, so the agency worked a deal with NASM for that institution to make the film with NASA's cooperation. Lockheed Corporation, winner of a major Shuttle support contract, became a corporate sponsor. In a 1983 letter from Beggs to NASM's acting director, Walter Boyne, NASA consented to allowing astronauts to be trained to operate the IMAX camera on

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[244] Brian Duff, "*The Dream Is Alive* – The Story Behind a Historic Film," *NASM Research Report*, 1985, 195-201; Folder 15429, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Joseph P. Allen, interview by Jennifer Ross-Nazzal, Washington, DC, March 16, 2004, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/AllenJP/AllenJP_3-16-04.pdf.

[245] Duff, "*The Dream Is Alive* – The Story Behind a Historic Film," 198.

Shuttle missions with the objective "to help create the most effective possible film for communicating the potential and beauty of mankind's newest environment – Outer Space."[246] The IMAX camera flew on four Shuttle missions during 1984 and 1985, resulting in *The Dream is Alive*, a film that depicted many aspects of life aboard the Shuttle and which premiered at NASM in 1985. The IMAX partnership continued for the next few decades and led to the production of films that captured the Hubble Space Telescope servicing missions, the Shuttle's visit to the Russian Mir space station, and the construction of the International Space Station, among other, non-human space flight projects.

Similarly, NASA entered directly into a partnership with Cinema-360, a consortium of four U.S. planetariums that desired to fly a camera aboard the Shuttle to make a film about the Shuttle program that would be designed for domed screens. Agreed to by Beggs in 1983, the project called for the consortium's 35-millimeter camera to fly on up to three missions.[247] The camera flew on two missions, STS 41-B and STS 41-C; when weight limitations arose on its next scheduled flight, NASA worked out an agreement between Cinema-360 and the IMAX Corporation for the IMAX camera to capture footage for the former company.[248] The completed film, *The Space Shuttle: An American Adventure*, debuted in planetariums in 1985.

NASA likewise aimed to give external publics an opportunity to feel more closely connected to the Shuttle and the astronauts through a partnership with AT&T which allowed individuals to listen in on communications between ground controllers and Shuttle mission crews in flight by calling a designated telephone number on a pay-per-minute basis. After affording this opportunity to members of the

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[246] Ibid.

[247] John F. Murphy to Thad Cochran, April 14, 1983, Folder 6414, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[248] NASA, "41-D Crew to Film Shuttle Mission for IMAX and Cinema-360," news release 84-124, August 29, 1984, NASA Historical Reference Collection online, accessed December 19, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/42400.pdf?w=NATIVE%28%27DOC_DATE+ph+is+%27%271984%27%27%27%29&upp=0&rpp=20&order=native%28%27SERIES%27%29&r=1&m=81.

domestic and foreign media for the first few Shuttle flights, NASA extended the service, which became known as Dial-a-Shuttle, to all interested parties beginning with the STS-5 mission in November 1982. More than one million people dialed the 1-900 number to listen in through the service that AT&T advertised as "just the thing for armchair astronauts."[249] NASA turned to the National Space Institute to administer the popular service beginning with the next Shuttle mission. Because callers would often dial in when the Shuttle was out of range or crews were sleeping, the National Space Institute provided live commentary, highlights, and interviews to ensure that callers never or rarely listened to dead air. Duff's successor as public affairs chief, Frank Johnson, considered Dial-a-Shuttle "an importance service" to NASA as well as to the public."[250] With up to five million people calling in for some missions, the National Space Institute and its successor, the National Space Society, continued to offer the service until at least 1995, when the National Space Society and Rockwell sponsored Dial-a-Shuttle for the first docking of the Shuttle *Atlantis* with the Russian *Mir* space station.[251]

NASA used still other techniques to engage external publics on the ground with mission crews and their activities in flight to relate to them the experience and significance of space flight. Just as it had during the 1960s, the agency continued to regard its astronauts as one of its most valuable public relations assets, and senior NASA officials, public affairs officers, and the agency enlisted them actively to help make space flight relevant and accessible. Regarding astronauts through the Apollo era as not particularly well-versed in public and media relations, NASA required its first class of astronauts selected explicitly for Shuttle flights in 1978 to take public speaking classes so that they could, as former Johnson Space

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[249] AT&T, "During the Next 6 Days, You Can Make an Extraordinary Long Distance Call" (advertisement), 1984, Folder 5005, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[250] Frank S. Johnson, Jr., to Paul R. Guild, June 1, 1984, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[251] Mark R. Chartrand, "National Space Institute: The Middle Years, 1980-1984," *Ad Astra*, November/December 1994, 32-33; National Space Society/Rockwell, "Dial-A-Shuttle: The Ultimate Long Distance Call" (advertisement), *Ad Astra*, May/June 1995, back cover. Both documents located in Folder 5006, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Center director George Abbey put it, "portray NASA the right way."[252] NASA encouraged and often required Shuttle crews to go on public speaking circuits following completion of their missions, where they were met with audiences enthusiastic to hear from them. As Beggs says of his experience touring with the crew of STS-1: "I went out with Young and Crippen and we wandered around the country talking to people about the experience, and the turnout in almost every city we visited was enormous… The thing that surprised me and made me feel kind of good about the thing was the fact that we got the general public interested, and they hadn't been all that interested in the interim."[253] In 1983 NASA astronauts supported nearly 2,500 appearances in 43 states and 20 foreign countries, reaching an estimated 2.3 million people.[254]

NASA officials were determined to ensure that astronauts' roles in engaging with external publics would not only take place prior to and following missions: rather, these interactions would become part and parcel of the Shuttle missions themselves. But like the use of cameras for public engagement purposes, efforts to use mission time for interacting with external publics were not small feats: not everyone at NASA considered activities primarily intended to meet public communications or education goals to be important or even appropriate activities for astronauts during missions. Public affairs and Shuttle program officials often held quite different views of what it meant to serve and legitimize the Shuttle with external publics. Shuttle program managers tended to be highly focused on each mission's technical success, the fulfillment of planned scientific objectives, and the completion of tasks for Shuttle customers. It was only through the strong advocacy of public affairs officials that missions beginning with STS-8 included a single half-hour press conference featuring the crew. Shuttle program officials

[252] George W. S. Abbey, interview by author, Houston, TX, June 12, 2013.

[253] Beggs, interview, April 8, 2013.

[254] LFF/Chief of Special Events Branch (Gene Marianetti) to L/Associate Administrator for External Relations, "Year End Report of Astronaut Appearances," January 25, 1984, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

also objected to certain efforts public affairs staffers championed to publicize missions. While NASA's external relations officials in 1985 endorsed a proposal by *Sesame Street* to fly Big Bird's teddy bear, Radar, on STS-51L, NASA associate administrator for space flight Jesse Moore overruled it, noting that honoring the children's television show's requests for astronauts to appear on its shows was fine, but flying a character, and requiring any involvement of the astronauts with it, "would set a precedent that we would rather not establish." Moore added: "I am becoming increasingly concerned that the fight of such nonessential mission items in the Orbiter can have a negative impact on the NASA image.…While I am a major supporter of educational and public affairs initiatives, I believe we can find more appropriate means to deliver our message to the taxpayers."[255]

In still other cases, astronauts were personally interested in engaging with external publics during their missions but were required by Shuttle program managers to confine these activities to their free time in orbit until agency officials came to see their value and endorsed them as ways to engage various publics, particularly to inspire youth to pursue studies and careers in science and engineering fields, with the Shuttle program. Astronaut Owen Garriott, an amateur ham radio operator, carried within his personal kit a handheld antenna to communicate with hams around the world during his flight on STS-9, which he used to make specific as well as general calls during his off-duty hours. Garriott had partnered in making the request to NASA with the American Radio Relay League (ARRL) and the Amateur Radio Satellite Corporation (AMSAT), and NASA had accepted it provided it did not interfere with mission activities or run afoul of safety requirements.[256] His communications were the first between astronauts and individuals on the ground outside of official NASA channels. Starting with STS 51-F, NASA flew the Shuttle Amateur Radio Experiment (SAREX) to further test ham radio equipment in space but also to

[255] M/Associate Administrator for Space Flight (Jesse W. Moore) to L/Associate Administrator for External Relations, "Sesame Street Television Production," November 22, 1985, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[256] NASA, "Ham Radio to Fly on STS-9," news release 83-90, June 3, 1983, Folder 16907, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

communicate with amateurs and youth. Recognizing SAREX's role in generating "wide-spread public interest" and making young people feel like participants in the Shuttle program, the agency partnered with ARRL, AMSAT, and ham radio operators around the world to fly SAREX on many more Shuttle missions, allowing student groups to ask questions directly of Shuttle (and eventually space station) crews on orbit.[257] NASA selected school groups to participate based on their completion of an application and proposal. Pat Palazzolo, a Pennsylvania teacher who spearheaded efforts for her school district to participate in SAREX contacts, recalls that not only did the opportunity reach "monumental" numbers of students, teachers, and the general public but "no one can watch the faces of those viewing students talking via amateur radio to an astronaut and doubt the 'inspiration factor,' even for those who are simply 'audience members.'"[258]

Likewise, a plan developed by Carolyn Sumners of the Houston Museum of Natural Science and Johnson Space Center personnel to have astronauts "play" with different toys in the microgravity environment of space to teach school-age children about physics was not originally sanctioned by NASA as an official mission activity; astronauts who agreed to participate, on STS 51-D in 1985, had to carry the toys as part of their personal belongings and run the experiments during their free time. Sumners notes that personnel at NASA Headquarters were concerned that authorizing astronauts to play with toys on missions costing taxpayers billions of dollars to fund could tarnish NASA's credibility and image as a good steward of federal resources.[259] Agency officials, however, came to see the value of the "Toys in Space" initiative as a means to interest students in science, math, and engineering and make Shuttle missions more relatable, even if not completely serious in image. NASA flew toys as part of NASA's

[257] LF/Director, Public Affairs Division (Shirley M. Green) to M/Associate Administrator for Space Flight, February 18, 1986, Folder 1260, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[258] Patricia Palazzolo, "Launching Dreams: The Long-Term Impact of SAREX and ARISS on Student Achievement," n.d., accessed December 20, 2014, http://www.amsat.org/amsat/ariss/Presentations/AMSAT%20Symposiums/2007%20Symposium/Launching%20Dreams.pdf.

[259] Carolyn Sumners, telephone interview by author, April 26, 2013.

official payload on Shuttle flights in 1993 and 1996 and later on the International Space Station, creating video recordings of the astronauts' experiences for dissemination to schools. As a booklet summarizing the project explains, "This toy cargo gave the Space Shuttle one more role in extending human access to the space environment. With the addition of a few pounds of toys, the Shuttle mid-deck became a space classroom where astronauts could teach the nation's children about life in space."[260]

In addition, NASA regularly conducted live in-flight video downlinks with schools for students to ask questions and watch astronauts perform demonstrations in space, reaching more than six million students through these connections.[261] As NASA astronaut Donald Thomas put it: "For the first time, we made access to space available to the classroom, and many teachers and students from across the country and around the world were able to participate."[262]

NASA's commitment to making young people feel like virtual participants in the Shuttle program went still further. Much of the effort was driven forcefully by the Reagan administration, which believed American science and math education had reached such an abysmal state in comparison to that of its worldwide counterparts that it threatened the nation's economic and military security.[263] President Reagan viewed space as an inspirational teaching tool and in 1984 began an initiative called "Operation Liftoff" to harness NASA resources in science, engineering, and math education. Regarding the Shuttle and human space flight as particularly motivational, syndicated columnist Jack Anderson proposed to Reagan that the initiative include decentralized clubs around the country that youngsters could join to

[260] "Toys in Space: Results of the Space Shuttle Mission STS-51D," n.d., Box 23, General History V Subseries, General Reference Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston TX.

[261] NASA, *Wings in Orbit: Scientific and Engineering Legacies of the Space Shuttle*, eds. Wayne Hale, Helen Lane, Gail Chapline, and Kamlesh Lulla, NASA SP-2010-3409 (Washington, DC: U.S. Government Printing Office, 2010), 473.

[262] Ibid., 471.

[263] Robert Reinhold, "Reagan Warns Schools Are Failing to Meet Science and Math Needs," *New York Times*, May 13, 1982, B18, accessed March 1, 2015, ProQuest Historical Newspapers: The New York Times.

become immersed in and knowledgeable about the space program wherever they lived. With Reagan's support, NASA partnered with the National Space Institute to develop the Young Astronauts Program "to involve young Americans more directly in our space program."[264] According to Anderson, who became chairman of the White House-based Young Astronauts Council, "The Young Astronauts will give the aerospace industry a constituency of millions of kids who believe in space."[265] NASA, the National Space Institute, and Reagan envisioned the Young Astronauts program enrolling children at the elementary and middle school levels in local chapters across the country in which they would learn about the space program through NASA-provided materials and participate in hands-on projects, special contests, and sponsored trips related to space – with the privilege of wearing astronaut insignias in doing so. While the program ultimately came to be managed out of the White House with grants provided to chapters by private sector sponsors, NASA remained a partner in the effort.

The Young Astronauts Program partners went to great lengths to make membership in the organization highly appealing to children, their parents, and teachers. Blasting chapter application materials to all 77,000 elementary and middle schools in the nation, the program pledged to fly the charter certificates of the first 1000 chapters formed aboard the Shuttle prior to delivery to heighten the sense of virtual participation.[266] NASA and the U.S. Postal Service approved a plan by which Young Astronauts members could send personal postcards aboard the Shuttle as part of what Anderson called "a campaign to win the massive support of teachers and parents" for NASA.[267] In 1985 Anderson suggested to Reagan that a Young Astronauts member be permitted to fly on a Shuttle mission. While NASA administrator

[264] National Space Institute, "Young Astronauts Program to Be Formed," news release, June 20, 1984, Folder 8926, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[265] Ellen I. Kelly, "The Young Astronauts," *AIA Aerospace* 23, no. 3 (Summer 1985): 14-16.

[266] Jack Anderson, "Dear Educator" letter, October 24, 1984, Folder 8926, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[267] Jack Anderson to James M. Beggs, November 21, 1985, "Young Astronauts" Folder, Box 4, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

James Beggs noted that a careful selection process would need to be crafted to ensure the student's safety, he indicated that NASA would "not rule out" the possibility.[268] Clearly the Young Astronauts Program captured the imaginations of those its organizers targeted: three years after its founding, it boasted 14,000 chapters and 350,000 student members.[269]

In the absence of student opportunities to become members of Shuttle flight crews, various NASA centers helped to give children opportunities to experience what it would be like to be an astronaut flying on a Shuttle mission. Johnson Space Center education personnel assisted a local Texas elementary school assemble its own Shuttle mockup on its playground to be used for classroom instruction and local Young Astronaut chapter meetings and camps. The U.S. Department of Education also helped the project by providing a $30,000 grant.[270] NASA's Lewis Research Center in Cleveland, Ohio, meanwhile, converted school buses into Shuttle orbiters and outfitted them with computers, scientific laboratory equipment, and two-way radios. They selected elementary and high schools from around the region to participate in simulated Shuttle missions, assigning some of the students to roles as astronauts aboard the "orbiters" and others to serve as mission planners and flight controllers, scientific experiment designers, and public relations specialists. During 1985 and 1987, NASA Lewis, along with the support of Rockwell and other private and community sponsors, facilitated the simulated missions, which ranged from a few hours to up to 24 hours, and involved students donning space suits, conducting experiments, and working through challenges with their peers on the "ground."[271] A report Lewis compiled on the

[268] Lawrence F. Herbolsheimer to James. M. Beggs, "Young Astronauts Program," April 5, 1985; Beggs to Herbolsheimer, April 25, 1985. Both documents located in "Young Astronauts" Folder, Box 4, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[269] XE/Director, Educational Affairs Division (Robert W. Brown) to XE/Staff, "Update on Young Astronaut Council (YAC)," September 21, 1987, Folder 8926, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[270] Susan Alsup, "Move Over Monkey Bars," *Space News Roundup*, September 21, 1990, 3, Folder 5849, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[271] NASA Lewis Research Center, "Launching a Dream: A Teachers Guide to a Simulated Space Shuttle Mission," n.d., Folder 7906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

projects testified to their value in not only motivating students' interest in space, science, and math but also exciting entire communities about the space program.[272]

Chapter Synthesis

Determined to sustain the human space flight enterprise in the face of mixed public opinion about its value, NASA and the Nixon administration framed the Shuttle as a program that, unlike Mercury, Gemini, and Apollo, would serve a variety of societal needs and publics interests. In the Apollo era, NASA officials regarded ongoing and improved communications, information, and the sharing of experiences relating to legitimizing the space program to what it perceived as a singular attestive public. During the early Shuttle era NASA continued to seek legitimacy by relying on discourse; however, with NASA's imaginary for the Shuttle casting human space flight in more democratic terms, as an enabler of manifold societal benefits and an enterprise open to broad participation, officials aimed to interact directly with and serve various publics via tailored messages and opportunities. Invoking both pragmatic and idealistic arguments and appealing to emotion as well, NASA officials aimed to reach audiences already enthusiastic about space flight as well as those who were neutral or doubtful about the matter. NASA, often in partnership with other organizations, married rhetoric, the unique physical attributes of the Shuttle, and available communications technologies to allow all Americans to feel like a part of the Shuttle program. Through these approaches, the agency aimed to suggest to all that a new, democratized era in space flight was truly upon America. While a fair amount of skepticism prevailed as NASA worked through a number of hitches during the Shuttle's development period and among women and minorities even later, NASA took encouragement from the enthusiastic reactions of so many citizens by

[272] Ibid. pp. iii-iv

the time the Shuttle finally flew that many Americans were persuaded that the Shuttle program belonged to them, would benefit them, and, just might, carry them into space one day.

At the same time, sharing the Shuttle through rhetoric, demonstrating results, and giving citizens opportunities to see and connect more closely with the Shuttle mission experience were not the only approaches NASA used to serve external publics and attain legitimacy for the Shuttle. As the next two chapters show, the agency also sought to bolster the new space transportation system's viability, and a broader future in human space flight, by considering and engaging a multitude of publics as users and flyers aboard its fleet of orbiters.

Chapter 3: Using the Space Truck

The previous chapter showed NASA's uses of discourse and visual and virtual experiences during the 1970s and 1980s with both general and specific audiences within the American public to convey the promises, achievements, and excitement of the Space Shuttle. These forms of engagement were familiar to the agency from its Apollo-era days as means to connect with broad segments of the public not necessarily equipped with technical backgrounds, and NASA relied heavily on them in the Shuttle age in its quest to serve various external publics and in turn attain supporters for human space flight. But remaining true to the agency's promulgated democratized imaginary for human space flight vis-à-vis the Shuttle – that the vehicle would be relevant, useful to, and inclusive of a variety of people in a variety of ways – also meant that its relationship with those outside of the traditional circle of space program developers would need to extend beyond one based solely on information consumption and spectatorship.

Indeed, delivering on the promises it made about the Shuttle's utility and economic advantages required the agency to make the Shuttle accessible to the American public in physical ways: namely, to attract and accommodate users for the new vehicle. To do this, NASA not only offered new sorts of participatory opportunities to its traditional affiliates, including the aerospace and space science communities, but also sought to enroll new segments of the American, and global, citizenry as active participants in the Shuttle program as users of this novel space vehicle. Just as NASA officials aimed to legitimize the Shuttle and additional human space flight enterprises by showing and telling citizens about the Shuttle and its achievements, they too saw involving citizens substantively, as owners of payloads and experiments flown aboard the Shuttle, as crucial to proving the vehicle's viability. By helping to close the business case NASA had made for the Shuttle in the early 1970s, NASA officials anticipated gaining the support of political stakeholders who recognized the Shuttle's service to a variety of publics.

This chapter examines NASA's commitment to accommodate potential new users, or "customers," of the Shuttle as yet another, vital means of broadening the base of Americans enrolled in

the agency's human space flight program during the 1970s and early to mid-1980s. It shows that in opening space flight opportunities to new users, NASA officials constantly reconciled how to serve individual customers' needs and interests while concomitantly demonstrating accountability to the nation's taxpayers. The effort was led not by NASA's public affairs office, as were so many of the engagement activities outlined in the previous chapter, but instead by the Office of Space Flight, which had responsibility for management of Shuttle development and operations. The agency's education office, however, remained a key actor, and NASA's science office also played a role. The staffs of the agency's various offices both collaborated and debated with one another regarding how best to achieve non-mutually-exclusive aims including demonstrating the Shuttle's utility, responding to various publics' interests in using the Shuttle, providing equal access to the Shuttle for a variety of scientific and other purposes, and maintaining scientific quality of activities conducted aboard the Shuttle. Achieving these objectives required NASA officials to coax some publics to participate as users of the Shuttle while determining the suitability or priority they accorded to prospective Shuttle users and uses that the agency did not solicit. NASA also had to balance promoting the Shuttle with growing commercial sector concerns about the government-owned vehicle competing with private efforts to develop and offer launch services.

The chapter begins by describing NASA's efforts to solicit customers for the Shuttle from among the scientific community and corporate world. Next, I highlight an initiative the agency established to make Shuttle missions' excess cargo capacity available to a variety of experimenters at low cost. I then trace the agency's efforts to create dedicated opportunities for students to participate in Shuttle-based research projects. Finally, I discuss how the agency responded to proposals from an eclectic set of external publics, from entrepreneurs and advertisers to artists, to put payloads on the Shuttle. Ultimately at stake for NASA was figuring out how to enroll these various publics in ways that served those who wanted to use the Shuttle and enabled the Shuttle to become the useful and multipurpose vehicle the agency had espoused. NASA strived to ensure that its chosen policies and paths to engage a variety of

external publics as Shuttle users would bestow credibility on the agency and demonstrate the legitimacy of its continued human space flight endeavor.

Adopting a Customer Orientation

NASA had made a bold promise to the world in 1972. In an attempt to gain and then maintain the support of elected officials who held the purse strings and power to continue the agency's human space flight program, as well as the Department of Defense, space science communities, and external American publics, NASA pledged that the Shuttle would open a new era of the United States' presence in space by shifting its human space flight focus from learning how to live and operate in space to fostering the exploitation of this unworldly environment for economic, national security, and other societal benefits. Creating a new guiding imaginary for human space flight, the agency boasted that the Shuttle would provide economic, versatile, and routine access to space for civilian government as well as military space users; it also declared that the Shuttle, with its spacious cargo bay and crew cabin and 65,000-pound carrying capacity, would offer plenty of room and capability to open the doors for still other actors to exploit space for their own purposes. NASA official Frank Hoban indicated that George Low, NASA's deputy administrator who helped to convince the Nixon administration to approve the Shuttle, recognized that NASA needed to make space more accessible and relevant to "a broad variety of new users." According to Hoban, "Low's vision was to make space attractive and available to a whole new range of customers – the entrepreneurs, the small science advocates, the low budget payloaders, the venture capitalists, and the space pioneers."[1] Low saw the Shuttle as a means to make NASA "a low cost supplier of space services."[2]

[1] Francis T. Hoban, *Where Do You Go after You've Been to the Moon?* (Malabar, FL: Krieger, 1997), 14.

[2] Ibid., x.

The Nixon administration, along with the Congress, was willing to fund the Shuttle based on NASA's claim that the new vehicle would serve as an all-purpose carrier and Mathematica's analyses indicating that the vehicle would prove economical if flown at least a few dozen times per year. While it seemed there would be plenty of NASA and Department of Defense payloads to fill the Shuttle's cargo bay, the agency also would be able to recoup the government's costs to operate the Shuttle by leasing onboard space to an assortment of external entities from the United States and abroad to fly payloads and experiments. By the time NASA's "space truck" – as many within NASA, the aerospace industry, and the media came to refer to the Shuttle – started flying in the early 1980s, the Reagan administration directed that the new vehicle would be the primary launch system for civil government and national security users and also be made available to "authorized users – domestic and foreign, commercial and governmental."[3] Thus, while the agency labored throughout the 1970s and 1980s to overcome technical and cost challenges associated with the spacecraft's development and to learn how to operate the new system, it also expended considerable effort to reach out to and solicit a broad range of users. Their active participation as innovators and paying clients in the Shuttle program would be crucial to ensuring the Shuttle's economic viability and its legitimacy as well as NASA's credibility to deliver on the human space flight imaginary it had promulgated.

But whom would NASA succeed at gaining as Shuttle customers and how? Some of the groups Mathematica and the agency had implicated as potential users of the new space transportation system – those to whom they had pointed in an effort to close the Shuttle's economic case and otherwise justifying it – had not expressed specific plans or even a clear desire to use the new vehicle. The two publics NASA officials recognized as most instrumental to the Shuttle's success but that were not fully sold on using the Shuttle included university-based scientists and corporate satellite owners and researchers. During the

[3] Ronald Reagan: "Fact Sheet Outlining United States Space Policy," July 4, 1982, in *The American Presidency Project*, eds. Gerhard Peters and John T. Woolley, accessed January 3, 2014, http://www.presidency.ucsb.edu/ws/?pid=42705.

Shuttle's earliest days, the agency worked tirelessly to create demand for the system among these entities and to enroll them as regular users of the vehicle.

Enrolling Science Communities

The National Aeronautics and Space Act of 1958 had directed NASA to "arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations."[4] While academic scientists in the fields of astrophysics, solar physics, Earth and planetary science, and life science had participated in NASA-funded space science research by flying instruments on analyzing data obtained using sounding rockets, high-altitude balloons, and unmanned Earth-orbiting platforms and deep space probes, they had far less experience conducting investigations on manned vehicles. Science and human space flight largely had remained separate in terms of budgets, communities, and organizational management within NASA; moreover, President Kennedy's ambition of sending American astronauts to the Moon had set NASA's human space flight program focus on that singular engineering goal, rendering science a lower priority.

Seeing, however, that human space missions could carry their experiments aloft, individual scientists as well as the National Research Council's Space Science Board pressed somewhat successfully for scientists' participation in Project Gemini, the Apollo lunar missions, Skylab, and the Apollo-Soyuz Test Project.[5] Nonetheless, the scientific community was divided over the merits of the human space flight program as the Shuttle era dawned. While some scientists, including some very notable in their fields, expressed interest in the possibilities the Shuttle could provide for researchers, others maintained

[4] National Aeronautics and Space Act of 1958, Public Law 85-568 (July 29, 1958).

[5] National Research Council, Space Science Board, *Space Research: Directions for the Future* (Washington, DC: National Academy Press, 1966).

that NASA's manned initiatives did not accord science enough attention while funneling money from research programs and lower-cost, unmanned probes and vehicles that could deploy their experiments.[6]

Recognizing this skepticism yet seeing the need to attract scientists as users of the Shuttle, NASA officials, with the assistance of Shuttle contractors, worked to convince these traditional affiliates of its unmanned programs of the Shuttle's value and the agency's desire to include their experiments aboard the new vehicle. The Shuttle, NASA posited to them, not only would provide the capability to launch major scientific payloads weighing ten tons or more, such as large space telescopes, but also would improve individual researchers' access to space. Compared to flying a payload on a sounding rocket, they contended, a Shuttle-based experiment could be conducted for many days rather than just a few minutes in the space environment and at higher altitude and be recovered upon return to Earth; the anticipated frequency of flight would allow for re-flights of experiments when necessary. As Chris Kraft, Johnson Space Center director, said of the Shuttle, "We now know what man can do in space so we are taking the next logical step. We have opened up a new environment and made it accessible for experimentation."[7]

NASA and its contractors created a variety of publications to capture scientists' interest in using the new vehicle. A Rockwell brochure from the 1970s targeted at university faculty and graduate students stated that the Shuttle would bring "the advantages of space flight within reach of every university researcher with an appropriate experimental objective," noting that experiments flown aboard the Shuttle would be comparable to typical laboratory experiments and not require the years to review and integrate involved in flying payloads on expendable vehicles.[8] The brochure prognosticated that

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[6] This debate is recounted in Chapter 1, pages 90-91. These concerns were not unfounded, as the Shuttle program took the highest funding priority within the agency, and NASA secured resources to sustain the new space transportation system in the early 1980s when it faced cost overruns and delays by reducing funds for, delaying, and cancelling several space science missions.

[7] "NASA Selling Space Medicine Idea," *Today* (Florida), May 25, 1978, 8A, Folder 8189, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[8] Rockwell International, *Space Shuttle: An Opportunity for University Research* (Rockwell, n.d.), 7, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

"universities will become centers of warm support for Shuttle, because it will give them access to the space environment that is otherwise available only to a few investigators in long-term programs."[9] NASA also sought to appeal to scientists by suggesting that they would have the opportunity to fly aboard the Shuttle with their experiments.[10] A 1972 NASA brochure noted that scientists would be able to go up on the Shuttle to "supervise and check" on their experiments due to its "easy and routine access to space."[11]

Working across offices and field centers, the agency provided many opportunities for scientists to participate in Shuttle-based research. NASA's Office of Space Science and Office of Applications announced several opportunities for university researchers interested in life sciences and materials sciences to propose and fly experiments that would harness the microgravity environment of space for earthly benefit and potential commercial use.[12] NASA's Langley Research Center in Hampton, Virginia,

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[9] Ibid., 8.

[10] NASA, *The Role of the Payload Specialist in the Space Transportation System for NASA or NASA-Related Payloads* (NASA, n.d.), Folder 8971, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Payload Specialists for NASA or NASA-Related Payloads, 43 *Federal Register* 9790 (March 10, 1978) (amending 14 C.F.R. pt. 1214).

[11] NASA, *Space Shuttle* (Washington, DC: U.S. Government Printing Office, 1972), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[12] NASA, "Materials Researchers Sought for Shuttle and Spacelab," news release 77-65, March 30, 1977, NASA Historical Reference Collection online, accessed December 21, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/21725.pdf?w=NATIVE%28%27SUBJECT+ph+is+%27%27PRESS+RELEASES%27%27+and+DOC_DATE+ph+is+%27%271977%27%27%27%29&upp=0&rpp=20&order=native%28%27SERIES%27%29&r=1&m=3; NASA, Early Shuttle Flight to Carry Materials Processing Experiments," news release 77-222, October 17, 1977, NASA Historical Reference Collection online, accessed December 21, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/21734.pdf?w=NATIVE%28%27SUBJECT+ph+is+%27%27PRESS+RELEASES%27%27+and+DOC_DATE+ph+is+%27%271977%27%27%27%29&upp=0&rpp=20&order=native%28%27SERIES%27%29&r=1&m=10; NASA, "NASA Seeks Life Science Experiments for Shuttle," news release 78-64, April 21, 1978, NASA Historical Reference Collection online, accessed December 21, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/21797.pdf?w=NATIVE%28%27SUBJECT+ph+is+%27%27press+releases%27%27+and+DOC_DATE+ph+is+%27%271978%27%27%27%29&upp=0&rpp=20&order=native%28%27SERIES%27%29&r=1&m=4; NASA, "NASA Seeks Microgravity Research Proposals," news release 84-61, n.d., NASA Historical Reference Collection online, accessed December 21, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/42395.pdf?w=NATIVE%28%27SUBJECT+ph+is+%27%27press+releases%27%27+and+DOC_DATE+ph+is+%27%271984%27%27%27%29&upp=0&rpp=20&order=native%28%27SERIES%27%29&r=1&m=8.

developed the Long Duration Exposure Facility (LDEF), a 12-sided cylindrical frame the size of a school bus which contained 76 trays to hold an assortment of passive experiments to be exposed to the space environment. After releasing an announcement of opportunity to potential users in 1976, Langley worked in partnership with the Universities Space Research Association, a consortium formed in 1969 to promote the academic community's participation in the space program, to streamline proposal procedures, solicit experiments for LDEF, advise inexperienced researchers, and help proposers locate funding, all with the aim to increase participation by those with no space research experience.[13] The agency launched the probe aboard STS-41C in 1984 carrying 57 competitively selected experiments developed by 200 investigators from 7 NASA centers, 9 Department of Defense labs, 8 foreign nations, 21 universities, and 33 private companies studying materials, thermal systems, electronics and optics, power and propulsion, and other scientific areas.[14] While NASA planned to retrieve the LDEF one year later, payload scheduling issues followed by the 1986 *Challenger* accident delayed the LDEF's return until 1990.

Perhaps most significant opportunity NASA made available for researchers to fly experiments aboard the Shuttle was via the Spacelab flown on several Shuttle missions. Designed "to provide the scientific community with continuing, economical access to space," Spacelab was developed by the European Space Research Organization (ESRO), representing nine Western European nations, at NASA's invitation in the early 1970s. President Nixon had expressed keen interest in international cooperation in NASA's space initiatives following Apollo; Dale Myers, NASA associate administrator for manned space flight, recommended to agency administrator Jim Fletcher that Europe could be involved in the Shuttle program without being in its critical path if it developed a laboratory facility that could be installed in the

[13] National Space Institute, "LDEF for New Experimenters," *Newsletter of the National Space Institute*, August 1976, 1-2, Folder 1260, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Leonard W. David, "Student Experimentation via the Shuttle (An Overview)," paper presented at the 85th annual conference of the American Society for Engineering Education, University of North Dakota, June 27-30, 1977, 8-9, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[14] NASA, Langley Research Center, *69 Months in Space: A History of the First LDEF (Long Duration Exposure Facility)*, NP-149 (Hampton, VA: NASA, 1992), inside cover.

Shuttle's cargo bay on selected missions.[15] Envisioned by NASA to fly twice per year, the Spacelab provided a pressurized module for researchers interested in solar physics, astrophysics, materials processing, life sciences, and Earth observations to work in a "shirtsleeves" laboratory as well as external pallet sections for experiments requiring exposure to the space environment.[16] In February 1977 NASA's Office of Space Science and ESRO's successor, the European Space Agency (ESA), selected 222 scientists from around the world to fly experiments on the first Spacelab mission; soon thereafter, the participants selected from among themselves two payload specialists to operate the experiments on their behalf. After Spacelab 1 flew on STS-9 in November 1983, NASA and ESA flew more than 20 Spacelab missions aboard the Shuttle.

NASA also invited researchers from around the world to propose instruments and investigations for the Hubble Space Telescope and other observatories and probes slated to be deployed from the Shuttle. Between these opportunities and those involving research to be carried out within the confines of the Shuttle orbiter, scientists from a variety of disciplines took advantage of the access to space that the Shuttle provided. Their participation helped NASA to fulfill and validate the Shuttle as a broadly useful space transportation system.

Recruiting Corporate Payload Owners

While university space scientists comprised an important constituency for NASA to attract in an effort to prove the Shuttle's utility, the agency financially supported much of their research. NASA needed, however, to realize the commitment it had made to its political stakeholders and the American people to transform the Shuttle program into a self-sustaining operation. Making good on this promise

[15] Associate Administrator for Manned Space Flight (Dale D. Myers) to James C. Fletcher, February 4, 1972, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[16] NASA, *Spacelab* (1983), Box 33, Robert Parker Papers II Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

and offsetting the Shuttle's operating costs meant that the agency would need to broaden involvement and find a sufficient number of customers willing to pay to take advantage of the Shuttle's spacious cargo bay, mission duration, and other attributes. In some respects, it seemed like this would be a natural transition for NASA: the agency had professed, and space enthusiasts within and outside of NASA had envisioned, a future in which people would exploit space as a routine part of their lives and economies. In reality, however, marketing the human space flight program to generate a user base and serve clients within the external public beyond its own or its political stakeholders' aims represented a major cultural shift for the research and development (R&D)-oriented agency; it was an entirely new type of promotion of human space flight than with which the agency was accustomed. Many did not regard becoming a space access service for others as befitting an exceptional engineering outfit like NASA. Chester "Chet" Lee, Shuttle operations director-turned-marketing manager, for one, hoped the Shuttle would become financially self-sustaining so that NASA could then turn its operations over to the private sector for profit, shed its image as "a trucking company," and get back to the "sexy" work of exploring space.[17] John Noble Wilford summarized the challenge for NASA in the *New York Times Magazine* in 1983:

> The leaders of NASA are striving to reshape the agency to respond…and also maintain the can-do fervor that has motivated its best engineers and managers. It is not an easy task. If the agency does not get into step with the new economic and political realities, especially regarding its relations with industry and the military, it could wind up on the periphery of the space enterprise it did so much to mobilize. …If, on the other hand, the agency does not continue to have challenging goals, it could lose many of its best engineers and managers.[18]

NASA's top officials during the 1970s and early 1980s nonetheless did what they felt necessary and embraced a conceptualization of the Shuttle as a business enterprise for the foreseeable future, effectively saluting the idea that NASA's new human space flight focus would be not only to meet its

[17] "How NASA Went into the Freight Business," *Business Week,* August 22, 1977, Folder 8112, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Kevin Anderson, "Shuttle Shoots for Customers and Profits," *Washington Post*, November 10, 1982, 1B, Folder 8163, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[18] John Noble Wilford, "NASA's Next Mission: Big Business in Space," *New York Times Magazine*, September 18, 1983, accessed December 22, 2014, http://www.nytimes.com/1983/09/18/magazine/big-business-in-space.html.

own objectives but also to realize its Shuttle imaginary in part by offering reimbursable services to others. Administrator Jim Fletcher attested in a number of venues to the Shuttle's contributions to commerce, while Robert Frosch, who assumed the agency's helm during the Carter administration, internalized NASA's responsibility in human space flight as "finding out things for other people and building the technology to enable us to keep doing this."[19] His successor under President Reagan, James Beggs, acknowledged in retrospect that NASA's ability to meet the Mathematica study's assumptions about how frequently the Shuttle would need to fly to cover its operational costs as well as its expectations about the availability of payloads was "a pipe dream." Nonetheless, he points out, NASA had "sold" the Shuttle to President Nixon as an all-purpose carrier. Determined to uphold that imaginary, Beggs explains the promise he made to the Reagan administration: "I said, 'Okay, you got me. That's the way I'll sell it.'"[20] Indeed, Beggs' commitment was sustained by the Reagan administration's desire to develop commercial uses of the Shuttle and space. As political scientist Mark Byrnes has expressed, Reagan saw the Shuttle as integral to his political theme of "renewed American confidence and pride" and in his 1984 State of the Union address noted that "Just as the oceans opened up a new world for clipper ships and Yankee traders, space holds enormous potential for commerce today."[21] That the European Space Agency, led by France, had also developed its own rocket, Ariane, and was marketing it for commercial satellite launches further heightened the impetus for NASA to strive provide payload owners with confidence in the Shuttle's performance and to make the craft competitive in yet other ways.

NASA's Office of Space Flight, the organization within NASA Headquarters responsible for the Shuttle's development and eventual operations, configured itself for business operations in the mid-

[19] Jim Maloney, "'Interest Expressed' in Shuttle as Commercial Spaceliner," *Houston Post*, November 3, 1978, Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[20] James M. Beggs, interview by author, Chevy Chase, MD, April 8, 2013.

[21] Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994), 125; Ronald Reagan, "Address Before a Joint Session of the Congress on the State of the Union, January 25, 1984," *Public Papers of the Presidents: Ronald Reagan, 1984*, bk. 1 (Washington, DC: U.S. Government Printing Office, 1986-1987), 90.

1970s. Associate Administrator for Space Flight John Yardley, a McDonnell Douglas executive during the Mercury, Gemini, and Apollo programs, stood up a customer service branch within the office and appointed Chet Lee as its head. Yardley also invited Jon Michael Smith, a marketing manager from Computer Sciences Corporation, to come to NASA and work with Lee to help market the Shuttle. As Smith observed, "The pressures are very different from what we are used to in the agency."[22] Gene McCoy, the chief of NASA's Payload Integration Office, expressed in 1979 that NASA was not accustomed to a "customer mentality."[23] Nonetheless, beginning in the 1970s, the Office of Space Flight's marketing team worked steadfastly to attract customers for the Shuttle. According to Smith, Fletcher and other NASA senior leaders encouraged "out-of-the-box thinking" and were "intolerant of amateurish kind of marketing."[24]

Because selling capacity on a spacecraft was completely new to the agency, Smith and his colleagues took as one of their first steps reaching out to external consultants for assistance. Smith contracted with George Abrams, who had ably promoted the denture cleanser Polident, to review NASA's Shuttle marketing plans.[25] NASA also awarded Battelle two contracts to help sound out prospective customers and develop a marketing approach. Battelle advised NASA on whom the agency should meet at companies, sales tactics it should use and avoid, and pricing policies.[26] A three-year study General Electric conducted on NASA's behalf and released in 1976 indicated the existence of an untapped market of non-aerospace companies which could harness the microgravity environment the Shuttle could provide for research, new product development, and manufacturing of superior products in fields ranging from

[22] "How NASA Went into the Freight Business."

[23] Charlie Peek, "Space Agency Sheds 'Gee-Whiz' Approach," *Today*, February 11, 1979, 22C, Folder 8131, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[24] Jon M. Smith, interview by author, Houston, TX, June 10, 2013.

[25] Ibid.

[26] "How NASA Went into the Freight Business."

pharmaceuticals to metallurgy.[27] The study also recommended that NASA interact early and frequently with non-aerospace industries to share information about the Shuttle and address their concerns about business planning and handling of proprietary and patent issues.[28]

Smith, Lee, and other agency officials embraced the advice, attending and conducting seminars about Shuttle opportunities for prospective users at professional conferences and trade shows around the world. Associate Administrator for Space Flight James Abrahamson made quarterly trips to Wall Street on the premise that educating bankers on NASA's plans for and success with the Shuttle would improve entrepreneurs' chances of attracting investment in Shuttle-based commercial endeavors.[29] While U.S. government regulations prohibited NASA from spending funds to woo clients with fancy meals and parties the way the European quasi-government launch company, Arianespace, did, the NASA officials strived to persuade their audiences that the Shuttle would offer a robust, well-priced platform for conducting business given its flexibility, ability to offer special services, and the expectation that it would achieve a schedule with airline-like regularity.

As the Shuttle's debut grew closer, NASA, with the assistance of its Shuttle contractors, stressed a commitment to serving customers' needs as it tacitly aimed to make the vehicle viable. Believing that corporate customers would not be receptive to a "razzle-dazzle style," Frosch desired that NASA representatives not paint elaborate pictures of Shuttle benefits at industry meetings but instead reach potential customers "in a more solid way," through direct, private interactions with "the technical people."[30] As McCoy expressed, "The image we want to have is of a responsive and cost effective

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[27] Erwin J. Bulban, "Non-Aerospace Firms Eyed for Shuttle," *Aviation Week & Space Technology*, April 5, 1976, 52-55, Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[28] Ibid.

[29] James Abrahamson, interview by author, Washington, DC, June 19, 2013.

[30] "NASA's Tough Job of Selling Its Space Shuttle," *Business Week*, December 25, 1978, Folder 8112, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

operation."[31] A brochure from the early 1980s entitled "NASA: Ready to Serve You in Space" promoted not only the Shuttle's capabilities but also the agency's commitment to service.[32] Abrahamson referred in speeches he gave to assorted audiences to the various "levels of service" the Shuttle provided to different sorts of customers.[33]

As part of their commitment to customer service, NASA's Johnson Space Center as well as Shuttle contractors extended offers of technical support to prospective clients. McDonnell Douglas, the payload integration contractor for Spacelab flights and developer of a system to propel satellites into higher orbits from the Shuttle, took out a *Wall Street Journal* ad stating: "If you want to carry payloads into space, come see McDonnell Douglas…We have the people, the technology, and systems, and the experience to get you there."[34] Spending $100,000 annually on Shuttle-related advertising, Rockwell, the orbiter's prime contractor, sponsored a 1978 ad featuring an image of an orbiter's open cargo bay inscribed with the words "Rockwell can fit you in" and detailing the many ways the company could assist Shuttle customers.[35] One Rockwell brochure stated plainly: "We want to help you become a user of the STS" while another offered to help all Shuttle customers with payload design, fabrication, and

[31] Peek, "Space Agency Sheds 'Gee-Whiz' Approach."

[32] NASA, *Ready to Serve You in Space*, n.d., Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[33] See, for example, James A. Abrahamson, "Can the Space Shuttle Compete?," remarks to the Aviation/Space Writers Association, April 12, 1983, 13-14, NASA HQ Historical Reference Collection online database, accessed December 17, 2014, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Record?w=NATIVE%28%27DESCRIPTION+ph+words+%27%27abrahamson%27%27%2C%27%27writers%27%27%27%29&rpp=20&order=native%28%27SERIES%27%29&r=1&m=7.

[34] McDonnell Douglas, "Room for Rent" (advertisement), *Wall Street Journal*, May 3, 1978, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[35] "NASA's Tough Job of Selling Its Space Shuttle"; Rockwell International, "Rockwell Can Fit You In" (advertisement), 1978, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

integration, and other planning activities through the Rockwell's Space Division's "STS utilization planning service."[36]

NASA took many measures to build the confidence of would-be customers to choose to use the Shuttle to deliver satellites to orbit. After the new space transportation system began flying, crews of some of the earliest missions to deploy or retrieve satellites began dutifully exclaiming and displaying signs emblazoned with "We deliver!" upon successful handling of their payloads. Embracing the motto for marketing purposes, the agency's produced a 1983 publication entitled "We Deliver" which boasted that "Twenty-five years of hands-on experience assures you of the most reliable, flexible, and cost-effective launch system in the world…You can't beat manned reliability…In all the world, you won't find Shuttle's equal."[37] Clearly aiming to highlight its long track record to distinguish the Shuttle from its competitor, Ariane, the agency also published "We Deliver" in other languages to market Shuttle business opportunities at the 1983 Paris Air Show, where NASA representatives were equipped with computers to provide on-the-spot projections of Shuttle availability to prospective clients.[38] NASA's 1984 Shuttle marketing plan indicated that "the same standard of excellence demonstrated by NASA throughout its history as a premier R&D organization will guide this new effort" and that the agency wanted to be

[36] Rockwell International, *Integrating Payloads into Space Shuttle* (Downey, CA: Rockwell, 1976), Box 14, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Rockwell, *Space Shuttle: A Promising New Era for Earth* (February 1977), Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[37] See Thomas O'Toole, "'We Deliver' Shuttle Comes Home," *Washington Post*, November 17, 1982, accessed December 22, 2014, LexisNexis Academic; NASA, *We Deliver* (Washington, DC: U.S. Government Printing Office, 1983), Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[38] See, for example, the French language version: NASA, *We Deliver: Comptez sur Nous!* (Washington, DC: U.S. Government Printing Office, 1983); "Space Shuttle Marketing Effort Planned at Paris Air Show," *Defense Daily*, May 17, 1983, 94. Both documents located in (Washington, DC: U.S. Government Printing Office, 1983), Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

viewed by customers as "capable of solving their problems, reducing their technical risks, and providing new opportunities for space-based ventures."[39]

Lee's Shuttle customer service office, meanwhile, developed pricing policies and a range of incentives to appeal to and broaden NASA's Shuttle customer base. In 1977 NASA published Shuttle reimbursement policies for major payloads, namely satellites to be carried in the orbiter's cargo bay, in the *Federal Register*.[40] With the exception of giving priority to Department of Defense or major NASA payloads or those having critical launch window constraints, NASA would assign customers to missions on a first-come, first-served basis once they provided a down payment of $100,000.[41] Believing a simple pricing structure would be most attractive to payload owners, the customer service office established a standard price of $18 million (FY 1975 dollars), plus a facility and equipment use fee of $4.3 million, for the dedicated use of the Shuttle's cargo bay, payload handling, and deployment supported by a three-person crew over the course of one day. NASA arrived at the price based on its requirement to recover the Shuttle's estimated $9.3 billion costs over its first 12 years of operations, during which it believed would fly 560 missions.[42] The agency anticipated adjusting the prices after some time based on actual costs and mission demand but chose to keep them at this level initially to make the Shuttle competitive with the Ariane, which carried a $25 million price tag.[43] NASA's policy offered pro-rated prices for customers whose payloads would fill only part of the cargo bay and could be paired with others as well as

[39] NASA, "The Space Transportation System Marketing Plan," June 1984, Folder 8085, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[40] Reimbursement for Shuttle Services Provided to Non-U.S. Government Users, 42 *Federal Register* 3829 (January 21, 1977) (amending 14 C.F.R. pt. 1214). This policy was not subject to public comment because it involved the use of U.S. government property.

[41] Ibid.

[42] NASA, *Space Transportation Operations Information* (Washington, DC: NASA, [1981?]), Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[43] John Noble Wilford, "'Bargain' Prices Set for Space Shuttle," January 13, 1977, 21, Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

discounts for clients willing to fly their payloads on a standby basis. Customers could pay additional fees for priority scheduling, re-flight guarantees in the case of problem with a payload, as well as for optional services to include retrieval of payloads from orbit, data processing, and use of upper stages to boost payloads to orbits the Shuttle itself could not reach. Also, just as NASA had conveyed to the scientific community, the agency aimed to attract companies to fly satellites by providing them with what General Abrahamson called "an extra level of confidence" by offering them the prospect of flying their own representatives – to be called "corporate payload specialists" – aboard the Shuttle along with their payloads.[44]

In addition to enticing customers with satellites and other payloads to be carried and deployed from the Shuttle's cargo bay, the Office of Space Flight wanted to interest companies in using the Shuttle to conduct experiments with potential downstream commercial applications. Maintaining for many years maintained that substances that could benefit society, such as vaccines, enzymes, and protein crystals, could be produced in refined and purer forms in the microgravity environment than they ever could be on Earth, agency officials believed the Shuttle would offer companies a venue to manufacture these products. Enrolling such publics as Shuttle users would not only further the new vehicle's economic posture but also help fulfill NASA's imaginary of the Shuttle as a system that would facilitate the development of products and services that would benefit society. In 1979, the Office of Space Flight developed a concept called a joint endeavor agreement to share with customer companies the costs and risks associated with use of the Shuttle for these purposes. By signing a joint endeavor agreement with NASA, a company could develop an experiment intended for commercial purposes using its own funds and NASA would provide it space on a Shuttle mission at no cost. Companies, not NASA, would retain the results of the research, although some of the agreements allowed NASA researchers to use the equipment for their own

[44] Abrahamson, interview. Corporate payloads specialist are discussed in detail in Chapter 4.

investigations.[45] NASA anticipated that the companies would capitalize on the proprietary data and commercialize the technology at their own expense and purchase space on future Shuttle flights to manufacture commercial products.[46] The agency extended its incentive to fly corporate payload specialists to industry experiment flights as well.

Following four test flights, NASA along with President Reagan in 1982 declared the Shuttle operational and open for business of the sort that NASA had been working to attract through its promotional campaigns, policies, and incentives. The satellite flight manifest that NASA drummed up bolstered the agency's case that the Shuttle had begun right away to serve as a widely accessible and valuable national asset. The agency flew the Shuttle's first two commercial satellites, Satellite Business System's SBS-3 and Telesat Canada's Anik C-3, on STS-5 in November 1982, and a succession of other satellites followed. Agency officials boasted to members of Congress and other audiences throughout the 1980s that the Shuttle's cargo bay was fully scheduled with major payloads into 1985; even before STS-1 flew, the agency had manifested nearly 100 satellite payloads to fly on the Shuttle, 22 percent of which were owned by commercial and foreign clients.[47] The communications industry in the United States and abroad proved to be the agency's predominant non-U.S. government customer, making up 110 of 130

[45] Charles D. Walker, interview by Jennifer Ross-Nazzal, Washington, DC, November 19, 2004, transcript, Johnson Space Center Oral History Project, Houston TX, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_11-19-04.pdf.

[46] NASA, "NASA-McDonnell Douglas Sign Joint Endeavor to Stimulate Commercialization of Space," news release 80-8, January 25, 1980, Folder 8189, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, Office of Space Science and Applications, Microgravity Science and Applications Division, *Microgravity…A New Tool for Basic and Applied Research in Space*, EP-212 (Washington, DC: U.S. Government Printing Office, n.d.), Folder 7906, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[47] See, for example, Terence T. Finn to Don Fuqua, December 10, 1980, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Abrahamson, "Can the Space Shuttle Compete?"; and NASA, *Space Transportation Operations Information*. The remaining satellites were owned by the Department of Defense (35 percent) and NASA and other U.S. government agencies (36 percent). The remaining 6 percent represented NASA's anticipation of re-flights of satellites that encountered problems on their initial flights.

commercial and foreign payload reservations by 1984.[48] By the time of STS-51L, the fateful 1986 flight of *Challenger*, NASA had deployed more than two dozen satellites owned by U.S. commercial companies and foreign entities. The agency also proved the ability to use the Shuttle to retrieve satellites for in-space repair and redeployment by astronaut crews, as was done with the Solar Maximum Mission spacecraft in April of 1984 during STS-41C. Shuttle crews used the technique in November of that year to retrieve two customer satellites, Indonesia's Palapa-B2 and Western Union's Westar-VI, which had failed to reach proper orbits during an earlier Shuttle mission after the kick motors intended to position them failed.

Further helping to advance NASA's Shuttle imaginary and hence the vehicle's legitimacy, several companies and university researchers signed on with NASA to conduct experiments aboard the Shuttle they believed might evolve into profitable enterprises. McDonnell Douglas teamed with Ortho Pharmaceuticals Company, a Johnson & Johnson subsidiary, to sign the first joint endeavor agreement with NASA in 1980. The industry team wanted to fly a series of experiments aboard the Shuttle to test whether they could perfect a process called electrophoresis to manufacture highly purified drugs that could treat diseases such as diabetes and anemia. The technique had been under study in Earth laboratories, but studies during Apollo, Apollo-Soyuz Test Project, and Skylab missions suggested that in the microgravity environment the technique could be applied with substantial enhancement of the purity of hormones, enzymes, and other medical products it generated.[49] McDonnell Douglas aimed to refine the process for large-scale production aboard future Shuttle missions, and an eventual space station, and make it commercially viable.[50] As Charlie Walker, a McDonnell Douglas engineer who became the Shuttle's first corporate payload specialist when he flew with experiment three times, put it: "We all felt like that with the yet-to-be-flown Space Shuttle, but when the Space Shuttle flew, we were just all

[48] NASA, "The Space Transportation System Marketing Plan."

[49] NASA, "ASTP Experiment May Resolve the Value of Electrophoresis in Space," news release 75-178, n.d., Folder 8189, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[50] Walker, interview, November 19, 2004.

enamored with the prospect of ready access to space for all interests in this nation, both government, civil, commercial, and the prospects that we all believed were going to flow from that were just going to be enormous."[51]

The list of commercial experimenters planning to use the Shuttle went on. A company with no aerospace affiliation, GTI Corporation signed the second joint endeavor agreement with NASA for four flights in the Shuttle's cargo bay of a furnace designed to understand how metal alloys behave in weightlessness; it if worked, GTI planned to pay NASA to fly the furnace on subsequent flights and lease room within it to parties interested in using it for their own research.[52] NASA also signed an agreement with 3M to fly three experiments in 1984 and 1985 to grow crystals of organic compounds in space and make thin films from them; the company contracted with NASA for a total of 72 flights over a decade.[53] A Texas-based startup company called Microgravity Research Associates booked a slot on a 1986 Shuttle mission to test the production in microgravity of gallium arsenide integrated circuit chips for electronics equipment, which the company's founder believed would prove superior to silicon.[54] Lehigh University and NASA's Marshall Space Flight Center teamed up under a grant by the agency's Office of Space Science and Application to fly an experiment in mid-deck lockers on five Shuttle missions to develop small, uniformly-sized latex spheres for uses in calibrating scientific instruments and drug research. The

[51] Ibid.

[52] Arlen J. Large, "Space Shuttle Plans Free Rides for Firm to Do Tests in Orbit," *Wall Street Journal*, February 1, 1982, 18, Folder 8189, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[53] "Shuttle Crystal-Growing Experiment 'Unqualified Success': 3M Co.," *Aerospace Daily*, December 5, 1984, 174, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[54] Michael Schrage, "Business Use of Shuttle Slower Than Expected," *Washington Post*, March 7, 1984, D16, Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Eric Gelman, "Starship 'Free Enterprise'," *Newsweek*, September 17, 1984, 63.

U.S. Bureau of Standards certified the material in 1984 and planned to begin marketing it as a standard reference material in mid-1985.[55]

Other external entities, convinced of the business opportunities the Shuttle program would produce over its lifetime, approached NASA about alternative forms of involvement. NASA officials evaluated and accommodated them where collaboration would advance the agency's vision of a useful, relevant, and participatory spacecraft. The agency signed an agreement with Spacehab, a company formed in 1983, to fly modules in the payload bay filled with additional mid-deck-sized lockers for the many experiments NASA anticipated flying. The Coca-Cola Company pitched testing a Coke-filled dispenser specially designed for drinking carbonated beverages in the microgravity environment aboard a Shuttle flight that the company could then market for use on an eventual space station or private space ventures; the company also hoped the experiment with astronauts would help with its research to understand how taste preferences change among specific populations on Earth, such as the elderly. After the company publicized the plan prior to concluding an agreement with NASA, Pepsi Co. also approached the agency about the flight of a can prototype containing its own soft drink. Determined not to show a preference for either beverage, NASA reached agreements with both soft drink companies in 1985 and flew their cans on the same mission that year, STS-51F.[56]

NASA also established limits to partnering with external entities. While the agency wanted to make the Shuttle commercially viable, officials were unwilling to enter into agreements that could compromise taxpayer trust in the agency. One such proposition NASA received and rejected was for commercial operations of the Shuttle program. As Alan Ladwig, who held several positions at NASA

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[55] Eric Gelman, "Starship 'Free Enterprise'," 63. See also NASA, Marshall Space Flight Center, *Monodisperse Latex Reactor (MLR): A Materials Processing Space Shuttle Mid-Deck Payload*, by Dale M. Kornfeld, TM-86487 (Washington, DC: U.S. Government Printing Office, 1985).

[56] James Fisher, "Space: The Final Frontier for Coke, Pepsi," *Orlando Sentinel*, July 6, 1986, accessed December 21, 2014, http://articles.orlandosentinel.com/1985-07-06/news/0310220141_1_soft-drink-coke-and-pepsi-dispensing-valve; NASA, "NASA to Test Dispensing Technology in Space," news release 85-97, June 25, 1985, Folder 5718, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Headquarters in which he supported efforts to increase public participation in the Shuttle program, expressed:

> In the early '80s you get the proposals about commercializing the Shuttle program. And what might have happened – was that even possible? I question: could any company have afforded to do that? I think probably not – what did it cost to launch a Shuttle at the end? — $800 million or some ridiculous thing. But that was part of the zeitgeist of the times: that the Shuttle is going to be so successful that a private company can run it. And there were serious proposals that were put in back then.[57]

According to George Low, NASA's deputy administrator at the time of Shuttle's approval, NASA had long contemplated turning over Shuttle operations to a commercial entity to free NASA to focus on "what remains our prime agency mission, namely, advancing the frontiers of technology" while "putting more work in the hands of industry."[58] Perhaps the most serious proposal was from William Sword, a Wall Street investor, who offered to purchase a fifth orbiter for NASA in exchange for marketing rights and profits from the entire fleet.[59] NASA's negotiations with Sword failed, however, as the investor's desire for NASA to fund the orbiter's operations costs – via American taxpayers – didn't "pass the smell test" to Abrahamson.[60] NASA achieved a middle-ground when it later consolidated contracts with major aerospace companies to manage many aspects of Shuttle operations on the agency's behalf.

Ultimately, NASA found attracting steady commercial use of the Shuttle challenging. While NASA enjoyed a full manifest for major payloads through 1985, much of the crowding stemmed from the Shuttle's delayed debut from 1979 to 1981 and the slate of commercial payloads for the latter part of the 1980s was not nearly as dense. Some satellite owners expressed concerns about the Shuttle's schedule

[57] Alan Ladwig, interview by author, Washington, DC, January 31, 2013.

[58] AD/Deputy Administrator (George M. Low) to M/Associate Administrator for Space Flight, "Space Shuttle Operations," December 30, 1975, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[59] Building a fifth orbiter to increase the Shuttle program's capability had been the subject of ongoing discussion among NASA, the Department of Defense, Reagan administration, and the Congress.

[60] Abrahamson, interview.

reliability as Department of Defense payloads received priority while NASA's experience with the complexity of preparing the first missions led to the agency quickly revising downward the number of flights the Shuttle could make annually. Some companies made reservations on both the Shuttle and Ariane to safeguard their flight opportunities, and NASA ended up promising some customers launches on expendable U.S. launch vehicles if the Shuttle proved to be unavailable when needed. When the agency announced in 1982 an 85-percent increase to its prices, to become $38 million beginning in 1985, to recover higher than anticipated operating costs while flying fewer missions, the Shuttle promised to become all the less competitive with Ariane.[61]

Challenges also emerged from within the Reagan administration. While President Reagan praised the Shuttle, his admiration of the vehicle stood in tension with his commitment to support the private sector. Even NASA's lower level of subsidy irked advocates in the White House, the Congress, the Department of Transportation, and the private sector who advocated for the development of a U.S. commercial launch industry.[62] NASA committed to Reagan to begin recovering the full costs of Shuttle use from customers by 1988. Objections from NASA about the inability to rival Ariane and from those with business interests in using the Shuttle, however, prompted the administration to limit the price to commercial users of the Shuttle to $71 million while directing the agency to auction off access to the vehicle if demand surpassed availability.[63]

[61] NASA, "NASA Announces New Shuttle Launch Prices for 1985-88," news release 82-94, June 15, 1982, Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Craig Covault, "NASA Curtails Shuttle Flights," *Aviation Week & Space Technology*, June 21, 1982, 16-18.

[62] "DOT Wants Shuttle Prices Based on Full Cost Recovery," *Defense Daily*, March 12, 1985, 62; "NASA-DOT Conflict Emerges Over Shuttle Pricing Policy," *Aerospace Daily*, March 8, 1985. Both articles located in Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[63] Elizabeth Tucker, "Space Shuttle Pricing Debated," *Washington Post*, June 20, 1984, F1; Mary Belcher, "NASA to Sell Shuttle Space by Auction," *USA Today*, August 2, 1985, 10C. Both articles located in Folder 8084, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Likewise, the agency struggled to enroll private research ventures aboard the Shuttle. The costs of using the Shuttle versus Earth-based facilities for manufacturing purposes, combined with industry concerns about research patent rights, the long timeframe involved from making an investment decision to acquiring data on a Shuttle experiment, and the advance of new ground-based laboratory breakthroughs meant that NASA had a tough time convincing companies of the economics of performing research in space.[64] In the case of the electrophoresis venture, Johnson & Johnson parted ways with McDonnell Douglas to pursue similar research in Earth-based laboratories after the venture's first experiment produced contaminated products and another company identified a way to develop proteins using breakthroughs in genetic engineering, rendering the Shuttle-based electrophoresis experiments unnecessary.[65]

Even in the face of these challenges, NASA continued to promote opportunities for external entities to become actively involved with the Shuttle. James Beggs accepted that Shuttle market development would be slow but never lost confidence:

> I figured that sooner or later somebody in the industrial world was going to figure out that something maybe in the solid-state business, maybe in the metallurgical business, maybe in some arcane business where somebody wants a strange wonderful product in the nature of nanotechnology that requires that kind of environment – so I thought we might get payloads in that. But I was not optimistic that we were going to develop a big broad market in the near term; it was going to develop over time.[66]

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[64] "NASA's Tough Job of Selling Its Space Shuttle."

[65] John F. Yardley, interview by Summer Chick Bergen, St. Louis, MO, June 30, 1998, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/YardleyJF/JFY_6-30-98.pdf. McDonnell Douglas, however, did not give up so readily. The company attained success by the seventh flight of its electrophoresis demonstration and sought partnerships with other pharmaceutical companies to participate in its planned manufacturing-scale project to fly in the Shuttle's cargo bay. By the mid-1980s, McDonnell Douglas was developing an agreement with NASA to extend its Joint Endeavor Agreement to fly more experiments in the Shuttle's middeck and two demonstrations in the cargo bay. See Charles D. Walker, interview by Sandra Johnson, Springfield, VA, November 7, 2006, transcript, Johnson Space Center Oral History Project, Houston TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_11-7-06.pdf.

[66] Beggs, interview, April 8, 2013.

Indeed, throughout the first several years of Shuttle development and operations, the agency remained determined to realize the imaginary of accessibility and make the Shuttle a viable, relevant, and legitimate enterprise.

Offering Low-Cost Opportunities for Experimenters

Officials within NASA's Office of Space Flight's Customer Services Division at NASA Headquarters went to still greater lengths to maximize the Shuttle's utility and thereby legitimize the promises NASA made for the Shuttle. Specifically, the agency would not only strive to enroll entities who could afford to spend millions of dollars on the development and launch or return of a satellite or experiment but also aim to "[make] the space environment available to a new class of customers."[67]

NASA's plans called for the Shuttle to carry one or more "primary" payload on each flight in the orbiter's payload bay: either a Spacelab module or a satellite owned by NASA itself, the Department of Defense, or a domestic or foreign commercial entity. As Office of Space Flight officials began assigning these major payloads to Shuttle missions in the mid-1970s, however, they found that the payloads that had been reserved to date would not fill the Shuttle's available volume or 65,000-pound weight capacity. The Office of Space Flight turned to examining alternatives for what to do with the empty space, recognizing that in some cases the Shuttle would at least need to fly with some ballast in the cargo bay to balance out the primary payloads.[68]

Rather than flying containers of sand, Yardley and Smith recognized an opportunity for the Shuttle to carry additional, smaller, "secondary" payloads and for NASA to maximize the system's utility while broadening its customer base. They devised the Small Self-Contained Payload program, in which

[67] Abrahamson, "Can the Space Shuttle Compete?"

[68] Ladwig, interview, January 31, 2013.

NASA would fill the spare room in the Shuttle's cargo bay with canisters purchased by private entities interested in flying their own space experiments. As the program extended researchers' access to the Shuttle for experimentation beyond announced grant opportunities, use of Spacelab, and joint endeavor agreements, Yardley and Smith believed it would appeal to small companies and university researchers who had ideas for manufacturing products in the space environment: they could try out their ideas at relatively low cost and risk in the canisters and then later reserve more Shuttle space for full-scale manufacturing activities.[69] An early concept paper for the program envisioned its purpose as ""to incentivise [sic] the use of space by private individuals and companies for research purposes at an inexpensive price and to offer unique opportunities to stimulate growth for follow-on experiments that could be flown on a pallet or in the Spacelab or in the Shuttle bay itself."[70] Dubbing the program the Get Away Special (GAS) after TWA's then-current promotional airfare to Hawaii, they offered the canisters at prices well below cost to NASA, ranging from $3000 to $10,000 (in 1975 dollars, but then in real-year dollars through 1992) depending on the size and weight payload a customer desired to fly. Yardley publicly announced NASA's plans for the program at the annual meeting of the International Astronautical Federation in Anaheim, California, in October 1976.

The GAS program was revolutionary on several levels. Just as NASA was doing with major payloads, the GAS program represented a change in the way the agency did business, allowing usage of the Shuttle to be driven by one's willingness to pay the purchase price rather than by a competitive selection process using peer review to assess scientific merit. A down payment of $500 was all that was needed to hold one's place in the launch queue, which was determined on a first-come, first-served basis. NASA also did not require purchasers to share their results with the agency as they required of scientists

[69] Gil Moore, "Remarks at the Funeral of NASA's Get Away Special Program: An Open Letter to Dr. Michael Griffin," March 20, 2005, SpaceRef, accessed December 24, 2014, http://www.spaceref.com/news/viewnews.html?id=1009.

[70] M/Associate Administrator for Space Flight (John F. Yardley) to distribution, "Small Self-Contained Payload Concepts," with attachment, July 28, 1977, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

who received grants for research projects; as with joint endeavor agreements, the agency would not seek rights to users' data, inventions, or patents unless the results were likely to have a significant public health or safety impact.[71] What this meant was that GAS cans afforded access to space to a multiplicity of users – and in doing so embodied the democratic imaginary for the Shuttle NASA had promulgated. A NASA publication reflecting on the program's achievements over the course of a decade expressed that, in addition to being of use to "professional" experimenters, the GAS program "was an avenue, never before available, to space experimentation for the 'man and woman on the street.'"[72] The *Washington Star* declared that with the GAS program, "[f]or the first time since the space age began 20 years ago, the average citizen is being given a chance to participate in the program with something more tangible than tax dollars."[73]

Indeed, NASA's Office of Space Flight personnel banked on the idea that encouraging new uses of space, and of the Shuttle in the nearest term, would be realized by "opening GAS to the broadest community possible."[74] That community, as the NASA officials imagined it, encompassed inquisitive and entrepreneurial individuals, civic groups, academic institutions, and for-profit companies in various industries in the United States and worldwide. A September 1977 brochure on the GAS program noted that "Any responsible person, organization, or institution can take advantage of this program."[75] The

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[71] NASA, Office of Space Flight, Customer Services Division, *Get-Away Specials* (Washington, DC: U.S. Government Printing Office, n.d.), Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[72] NASA, Goddard Space Flight Center, Special Payloads Division, *Get Away Special…The First Ten Years* (Greenbelt, MD, NASA, 1989), 3, Folder 8182, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. While opening the opportunity for space experimentation to a variety of people, the $3000-$10,000 price tag, let alone the additional costs of developing experiments, still kept the prospects of participation beyond the reach of many.

[73] Ike Flores, "Here's a GAS of a Cargo Flight," *Washington Star*, May 14, 1978, A-14, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[74] NASA, *Get Away Special…The First Ten Years*, 3.

[75] NASA, "Space Transportation System: Small Self-Contained Payload Program," September 1977, Folder 8182, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

agency also allowed NASA program offices and other U.S. government entities to take advantage of GAS canisters as well. The key condition for participation was that the purchaser's proposed use be related to a "scientific or technological objective." Payloads also could not jeopardize the safety of the Orbiter or its crews or interfere in any way with other payloads. Any experiments involving live animals would require approval by the Life Sciences Division of NASA's Office of Space Science, which followed Department of Health, Education, and Welfare guidance about laboratory animal use. All payloads had to serve peaceful purposes consistent with the United States' international obligations. As Alan Ladwig, the GAS program manager at NASA Headquarters in the mid-1980s, recalled: "This wasn't just working in your backyard and go and throw it down in the cargo bay. You had to go through a series of safety reviews just like anything else did. But…it was opening the aperture for more than just NASA-funded scientists to do things."[76]

While the Office of Space Flight's marketing personnel had to work hard to secure major payload and experiment customers, the GAS program seemed to sell itself. NASA's first customer provided the agency with a check for his $500 earnest money the day after Yardley announced the program in 1976. Gil Moore, a Thiokol executive from Utah with a deep commitment to science education noted that "since the earliest days of the space program there has been no way to get students involved. Space was the province of the intellectual and physical elite. But NASA, in what I call its infinite wisdom, has come up with a way of getting around all that."[77] After asking Yardley at the Anaheim meeting whether educational institutions could take advantage of the opportunity, Moore purchased a GAS can for his two sons to fly an experiment to determine whether the family's pet lizard would regenerate its tail in the

[76] Ladwig, interview, January 31, 2013.

[77] David Yoel, Steven Walker, James Elwell, and Gilbert Moore, "The First Getaway Special: How It Was Done," *Space World*, May 1983, 9, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

weightlessness of space and donated the other half to Utah State University for student experiments.[78] The ten experiments packed into the container became the first to fly in a GAS canister, launched aboard STS-4 in 1982. Moore, together with Utah State professor Rex Megill, purchased with their personal funds additional GAS containers for use by students at other universities and a Utah public school district. The two men began a program at Utah State for high school students to propose their own experiments and earn scholarships to the university in space fields and eventually fly their payloads in these GAS canisters.[79] Dubbing the endeavor "Project Enterprise," Moore tried to build up the effort as a nonprofit volunteer program and attempted to persuade others to donate GAS cans to educational institutions, an effort Senator Stevenson of Alaska went on to praise as "an outstanding example of public participation in support of space experimentation."[80] Moore went on to purchase several more GAS containers over the course of the program's existence.

NASA rapidly received dozens, and eventually hundreds, more letters of interest and down payments for canisters. Just a year after announcing the GAS opportunity, NASA had accepted earnest money from 85 individuals or companies from the United States and abroad eager to conduct a wide range of experiments and studies for a variety of purposes.[81] Participants represented universities and high schools; corporations involved in life sciences, materials, and chemistry research; hospitals; publishing companies; banks; and real estate agencies; they also included individuals and families with no

[78] Gil Moore, "Remarks at the Funeral of NASA's Get Away Special Program: An Open Letter to Dr. Michael Griffin"; Gordon Harris, "Shuttle to Carry Family Lizard," *Today* (FL), March 16, 1978, 10A, Folder 8164, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[79] L. R. Megill to Director of Financial Management, NASA, December 21, 1976, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; R. Gilbert Moore to Charles H. Carter, April 18, 1977, with attachment, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[80] *Cong. Rec.*, 95th Cong., 1st sess., May 13, 1977, vol. 123: S7579-7581.

[81] MO/Director, STS Operations (Chester M. Lee) to SP/Manager, Shuttle Projects Office, Kennedy Space Center, "Technical Support for Getaway Special Payloads," October 28, 1977, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

organizational affiliation who simply wanted to experience the thrill of flying their own payloads.[82] Domestic and foreign research institutes, many of which had never been involved before with space research, purchased and flew GAS cans to investigate the promise of space for enhancing biological, material science, and other research. Two individuals, Ellery Kurtz and Howard Wishnow, flew four of Kurtz's oil paintings and other art materials as a GAS payload on STS-61C in 1986 to understand the effects of space flight on the materials as an art conservation experiment. George Park, Jr., assistant vice president of the Park Seed Company, purchased and flew a GAS canister on STS-6 full of 40 varieties of fruit and vegetable seed to understand how one could ship seeds into space in a manner that would survive the journey and produce a viable crop aboard a human-tended space station. A long-time space enthusiast, the seed purveyor pursued the opportunity not only for its business prospects but also "because I think that by doing this I can maybe make the space program more real. Bring it down on a day to day level. Down to the soil, if you will, for the people in America. This is our program and I feel very strongly that my kids…I want them to have the opportunity. I want them to have a frontier somewhere."[83]

Perhaps the aspect of the GAS program NASA least anticipated was the initiative's ability to involve so many participants and through unexpected channels. Letters of intent and down payments exceeded the Office of Space Flight's original expectations as did the numbers of individuals who contributed to or would in some way benefit from the development of GAS payloads. The Tokyo newspaper *Asahi Shimbun* reserved a GAS can and conducted a contest among readers to propose uses; the publication chose from among 17,000 ideas and flew on STS-6 an experiment suggested by two

[82] See, for example, Chester M. Lee to Robert C. Macauley, March 9, 1978, and Chester M. Lee to Earl R. Nadeau, April 12, 1978. Both letters, along with dozens of similar ones, located in Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[83] Park Seed, "Seeds in Space," Park Seed, accessed December 8, 2013, http://parkseed.com/seeds-in-space/a/13/; NASA, "STS-6 Pre-Flight Get Away Special Briefing," January 1983, 8, Box 4, STS-6 Mission Documents Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

Japanese high school students to make pure artificial snow crystals from a gaseous substance.[84] A planetarium in Mississippi purchased a container to house a movie camera that would record the view of Earth as the Shuttle orbited the planet for later analysis and incorporation into an educational film.[85] A connection between an RCA executive and the principal at an underprivileged New Jersey high school led to a group of students flying an experiment on STS-7 in June 1983 to study microgravity's effects on the behavior of carpenter ants. Although the ants were dead upon their return to Earth and probably never reached space alive due to prelaunch handling of the GAS canister, some 300 students participated in the project as experiment designers, fundraisers, and publicists along with members of the surrounding community who served as sponsors and advisers.[86] Also, like Moore and Megill, several other individuals and corporations purchased GAS canisters to donate to academic institutions and youth organizations: movie producer Steven Spielberg donated a GAS container to CalTech, aerospace company TRW donated a canister to the Explorer Boy Scouts, and a Texas beer distributor reserved three GAS cans for use by the University of Texas-El Paso, two school districts, and shared use by the bordering cities of El Paso and Juarez, Mexico.[87]

Even with the high level of public interest expressed in GAS payloads, personnel from NASA's Office of Space Flight and elsewhere within the agency did all they could to ensure the program's success and the satisfaction of its customers. The Office of Space Flight and public affairs offices around NASA issued fact sheets and brochures written in simple language explaining the basic idea of the program. One

[84] NASA, "Japanese Newspaper to Sponsor Space Shuttle Experiment," news release 81-191, December 8, 1981, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The experiment was reflown on STS-8 because water in the experiment chamber froze prematurely on STS-6.

[85] John Dingman, "Shuttle to Make Eye-in-Sky Movie," *Birmingham News*, August 20, 1982, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[86] Ladwig, interview, January 31, 2013; Linda Billings, "Get Away Special," *Air and Space*, March 1988, 48-51, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[87] NASA, *Get Away Special…The First Ten Years*, 13; NASA, "Space Shuttle to Carry Explorer Scout Experiments," news release 82-68, April 22, 1982, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Flores, "Here's a GAS of a Cargo Flight."

brochure from the late 1970s produced by NASA's Marshall Space Flight Center noted that the GAS program offered "individuals and organizations such as civic and fraternal groups an opportunity to help enhance science and engineering education in the U.S. and to help set the course for the beneficial uses of space for years to come" and provided guidance for organizations who desired to sponsor student GAS experiments.[88] While the Office of Space Flight decided early on that it would not collaborate in formulating experiments or interpreting data generated by GAS payload customers, the Office made available technical advice given that so many customers were inexperienced in space experiment development. Recognizing commonalities between GAS payloads and those flown on sounding rockets, Yardley reached out to the director of NASA's Goddard Space Flight Center, the agency's Greenbelt, Maryland, R&D facility, to solicit the help of the center's Sounding Rocket Division in working with GAS customers as well as to design and develop hardware, including the GAS containers, to support the program.[89] Goddard agreed. Eventually renamed the Special Payloads Division to reflect its broader suite of responsibilities, the Goddard office developed an experimenter handbook and conducted a series of symposia, beginning in 1984, to convene GAS experimenters to discuss their experiences and results.[90]

As the program grew, the Office of Space Flight strived to account for customer equitability as well as concerns and preferences in its policies and practices. In 1980 the agency proposed a rule in the *Federal Register* to codify its policies concerning the use, flight scheduling, and reimbursement for the GAS program. NASA noted that the rule was needed "to ensure equitable allocation of space…to three

[88] NASA, Marshall Space Flight Center, *Getaway Specials: Fly YOUR Experiment on Space Shuttle!* (Marshall Space Flight Center, AL: NASA, n.d.), Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[89] M/Associate Administrator for Space Flight (John F. Yardley) to 100/Director, Goddard Space Flight Center, "Support for Self-Contained Payload Users," May 3, 1977, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[90] NASA, Goddard Space Flight Center, *Getaway Special (GAS) Small Self-Contained Payloads: Experimenter Handbook* (Greenbelt, MD: NASA, December 1978), Folder 8182, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Clarke Prouty, "Get Away Special: The Low-Cost Route to Orbit," n.d., 5, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

groups of users – educational, commercial and governmental."[91] Concerned that industry users purchased more than twice the number of GAS canisters as educational institutions and governmental entities combined as they tended to buy GAS canisters in blocks, thus curtailing access to the program by less moneyed entities such as educational institutions, NASA proposed to modify its first-come, first-served policy to allow for a rotation sequence among the three types of users. [92] NASA sent copies of the proposed rule to GAS reservation holders and invited them to attend one of two meetings the agency held to discuss the proposed rule and solicit public comments.[93] While some commenters objected to the agency's deviation from first-come, first-served, NASA opted to maintain the rotation sequence to "assure access by diverse groups of users…consistent with the intent of the…program."[94] Noting also the growing flight wait time due to the imbalance between the demand for and availability of Shuttle flights could frustrate existing and prospective customers, GAS program management sought to expand the ability to efficiently fly as many of the increasing backlog of GAS containers as possible by releasing a contract for the development of a "bridge" that fit across the Shuttle's payload bay and could accommodate twelve canisters. Built by Teledyne Brown Engineering, the bridge first flew, and with a full suite of a dozen canisters, on STS-61C in January 1986.[95]

In some cases, however, the Office of Space Flight had to defend and reconcile its own desire to satisfy a broad range of customers vis-à-vis the priorities, values, concerns, and conservatism of others

[91] Space Transportation System; Use of Small Self-Contained Payloads, 45 *Federal Register* 73022 (November 4, 1980) (amending 14 C.F.R. pt. 1214).

[92] Chester M. Lee, "Meeting with Mr. Yardley on the Small Self-Contained Payload Priorities and Amplification of Policy, March 20, 1978," memorandum, March 28, 1978, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Space Transportation System, Use of Small Self-Contained Payloads, 45 *Federal Register* 73022 (November 4, 1980) (amending 14 C.F.R. pt. 1214). See §1214.905(h).

[93] Prouty, "Get Away Special: The Low-Cost Route to Orbit," 2.

[94] Space Transportation System, Use of Small Self-Contained Payloads, 45 *Federal Register* 73022 (November 4, 1980) (amending 14 C.F.R. pt. 1214).

[95] Prouty, "Get Away Special: The Low-Cost Route to Orbit," 5.

within NASA. Philosophical differences arose between offices at NASA about the program's objectives. Noel Hinners, NASA associate administrator for space science, argued that programs "aimed at flight of student experiments paid for by the local 'Lions Club' and without major participation by a reputable scientist are wasteful and pointless and should be discouraged."[96] Chet Lee took exception to the view, saying that rather than scientific merit and validity of results, the figures of merit for GAS cans should be the "educational process and the introduction of this nation's young people to this new frontier."[97] Several operating concerns also cropped up. The GAS program had been designed to require no additional services like electrical power or deployment of a payload from the canister, but the office and its customers sought to maximize the capabilities available to them using this low-cost form of access to space. As Shuttle operations director, Chet Lee conveyed in a 1977 memo to Shuttle payload integration and development management at Johnson Space Center that he believed it important that NASA's accommodations for small payloads on the Shuttle "strike a balance between customer needs and the difficulty of satisfying them."[98] Lee noted in correspondence from later that year that only "against a great deal of opposition within NASA" did his office get approval to provide GAS cans customers with standardized containers and the services of an onboard astronaut to operate three on-off controls for the experiment from inside the Shuttle's middeck during the mission's duration.[99]

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[96] S-1/Associate Administrator for Space Science (Noel W. Hinners) to LC-5/Legislative Affairs Officer, "Student Involvement in NASA Programs," April 20, 1978 [date handwritten], Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[97] MO-6/Director, STS Operations (Chester M. Lee) to MT-3/Director, Advanced Programs, Your Memorandum Dated April 24, 1978, Same Subject," May 1978 [day illegible], NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[98] MO/Director, STS Operations (Chester M. Lee) to PA/Acting Manager, Shuttle Payload Integration and Development Program Office, Johnson Space Center, "Accommodations for Small Payloads," June 10, 1977, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[99] Chester M. Lee to Patti Mancini, October 20, 1977, Folder 8184, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Lee does not specify the source of opposition within NASA, but it almost certainly arose from the Johnson Space Center, which Ladwig avers was concerned about mission safety and interfering with the astronauts' time for other duties. Ladwig, interview, January 31, 2013.

Similarly, while the Office of Space Flight was able to increase the sophistication of the GAS containers to include features such as windows and opening lids at the behest of customers, it faced resistance from other quarters within NASA over providing the capability to eject small payloads or substances from GAS canisters. Two MIT artists wanted to fly a GAS can housing a high-power electron gun that would project a beam of electrons into the Earth's ionosphere in an attempt to create an artificial aurora. They dubbed the project *New Wave Ruby Falls* after the site of an underground waterfall in Tennessee.[100] As Ladwig recalled of this and other proposals with ejectable components, "Of course the safety people went crazy.… [For] the people at JSC [Johnson Space Center]… that was way too much risk. They didn't want to do it. And you know, eventually you have to get the AA [associate administrator] here at Headquarters to stand up and say well, we're going to do it."[101] Indeed, with the advocacy of Yardley's successor as head of the Office of Space Flight, James Abrahamson, who viewed the Shuttle as "a means of making the dreams of Americans come true," NASA flew and ejected small experimental satellites from GAS containers for the first time on STS-51B in 1985.[102]

For those researchers who wanted still more capabilities for more sophisticated experiments, NASA offered alternative carriers. The Hitchhiker and its derivative, Hitchhiker Junior, grew out of the GAS program to provide flights in the Shuttle's cargo bay to payloads too large for a GAS container but too small to be affixed to the Spacelab pallet. As Abrahamson described it, the program's intent was that "anyone can come to us with an experiment and within a six month period, on a stand-by basis, get a

[100] Robert Horvitz, "Art into Space: Artists Using Space Technology to Launch Aesthetics into Orbit," *Whole Earth Review*, Fall 1985, 27-28.

[101] Ladwig, interview, January 31, 2013.

[102] Abrahamson, "Can the Space Shuttle Compete?"; NASA, "Satellites to Be Deployed from GAS Containers," news release 85-35, March 7, 1985, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA Daily Activities Report, May 8, 1985, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Prouty, "Get Away Special: The Low-Cost Route to Orbit," 6.

flight on a Shuttle."[103] The first launched carrying three experiments on STS-61C in January 1986. As these opportunities had price tags on the order of $1 million, GAS remained an attractive option to many experimenters. By the eve of the *Challenger* accident in January 1986, NASA had flown 53 GAS payloads on 14 of 24 Shuttle missions flown to date while 458 reservations remained in the queue.[104] Clearly, NASA had sparked many citizens' enthusiasm for participating as users of the Shuttle and in turn worked to satisfy the tremendous demand it had incurred.

Providing Access to Student Experimenters

As previous chapters have shown, from its earliest days NASA aimed to create close connections with the nation's elementary, secondary, and post-secondary education communities in an effort to build the space agency's future workforce. Indeed, the agency was impelled toward involvement in education, as Presidents Eisenhower, Kennedy, Johnson, and members of Congress during the post-Sputnik era stressed the urgent need for the nation to produce more scientists and engineers in response to the perceived threat of Sputnik and the Soviet Union to America's economic and political security. NASA sought to "meet the needs of education in and for the Space Age" by standing up an office that worked tirelessly to distribute publications, films, speakers, as well as traveling "Spacemobile" vans packed with models and demonstrations to convey to schoolteachers, students, civic groups, and others what the space agency was achieving for the nation and inspire youth to pursue science and engineering careers.[105]

[103] Abrahamson, "Can the Space Shuttle Compete?" The speech references the Hitchhiker program by its original name: Capability for Opportunity Payloads and Experiments.

[104] Prouty, "Get Away Special: The Low-Cost Route to Orbit," 6.

[105] James E. Webb and Hiden T. Cox, "Accelerated Space Exploration: An Imperative for Americans," remarks for delivery at the Annual Convention, American Association of School Administrators, Atlantic City, NJ, February 18, 1962, NASA news release 62-34, 15, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, *Educational Programs and Services* (Washington, DC: U.S. Government Printing Office, 1962), Folder 18178, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Education champions within NASA remained determined as the Shuttle era rolled around to build on the agency's heritage of student interaction and create ways for students below the collegiate level to engage with NASA's newest human space flight vehicle. As chapter 2 demonstrated, NASA officials sought to nurture those connections and inspire student interest in the space program by providing opportunities for them to interact with astronaut crews on orbit and to learn about the Shuttle by participating in simulated missions. Some education proponents within and outside of NASA believed they could go even further in inspiring student interest in pursuing space careers by allowing these students to get involved in Shuttle-based research. Thus, in addition to opening the GAS program to involvement by education organizations, NASA established additional opportunities to enroll students as active participants in the Shuttle program. Although they encountered resistance from others within the agency who doubted the prudence of flying student experiments, champions for these endeavors persisted in their efforts. They believed that student participation provided immense educational value, offered a means by which many citizens could relate to the Shuttle, and was fully consistent with NASA's determination to validate the Shuttle as a widely accessible and useful space vehicle.

Developing a Dedicated Shuttle Research Opportunity for Students

During the 1960s and early 1970s the agency invited proposals from academic scientists and their graduate students to participate in space research projects aboard a variety of NASA platforms, including manned and unmanned spacecraft, sounding rockets, and high-altitude balloons. Research experiences for less advanced students, meanwhile, were quite limited. Undergraduate students could participate in cooperative education programs and summer internships hosted by a few of NASA's field centers. Beginning with the Skylab program, however, NASA officials began to recognize the value of providing hands-on space research opportunities for high school students.

In the early 1970s, the agency sought to promote the value and benefits of Skylab, the manned space station it was developing with spare Apollo components to serve as a biomedical, Earth-observing,

and solar physics laboratory. As part of this effort, NASA's Education Programs Division (as it was called by 1971) and Skylab program officials at Marshall Space Flight Center devised a plan to solicit experiments for Skylab via a competition among youth in grades 9 through 12.[106] They regarded the project as "an effort to promote the interest and involvement of the public, especially youth, in the expansion of scientific research and the development and utilization of the resources and unique advantages of space, for the benefit of the nation and the world."[107] While the agency had considered the option of providing Skylab data to schools rather than dealing with the logistics of conducting a competition and developing flight hardware, Associate Administrator for Manned Space Flight Dale Myers endorsed the competition as "an unparalleled opportunity for direct public involvement in the values and benefits of the space program." Administrator Jim Fletcher approved the program in August 1971 on the assumption that the student experiments would not interfere with Skylab's mission objectives or safety and require minimal crew time.[108] More than 80,000 teachers requested applications for the Skylab student program, and in March 1972, 25 winners were selected from among 3,409 proposals submitted through a competition process administered by the National Science Teachers Association (NSTA). Although the competition's conclusion late in Skylab's development phase meant that NASA

[106] NASA's education office has gone through numerous renamings and reorganizations, sometimes being combined with other organizations. The idea for the Skylab student competition originated with a NASA Skylab contractor from Martin Marietta. For more details, see NASA, *Skylab: Classroom in Space*, ed. Lee B. Summerlin, NASA SP-401 (Washington, DC: U.S. Government Printing Office, 1977), accessed 21 December 2013, http://history.nasa.gov/SP-401/contents.htm.

[107] NASA George C. Marshall Space Flight Center, *Skylab Student Project Summary Description*, MSFC-SL-73-3 (Marshall Space Flight Center, AL: NASA, March 1973), 1, Box 30, Robert Parker Files Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[108] M/Associate Administrator for Manned Space Flight (Dale D. Myers) to A/Administrator, "High School Student Participation in the Skylab Missions," August 18, 1971, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

and the winning students had to move quickly through experiment reviews and preparations, NASA flew 19 of the projects on Skylab.[109]

Dale Myers had noted in his letter endorsing the Skylab student program that the effort presented a new and valuable way for NASA to connect with citizens. As Myers expressed, "We recognize that it represents a commitment to deliver the benefits of the space program to the public in a way that is different from what we are accustomed to, and that it would be a commitment not easily withdrawn."[110] Indeed, the demonstrated feasibility of the approach, the broad teacher and student interest, and the general public support for the program in the form of media stories and donations individuals sent to the agency to defray the costs of the student projects inspired many within NASA to advocate a similar program once the Space Shuttle began operations.[111] The Shuttle would have many advantages over Skylab: its projected frequent flights would provide numerous opportunities for student participation and free them from Skylab's tight timelines for preparing experiments. The Shuttle would even allow re-flights of experiments as needed.[112]

Just a month after President Nixon's approval of the Shuttle, and while the Skylab student competition was underway, Frederick Tuttle, head of the education division, raised the possibility to Charles Donlan, the acting director of the Shuttle program at NASA Headquarters.[113] A few years later,

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[109] Six of the projects were determined not to be feasible or compliant with Skylab requirements. NASA found opportunities for the students who developed them to work with NASA scientists on other Skylab projects.

[110] M/Associate Administrator for Manned Space Flight to A/Administrator, "High School Student Participation in the Skylab Missions."

[111] AD/Deputy Administrator (George M. Low) to F/Assistant Administrator for Public Affairs, "Use of NASA Gift Fund for Skylab Student Experiments," April 24, 1973, Folder 5851, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[112] Glen P. Wilson, "Outline of a Shuttle Student Involvement Program," April 1979, 8-10, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[113] LF-13/Special Assistant (Education) for the Director of Public Affairs (Frederick B. Tuttle), "Space Shuttle Student Project and Its Education-Related Activities," memorandum for the record, February 8, 1979, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Marshall Space Flight Center, which had managed the Skylab student program, contracted with the University of Alabama-Huntsville to examine potential educational uses of the Shuttle; the resulting report suggested that NASA could build on the Skylab experience and consider flying high school as well as college student experiments aboard the Shuttle.[114] In June 1976, a Skylab student experimenter who was then serving as a co-op student at Marshall, drafted a concept for a Shuttle student experiment program, noting it would yield benefits for NASA, students, and educators alike.[115] James Murphy, an official at Marshall, sent the proposal to Philip Culbertson in the Office of Space Flight at NASA Headquarters, encouraging its initiation during the Shuttle's orbital flight tests as "an activity in the very earliest Shuttle flights to which the general public could relate."[116] Frank Hansing, director of university affairs at NASA Headquarters, also favored a student experiments program for Shuttle and at about the same time took the idea to NASA's third highest-ranking official, Associate Administrator John Naugle.[117]

Pressure to enroll students as Shuttle experimenters came from outside of the agency as well. Private entities submitted ideas to NASA. Operations Research, Inc., of Silver Spring, Maryland, for example, submitted to NASA a proposal to pilot a program that would involve junior and senior high school students and college students in the Washington, DC, area in research in the Spacelab module

[114] H. A. Engle and D. L. Christensen, *Educational Planning for Utilization of Space Shuttle (ED-PLUSS)*, Executive Summary: Identification and Evaluation of Educational Uses and Users for the STS (Huntsville: University of Alabama in Huntsville, February 1975), 10, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[115] Robert Staehle, "STS Operational Era Student Experiment Program," presentation charts, June 1976, Folder 19813, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[116] PA01 (James T. Murphy), Marshall Space Flight Center, to Philip Culbertson, NASA Headquarters, "Student Experiments for Shuttle OFT Flights and STS Operational Era," June 29, 1976, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[117] O/Special Assistant to the Assistant Administrator for Planning and Program Integration (Robert G. Wilson) to P/Director, University Affairs, "Student Experiments on STS," July 15, 1976, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

aboard the Shuttle.[118] Martin Marietta would later share its own ideas for Shuttle-era education programs.[119] But perhaps the most influential entity was the Forum for the Advancement of Students in Science and Technology (FASST). An affiliate of the American Association for the Advancement of Science, FASST represented a national network of individuals and organizations, mostly centered on college-age students, supporting the belief that "students should not merely be recipients of scientific and technological information, but should actively participate in all aspects of science – in the policy process, in current research, and in new applications."[120] In 1973 the activist youth organization (by then renamed the Federation of Americans Supporting Science and Technology) began to press NASA to make the means available to fly student experiments on the Shuttle. FASST's organizers wanted to be sure that students would be included, not as an afterthought, as on Skylab, but in a meaningful way beginning early in the Shuttle payload planning process.[121]

Regarding itself as an ideal conduit to help create awareness of Shuttle opportunities among the university sector and collect ideas upon which NASA could draw, FASST succeeded in gaining support from NASA to analyze and provide to the agency student ideas for experiments to be flown on the Shuttle or the space station NASA eventually hoped to build.[122] FASST also worked strategically to develop and leverage an advisory board of prominent and powerful individuals. In July 1976 FASST's director of

[118] Roger D. Kaul to Robert S. Tiemann, June 10, 1975, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[119] Martin Marietta, "An Education Program for the Shuttle Era," presentation charts, September 21, 1976 [handwritten], Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[120] Forum for the Advancement of Students in Science and Technology, "FASST Workshop Spurs Planning for Student Competition," news release, December 18, 1979, Folder 19813, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[121] Federation of Americans Supporting Science and Technology, "A Proposal for a National Clearinghouse for Student Space Shuttle Payload Ideas," n.d., 5-6, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[122] William A. Huff to David Fradin, January 3, 1974, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

student programs, Leonard David, discussed student Shuttle experiments with Glen Wilson, staff member to one of FASST's advisors, Senator Frank Moss, who served on the Aeronautical and Space Sciences Committee. A month later, Moss sent a letter to NASA administrator Jim Fletcher expressing his belief that the Shuttle's promise of routine and frequent flights would allow for more student participation at all levels and stimulate youth interest in space programs. He suggested that NASA designate an individual or office with the authority to develop a Shuttle student participation program.[123] With the idea already in circulation within NASA in the months leading up to that point, Fletcher replied in the affirmative to Moss that the agency was actively considering a competitive program open to high school and college students.[124]

By February 1977, NASA's Office of External Relations, the organization under which the education and university affairs offices then resided, submitted for Fletcher's approval a detailed plan for a "Space Shuttle Student Involvement Program" (SSIP) intended to "tap the ingenuity and resourcefulness of young minds in devising meaningful experiments and demonstrations that will add to our store of scientific knowledge," "create a spirit of involvement in the resumption of human space flight among students, faculty and parents with a multiplier effect that can impact favorably upon public attitudes toward the space program," and promote interaction between students and NASA scientists to help students with career planning in scientific fields.[125] Fletcher's announced resignation a month later, however, along with Shuttle-related technical and financial challenges that came to occupy NASA's new administrator, Robert Frosch, brought the momentum behind the initiative to a crawl. FASST, however,

[123] Frank E. Moss to James C. Fletcher, August 9, 1976, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[124] Clearly, the timing of FASST's meeting with Moss and the internal endorsements of a Shuttle student program were not coincidental. A letter from NASA Marshall co-op student Robert Staehle to Leonard David reveals the two knew each other and were in communication about this subject. Staehle to David, September 25, 1976, Folder 19813, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[125] L/Associate Administrator for External Affairs (Herbert J. Rowe) to A/Administrator, "Space Shuttle Student Project," February 7, 1977, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

would not let the issue fade. Along with several of its affiliate organizations, FASST appealed directly to Frosch via a letter-writing campaign urging him to heed the strong student interest in Shuttle research. The organization had collected more than 500 ideas for experiments from its members and affiliates and called on NASA to provide students with a multiplicity of opportunities to fly experiments in space beyond GAS, assist schools with participation costs, and provide a focal point for student input to NASA.[126] While Frosch responded that NASA would carefully consider their recommendations, FASST also reached out again to influential members of Congress. Adlai Stevenson and Harrison Schmitt of the Senate Subcommittee on Science, Technology, and Space sent Frosch a letter stating that "What seems to be needed at this time is greater recognition and consideration of the student as part of the 'user' community" and to see Shuttle, along with other NASA spacecraft, as "educational tools."[127] In May 1978 the Senate report accompanying NASA's FY 1979 authorization bill included language requesting that NASA review its student programs and develop options for expanding student involvement.[128]

With this impetus, the SSIP moved a step closer to becoming reality. Frosch told the Senate that NASA was working actively on developing concepts for Shuttle student programs.[129] Coming to embrace the concept, Frosch averred that enrolling students in the Shuttle program was not an attempt to gain supporters for NASA but to maximize creativity in space research. According to Frosch, "involvement of students in NASA's work is not in any sense a kind of add-on or a public relations gimmick, or a let's-do-this-and-see-what-we-can-get-in-the-way-of-a-constituency. It is much more essential and inherent in

[126] Leonard David to Robert Frosch, July 8, 1977; J. Jeffrey Irons to Robert A. Frosch, July 13, 1977; Dion W. J. Shea to Robert A. Frosch, August 1, 1977. All letters located in Folder 19813, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[127] Adlai E. Stevenson and Harrison Schmitt to Robert A. Frosch, December 14, 1977, Folder 19812, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[128] Committee on Commerce, Science, and Transportation, NASA Authorization for Fiscal Year 1979, 95th Cong., 2nd sess., 1978, S. Rep. 95-799, 59.

[129] Robert A. Frosch to Harrison H. Schmitt, April 26, 1979, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

what our task is than just something hung on the edge.…[T]he idea of having student contests for research using the Shuttle is not only to interest new people in space research and in the Shuttle, but as a way of finding people with new ideas and new things to do."[130] By mid-1978, Frosch hired Glen Wilson, formerly of the Senate subcommittee staff, as his assistant for student activities and appointed a steering committee of representatives from within the agency to assist Wilson with the development of a Shuttle student experiment program.

Wilson set to work on a number of open issues. Wilson had to figure out, for one thing, how to finance the program. Budget pressure brought on by Shuttle development costs and other agency program needs meant the agency could not fund all of the costs associated with administering the SSIP and then flying the winners' experiments. Another issue regarded determining who could participate and how the program would be managed. Proponents inside and outside of NASA desired a program available to both high school and college students. But while NASA had a clear understanding of how to administer a high school program, as it did with the Skylab program, figuring out how to manage the selection process proved challenging. Wilson accepted an unsolicited proposal from FASST to conduct a workshop to help the agency determine the size, scope, and implementation of a college-level program.[131] Held at NASA Headquarters in November 1979, the workshop involved 64 individuals representing 43 national and international student organizations, academic institutions, government agencies, and industry. The attendees recommended that NASA assemble a consortium of professional societies and

[130] Robert A. Frosch, statement, November 30, 1979. Appears as Appendix L in FASST, "Final Report: Workshop to Develop a National College-Level Student Experiment Competition for the Space Shuttle," January 31, 1980, Folder 19812, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[131] FASST, "An Unsolicited Proposal to Support a Workshop to Develop a National College-Level Student Experiment Contest for the Space Shuttle," September 1979; Glen P. Wilson to Alan Ladwig, September 28, 1979. This was the second such proposal FASST made for a workshop. FASST submitted a proposal in October 1976, but NASA preferred to hold off on a conference until its student experiment program plans were better developed. See Alan Ladwig to Herbert J. Rowe, October 27, 1976, with attachment, and Herbert J. Rowe to Alan Ladwig, February 16, 1977; FASST, "Final Report: Workshop to Develop a National College-Level Student Experiment Competition for the Space Shuttle," January 31, 1980. All documents located in Folder 19812, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

student organizations to facilitate the competition.[132] They also advocated broadening the program to include students whose greatest interests and strengths might lie in the humanities and social sciences.[133]

A third major area of concern swirled around the scientific value of the program. Wilson was aware that the agency had failed during the Skylab program to ensure sufficient follow-through with students to maximize the merit of their work, not requiring students to complete final reports or providing avenues for them to share their results. That was something he wanted to make sure the SSIP corrected. Scientists within NASA were critical and skeptical for still other reasons. Charles Pellerin, while head of NASA's Office of Space Science, expressed that "the student programs have substantial value as publicity- and interest-generating devices, but their scientific productivity has been small" while pointing out that Skylab student projects often were not properly completed due to inadequate advisory aid to students.[134] Just as Noel Hinners had lamented Lions Club-type sponsorships of GAS experiments, the deputy director of the space science office's life sciences division concurred with the need for a credentialed scientist's supervision: "Students sponsored by a civic organization with the causal participation of a local high school teacher are not likely to learn much and I would guess NASA will often end up in an embarrassing public position."[135] NASA scientists also expressed concerns about the resources NASA would accord to SSIP, questioning how the agency could justify supporting student experiments when it could not afford to fund many good proposals from "qualified scientists."[136] As the

[132] FASST, "FASST Workshop Spurs Planning for Student Competition."

[133] FASST, "Final Report: Workshop to Develop a National College-Level Student Experiment Competition for the Space Shuttle," 30.

[134] Charles Pellerin to Mr. Culbertson, "Student Program," draft memo, June 21, 1977, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[135] SB-3/Acting Deputy Director for Life Sciences (Richard S. Young) to LF-13/NASA Consultant, "Spacelab Accommodations for Student Experiments' Draft Letter – Yardley to Lovelace," June 6, 1979, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[136] Student Activities Steering Committee, summary minutes, August 28, 1979, Folder 19812, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Shuttle's readiness date continued to slip, NASA's science offices argued that students should not have priority over professional researchers whose experiments faced postponements.[137] Glynn Lunney, acting associate administrator for space transportation operations, raised the additional concern that putting the student experiments in middeck lockers of the crew cabin, as Wilson envisioned, would be somewhat unfair to the GAS program's paying experimenters who had access only to the Shuttle's cargo bay.[138]

The program structure Wilson and others at NASA formulated attempted to reconcile these issues. They designed SSIP as an annual nationwide competition for students in grades 9 to 12 to propose experiments that could fit in a Shuttle middeck locker and be performed on a mission and require up to one hour of an astronaut's time in flight.[139] NASA contracted with the National Science Teachers Association to run the competition, which involved selecting up to 20 semi-finalists across ten geographic regions and then choosing up to 10 national winners among them. The agency's intent was to add a college component at a later point when the organizers had a better handle on funding availability and experience with the first competition; no plans, however, were made to create participatory roles for students with nonscientific interests. The NASA planners also envisioned the program expanding to accommodate experiments that could fly as part of the Spacelab module. In an effort to address financial and scientific value concerns and to "broaden participation," NASA would pair each winner with a NASA scientist or engineer to help with necessary modifications to prepare the experiment for flight as well as with an industry or other non-NASA sponsor who could defray travel and hardware development

[137] L/Special Assistant for Student Activities (Glen P. Wilson) to L/Acting Associate Administrator for External Relations, "Selection of Contractor for SSIP-S," May 1, 1980, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[138] Glynn S. Lunney to ADB/Bob Allnut, June 20, 1980, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[139] NASA considered foreign participants but decided to restrict eligibility to U.S. citizens because of issues such as travel costs and language barriers. See Wilson, "Outline of a Shuttle Student Involvement Program," 14.

expenses and provide technical advice.[140] The agency did not, however, guarantee all experiments would fly, noting that they would do so only if deemed appropriate and based on the experiment's readiness and the availability of room on a mission.[141]

NASA articulated SSIP's objective as "to stimulate the study of science and technology." The agency conveyed the program's specific purposes as including providing new ideas to NASA, recruiting students for positions at NASA and in related industries, meeting NASA's Space Act commitments to disseminate information widely and preserve U.S. leadership in space, "humanizing" the space program for the public, and building a supportive constituency for NASA among students, teachers, and parents.[142] Indeed, in contrast with Frosch's expressed sentiment, it was the inclusion and enrollment of students, parents, and teachers as participants in and proponents of the Shuttle and the broader space program that Wilson saw as the SSIP's primary purpose. Wilson noted that, as a secondary aspect, "you would hope for, but not necessarily expect to get good science."[143]

Beginning with the 1980-1981 academic year, during the eight months before the launch of STS-1, NASA ran its first SSIP competition. The agency received more than 70,000 requests for information and 1,500 proposals, from which the NSTA's teams of teachers, scientists, and engineers selected 191 semi-finalists and then 10 national winners.[144] When NASA ran the competition during the next year, the agency experienced a 30 percent increase in requests for materials and received 2,800 proposals – nearly

[140] NASA, "Student's Experiment to Fly on Third Shuttle Mission," news release 82-27, February 24, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[141] NASA, "Shuttle Student Project Winners Meet with NASA Scientists," news release 81-125, August 20, 1981, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[142] NASA, "Selection Begun in Shuttle Student Project Competition," news release 81-31, February 24, 1981, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[143] Student Activities Steering Committee, summary minutes, August 28, 1979, 4.

[144] NASA, "Student's Experiment to Fly on Third Shuttle Mission," press kit, February 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

twice as many as in the first contest – and chose 20 national winners.[145] NASA selected 10 more winners during each of the next two competitions and another 7 during the following one. The winning experiments covered a wide range of scientific topics: 18-year-old Todd Nelson of Minnesota proposed to study the motions of moths and bees in microgravity; Daniel Weber sought to understand the effects of weightlessness on arthritis, and Karla Hauersperger wanted to examine how prolonged space travel impacted chromium levels in the human body.[146] NASA succeeded in receiving commitments to sponsor the students from throughout the aerospace industry as well as in industries aligned with the students' experiments, including biotechnology and pharmaceuticals. The students received considerable levels of media attention, as NASA had anticipated, in part due to the agency's own public relations but also due to the publicity efforts of their sponsors. NASA's 1985 evaluation of the SSIP to date revealed that participating student entrants, teachers, and corporate sponsors held highly favorable impressions of the program and felt they had learned much about the scientific method through their experiences.[147] An overwhelming number of the regional and national winners went on to study science and engineering in college.[148]

Even given the years of preparation and anticipation of issues, transforming the students' ideas into flight-ready projects proved challenging at many points. Alan Ladwig, who left FASST to join NASA in 1982 to assume the role of SSIP manager after Glen Wilson became director of the education office, observed that Johnson Space Center Shuttle managers were reluctant to put student experiments on

[145] Alan Ladwig to Jack Loosbrock, September 17, 1981, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[146] M/Associate Administrator for Space Transportation Systems (James A. Abrahamson) to JSC/Manager, Space Transportation Systems Operations, "Shuttle Student Involvement Project for Secondary Schools (SSIP-S)," January 22, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[147] Shuttle Student Involvement Program Task Force, "Space Shuttle Student Involvement Program (SSIP) Task Force Analysis," February 8, 1985, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[148] "Space Science Student Involvement Program, 1980-1990: Where Are They Now?" 1990, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

the Shuttle's four orbital flight test missions so as not to interfere with "mission priorities" or burden Shuttle safety reviews.[149] Just as James Abrahamson, head of the space flight office, championed the GAS program, he believed strongly in the importance of the SSIP and transferred the SSIP to his office.[150] He pressed Johnson to fly as many SSIP experiments on NASA's earliest Shuttle missions, noting that the students "deserve" an opportunity fly their experiments and these flights would help the program sign up sponsors for later student winners.[151]

Opposition to student Shuttle experiments stemmed from concerns other than safety. In another instance, resistance to a student project to study biofeedback processes came from the would-be astronaut participants as well as an external scientist who aspired to conduct a similar experiment.[152] Further, with an active antivivisection campaign directed at NASA's animal research work at Ames Research Center, Life Sciences division director Gerry Soffen raised concerns about the "public outcry" and "serious mischief to NASA and especially the life science program which is so important to the future of manned space flight" that might result if the agency flew two student experiments involving rats: one involving breaking rats' bones to study fractures and healing in microgravity, and the other to inject rats with an arthritis-inducing serum and dissecting the animals upon return to Earth.[153] Recalling earlier scientists'

[149] Ladwig, interview, January 31, 2013.

[150] M/Associate Administrator for Space Transportation Systems (James A. Abrahamson) to Johnson Space Center, Kennedy Space Center, and Marshall Space Flight Center, "Shuttle Student Involvement Program," August 9, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[151] M/Associate Administrator for Space Transportation Systems to JSC/Manager, Space Transportation Systems Operations, "Shuttle Student Involvement Project for Secondary Schools (SSIP-S)"; James A. Abrahamson to Glynn S. Lunney, February 22, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[152] MP-5/SSIP Program Manager (Alan Ladwig) to M/Associate Administrator for Office of Space Transportation Systems, "A. JSC Project Office for SSIP; B. Lunney Memo of May 11; C. Soffen Memo of May 21; D. Code M SSIP Responsibility," June 2, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[153] EB-3/Director, Life Sciences Division (Gerald A. Soffen) to M/Associate Administrator for Space Transportation Systems and E/Associate Administrator for Space Science and Applications, "Student Experiments Involving Rats," May 21, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

criticisms of the student experiment programs, he also noted that the experiments constituted "poor science" and "that they are poor ideas to begin with is to encourage not only the criticism by the non-scientific community, but will draw ridicule from our own scientific community for allowing this to happen."[154] Soffen instead preferred students to participate in Shuttle research as part of preformed teams. Burt Edelson, associate administrator for space science and applications, agreed with Soffen, stating that the "appropriate mechanism for student involvement needs to be reexamined."[155]

Yet over these objections, the SSIP flew student experiments aboard the Shuttle beginning with Todd Nelson's insects study on STS-3 and continuing with 17 more of the 50 winning experiments to date before the January 1986 launch of STS-51L/*Challenger*. Many more were in preparation stages at the time of the accident, and three were on the *Challenger* mission itself. President Reagan's remarks during his State of the Union address, which was scheduled for the day the *Challenger* exploded but then was deferred by one week, illustrate just how significant the participation of students had become to the Shuttle program. Tying the work of one of the SSIP participants to the concept of the American dream, Reagan stated:

> We see the dream coming true in the spirit of discovery of Richard Cavoli. All his life he's been enthralled by the mysteries of medicine. And, Richard, we know that the experiment that you began in high school was launched and lost last week, yet your dream lives. And as long as it's real, work of noble note will yet be done, work that could reduce the harmful effects of x rays on patients and enable astronomers to view the golden gateways of the farthest stars.[156]

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[154] Ibid. Ladwig objected to Weber's work being called "poor science" given Pfizer's assistance and the project's compliance with state and federal animal research laws and passing of key reviews at Johnson Space Center. See MP-5/SSIP Program Manager (Alan Ladwig) to M/Associate Administrator for Office of Space Transportation Systems, "A. JSC Project Office for SSIP; B. Lunney Memo of May 11; C. Soffen Memo of May 21; D. Code M SSIP Responsibility."

[155] E/Associate Administrator for Space Science and Applications (B. I. Edelson) to M/Associate Administrator for Space Transportation Systems, "Shuttle Student Involvement Project," June 9, 1982, Folder 19815, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[156] Ronald Reagan, "Address Before a Joint Session of the Congress on the State of the Union, January 25, 1984," 90.

Facilitating a Shuttle-Enabled Science Opportunity for Students

As SSIP became an ongoing opportunity for students to participate in Shuttle-based research, NASA also sought to engage youth in other space-based scientific projects to be facilitated by the Shuttle. In 1983 NASA Langley Research Center's Bill Kinard began to pursue such a possibility. Kinard was then serving as chief scientist for the Long Duration Exposure Facility (LDEF). After the LDEF endured several launch delays, some of the commercial companies that had planned to fly experiments aboard the large space platform withdrew, creating availability for additional experiments. Kinard recognized the educational and outreach value of student participation in the SSIP and the space program more generally and desired to provide the spare room aboard the LDEF to projects that involved schoolchildren. Rather than soliciting student ideas, a process that would likely exceed the time remaining before the LDEF's launch, Kinard sought to develop an experiment in which NASA could later reach out to students to take part. At the time, the Park Seed Company was making final preparations to fly an experiment to measure the effects of Shuttle launch and reentry on a variety of plant seeds in a GAS canister on STS-6. Kinard took a keen interest in the experiment and approached the company about participating in the LDEF. Park Seed agreed to fly a follow-up experiment on the LDEF to test the effects of long-term space exposure on a variety of plant seeds. In addition, Park Seed investigators, George Park, Jr., and Jim Alston, discussed with Kinard the prospects for developing a project in which seeds exposed to space on the LDEF and returned by the Shuttle could be distributed to students, who could grow them.[157] The LDEF chief scientist teamed with the NASA Headquarters education office to create a plan to realize this idea to garner broad student interest in participating in a space research project.

Federal rules, however, prevented NASA from entering into a non-competitive agreement with Park Seed, and so NASA issued an open solicitation inviting proposals from organizations to partner with

[157] Jim Alston, telephone interview by author, April 11, 2014.

NASA on a student seeds-in-space project. Only Park Seed submitted a proposal and hence became NASA's partner in the project they dubbed SEEDS: Space Exposed Experiment Developed for Students. Both NASA and Park Seed were excited about the project's potential to broaden participation in space research. NASA articulated its goal for the project as "to stimulate interest in science through the active involvement of all participants."[158] According to Jim Alston, Park Seed's director for research who became the lead investigator for SEEDS, the seed company was excited about the prospects of embarking on a high-profile project with NASA and inspiring students to cultivate an interest in plant science.[159] Park Seed furnished 12.5 million tomato seeds, which were placed into five aluminum canisters aboard the LDEF.[160] NASA, meanwhile, funded, tested, and flew the experiment's hardware and developed promotional and instructional materials for the project. Oklahoma State University also supported NASA in interacting with prospective and participating schools.

As with SSIP, the SEEDS project encountered some skepticism about its scientific value. Certain scientists expressed concern, for example, about how NASA would assure project data's quality when the returned seeds would be distributed to and the plants grown and measured by thousands of schools. Some university researchers objected to the fact that only schools could receive the seeds for study. SEEDS endured far less resistance than did SSIP, however, primarily because the LDEF space would otherwise go unused. In addition, NASA made clear that while the SEEDS project represented the agency's first

[158] NASA, *SEEDS: A Celebration of Science*, NASA EP-281 (Washington, DC: U.S. Government Printing Office, 1991), v.

[159] Alston, interview.

[160] NASA, "NASA Space Shuttle to Carry Tomato Seeds on Mission 41-C," news release 84-47, n.d., NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000041998.pdf.

known opportunity to examine the effects of long-duration exposure of living tissues, its primary aim was education and engagement rather than world-class science.[161]

Ultimately, the project enjoyed tremendously positive reception across NASA and the education community it intended to serve. Launched in 1984 aboard the STS-41C, the SEEDS project remained in space for five years, after which STS-32 retrieved the LDEF; the project's stay in space was longer than anticipated after the 1986 *Challenger* accident delayed the LDEF return mission. NASA sent some 132,000 experimental kits to 64,000 teachers in more than 40,000 schools in 31 different countries and serving more than 3 million students. Elementary schools, high schools, and universities alike participated in the project. Each participating entity received at least 50 space-exposed seeds and 50 control seeds.[162] Students grew the seeds and sent reports of their observations to Oklahoma State, which compiled the results for NASA. The agency published those results in *SEEDS: A Celebration of Science*. The SEEDS project proved to be a successful forerunner of collaborative "citizen science" projects but more importantly for NASA garnered enormous levels of enthusiasm and appreciation among participants. The margins of NASA's *SEEDS* publication include dozens of testimonials from teachers, students, and parents explaining how the project benefitted them and expressing gratitude to the space agency for the opportunity to participate.[163]

Setting Policy for Nonscientific Uses of the Shuttle

As Yardley, Lee, Smith, Abrahamson, and others in the Office of Space Flight contemplated marketing the Shuttle to a new set of users, their vision was focused initially on accommodating parties

[161] Alston, interview; Doris Grigsby, telephone interview by author, April 11, 2014; NASA, "NASA Space Shuttle to Carry Tomato Seeds on Mission 41-C."

[162] Park Seed, "Seeds in Space," accessed February 9, 2015, http://parkseed.com/seeds-in-space/a/13/.

[163] NASA, *SEEDS: A Celebration of Science*.

who would want either to study the space environment's effects on various aspects of earthly existence or to leverage it to support business development or societal applications. But the democratized imaginary for the Shuttle that NASA had promoted beginning in the 1970s depicted the new vehicle as capable of opening access to space for a variety of users and uses, including many the agency knowingly could not predict. Indeed, this vision piqued the interest of many segments of the public who had not traditionally participated in the space program, and the agency found itself facing an onslaught of proposals to fly payloads or otherwise use the Shuttle for an assortment of non-R&D-related objectives and entrepreneurial endeavors. NASA officials had to evaluate how these new payload activities would contribute to the goal of making the Shuttle the sort of vibrant enterprise in service to citizens and the nation that NASA's human space flight advocates hoped it would become. Specifically, the agency had to balance realizing its promise that the Shuttle would serve many users, finding ways to make the vehicle financially self-sustainable, and demonstrating the space transportation system's legitimacy in the hopes of justifying continued public and political support for human space flight initiatives. These aims were not necessarily one and the same; hence, agency officials had to define the bounds of what uses of the Shuttle it would deem appropriate.

By the late 1970s, a wide variety of individuals and small companies began to query the agency about the possibility of gaining access to the Shuttle to fly payloads of interest to them. Given its relative affordability, the GAS program attracted numerous R&D project proposals, but NASA also received dozens of inquiries and earnest money checks from individuals and small companies wanting to use GAS containers for other purposes. Some people were enamored with the idea of flying aboard the Shuttle something of symbolic or cultural value or that was personally meaningful to them. A doctor from New York expressed interest in deploying a small satellite from a GAS can in honor of his son's wedding.[164] Several artists sent checks to NASA to fly works of art aboard the Shuttle to enhance the meaning

[164] Thomas O'Toole, "Gerbils, Ashes Nixed in Shuttle Bids," *Today* (FL), January 21, 1978, A1, Folder 8164, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

conveyed in their artwork, while some children wrote to NASA asking about deploying a small "space child" sculpture from the payload bay.[165] Some schools and companies inquired about flying small mementos bearing their insignia to place proudly in display cases after flight. Others had commercial purposes in mind. Some wanted to fill canisters with T-shirts, coins, or other collectible items for resale due to the fact that they had been flown in space. A Dallas retailer desired to fly gerbils in a GAS can for later resale.[166] Multiple individuals inquired about flying human ashes in space as a means of memorializing loved ones. Joe Roberto, for one, founded a company called Astro Burial Ltd. with the vision of making a business of deploying individuals' cremains for $2,995. His plan was to pack between 6 and 20 specially-designed containers containing ashes into a GAS can and eject them using a spring device or rocket into a separate orbit, where they would disintegrate and release the ashes.[167]

Further, some advertisers sought to physically employ the Shuttle and related ground-based assets to market products. Actifed maker Burroughs Wellcome desired to film a TV promotion for its product, which Apollo 7 astronauts had used to relieve cold symptoms on their mission, using a Shuttle mockup at NASA's Marshall Space Flight Center.[168] Even before STS-1 flew, a Los Angeles advertising executive named Bob Lorsch pitched to NASA the idea to sell what he called "public affairs advertising" space on Shuttle missions. According to his proposal, companies could purchase plaques for $1 million apiece on which they could inscribe "supportive, non-commercial" statements. After taking a fee of nearly 18 percent, Lorsch would turn over the funds to NASA. The agency, according to his plan, would take responsibility for mounting the plaques in the crew compartment and focusing a television camera on

[165] Chester M. Lee to Udo Schlegel, August 25, 1978; Lee to Albert Notarbartolo, December 19, 1978; John F. Murphy to Senator Howell Heflin, May 2, 1984. The first two letters located in Folder 5310 and the third letter located in Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[166] O'Toole, "Gerbils, Ashes Nixed in Shuttle Bids."

[167] Joseph M. Roberto to Donna S. Miller, August 6, 1979; Roberto to Chester M. Lee, August 20, 1979. Both letters located in Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[168] Charles S. Adorney to Frank S. Johnson, Jr., September 16, 1985, Folder 1134, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

each one for 60 seconds while in flight and perhaps provide VIP treatment to purchasers at the launch. Because purchasers would not be able to promote their products, Lorsch averred the proposal would not be considered outright advertising and likened the idea to the sponsorship model used by the Olympics.[169] Pulling on NASA's constant quest to expand public relevance and awareness of its activities, he further insisted that the concept would "give the American people an opportunity to become involved" in the space program while leading to greater public support and thus expansion of NASA's abilities to do more in space.[170]

NASA officials in the Office of Space Flight, in collaboration with others throughout the agency, set to work to navigate this new terrain and adjudicate the myriad interests. In doing so, they wrestled with conflicting goals and concerns. On one hand, the Office of Space Flight desired to sign up as many users as possible for the Shuttle to demonstrate the system's demand and viability. The revenues NASA would receive from these additional customers, especially from advertisers, could help prove the Shuttle as an economically sensible enterprise and reduce costs borne by taxpayers. As it was, elected officials during the early Shuttle period including Vice President George Bush and Senator William Proxmire expressed interest in some of the proposals to generate revenue from selling Shuttle space to advertisers.[171] They also wanted to demonstrate NASA's willingness to make the space frontier accessible to as many people as possible and not close off ideas that might help to expand and strengthen the nation's presence in space and lead to future space development.

On the other hand, NASA space flight officials worried, just as NASA space scientists lamented flying certain student experiments aboard Shuttle, that allowing individuals to fly objects that they

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[169] Robert H. Lorsch to Jesse W. Moore, July 3, 1984, with attachment, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[170] Ibid.; "Moon Billboards," *Omni*, November 1981, 42, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[171] "Moon Billboards."

intended for later resale or which others could find objectionable could lead to criticism or embarrassment for the agency. Indeed, as the proposals rolled in to NASA, some media articles decried or questioned NASA for not keeping the Shuttle and the agency's image "serious," while others followed the most eccentric ideas with amusement.[172] NASA had been established by the Congress as an R&D agency tasked with maintaining U.S. leadership in space and had for the most part had earned a reputation for competency among the American population. But the agency still faced skeptics who doubted the value of the Shuttle and human space flight and did not want to be accused of having urged the nation to build the multi-billion-dollar Shuttle only to use it for frivolous and unproductive purposes or for appearing to endorse particular companies or products. It also still reeled from the criticism unleashed by some members of Congress and the media when the Apollo 15 astronauts were accused in the early 1970s of selling postage stamps flown on their mission for personal gain.[173] Thus, in addition to articulating the need for payloads to comply with specific crew, spacecraft, and live animal subject safety regulations, the agency would insist on some degree of decorum concerning the Shuttle's uses.

NASA worked to accommodate citizens interested in using the Shuttle in unsolicited ways as best it felt it reasonably could. By the start of the Shuttle era, companies with no business relationship with NASA invoked space themes along with specific mentions of the Shuttle to connote their products' quality: indeed, product manufacturers had considered affiliation with the space program a sign of prestige and excellence since NASA's earliest years and did not hesitate to signal in their advertising campaigns when NASA had used their products, with the Gemini astronauts' consumption of Tang being

[172] See, for example, Joan Johnson-Freese, "Launch Dazzling but Cut Out P.R., Commercialism," *Orlando Sentinel*, November 30, 1985, Folder 6619, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; O'Toole, "Gerbils, Ashes Nixed in Shuttle Bids."

[173] See, for example, Thomas O'Toole, "Ex-Astronauts Disregarded Warning against 'Souvenirs'," *Washington Post*, August 1, 1972, A8, Folder 6715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

perhaps the most notable example.[174] They ranged from Volkswagen's depiction in the *New York Times* of its "Vanagon" van as "space shuttle" with an image of the vehicle's roomy interior to *Playboy* magazine's full-page advertisement in the *Times* a month later. The latter ad displayed a photo of a Shuttle orbiter in an attempt to woo potential *Playboy* advertisers with the claim that America was returning to prosperity and thus meant *Playboy* readership would rise.[175] As long as ads merely stated that NASA had used the products and did not use NASA's name or insignia to claim or imply that the agency endorsed them, NASA would generally not object. NASA's public affairs office permitted advertisers promoting products ranging from cars to fashion to orange juice to take photographs or film for ads at NASA's visitor centers as long as they did so "without adverse impact on our program."[176] Where NASA denied them from using operational assets, as Actifed's promoters wished to do, public affairs officials explained that their decisions were based on the burden they would pose on NASA's limited resources and pointed them to the non-operational alternatives.[177] Forbidden to engage in self-promoting activities by appropriations laws and the 1919 Anti-Lobbying Act, the agency appreciated the positive publicity it received through ads that, according to NASA public affairs officers, would "identify us with excellence" or which provided "some visual reinforcement of the prominent role Shuttle plays in our lives."[178]

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[174] Julian Scheer to Edward S. Stephenson, October 10, 1966, Folder 1904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[175] Volkswagen, "Space Shuttle" (advertisement), *New York Times*, April 15, 1981; *Playboy*, "Confidence. America's Got It Again" (advertisement), *New York Times*, May 21, 1981. Both advertisements located in Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[176] Frank S. Johnson, Jr., to Charles S. Adorney, n.d., Folder 1134, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[177] Ibid.; James Fisher, "NASA Image Can Put Sales in Orbit," *Orlando Sentinel*, June 6, 1985, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[178] Kevin Anderson, "NASA Promotion Won't Fly without Approval of Agency," *USA Today*, December 6, 1983; Frank Johnson to Mike Weeks, handwritten note, October 22, 1985. Both documents located in Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Moreover, the agency addressed the issue of serving groups interested in sending very small items on the new vehicle. In 1978 NASA established a policy and procedures whereby Shuttle customers, foreign governments, companies, and schools could request that NASA fly patches, medallions, and other similarly-sized items meaningful to them aboard the Shuttle. Rather than allowing these groups to purchase GAS cans for these purposes, the agency would, for each mission, compile the items in an Official Flight Kit, which would be stowed in the orbiter's middeck. The items would be returned to their owners following the flight. The policy stipulated that these groups could fly the mementos for the purposes of distributing them as awards or preserving or displaying them in museums or archives. Mementos could not be flown for economic gain nor could they have the potential to "create problems with respect to good taste." Johnson Space Center's Shuttle program management reserved the right to deny the flight of any items due to size, weight, or any other reason, and all mementos had to earn the approval of NASA's administrator.[179] Astronauts also had allowances to fly mementos with significance to them and on behalf of others on their missions, although sale of memorabilia was prohibited.[180]

At the same time, NASA officials grappled with many requests and proposals that did not fit the agency's "comfort zone" of advancing R&D-related purposes. Indeed, the agency took responsibility for mediating the democratized imaginary it had established for the Shuttle, determining which uses of the vehicle would be considered legitimate and which would not. NASA crafted language for its 1980 regulation on the GAS program, stating that "NASA shall reserve the right to reject any payloads which, in the opinion of the NASA Administrator, would be contrary to the spirit of this program or NASA's mission."[181] While the agency encouraged GAS canister purchases for experiments intended to develop

[179] Articles Authorized to Be Carried on Space Transportation System Flights, 43 *Federal Register* 49979 (October 26, 1978) (amending 14 C.F.R. pt. 1214). Later revisions designated the Associate Administrator for Space Flight as the final authority.

[180] Ibid.

[181] Space Transportation System; Use of Small Self-Contained Payloads, 45 *Federal Register* 73022 (November 4, 1980) (amending 14 C.F.R. pt. 1214).

or refine proprietary processes, it prohibited their use for "crassly commercial" purposes, such as for flights of objects to be sold later for having been flown in space, or to fly payloads the agency considered to be "in poor taste."[182] The Space Transportation System Users Service Council, a group of officials representing several NASA offices that the Office of Space Flight assembled to evaluate each GAS payload proposal's suitability, liberally interpreted what payloads constituted R&D projects. The group encouraged commercial applications of GAS research but did not hesitate to rebuff proposals that did not seem to fulfill a research purpose or satisfy the GAS program's guidelines for decorum. Thus, while a few artists who framed their proposals as research projects were able to fly payloads in GAS canisters, Chet Lee sent a letter to Ann Preston of the California Institute of the Arts, for one, rejecting Preston's proposal to fly artwork aboard the Shuttle that lacked a research angle. Lee did so on the basis that a "policy that has governed almost all past space flight activities is that they should be designed to yield knowledge that could not be obtained by investigations on the ground."[183]

Likewise, Lee returned Joe Roberto's $500 for a canister to fly human ashes on the Shuttle along with a letter stating that "the key criteria [sic] for flying this type of payload GAS is that they [sic] must be of a scientific research and development nature."[184] Roberto argued that the Astro Burial proposal was an experiment in the humanities," met the GAS program's technical requirements, and comported with Congressional direction to NASA to open opportunities for modestly sized businesses in the space program. Even so, Yardley rejected Roberto's appeal to the council, stating in a letter: "Flying human

[182] NASA, "Getaway Special," fact sheet, March 1981, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. NASA made something of an exception to its rule about using GAS cans to fly payloads for later resale. In 1983 the agency carried nearly a quarter-million commemorative postal covers aboard STS-8 for NASA and the United States Postal Service to sell to collectors in honor of NASA's 25th anniversary for $15 apiece, with the revenue to be split between the two agencies. Room for the covers became available when a technical problem prevented the mission from carrying the satellite originally scheduled to fly in the Shuttle's cargo bay on that launch.

[183] Lee to Ann Preston, September 28, 1977, Folder 5310, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[184] Chester M. Lee to Joseph M. Roberto, August 27, 1979, Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

beings alive or deceased on the Shuttle for the purpose of fulfilling an individual desire to orbit the Earth does not meet the requirements at this time for an acceptable payload."[185] A 1981 response from NASA to another individual who inquired about sending ashes into space noted that the agency's Shuttle policy was to fly "only those people essential to mission success" and payloads to serve a useful purpose when deployed in space or benefit from exposure to space environment." Public affairs director Brian Duff responded to Bob Lorsch's advertising concept that it would be "inappropriate to attempt to raise money by an advertising plan along the lines that you have proposed."[186]

Common to all of the Office of Space Flight's responses to these rejected proposals, however, was language suggesting that NASA might review the possibility of flying such unorthodox payloads in the future. Lee's letters to the artists and would-be celestial undertakers also conveyed that the agency was cognizant of the importance of "extending the involvement in space activities to a wider range of human interests."[187] Terrence Finn of NASA's legislative affairs office responded to inquiries about flying ads and human ashes aboard the Shuttle, stating that NASA might consider developing policies and criteria for "unconventional" and "innovative and imaginative ideas for the use of space" as the Shuttle system matured.[188] Lee conveyed to Roberto that NASA might consider "payloads based solely on individual desires" once Shuttle flights become routine while noting that the User Services Council was

[185] "Astro Burial," *Omni*, February 1980, 39, Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Roberto to Miller, August 6, 1979; Roberto to Lee, August 20, 1979; John F. Yardley to Joseph M. Roberto, October 15, 1979, Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[186] Brian M. Duff to Bob Lorsch, November 25, 1980, Folder 11903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[187] See, for example, Lee to Roberto, August 27, 1979; Lee to Ann Preston, September 28, 1977; Lee to Bruce Batler, December 14, 1977, Folder 5310, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[188] Finn to Fuqua, December 10, 1980; Terence T. Finn to Keith Luse, March 11, 1981, Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

reviewing the possibility of flying non-R&D-related payloads in the Shuttle's cargo bay under NASA's regular commercial rate, which started at $1.8 million (FY 1980).[189]

Indeed, Lee's marketing advisor, Jon Michael Smith, recognized that the Shuttle was "bigger" than science. Yardley had sent him to a training program at Harvard Business School, where he became aware that the Shuttle could offer opportunities in space for a wide range of people. The inquiries of so many individuals from the arts community suggested to Smith and others at NASA that the agency had to think about the Shuttle's ability to allow people of all backgrounds to "go to space and do their thing, whatever it was."[190] With a commitment to realizing this possibility, NASA could truly honor its imaginary of the Shuttle as a vehicle that would serve the interests of and become uniquely meaningful to many. This sort of engagement, many NASA officials hoped, would help to enroll people as supporters of NASA's planned activities. As Tony Maull, a NASA official who would go on to help the agency evaluate nonscientific proposals, explained, "[W]hat motivates the American people to support the space program – and it is their program, not a hobby-shop for us – isn't just for the reasons of science and engineering, but perhaps as important, for the reasons of poetry, the spirit of adventure."[191]

The Office of Space Flight personnel informed NASA's deputy administrator, Alan Lovelace, of the brewing public interest in using the Shuttle for nonscientific purposes. In 1979 Lovelace approved the establishment of a committee to study the issue and make recommendations concerning the flight of art and other payloads on the Shuttle within the GAS program. He appointed NASA chief scientist Frank McDonald to head the committee but called for it to include "expertise in the non-technical fields from which subject proposals eminate [sic]."[192] While the idea of a nonscientific payload program for the

[189] Yardley to Roberto, October 15, 1979; Lee to Roberto, August 27, 1979; "Astro Burial." As Roberto noted, however, this price tag would prohibit small businesses from taking advantage of the opportunity.

[190] Smith, interview.

[191] Horvitz, "Art into Space," 31.

[192] AD/Deputy Administrator (A. M. Lovelace) to M/Associate Administrator for Space Transportation Systems and P/Chief Scientist, "Approval to Establish Committee to Review Art and Structure Proposals to Fly as Self-Contained

Shuttle encountered resistance from McDonald and others within NASA who believed such an initiative would trivialize the space program, Lovelace reluctantly authorized the Office of Space Flight to draft a policy.[193] The going to do so proved slow. Preoccupied with juggling its many payload customers at the same time that the STS-1 launch date continued to slip and then focused on manifesting them on the Shuttle's early flights, the Office of Space Flight deferred the task of composing the policy until 1984. According to Tony Maull, "We saved all of these proposals, waiting for the day when we finally got the shuttle operating and on a reliable schedule, and as that day approached, we went through our files and tried to figure out how we could best accommodate the people who wanted to send up nonscientific payloads."[194]

Finally, in May 1984, NASA proposed in the *Federal Register* to amend its rule on Shuttle use to "broaden the range of potential launch service customers and increase the access of the general public to the [Shuttle]." Published in final form in August, the rule declared NASA's willingness to consider Shuttle flights on a space-available basis of "cargoes that do not meet the definitions of national defense payloads; communications, weather, or other high-technology satellites; materials sciences/processing payloads scientific experiments; engineering test articles or other similarly technical cargoes routinely considered for flight as conventional or self-contained payloads." The agency would stand up an internal Nonscientific Payload Evaluation Committee to meet quarterly to determine the propriety of flying any payload that otherwise met NASA's safety and operating standards. Preconditions for acceptance included that the payload was not an untethered satellite and did not contain human or animal life. Further, the agency would not accept any payload "inconsistent with NASA's mission or otherwise not in the national interest" and reserved the right to reject payloads "proposed – or which appear to be proposed

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Payloads on the Space Shuttle," n.d., Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[193] Smith, interview; Ladwig, interview, January 31, 2013.

[194] Horvitz, "Art into Space," 31.

– solely or primarily for the purpose of advertising, publicity, endorsements, or other means of promotion." This stipulation aimed to curb customers from attempting to capitalize on their connections to NASA, as a Dutch artist had in 1971 when he persuaded the agency to have the Apollo 15 crew leave a small sculpture of his on the Moon, only to later sell replicas for $750 each. Finally, the policy stated that NASA would employ no more than 10 percent of the Shuttle's flight capability for nonscientific payloads and required customers to reimburse NASA for its operations costs plus a non-refundable processing fee.[195] NASA charged nearly $1500 per pound plus integration fees.[196]

During 1985, the Nonscientific Payload Evaluation Committee poured over more than 200 requests it had received to fly payloads through the nonscientific payload program. The vast majority, the committee deemed, failed to satisfy all of the policy's criteria. But after consulting with the National Endowment for the Arts, the committee decided that a work by Massachusetts College of Art professor Lowry Burgess fit the agency's requirements.[197] "Out of all proposals made to us, only Lowry Burgess' seemed to be innocent," Tony Maull said, referring to the stipulation prohibiting flight of nonscientific payloads for blatantly promotional purposes.[198] Burgess had been among the many artists who had queried NASA in the late 1970s about flying a piece of artwork in space. While he had then envisioned flying a piece for astronauts to deploy outside of the Shuttle, the policy's requirement that no payload could be left in orbit prompted him to reconceive his plan.[199] He proposed instead a piece he named *The Boundless Cubic Lunar Aperture*. A 5-inch cube of bronze-tinted glass contained water Burgess had collected from 18 famous rivers on Earth, plus water from 18 glaciers, wells, geysers, and ponds, inside of

[195] Nonscientific Payloads, 49 *Federal Register* 34445 (August 31, 1984) (amending 14 C.F.R. pt. 1214).

[196] Horvitz, "Art into Space," 30.

[197] David Stipp, "Spaced-Out Artwork Adds Allure to Flights of NASA's Shuttles," *Wall Street Journal*, December 10, 1985, Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[198] Charlie Jean, "Artist's Little World to Fly on Discovery," *Orlando Sentinel*, February 20, 1989, Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[199] Horvitz, "Art into Space," 29-30.

which a smaller, empty glass cube.[200] Burgess's intent was to place the artwork, once returned to Earth, in a petrified tree within a rock formation near Walden Pond in Massachusetts. Having been perplexed about the United States' role in Vietnam and his own life's purpose, he saw putting a piece of his artwork in space as a means to juxtapose perceptions of what is inside and outside and "to express through art the scientific observation of order and harmony in the universe."[201] He found funding for it through the De Cordova Museum, the New Works Program of the Massachusetts Council on the Arts and Humanities, and the Massachusetts Artists Foundation.

Burgess' six-pound sculpture was assigned to fly aboard a spring 1986 Shuttle mission as NASA's first nonscientific payload. The Shuttle flight hiatus imposed by the *Challenger* catastrophe in January of that year, however, delayed *The Boundless Cubic Lunar Aperture*'s launch until 1989. According to Alan Ladwig, Burgess had wanted the astronauts onboard to take the work out of the middeck locker in which it was stowed to photograph it in the microgravity environment, but the crew refused because the concept was "so far out, beyond their normal thinking" to the point that they were "embarrassed by it."[202] Whether subsequent astronaut crews would feel the same would never be known, as Burgess' artwork would be the first and also the last to fly under the Nonscientific Payload Program. While NASA had been reluctant to initiate this effort to engage publics with the Shuttle in a very untraditional way for the agency, the agency altogether eliminated the nascent initiative when it changed its payload policies following the Space Shuttle *Challenger* accident.

Chapter Synthesis

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[200] NASA, "Art Work to Be First Shuttle Non-Scientific Payload," news release 85-175, December 20, 1985, Folder 8163, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[201] Ibid.; "Lowry Burgess: Artist, Educator," *Folly*, August 2009, 4-5, accessed January 6, 2015, http://www.follymag.com/files/FOLLY_August_09.pdf.

[202] Alan Ladwig, interview by author, Washington, DC, March 19, 2013.

Along with efforts to share the Shuttle through informational and spectatorship activities, NASA officials sought to redefine relationships with citizens to include them as customers of and substantive contributors to the Shuttle to realize the imaginary of accessibility it had set forth for the new vehicle. In doing so, the agency aimed to legitimize human space flight as a purposeful activity of the United States government. Creating pathways for publics to engage as Shuttle users was hardly straightforward or even initially unified, as agency officials had to reconcile a considerable number of differences among themselves and disparate views from external entities in forming policies on public uses of the Shuttle that balanced so many different interests.

In spite of these challenges, NASA made significant strides within the first few years of Shuttle operations to open space to use by publics that had not been materially involved in space flight in NASA's first decade. For the first time, NASA actively responded to public petitions to participate in the human space flight program. Conditions for access to the Shuttle were not limited to being a NASA insider, or a credentialed expert in space science or technology, or even passing a scientific peer review; instead, one could fly a payload if he or she could afford it monetarily and had a research idea or another innovative use of space. High school students and non-scientists had the chance to compete on level playing fields to fly experiments and payloads. While corporations proved more reluctant to fund experiments and other Shuttle payloads than NASA had anticipated, the response of external publics to opportunities to fly payloads costing relatively little or nothing proved overwhelming. NASA's success in enrolling a wide variety of publics as Shuttle users encouraged the space agency in the validity of these forms of public engagement.

Chapter 4: Creating Space for New Flyers

NASA's introduction of novel users and uses of the Shuttle constituted a key means of making the vehicle relevant and meaningful to American citizens and thereby boosting its viability and legitimacy. The agency's efforts to involve new segments of society substantively in the Shuttle program, however, did not stop there. Since NASA's earliest days, the most overt features of its human space flight programs were the astronauts themselves. Consequently, agency officials recognized who they actively involved as flyers aboard the Shuttle would be a crucial way to preserve the apparent relevance of human space flight. Reconsidering the types of individuals the agency selected to fly aboard the new spacecraft was particularly important as social attitudes toward participation and equal opportunities changed around the time of the Shuttle's inception. The shift would also be somewhat responsive to space enthusiasts who had long expressed to NASA their desire to fly in space.

The astronauts NASA flew throughout the 1960s were cut from a similar mold: they were white male aviators, mostly drawn from the ranks of military test pilots. In 1958 NASA's Space Task Group, established to set the agency's course in human space flight, had considered conducting an open competition with the potential to recruit explorers of extreme environments and other adventuresome types to serve as its first human space flyers.[1] Ultimately, however, the group came to favor choosing military aviators because they had already undergone a degree of rigorous physical and psychological screening, and President Eisenhower approved this approach.[2] NASA announced its first class of Mercury astronauts in April 1959, comprised of seven pilots: three hailing from the Air Force, two from

[1] This Space Task Group, comprised of dozens of NASA personnel (predominantly engineers), differed from the Space Task Group of high-level government leaders that Nixon established at the start of his administration.

[2] "NASA Project A, Announcement 1: Invitation to Apply for Position of Research Astronaut-Candidate," December 22, 1958, Folder 8947, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Lee D. Saegesser, "Report of Telephone Conversation with Dr. T. Keith Glennan," January 24, 1995, Folder 16404, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. For more on this topic, see Joseph D. Atkinson and Jay M. Shafritz, *The Real Stuff: A History of NASA's Astronaut Recruitment Program* (New York: Praeger, 1985).

the Navy, and one from the Marine Corps. These pioneering men and those that would join them through selection processes held over the next few years to support the Gemini and Apollo programs became the most visible symbols of the space agency and its extraordinary achievements as the nation sought to prove its technological and ideological superiority to the Soviet Union in the Cold War of the 1960s.[3] NASA, in partnership with the news media, fostered a public image of these astronauts as heroic, chaste, and invincible – even when their personal lives often belied these attributes – in an effort to exude an infallible aura around them, the space agency, and the nation.[4]

These early astronauts ably demonstrated that humans could live and work on the space frontier and also set a precedent that astronauts would remain an invaluable element in NASA's public outreach efforts. But the demographic makeup of NASA's astronaut corps became increasingly out of synch with the national focus on promoting workplace diversity and opportunities for all. Thus, as part of its shift to a democratized imaginary for the Shuttle, NASA and the Nixon administration depicted the new space transportation system as a versatile one unlike the space capsules of the 1960s in that it would have a high flight rate, a roomy payload bay that could accommodate a wide variety of civilian, military, and commercial uses of space, and a winged, plane-like design that would reduce launch and reentry stresses on astronauts. Moving beyond rhetoric, the agency actively worked to make the Shuttle a more democratic technology, accessible to individuals with credentials different from, and who did not necessarily meet the stringent physical qualifications of, the military test pilots who had made up most of NASA's astronaut corps for a decade.

This chapter shows that, as was the case with the inception of new users and uses of the Shuttle, NASA personnel grappled with the implications of expanding flight opportunities. Many at NASA

[3] The story of the selection and journeys through astronaut training and flights of these pilots is outlined in Tom Wolfe's *The Right Stuff* (New York: Picador, 1979).

[4] See, for example, Walter Cunningham, *The All-American Boys* (New York: Macmillan, 1977) and Roger D. Launius, "Heroes in a Vacuum: The Apollo Astronaut as Cultural Icon," *Florida Historical Quarterly* 87, no.2 (Fall 2008): 174-209.

Headquarters saw the introduction of opportunities for new sorts of flyers as a welcome and necessary means to bolster the human space flight program's relevance. Some astronauts and those who worked closely with them at Johnson Space Center, however, worried about the impact of flying people with different credentials and qualifications on the cost and safety of Shuttle missions and, especially, the flight priority of career astronauts already waiting to be assigned to missions. At stake in the minds of members of both camps was the agency's credibility and legitimacy, with the former seeing broader access and democratization as an antidote and the other wedded to conservatism, preservation of tradition, and even elitism. While these two aspects remained in tension with one another, NASA's increasing experience with human space operations along with external pressures to open the enterprise to more types of people pushed the agency to move in an incremental fashion toward broadening the range of Shuttle flyers.

The chapter reveals the steps and challenges NASA faced in opening space flight opportunities to specific groups beyond the cohort of military test pilots: first, as it recruited scientists and women and minorities into the astronaut corps; next as it invited Shuttle flights by representatives of corporations and international payload owners as well as representatives in the United States Congress; and finally as it laid plans to make Shuttle seats available to "ordinary" citizens.

Expanding the Astronaut Corps' Professional and Social Diversity

NASA imagined and portrayed the Shuttle as a vehicle intended to move the nation beyond experimental vehicles and into the realm of routine uses of and operations in space. In the absence of a space station to build anytime soon, it had to be manifested with meaningful work. Such tasks, NASA officials recognized, were likely to consist of an eclectic mix of launching satellites and conducting medical and other scientific experiments on behalf of NASA researchers, private customers, other U.S. government agencies, and foreign governments. Anticipating dozens of Shuttle flights per year, each

with unique goals, NASA officials had to decide on what sorts of individuals and expertise it would need to staff the flights and adequately fulfill the objectives for this post-Apollo human space flight initiative.

The agency's choice of space flyers for the Mercury, Gemini, and Apollo programs had largely been driven by its quest for engineering advancements over the Soviet Union. Charged to fulfill President Kennedy's stated goal of sending humans to the Moon and returning them safely to Earth, NASA leadership, including human space flight managers who commanded the majority of the agency's budget, ensured that these first human space flight initiatives focused almost entirely on achieving this aspiration. NASA's earliest astronaut selection criteria were intended to satisfy these objectives. Although President Eisenhower had established NASA as a civilian agency, he believed that the best, most accessible talent for achieving space feats would come from tapping military pilots for these tasks. Thus, in selecting the Mercury astronauts in 1959, the agency looked to military men younger than 40 in impeccable physical condition with college engineering degrees and extensive jet test pilot experience. Recruitment for Gemini and Apollo astronauts in 1962 opened eligibility to civilians but still required the same education pedigree and emphasized high-performance aircraft flight experience.[5] As Tom Wolfe explains in his account by the same name, these origins gave way to a "right stuff," pilot-dominated astronaut culture within NASA. As Wolfe put it,

> The right stuff was not bravery in the simple sense of being willing to risk your life…Any fool could do that…No, the idea (as all *pilots* understood) was that a man should have the ability to go up in a hurtling piece of machinery and put his hide on the line and have the moxie, the reflexes, the experience, the coolness, to pull it back at the last yawning moment…[6]

Where the Shuttle was concerned, however, NASA officials estimated that pilot astronauts would have responsibility enough to operate the system safely and provide overall authority onboard. Another cadre of space flyers capable of acquiring detailed knowledge of the Shuttle systems along with the

[5] "Astronaut Selection and Training," NASA Facts, Lyndon B. Johnson Space Center, JSC-11863, September 1979, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[6] Wolfe, *The Right Stuff*, 148.

myriad scientific and technical payloads the missions would fly would be needed to manage the substantive requirements on each flight. The agency would welcome and employ with regularity a new breed of career astronaut: the scientist, engineer, or physician trained not as a pilot but as a "mission specialist."[7]

Even in the midst of the "right stuff" heyday, many scientists advocated that NASA consider an expansion of the astronaut ranks to include the expertise of professional scientists. Although the one-man Mercury flights were largely devoted to proving the capsules' operational capabilities, the Gemini and Apollo initiatives flew multiple astronauts, offered somewhat more time on-orbit, and had less need for systems tests, thus allowing some time for scientific research. From as early as 1962, members of the space science community involved in planning for scientific observations and research for the upcoming Apollo flights to the Moon stressed to NASA officials that their involvement in the missions should also extend to serving as crew members. Accordingly, they recommended by way of a Space Science Board study that Ph.D. scientists be included in the lunar missions.[8] Noting that humans possessed judgment and ability unlike what any machine could offer, the Board's report concluded that scientifically trained astronauts proved essential to exploration of the moon and the planets. The Board also recommended that current pilot astronauts also be given scientific training.[9]

While some current astronauts argued that the supplemental training would indeed qualify them to fulfill research duties and obviate NASA's need for astronauts with scientific credentials, agency officials nonetheless accepted the idea of broadening the astronaut corps to include credentialed

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[7] For an in-depth history of NASA's involvement with scientists as astronauts, from Apollo to International Space Station missions, see David J. Shayler and Colin Burgess, *NASA's Scientist Astronauts* (New York: Springer-Praxis, 2007).

[8] Hugh L. Dryden to Evan H. Walker, October 16, 1962, Folder 8947, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; National Research Council, Space Science Board, *A Review of Space Research* (Washington, DC: National Academy Press, 1962).

[9] W. David Compton and Charles D. Benson, *Living and Working in Space: A History of Skylab*, NASA SP-4208 (Washington, DC: U.S. Government Printing Office, 1983), 65.

scientists.[10] In 1964 the agency made plans to include a "scientist-astronaut" on each Apollo lunar landing flight crew and in October of that year began soliciting applications.[11] According to criteria developed by NASA's Office of Manned Space Flight, the Manned Spacecraft Center (later renamed the Lyndon B. Johnson Space Center), the Office of Space Science and Applications, and the National Academy of Sciences, candidates would need to possess a doctorate or equivalent experience in a science, be less than 34 years old, and – like pilot astronauts – have 20/20 uncorrected vision and be able to pass a class I military flight status physical.[12] More than 1000 individuals applied. NASA sent dossiers of 400 of the applicants to a special committee of the National Academy of Sciences for review for scientific potential and received back recommendations for 16 nominees. From these, NASA chose six: one geologist, two physicians, and three physicists.[13] In 1966 the agency undertook a second round of scientist-astronaut selections and, using a similar process, chose 11 from another pool of nearly 1000 applicants.[14]

In practice, however, the agency was not committed to broadening its human space flight missions to these new types of astronauts. In his study of the development of the American astronaut profession, historian Matthew H. Hersch concludes that while NASA offered "public pronouncements of support" for scientist-astronauts, the agency "accorded them less respect [than pilot astronauts] and

[10] John W. Finney, "NASA to Recruit Scientists to Fly with Astronauts," *New York Times*, October 18, 1964, 1, Folder 8954, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[11] "Scientist Astronauts," March 13, 1964, Folder 8954, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[12] NASA, "NASA Reports Some 900 Persons Interested in Scientist-Astronaut Program," news release 64-315, December 16, 1964, Folder 8954, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[13] NASA, "NASA Selects Six Scientists-Astronauts for Apollo Program," news release 65-212, June 28, 1965, Folder 8954, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[14] NASA, "Eleven Civilian Scientist-Astronauts Join NASA Team," news release 67-211, August 4, 1967, Folder 8956, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

addressed scientific interests in a haphazard fashion."[15] Despite support from the agency's space science proponents, mission managers and astronauts at the Manned Spacecraft Center were not overly enthusiastic about the scientists' arrival. With the number of scheduled Apollo lunar landing missions countable on two hands, the Astronaut Office's chief, Deke Slayton, told the new recruits not to expect flights.[16] Nonetheless, bowing to pressure from NASA deputy administrator George Low, who was sympathetic to vocal advocates in the National Academy of Sciences, mission planners assigned geologist Harrison Schmitt, one of the original scientist-astronauts, to Apollo 17, the last of the Apollo missions. Another three of the original scientist-astronauts – Joseph Kerwin, Owen Garriott, and Edward Gibson – flew on each of the three Skylab missions launched in 1973. This move made practical sense given the research emphasis of the program. Beyond Skylab, however, it would be years before the Shuttle was ready to fly and NASA could make mission assignments for its other scientist-astronauts. NASA found interim assignments for some to support various programs and functions around the agency, but several resigned out of frustration when future opportunities looked so bleak.[17]

As Shuttle program planning got into swing, NASA officials established a subcommittee of its Space Program Advisory Council to review the effectiveness and value of having scientist-astronauts remain a part of NASA's cadre of career space flyers and to make recommendations for their involvement in the Shuttle program.[18] The question centered on two issues: whether scientists ought to fly at all on the Shuttle, and whether NASA needed to include individuals with such expertise within its ranks of

[15] Matthew H. Hersch, *Inventing the American Astronaut* (New York: Palgrave Macmillan, 2012), 149.

[16] Joseph P. Allen, interview by Jennifer Ross-Nazzal, Washington, DC, March 16, 2004, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 4, 2015, http://www.jsc.nasa.gov/history/oral_histories/AllenJP/AllenJP_3-16-04.pdf.

[17] Homer E. Newell, "Meeting at Houston between Headquarters and Houston Management and the Scientist-Astronauts on April 8, 1971," April 19, 1971, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[18] "Report on the Subcommittee on Scientists Astronauts of the NASA Space Program Advisory Council," 1975, quoted in Hersch, *Inventing the American Astronaut*, 148.

professional astronauts, as so-called "mission specialists," when it might instead allow researchers and technicians outside of the agency ("payload specialists") to fly with their payloads as needed. Addressing the first issue, the new subcommittee, chaired by NASA's science chief Homer Newell, perhaps unsurprisingly advised NASA not only to continue but to expand the agency's use of scientists as astronauts "in consonance with space shuttle science and applications needs."[19] The subcommittee further opined that NASA should organize itself to "reflect appreciation and approval of science and its support."[20] NASA acting associate administrator John Naugle, also a scientist, concurred with the subcommittee's assessment, noting that the "Space Shuttle offers great potential for the conduct of a wide variety of significant scientific experiments in space, and the utilization of man adds a major increment in scientific capability. Your study has shown how the scientist astronaut, bridging the sometimes wide gap between scientific and flight operations points of view, can contribute to a productive Space Shuttle science program."[21]

Debate about the second issue ensued for several years, with NASA officials differing over the relative roles and responsibilities of and criteria for determining when to use career astronauts versus customer-appointed flyers.[22] As they all generally agreed, however, with the Space Program Advisory Council subcommittee's recommendation that NASA include mission specialists on Shuttle missions to liaise between and integrate payload and flight operations, the agency adopted plans to fly at least one mission specialist on each Shuttle flight to have responsibility for the coordination and management of

[19] Frederick Seitz, "Letter to George M. Low," September 8, 1975, Folder 4159, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[20] Nathaniel B. Cohen to distribution, "Transmittal of Minutes of January 15, 1975, SPAC Ad Hoc Subcommittee on Scientist Astronauts Meeting," with attachment, April 3, 1975, Folder 8948, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, 4.

[21] John E. Naugle to Charles Berry, June 27, 1975, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[22] This debate is captured more fully in the next section of this chapter.

Shuttle resources to support the carried payloads.[23] Given the array of payloads that NASA officials anticipated the Shuttle might fly, they envisioned mission specialists coming from life and physical science disciplines, to include individuals with medicine and engineering backgrounds, but operating onboard as generalists. While Johnson Space Center director Christopher Kraft wanted to require that they hold Ph.D.s, Yardley decided NASA would accept applicants with a minimum of a bachelor's degree.[24] These career NASA astronauts would receive more training than the transient payload specialists and would require gaining familiarity with the Shuttle's operating systems but would not need pilot training as their Apollo-era predecessors did.[25] The agency would also relax the medical standards for these astronauts, as they would not be directly responsible for mission safety as would the pilots who would fly the Shuttle and also because the Shuttle would subject riders to less strenuous forces of acceleration during launch and reentry than previous spacecraft. Unlike the original scientist-astronaut standards, the Shuttle mission specialists would need to be able to pass a NASA class II, not class I, space flight physical; have 20/100 visual acuity correctable to 20/20 in each eye, and be of any age. As NASA's director for life sciences David Winter stated," Our aim is to get the best qualified scientists that we can into space and bring them back safely….Therefore, our approach must be to broaden the medical criteria as widely as we safely can."[26]

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[23] "Summary Minutes of the SPAC Ad Hoc Subcommittee on Scientist Astronauts, January 15, 1975," 2, attached to Cohen to distribution, "Transmittal of Minutes of January 15, 1975, SPAC Ad Hoc Subcommittee on Scientist Astronauts Meeting," April 3, 1975, Folder 8948, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, *Opportunities as Candidates for Mission Specialist Astronauts*, n.d., Folder 8946, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Payload Specialists for NASA or NASA-Related Payloads, 43 *Federal Register* 9790 (March 10, 1978) (amending 14 C.F.R. pt. 1214).

[24] T. A. Heppenheimer, *History of the Space Shuttle, Volume 2: Development of the Shuttle, 1972-1981* (Washington: Smithsonian Institution Press, 2002), 390.

[25] Christopher C. Kraft, Jr., to John E. Naugle, September 3, 1976, Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[26] NASA, "Requirements May Ease for Shuttle Non-Pilot Crew Members," news release 75-79, March 24, 1975, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

In 1976 Kraft transferred the agency's ten remaining Apollo-era scientist-astronauts to a new Office of Mission Specialists. Later that year, NASA issued its first call for astronauts in more than a decade, noting that the agency sought to add at least 15 new mission specialists to its ranks. No longer involving the National Academy of Sciences, NASA's recruitment and selection process was driven by agency managers, astronauts, and discipline specialists, who ultimately chose 20 mission specialist candidates representing a wide range of scientific and technical expertises from civilian as well as defense organizations.[27] NASA announced them, along with 15 newly selected pilots, in January 1978. Determined to avoid giving them the unsatisfying experience the scientist-astronauts had endured after their selections, Kraft wrote to John Naugle that it was his desire "to give the mission specialists visibility in the Shuttle Program" and to keep them "competent and content professionally."[28] NASA's call for mission candidates suggested that they would be given the opportunity to continue working in their research fields and possibly be able to conduct their own experiments aboard the Shuttle.[29] While the new mission specialists' hectic schedules as astronauts did not allow them the time to keep up with their previous research careers, NASA delivered on giving them active roles in the Shuttle program. Upon successful completion of a two-year training and evaluation period, the candidates were converted to active career status, assigned to, and then trained for specific missions.[30]

[27] NASA Astronaut Candidate Recruitment and Selection Program, 44 *Federal Register* 36024 (June 20, 1979) (amending 14 C.F.R. pt. 1214); NASA, "NASA Selects 35 Astronaut Candidates," news release 78-7, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[28] Kraft to Naugle, September 3, 1976.

[29] NASA, *Opportunities as Candidates for Mission Specialist Astronauts*.

[30] NASA, *Opportunities as Candidates for Mission Specialist Astronauts*. Military candidates' tour length as astronauts would be worked by agreement between NASA and the Department of Defense. According to a 1983 astronaut recruitment brochure, by the 1983 astronaut selection cycle, NASA reduced mission specialist training and evaluation period to one year. See NASA/Lyndon B. Johnson Space Center, *Announcement No. 3ACS-83 for Mission Specialist and Pilot Astronaut Candidates*, 1983, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

After NASA completed four orbital flight tests of the Shuttle system, STS-5 flew in 1983 with two of the scientist-astronauts selected in the 1960s, Joe Allen and Bill Lenoir, as mission specialists, who deployed the first commercial satellites from the Shuttle's payload bay. In June 1983, STS-7 carried three mission specialists, all drawn from NASA's latest class. This new breed of space flyer would be part of every astronaut selection cycle and every Shuttle mission crew throughout the program's three decades of operations. Expanding the astronaut corps' professional diversity was thus one way in which NASA helped to realize the vision it had established for the Shuttle as a vehicle that would serve to democratize and expand the relevance and accessibility of human space flight.

For most outside observers, however, NASA's 1978 astronaut class reflected yet another, more palpable and socially significant shift in its approach to astronaut selections. The thirty-five new recruits, for the first time in NASA's history of hitherto all male, Caucasian astronauts, included among them six women, three African Americans, and one American of Japanese origin. Finally, NASA's astronaut corps would resemble the diverse gender, racial, and ethnic makeup of the nation the Shuttle served. Social, political, and legal developments and pressures on the agency to establish diversity in the workplace helped to drive NASA's inclusion of these publics in its ranks as flyers. Agency managers would take steps to ensure that it provided citizens with opportunities to become astronauts regardless of these demographics differences. Meanwhile, they believed that ensuring that flyers conformed to these evolving public attitudes and standards would help the agency make human space flight relatable to all Americans.

Also like the situation in which scientist-astronauts found themselves, the journey to NASA's inclusion of women and minorities in its ranks of flyers dated back to the 1960s. NASA had made the Mercury, Gemini, and Apollo astronauts the centerpieces of the human space flight program. The agency's public affairs officers lined up appearances for them around the country, and facilitated media access to them, including setting up a contract with *Life* magazine for the astronauts to share their

personal stories on an exclusive basis.[31] Given the intense publicity NASA afforded the spacemen, as historian Henry Dethloff has expressed, "In the public's mind, the astronaut was what NASA and space were all about."[32] At the same time, all of this publicity starkly highlighted the homogeneity of NASA's Caucasian male astronauts. In an era of civil and women's rights movements, NASA was hardly exempt from questions by members of the public, civic groups, and the Congress about the lack of racial and gender diversity in its workforce, including the astronaut corps. Why, many people queried NASA, had the agency not selected a female or black astronaut? The matter certainly could not be said to be one of inherent competence: the Soviets, after all, flew Valentina Tereshkova and brought her safely back to Earth in June 1963. Additionally, thirteen American female pilots had, under a private program partly funded by one of the women's husbands in the early 1960s, passed the same physiological tests that NASA had administered to male candidates.[33]

Where women were concerned, some NASA personnel and elected officials offered misogynistic reasons for their exclusion from the astronaut corps. According to Brian Duff, who came to head NASA's public affairs office in the 1980, "it took a long time to get women in the position of trust in the astronaut program, unless they were nurses, dieticians, or in other traditional roles."[34] Indeed, beyond such positions, only Frances (Poppy) Northcutt was more closely connected to human space flight in the

[31] See chapter 4 of James L. Kauffman, *Selling Outer Space: Kennedy, the Media, and Funding for Project Apollo, 1961-1963* (Tuscaloosa, AL: The University of Alabama Press, 1994). NASA received a fair amount of criticism from other media outlets about its commitment to preserving a policy of open communications when it contracted with *Life*.

[32] Henry Dethloff, *Suddenly, Tomorrow Came…A History of the Johnson Space Center*, NASA SP-4307 (Washington, DC: U.S. Government Printing Office, 1993), 117.

[33] For more on this program, see Margaret A. Weitekamp, *Right Stuff, Wrong Sex: America's First Women in Space Program* (Baltimore, MD: Johns Hopkins University Press, 2004).

[34] Brian Duff, interview by John Mauer, May 24, 1989, transcript, Glennan-Webb-Seamans Project, Smithsonian National Air and Space Museum, Washington, DC.

1960s, serving as NASA's sole female flight controller in mission control during the Apollo program.[35] Duff continued, "A number of the old NASA people fought that movement and predicted all sorts of bad things would happen if women flew."[36] Apollo 8 astronaut Frank Borman, for one, stated that women "would have caused more problems than they would have been worth" on early flights, while Senator Clinton Anderson believed NASA needed to learn more about space flight we needed to learn more "before we hazard a woman in space."[37] As late as 1970, NASA physician Charles Berry asserted that having women accompany men on long space trips might be "more comfortable" and "more normal," but that more research would be needed to be sure it would indeed be better for women to go than not.[38]

For the most part, however, NASA officials justified the composition of the astronaut corps on the grounds of getting the job of beating the Soviets to the Moon done as efficiently as possible. They contended that they had established specific criteria for astronauts – namely, engineering educations and extensive experience with high-performance aircraft – but that no woman or minority applicant had come to the fore with those qualifications. "There is no discrimination whatever against candidates of any race, color, or creed.…If a qualified Negro candidate volunteers for service as an astronaut," NASA public affairs assistant administrator George Simpson wrote in a 1962 letter to Miss Joan Duge of Williamsville, New York, "you may be sure that he will receive equal consideration with other candidates."[39] Likewise,

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[35] Mary Lu Zuber, "There's Space for Women," *Houston Chronicle*, January 25, 1970, Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[36] Duff, interview, May 24, 1989.

[37] Frank Macomber, "With Man on Moon, Can Space Lady Be Far Behind," *San Jose Mercury*, July 26, 1972; "Women Aid Astronauts, Not Yet Needed in Spacecraft," *Telegram* (Bridgeport, CT), June 26, 1963. Both articles located in Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[38] "Women May Share Man's Space Trips," *Huntsville News*, February 10, 1970, Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[39] Simpson to Duge, October 11, 1962, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. According to a memorandum written by H. E. Van Ness, assistant director for manned space flight operations in NASA's Office of Manned Space Flight, no Negro civilian applicants met the minimum criteria for astronaut selection, and an Army test pilot qualified but was not recommended by the Army due to "disciplinary problems." However, a 1974 *Los Angeles Times* article suggests African American U.S. Air Force Captain Edward Dwight was recommended by the Air Force but that NASA passed over him. See H. E. Van Ness, "Status of Negro

NASA's Julian Scheer responded to a query from Virginia Allan, president of the National Federation of Business and Professional Women's Club, that "NASA has no policy of keeping women out of the astronaut program. However no woman has as yet met all the stringent qualifications which NASA has established for astronaut trainees." Scheer continued: "NASA has erected no barriers against women in space; we are instead trying to establish the most effective program possible."[40] Aviatrix Jerrie Cobb testified before a House select subcommittee on astronaut selection that NASA had discriminated against her and the other females who had proved able to pass the agency's medical tests. The agency, however, held to the view that it needed not just pilots but individuals with test operations experience who could participate in flight planning and design activities.[41] It was this broader package of qualifications that constituted the "right stuff" for the agency's astronaut corps. With so few women and minorities graduating with science and engineering college degrees and as military test pilots, it was no wonder why the few females and African Americans who did apply during that era failed to break in: the standards *were* the barriers and NASA seemed unwilling, at the time, to take them down.

By the early 1970s, NASA could no longer explain away the absence of women or minorities in its astronaut corps under the instrumental rubric of needing to find the best people for the job. The agency had reached the Moon. While billions of people around the nation and the world had marveled at the achievement, plans to complete all of the scheduled lunar landing missions were on shaky ground as the nation was financially and politically consumed with its involvement in Vietnam, and social issues such as urban growth and poverty demanded attention and resources. Meanwhile, the women's and civil rights movements had moved forward with vigor. The Apollo program increasingly seemed like an

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Applicants for Astronaut Selection," July 9, 1962, and J. K. Obatala, "We Need to Correct a Space Age Injustice: America Can Still Have a Black Astronaut," *Los Angeles Times*, March 21, 1974. Both documents located in Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[40] Julian Scheer to Virginia Allan, August 28, 1963, Folder 8996, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[41] Hugh L. Dryden to John W. Wydler, July 1, 1963, Folder 8996, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

anachronism, with the uniform whiteness and military image of the majority of the astronauts – the initiative's most visible representatives – only further suggesting that NASA was out of step with the times. As Matthew Hersch has pointed out, "astronauts constructed as humorless Cold Warriors no longer held the same appeal to the American public."[42]

Many journalists and pundits raised this concern. Joseph Morgenstern raised the issue days before the Apollo 11 launch in a *Newsweek* piece questioning the value of Apollo from the perspective of "groundbound bystanders." Morgenstern asked: "Are the astronauts really representative of humankind and the dreams of humankind, when they are white, male, and American?…Do they instead connote a sense of domination, as 'cowboys in a new uniform'?"[43] A 1974 *Los Angeles Times* article by J. K. Obatala entitled "America Can Still Have a Black Astronaut" suggested that the zeitgeist necessitated a change in NASA's selection process:

> [E]veryone foots the bill for the space program, and so NASA has an obligation to include all segments of society. It is understandable why, up to now, this issue has been soft-pedaled by both blacks and whites… For blacks, the primary concern has been with such down-to-earth problems as jobs, housing, education and electoral politics. For America, as a whole, the sheer drama of manned space flight has tended to overshadow the exclusionary policies of the program's administrators. Now the drama and excitement have ebbed, but the space program is here to stay… Mars and the moon are as much a part of America's future as are Madison Ave., Hollywood Blvd., and the Mississippi Delta. From now on, it is essential that the standard of social equality is carried aloft whenever – and wherever – America may explore.[44]

Science fiction writer and thought leader Isaac Asimov, meanwhile, registered his view in the *Boston Globe* that NASA should "call off" the space program if the agency was unwilling to accept female

[42] Hersch, *Inventing the American Astronaut*, 134.

[43] Joseph Morgenstern, "What's It to Us?" *Newsweek*, July 7, 1969, 64, 67, 68.

[44] Obatala, "We Need to Correct a Space Age Injustice."

astronauts, as women were "biologically sounder" and "more resistant to stress and less subject to a variety of metabolic diseases" than men.[45]

In addition to these normative and instrumental impetuses, legal ones bore down on the agency. The civil rights and women's movements of the 1960s had given way to a set of policies and legislative measures intended to ensure that all citizens received equality treatment on many fronts including in federal government hiring practices. Like other federal agencies, NASA responded to the various directives for affirmative action, taking steps to increase the involvement of minority-owned business firms in government procurements and inviting minority university participation in NASA research opportunities. The agency established an Equal Employment Opportunity (EEO) office in 1972 in response to the passage that year of the EEO amendment to the 1964 Civil Rights Act. NASA's responses, however, proved unsatisfactory to many. Around the time of the EEO amendment's passage, NASA was sued, along 15 other federal agencies, for discriminatory hiring practices in Alabama.[46] NASA's EEO office released a report in 1973 calling the agency's affirmative action efforts a "near-total failure." In contrast with the federal government's average minority composition of 20 percent, NASA came in with 5.1 percent, the lowest representation of all agencies; women at NASA, meanwhile, were primarily hired for clerical jobs.[47] Members of Congress had little tolerance for NASA's hiring practices. Despite NASA's claim in a January 1974 Senate hearing that a decline in NASA's overall ability to hire following the Apollo peak and an inability to offer salaries on par with private industry precluded the agency from attracting and hiring from the limited pool of women and minorities scientists and engineers,

[45] "A Plea for U.S. Spacewomen," *Boston Globe*, February 23, 1971, Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[46] Ruth Bates Harris to Robert J. Brown, May 30, 1972, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[47] "NASA Defends Lag on Women's Jobs," *New York Times*, January 12, 1974, Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

legislators concluded that NASA had an undeniable record of discrimination.[48] NASA's failure to accept any minorities or women into the astronaut corps was at the center of some Congressional criticisms. New York congressman Charles Rangel asked the Federal Civil Rights Commission in 1972 to conduct an investigation into NASA's failure to accept any minorities or women as astronauts while Senator William Proxmire of Wisconsin took up the matter in a 1975 hearing.[49]

NASA was not quite ready to hire new astronauts in the early 1970s: the Shuttle was at least several years away from flight readiness at that point and its requirements, and thus its personnel needs, were not fully understood. But NASA's top officials recognized that the social milieu required a new approach to hiring, including in the selection of Shuttle astronauts when the time came, that would value not only qualifications but also social diversity. In addition to redoubling efforts to recruit and provide career growth and leadership opportunities for women and minorities across NASA's science and engineering workforce, Administrator Jim Fletcher made clear, purposeful public statements that "both blacks and women will fly" aboard the Shuttle.[50] In March 1972 Fletcher informed attendees at an EEO conference at Kennedy Center that NASA was "working on plans to get members of minority groups into space" using the Shuttle.[51] NASA assistant administrator for EEO Dudley McConnell responded to public letters about astronaut corps diversity. "We fully expect that flight crews aboard our Shuttle will be representative of all people both male and female – minority and nonminority," he replied to a Virginia

[48] Ibid.; NASA, *Wings in Orbit: Scientific and Engineering Legacies of the Space Shuttle*, eds. Wayne Hale, Helen Lane, Gail Chapline, and Kamlesh Lulla, NASA SP-2010-3409 (Washington, DC: U.S. Government Printing Office, 2010), 462.

[49] Hersch, *Inventing the American Astronaut*, 155.

[50] NASA, "NASA Administrator Cites Equal Employment Advances," news release 74-133, Folder 4215, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; James C. Fletcher to Earle F. Kyle, Jr., November 23, 1971, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[51] Ruth Bates Harris, March 7, 1972, with attachment, "Remarks by NASA Administrator Dr. James C. Fletcher at the Equal Employment Opportunity Conference, Kennedy Space Center, March 2, 1972," 5, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000038126.pdf.

man, adding: "We feel that the provision of true equal opportunity is not only our moral responsibility but also our duty; it is something that is right."[52]

The agency also indicated steps it was actively taking to change its astronaut corps demographics. In a letter to Gemma Arnott of South Carolina, McConnell noted that "the Space Shuttle is specifically being designed to accommodate both male and female flight-crew members." McConnell undoubtedly was referring to the Shuttle toilet, which NASA was indeed exploring ways to make usable by members of both sexes.[53] Meanwhile, beginning in 1973 NASA's Ames Research Center recruited women for horizontal bed-rest and centrifuge studies to understand the physiological impacts of the gravity changes one would experience during launch and reentry and on orbit during a Shuttle flight. Following similar studies conducted with men, the first phase involved 12 Air Force nurses of 20-35 years of age, while a 1977 study involved women 35-45 years old from a variety of professional backgrounds.[54] Intending to use the results to develop medical standards for Shuttle passengers of both sexes and also to establish norms for "ordinary human beings" who might one day live and work in space, the researchers found no inherent issues to prohibit women from flying aboard the Shuttle.[55] In both words and actions, NASA was moving toward accepting a broader range of Americans as participants in the Shuttle program.[56]

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[52] Dudley G. McConnell to Vernon A. Burford, April 22, 1974, Folder 8996, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[53] Dudley G. McConnell to Gemma Arnott, April 19, 1974, Folder 8996, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Bathroom Commode Design for Space Shuttle Passengers," news release 72-163, August 9, 1972, Folder 8994, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[54] NASA, "Women as Shuttle Passengers under Study," news release 73-185, September 17, 1973; NASA, "Bay Area Women in Space Tests," news release 77-15, March 24, 1977. Both documents located in Folder 8994, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[55] NASA, "Women to Begin Tests to Assess Fitness for Space Travel," news release 77-74, April 7, 1977, Folder 8994, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Heppenheimer, *History of the Space Shuttle, Volume 2*, 388.

[56] Even still, uses of male-oriented language lingered for some time. For example, a 1974 NASA overview of the Shuttle uses the language "crewmen" and contains a sketch of four men in the orbiter's flight deck. See NASA, *Space Shuttle Program Overview* (Washington, DC: U.S. Government Printing Office, 1974), 10, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-

While NASA was committed to the concept that women and minorities would fly on the Shuttle, the agency nonetheless faced the challenge of determining how to go about achieving affirmative action in the astronaut corps. There was a strong conviction among many in NASA connected closely to the human space flight program that the agency could not, and should not, compromise its emphasis on technical qualifications for astronaut positions for the sake of social diversity. George Low's 1973 reply to an inquiry by Brian King of the Associated Press about NASA's plans to democratize the astronaut corps indicated that the agency would focus on social diversity with the Shuttle program but would continue to accept only technically qualified individuals.[57] Christopher Kraft responded to a request by Fletcher and Associate Administrator for Manned Space Flight, Dale Myers, to develop a plan for NASA's next astronaut selection "with full consideration to be given to minority groups and women" by stating that the "primary consideration" for selection should remain "personnel with the capabilities necessary" and that "no distinction" should be made regarding sex, race, or ethnicity.[58] NASA public affairs director John Donnelly recognized the importance of achieving both social diversity and maintaining technical standards. In 1974 he advised Fletcher that "it may be time for us to go out and get ourselves a black astronaut from the Air Force or Navy" as a "visible means of demonstrating NASA's commitment to EEO" and to generate a "favorable response in the minority community and among some of our congressional critics." Concurrently, Donnelly noted that NASA would need to make sure the selected individual was "as well qualified as possible" to "minimize the potential backlash based on the idea that this is a publicity gimmick." He suggested that the agency could request that military agencies loan to NASA several pilots, including at least one black pilot, to assist with Shuttle flight planning such

Clear Lake, Houston, TX. NASA eventually withdrew completely from formally using the term "manned," but the adjective still appears with regularity in external works discussing the human space program, particularly when other, non-gendered terms do not seem to fit naturally in speech or narrative text.

[57] Hersch, *Inventing the American Astronaut*, 155.

[58] Dale D. Myers to Christopher C. Kraft, "Future Astronaut Selection," September 26, 1972, Folder 8996, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Kraft to Myers, November 3, 1972, Folder 8946, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

that NASA could evaluate the individual's qualifications before permanently naming him (Donnelly stated it would be a "him") to the astronaut corps.[59]

NASA did not follow through with Donnelly's specific suggestion. But later in 1974, Fletcher asked Rocco Petrone, NASA's associate administrator, to "develop a sequence of events on NASA's employment or use of black and female flight crew astronauts or scientist astronauts" by the start of 1975.[60] During the course of the year, Associate Administrator for Space Flight John Yardley worked with Kraft to develop plan for the upcoming astronaut selection. By the end of that year, Yardley submitted a proposed plan for the administrator's office to review. Deputy Administrator George Low told Yardley that while the plan was generally "most satisfactory," it failed to "indicate a method for insuring application by minorities and/or women" in the call for pilots or mission specialists. "I am sure that you are aware of the importance to NASA that every opportunity be presented to these potential candidates to encourage application, and if qualified, selection," Low stated, requesting that Yardley return with a plan to "solve this problem."[61] The revised plan, which Kraft sent to Yardley in March 1976, called for NASA to establish selection board panels for pilots and mission specialists which included Johnson's EEO office head Joseph Atkinson, who was an African American, and Carolyn Huntoon, Johnson's senior-most female manager.[62]

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[59] John P. Donnelly to A/Administrator (Fletcher), "Black Astronaut," April 24, 1974, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Donnelly may have recalled that African-American U.S. Air Force Major Robert Lawrence had been selected as part of the Air Force's Manned Orbiting Laboratory (MOL) astronaut corps but had been killed in a 1967 flying accident or else likely would have been transferred to NASA in 1969 along with the other MOL astronauts when the Air Force cancelled the MOL program. Donnelly makes this point in Donnelly to Elizabeth A. Cooper, July 13, 1972, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[60] Henry E. Clements to AA/Associate Administrator (Petrone) and AAD/Deputy Associate Administrator, "Black and Female Astronauts," Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[61] George M. Low to M/Associate Administrator for Space Flight (Yardley), "Astronaut Selection Program," December 15, 1975, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[62] Heppenheimer, *History of the Space Shuttle, Volume 2*, 389.

Rather than sacrificing its commitment to hiring pilots, engineers, and scientists, NASA devised a solution to its conundrum in the form of its "Shuttle Astronaut Recruitment Program." The agency kicked off the process in July 1976 by releasing a press announcement about the call for new astronauts which stated: "NASA is committed to an affirmative action program with a goal of having qualified minorities and women among the newly selected astronaut candidates. Therefore, minority and women candidates are encouraged to apply."[63] But NASA officials recognized that they could not expect to recruit women and minorities simply by sending information packets in response to inquiries they received; rather NASA would need to announce its requirement for new astronauts as broadly as it could, targeting minorities and women with the credentials the agency sought in the places NASA thought it could best reach them. Even women and minorities with scientific training were skeptical about career prospects in space, tended instead to gravitate to professions in fields such as medicine.[64] For example, shortly after NASA released its call for astronaut applications, Fletcher contacted the Tuskegee Airmen to help NASA locate qualified candidates as their annual convention approached.[65] The agency also interviewed its co-op students and sent letters and brochures to nearly a thousand colleges and universities asking for their assistance in referring potentially qualified female and minority students to NASA.[66]

By the end of 1976, however, the response to the announcement by females and minorities had been "less than satisfactory" according to Alfred Clinkscales, manager of NASA's equal opportunity professional recruiting office.[67] Indeed, these groups seemed reluctant to believe NASA's commitment to

[63] NASA, "NASA to Recruit Space Shuttle Astronauts," news release 76-122, July 8, 1976, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[64] Duff, interview, May 24, 1989.

[65] James C. Fletcher to Tuskegee Airmen, Inc., Attending Their Annual Convention in Philadelphia, August 18, 1976, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[66] QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to QP/Director of Personnel, "Project Status Report for QP-1," January 5, 1977, Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Heppenheimer, *History of the Space Shuttle, Volume 2*, 389.

[67] QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to distribution: regional coordinators, "Recruitment for Space Shuttle Astronauts," November 23, 1976, Folder 8959, NASA Historical

incorporating them into the astronaut corps. As Fletcher put it, "blacks thought they weren't wanted so they didn't apply."[68] Clinkscales asked recruitment coordinators at each of NASA's field centers to make minority and female recruitment for astronaut positions their highest priority and sought their ideas for an "all out recruitment effort," convening a meeting in January 1977 at NASA Headquarters to discuss ways to redouble Shuttle recruitment advertising and publicity.[69] The agency's personnel office set an ambitious schedule of visits to colleges and universities with high female and minority enrollments and continued to seek school officials' referrals of promising students, whom NASA recruiters contacted directly to encourage them to apply and followed up with reminder calls as the June 30 deadline approached.[70] The agency contacted ninety aerospace companies asking for their assistance with identifying qualified individuals.[71] Recruiters also focused on specific minority groups. For example, Hispanic outreach alone consisted of making contacts through the League of United Latin American Citizens and other major Hispanic organizations and magazines such as *La Luz*, appearing at Hispanic conventions, and conducting recruitment campaigns in southwestern states, California, and Puerto Rico.[72] The agency aimed to reach black candidates through the NAACP, placing ads in *Ebony*, *Black Enterprise*, and searching the names listed in *Black Engineers in the U.S.* and *Who's Who among Black Americans*.

Reference Collection, NASA Headquarters, Washington, DC. Clinkscales' letter did not provide total numbers of applicants to date, but perhaps the lack of women and minority responses to the call should not have been surprising given that the application deadline was still more than six months away.

[68] Atkinson and Shafritz, *The Real Stuff*, 156.

[69] QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to QP/Director of Personnel, "Project Status Report for QP-1."

[70] QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to QP/Director of Personnel, "Activity Report for QP-1," March 11, 1977; QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to QP/Director of Personnel, "Status Report for QP-1," March 28, 1977. Both documents located in Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[71] Heppenheimer, *History of the Space Shuttle, Volume 2*, 389.

[72] Ibid.; Joseph P. Allen to Alan Cranston, July 12, 1978, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Women were sought through the Society of Women Engineers and the American Association of University Women among other organizations.[73]

NASA found one of its most potent recruitment assets in the realm of science fiction. Nichelle Nichols, who had played Lieutenant Uhura, the communications officer aboard the Federal Starship Enterprise on the *Star Trek* television series, proved passionate about the real-life NASA space program as well as educational advancements of women and minorities in science and engineering fields. A black actress claiming a mixed racial heritage, Nichols had given a speech at the annual meeting of the National Space Institute, where she was a board member, calling attention to the dearth of women and minorities in NASA's astronaut corps, which she attributed to these groups' fear, apathy, and lack of information regarding opportunities to participate. Recognizing her credibility and visibility not only with *Star Trek* fans but also as a role model for minority youth and women, NASA officials asked her for assistance with the task of attracting female and minority applicants. In February 1977 the agency contracted with Nichols to serve as its spokesperson with the aim of convincing these groups that NASA was serious about wanting their participation in the astronaut corps.[74] Over the course of her six-month agreement with NASA, Nichols appeared on nearly three dozen major television and radio talk shows geared toward general as well as women and minority audiences.[75] She also recorded several public service radio spots at the agency's request.

Nichols' message simply and clearly vocalized NASA's imaginary for the Shuttle: space is for everyone. "There were no social barriers on the Starship Enterprise…men and women…all races and ideologies," one public service announcement script read. "That's the way NASA wants it with its new

[73] Heppenheimer, *History of the Space Shuttle, Volume 2*, 389.

[74] NASA, "Television Celebrity to Help NASA Recruit Shuttle Astronauts," news release 77-32, February 24, 1977, Folder 8935, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[75] Women in Motion, Inc., Final Report for NASA, August 10, 1977, 12-13, Folder 8935, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Space Shuttle program."[76] Visiting colleges and aerospace companies, she sought to persuade female and minority scientists and engineers that NASA had changed its ways. She explained that while NASA was guilty of "ingrained, institutionalized racism" in its previous astronaut selection processes as a byproduct of its quest to find the best science and engineering talent to win the race to the Moon, the agency was now offering a "tremendous opportunity" for women and men of color that would enable them to become role models for those with similar backgrounds.[77]

NASA's massive recruitment campaign had its intended effect. A total of 8079 individuals applied for pilot and mission specialist positions, including 1544 women and several hundred racial or ethnic minorities.[78] More than 20 percent of those who met the mission specialist qualifications were women and 6 percent were minorities.[79] NASA's announcement in January 1978 that its 35 new astronaut selectees included 6 women and 4 racial and ethnic minorities demonstrated to the agency as well as the American people that the agency was committed and able to find highly qualified female and minority astronaut candidates. Anna Fisher, Rhea Seddon, and Shannon Lucid came from the fields of medicine and the biological sciences, Sally Ride was a physicist, Judy Resnik held a Ph.D. in electrical engineering, and Kathryn Sullivan had a background in geology. As Kraft noted in a post-selection press conference, NASA found that many of the women selected "had prepared themselves to be astronauts. That is what they had set out to do. It just didn't occur to them" when NASA announced the

[76] "#2 NASA Public Service Announcement, N. Nichols," with cover memo, June 24, 1977, Folder 8935, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[77] Robert Churchwell, "Star Trek's Uhura Fights Racism in NASA," *Nashville Banner*, March 18, 1977; "Sample Presentation, Professional Organization" n.d. Both documents located in Folder 8935, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[78] NASA, "NASA Selects 35 Astronaut Candidates," news release 78-7, January 16, 1978, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; QP-1/Manager, Equal Opportunity Professional Recruiting Office (Alfred Clinkscales) to QP/Director of Personnel, "The Shuttle Program," June 15, 1977, Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Allen to Cranston, July 12, 1978.

[79] Heppenheimer, *History of the Space Shuttle, Volume 2*, 390.

opportunity.[80] African American Guion Bluford was an Air Force major and an aerospace engineer, Ronald McNair held a physics Ph.D., and Fred Gregory – the only pilot chosen among the women and minorities – was also an Air Force major. Ellison Onizuka, a Hawaiian of Japanese descent, served as a manager and engineer at the Air Force Test Pilot School in Southern California.

Both in discourse and in deeds, NASA made clear that social diversity and technical eligibility alike would be essential to shaping and carrying out the Shuttle program as the agency had characterized it. While eight women qualified for pilot positions, NASA ultimately selected none of them; of three Hispanics considered in the final reviews for mission specialists, the one who was considered medically suited also was not chosen.[81] When a *U.S. News and World Report* journalist asked Administrator Frosch at a post-selection press conference about whether NASA used a formula to determine the social, racial, and ethnic distribution of the selected candidates, Frosch replied that while NASA aimed to balance among the professional specialties of the mission specialists: "There was no formula. There was a very strong affirmative action program to get as many candidates as we could from as wide a selection of U.S. society as possible, and particularly to get both minority and women candidates. When it came to the selection process, there were no formulas applied."[82]

The news media lauded NASA's selection of minority and female astronaut candidates as a "humanizing of the astronauts" and approached it with a strong degree of enthusiastic curiosity. The women in particular were peppered with questions, which ranged from what they thought about the historical significance of their selections to somewhat prying questions about impact on their family lives

[80] NASA, "Space Shuttle Astronauts Press Conference," January 16, 1983, 13, Folder 8963, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[81] Heppenheimer, *History of the Space Shuttle, Volume 2*, 390.

[82] NASA, "Space Shuttle Astronauts Press Conference," 18-19.

and more trivial inquiries, such as how often they played racquetball each week.[83] While the latter questions surprised and downright aggravated some of the female astronaut candidates, the first elicited an insightful response from Sally Ride: "I think I owe a lot of the women's movement. I think I came along, from the point of view of my career, at an excellent time because the women's movement had already paved the way."[84] When Ride finally flew aboard STS-7 in June 1983, becoming the first American women in space, her flight, according to Henry Dethloff, "quelled a festering public relations problem that had plagued NASA since the early 1970s when women activists began to perceive NASA and the astronaut corps as a macho, male only, antifeminist organization."[85] Similarly, when Guion Bluford made history as the first African American in space, the Associated Press hailed the event as an "overdue breakthrough in the struggle for racial equality."[86] President Reagan offered praise as well, noting that Bluford's flight was "paving the way for many others" and showed that "we are in an era of brotherhood."[87]

NASA continued with its commitment to diversity in astronaut hiring in ensuing selection cycles. In July 1980 the agency chose from nearly 3000 applicants 19 new astronaut candidates: two female mission specialists, one black pilot, and its first Hispanic-American mission specialist, Franklin Chang-Diaz.[88] Years later, in 1985, NASA officials were still in active pursuit of women and minorities, with

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[83] Earl Lane, "Skylab [sic: Shuttle] Promises Humanized Astronauts," *Los Angeles Times*, November 12, 1978, Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[84] Jim Maloney, "Shuttle Precedents Secondary," *Houston Post,* April 30, 1982, 17A, Folder 8958, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[85] Dethloff, *Suddenly, Tomorrow Came*, 287.

[86] Associated Press, "Shuttle – Black Reaction," August 30, 1983, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[87] Bill Kling, "President Talks to Challenger Crew," *Washington Times*, September 1, 1983, 2A, Folder 8993, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[88] NASA, "2,937 Apply for Astronaut Positions," news release 79-175, December 13, 1979, Folder 8959, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "NASA Selects 19 Astronaut

Administrator James Beggs asking NASA personnel, agency contractors, and military sources to recommend qualified individuals from within their ranks.[89] On the ground, too, women and minorities entered significant positions related to the Shuttle program. By 1987 women held 10.2 percent of NASA civil service science and engineering jobs.[90] Mission control welcomed its first female Shuttle flight director in 1985, and its first black flight director (for the International Space Station), Kwatsi Alibaruho, in 2005. Trudy Tiedmann earned the place as NASA's first female commentator for the human space flight program, serving as the voice for the Shuttle ALT tests in 1977, while Kennedy Space Center spokesperson Lisa Malone became NASA's first female launch commentator in 1989.[91]

Even as NASA administrators successively continued to reaffirm their commitment to diversity hiring, they continued to experience pressure to do more to expand the agency's breadth of astronaut selections. One issue, which would pick up momentum in the 1990s, regarded the selection of physically disabled individuals for astronaut positions. Another involved concerns raised by members of Congress, the media, and citizens that NASA's astronaut selections favored applicants from military branches or NASA's own workforce. While 13 of the 20 mission specialists named in NASA's astronaut class of 1978 hailed from universities, industry, or medical institutions, the classes of 1984 and 1985 were entirely comprised of individuals with NASA or military backgrounds; physician Mae Jemison was the only candidate with alternate credentials in the 1987 class. An *Aviation Week & Space Technology* reader's letter to the editor expressed that this phenomenon "should be viewed with alarm by everyone who is

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Candidates," news release 80-78, May 29, 1980, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[89] James M. Beggs to Directors, NASA Field Installations, "Astronaut Candidate Recruiting," attached to cover memo, September 20, 1985, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[90] JoAnn H. Morgan and James M. Ragusa, "Women: A Key Work Force in Preparation for Space Flight," June 26, 1972, exhibit 3, Folder 8995, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[91] NASA, "NASA Features Woman Commentator for Shuttle Flights," news release 77-84, April 25, 1977, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021075.pdf.

interested in America's space program being an open one" and that NASA should reserve equal numbers of slots for outsiders and those connected to NASA and the military.[92] Congressman Manuel Lujan of New Mexico introduced an amendment to NASA's 1987 authorization act to direct NASA to make a greater effort to select candidates from industry, academia, and other government agencies, but the legislation died for other reasons.[93]

NASA defended its selections, which continued to include a majority of candidates from either NASA or military backgrounds throughout the Shuttle's lifetime, on the basis that people who aspired to be astronauts tended first to build careers in these institutions to gain the experience the agency most valued.[94] At the same time, the agency also tended to approach expansion of the astronaut corps with conservatism. The agency rejected an effort by the American Society of Aerospace Pilots, a group formed by United Airlines, to develop a two-year training course to prepare commercial pilots to fly the routine commercial Shuttle flights NASA touted would eventually become a reality. According to Johnson Space Center public affairs official Hal Stall, NASA had no plans to hire externally trained pilots because the Shuttle "may look like an airplane, but flying it is nowhere as simple."[95] NASA thus carefully weighed its promise that the Shuttle would be more inclusive against its sense that the agency needed to remain competent and responsible in managing the Shuttle program, taking the steps it deemed most prudent to achieve a comfortable balance.

Accommodating Outsiders with Their Payloads

[92] Al Stewart, letter to the editor, *Aviation Week & Space Technology*, September 9, 1985, 120.

[93] Philip M. Boffey, "Despite Numbers of Applicants, Few Civilians Are Selected As Astronauts," *New York Times*, August 17, 1987, A8, Folder 8946, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[94] Ibid.

[95] Kevin Shyne, "High School Grads Can Train to Fly Space Shuttle," *USA Today*, October 6, 1983, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

NASA made ostensible changes to the astronaut corps during the early years of the Shuttle program to staff flights with NASA astronauts with the right sets of skills to ensure the fulfillment of mission objectives and to conform to evolving social policies and attitudes. But as part of its effort to broaden the relevance of human space flight to more external publics, the agency set another precedent in whom it flew into space during the Shuttle program: it also invited individuals from outside the ranks of career astronauts to join particular missions. Since introducing the Shuttle concept, NASA touted in speeches, media interviews, and publicly distributed literature that the new vehicle would be capable of ferrying individuals apart from its astronaut corps to and from space to serve a variety of functions due to its spacious capacity and promise of a flight environment more benign than the space capsules of the past. The need to demonstrate the Shuttle's viability by attracting and demonstrating broad and meaningful uses, combined with expressions of interest from various entities outside of NASA in flying aboard the new vehicle, prompted NASA to change its status quo and lay plans to invite external individuals to participate as flyers on Shuttle missions.

The agency's efforts to accommodate non-NASA flyers aboard the Shuttle began with scientists who could fly aboard the Shuttle and the Spacelab module with their payloads. This initiative built upon Administrator Jim Fletcher's statement in a 1973 *Saturday Evening Post* article that "The Shuttle will open the laboratory of the space environment not just to specially trained astronauts, but to engineers, scientists, technicians and others who will be able to accompany their experiments into orbit."[96] Many members of the space science community had formally made clear their interest in operating their own research experiments in space beginning with the Space Science Board's 1962 summer study.[97] Several NASA officials embraced the idea that allowing scientific payload owners to fly with their experiments would incentivize their further interest in using the Shuttle and Spacelab facilities for research purposes,

[96] James C. Fletcher, "Coming – The Space Shuttle," *Saturday Evening Post*, May/June 1973, 68.

[97] National Research Council, *A Review of Space Research*.

boost the scientific return of these payloads, and validate the Shuttle's value to the nation. Although mission specialists could conceivably operate these payloads, sentiment emanated from NASA officials at Headquarters and among those close to the space science community that bringing aboard individuals to manage their own experiments would enhance mission success from both a scientific and a marketing perspective.

Thus, while NASA officials formulated the concept of the Shuttle mission specialist to integrate flight and payload operations, they also began discussing the concept of a "payload specialist" – an individual who would not join the agency's corps of career astronauts but would fly to support a specific payload on a mission and be chosen through a separate selection process. NASA associate administrator Rocco Petrone considered the payload specialist program to be "critical to the Shuttle" and stressed the importance of finding "innovative methods" to keep the costs of training payload specialists low so as to allow "small payload developers" to accompany their payloads, lest NASA find itself providing "professional [astronauts] on a large portion of the flights."[98] Hans Mark, who was serving as director of NASA's Ames Research Center in California in the mid-1970s, expressed in a 1975 letter to an official at NASA Headquarters: "I believe that the Payload Specialist will ultimately become by far the most important member of the Shuttle team."[99]

The agency spent several years studying and debating plans for the selection, training, and flight of payload specialists. NASA's Johnson Space Center conducted a study on the selection and training of payload specialists in 1974.[100] Early the following year, the Space Program Advisory Council's ad hoc

[98] AA/Associate Administrator (Rocco A. Petrone) to AA/Director, Johnson Space Center, "Selection Criteria and Training Requirements for Payload Specialists," September 17, 1974, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[99] Hans Mark to Nathaniel B. Cohen, February 21, 1975, Folder 8948, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[100] AA/Associate Administrator (Petrone) to AA/Director, Johnson Space Center, "Selection Criteria and Training Requirements for Payload Specialists."

subcommittee on scientist-astronauts met in Houston to discuss the question of payload specialists' roles, as distinguished from mission specialist roles, and training requirements. By late 1976, as selections for experiments for the first Spacelab mission were underway, senior leaders from across NASA were actively working to develop a policy outlining the roles and responsibilities and selection and training procedures for payload specialists.[101] Officials were in close agreement about certain issues, such as selection processes and training requirements: they all believed, for example, that the scientific community should have a major hand in choosing candidates and that payload specialists would require less training on Shuttle systems than career astronauts.

Major differences of opinion arose, however, concerning the appropriate use of payload specialists versus mission specialists. Johnson Space Center director Christopher Kraft shared Petrone's and Mark's recognition of the scientific and marketing value of the payload specialist position. Even so, Kraft, along with Astronaut Office chief Deke Slayton, also had a vested interest in preserving Shuttle flight opportunities for NASA's career astronauts, including the mission specialists. Why, Kraft questioned in letters to NASA Headquarters officials, should NASA jump to involve external space flyers when the agency also had at its disposal a cadre of paid-for and trained mission specialists with science and engineering backgrounds that might also be trained to operate investigators' payloads?[102] The Johnson center director indicated a concern with expending resources on the costs of training additional individuals but almost certainly was looking out for the interests of the Apollo-era scientist-astronauts still with NASA and who were still waiting after a decade or more for a chance to fly on a mission.[103]

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[101] AA/Associate Administrator (John E. Naugle) to M/Associate Administrator for Space Flight, "Mission Specialist Selection Process," December 30, 1976, with attachment, "Space Shuttle Crew Policy Issues," Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[102] Christopher C. Kraft, Jr., to James C. Fletcher, October 12, 1976, Folder 8945, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Christopher C. Kraft, Jr., to Alan M. Lovelace, May 10, 1978, Folder 8946, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[103] Kraft to Lovelace, May 10, 1978.

Kraft's view was that NASA should use payload specialists only "when and where they are needed" – that is, when career astronauts lacked specialized expertise to conduct particular experiments. Regarding them as "passengers" and NASA's career astronauts as "crew," Kraft also called out the safety implications of flying external individuals, noting that "a passenger onboard the shuttle poses a special kind of problem" and arguing that "we should not be willfully planning for payload specialists when mission specialists are available with adequate to expert technical ability in payload research areas."[104] A draft of the policy from December of 1976 revealed the tensions at play, calling for the agency to keep the initial mission specialist selection to a "minimum" to "ensure a maximum opportunity for 'outside' skilled people to fly with specific payloads" while making mission specialists available to sponsors to serve as payload specialists.[105]

The resulting policy and procedures for payload specialists, which the agency published as a final rule in the *Federal Register* in March of 1978, preserved the notion that NASA remained committed to providing flight opportunities to external scientists while delineating the roles and responsibilities of each specialist.[106] According to the rule, which applied to payload specialists for payloads developed by a NASA program office or in partnership with another entity, such as Spacelab, NASA would "provide individuals associated with space investigations the opportunity to perform as payload specialists aboard STS flights to conduct measurements and observations in pursuance of mission objectives." Payload specialists would operate assigned payload elements on a specific mission; mission specialists were responsible for coordination of the payload with Shuttle operations, including allocating needed onboard resources for its success. The rule did not provide conditions for using an external payload specialist,

[104] Kraft to Fletcher, October 12, 1976.

[105] AA/Associate Administrator (Naugle) to M/Associate Administrator for Space Flight, "Mission Specialist Selection Process," with attachment, "Space Shuttle Crew Policy Issues."

[106] Payload Specialists for NASA or NASA-Related Payloads, 43 *Federal Register* 9790 (March 10, 1978) (amending 14 C.F.R. pt. 1214).

stating only that the head of the organization sponsoring a Shuttle payload within the agency would determine the need for one. If he or she decided to use a payload specialist, then, parting with NASA practice for career astronaut selection, researchers working on the project would convene an Investigator Working Group to identify candidates having the expertise they deemed necessary and forward their recommendations to the sponsoring organization's leader to approve. The selected candidate would need to meet NASA's class III space flight medical selection standards – a less rigorous set of qualifications than mission specialists – and undergo training to operate the payload, as determined by the project team, as well as training related to Shuttle systems as prescribed by NASA's Office of Space Transportation Systems. NASA refrained from placing restrictions on a payload specialist's national origin or employer but required participants who were not U.S. government employees to have a contract or similar arrangement with an institution involved in the payload before they pursued training with the agency. Finally, while stating that the payload specialist was responsible to the mission specialist's authority, the rule indicated that mission specialists would provide options from which payload specialists could make onboard decisions to deviate from flight plans in the case of unexpected changes during the mission.[107]

Concurrent with the rule's release, Investigator Working Groups for the first and second Spacelab missions were in the midst of identifying payload specialists for these projects.[108] In May of 1978, Kraft wrote to NASA deputy administrator Alan Lovelace expressing a number of concerns about the selections in progress.[109] Lamenting that the payload specialist finalists identified for both missions lacked unique capabilities, he noted they also had not risen to the top of NASA's own lists when the same individuals

[107] Ibid.; NASA, *The Role of the Payload Specialist in the Space Transportation System for NASA or NASA-Related Payloads* (n.d.), Folder 8971, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[108] NASA, "Payload Specialists to Be Selected for Spacelab 1," news release 77-189, September 14, 1977, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021082.pdf; NASA, "Six American Finalists Are Finalists for Spacelab Job," news release 77-255, December 22, 1977, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021086.pdf.

[109] Kraft to Lovelace, May 10, 1978.

had applied for mission specialist positions in the 1977 call. He argued that only two of the Spacelab 2 experiments even required specialized expertise, and claimed that the Investigator Working Group did not adequately consider missions specialists for either Spacelab mission. Kraft also took a swipe at the payload specialist policy's authority structure, asserting that "it could prove wrong to expect that a payload specialist would be as qualified as the flight crew to make onboard decisions," especially when, he posited, the payload specialist "is likely to spend much of the flight being sick."[110] Summing up his sentiments, the Johnson center director stated:

> I recognize that a fundamental Agency precept is to provide the scientific community with an opportunity to conduct research in space, and, admittedly, their involvement in the selection and training of payload specialists to conduct this research adds credibility to the precept. However, in my opinion, we are becoming too enamored with the public relations aspects of such selections without properly considering what we are doing practically and operationally….Operations and program marketing are not necessarily compatible factors and must be carefully integrated to insure mission success….I strongly recommend that you initiate an activity to integrate the operational, scientific, and marketing groups within the Agency so that we are all working together toward a common goal: a safe flight will all scientific objectives accomplished at the lowest possible cost to the user.[111]

Responding to Kraft's concerns, NASA administrator Robert Frosch put a hold on the imminent Spacelab 1 payload specialist selection announcement in June 1978 and ordered a review of the guidelines for use of the external space flyers. Shortly thereafter, Frosch allowed the Spacelab 1 and 2 selections to proceed under the publicly released rule.[112] NASA announced Byron Lichtenberg, an engineer at MIT, and physicist Michael Lampton as the first American payload specialist candidates, and the European Space Agency announced Swiss astronomer Claude Nicollier, Dutch physicist Wubbo Ockels, and German physicist Ulf Merbold to represent Europe. Lichtenberg and Merbold went on to become the first non-NASA astronauts to fly aboard the first Spacelab mission, on STS-9, in November

[110] Ibid.

[111] Ibid.

[112] "NASA Restudies Process for Picking Shuttle Crew," *Aviation Week & Space Technology*, June 19, 1978, 31.

1983. To the chagrin of many within the space science community who had desires to fly into space with their experiments, however, Kraft's objections prevailed, and NASA adopted a modification to its payload specialist policy.[113] Amending the rule in the *Federal Register* in 1980, the new policy stated that NASA would provide payload specialist opportunities to those connected to mission payloads "whenever a unique criterion exists which is satisfied by their capabilities or qualities and justifies their presence. Payload Specialists are otherwise selected from the Mission Specialists cadre." It went on to state: "The official-in-charge of the sponsoring Program Office will be responsible for verification of the need, technical criteria, and uniqueness for payload specialists. This determination will be coordinated with the Associate Administrator of Space Transportation System Operations and reviewed with the Administrator and Deputy Administrator."[114]

The policy restriction did not deter some NASA officials from continuing to conceptualize the payload specialist position as a means of making space flight opportunities available to a broader cross-section of people that would contribute to the Shuttle's vitality and viability. Scientists were the first group NASA sought to accommodate, but individuals such as John Yardley, head of the agency's Office of Space Flight, believed offering corporations the opportunity to choose their own representatives to fly with their payloads would incentivize them to fly payloads and experiments aboard the Shuttle.[115] Even while Frosch was evaluating the guidelines for NASA-related payloads, NASA's Office of Space Flight made known in Congressional testimony that it was reviewing the possibility of allowing non-NASA-related customers to select payload specialists to accompany their payloads.[116] Although Frosch sided

[113] "Shuttle Crew Selection Change Worries Scientific Community," *Aviation Week & Space Technology*, August 7, 1978, 23.

[114] Payload Specialists for NASA or NASA-Related Payloads, 45 *Federal Register* 8001 (February 6, 1980) (amending 14 C.F.R. pt. 1214).

[115] Jon M. Smith, interview by author, Houston, TX, June 10, 2013.

[116] John F. Yardley, "Office of Space Transportation Systems Status Summary," statement for the record to the Subcommittee on Space Science and Applications, Committee on Science and Technology, U.S. House of Representatives, September 25, 1978, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Alex P. Nagy, "Passenger Flight on Space Shuttle (draft)," May 19, 1978, attachment to Alex P. Nagy to John

with Kraft to limit the use of payload specialists, his replacement during the Reagan administration, James Beggs, shared Yardley's position. Beggs supported the idea that NASA could give companies flying satellites aboard the Shuttle what Yardley's successor, James Abrahamson, called "an extra level of confidence" by "having a representative on the scene."[117] In October 1982, Beggs informed the chairmen of NASA's appropriations and authorization committees in the House and Senate of his belief that the agency's policy on payload specialists was "overly restrictive" and that he intended to "expand this policy and offer it directly to potential foreign and domestic customers of the Shuttle." Beggs noted also that he planned to "expand the opportunities for scientist flights as well" and to "make it a matter of routine to allow a Department of Defense Payload Specialist to participate on flights with security payloads."[118]

Shuttle customers soon put to the test NASA's willingness to expand its ranks of flyers to include payload specialists. Aware of the agency's burgeoning interest in corporate payload specialists, McDonnell Douglas executive Jim Rose approached NASA Shuttle program manager Glynn Lunney in 1982 about flying its own representative on the next flight of its electrophoresis experiment. As Charlie Walker, the McDonnell Douglas engineer who would ultimately fly three times with the company's equipment, put it, Rose told Lunney: "We really would learn the most we possibly can and more than we can do with a mission specialist if we get the opportunity to have a payload specialist devoted specifically to the electrophoresis device and its research and development activities during a flight." Lunney

Naugle, December 7, 1982, Folder 8074, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[117] James Abrahamson, interview by author, Washington, DC, June 19, 2013.

[118] James M. Beggs to Harrison H. Schmitt, October 7, 1982, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. A handwritten note on the letter indicates that NASA sent identical letters the chairmen of NASA's other oversight committees.

encouraged Rose to put in a formal request, which Lunney would share with NASA Headquarters.[119] In early 1983 NASA approved Walker as the Shuttle's first corporate payload specialist.

Beggs' aim was to revise the rule in the *Federal Register* to allow payload specialists to fly whenever a customer deemed it necessary, regardless of the need to satisfy a criterion of uniqueness, as Kraft had urged.[120] While the agency never changed the federal regulation, it endorsed the requests of major customers who asked that they, too, be able to fly a representative in space with their payloads. Most of these customers consisted of companies and foreign governments that were reimbursing NASA to deploy communications satellites from the Shuttle's cargo bay but who also prepared representatives to do other research that interested them. RCA's Robert Cenker, for example, flew as a payload specialist aboard STS-61C in 1986 to observe the deployment of the company's Satcom K1 satellite and also tested a classified infrared camera for an Air Force client. Sultan Salman Abdelazize Al-Saud of Saudi Arabia accompanied an Arabsat communication satellite on STS-51G in June 1985 while also photographing the Arabian Peninsula from on orbit and conducting research on fluid behavior in microgravity potentially useful to the oil industry.[121] The customers chose their own payload specialists, who received enough training to be able to work with the mission crew safely and effectively and to operate their own payloads or experiments. Each customer was required to fund the marginal costs of NASA training and flying their payload specialist aboard the Shuttle. According to Charlie Walker, McDonnell Douglas paid NASA

[119] Charles D. Walker, interview by Jennifer Ross-Nazzal, Washington, DC, November 19, 2004, transcript, Johnson Space Center Oral History Project, Houston TX, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_11-19-04.pdf.

[120] James A. Abrahamson, "Statement of Lieutenant General James A. Abrahamson, Associate Administrator for Space Flight, National Aeronautics and Space Administration, before the Subcommittee on Space Science and Applications, Committee on Science and Technology, House of Representatives," March 1, 1983, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000043019.pdf.

[121] NASA, "Arabsat Payload Specialist Activities," news release 85-69, May 4, 1985, Folder 8971, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

$40,000 for his first flight.[122] By mid-1985, that price had escalated to about $78,000.[123] Following Walker's first flight aboard STS 41-D in 1984, nearly every Shuttle through the catastrophic launch of *Challenger* in January 1986, and many up through the fateful *Columbia* mission in 2003, included one or more payload specialists from industry, academia, or the military.

While connections to the payloads and experiments manifested for each flight drove the approvals of most payload specialists, diplomacy and politics had their places within the payload specialist initiative as well. President Reagan issued invitations to nations including France, Italy, China, and Brazil to name delegates to fly aboard the Shuttle apart from any previous dealings with NASA or plans they had to send a payload into space. The move paralleled the Soviet space program's practice, in place since 1978, of selecting "guest cosmonauts," primarily from Communist-bloc but also from western nations, to visit the Soviet developmental space station, *Salyut*.[124] By 1984, French fighter pilot Patrick Baudry and others flew aboard the Shuttle at Reagan's invitation as an expression of international goodwill and also as an incentive for foreign nations to put payloads on the Shuttle.

In addition, NASA administrator James Beggs similarly recognized that granting access to the Shuttle to key political stakeholders could enhance support for this and future human space flight endeavors. Beggs invited the chairs of NASA's appropriations and authorization committees in the House and Senate to fly aboard Shuttle missions as part of their oversight duties.[125] The action was

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[122] Walker, interview, November 19, 2004.

[123] Robert C. Cowen, "Opening the Hatch to Foreign Astronauts," *Christian Science Monitor*, June 24, 1985, 8.

[124] Ibid.

[125] James Fisher, "Nelson Awaits Slot to Go on Shuttle Mission," *Orlando Sentinel*, August 8, 1985, Folder 1570, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. While some Congressional leaders accepted the offer, others, such as Don Fuqua, chairman of the House Committee on Science and Technology, rejected the opportunity. Fuqua did so on the premise that NASA should only fly trained astronauts and that he could not focus adequately on both flight training and serving as a member of Congress. See Chris Dubbs and Emeline Paat-Dahlstrom, *Realizing Tomorrow: The Path to Private Spaceflight* (Lincoln: University of Nebraska Press, 2011), 80-81.

clearly prompted by Senate Edwin Jacob "Jake" Garn, a former Navy aviator who served as the chairman of the Senate subcommittee that appropriated funding for NASA. Garn confronted Beggs about the matter in 1981. According to Beggs,

> The first thing that came out of his mouth was 'I want to fly.' I said, 'Well, I'll think on that.' We were just starting to fly the Shuttle at that point and hadn't even declared it operational. The first thing we had to do is get it operational and then we could think about what we did after that. So he was the first candidate. And I did take that very seriously. 'If he wants to fly, by God, he'll fly.' I said that to myself because I thought if he flew then he could come back and he could really make it real for the other members of Congress.[126]

Naming Garn to be a payload specialist in early 1985, NASA publicly stated that the flight would allow the Senator to share the knowledge he gained and aid decision-making of those in Congress and "in turn, benefit the American taxpayer." NASA also noted that Garn and the agency agreed to the flight only if Garn could "perform some meaningful task," and they assigned him to serve as a subject for several medical experiments on STS-51D, which flew in April 1985.[127] Florida's Bill Nelson, chair of the House subcommittee overseeing space issues, then flew on STS-61C in January 1986, the mission preceding the final flight of *Challenger*. Despite NASA's justifications and strong support among constituents living near Kennedy Space Center, many journalists did not consider the flights of politicos to be legitimate uses of the Shuttle. To the contrary, Florida media critics complained that the flights constituted "the ultimate junket" at taxpayer expense and meant that the members of Congress "no longer had the arm's length relation with NASA that is needed to ensure that he oversees the space program objectively."[128] Others noted that these flights would restrict "legitimate research" and be unfair to

[126] James M. Beggs, interview by author, Chevy Chase, MD, April 8, 2013.

[127] John F. Murphy to Lawton Chiles, March 7, 1985, Folder 10990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[128] Edward Crosby, "Why 'Astro-naughts' on Shuttle Flights?" *Florida Today*, September 15, 1985; Douglas Pike, "Nelson's Joy Ride into Space a Stunt We Don't Need," *Orlando Sentinel*, October 27, 1985. Both articles located in Folder 1570, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

astronauts who had trained for years.[129] Clearly, credible uses of the Shuttle were debated and debatable, and NASA officials constantly traded off whose participation would help to ensure the vehicle's viability.

Just as flights of members of Congress had public and media critics, their presence along with that of the other payload specialists was a social and cultural adjustment for many of NASA's career astronauts. Their specific concerns hovered between the outsiders' effect of taking away seats that they are their brethren might occupy and their impact on crew safety. To the former matter, Bob Crippen, pilot of STS-1, put it quite simply: "Everybody wants to fly."[130] Shuttle pilot Hank Hartsfield noted: "Some of the guys who hadn't flown resent these guys coming along and these people flying. 'I'm sitting here, I'm trained, I've been picked, and these people are going.' So it's a morale issue for them."[131] Some of the astronauts worried that a payload specialist's limited training program – Garn's experience of less than three months was an extreme example – meant that a crew could never be sure of his or her level of preparedness for flight. Claiming to speak on behalf of other NASA astronauts, Hartsfield added:

> We thought that that was not appropriate to take inexperienced people and put them on there, because there's [sic] a lot of resources in getting them ready to fly. You had to determine their personality. It was hard to do in a short period of time. Were they going to be stable? … If you had a big problem, you could wind up having a person that wasn't used to that kind of conditions to endanger the rest of the crew because you have to attend to them.[132]

Charlie Walker, who described himself and payload specialists in general as "the itinerant space flyer," explained the skepticism he endured. A few individuals inside and out of the Astronaut Office, he said, "made it clear to me that 'You're not one of us. You're along for the ride, and you've got a job to

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[129] "Launching 'Buck Rogers' Nelson," *St. Petersburg Times*, September 11, 1985; "No Amateurs, Please," *Augusta (GA) Herald*, September 18, 1985. Both articles located in Folder 1570, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[130] Robert Crippen, telephone interview by author, June 24, 2013.

[131] Henry W. "Hank" Hartsfield, Jr., interview by Carol Butler, Houston, TX, June 12, 2001, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/HartsfieldHW/HartsfieldHW_6-12-01.pdf.

[132] Ibid.

do.[133] While Walker never experienced any overt belligerence from career astronauts, he noted that there was "no clearer indication" of the fact that payload specialists were "outsiders" as far as the astronauts were concerned than that their work spaces at Johnson Space Center were confined to separate buildings. "It was made clear to us from the beginning that they didn't expect to see us over [in the Astronaut Office] in Building 4 except for scheduled meetings," Walker said. He noted also that even with the need to be sure the payload specialists would work effectively and safety as part of mission crews, there was still a "tension" in the Astronaut Office and among mission managers about not wanting "to bring them into the office too close."[134]

Over time, however, career astronauts grew accustomed to the inclusion of payload specialists on Shuttle missions. NASA made them a regular, predictable presence on flights, even if their backgrounds and objectives were quite disparate. Walker noted that following his trailblazing as the first corporate payload specialist trainee, NASA as an institution and those in the Astronaut Office became increasingly comfortable with payload specialists being part of mission crews.[135] They proved able to function aboard flights without putting crewmembers in danger while freeing the career flyers from having to learn to operate customers' payloads, as mission specialists had before Walker flew with the electrophoresis hardware. Perhaps as the strongest indicators of this change, shortly before the *Challenger* accident, the payload specialist office was unified with the Astronaut Office, and only "a vanishingly small number of people" held separatist attitudes years later.[136] As Walker put it: "[it] took a couple of years, and the

[133] Charles D. Walker, interview by Sandra Johnson, Houston, TX, April 14, 2005, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_4-14-05.pdf; Walker, interview, November 19, 2004.

[134] Charles D. Walker, interview by Sandra Johnson, Springfield, VA, November 7, 2006, transcript, Johnson Space Center Oral History Project, Houston TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_11-7-06.pdf.

[135] Ibid.

[136] Ibid.

adaptation began to happen, I think, in serious fashion as those that saw, looking at you're taking the risks and you're flying in this thing together. It's not a positive to keep yourselves apart during the preparations for all of that. So I think that reality certainly came home."[137]

Welcoming "Ordinary" Citizens to Space

The payload specialist position afforded NASA a means to fly a variety of individuals connected with payloads, or even just politically connected, aboard the Shuttle. Combined with efforts to broaden the professional backgrounds and social diversity of the career astronaut corps, it fulfilled the agency's pledge to President Nixon, the Congress, and all Americans to use the Shuttle to fly a whole new set of people to carry out work in space. NASA officials envisioned that, for the most part, Shuttle flyers would include pilots, scientists, and engineers from the United States and abroad who would conduct experiments, deploy payloads, and eventually construct a space station in Earth orbit. It was not lost on them, however, that the Shuttle, with its ability to carry multiple passengers on each flight without requiring them to comply with exceptionally stringent physical qualifications, could in principle accommodate additional sorts of flyers for other purposes. Thus, just as agency personnel would work through safety concerns and internal cultural standards to open the astronaut corps to new sorts of professionals as well as women and minorities during the 1970s and 1980s, they would simultaneously take steps to enhance the Shuttle's appeal and relevance to more people by flying non-scientific, non-technical, "ordinary citizens" on its missions. A key challenge would involve how to balance a desire on the part of those within and outside the agency to include such individuals as passenger participants on

[137] Ibid.

Shuttle flights with potential external criticism about the approach's value and purpose, along with the agency's credibility.[138]

Since its earliest days, NASA had received thousands of letters from citizens volunteering for astronaut duty or asking about when the agency would take "ordinary" people on trips to space. NASA would send them replies explaining that they needed to be pilots or scientists to qualify for these adventures.[139] More than 90,000 people had looked elsewhere for opportunities, making reservations with Pan Am Airways beginning in 1964 to take flights to the Moon that the airline anticipated offering eventually. The notion of routine space flight had also been ensconced in science fiction literature for decades but was reignited in television series like *Star Trek* and *Battlestar Galactica*, thanks to Apollo's influence. While agency officials did not expect the Shuttle to satisfy the desires of every individual who dreamt of personally going into space, some NASA personnel truly believed they could and eventually would harness the new space flight vehicle's capabilities and characteristics to make strides in realizing the visions so many people esteemed. Before the Shuttle had even been approved by President Nixon, Mercury astronaut Alan Shepard, for one, had spread word that Shuttle flights would include "citizen passengers." When Hugh Downs of ABC News wrote to NASA deputy administrator George Low asking about his own chances of flight as a news correspondent, Low replied: "I sincerely hope that the day when it will be possible for a journalist to go along on a Shuttle mission as an observer is not too far off."[140]

Downs and others like him made NASA aware that broadening participation beyond pilots, scientists, and engineers could have yet another effect on both human space flight enthusiasts and those

[138] Amy Paige Kaminski, "Explorers We? The Making, Unmaking, and Public Involvement Legacy of NASA's Space Flight Participant Program," *Quest: The History of Space Flight Quarterly* 20, no. 1 (2013): 12-21.

[139] See, for example, Julian Scheer to Robert E. Tinger, August 23, 1965, Folder 1903, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[140] George M. Low to Hugh Downs, April 5, 1971, Folder 498, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

who lacked space flight aspirations: it might at least round out and humanize the enterprise, making it more relatable and meaningful to more people. NASA and external entities alike recognized that the Mercury, Gemini, and Apollo astronauts had ably pioneered the space frontier but less proficiently described the experience to the billions below on Earth. Indeed, Apollo 16 astronaut John Young expressed after his lunar landing mission that having an artist along would have been a help. "There were things I saw and felt," Young said, "that just can't be put into words."[141] Nicholas Aumiller, a Baltimore artist-poet who wrote to NASA in 1973, put it this way: "Until now the personel [sic] in space have been individuals whose primary focus centered upon the exact, rational, and logical exploration. I beliave [sic] it time for an individual with a personally explorative nature to be 'allowed' the total experience of space."[142] Novelist Doris Lessing later commented that an artist's flight would limit the gap between scientists and artists.[143] Artist Chet Jezierski expressed, it would "be extraordinary not just because the artist will provide the peoples of the world a view, but because he will also provide a vision."[144] Years later, an *Aviation Week & Space Technology* letter to the editor further noted the need to fly people other than "soldiers and sailors" and scientists and engineers because "[a]s long as space is perceived as a sterile laboratory where high-tech eggheads measure stuff, the potential public excitement over NASA's goals will remain squelched."[145]

As early as the mid-1960s, the Martin Company had responded to a NASA search for ideas to do something useful and of great public interest during the Gemini program with the idea of putting a

[141] Chet Jezierski to James Beggs, July 22, 1985, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[142] Nicholas W. Aumiller, Jr. to James C. Fletcher, October 14, 1973, Folder 9237, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Other artists eventually made similar claims.

[143] Associated Press, "Artists Want to Expand Horizons – to Outer Space," *Chicago Tribune*, March 4, 1984, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[144] Jezierski to Beggs, July 22, 1985.

[145] Ken Jopp, letter to the editor, *Aviation Week & Space Technology*, November 4, 1985, 96.

National Geographic photojournalist into orbit with an astronaut on a spare Gemini capsule.[146] The Martin Company explained that a journalist would be a passenger "more like the public" and, unlike a "highly trained astronaut," would communicate the experience "with the public in mind, not a scientific program." Connoting a self-serving aspect as well, the proposal suggested that NASA also could use the experience to "unusual advantage" in educating the public about manned space flight and, in turn, strengthen taxpayer support.[147]

In the mid-1970s, two disparate sources of external pressure spurred NASA officials to take action on the idea of flying individuals who would help to humanize the human space flight program. The National Research Council's Aeronautics and Space Engineering Board, which NASA had briefed in late 1975 on its plans for the six Shuttle flight tests and their payloads, expressed the view that the proposed flights were "were not exciting, lack-lusters, and had nothing to stir the imagination of the American public."[148] Phil Culbertson, manager of NASA's Advanced Manned Missions Planning Group in the Office of Manned Space Flight, held a brainstorming session in February 1976 to come up with ideas for missions that might capture public interest and attention. When Culbertson shared his list with George Low, Low added to it the option of flying someone out of the ordinary ranks of NASA's astronauts – a "unique personality" – on the Shuttle.[149] The following month, a *National Geographic* editor asked NASA administrator Jim Fletcher about the possibility of flying a journalist from his

[146] John L. Hammersmith, "Note for Bill Land," n.d., with attachment, Martin Company, "The National Geographic Society Space Expedition," May 26, 1965, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[147] Ibid.

[148] M-N/Public Information Officer for Space Flight (David W. Garrett) to F/Acting Assistant Administrator for Public Affairs (Robert J. Shafer), "Space Shuttle 'Unique Personality'," June 28, 1976, Folder 8073, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The memo cites the "Aerospace Advisory Board (ASEB)," but no group by this exact name is known to have existed at NASA. Given the inclusion of the acronym, it is most likely a reference to the Aeronautics and Space Engineering Board of the National Research Council.

[149] Ibid.

publication on the Shuttle; such a measure, the editor said, could help NASA communicate the space flight experience to the public.[150] The idea resonated with Fletcher, who noted in his response to the editor that NASA would give consideration to his interest when the opportunity arose and that he believed "someday spaceflight would be available to people from all walks of life."[151] As a first step toward that future, Fletcher forwarded the editor's letter to public affairs official Bob Shafer with a suggestion to start an "observer" program for Shuttle flights.[152]

A group led by John Hammersmith of the Shuttle program office and including representatives from NASA's human space flight, public affairs, legislative, and legal offices set to work studying the possibility. Their July 1976 report evaluated several possible types of people – *National Geographic* photojournalists, news media representatives, students, entertainers, eminent scientists, and the "layman." Collectively, they favored foremost the selection of a journalist for that professional's ability to provide broad coverage of the Shuttle mission consistent with the agency's Space Act mandate to dissemination widely about the space program and also to "establish the fact that space flight is no longer the exclusive province of an elite few." The group recommended that NASA wait to take action on the initiative until after the Shuttle's first test flights to assure the new vehicle's safety and also because these flights would be newsworthy in their own right. But once Shuttle flights proved routine, the group stated, NASA should create a system by which fellow journalists would select a representative for flight and also make flight opportunities available to other interested persons who, too, would be recommended by committees of their peers rather than NASA.[153] Over the next couple of years, the group studied the concept's

[150] Kenneth F. Weaver to James C. Fletcher, March 8, 1976, Folder 8078, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[151] Fletcher to Weaver, March 24, 1976, Folder 8078, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[152] Fletcher to F (Deputy Assistant Administrator for Public Affairs), March 16, 1976, Folder 8078, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[153] "Non-Astronaut Flight Participation in OFT: Report of Ad Hoc Study Team," July 1976, Box 4, STS General Information Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake,

feasibility, and NASA's public affairs office drafted a policy in 1978 for Shuttle passenger selection; given their own commitments, they centered the policy's justification on the idea that passengers could "contribute to a greater understanding of space flight" by sharing their experiences with colleagues and the broader public[154]. NASA's external affairs chief Arnold Frutkin, however, successfully argued that NASA shelve the plan for the time given the Agency's lack of handle on the Shuttle's operational environment and delays in development.[155]

Policy or no policy, as the Shuttle's launch debut approached, several NASA officials continued to spread the idea that the Shuttle's frequent flights and roomy interior would provide access to space to almost anyone. Fletcher wrote in a letter to Senator Moss about student involvement in the Shuttle program: "As the Shuttle program advances into future years, it is possible that outstanding students would be selected to serve as actual payload specialists aboard Space Shuttle missions."[156] In December 1979, *Parade* magazine featured a cover story on the Space Shuttle in which former external affairs chief Herb Rowe said that the agency had developed a list of celebrities, scientists, journalists, and politicians it would want to invite to fly, while Shuttle spokesperson David Garrett indicated that the first non-technical participant "is sure to be a journalist."[157] The media helped to circulate the words of these NASA officials. Relaying the terms NASA had used to describe Shuttle flight, Tom DeVries wrote for the *Los Angeles Times* that those who would fly as payload specialists "have to meet qualifications that are very

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Houston, TX; John L. Hammersmith to General McNickle, "Non-Crew Flight Participation: Selection Process," February 15, 1977, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[154] Nagy, "Passenger Flight on Space Shuttle (draft)."

[155] Arnold W. Frutkin to LF-6/Robert Newman, "Draft NMI on Shuttle Passengers," June 7, 1978, attachment to Alex P. Nagy to John Naugle, December 7, 1982, Folder 8074, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. No doubt Administrator Frosch's review of the payload specialist selection policy at Kraft's behest, taking place in the same timeframe, also contributed to the hesitation.

[156] James C. Fletcher to Frank E. Moss, September 2, 1976, Folder 19814, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[157] Richard C. Levy, "Everybody is Lining Up for Space," *Parade*, December 30, 1979, 4-5.

low, quite within the reach of armchair command-module pilots like us."[158] A February 1977 article in the *American Legion Magazine* suggested that anyone could be a passenger on the Shuttle, noting that "outings in orbit may be practical a lot sooner than you think" due to the new vehicle.[159] Due to the expectation NASA and the media created, unsolicited applications from citizens across the country asking to fly aboard the Shuttle began to flow in to NASA by the hundreds. As public affairs director Bob Newman conveyed to Frutkin, the news media was exerting "too much external pressure" for NASA not to develop a passenger policy soon.[160]

James Beggs, NASA's administrator under President Reagan, certainly felt that pressure. Less than a year after the Shuttle's first orbital test flight, he was ready to figure out how to realize these claims. Like Fletcher before him, Beggs believed that citizens rightfully should and would have a future in space and that the Shuttle's high projected flight rates and large carrying capacity could accommodate at least some of them. He was reassured of the idea that NASA ought to consider flying people who were not trained as astronauts after learning that the agency would not even be setting precedent in this sort of enterprise. According to Beggs, "I said, 'let's do some research on what kind of experience we've had over the history of this country of people taking part in exploration.' There was [precedent]: Byrd took a Boy Scout to Antarctica."[161] Beggs conveyed in a NASA employee newsletter that "[n]ow a new opportunity is emerging – for people to go themselves, to see for themselves and to share with others. It

[158] Tom DeVries, "A Shot at Space," *The Sun* (Mississippi Gulf Coast), April 16, 1981, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[159] "The Plane That Will Take Us Out of This World," *American Legion Magazine*, February 1977, 7.

[160] LF-6/Director of Public Affairs (Robert A. Newman) to L/(Acting) Associate Administrator for External Relations (Arnold W. Frutkin), "Draft NMI on Shuttle Passengers," November 6, 1978, attachment to Alex P. Nagy to John Naugle, December 7, 1982, Folder 8074, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[161] Beggs, interview, April 8, 2013.

has long been a desire of NASA to allow private citizens to fly."[162] In February 1982 Beggs established through the NASA Advisory Council a task force to study issues and options for selecting private citizens for Space Shuttle flights. He noted at the task force's first meeting in July that "NASA's objective is to maintain the openness of the program and to invite the public to participate to the extent possible."[163] Beggs wanted to cast the Shuttle program in a good light, but he said did not want NASA to select just national celebrities for flight, as then the agency "would be charged with simply promoting the program which is not our intent."[164]

The task force was chaired by former NASA chief scientist John Naugle and comprised of former astronaut Richard Truly, former NASA public affairs chief Julian Scheer, novelist James Michener, historian Sylvia Fries, marketing executive Florence Skelly, and aerospace executives Daniel Fink and Willis Hawkins. At Beggs' direction, the task force adopted a working assumption that NASA would need to establish an equitable policy and selection process to assure a variety of passengers whose flights would "bring the fullest benefits to the public."[165] For nearly a year, the task force studied the issue, debating the merits of a citizens-in-space program, who should be tapped to fly, and how NASA should go about selecting citizen flyers. Some members advocated that NASA should focus on flying those whom Skelly called "key special people," including communicators well-versed in describing scientific and technological issues.[166] Such individuals, Skelly, for one, argued, would be valued by policy leaders

[162] James M. Beggs, "Should NASA Fly Private Citizens aboard the Space Shuttle?" *NASA Activities*, October 1982, 3, Folder 19754, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[163] NASA Advisory Council Informal Task Force for the Study of Issues in Selecting Private Citizens for Space Shuttle Flight, "Summary Minutes from July 22, 1982, Meeting," Folder 16713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[164] Carl R. Praktish to Sylvia D. Fries, September 28, 1982, Folder 16713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[165] Beggs, "Should NASA Fly Private Citizens aboard the Space Shuttle?"

[166] Florence R. Skelly to John E. Naugle, September 2, 1982, Folder 16713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

and citizens interested in NASA, whereas flying "the man on the street" could invite criticism by NASA's detractors as a waste of taxpayer funds.[167] Fries, on the other hand, worried less about critics and preferred a more democratic route: a lottery approach open to all interested parties.[168]

In June 1983 the task force presented NASA with its conclusion that the "flight of private citizens is both feasible and desirable." The justification they offered was threefold: this pursuit would expand human knowledge, contribute to human culture, and educate those who flew as well as the broader public about space program activities.[169] In other words, such an initiative would both engender public awareness of the Shuttle and make external publics an integral element of the program. The task force felt that NASA could conduct a citizens-in-space program aboard the Shuttle without creating a risk to the mission, crew, or citizen passengers and that such a program could legitimately and credibly be justified as long as citizen flights fulfilled purposes outlined in the Space Act – namely, to preserve U.S. space leadership and to disseminate information widely – rather than solely for tourism. In other words, these "observers" would not simply be along for the ride without purpose and obligation to the broader American public. While acknowledging the respective merits of peer review for selections in specific categories and a national lottery concept, the task force members refrained from recommending a specific approach. But they suggested that after flying a few people from NASA-chosen categories who would

[167] "Sectors of the NASA Public – Hypotheses on Shuttle Passengers," n.d., Folder 16713, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[168] Richard Gilluly, "NASA Lining Up the Shuttle Bugs," *Los Angeles Times*, November 18, 1982, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The Martin Company's 1965 recommendations to NASA about public engagement with Gemini also included the idea of selling tickets and choosing by lottery a "layman" to travel with a Gemini astronaut and bring back his impressions. See Hammersmith, "Note for Bill Land."

[169] John E. Naugle to Jake Garn, January 13, 1983, Folder 10990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. This letter also offered a fourth justification: stimulating interest in the use of the Shuttle. The task force ultimately decided, however, that this rationale seemed too self-serving.

serve the Space Act's aims, NASA could consider expanding the program and "opening space flight to all people."[170]

NASA's leadership endorsed the task force's rationales and recommendations for the citizen flight program. Next they had to decide how to implement it. The agency established an internal working group representing offices including public affairs, legal affairs, space flight, science, and equal opportunity programs to decide this matter. For years, NASA officials had rejected requests from citizens to "book reservations" or to fly aboard the Shuttle as mission specialists or payload specialists; they generally responded that as an R&D agency, NASA's priority was to fly only qualified pilots, scientists, and engineers whom the agency selected to accomplish known mission requirements.[171] Now NASA had adopted a requirement to invite more inclusiveness in human space flight for the purpose of connecting the public more closely with the program. It also had created high expectations for many that hoped they might be among those included. The working group needed to develop equitable selection procedures to achieve this aim but without compromising crew safety or marring the agency's credibility and reputation as an institution of technoscientific expertise and authority. It was a formidable task. As NASA spokesman Brian Welch summarized the concerns, "How do we pick individuals without making other people mad? How do we make sure we haven't cheapened the space program?"[172]

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[170] "Report of the Informal Task Force for the Study of Issues in Selecting Private Citizens for Space Shuttle Flight," June 16, 1983, Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[171] See, for example, Pat Legan to NASA/Johnson Space Center Information Center, January 4, 1979; Robert Gordon to Legan, January 24, 1979; Fitz-William Byrd Taylor III to Johnson Space Center, December 27, 1978; Gordon to Taylor, January 24, 1979. These letters located in Box 4, Public Affairs Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX. See also Terence T. Finn to Robert L. Schuft, June 4, 1981, Folder 1171, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, and Jesse W. Moore to Chet Jezierski, August 14, 1985, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[172] Jim Detjen, "NASA to Choose Citizen for Shuttle," *Boston Sunday Globe*, September 18, 1983, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

The draft rule NASA published in the *Federal Register* in December 1983 represented the agency's effort to achieve this balance, between open and fair access and seriousness of purpose, in guidelines for the program. The rule stated up front that "the intended effect of this rule is to increase the access of the general public" to the Shuttle and that NASA encouraged "the participation of a wide and diverse array of participants, including women and minorities." It noted that NASA's policy was "to provide opportunity for participation of private citizens in space flight to the extent possible, provided that doing so fulfills purposes defined in the National Aeronautics and Space Act, as amended, and poses no threat to the safety or success of other mission objectives." In this respect NASA established boundaries regarding the types of activities it was willing and unwilling to support. For example, flying individuals who could help promote understanding of space flight would be acceptable according to the agency, but allowing Michael Jackson to perform his Moonwalk in the Shuttle payload bay at the behest of Jackson's marketing agent would not be.[173] As much as NASA was at the time promoting the Shuttle's value to commercial endeavors and its candidacy for eventual privatization, the agency insisted on a decorum and seriousness in who would fly on the vehicle, just as it did for what payloads it was willing to carry.[174] NASA officials were determined to avoid public accusations of launching a frivolous publicity stunt and doubts about the legitimacy of the citizens-in-space initiative and, by association, all that the Shuttle did.

Other aspects of the proposed rule connoted NASA's intent to keep careful control of the program. Participants would need to be free of medical conditions that could impair their ability to participate or be aggravated by space flight; undergo background investigations and training periods; and sign agreements with NASA concerning insurance, liability, and rights to outside compensation. The agency would publicly announce opportunities, qualifications, and purposes for particular types of people

[173] Alan Ladwig, interview by author, Washington, DC, December 28, 2010. According to Ladwig, someone claiming to be Jackson's agent called him and asked about this possibility.

[174] Frank Hyland, "Get in Line Now to Hitch a Ride on Space Shuttle," *Atlanta Journal*, August 23, 1979, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; "NASA Curbing Space-Flight Merchandising," *New York Times*, May 13, 1984, accessed February 16, 2015, ProQuest Historical Newspapers: The New York Times.

to be considered for flight. NASA would designate outside "peer group" panels to screen applications but would retain final selection authority.[175] Several of the 22 individuals who offered comments on the rule voiced their opposition to this approach. They, and others who wrote to NASA on separate occasions, saw the Shuttle and the citizens program as an opportunity for all people to experience space flight. Consequently, they posited that NASA would most effectively serve its stated purpose of opening space to the public, as well as its obligations to taxpaying citizens and the aims of democracy, by flying "common citizens" selected via random lotteries.[176] NASA nonetheless opted to stick with its proposed plan.

A last point raised by the rule was what to call these new kinds of space flyers. The draft rule referred to them as "citizen observer/participants." A public commenter, however, suggested including "astronaut" in the title of these space travelers. But career astronauts were sensitive to the introduction of citizen Shuttle passengers, in the same way that pilot astronauts had resisted the inclusion of scientist-astronauts in the 1960s and some members of NASA's astronaut corps looked unfavorably at payload specialists. While some lamented the impact of these new flyers on their own waits to be assigned to missions, others, such as mission specialist Mike Mullane, called the notion that ordinary citizens could become Shuttle astronauts "immoral" when the Shuttle was still a relatively experimental and thus risky vehicle.[177] Asserting its limits to how it would define citizen space explorers, the agency responded that "NASA reserves the title 'Astronaut' for professional flight crew, but because the name used in the proposed regulation is clumsy, has decided to change the name to 'Space Flight Participant.'"[178]

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[175] Citizen Observers/Participants, 48 *Federal Register* 56770 (December 23, 1983) (amending 14 C.F.R. pt. 1214).

[176] Copies of the 22 public responses appended to a copy of the proposed rule can be found in Folder 8074, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[177] Dubbs and Paat-Dahlstrom, *Realizing Tomorrow*, 78.

[178] Space Flight Participants, 49 *Federal Register* 17736 (April 25, 1984) (amending 14 C.F.R. pt. 1214).

NASA approved the final rule in April 1984, nearly verbatim with the proposed rule, marking the start of what would be known as the Space Flight Participant Program. Alan Ladwig, the longtime advocate of public space flight who had been running the Student Shuttle Involvement Program, became its manager. Beggs maintained that as long as the Shuttle attained its 1980s' projected flight rate of 15 to 20 missions per year, NASA could accommodate two to four citizen flyers annually, on missions that were not dedicated to the Department of Defense, Spacelab, or a customer who purchased the full use of the Shuttle.[179]

But NASA now needed to make decisions about whom to fly, at least initially. Given the agency's desire to "provide a series of flight opportunities, with each having a different objective or purpose and each aimed at a different occupation or group of people," the regulation did not name specific groups the agency would ultimately solicit.[180] Since the agency had begun publicly discussing the possibilities the Shuttle might present for citizens, NASA received thousands of letters and telephone calls from people asking if they could be the first of their kind to fly into space, be it a poet, artist, evangelist, child, Olympic athlete, or disabled person – all of whom would add something unique to the human space flight program and address NASA's goals for the citizens program.[181] Some who had signed up for a Pam Am flight to the Moon asked NASA about redeeming their reservations with a

[179] Thomas O'Toole, "Reagan Tells NASA to Choose Schoolteacher for Shuttle Flight," *Washington Post*, August 28, 1984, A1, Folder 8077, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; M/Associate Administrator for Space Flight (James A. Abrahamson) to LB/Executive Secretary, NASA Advisory Council, "First Meeting of the Citizen Observer/Participant (COP) Evaluation Committee" (draft), 1984 [handwritten in corner], Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[180] Space Flight Participants, 49 *Federal Register* 17736 (April 25, 1984) (amending 14 C.F.R. pt. 1214).

[181] Arlen J. Large, "'Dear NASA,' They Write, 'Won't You Take Me Along?'" *Wall Street Journal*, April 25, 1983, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Michael Kernan, "Shuttle: Everyone Wants to Ride," *Los Angeles Times*, December 11, 1983, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Folder 19758 in the NASA Historical Reference Collection, NASA Headquarters, Washington, DC, contains many letters from those interested in flying aboard the Shuttle themselves or nominating other individuals or categories of people to do so.

Shuttle flight.[182] Inquiries about flying on the Shuttle came from celebrities including John Denver, the Rolling Stones, and legendary newsman Walter Cronkite.

For years NASA officials had given indications that the agency's first citizen program participant would be a journalist, but President Reagan's keen interest in America's involvement in space led the program to take a different approach. As finalization of the Space Flight Participant Program rule was underway, the Reagan administration worked with NASA to develop "Operation Liftoff," an initiative through which NASA would contribute to Reagan's initiative to boost students' interest and academic performance in science and math.[183] Specifically, NASA would expand its educational outreach programs, which had focused on secondary and college level students to create programs and materials for use in K-12 classrooms. As Operation Liftoff's planners at the White House inquired about flying a teacher aboard the Shuttle to support these educational goals, NASA's internal implementation committee for the Space Flight Participant Program recommended to Beggs that an educator serve as NASA's first citizen space flyer.[184] A 1983 commission appointed by Reagan had issued a report called *A Nation at Risk* that had condemned the American education system, including the quality of teaching.[185] Beggs recognized that the move would support Reagan's domestic policy objective of improving science education while meeting NASA's goals for the citizens program to normalize human space flight and enhance the Shuttle's societal relevance. "The biggest receptive audience we have in this country are the kids," Beggs said. "Kids love space. A teacher could give you an introduction to those kids that no one

[182] Ladwig, interview, December 28, 2010.

[183] NASA, "New NASA Educational Program for Science and Math Announced," news release 84-83, June 19, 1984, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000041999.pdf.

[184] ADB/Associate Deputy Administrator (Philip E. Culbertson) to A/Administrator (James M. Beggs), "Proposal for First Flights of Private Citizens," April 4, 1984, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[185] National Commission on Excellence in Education, *A Nation at Risk: The Imperative for Educational Reform* (Washington, DC: U.S. Government Printing Office, 1983).

else could."[186] Beggs forwarded the recommendation to fly a schoolteacher to Reagan, who on August 27, 1984, publicly directed NASA to make a teacher the agency's first competitively selected citizen in space.[187] Its official objectives were to increase the prestige of the teaching profession, increase the education community's awareness of the impact of science and technology on the Nation's future, and use space and aeronautics as a catalyst to enhance leaning for all subjects and grade levels.

That fall, NASA entered into an agreement with the Council of Chief State School Officers to develop the selection criteria and to collect and review applications during the 1984-1985 academic year for what NASA dubbed the Teacher in Space Project. Released in November, the announcement invited elementary and secondary schoolteachers from public and private schools in all U.S. states and territories as well as in overseas Department of Defense and Bureau of Indian Affairs schools to submit applications by February 1, 1985.[188] With such a short timeframe to identify a candidate teacher, NASA aggressively advertised the program through education organizations and conferences; Ladwig also promoted the opportunity during an appearance on the *David Letterman Show*.[189] The applications were not for the faint of heart: at 15 pages long, they required teachers to collect letters of recommendation and to complete essays outlining their education philosophies as well as proposals for educational projects they could conduct aboard a Shuttle mission. NASA distributed more than 45,000 applications and received more than 11,000 completed applications in addition to letters, drawings, and paintings from teachers and

[186] James M. Beggs, interview by Kevin M. Rusnak, Bethesda, MD, March 7, 2002, transcript, NASA Oral History, NASA Historical Reference Collection, Washington, DC, accessed February 7, 2015, http://www.jsc.nasa.gov/history/oral_histories/NASA_HQ/Administrators/BeggsJM/BeggsJM_3-7-02.pdf.

[187] O'Toole, "Reagan Tells NASA to Choose Schoolteacher for Shuttle Flight."

[188] NASA/Council of Chief State School Officers, *Announcement of Opportunity: The NASA Teacher in Space Project* (Washington, DC, 1984), Box 23, STS 51-L General History Files Subseries, General Reference Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[189] Patricia Palazzolo, interview by author, Pittsburgh, PA, March 25, 2013.

students who supported the program.[190] Each state, territory, and agency identified two finalists, who were sent to Washington, DC, in June 1985 for a week filled with workshops to orient them with NASA programs as well as interviews and more informal judging by an eclectic panel including Apollo astronaut Gene Cernan, rocket scientist Konrad Dannenberg, and Pam Dawber from TV's *Mork & Mindy*. NASA personnel made clear to the teachers that they were "not going to be astronauts" but would be partners with the agency as communicators of the space flight experience to the public. Pat Palazzolo, a Teacher-in-Space finalist from Pennsylvania, expressed:

> I remember them saying: 'You're the teachers. You figure out how to make it interesting for the public. … What are the ways to answer the public's questions that they will want to know… not just the students in the classroom…but also the public in general?' So that was communicated from the very beginning, as an opportunity to be the ultimate resource of everything people could want to know, but being in our hands to figure out how to make it interesting.[191]

NASA chose ten national finalists and on July 19, Vice President George H.W. Bush announced the selection of New Hampshire social studies teacher Sharon Christa McAuliffe with Idaho teacher Barbara Morgan as backup. Among her duties as part of the STS-51L *Challenger* mission crew, McAuliffe was slated to telecast live classroom lessons to the nation's schoolchildren. The first lesson, "The Ultimate Field Trip," would orient students to the Space Shuttle while "Where We've Been, Where We're Going, Why?" explained some of the benefits of human space flight.[192] Classrooms with access to satellite dishes or cable networks carrying the NASA Select television channel could also watch coverage throughout the mission moderated by Morgan.[193]

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[190] Alan Ladwig to Ms. Brown, March 13, 1985, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[191] Palazzolo, interview.

[192] NASA, *Teacher in Space Project* (Washington, DC: U.S. Government Printing Office, 1985), Box 1, STS 51-L Documents Subseries, Shuttle Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

[193] NASA, "Live Lessons, Mission Watch Highlight Shuttle Mission 51-L," news release 85-156, November 26, 1985, Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Perhaps the greatest surprise and benefit of the Teacher in Space Project in support of NASA's goals, however, centered not on the teacher who would fly but on those who would not. At NASA's request, the other eight finalists took year-long absences from teaching to support the agency's education initiatives at its field centers and to assist McAuliffe and Morgan, who were also busy with space flight training, with the development of lesson plans and activities to be carried out on the Shuttle flight. And recognizing the tremendous enthusiasm and assets represented in the state finalists, the agency also sought to partner in the longer term with them, naming them all "NASA ambassadors" and encouraging them to conduct public outreach activities in their own states and communities. Working as what Palazzolo described as "the line between NASA on all areas and the public," the state finalists reached more than 4 million people by participating in more than 2200 public and school-focused lectures, workshops, and other events by July 1986.[194] Palazzolo, for one, took leave from her teaching position in Pittsburgh to feature for one year in school assemblies and engage with dozens of civic organizations upon their request. Wearing their NASA-issued flight suits for speaking engagements, Palazzolo and the other ambassadors were often called astronauts by the media. Although the teachers did not claim the moniker, they sometimes incurred suspicion from astronauts who felt their identities were being co-opted.[195] With public requests and the finalists' commitment no doubt heightened by the *Challenger* accident that claimed the life of McAuliffe, NASA's Teacher in Space Project made countless unanticipated connections between the Shuttle, the education community, and the broader American public.

As the Teacher in Space Project finalist selections got underway, NASA administrator James Beggs became increasingly comfortable with conceptualizing citizens as Shuttle passengers.

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[194] Palazzolo, interview; "Appendix B: Teacher in Space Program, Educational Activities of the Space Ambassadors, June 1985 through July 1986," n.d., Folder 20198, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[195] Palazzolo, interview.

Consequently, the agency began moving forward with planning for its second space flight participant. In October 1985, Beggs announced that journalists would finally get their chance to vie for flight on a Shuttle mission.[196] But what sort of journalist should the agency select – a newspaper editor, a major television network broadcaster, a freelancer, a science writer? In an effort to avoid having to make the choice, NASA teamed with the Association of Schools of Journalism and Mass Communications (ASJMC) – made up of 170 member journalism schools and with connections to dozens more journalism-related professional organizations – to set the specific selection criteria and evaluate the applications. Keeping close to the procedure used for educators, NASA and ASJMC develop a comprehensive application packet that required recommendation letters as well as responses to essays that asked what projects the aspiring journalists would carry out on a Shuttle mission as well as how they believed a journalists' participation would serve their profession as well as their publics.[197] By the January 15, 1986, deadline, ASJMC had received more than 1700 applications. The plan was for ASJMC's member schools to choose 40 semi-finalists in each of five geographic regions, after which a national panel of nationally-known retired journalists, academics, and others would narrow the field to one finalist from each region; NASA would evaluate and select a winner and a backup in April 1986. NASA expected to fly the winning journalist in the fall of 1986.

With the journalist competition in progress, officials at NASA moved ahead to decide what sort of person to fly next. Indeed, James Beggs, Alan Ladwig, and others believed firmly that after a journalist, NASA's Space Flight Participant Program would invite many more Americans – artists, entertainers, lawyers, blue-collar workers, the man-in-the-street – to take the journey of a lifetime aboard the Shuttle and change the way Americans viewed and related to NASA's human space flight

[196] NASA, "Journalist to Fly on Space Shuttle," news release 85-147, October 24, 1985, Folder 19754, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[197] NASA/Association of Schools of Journalism and Mass Communication, Journalist-in-Space Project application packet, 1985, Folder 19753, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

enterprise.[198] Ladwig was thinking of proposing to fly an artist next, having talked with staff at the National Endowment for the Arts about their potential involvement in the selection process.[199] The agency was also gearing up to conduct a study on the feasibility of providing flight opportunities for physically disabled individuals. Some members of the House of Representatives' Committee on Science and Technology, including Robert Walker of Pennsylvania, believed that NASA's flight of someone with a physical handicap could "prove that those who bear the lifelong burden of a handicap on Earth may be freed to become highly valuable and fully productive" in space.[200] The Congress included in NASA's FY 1986 Authorization Bill direction to NASA to "initiate an immediate feasibility study to ensure flight opportunities for a diverse segment of the American public, including a physically disabled American."[201] Ladwig and legislative affairs assistant administrator John Murphy conveyed to the many people who inquired about such opportunities that while the Shuttle was not then equipped to accommodate someone with a disability and assure mission success and the safety of everyone on board, NASA was hopeful and confident that physically disabled Americans would have the chance to apply for a Shuttle flight.[202]

While Beggs, Ladwig, and others at NASA were eager to facilitate citizen flights aboard the Shuttle, Ladwig cautioned the myriad others who professed their desires to secure a spot on a Shuttle

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[198] O'Toole, "Reagan Tells NASA to Choose Schoolteacher for Shuttle Flight."

[199] Ladwig, interview, December 28, 2010.

[200] Michael Mecham, "Disabled May Fly on Shuttle," *USA Today*, March 22, 1985, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[201] National Aeronautics and Space Administration Authorization Act of 1986, Public Law 99-170, 99th Cong., 1st sess. (December 5, 1985). The report accompanying the House bill on which the public law was based states that the "Committee is highly supportive of the efforts of NASA to ensure that a wide variety of Americans will have an opportunity to fly in space." It goes on to state that flights of disabled persons, specifically "Americans who have become disabled as the result of spinal cord damage due to accidents or combat wounds," present "an historic opportunity to prove that those who bear the lifelong burden of a handicap on Earth may be freed to become highly valuable and fully productive members of the space based materials processing economy of the future." See House Committee on Science and Technology, Authorizing Appropriations to the National Aeronautics and Space Administration for Fiscal Year 1986. 99th Cong., 1st sess., March 28, 1985, HR Rep. 99-32, 26.

[202] See, for example, John F. Murphy to Lee B. Hamilton, May 10, 1985, and Murphy to Mark C. Munson, December 3, 1985. Both letters located in Folder 19758, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

mission that the agency would not be able to help all fulfill this dream. As he explained in letters responding to their inquiries: "Seats on the Shuttle are a limited national resource, and we at NASA are doing the best we can to insure that this resource is being used efficiently, effectively, and on behalf of the public's benefit." He noted, however, that NASA had come far from the seemingly "elitist" stance on space flight of the 1960s to its present position on space flight passengers.[203]

Indeed, the agency faced many possibilities for expanding opportunities for citizen space flight even further. A non-profit organization backed by Chevron, Lockheed, and other private sector entities and founded to promote educational excellence and space development proposed to forge a joint endeavor agreement with NASA to conduct a program to fly students along with teachers aboard the Shuttle to test experiments.[204] And while NASA had no intent to operate a tourism service, some NASA officials and others outside the agency viewed the Shuttle as a starting point for a private venture for doing so. Beggs noted that if the Shuttle became a commercial venture, as NASA and the Reagan administration were contemplating at the time, the operator could sell tickets and use a lottery system to select passengers.[205] By 1985, private companies had proposed developing modules that could accommodate dozens of extra seats in the Shuttle's cargo bay: concepts like Rockwell's were intended to carry crews to construct a space station one day, but exotic vacations purveyor Society Expeditions hoped to sign an agreement with NASA to fly tourists using the Shuttle, at least until other, privately-owned vehicles were available.[206] As

[203] Alan Ladwig to Robert J. Mason, December 5, 1984, Folder 801, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[204] Ann Bradley to members of the Space Flight Participation Evolution Committee, August 24, 1984, with attachments, Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[205] Clifford Cunningham, "Civilian Space Travel is Nearing Reality," publication name smudged, February 22 [handwritten] [1984?], Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[206] Alan Ladwig, interview by author, Washington, DC, January 31, 2013; Kevin Anderson, "2,000 Sign Up for Space Trip," *USA Today*, June 19, 1985, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Leonard David, "Commuting into the Cosmos," *Space World*, August 1985, 11, 14, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

far as these NASA officials were concerned at that point, it was just a matter of time to see what possibilities emerged.

Chapter Synthesis

Expanding the group of people to whom NASA granted access to space as Shuttle flight participants was a novel and critical aspect of the agency's effort to cast the human space flight program as a broadly accessible, socially legitimate, and meaningful undertaking in the post-Apollo era. NASA officials recognized that the Shuttle's ability to become and remain perceived as a vital national asset depended heavily on involving new publics as flyers aboard missions. Including credentialed scientists and engineers as mission specialists as well as technical and non-technical representatives of companies and countries as payload specialists helped to advance the projects each Shuttle mission carried, or at least served to promote awareness of the missions or build supporters for the Shuttle among individuals flown. Diversifying the demographics of its space flyers acknowledged and addressed evolving social norms and expectations in an effort to prove the Shuttle comported to the times. Considering "ordinary" citizens as space flight participants – a notion Apollo-era goals, technology, and culture simply did not allow – demonstrated NASA's commitment to its imaginary of an accessible Shuttle and helped to validate its claims about the opportunities made available due to the Shuttle's capacity and benign flight environment.

As was the case with its other novel forms of public engagement, NASA's provision of broader access to space flight opportunities faced its share of resistance. Whereas proponents of expanding flight opportunities believed these changes would enhance the Shuttle's viability, those who opposed felt inclusiveness would threaten astronauts' flight opportunities, raise safety issues, and compromise public perceptions of the vehicle's legitimacy as well as NASA's credibility as an institution of technoscientific authority. Agency officials thus treaded carefully as they opened Shuttle flight participation to new sorts

of people. Their choices indicated that NASA no longer justified human space flight solely by its role in supporting technological advancement and U.S. global leadership in space but also by its ability to serve domains such as the humanities and education which touched the lives of even those who would never fly in space. Partnering with people with these other backgrounds, expertises, and views would achieve this possibility and in turn humanize, normalize, and make the Shuttle more holistic in its relevance.

Despite NASA's commitment and the tremendous level of external enthusiasm, the agency brought to a sudden halt its journalist in space selection process and other aspirations to broaden public access to space flight opportunities. The catastrophic launch of the *Challenger* on January 28, 1986, the mission that carried teacher Christa McAuliffe, prompted NASA officials to revisit how it would conceptualize and engage with citizens going forward.

Chapter 5: Democratizing the Space Shuttle: A Sustainable Proposition?

In reaction to voiced public and political predilections during the 1970s, NASA had promoted the Space Shuttle as a technology that would achieve many useful things for and with the participation of many different people. That sociotechnical imaginary sustained the agency's approach to public engagement throughout the Shuttle's development and early operational periods. Proponents of the imaginary sought to enroll American citizens in making the Shuttle a viable program by conveying the Shuttle's capabilities and benefits in ways that would appeal to various publics, making the craft virtually accessible to almost anyone and involving disparate publics as users of and even flyers aboard the vehicle. Through this combination engagement approaches, NASA officials hoped to systematically (re)gain an American public that legitimized the Shuttle program by both appreciating and contributing to it.

After a few years of Shuttle operations, NASA officials had many reasons to believe its strategies for engaging citizens in the new human space flight program had been effective in serving existing and galvanizing new interest in the nation's future in space and helping to erase earlier doubts about the program's value. According to a June 1981 Harris poll, taken two months after the STS-1 mission, 63 percent of those surveyed expressed that the Shuttle was a worthwhile expenditure even in the midst of a general preference for cutting federal spending. More than three-quarters of those surveyed regarded the Shuttle as an important American technological breakthrough, particularly in the face of recent Japanese competition to the American automobile industry and the failure of the nation's technology to enable defeat of Vietnam or to rescue American hostages in Iran.[1] Meanwhile, slightly more than half of those polled beginning in 1981 thought the nation spent the right amount or too little on space while 40 percent

[1] Mark Chartrand and Leonard David, "James Beggs, NASA Administrator," *Insight*, November/December 1981, 6-7; Louis Harris, "Space Shuttle Considered Major Breakthrough for U.S. Technology," Harris Survey news release, June 1, 1981, "Harris" Folder, Box 16, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

said it spent too much.[2] Representing a near-reversal in figures from the early 1970s, these numbers were more favorable than any previous time in NASA's history and remained roughly constant during the Shuttle's first several years of operations in the early to mid-1980s. Agency officials believed their efforts to enroll citizens by making the Shuttle relevant to them had a major influence on the numbers. Administrator Beggs maintained that the polling statistics shift was partly due to the "spectaculars" generated by the Shuttle and the Voyager spacecraft flybys of the outer planets but also was a product of NASA's emphasis of the benefits of space flight. As he conveyed in a letter to a couple in South Bend, Indiana, "we like to believe the public is becoming more aware of the every day benefits of space research and development."[3]

The agency's efforts to share the Shuttle seemed to resonate with Americans in other palpable ways. Citizens expressed their sense of pride of ownership of the Shuttle, schoolchildren flocked to interact with the astronauts and participate in initiatives like Young Astronauts and the SEEDS project, and the nation's primary and secondary educators praised the Shuttle as an inspirational teaching tool for science, math, and other subjects. Companies of all sizes and people from all walks of life saw potential for the Shuttle to carry payloads to space that would help to answer research questions of value to them and society and, often, to answer their dreams of space flight. By the mid-1980s space advocacy groups remained small in terms of membership but were proliferating in numbers, spurred on by what Michaud A.G. Michaud calls the Shuttle's "symbolic beginning of the democratization of space."[4] Just as Apollo had hastened a litany of space-related television shows, so too did the Shuttle permeate American popular culture, with space-themed movies such as *E.T.: The Extraterrestrial* and *Space Camp* featuring on the

[2] Mark E. Byrnes, *Politics and Space: Image Making by NASA* (Westport, CT: Praeger, 1994), 126 (table 2).

[3] James M. Beggs to Mr. and Mrs. Dick Donahue, January 22, 1982, Folder 1570, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[4] Michael A. G. Michaud, *Reaching for the High Frontier: The American Pro-Space Movement, 1972-1984* (New York: Praeger, 1986), 294.

silver screen and novels such as James Michener's *Space* hitting bookshelves. Between NASA's focus on engaging citizens via rhetoric and visual and virtual experiences and how millions of them responded to these efforts, citizens helped to produce the Shuttle as fans, supporters, and members of the agency's future workforce.

All the same, democratizing the Shuttle was hardly a straightforward effort. As the previous chapters showed, from the Shuttle's development years onward, not all parties within or outside of NASA agreed with the agency's public engagement approaches, particularly those that involved "outsiders" using and flying aboard the spacecraft. Officials constantly negotiated questions of propriety, fairness, and safety risks associated with involving external publics as they worked to find a pathway to achieve a viable Shuttle program and, ultimately, a space station and other human space flight initiatives. Even where the agency aimed to engage citizens with the Shuttle virtually, naysayers doubted the propriety of the agency directing the use of astronaut and Shuttle mission time and resources in particular to support efforts to engage with external publics, believing the simple ability to fly missions successfully mattered most. To be sure, NASA's move in the direction of aiming to share the Shuttle in these ways to make the vehicle relevant to American citizens was imperfect and far from smooth.

The current chapter reveals that this commitment became even harder for NASA to maintain as the program went forward. Just a few years into the Shuttle's operational period, NASA's quest to make the Shuttle viable by enrolling citizens according to an imaginary of accessibility was jolted by a sequence of events. As the first section of this chapter explains, the 1986 explosion of the Shuttle *Challenger* became what historian Valerie Neal calls a "critical discourse moment," revealing that the risks of flying the vehicle were far less understood and effectively managed than NASA had indicated publicly and to its political stakeholders.[5] NASA's identity as a bastion of technoscientific expertise and

[5] Valerie Neal, "Framing the Meanings of Spaceflight in the Shuttle Era," in *Societal Impact of Spaceflight*, eds. Steven J. Dick and Roger D. Launius, NASA SP-2007-4801 (Washington, DC: U.S. Government Printing Office, 2007), 83.

the future of human space flight hung in the balance following the Shuttle disaster and some mishaps that ensued in the following years. NASA subsequently backed away from the participatory imaginary as its leaders strived to regain the trust of critics outside of the agency, and especially the Congress and the media, that NASA remained technically competent and credible, committed to flight safety, and in control of the Shuttle program. Over the next decade, NASA's ability and commitment to involving a broad range of Shuttle users and flyers continued to erode as the agency secured political support for a space station and repurposed the Shuttle to fulfill its original intent of constructing and ferrying crews between Earth and the orbiting station. Questions about the Shuttle unfairly competing for payloads and passengers with the nascent commercial space industry also served to limit the vision of the Shuttle serving as a physical site of public engagement.

The second section of this chapter traces the shifts in the agency's approaches to engaging external publics that followed the *Challenger* incident. NASA officials continued to recognize citizens as important to human space flight, but less to make the vehicle physically viable and more as potential supporters of the Shuttle, the International Space Station, and future human initiatives. Just as NASA had originally focused on articulating how the Shuttle would benefit citizens and the nation, agency officials continued to explain the Shuttle's value as well as share its achievements and make it visually and virtually accessible from the ground to serve enthusiasts, maintain accountability, and support youth education. Meanwhile, NASA did not abandon its efforts to involve various publics materially with the Shuttle but limited the growth of approaches to substantively engage new publics as the agency focused attention on returning the Shuttle safely to flight and then on using the Shuttle to construct the International Space Station. Broadening the direct involvement of a variety of publics in the Shuttle program, in other words, became less central to the agency's pursuit of legitimacy for the Shuttle program

(although it did eventually become essential again as NASA sought to establish a space station's viability).[6]

In 2003 NASA endured a second tragic accident involving a Space Shuttle, *Columbia*, upon its reentry from a 16-day mission. In the aftermath of the catastrophe, NASA and the George W. Bush administration decided to retire the remaining vehicles after International Space Station construction was completed. The Shuttle, the accident investigators would make clear, would need to be substantially upgraded and recertified to fly safely over the long run. NASA and the Bush administration chose instead to retire the Shuttle and to use the resources freed to embark on a program to send astronauts to destinations beyond Earth orbit, such as the Moon and Mars. As the last section of the chapter explains, throughout this period, the Shuttle remained NASA's only visible element of its human space flight aspirations. While the Shuttle no longer invited the degree of new public participation it once had, the agency aimed to showcase it and capitalize on the vehicle's popular legacy as an accessible vehicle to remain accountable to external publics and keep up interest in human space flight while the next phase of the enterprise remained subject to political debate.

Revisiting the Shuttle Imaginary after *Challenger*

Since the Shuttle's development years, NASA had sought to achieve legitimacy for the vehicle and human space flight generally by realizing an imaginary in which it would make space flight routine and accessible for many sorts of users and uses. The effort had enrolled many citizens as supporters and participants in the Shuttle program but had not been universally successful or easy. The agency strained to generate enough payload business to realize the agency's economic promises for the Shuttle while at the same time contended with the Reagan administration's rising concerns about the vehicle's competitive

[6] This dissertation does not explore NASA's efforts to engage and enroll external publics as it planned for a space station. Such work, however, would enhance the present analysis.

threat to nascent private launch companies. Meanwhile, weather issues and technical challenges in processing the vehicles in rapid succession obfuscated NASA's ability to achieve anywhere near the high flight rates that it had touted publicly. By 1985 it was clear that NASA was struggling to accommodate many flights per year: the agency was still far from achieving its downward revised target of 24 launches annually. Despite NASA's efforts to engage the media, many commentators, expecting more from the agency, criticized the Shuttle's underperformance. John Noble Wilford wrote in the *New York Times*, for example, of a gap between what NASA promised the Shuttle would achieve and the vehicle's actual performance, pointing to the missions it accomplished and the numbers of satellites it put into orbit versus its projections and schedules.[7] Historian of technology Alex Roland penned a critique in *Discover* magazine arguing that the Shuttle was a "turkey" based on the program's cost.[8]

NASA had remained determined to demonstrate its credibility and deliver on its promises, actively soliciting new users and diversifying Shuttle mission crews while aiming to boost its efficiency in readying Shuttles for launch. Indeed, performance was key as the agency worked to secure funding for a permanent Earth-orbiting space station. Believing in the importance of a human future in space, and especially the commercial opportunities a long-term space-based research platform could offer, President Reagan had announced his support for the space laboratory in 1984. NASA, however, faced difficulty gaining Congressional support for the project. By the mid-1980s, NASA had set for itself an ambitious launch schedule, releasing a plan in early 1985 to conduct 41 missions in 33 months.[9] NASA hoped doing so would attract commercial entities that might otherwise entrust their payloads to Europe's Ariane and also show naysayers that the agency was indeed turning the corner with the Shuttle program and

[7] John Noble Wilford, "Gap between Early Hope and Present Accomplishment Grows Large; Space Shuttle Re-evaluated," *New York Times*, May 14, 1985, C1, ProQuest Historical Newspapers: The New York Times, accessed February 17, 2015.

[8] Alex Roland, "The Shuttle: Triumph or Turkey?" *Discover*, November 1985, 29-49.

[9] Associated Press, "NASA Releases Shuttle Launch Schedule," *Greensboro (NC) News & Record*, April 7, 1985, A19, Folder 8163, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

moving toward increasing flight rates. Confident in its progress toward making space flight routine, the agency assigned its first "citizen" space traveler, teacher Christa McAuliffe, to the crew of STS 51-L *Challenger*, slated for a January 1986 launch. McAuliffe's presence along with crewmembers including African American astronaut Ronald McNair, Japanese-American astronaut Ellison Onizuka, Jewish astronaut Judith Resnik, and Hughes payload specialist Gregory Jarvis suggested that the agency was on the way truly on the way to realizing its vision of broad accessibility for the Shuttle.

As painstakingly as NASA had worked to nurture this imaginary, however, the very mission that was seen as an epitome of NASA's commitment to the democratization of human space flight would soon challenge the vision's sustainability. The overnight temperatures preceding *Challenger*'s January 28, 1986, launch were expected to be lower than they had ever been for a Shuttle launch, and engineers at Morton Thiokol, the firm that produced the Shuttle's solid rocket boosters, expressed concern about the cold weather's effect on the performance of the rubber "O-ring" seals that plugged segments of the rockets and kept the fuel and gases from escaping. Shuttle propulsion system managers at the Marshall Space Flight Center in Huntsville nonetheless recommended to NASA Headquarters officials to proceed with the launch. In what sociologist Diane Vaughan has called a normalization of deviance in high-technology cultures, they felt confident that their experience to date with the O-rings made the issue an "acceptable risk" – one they did not see as worth flagging as a concern.[10] Moreover, holding up the launch, which had already endured several delays, would ripple further through the aggressive manifest and likely induce further shameful press commentaries such as the one with which *CBS Evening News*' Dan Rather opened his newscast on the evening of January 27: "Yet another costly, red-faces-all-around Space Shuttle launch delay" due to a bad bolt on a hatch and poor weather."[11] Thousands of spectators,

[10] Diane Vaughan, *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA* (Chicago: University of Chicago Press, 1996).

[11] Rather quoted in David Ignatius, "Did the Media Goad NASA into the Challenger Disaster?" *Washington Post*, March 30, 1986, D1, accessed March 1, 2015, LexisNexis Academic. NASA Kennedy Space Center director Richard G. Smith averred that "98 percent of the pressure" to launch *Challenger* came from news media, which ridiculed NASA any time there was a launch delay. Smith stated: "You think that doesn't have an impact? If you think it doesn't, you're stupid." See Michael Isikoff, "Space Official Criticizes Probe," *Washington Post*, March 15,

many teachers among them, flocked to the Cape on that unusually chilly Florida morning to see the diverse crew off on their mission. Countless more, including millions of educators and their classrooms of students, tuned in to view the nationally televised broadcasts of the launch. Seventy-three seconds into *Challenger*'s ascent, they all watched in confusion and horror when the vehicle exploded and the crew of seven perished.

As investigators would soon discover, NASA's judgment had faltered: the O-rings had not withstood the atypically cold temperatures and thus failed to seal the boosters to ensure safe flight. The agency had, of course, endured failure previously with the tragic deaths of the three Apollo 1 astronauts during a spacecraft systems test in 1967. But NASA's ultimate success with Apollo 11 had had what former astronaut Joe Allen calls an "after-burner effect," bestowing on the agency an image and identity around the world as a "can-do agency, the best agency in the federal government."[12] In promulgating its imaginary of accessibility for the Shuttle nearly ever since, NASA had drifted far from publicly discussing the notion that calamity could strike again; risk had completely escaped from NASA officials' human space flight lexicon. As Brian Wynne points out, the agency had been portraying the Shuttle as a well-understood technology when in fact it was quite the opposite.[13] Hence, the *Challenger* disaster, which had unfolded on live national television before millions of witnesses, was all the more tragic because it defied people's sensibilities of what the Shuttle and NASA itself seemed to promise and embody. It was completely unexpected to those outside of NASA, including the media, elected officials, and many at NASA itself whose jobs entailed promoting and publicizing the Shuttle's success.[14] On that

1986, A1, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. While the news media were not the direct cause of the accident, they certainly were a factor that loomed in the minds of many at NASA.

[12] Joseph P. Allen, interview by author, Washington, DC, April 2, 2013.

[13] Brian Wynne, "Unruly Technology: Practical Rules, Impractical Discourses and Public Understanding," *Social Studies of Science* 18, no. 1 (February 1988): 147-167.

[14] Wayne Hale, telephone interview by author, April 12, 2013.

fateful day, as one *Chicago Tribune* headline expressed, "NASA wizards' legendary infallibility blew up with [the] Shuttle."[15]

Indeed, while NASA had been focused on building and proving the Shuttle to be a viable human space flight initiative and selling the space station concept to Congress, the agency suddenly found its reputation of competence and technical expertise marred by the *Challenger* disaster. Almost immediately, the agency also found itself to be the butt of numerous jokes. "What does N.A.S.A. stand for?" went one prevailing wisecrack, to which cynical citizens would answer "Needs Another Seven Astronauts." Haynes Johnson of the *Washington Post* called NASA "a once-proud agency rudderless, uncertain, torn by dissension and low morale" and noted that "potentially irreparable harm is being done to public confidence" in NASA.[16]

The situation was exacerbated as NASA, shocked by the reality of what had occurred, abandoned its longstanding commitment to open communications. The agency angered and bred the distrust of news reporters, many of whom were covering the *Challenger* launch and disaster as novices to space affairs, when it impounded their cameras and film onsite at Kennedy Space Center to use in investigating the accident and waited nearly five hours to host a press conference on the event, saying very little when it did.[17] NASA public affairs and Shuttle program staff seemingly fell silent, failing to return calls and

[15] Storer Rowley, "NASA Wizards' Legendary Infallibility Blew Up with Shuttle," *Chicago Tribune*, March 2, 1986, Chicago Tribune archives online, accessed February 18, 2015, http://articles.chicagotribune.com/1986-03-02/news/8601160039_1_nasa-officials-rocket-casing-space-administration.

[16] Haynes Johnson, "NASA's Decaying Public Image," *Washington Post*, February 12, 1986, A2, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[17] NASA's Shuttle public affairs contingency plan had allowed for impounding unspecified materials following a contingency situation asserted that "a continuing information flow must be maintained" and that "no longer than 20 minutes should elapse" before making an announcement about the crew's welfare. See Brian M. Duff to Distribution, "Space Transportation System (STS) Public Affairs Contingency Plan," March 13, 1983, with attached subject plan, Folder 18179, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The most current version of the plan at the time of the *Challenger* accident, date March 30, 1984, retained this language. See William Safire, "Handling Bad News," *New York Times*, January 30, 1986, A21, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

prompting journalists to resort to seeking information by other means.[18] Reporters talked to anonymous NASA sources in bars, went to Navy ports to see what Shuttle remains were salvaged, and demanded NASA's release of information through the government's Freedom of Information Act.[19] Reporters felt misled when NASA issued a statement prognosticating that the crew had died instantly when evidence ultimately revealed that at least some of the astronauts were aware of the danger and took measures to survive.[20] As Michael Cabbage, a space beat reporter who later joined NASA's public affairs staff, put it, NASA's handling of the *Challenger* was a "textbook case" in how not to communicate with the media. Consequently, the press would no longer be protective of NASA.[21] Indeed, what *Columbia Journalism Review* editor William Boot called the "spellbound press," dazzled by NASA's spectacular space feats, was replaced by scores of journalists, frustrated by NASA's lack of transparency, who did not hesitate to publish stories suggesting NASA had been lax in Shuttle management all along.[22]

NASA's credibility and technical judgments came under scrutiny from still others whom NASA considered essential to its support. According to Frank Johnson, who led NASA's public affairs office up until just weeks before the fateful launch, the agency's failure to be up front from the start "sent out a

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[18] Thomas O'Toole, "After 27 Years of Openness, NASA Falls Silent," *Washington Post*, January 31, 1986, B2; Alex S. Jones, "Journalists Say NASA's Reticence Forced Them to Gather Data Elsewhere," *New York Times*, February 9, 1986; Matt Moffett and Laurie McGinley, "NASA, Once a Master of Publicity, Fumbles in Handling Shuttle Crisis," *Wall Street Journal*, February 14, 1986. All of these articles located in Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[19] Lisa Malone, interview by author, Arlington, VA, April 17, 2013.

[20] NASA, "Statement by RADM Truly," news release 86-53, April 25, 1986, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021173.pdf; William V. Shannon, "Did NASA Conceal Astronauts' Fate?" *Philadelphia Inquirer*, April 24, 1986; Kathy Sawyer, "NASA Statement on Shuttle Deaths Assailed," *Washington Post*, August 2, 1986, A4. Both newspaper articles located in Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[21] Michael Cabbage, interview by author, Washington, DC, June 3, 2013.

[22] William Boot, "NASA and the Spellbound Press," *Columbia Journalism Review*, July/August 1986, 23. See, for example, Philip M. Boffey, "Space Agency Image: A Sudden Shattering," *New York Times*, February 5, 1986, A1, Folder 6619, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Stuart Diamond, "NASA Wasted Billions, Federal Audits Disclose," *New York Times*, April 23, 1986, A1; and Stuart Diamond, "NASA Cut or Delayed Safety Spending," *New York Times*, April 24, 1986, A1. The latter two articles located in Folder 8295, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

strong signal that they were not in control of the situation."[23] Whereas NASA had handled the Apollo 1 investigation on its own, President Reagan appointed an independent commission chaired by former Secretary of State William P. Rogers with Neil Armstrong as vice chair and ten other leaders of the scientific, military, technical, and management communities to examine what went wrong with the *Challenger* launch. The commission identified the O-ring's integrity to be the accident's direct cause, noting that it was one of several problems that posed high risks to Shuttle flights of which NASA was aware but apparently did nothing to mitigate. In addition to identifying the technical reason for the disaster, the commission identified as a contributing cause what the commissioners regarded to be a "serious flaw" in NASA's decision-making process leading up to *Challenger*'s fateful launch due to an inadequate focus on safety assurance and an ineffective management structure and communications across NASA and its contractors for dealing with technical issues.[24]

Of particular note, the Rogers Commission called into question the veracity and prudence of NASA's ambitious, broad-reaching sociotechnical vision and economic rationale for the Shuttle. Built as the Shuttle's strategy for success was on maintaining a packed payload manifest and an aggressive launch schedule, the commissioners suggested it had much to do with the accident. They noted that NASA was occupied with managing payloads and increasing flight rates at the expense of safety. One commissioner, physicist Richard Feynman, accused NASA of exaggerating the Shuttle's reliability, taking particular umbrage to the impact on citizens like Christa McAuliffe. Feynman chastised the agency for seeking "to encourage ordinary citizens to fly in such a dangerous machine, as if it had attained the safety of an ordinary airliner" when clearly it had not. The Mathematica study of the 1970s had established expectations that the Shuttle would be in great demand and prompted the agency, according to the

[23] Johnson quoted in Sam A. Marshall, "NASA after Challenger: The Public Affairs Perspective," *Public Relations Journal* 42, no. 8 (August 1986): 23.

[24] Presidential Commission on the Space Shuttle Challenger Accident, *Report of the Presidential Commission on the Space Shuttle Challenger Accident* (Washington, DC: U.S. Government Printing Office, 1986).

commissioner, to "assure the government of NASA perfection and success in order to ensure the supply of funds." Feynman, however, averred: "NASA owes it to the citizens from whom it asks support to be frank, honest, and informative…For a successful technology, reality must take precedence over public relations, for nature cannot be fooled."[25]

Others also raised concerns about the imaginary NASA had set forth for the Shuttle and the agency's now seemingly overzealous approach to realizing it. Like the Rogers Commission, members of Congress expressed concern that NASA had prioritized proving the Shuttle's capabilities over the astronauts' safety. The House Committee on Science and Technology conducted its own investigation and also concluded that NASA's drive to increase the Shuttle launch rate and evolve the agency into a business operation prompted the agency to demote its commitment to safety.[26] Senator Hollings of South Carolina rebuked NASA for ignoring expert advice to not launch. The legislator accused NASA and the Reagan administration of making the launch decision so the President could take credit in his State of the Union speech, slated for the same day, for launching McAuliffe as the "first citizen passenger" on the Shuttle.[27] Political scientist John Logsdon penned in *Science* his observations that NASA's credibility was doomed from the start, as the agency made a promise it could not honor in seeking approval for the Shuttle in part on cost-effective grounds.[28] As a *U.S. News and World Report* article neatly summed up the situation: "The shuttle will simply never be able to provide the cheap, versatile and reliable access to

[25] Ibid., Vol. II, Appendix F.

[26] Jessie Harris, memorandum for the record, "Science and Technology Committee Hearing to Consider the Challenger Accident Investigation Report, October 7, 1986," with attachment, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[27] Steven V. Roberts, "Congress Is Divided Over What to Do about NASA," *New York Times*, February 23, 1986, ProQuest Historical Newspapers: The New York Times, accessed February 18, 2015. Reagan had planned to say in his State of the Union speech: "Tonight while I am speaking to you, a young secondary school teacher from Concord, New Hampshire, is taking us all on the ultimate field trip, as she orbits the each as the first citizen passenger on the Space Shuttle."

[28] John M. Logsdon, "The Space Shuttle Program: A Policy Failure?" *Science* 232 (May 30, 1986): 1099-1105.

space it was supposed to as the do-all and be-all of the space program… reality [is] that the shuttle is a complex and sophisticated vehicle – a Ferrari, not a truck."[29]

The many concerns about NASA's competence and the propriety of its vision for the Shuttle surfaced questions about whether the nation ought to continue to pursue the Shuttle program, and human space flight altogether, in a variety of circles nearly identical to those that swirled as Nixon and the Congress considered the Shuttle in the 1970s. Just two days after the *Challenger* disaster, David Rosenbaum wrote an article for the *New York Times* asking "Should U.S. Continue to Send People Into Space?"[30] Daniel Greenberg wrote in the *Los Angeles Times* bemoaned the "folly of a space program fixated on humans," whom he called "the most useless cargo ever sent into orbit."[31] Astrophysicist Thomas Gold, who had opposed the Shuttle in the early 1970s, pointed out in a 1987 letter to the *New York Times* that the Shuttle had now hampered the ability of the nation to launch its scientific, military, and commercial payloads into space, noting that the decision to require these assets on a spacecraft carrying humans drove up costs and risks to the satellites as well as the humans.[32] Some citizens wrote letters to NASA and their representatives in Congress expressing their preference for NASA to leave the job of space flight to robotic explorers.[33] As payload specialist Charlie Walker recalled, "I remember

[29] Stephen Budiansky with Robert Kaylor, "What's Wrong with America's Space Program," *U.S. News & World Report*, December 28, 1987-January 4, 1988, 32.

[30] David Rosenbaum, "Should U.S. Continue to Send People into Space?" *New York Times*, January 30, 1986, A18, ProQuest Historical Newspapers: The New York Times, accessed February 18, 2015.

[31] Daniel S. Greenberg, "NASA's Misplaced Reliance on the Shuttle Program," *Los Angeles Times*, October 31, 1988, accessed February 18, 2015, http://articles.latimes.com/1988-10-31/local/me-482_1_shuttle-flight.

[32] Thomas Gold, "Don't Send People into Space Unnecessarily," *New York Times*, September 28, 1987, A24, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[33] Jon A. McBride to Lloyd Bentsen, April 11, 1988, Folder 20116, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The letter provides a response to Bentsen's constituent, John L. Sutterby.

having to address directly and indirectly…from the public and certainly from our elected officials many times…in the late 1980s, 'Well, why do we need to be doing this, anyway?'"[34]

But many American citizens expressed a deep sense of sorrow concerning the loss of the crew as well as support for NASA and the continuation of the human program.[35] The agency received some 300,000 letters along with poems and drawings from citizens in the six months following the accident, many of which conveyed that humans should press even further into space.[36] Children who were members of the Young Astronauts expressed that the tragedy had not discouraged but inspired them to want to pursue space careers.[37] Youth and adults alike showed their support for restoring the nation's human space program by sending unsolicited monetary donations to NASA and other space-related organizations to build a replacement orbiter as well as to benefit the children of the crewmembers lost.[38] Thousands of Floridians purchased special license plates commemorating the tragedy; the proceeds went

[34] Charles D. Walker, interview by Sandra Johnson, Springfield, VA, November 7, 2006, transcript, Johnson Space Center Oral History Project, Houston TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/WalkerCD/WalkerCD_11-7-06.pdf.

[35] For more on public and media rhetorical responses to and sense-making of the accident, see Jeffrey S. Philpott, "From 'Major Malfunction' to 'Pulling Us into the Future': Rhetorical Transformation and the Reconstruction of Public Coherence in Immediate Public Responses to the Explosion of Space Shuttle *Challenger*" (Ph.D. dissertation, University of Washington, 1995).

[36] Marshall, "NASA after Challenger: The Public Affairs Perspective," 24.

[37] Statement of Jack Anderson in *Hearings before the Subcommittees of the Committee on Appropriations, United States Senate*, NASA Space Program, 99th Cong., 2nd sess., March 25-26, 1986, 107-114.

[38] See, for example, American Security Bank news release, January 28, 1986, Folder 8521, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Associated Press, "Bank Shuttle Fund Nets $350,000," *Washington Post*, February 14, 1986, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "U.S. Space Foundation Outlines Challenger 7 Fund," news release 86-18, February 27, 1986, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021173.pdf.

toward building an astronaut memorial. Kennedy Space Center set a record to date of hosting 2.1 million visitors in the year the accident occurred even though the Shuttles were grounded.[39]

Meanwhile, opinion polls indicated unprecedented levels of public support for the Shuttle program in the several months following the accident. According to studies by Jon Miller, some 97 percent of citizens regarded the Shuttle as an outstanding example of American technology even in spite of the disaster.[40] Miller's 1987 study also found American citizens' support for more funding for space program went up by 47% and their positive assessment of benefits and costs of space exploration went up by 8% overall.[41] Miller suggested that previous high public confidence in NASA contributed to the prevention of "long-term attitudinal damage."[42] As John Noble Wilford expressed in the *New York Times*, "With the loss of the *Challenger* and its crew of seven, we learned, to our surprise, how much these adventures into space, into the future, mean to us as a people."[43]

Indeed, even before the accident, citizens across the nation had indicated their interest in a robust space program. In 1984 President Reagan and the Congress had established the National Commission on Space to create a vision for the United States' next 50 years in space. Former NASA administrator Tom Paine, who chaired the panel, decided the vision should be created in consultation with ordinary Americans, noting that the "support of the American public is the most critical resource of the U.S.

[39] NASA/Kennedy Space Center, "May Was Ninth Straight Record-Breaking Month at Spaceport USA," news release 87-64, June 1, 1987, Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[40] James Fisher, "America Loves NASA, Budget Writers Don't," *Orlando Sentinel*, November 24, 1987, Folder 6619, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[41] Jon D. Miller, "The Impact of the Challenger Accident on Public Attitudes Toward the Space Program: A Report to the National Science Foundation," January 25, 1987, unnamed folder, Box 16, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[42] Ibid., ii.

[43] John Noble Wilford, "America's Future in Space: After the Challenger," *New York Times*, March 16, 1986, ProQuest Historical Newspapers: The New York Times, accessed February 18, 2015.

civilian space program."[44] Feedback received from citizens via more than a dozen town meetings and thousands of letters suggested to the Commission that "the American people want a bold, imaginative civilian space effort" that included human and robotic voyages to the Moon and Mars while providing economic, technological, and national security benefits on Earth.[45]

The National Commission on Space's report, *Pioneering the Space Frontier*, was issued shortly following the *Challenger* accident and did not receive strong attention due to the Rogers Commission investigation. Nonetheless, the idea that NASA should renew its human exploration commitment seemed to be validated by external publics in the minds of space policy makers. Even in the midst of the criticism NASA, the Shuttle, and human space flight endured, leaders within NASA and elected officials in the White House and Congress took encouragement from the expressions of support and looked toward renewing the nation's human exploration commitment and developing a long-term human future in space. Jim Fletcher, who returned to head the agency following the *Challenger* disaster, felt justified in continuing with human space flight, contending that, "Middle America is more interested in the astronauts, the human element."[46] Fletcher indicated in a February 1988 speech that "public examination" of the space program after the *Challenger* accident resulted in a "consensus among people in all walks of life" that the nation needed a "major new goal in space" consistent with its status as a "great nation."[47]

Accordingly, Fletcher appointed astronaut Sally Ride to chair an internal committee to help NASA identify long-term goals for the agency. The resulting report, *Leadership and America's Future in*

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[44] National Commission on Space, *Pioneering the Space Frontier: The Report of the National Commission on Space* (New York: Bantam Books, 1986), 169; Marcia Smith, interview by author, Arlington, VA, July 7, 2014.

[45] National Commission on Space, *Pioneering the Space Frontier*, 169.

[46] "NASA: No Flight Plan," *Scientific American*, February 1987, 58.

[47] James C. Fletcher, "Excerpts from Remarks Prepared for Delivery: The Forum Club of Houston, February 19, 1988, Houston, TX," 7, Folder 8977, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Space, identified human missions to the Moon and Mars as ultimate goals to which the agency should strive.[48] President Reagan included in his 1988 National Space Policy "the long-range goal of expanding human presence and activity beyond Earth orbit into the solar system" as a means of expanding commercial opportunities and asserting U.S. military leadership as the Soviet Union continued to send its own cosmonauts into Earth orbit.[49] President George H.W. Bush would announce in 1989, on the 20th anniversary of Apollo 11's lunar landing, a plan to return human to the Moon and send them on to Mars, although Congress would scuttle plans for this "Space Exploration Initiative" due to the exorbitant half-a-trillion-dollar price tag over multiple decades.[50]

In the near term, NASA and the contributors to these reports and policies held that returning the Shuttle program to full operating status was vital to the human space program's future. The space agency needed to get back on its feet and restore American and global confidence in the nation's space program and fly the backlog of payloads created by the accident. Moreover, only with the Shuttle's heavy-lift capability, large payload bay, and human transport capabilities could NASA construct and sustain the nascent space station which Fletcher regarded as the "next logical step" and also "the key to all other steps" beyond Earth orbit.[51] As a platform for studying the long-term effects of microgravity and the radiation of space on the human body as well as systems and technologies needed for lengthy stays in space, a station would serve as an essential steppingstones to humanity's reach beyond Earth orbit. Building a station also would provide valuable insights into how best to build large structures in space.

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[48] Sally K. Ride, *Leadership and America's Future in Space* (Washington, DC: U.S. Government Printing Office, August 1987).

[49] Office of the Press Secretary, "Fact Sheet: Presidential Directive on National Space Policy," February 11, 1988, in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program, Vol. I: Organizing for Exploration*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 1995), 605.

[50] For a comprehensive historical analysis of Bush's proposal, see Thor Hogan, *Mars Wars: The Rise and Fall of the Space Exploration Initiative*, NASA SP-2007-4410 (Washington, DC: U.S. Government Printing Office, 2007).

[51] Fletcher, "Excerpts from Remarks Prepared for Delivery: The Forum Club of Houston," 3.

Given that even under the best of circumstances a station would not be completed for many years (and as it was, construction did not commence until 1998), the Shuttle also would be important for flying laboratory facilities and conducting studies in life and microgravity sciences in the interim.

Engaging Publics after *Challenger*

Supporting these aims, President Reagan requested funds as part of NASA's FY 1987 budget for a replacement Shuttle orbiter, which the Congress overwhelmingly voted to approve within a single appropriation. Meanwhile, NASA officials focused their efforts on making technical and managerial process changes to enhance the safety of Shuttle missions, returning the Shuttle to flight, and developing a comfortable mission cadence. As they worked through the challenges the accident had bestowed and sought to restore normalcy to the human space program, they remained committed to sharing the Shuttle with the American people. The agency continued to recognize a connection between public backing and political support for human space flight and sought to enroll citizens as attestive supporters of the program.[52] Officials also sustained their view of the Shuttle as invaluable to building student interest in science and engineering careers and hence a future NASA workforce. Consequently, NASA's continued to embrace the ground-based approaches to public engagement the agency had employed during the vehicle's earlier period.

NASA's imaginary had also entailed engaging a variety of external publics as physical resources, as users of and flyers aboard the Shuttle, to make the vehicle viable. Subjected to new public perceptions of the Shuttle's capabilities and risk posture, however, NASA's leadership found it difficult to uphold its commitment to including a wide range of external publics as direct participants in the Shuttle program. NASA did not abandon altogether its commitment to diversity and broad public involvement in the

[52] L/Associate Administrator for Communications to distribution (William Sheehan), "Theme Message for NASA Spokesmen," February 29, 1988, Folder 8977, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

human space flight enterprise but relied on the active engagement of a variety of publics far less as a means to substantiate the Shuttle. These limitations were only heightened as the agency became occupied with using the Shuttle to construct the International Space Station and responded to industry pressures not to allow the Shuttle to compete with commercial space activity.

Continuing Themes and Virtual Engagement

A key approach for NASA since the agency's inception, communicating its human space flight plans through the news media and directly remained a valuable tool for connecting with external publics en masse in the post-*Challenger* era. NASA had strived to foment confidence in the Shuttle's capabilities and suitability for successful flights as it began operations, and the agency continued to do the same – this time, to seek to regain lost public and political trust in both the vehicle and itself, especially after having failed to share information in a timely fashion in the immediate wake of the *Challenger* disaster. As public affairs chief Shirley Green noted in a 1987 letter to the head of NASA's external relations office, "My primary goals is [sic] to help NASA reestablish its reputation for competency as the world's leading R&D agency for aeronautics and space exploration and its credibility in the eyes of the media, the Congress and the public."[53] The agency revised its contingency plan for Shuttle accidents to clarify responsibilities and ensure that public affairs officers, Shuttle managers, and other key agency personnel worked seamlessly to release known information to the media as soon as it was available and to at least provide a statement within one hour of a mishap.[54] NASA answered some citizen inquiries about what NASA was doing to prevent another Shuttle accident by sending them copies of a report detailing what

[53] L/Director, Public Affairs (Shirley Green), to L/Associate Administrator for External Relations, "LF Objectives," February 10, 1987, Folder 18180, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[54] L/Deputy Associate Administrator for Communications (Shirley Green) to distribution, "Contingency Planning," November 25, 1987, with attachments, Folder 18180, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA/Office of Space Flight, "National Space Transportation System Contingency Action Plan," July 1988, Folder 7990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; June Malone, telephone interview by author, March 5, 2013.

measures it had taken.[55] The agency pledged in other letters of response that "When we resume space shuttle flight, the spacecraft will be a safer, more dependable system, and NASA will be a better disciplined and managed agency."[56]

NASA's and the Shuttle's credibility challenges persisted even after returning successfully to flight in September 1988: the agency was attacked in Congressional hearings and the media when the orbiters suffered from potentially disastrous hydrogen leaks, processing mishaps, and main engine and booster difficulties, and also when the agency spent $23 million to combat troubles with the Shuttle's toilet facility.[57] Meanwhile, NASA endured criticism for botching the Hubble Space Telescope's primary mirror and losing the Mars Orbiter when the spacecraft was about to reach the red planet.[58] Shuttle program managers left the job of sharing what was going on with the Shuttle to public affairs, who, according to Marshall Space Flight Center public affairs officer June Malone, to be "very public about how we were wrestling and dealing with those tough problems."[59] NASA held press conferences and openly answered reporters' questions to maintain transparency and avoid the speculation and distrust incurred with the *Challenger* incident.

As part of its efforts to regain credibility and demonstrate value, as well as to garner public and Congressional support for a space station, NASA's public affairs officials continued to work actively to

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[55] Jon A. McBride to Daniel P. Moynihan, April 11, 1988, Folder 20116, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[56] Jon A. McBride to Jimmy Hayes, April 6, 1988; Folder 20116, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[57] Brian Welch, "Musings of an Unabashed Shuttle Apologist," *NASA Activities*, November/December 1990, 20-21, 24, Folder 7990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Suzanne Sataline, "NASA, Hamilton Standard Face Questions on Space Toilet's Price," *Hartford Courant*, February 24, 1993, accessed February 20, 2015, http://articles.courant.com/1993-02-24/news/0000104481_1_house-space-subcommittee-nasa-space-flight.

[58] Welch, "Musings of an Unabashed Shuttle Apologist."

[59] James Hartsfield, interview by author, Houston, TX, June 12, 2013; June Malone, interview.

explain the societal relevance of its human space flight pursuits, aiming to craft messages that would resonate with various audiences. During the late 1980s, NASA issued one-page reports summarizing the results of research performed aboard the Shuttle orbiters "that offer special promise for benefitting the economy, health, and well-being of the American people." Examples of experiments highlighted ranged from research on bone metabolism that could improve osteoporosis treatment to studies of plant growth in space that could boost terrestrial crop yields.[60] At the same time, NASA administrator Richard Truly and his leadership team worked actively with the aerospace industry and space advocacy groups to secure their assistance with promoting the space program.[61]

These tactics became all the more valued by agency leadership in the years following the accident after hearing from members of Congress the media, and the public alike that NASA needed to do a better job communicating about its plans, achievements, and value.[62] Indeed, shortly after arriving as NASA administrator, Dan Goldin held public meetings in six U.S. cities to share the agency's plans and receive feedback from citizens, which revealed confusion about the agency's activities.[63] Goldin pressed agency staff to showcase the research benefits of Shuttle missions. The agency consequently issued press releases and fact sheets outlining the Shuttle program's contributions in areas ranging from airliner fuel economy to race car insulation to artificial heart designs.[64] In addition, Goldin intensified pressure for the

[60] A folder entitled "Space Shuttle Research Reports" that contains several such reports can be found in Folder 7990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. The quotation comes from the inside pocket of the folder containing the reports.

[61] Jack Anderson and Dale Van Atta, "Selling the Space Program," *Washington Post*, July 16, 1988, Folder 6614, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; L/Associate Administrator for Communications (William Sheehan) to A/Aaron Cohen, "Role of Office of Communications in Moon/Mars Initiative," August 9, 1989, Folder 8978, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[62] Kathy Sawyer, "Columbia Crew Shares TV Limelight," *Washington Post*, July 6, 1992, A17, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[63] NASA, *Toward a Shared Vision: 1992 Town Meetings*, NASA NP-205 (Washington, DC: U.S. Government Printing Office, 1993), 6.

[64] NASA, "Applying NASA Shuttle Engine Test Findings May Save Airlines Millions in Fuel Costs," news release 96-254, December 12, 1996, Folder 6901, NASA Historical Reference Collection, NASA Headquarters,

aerospace industry to be proactive about reversing what he perceived as waning public interest in the space program.[65] A 1995 ad in a space trade publication sponsored by Rockwell, the orbiter's prime contractor, pointed out that the Shuttle's ability to carry humans and a wide range of cargo continued to enable "research that provides benefits to all on Earth."[66] The Shuttle's prime contractor, United Space Alliance, asserted in a 1998 ad that "Every mission improves your world."[67] The agency also continued to associate the Shuttle with the visions of those who aspired to see humanity move further into space. A Kennedy Space Center brochure released after the *Challenger* accident averred that "the original promise of the Space Shuttle remained undiminished. The Kennedy NASA/industry team was doing its part to fulfill the dream of steady progress living and working on the new frontier of space."[68] As the agency sought public and Congressional validation for a space station program, NASA made a point to associate the Shuttle and the station and attribute these themes to both programs. The agency noted in communicating its budget priorities and in corresponding with members of Congress that the Shuttle was a critical link to enabling a station, which would, like the Shuttle, advance science and commerce in space

Washington, DC; NASA Kennedy Space Center, "Space Shuttle Insulation to Be Commercially Produced for Use on Race Cars," news release 118-96, October 4, 1996, Folder 8136, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Spinoffs from the Space Shuttle Program," fact sheet FS-2000-01-007-HQ, 2000, Folder 19748, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[65] Sarah C. Hoyt to Alan Ladwig, February 28, 2000, with attachment, "Space Awareness Alliance → Space Awareness Initiative, Frequently Asked Questions," "Space Awareness Alliance Folder," Box 14, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Paul Hoversten, "NASA Supporters, Phone HOME, and Write to Congress," *USA Today*, March 22, 1996, Folder 6620, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[66] Rockwell, "We're Right on Course for a Rendezvous with Destiny" (advertisement), *Space News*, June 19-25, 1995, Folder 11904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[67] United Space Alliance, "Every Mission Improves Your World" (advertisement), *International Space Industry Report*, February 4, 1998, Folder 11904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[68] *America's Spaceport: John F. Kennedy Space Center*, [1986-1989?], pages unnumbered, Folder 4636, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

while teaching NASA how to live and work in space so that humans could one day safely voyage to destinations outside of Earth orbit.[69]

NASA also sought to appeal to the range of citizens' interests by employing many of its other earlier tactics for promoting the Shuttle. Within months of the *Challenger* disaster, the agency initiated the NASA Alumni League to involve former agency employees in restoring "public appreciation" of NASA through surveys and the promulgation of analyses focused on NASA's impacts on job creation and the economy.[70] NASA also tried to build public confidence in the Shuttle program by appealing to emotion and invoking patriotic themes, as it had previously done. One of the agency's principal messages in delivering the President's FY 1989 budget to the nation's citizens and members of Congress centered on the idea that the human space program had been instrumental in allowing the United States to progress and "remain a great nation."[71] President Reagan voiced his longstanding sentiment that the Shuttle belonged to all citizens of the United States in a speech at Johnson Space Center just prior to the Shuttle's 1988 return to flight: "When we launch *Discovery*, even more than the thrust of great engines, it will be the courage of our heroes and the hopes and dreams of every American that will lift the Shuttle into the heavens."[72] During the 1990s, Dan Goldin also saw fit to revise NASA's insignia once again, replacing

[69] Jerry Hlass to NASA Speakers and Space Program Supporters, February 10, 1989, Folder 18175, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; James C. Fletcher to Patrick J. Leahy, May 27, 1988, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[70] Robert B. Seamans, Jr., to Lewis Alumni, with attachment, "Fact Sheet," n.d., Folder 6614, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "NASA Programs Generate More Than 300,000 Jobs, Study Shows," news release 89-94, Folder 5715, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[71] L/Associate Administrator for Communications to distribution (William Sheehan), "Theme Message for NASA Spokesmen."

[72] NASA, *Wings in Orbit: Scientific and Engineering Legacies of the Space Shuttle*, eds. Wayne Hale, Helen Lane, Gail Chapline, and Kamlesh Lulla, NASA SP-2010-3409 (Washington, DC: U.S. Government Printing Office, 2010), 36.

the stylized "worm" logo with the agency's original "meatball." The move nostalgically recalled NASA's exceptional achievements of the Apollo era.

NASA, too, remained committed to giving citizens a sense of ownership of the Shuttle and thus continued to provide opportunities for them to see and virtually experience the Shuttle. The *Challenger* accident prompted agency safety officials to restrict viewing locations around the Kennedy Space Center, and hence the numbers of public visitors and media to attend Shuttle launches, but did not altogether preclude the opportunity for tens of thousands to see launches from on NASA property.[73] NASA continued to distribute free passes on a first-come, first-served basis for public viewers to drive onsite for launches and established a phone hotline that provided updated launch information, and NASA employees could invite family and friends to attend launches and special briefings about them. During the mid-1990s the agency also renewed efforts to broaden its reach to influential women's and minority groups, as it had done prior to the accident. According to NASA's Beth Beck, the agency's aim was to get these groups to "fall in love with NASA" and tell others about their positive experiences.[74] NASA's visitor facilities at Kennedy Space Center and Johnson Space Center underwent massive expansions during the 1980s and 1990s. As Kennedy's internal newsletter explained in 1995 its visitor center's revitalization, "To ensure that visitors leave KSC [Kennedy Space Center] feeling more like owners and participants, rather than just spectators, new exhibits and activities will be destined to be more interactive. For example, in choosing the Human Space Exploration Mission, visitors might test mockups of space suits and plan a journey to Mars."[75] Johnson Space Center's visitor center, Space Center Houston, was designed around similar principles and remained committed since its new facility opened in 1992 to

[73] Hugh Harris, interview by Roger Launius, February 20, 2002, transcript, Kennedy Space Center History Project, Kennedy Space Center, FL.

[74] Beth Beck, interview by author, Washington, DC, June 18, 2013.

[75] "Delaware North Brings Vision to Spaceport USA," *Spaceport News*, May 19, 1995, 5, Folder 14098, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

completing exit interviews with 100 visitors each month to understanding their impressions of their experiences at the facility.[76]

NASA also continued to employ a range of communications and information technologies and techniques to make the Shuttle directly accessible to those who could not behold it in person. NASA Select TV, freely available to any U.S. cable television station, provided 24-hour coverage of certain Shuttle missions to millions of homes and schools.[77] The service was notably employed to broadcast the Hubble Space Telescope repair mission in 1993 and subsequent servicing efforts. The agency affixed high-resolution cameras to the Shuttle's external tank to give television (and later, internet) viewers a new perspective on the vehicle's launch and ascent into space. During the 1990s NASA's public affairs office succeeded in securing more on-orbit mission time for press conferences and interaction with media and schools.[78] NASA's educational and public outreach proponents teamed with Disney to send an action figure of Disney-Pixar's *Toy Story* character Buzz Lightyear to the International Space Station aboard STS-124 in May 2008 to star in video games intended to promote youth science, technology, engineering, and mathematics education.[79]

The emergence of the internet in the mid-1990s generated within NASA a new excitement about the possibilities of engaging directly with American as well as global publics, and NASA became an early adopter of website development for delivering up-to-date information about Shuttle missions. As NASA administrator Dan Goldin's page on the NASA website expressed, the agency was "deeply committed to spreading the unique knowledge" that came from its research and saw the internet as a promising way "to

[76] Richard Allen, interview by author, Houston, TX, June 11, 2013.

[77] Craig Covault, "'Earth Watch' Could Boost Interest in Shuttle Missions," *Aviation Week & Space Technology*, December 24, 1990, 53-54.

[78] James Hartsfield, interview; Sawyer, "Columbia Crew Shares TV Limelight."

[79] NASA, "NASA Launches New Education Initiative with Disney Parks and Buzz Lightyear," news release 08-134, May 29, 2008, accessed March 1, 2015, http://www.nasa.gov/home/hqnews/2008/may/HQ_08134_Buzz_Lightyear.html.

expand this outreach exponentially."[80] Kennedy Space Center's website had Shuttle mission status information, and STS-71, which launched on June 27, 1995, became the first Shuttle mission to have its own page while NASA's new "Shuttle Web" service provided real-time mission updates.[81] The October 1998 STS-95 mission, which flew John Glenn, was the first to include a live webcast from space.[82] Johnson Space Center answered public questions about the Shuttle program through an online forum called "Ask the MCC (Mission Control Center)" for several years beginning in the late 1990s.[83]

Consistent with its practice during the earlier Shuttle period, NASA officials continued to put a particularly strong emphasis on directly engaging schoolchildren with human space flight. The agency remained committed to inspiring new generations of scientists and engineers in concert with the Reagan and George H.W. Bush administrations' focus on American education reform and a flurry of high-level reports continuing to link the nation's global competitiveness with the preparedness of its workforce to excel in research and technological innovation. NASA's education office also deeply desired to fulfill Christa McAuliffe's commitment and maintain its ties to the K-12 education community. After receiving authority from Congress in 1987 to replace *Challenger* with a new orbiter, the agency invited the elementary and secondary schoolchildren of America to participate in a competition to name the new vehicle.[84] In May 1989 President Bush announced that the orbiter would be called *Endeavour*. Many schools proposed the name, although NASA attributed its decision to the Tallulah Falls School in Georgia

[80] NASA, Office of the Administrator website, [1994-1995?], "nasa.gov" Folder, Box 15, Alan Ladwig unprocessed papers, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[81] "World-Wide Response," *Countdown*, July/August 1993, 18-19, Folder 6620, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Rob Pegoraro, "NASA: Off to a Flying Start," *Washington Post*, July 6, 1995, Folder 8015, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[82] "STS-95 Launch to be Webcast; Citizens Get Live Answers via Internet," *Florida Today*, October 28, 1998, Folder 17720, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[83] James Hartsfield, interview.

[84] NASA, Name the New Orbiter program entry packet, 1988, Folder 19382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

and Senatobia Falls Middle School in Mississippi, whose required projects supporting the name scored highest. The crew of the orbiter's inaugural mission in 1992, STS-49, incorporated the schools' colors into the mission patch.[85] NASA administrators Truly and Goldin both promoted several other initiatives connected with the Shuttle to encourage students to pursue science and engineering careers. These included using public donations made in the wake of the *Challenger* to establish a fund for teacher scholarships, bringing underserved students and teachers to Shuttle launches, continuing ham radio connections between Shuttle (and eventually International Space Station) astronauts and classrooms, and having astronauts teach science lessons from orbit.[86]

Revisiting Shuttle Use Policy

While NASA's commitment to engaging with external publics through discourse and visual and virtual means remained largely unchanged, NASA's dependence on the involvement of external publics as Shuttle users ebbed significantly in the post-*Challenger* era. Questions about the Shuttle's safety and reliability came to threaten NASA's carefully laid vision for the Shuttle as a "space truck" intended to haul cargo, retrieve and repair damaged satellites, and conduct experiments in orbit for a variety of customers. Pundits and politicians asked whether human-tended vehicles were necessary to carry payloads. Couldn't an expendable vehicle just have easily hoisted the Hughes communications satellite that was contained in the cargo bay of STS-51L? Moreover, NASA's two-and-a-half-year effort to return the Shuttle to flight created a massive backlog of probes awaiting rides into space, delaying the planned

[85] NASA, "President Bush Names Replacement Orbiter 'Endeavour'," news release 89-70, May 10, 1989, Folder 19382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Space Shuttle Overview: Endeavour (OV-105)," accessed February 20, 2015, http://www.nasa.gov/centers/kennedy/shuttleoperations/orbiters/endeavour-info.html.

[86] NASA, "Endeavour Fund to Be Used for Teacher Fellowships," news release 91-64, April 25, 1991, Folder 5849, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "NASA Administrator Invites Local Students to Shuttle Launches," news release 90-48, April 2, 1990, Folder 7990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; NASA, "Space Classroom – Assignment: The Stars," August 28, 1990, Folder 5849, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

replenishment of defense and communications satellites and slowing the deployment of major telescopes on which the space science community's work depended. Among its recommendations, the Rogers Commission advocated that the nation avoid these sorts of problems by revisiting its policy to rely on a single launch capability.[87] Four years later, a committee established by Vice President Dan Quayle and chaired by Norman Augustine of the Martin Marietta Corporation to provide advice on the space program's future echoed these sentiments. The latter panel maintained that relying on the Shuttle to achieve what expendable vehicles could was an inappropriate risk to human lives and to the Shuttle orbiters and argued that investing in new heavy-lift expendable vehicles would assure access to space while lessening schedule pressure and risk associated with flying the Shuttle.[88] The accident also fueled the positions of those within the Reagan administration, the Congress, and the private sector who had raised concerns beginning in 1984 about the Shuttle serving as an unfair competitor to the development of a U.S.-based commercial launch industry that could haul payloads to orbit for profit.

The vise on NASA's imaginary of an accessible Shuttle grew stronger as political figures reshaped space transportation policy. Six months after the *Challenger* accident, Congressmen Bill Nelson and Bob Walker issued a bipartisan call "to develop a strong and definite policy for access to space that includes maximum flexibility and efficiency" that included building a replacement Shuttle orbiter, acquiring expendable launchers to work off the backlog of Shuttle payloads, and allowing private satellite owners to fly on commercial launch vehicles while continuing to give them the option of flying on the Shuttle.[89] NASA leadership had concurred with the Rogers Commission's recommendation to move to use of a mixed fleet of vehicles to satisfy launch requirements and, like the congressmen, saw the Shuttle

[87] Presidential Commission on the Space Shuttle Challenger Accident, *Report of the Presidential Commission on the Space Shuttle Challenger Accident*.

[88] Advisory Committee on the Future of the U.S. Space Program, *Report of the Advisory Committee on the Future of the U.S. Space Program* (Washington, DC: U.S. Government Printing Office, December 1990).

[89] "Bipartisan Call for Leadership to Save Space Program," August 8, 1986, Folder 1570, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

as continuing to play a part in serving commercial access to space.[90] Over NASA administrator Fletcher's objections, however, Reagan released a statement in August of 1986 that took a tighter stance on the Shuttle's role as a market-driven enterprise. Reagan continued to regard the importance of the Shuttle: he called for the nation to build an orbiter to take *Challenger*'s place and stated that "NASA and our shuttles will continue to lead the way, breaking new ground, pioneering new technology, and pushing back the frontiers." The statement then indicated a shift in Shuttle policy, noting that "NASA will no longer be in the business of launching private satellites" – a task, Reagan said, that could be done "better and cheaper in the private sector."[91] A few months later, Reagan codified the decision in a policy directive stating that the Shuttle would no longer be used to launch commercial or foreign payloads unless its unique capabilities were required or there were compelling national security or foreign policy reasons to do so. It also affirmed that U.S. government payloads would rely on a mixed fleet of Shuttles and expendable vehicles.[92]

NASA had sold the Shuttle on the premise that it would serve a variety of customers, and Reagan's policy shift forced the Shuttle's *raison d'être* to slip away where most major payloads were concerned. The agency continued to serve scientists by launching major spacecraft that had been designed to fit within the orbiter's payload bay and were too large to fit on any other vehicle, such as the Hubble Space Telescope, Compton Gamma Ray Observatory, Chandra X-ray Telescope, Galileo, Cassini, and Ulysses. Future major payloads, however, would not fly on the space transportation system. Subsequent scientific probes would launch aboard expendable vehicles after Fletcher cancelled the

[90] NASA, *Report to the President: Actions to Implement the Recommendations of The Presidential Commission on the Space Shuttle Challenger Accident*, *Executive Summary* (Washington, DC: U.S. Government Printing Office, July 14, 1986), 4.

[91] President Ronald Reagan, "Statement by the President," August 15, 1986, in *Exploring the Unknown: Selected Documents in the History of the U.S. Civil Space Program: Vol. IV: Accessing Space*, ed. John M. Logsdon, NASA SP-4407 (Washington, DC: U.S. Government Printing Office, 2008), 383.

[92] The White House, Fact Sheet, NSDD-254, "United States Space Launch Strategy," December 27, 1986, in *Exploring the Unknown, Vol. IV*, 384-385.

agency's effort to develop an upper stage to boost these spacecraft to the proper orbits and trajectories given the risk of carrying rockets with highly combustible liquid fuel aboard the Shuttle. The *Challenger* accident further validated the Department of Defense's long-held concern that vehicles designed to carry people could never be as reliable as expendable rockets. The Air Force pulled out of plans to commission a Shuttle launch site in California capable to launching into the polar orbits many of its payloads required, and the Congress authorized the military to purchase dozens of Titan IV heavy-lift expendable launchers and smaller rockets to deploy its payloads.[93]

Looking back, former administrator James Beggs lamented, "The military abandoned us, and commercial payloads were taken off, and the [Shuttle] program kind of went into the doldrums."[94] Beggs rued the Reagan administration's decision to cease making the Shuttle available for commercial use, not only because it resulted in turning much of the heavy-lift launch market to France's Ariane rocket but also because it impinged on NASA's ability to preserve its democratic philosophy regarding the Shuttle.[95] According to Beggs, NASA's ideal for the Shuttle was that "anybody who wants to get on it can pay something for it." Those who had participated as Shuttle customers had helped to give the Shuttle purpose and legitimacy. Now the agency could not depend so extensively on partnerships with public users of the vehicle to substantiate its value. Beggs considered the reversal of the Shuttle user policy "one of my regrets after the *Challenger* [accident]."[96]

The policy did not restrict all Shuttle engagement with would-be users, and thus the agency remained committed to attracting and serving external customers in the government, commercial, and

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[93] Robert Bazell, "Shuttlecrock," *New Republic*, December 26, 1988, 13-14. The Air Force had received authority to contract with Martin Marietta Corporation to design the Titan IV in 1985.

[94] Beggs, interview, April 8, 2013.

[95] James M. Beggs, interview by Kevin M. Rusnak, Bethesda, MD, March 7, 2002, transcript, NASA Oral History, NASA Historical Reference Collection, NASA Headquarters, Washington, DC, 43.

[96] Beggs, interview, April 8, 2013.

university domains interested in using the Shuttle as a platform for space-based scientific research.[97] Many missions would include the European Space Agency's Spacelab module, which flew more than two dozen times through 1998, and its unpressurized pallets, which flew as late as 2008. Moreover, with so many other anticipated payloads no longer flying and space station construction still years away, NASA continued to encourage use of the Shuttle by a range of researchers and aimed to facilitate access to the vehicle. The agency invited and awarded many grants to external entities to fly experiments via the Shuttle's middeck lockers and also offered low-cost opportunities for individuals and organizations to fly secondary payloads that fit into the Shuttle's cargo bay, including GAS cans, Hitchhikers, and other carriers. All of these opportunities were highly subscribed. Indeed, NASA had hopes that by continuing to use the Shuttle for science, it would not only give the Shuttle a reason for being but also grow a community of users of the International Space Station for continued research, manufacturing, and other purposes.

At the same time, the realization that the Shuttle would never fly dozens of missions per year also prompted NASA to set priorities regarding what types of payloads it would fly and, hence, who might participate. The accident altered NASA's Shuttle flight rate projections and vehicle performance and meant that the agency would fly less than one-third of the flights previously planned through 1992.[98] A couple of years after the *Challenger* accident the agency revoked its policy on flights of nonscientific cargo, such as artwork, stating that Shuttle space was at a premium given the many scientific payloads awaiting flights and the vehicle's ability to fly fewer missions annually than anticipated.[99] The amendment to the policy in the *Federal Register* was published without public comment and simply read

[97] Cass Peterson, "Refocusing the Shuttle Toward Science," *Washington Post*, September 26, 1988, A4, Folder 7990, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[98] Richard H. Truly to Sister Mary Carroll McCaffrey, July 29, 1987, Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[99] Charlie Jean, "Artists's Little World to Fly on Discovery," *Orlando Sentinel*, February 20, 1989, Folder 5308, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

that the Nonscientific Payload Program "has served its purpose and is no longer in keeping with current policy."[100]

In addition, despite the implorations of teachers who felt that the Shuttle Student Involvement Program's creation of opportunities for direct student involvement in the space program allowed students interested in science careers to flourish, NASA also brought a temporary halt to and ultimately modified the program.[101] While the agency eventually flew the experiments of students who had won competitions prior to the *Challenger* accident, officials realized they would be unable to keep up with flying subsequently selected experiments in a timely fashion going forward. Instead, NASA rebranded the program as the "Space Science Student Involvement Program" and presented it as a competition for high school and middle school students to propose experiments that *could* be performed on a space station or in a NASA test facility and awarded not Shuttle experiment flights but NASA internships, scholarships, trips to Space Camp, and computers to winners.[102] The agency later expanded the program to include elementary students and to promote scientific literacy and creative thinking among students with a range of interests through contests for news articles, art, and spacecraft design.[103]

Agency officials remained committed to continuing the popular GAS program, desiring to provide low-cost access to space and to encourage Shuttle use by a variety of researchers in the hope that purchasers of canisters would build on their experiments and continue their relationships with NASA. Interest remained high among organizations and individuals within the commercial and other sectors in

[100] Nonscientific Payloads, 53 *Federal Register* 47949 (November 29, 1988) (amending 14 C.F.R. pt. 1214).

[101] Sister Mary Carroll McCaffrey to Richard Truly, June 11, 1987, Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[102] NASA, "Reach for the Stars through NASA's Space Science Student Involvement Program," fact sheet, July 30, 1991, Folder 5849, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Space Camp is a non-NASA venture, operated by the State of Alabama.

[103] NASA/National Science Teachers Association, *Everyone's a Winner with SSIP!*, EP-917, June 1994, Folder 19816, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

flying more modest scientific payloads aboard the Shuttle: reservations to purchase GAS cans poured in to NASA even after the *Challenger* disaster. The canisters remained secondary payloads, however, subject to the availability of room in the cargo bay to fly them. With a formidable backlog of primary payloads to accommodate and a queue of nearly 500 GAS experiments alone awaiting launch, NASA announced in 1987 that it was closing the reservation queue to new payloads until sometime after the Shuttle returned to flight.[104] After the agency worked through the backlog of major payloads, NASA resumed GAS experiment flights in earnest in 1991, flying 114 payloads over the next 11 years. It reopened the reservations list in 1992.[105]

Despite NASA's commitment to the GAS program, the accident drove the agency to revisit its policy on these small, self-contained payloads. Due to concern about the safety risk following the Shuttle accident, NASA reinstated its restriction on the ejection of small satellites from GAS canisters; users desiring to deploy payloads would now have to fly small satellites on a Hitchhiker carrier or a "complex autonomous payload," which could cost up to ten times more than a GAS can.[106] In addition, NASA raised prices for most users to reflect the impact of inflation. Whereas a full-sized canister formerly would cost $10,000, the same container climbed to $27,000.[107] These prices, like the old ones, however,

[104] Dale D. Myers to Officials-in-Charge of Headquarters Office, Directors, NASA Field Installations, Director, Jet Propulsion Laboratory, "Secondary STS Payloads," June 5, 1987, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[105] By then, the queue was also much shorter, as many would-be GAS investigators had withdrawn due to the inability to plan for flight in the wake of the *Challenger* accident. See James K. Asker, "NASA Hikes Price for 'GAS' Payloads," *Aviation Week & Space Technology*, October 26, 1992, 73-74; Liz Tucci, "NASA Price Hike for Small Shuttle Users Cuts Demand," *Space News*, June 7-13, 1993, 22, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[106] Asker, "NASA Hikes Price for 'GAS' Payloads"; Liz Tucci, "Shuttle GAS Canisters Program Running on Empty," *Space News*, October 11-17, 1993, 9, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[107] NASA, "NASA Reopens Reservations Queue for Get Away Specials," news release 92-174, October 20, 1992, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Use of Small Self-Contained Payloads, 57 *Federal Register* 41077 (September 9, 1992) (amending 14 C.F.R. pt. 1214); Use of Small Self-Contained Payloads, 56 *Federal Register* 47146 (September 18, 1991) (amending 14 C.F.R. pt. 1214).

were far below the true costs borne by NASA. In 1998 NASA again reviewed its policy. Whereas the agency continued to preserve opportunities for NASA employees as well as researchers from foreign, industry, and educational institutions, it ceased inviting independent users it had also sought to entice in the early stages of Shuttle flight.[108]

One Shuttle user community that continued to receive special attention by NASA was educators and students of all ages. NASA's revised GAS payloads policy indicated that a goal of the program was "to stimulate and encourage the use of space by a wide range of users, particularly those associated with education."[109] Demonstrating that commitment, the agency made an exemption to its increased price schedule for entities who could demonstrate that students were involved throughout the entirety of a project. The exception came when educational users protested the increase, noting that NASA's costs came on top of expenditures educational institutions also had to bear to develop hardware for their experiments.[110] In addition, beginning in 1996, the agency further accommodated student Shuttle experimenters by offering a new container, the Space Experiment Module (SEM) designed expressly for their use. Packed into GAS canisters, the new modules took care of power and control requirements and allowed students from kindergarten through college to focus on creating their experiments rather than on the engineering complexities of integration. NASA made the SEM program available to students of all ages at no cost.

NASA continued to make the Shuttle available to educational users in still other ways. The Shuttle accommodated Hitchhiker payloads developed by educational organizations. One such project,

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[108] David A. Wilcox, "The Get Away Special Program: Year 2000 and Beyond," in NASA, *1999 Shuttle Small Payloads Symposium*, eds. Gerard Daelemans and Frances L. Mosier, NASA/CP-1999-209476 (Greenbelt, MD, NASA, September 1999), 91-95.

[109] Special Policy on Small Self-Contained Payloads by Domestic Educational Institutions, 57 *Federal Register* 61794 (December 29, 1992) (amending 14 C.F.R. pt. 1214)

[110] Kathy Sawyer, "NASA's 'Get Away Special': Prices Soar Along with the Payload," *Washington Post*, November 19, 1991, A19, Folder 8183, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Starshine, consisted of a partnership among the Utah Department of Education, the Hansen Planetarium in Salt Lake City, amateur astronomers and radio users, and other organizations to develop and build a set of satellites designed to be observable from Earth so that students could measure their movements. Two of the three satellites deployed were launched by the Shuttle, during STS-96 in 1999 and STS-108 in 2001.[111] The project engaged 120,000 students in 43 countries.[112] Meanwhile, astronaut Sally Ride along with colleagues at NASA's Jet Propulsion Laboratory and the University of California, San Diego (UCSD), developed the idea of putting a camera aboard the Shuttle that could be controlled by middle school students from their classrooms. According to Ride, the project, dubbed "KidSat," allowed kids to "feel like they were participating in a very real way."[113] Students would write research proposals for images to be taken by an electronic still camera, which was connected to a laptop computer aboard the Shuttle. Undergraduate students at UCSD would write and upload code directing the camera what to image and then send students the photos over the internet for analysis. Flown on six Shuttle missions beginning in 1996, the camera eventually moved from the Shuttle to the International Space Station, becoming known as ISS EarthKam and involved 73,000 students in 17 countries through 2012.[114]

Following the *Challenger* accident, NASA also strived to hold the interest of private companies in tapping the Shuttle's unique capabilities to perform larger experiments and for longer-term use of the Shuttle. Prior to the accident, commercial business had not materialized at the level NASA had anticipated due to flight costs and scheduling uncertainties, but NASA had held out hope that over time business would pick up as flights became more routine and the benefits of Shuttle use became apparent.

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[111] The third satellite was launched by an expendable launch vehicle. A fourth proposed satellite was cancelled following the 2003 STS-107/*Columbia* accident.

[112] NASA, *Wings in Orbit*, 474.

[113] Sally K. Ride, interview by Rebecca Wright, San Antonio, TX, December 6, 2012, transcript, Johnson Space Center Oral History Project, Houston, TX, accessed February 8, 2015, http://www.jsc.nasa.gov/history/oral_histories/RideSK/RideSK_12-6-02.pdf.

[114] NASA, *Wings in Orbit*, 475.

The accident, however, exacerbated the lower rates of Shuttle use given NASA's inability to accommodate them expeditiously in the wake of the backlog of payloads once Shuttle flights resumed. McDonnell Douglas, for one, reconsidered plans for going beyond its original electrophoresis experiment agreement with NASA and pursuing other R&D and manufacturing using the Shuttle.[115] As McDonnell Douglas payload specialist Charlie Walker explained, "The only reason that the company was able to… support the project…was with the situation that NASA had in mind and was working toward with Space Shuttle, that situation being a space transportation system that flew regularly, that flew often, and that provided, consequently, lots of opportunity to fly up and back for science, technology, and commercial." Once commercial payloads took lower priority and it appeared that flights would unlikely reach levels NASA had claimed, McDonnell Douglas management cancelled its plans for electrophoresis as well as subsequent experiments.[116] As former NASA human space flight manager Michael Hawes notes, many other corporations also reassessed their interest in performing research aboard the Shuttle.[117] The Shuttle's failure to achieve higher flight rates combined with the slump in commercial demand also had ripple effects on other sorts of private involvement with the vehicle. The company Spacehab had formed in the early 1980s to expand the number of small experiments each mission could fly via a module carried in the cargo bay that contained dozens more lockers like the ones contained on the Shuttle's middeck, but they attracted much less commercial interest than envisioned originally.[118]

As NASA's own fortune changed, however, by the mid- to late-1990s, finding customers for the Shuttle was no longer quite so paramount for the agency. After years of making the case for its next step in human space flight, NASA secured Congressional approval in 1993 to develop a space station. As the

[115] Walker interview, November 7, 2006.

[116] Ibid.

[117] W. Michael Hawes, interview by author, Washington, DC, July 15, 2014.

[118] Spacehab remained viable because NASA paid to use the company's carriers to fly many of its own experiments and to ferry supplies to *Mir* and, eventually, the International Space Station.

agency had envisioned, the Shuttle would become an integral part of the station project. During the mid-1990s, years before construction began, NASA employed the Shuttle in a series of flights to dock with the Russian space station *Mir* as both a technological and diplomatic prelude to collaborating with the United States' former foe on what would ultimately become not just an American space research laboratory but a global one, to be dubbed the International Space Station.[119] Then, beginning in 1998, the Shuttle assumed the role the agency had articulated for it as long before as the late 1960s: hauling elements of the Station to orbit for assembly 200 miles above Earth.

During this time, NASA's focus on customer development began to turn to the Station. Whereas the Shuttle offered access to the space environment for up to two weeks, NASA officials imagined that the Station would ultimately provide a stable, longer-lasting platform for experiments and theoretically produce more meaningful science. Just as it did for the Shuttle, NASA sought to create a community of Station researchers and worked to generate awareness among academic institutions and private companies of the forthcoming facility and its value for life and microgravity sciences studies and manufacturing purposes.[120] The agency did not abandon altogether a commitment or desire to continue to use the Shuttle for flying customers' payloads while Station construction proceeded; however, given the monumental demands of assembling the Station, the Shuttle had little room – and the astronauts had little time – to accommodate research payloads. Devoting the Shuttle to Station construction quickly created a backlog of small research payloads, with no GAS payloads at all being flown in 1999.[121] NASA responded by

[119] For a detailed account of the U.S. decision to cooperate with Russia in human space flight during the post-Cold War era, see Bryan Burrough, *Dragonfly: NASA and the Crisis aboard Mir* (New York: HarperCollins, 1998).

[120] George W. S. Abbey, interview by author, Houston, TX, June 12, 2013.

[121] Wilcox, "The Get Away Special Program: Year 2000 and Beyond," 95.

developing STS-107, a mission that would not support Station construction but instead would carry dozens of research experiments using the Spacehab module.[122]

Meanwhile, NASA and United Space Alliance recognized another critical need to keep external publics involved substantively in the Shuttle program. Specifically, they had to determine how to keep the Shuttle economically viable after completing the International Space Station. Plans called for the Shuttle to continue its service to the Station by ferrying cargo and crew to and from the orbiting facility; however, the vehicle would not have to dedicate every flight and all of its capacity for this purpose. Even after NASA enacted a series of cost-cutting measures, the Shuttle remained tremendously expensive to operate, particularly without being able to accept the range of customers it could prior to the *Challenger* accident to offset costs. In 1997 United Space Alliance publicly announced its desire to market space for rent aboard *Columbia*, which, unlike the other orbiters, was too heavy to use for Station construction. Aspiring to fly privately owned satellites as well as commercial advertisements aboard *Columbia* for a fee, the company urged the Clinton administration to rescind the prohibitive Shuttle use policy.[123] In 1998 NASA's Office of Space Flight pressed to reinstate the Shuttle as a national asset. By amending the Shuttle use policies that went into effect following the *Challenger* accident to allow once again a broader range of payloads on the Shuttle – and possibly even to fully commercialize at least one orbiter – the Office of Space Flight hoped to relieve the backlog of small research payloads, reduce costs to NASA of launch operations, and evolve to a commercial operations model through a higher flight rate.[124] Later that year, the Congress directed NASA via the Commercial Space Act to evaluate whether the Shuttle should

[122] This mission, carried out by *Columbia*, ended tragically when the orbiter broke up on its return to Earth on February 1, 2003.

[123] Seth Borenstein, "Space for Rent: Shuttle Columbia Could Take Advertising to New Heights," *Orlando Sentinel*, May 15, 1997, Folder 11904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; United Space Alliance, "Every Mission Improves Your World" (advertisement).

[124] Alan M. Ladwig, "Administrator's Policy Review: National Policies and Statutes, and the Execution of NASA's Space Transportation Implementation Plan with Particular Attention to the Safe and Efficient Use of the Space Shuttle," February 10, 1998, Folder 17980, NASA Historical Reference Collection, NASA Headquarters.

be able to carry commercial payloads and how to prioritize among its various payloads. The act also established commercial utilization of the International Space Station as a primary goal.[125]

Attempting to reassume a business development aspect to human space flight, NASA was able to take some steps to forge commercial partnerships and thus make the Shuttle and Station more broadly relevant. For example, the agency entered into a partnership in 2000 with a company called Dreamtime Holdings to put high-definition cameras on the Shuttle and Station and to develop new multimedia products and programming featuring these and other NASA programs.[126] But the Commercial Space Act at the same time suggested limits to the agency's ability to engage in business pursuits with external publics as a means to enhance the viability of its human space flight initiatives, as competition with the private sector became an issue. In 1998 a company that went into business flying the ashes of cremated individuals lodged a complaint with NASA about unfair competition after discovering that the agency had flown *Star Trek* creator Gene Roddenberry's ashes on a 1992 Shuttle flight.[127] NASA consequently issued a policy banning Shuttle flights of any other human or animal remains.[128]

Further, some within the agency shared United Space Alliance's stance on offsetting Shuttle and Station costs through commerce-oriented Shuttle sorties as well as securing corporate sponsorships and displaying companies' names and logos aboard the Shuttle and Station.[129] The Russians had been doing so to keep their own space program solvent. Even so, and while members of Congress such as

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[125] Commercial Space Act of 1998, Public Law 105-303, 105th Cong., 2nd sess., (October 28, 1998).

[126] NASA, "NASA Dreamtime Partnership Propels Space Information Age to New Heights," news release 00-87, June 2, 2000, accessed March 1, 2015, http://www.nasa.gov/home/hqnews/2000/00-087.txt.

[127] Charles M. Chafer to Daniel S. Goldin, January 21, 1998, Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[128] NASA Policy Directive 8870, "NASA Policy for the Flight and Disposal in Space of Human or Animal Remains" (draft), n.d., Folder 5382, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[129] Larry Wheeler, "Will the International Space Station Be a Flying Billboard?" *Florida Today*, December 2, 1998, Folder 11904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Representative Dana Rohrabacher of California and space advocacy groups like the National Space Society and the Space Frontier Foundation supported the proposal, top NASA officials ruled against allowing advertising on the outside of the Shuttle or the Station in 2000 given the potential impact of NASA's dignified image and public trust.[130] As was the case in the early Shuttle days, external concerns about competition with the private sector and internal commitments to preserving a particular image of the agency precluded NASA from enrolling some publics as Shuttle program participants to shore up the vehicle's financial posture.

Reevaluating Shuttle Flyer Policy

The most salient impact of the *Challenger* accident on NASA' imaginary of a broadly accessible Shuttle and therefore on its relationships with external publics involved its decisions regarding who would fly aboard the vehicles. One of the most palpable ways in which NASA had sought to make the Shuttle program more relevant to the American citizenry was to diversify the spacecraft's crews. From expanding eligibility to scientists and engineers beyond the realm of military test pilots, actively recruiting women and racial and ethnic minorities to inviting corporations to fly their own personnel with their payloads to beginning a program to invite citizens to fly on the Shuttle, the agency had taken steps to make the Shuttle more accessible to more people and presented an image of commitment toward democratizing the human space flight endeavor. The STS-51L *Challenger* crew had reflected and stood as a testament to these changes in the demographic makeup of NASA's space flyers.

Changes to selecting career astronauts proved minimal. NASA continued to require pilot and mission specialist astronauts to fulfill the Shuttle's mission tasks. The agency began in 1988 to conduct

[130] Amanda Orion, "Ads in Space," *Fox News*, October 14, 1999; Bob Garfield, "Should NASA Sell Ads?" *Air & Space*, June/July 2000, 74-75; Dee Ann Divis, "NASA Reviewing Sponsorship Possibilities," *Aviation Now*, September 5, 2000. All articles located in Folder 11904, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

astronaut selections on a two-year cycle to balance its need for career space flyers with the demand on resources necessary for selecting and training candidates and welcomed classes ranging from a total of 15 to 35 pilot and mission specialist astronauts at a time.[131] NASA retained its pre-*Challenger* era medical and professional background eligibility criteria and selection processes for its pilot and mission specialist positions. Consequently, selected pilots continued to come from the armed services. NASA had been subject to criticism in the media and in Congress prior to and shortly after the *Challenger* accident for limiting its selections of mission specialist candidates to those with military or NASA employment experience. Beginning with NASA's 1990 astronaut class, however, candidates were more balanced in their origins, with backgrounds evenly distributed among the military, NASA, academia, and industry. The agency also remained committed to gender, racial, and ethnic diversity in all of its hiring, including for its career astronauts. Many more women and minorities were selected into astronaut positions, leading to more social firsts-in-flight in the post-*Challenger* era. Physician Mae Jemison became the first African American woman in space aboard STS-47 in 1992. The first Native American, Navy pilot and registered member of the Chickasaw Nation John Herrington, flew on STS-113 in 2002. Eileen Collins broke more than three decades of history of male-piloted American space missions when she piloted STS-63, a Shuttle mission to the Russian *Mir* space station and then became the first female Shuttle commander on the flight of STS-93 in 1999.

While NASA's approach to selecting career astronauts remained largely unchanged following the *Challenger* disaster, the event had a major impact on NASA's ambitions to broaden further the scope of those it might fly. Before the accident, enthusiasm for democratizing the ranks of Shuttle flyers emanated from many quarters: the Reagan administration, members of Congress, the media, and citizens. These entities saw space as the domain of everyone and the Shuttle as the nation's equal opportunity provider. NASA flew dozens of corporate and international payload specialists, trained far less than its career

[131] NASA, "NASA Announces 2-Year Astronaut Selection Cycle," news release 88-63, May 11, 1988, Folder 8929, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

astronauts, during the first five years of Shuttle missions without incident; hence, the agency was encouraged to continue and expand its flight of agency outsiders. But the explosion of *Challenger*, carrying NASA's first citizen space flight participant, teacher Christa McAuliffe, as well as payload specialist Gregory Jarvis of the Hughes Corporation, threw the wisdom of this practice into question. As former Shuttle program manager Wayne Hale observes, the idea of democratizing space flight was integral to making the Shuttle viable and relevant to many Americans; the idea of flying anyone on the Shuttle, however, begged revisiting after the *Challenger* accident because, as Hale put it, "it was pretty clear that was not the kind of vehicle we had technologically."[132]

Many citizens and educational organizations expressed their desire and determination to see NASA's commitment to flying non-career space flyers continue in the aftermath of the tragedy. The flight of *Challenger* with McAuliffe's presence on it had sparked a great deal of interest in the mission among Americans. Schoolteachers recognized the flight's unique value to education and set up televisions in their classrooms so their students could witness the launch. That many citizens – including hundreds of thousands of children – wrote to NASA following the accident imploring the agency not to end the Teacher in Space Program indicates the wide support the idea of flying citizens of all walks of like on the Shuttle had even in light of the tragedy. Public speaking requests to McAuliffe's back-up, Idaho teacher Barbara Morgan, and the other Teacher in Space Program finalists soared, and the nine educators collectively reached audiences of more than four million Americans by the end of 1986.[133] The

[132] Hale, interview.

[133] Robert W. Brown and Barbara R. Morgan, "Teacher in Space Program: The Challenge to Education in the Space Age," paper presented at the 37th Congress of the International Astronautical Federation, Innsbruck, Austria, October 4-11, 1986, Folder 8076, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

U.S. Department of Education, National Education Association, National Science Teachers Association, and Young Astronaut Council all supported the Teacher in Space program's continuation.[134]

In the weeks following the accident, President Reagan and NASA expressed their resolve to fulfill the dreams so many had for the *Challenger* flight and its promise of democratizing human space flight. Speaking on national television after the accident, President Reagan mourned America's loss while stating affirmatively: "There will be more Shuttle flights and more Shuttle crews and yes, more volunteers, more civilians, more teachers in space."[135] While visiting a high school in Alexandria, Virginia, Reagan answered a student's question about plans to fly another teacher by expressing, "Yes. I don't believe that this tragedy should in any way affect the policy that we had," noting that space exploration "should not just be left to scientists or career people." Reagan added: "The space program belongs to all of us and to the people."[136] Two weeks following the accident, NASA's acting administrator, William Graham, affirmed the agency's continued support for the Space Flight Participant Program and the Teacher in Space initiative.[137] Graham announced that Morgan would be offered the opportunity to fly as the next citizen aboard a Shuttle mission. Graham also stated that NASA still intended to fly a journalist after Morgan.[138]

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[134] NASA, "Teacher in Space Program to Continue," news release 86-12, February 12, 1986, NASA Historical Reference Collection online, accessed March 1, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000021173.pdf.

[135] Ronald Reagan, "Address to the Nation on the Explosion of the Space Shuttle Challenger," *The Public Papers of President Ronald W. Reagan*, Ronald Reagan Presidential Library, accessed February 21, 2015, http://www.reagan.utexas.edu/archives/speeches/1987/061287d.htm.

[136] Reagan quoted in Bernard Weinraub, "Reagan Sees More Teachers in Space," *New York Times* (February 8, 1986), 17, accessed 6 August 2014, http://www.nytimes.com/1986/02/08/us/reagan-sees-more-teachers-in-space.html.

[137] William R. Graham, "Remarks Prepared for Delivery: Press Briefing, Washington, D.C.," February 13, 1986, Folder 8072, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[138] Walter Pincus, "Space Flights by Teachers to Continue," *Washington Post*, February 14, 1986, A14, accessed March 1, 2015, LexisNexis Academic.

But as the Rogers Commission's investigation unfolded and showed the Shuttle to be a highly complex vehicle more aptly described as experimental rather than operational, opposition to the idea of flying non-career astronauts aboard the Shuttle emerged. Flying citizens not trained as extensively as NASA's astronauts was a risky and imprudent policy, said many scientists, engineers, astronauts, and members of Congress. John G. Stewart, a member of NASA's Aerospace Safety and Advisory Panel, was "ashamed" the panel had not "raised questions earlier" about the citizen program.[139] Mercury astronaut-turned-senator John Glenn disputed the strategy of putting a "lay person" in space for what seemed to him to be the purpose of "gaining public support" while the Shuttle was "still in its embryonic stage," according to an aide. Glenn, however, wanted the Shuttle to carry scientists involved in basic research when seats were available.[140] Senator Ernest Hollings, Ranking Member of the Senate Commerce Committee which had jurisdiction over NASA, had supported the Space Flight Participant Program but thought that, for the time being, Shuttle flights should be left to "the professionals."[141] Veteran Shuttle flyers John Young, Bob Crippen, and Richard Truly did not believe the door should be closed forever to citizen Shuttle flyers but that NASA needed to first focus on gaining a better understanding of the vehicle before resuming citizen flights.[142]

As internal debates about the future of the citizens-in-space effort continued, officials in NASA's education and public affairs organizations argued that NASA's credibility was at risk if it did *not* carry forward with the initiative. Educational affairs director Robert Brown contended that withdrawing from it

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[139] Stewart quoted in Walter Pincus, "NASA's Push to Put Citizen in Space Overtook Fully 'Operational' Shuttle," *Washington Post*, March 5, 1986, A8, accessed March 1, 2015, LexisNexis Academic.

[140] Glenn quoted in Pincus, "NASA's Push to Put Citizen in Space Overtook Fully 'Operational' Shuttle."

[141] Ernest F. Hollings, "Disaster Showed Delay Is Needed," *San Bernardino County (CA) Sun*, June 29, 1986, 54, accessed February 21, 2015, http://www.newspapers.com/newspage/66147505/. A copy of Hollings' article under a different title, "Space Flight – For Now, Leave It to the Pros," appears in Folder 19753, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[142] "Civilians-in-Space on Back Burner," *Defense Daily*, May 16, 1986, 90, Folder 8163, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

would "be a demoralizing blow to the motivational and aspirational space spirit that the space program has generated among the Nation's school children and adults alike." Public affairs head Shirley Green concurred, noting that "to reverse course now would seem to confirm the accusations" that the program was just a public relations stunt.[143] But the sentiments of doubt and the desire to restore the agency's image as a competent and responsible technoscientific authority weighed heavily on Jim Fletcher, who, upon returning to the NASA administrator's post in 1986 prioritized proving the reliability and safety of the Shuttle and focusing on projects that required the vehicle's unique capabilities over reestablishing citizen flights. NASA published a new policy in the *Federal Register* in 1989, without a solicitation of public comment, acknowledging that "[t]he *Challenger* accident marked a major change in the U.S. outlook and policies with respect to the flight of other than NASA astronauts" and reexamining "previous understandings, expectations, and commitments regarding flight opportunities." It stated that Shuttle flight opportunities would "generally be limited to professional NASA astronauts and payload specialists essential for mission requirements."[144]

According to the new rule, NASA would only fly individuals outside of NASA whose presence was necessary aboard Shuttle missions to perform specialized functions regarding operation of payload(s) or other essential mission activities; the agency would look to its mission specialists to perform tasks first. Payload specialists had previously included scientists outside of NASA and representatives of other countries or corporations that were operating experiments or launching satellites from the Shuttle. This policy change and the Reagan administration's decision to remove all payloads not requiring the Shuttle's unique capabilities prompted the corporate payload specialist program to wither. The new policy allowed

[143] LE/Director, Educational Affairs Division (Robert W. Brown) to L/Associate Administrator for External Relations, "Background Information for Civilians in Space Policy Deliberations," March 20, 1987; LF/Director, Public Affairs (Shirley Green) to L/Associate Administrator for External Relations, "Civilians in Space Policy Deliberations," March 23, 1987. Both documents located in Folder 8074, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[144] Payload Specialists for NASA or NASA-Related Payloads, 54 *Federal Register* 48586 (November 24, 1989) (amending 14 C.F.R. pt. 1214).

for foreign payload specialists but required them to train alongside career NASA astronauts as mission specialists. Moreover, the policy conveyed NASA's commitment to providing space flight opportunities to individuals whose presence was not required for "the operation of payloads" or other "essential mission activities" but was still deemed by the agency to "contribute to other approved NASA objectives or to be in the national interest."[145]

The policy considered a "teacher in space" as falling within this category – being considered worthy but not mission-critical – and stated that when a flight opportunity was available, the agency would give a teacher first priority. While Barbara Morgan would remain NASA's Teacher in Space designee, her flight assignment was put on indefinite hold. NASA would review the Shuttle program annually to assess when it could safely and appropriately assign Morgan to a flight and allocate opportunities to others.[146] Meanwhile, the agency suspended the process to select a journalist as the next Space Flight Participant, after having announced 40 national semi-finalists for the competition.[147] In addition, Fletcher informed Congressional leadership that NASA would defer initiating the feasibility study and planning efforts the Congress had recently directed for NASA to support flight opportunities for disabled persons as the agency focused on recovering and learning from the *Challenger* incident.[148]

Two years passed, and NASA did not hold any reviews concerning Morgan's flight, in part because the policy did not assign any office responsibility for the job. During that time, the Soviet Union

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[145] Ibid.

[146] Ibid.

[147] Association of Schools of Journalism and Mass Communication press release, May 14, 1986; Ann Bradley, NASA Associate Deputy Administrator, to Robert Hoskins, President, Association of Schools of Journalism and Mass Communication, July 1, 1986. Both documents located in Folder 19754, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[148] James C. Fletcher to Don Fuqua, September 26, 1986, Folder 19759, NASA Historical Reference Collection, NASA Headquarters, Washington, DC. Various groups within NASA continued for at least the next decade to assess the matters of flying disabled citizen passengers as well as selecting disabled individuals for career astronaut positions. The agency never changed its policies in light of these analyses.

announced plans to fly a Japanese journalist to its orbiting space station, *Mir*, aboard a Soyuz rocket. Commercializing its space program to bring in much-needed cash, the former anti-capitalist superpower signed a $12-million contract with the Tokyo Broadcasting System for reporter Toyohiro Akiyama's December 1990 trip.[149] In contrast with this advance, NASA approached the fifth anniversary of McAuliffe's flight with no mission set for Morgan. Education organizations such as the National Science Teachers Association, meanwhile, urged President George H. W. Bush to reinstate the Teacher in Space program.[150] Truly asked a team representing the agency's education, public affairs, safety, and legislative offices to determine whether NASA could consider educators to be eligible for Shuttle flights under the 1989 policy. The group unanimously agreed that "Space Shuttle activities in support of our educational mission are consistent with NASA policy to allow only mission-critical personnel to participate in Space Shuttle flights."[151] Differences between Truly and the Bush administration prompted the administrator to depart NASA in March 1992, but before leaving Truly stated that he would recommend to incoming administrator Dan Goldin assigning Morgan to a flight. Truly declared: "She's ready, the Space Shuttle is ready, and the American people are ready for the educational inspiration that flying Barbara will provide."[152]

Goldin was a proponent of career astronauts sharing the Shuttle with students and teachers on the ground, but he was not so sure about flying Morgan. Just three weeks after Goldin's arrival at NASA, the House Committee on Science, Space, and Technology declared in a report accompanying NASA's

[149] T. R. Reid, "Japanese Journalist in Orbit," *Washington Post*, December 6, 1990, D1, Folder 2956, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Leonard David, "Interest Revived in Citizens in Space," *Space News*, December 10-16, 1990, 4, 21, Folder 19755, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[150] Lynn W. Glass and Wendell Mohling, National Science Teachers Association, to President George Bush, July 26, 1991, Folder 19755, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[151] AE/Chairperson, Teacher in Space Program (J. Wayne Littles) to A/Administrator, "Teacher in Space Program," October 4, 1991, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[152] NASA, "NASA Administrator Supports Teaching from Space," news release 92-40, March 26, 1992, Folder 19755, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

authorization bill that the risks made putting a teacher on the Shuttle "highly unwise."[153] Goldin needed the Congress's support to allow NASA to continue with the agency's priority project, the Space Station, which had endured considerable cost growth in its planning stages; the commitment of the Congress and the incoming Clinton administration to reduce federal spending made keeping the Station viable an uphill battle. The agency also was dealing with the bad press about the Hubble telescope's flawed primary mirror and hydrogen leaks on two orbiters. The new administrator noted in a 1993 speech that "for the NASA of today, the specific challenge is to win back our credibility through performance."[154] For Goldin, that meant not only completing projects at promised costs but also upholding the agency's Shuttle safety record since the 1988 return to flight. Indeed, the NASA chief was nervous that the agency had more to risk than to gain with the Congress by resuming the citizens-in-space program.[155]

Over the next six years, Goldin struggled with the issue. Publicly he maintained that flying non-career astronauts was risky and inconsistent with NASA's 1989 policy. Encouragement to fly Morgan, however, continued to come from many sectors. Representative Larry LaRocco and Senator Dick Kempthorne, who did not share the House Science Committee's views, urged Goldin to reconsider.[156] Teachers and others who supported Morgan deluged NASA and the White House with letters and petitions.[157] NASA's education office also continued to staunchly support her flight. Morgan met with

[153] House Committee on Science, Space, and Technology, National Aeronautics and Space Administration Multiyear Authorization Act of 1992, 102nd Cong., 2nd sess., April 22, 1992, HR Rep. 102-500, 59.

[154] Daniel Goldin, "On Risks Inherent in Exploration," *Los Angeles Times*, May 21, 1993, Folder 20198, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[155] Alan Ladwig, interview by author, Washington, DC, December 28, 2010.

[156] President Bill Clinton to Larry LaRocco, March 22, 1993, Folder 19755, NASA Historical Reference Collection, NASA Headquarters, Washington, DC; Dirk Kempthorne to Daniel Goldin, August 10, 1994, Folder 8076, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[157] See, for example, Ed Wardwell to Dan Goldin, [1994?]; Jerry Stoicheff to Dan Goldin, [1994?]; and Monica E. Beaudoin to Daniel Goldin, July 8, 1994, with attached petition from members of the National Education Association. All documents in Folder 20198, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

Goldin on several occasions, averring that NASA's claim that Shuttle flights were too risky for teachers was a flawed rationale for not flying her. Teachers accepted physical risks every day going to their classrooms, she said, and astronauts were no more expendable than teachers.[158] Goldin admitted to Morgan his personal desire for her to fly but in June 1994 sent her a letter stating that the "highly visible nature of the program and the diversity of opinion on whether it is appropriate to allow a teacher to accept the risks illustrates the need to consider all views."[159] He would only sanction her participation if he could justify it within the context of the 1989 policy.

Goldin directed an internal review of the matter. Comprised again of representatives from various NASA organizations, the group evaluated the merits of flying Morgan, noting the potential boon a successful mission including a teacher could have for the nation's science education goals and public awareness of NASA; it also flagged drawbacks, notably that a second accident with the mission "could mean the demise of NASA."[160] Like Truly's review group, they recognized education as a NASA mission and rationalized that Shuttle flyers dedicated to education activities aboard the vehicle would be considered mission-critical and thus complied with NASA's policy. The group recommended that NASA commit to selecting and training science and math teachers as Shuttle mission specialists, with Morgan as the first of this new class of astronauts. The recommendation called for NASA to return to its conceptualization of the utility of the Shuttle as encompassing more than the pursuit of scientific research and payloads to include the objectives of inspiring future generations.

The following year, Goldin was pushed to act on the recommendation to fly Morgan when John Glenn asked about flying aboard the Shuttle. Glenn had long desired to return to space and in the summer

[158] Barbara Morgan to Dan Goldin, April 17, 1994, Folder 19756, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[159] Daniel S. Goldin to Barbara Morgan, June 6, 1994, Folder 19756, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[160] "The Flight of a Teacher in Space," August 25, 1994 (draft), Folder 19755, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

of 1996 proposed to Goldin that, as a man in his mid-70s, he could participate in a flight to contribute to research on muscle and bone loss and sleep pattern changes in older citizens. As Goldin and senior NASA officials contemplated the prospect of flying Glenn, long-time supporter of Morgan's flight Alan Ladwig questioned the propriety of flying Glenn, who was by that time a non-astronaut, when NASA had not rendered a definitive decision on Morgan. How could NASA rightfully authorize Glenn but not Morgan to participate on a Shuttle mission? Once media reports broke the news in June 1997 that Glenn might fly on the Shuttle, some expressed enthusiasm about the possibility. "It would be good for America," said John Pike of the Federation of American Scientists, recognizing Glenn as a national hero whose flight aboard the Shuttle could cast attention on a space program that was far from the fore of public consciousness.[161] President Clinton publicly endorsed the idea. But many outside of NASA would soon call a Glenn flight into question as Ladwig had. NASA had no plans to send older people into space, and even encouraged retirements before astronauts reached anywhere near Glenn's age. If the intent was to aid senior citizens on Earth, then why not conduct geriatric research on Earth at far less cost and with a much larger sample size of volunteers than a single data point of Glenn? Many journalists speculated that Goldin was entertaining flying Glenn as a political favor to President Clinton, whom Glenn had defended during Senate hearings on campaign finance abuses. The Space Frontier Foundation argued that flying Glenn would be a slap in the face to career astronauts and American taxpayers when NASA had not committed to advancing all citizens' abilities to reach space.[162] The National Space Society (formed from the merger of the National Space Institute and the L5 Society in 1987) held that

[161] See, for example, Seth Borenstein, "Glenn Interested in Another Trip to Space," *Orlando Sentinel*, June 21, 1997; Paul Barton, "Sen. John Glenn May Return to Space in the Name of Medical Research," *Florida Today*, July 21, 1997; and Francis X. Donnelly, "John Glenn: A Hero for the Ages Hopes for One Last Launch," *Florida Today*, September 28, 1997. All articles located in Folder 16106, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[162] James Pura, "Sen. Glenn Shuttle Flight Most Expensive Congressional Junket Ever," Space Frontier Foundation, January 15, 1998, accessed February 21, 2015, https://spacefrontier.org/1998/01/sen-glenn-shuttle-flight-most-expensive-congressional-junket-ever/. Glenn himself had publicly opposed NASA's flight of citizen passengers aboard the Shuttle.

NASA should not launch Glenn unless the agency also settled the issue regarding Morgan and restarted the citizens-in-space program.[163]

Goldin took all these views into advisement and publicly resolved the matter of flying Morgan and Glenn on a single day, January 16, 1998. NASA would fly both on upcoming Shuttle flights. Goldin gave a speech confirming the agency's plans to fly Glenn as part of the crew of STS-95, a dedicated scientific research mission that would conduct 88 experiments in October of that year. The agency would get around its restrictions on flying non-career astronauts on the Shuttle by flying Glenn as a payload specialist.[164] Goldin's speech lauded Glenn's willingness to accept the risk of returning to space to serve the country and benefit the lives of older Americans. But he made no mention of Barbara Morgan. Instead, NASA announced her selection as a mission specialist quietly via a press release issued the same day. Lacking the enthusiasm of Goldin's speech, the release stated simply that NASA had "determined that it is appropriate to include educator mission specialists" among its astronaut ranks but remained silent about a flight assignment. However, this act suggested that Morgan's entry into the astronaut corps would not be the last of its kind: as Goldin's advisors had recommended, mission specialists with experience teaching science, technology, and math would be selected and trained in the astronaut corps.[165]

Goldin's successor, Sean O'Keefe, saw to it that NASA institutionalized the effort to expand participation in the astronaut corps to teachers. Both Goldin and O'Keefe shared a recognition of NASA's value in elevating student interest in science and engineering careers. O'Keefe, however, made education a pillar of his vision for NASA, including the aim "to inspire the next generation of explorers"

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[163] National Space Society, "Statement on Possibility of John Glenn Shuttle Flight," January 15, 1998, accessed February 21, 2015, http://www.nss.org/news/releases/release24.html.

[164] Daniel S. Goldin, "Announcement of NASA's Decision to Fly John Glenn," January 16, 1998, NASA Historical Reference Collection online, accessed February 21, 2015, https://mira.hq.nasa.gov/history/ws/hdmshrc/all/main/Blob/17771.pdf?w=NATIVE%28%27SERIES+ph+any+%27%27Goldin%27%27%27%29&upp=0+&rpp=100&order=DOC_DATE&m=707.

[165] NASA, "Media Availability with First Educator/Mission Specialist in Houston, Tuesday," news release N98-6, January 16, 1998, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/note2edt/1998/n98-006.txt.

within the agency's new mission statement. Moreover, in the first weeks of O'Keefe's tenure, President George W. Bush signed the No Child Left Behind Act into law, stressing his administration's commitment to recruit new teachers into the nation's classrooms. Whereas Goldin had worried about the ramifications for NASA on flying a non-career astronaut on the Shuttle, O'Keefe was primed to fulfill Christa McAuliffe's legacy and put a teacher on board the Shuttle once and for all. In an April 2002 speech at Syracuse University, O'Keefe announced that Morgan would "begin her mission as the first Educator Mission Specialist."[166]

NASA had taken another step to broaden the astronaut corps and in so doing reaffirmed education as a legitimate Shuttle use. While some astronauts questioned why NASA could not simply continue to rely on them to carry out educational initiatives, O'Keefe and the program's developers were determined to capitalize on the ability to use teachers' unique capabilities to inspire students. They worked closely with Johnson Space Center, however, to establish eligibility requirements for the new mission specialists, ultimately agreeing that candidates would need to be certified K-12 educators with a minimum of three years of teaching experience and at least 18 credit hours of science, math, or engineering to facilitate participants' ability to become familiar with Shuttle and International Space Station systems and experiments. NASA's internal planners considered how they could involve students and parents in the program at all stages.[167] They reached out to high school and middle school students to gain their inputs on various program details and encouraged them to nominate teachers.

O'Keefe announced in a December 2002 speech Morgan's assignment to STS-118, a mission to the International Space Station scheduled for November of the following year. NASA had designated citizen flyers on the Shuttle "space flight participants" to distinguish them from career astronauts, but

[166] Sean O'Keefe, "Pioneering the Future," address at the Maxwell School of Citizenship and Public Affairs, Syracuse University, April 12, 2002, NASA Historical Reference Center online, accessed February 21, 2015, https://historydms.hq.nasa.gov/sites/default/files/DMS/e000040280.pdf.

[167] NASA, "Educator Mission Specialist Program Plan," September 13, 2002 [handwritten], Folder 19749, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

O'Keefe made sure that teachers would have the coveted moniker in their title, calling them Educator Astronauts. The agency kicked off the program by rolling out a website inviting public nominations and applications for the program. Seeking to reach as diverse of a pool of applicants as possible, the agency ran Public Service Announcements for the program in both English and Spanish. Just ten days into the recruitment period, STS-107/*Columbia* disintegrated on its return to Kennedy Space Center. Educator Astronaut program managers decided to press ahead with the process when applications continued to roll in after the accident and citizens wrote in with encouragement to keep the program alive.[168] The agency received nearly 1,700 applications and forwarded those with superior qualifications to Johnson Space Center for review with all other applications for NASA's 2004 astronaut class. Of the 11 astronauts that NASA selected, three were Educator Astronauts.[169] After the Shuttle mission manifest shifted as a result of the *Columbia* tragedy, Barbara Morgan finally flew in 2007, with many of the original Teacher in Space finalists onsite at Kennedy Space Center to witness the launch, more than 20 years after the quest to put an educator on the Shuttle began. Two of the new Educator Astronauts, Joseph Acaba and Richard Arnold, were crewmembers of STS-119, a Shuttle mission to the International Space Station in 2009. The third Educator Astronaut, Dottie Metcalf-Lindenburger, flew to the Station aboard STS-131 in 2010.

Beyond opening the Shuttle to educators and preserving opportunities for scientists and foreign astronauts, NASA's efforts to broaden access to space for any other citizen flyers did not extend further. Not that the idea was not entertained: just as United Space Alliance considered offsetting Shuttle operations costs by make *Columbia* available to fly commercial payloads, the company also gave thought to opening the vehicle to private paying passengers.[170] Various factors, however, precluded the agency

[168] NASA Educator Astronaut Program Office, Code N-EAP, "Positive Comments Received: Post Columbia Tragedy," February 7, 2003, Folder 19748, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[169] NASA, "NASA Introduces the Next Generation of Explorers," news release 04-152, May 6, 2004, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/2004/may/HQ_04152_space_day_ascan.html.

[170] Borenstein, "Space for Rent: Shuttle Columbia Could Take Advertising to New Heights."

from seeing a value proposition for returning to its previous imaginary and using the Shuttle to further democratize space flyers. The agency remained concerned about the Shuttle's safety risk. Some thought NASA's plans to fly Glenn and Morgan signaled NASA's confidence regarding Shuttle safety and a desire to resume expanding access to space. Goldin, however, made clear that space flight remained risky and that the agency would not fly civilians with only brief training. In addition, the need to fill limited Shuttle seats with highly qualified individuals also was an issue. When it came to constructing the Station and performing specific research functions, NASA needed highly trained individuals to perform spacewalks and position and fuse the components together. Given those priorities, seats on the Shuttle went to career astronauts and payload specialists.[171]

These concerns were tested when former NASA engineer turned multimillionaire businessman Dennis Tito paid the Russian Space Agency $20 million for a flight to the International Space Station. The cash-strapped Russians had been flying paying passengers to *Mir* and had worked out a deal to send Tito; after that station's deorbit in early 2001, however, they invited Tito to visit the International Space Station instead.[172] Neither NASA nor the other Station partners had the power to stop the Russians from flying Tito there: partners were required only to notify, not to ask permission, of the others concerning whom it would fly to the Station. Despite Goldin's promotion of commercial activity in space, the NASA administrator protested the plan to fly Tito. Goldin worried that Tito's presence on the Station, which was still under construction, would create a major distraction and safety threat to the astronauts working on assembly. Goldin also was aware that some of NASA's key Congressional stakeholders, including Senator Barbara Mikulski and Representative Ralph Hall, objected to Russia's unilateral decision. Hall conveyed his concerns to Goldin about benefitting private citizens willing to pay to fulfill their personal

[171] Hawes, interview.

[172] Part of the reason why the Russians deorbited *Mir* was because they could not afford to continue to support it as well as their contributions to the International Space Station. NASA pressured them to support the latter. Tito's contract with the Russians stated that his visit to space would take place by the end of June 2001 or the deal would be terminated, thus prompting the Russians to fly him to the International Space Station.

desires to fly into space at the expense of those who had funded the Station, stating "an obligation to the American taxpayers to ensure that the International Space Station is not jeopardized during its assembly or its resources misallocated."[173] Despite receiving criticism for his own recent Shuttle flight, John Glenn argued that Tito's flight trivialized the costly space station.[174]

The flight nonetheless went forward in April 2001, without incident. Goldin averred afterward that NASA did not oppose trips by non-career astronauts once the Station was ready.[175] NASA's Hawes concurred, explaining that the key issue was one of timing: "We weren't trying to just give negative answers because we didn't want to fly other people. We just got overwhelmed with the constraints of the [ISS assembly] problem."[176] Following Tito's flight, the Station partners established guidelines for visits by non-career astronauts. Even so, NASA never endorsed Russia's subsequent flights by paying passengers – a fact that Alan Ladwig lamented: "NASA was really almost anti-Tito's flight. And I never fully understood why because… we're having a hard time selling the space program…and here you have a guy who's willing to spend $25 million of his own money to go to [space]. I've never quite understood why we didn't embrace that…and engage him or to help tell the story once he got up there."[177]

Tito returned from his flight as an advocate of opening space to a broader range of people. He pointed to a recent poll by a "respected publication" that found that nearly two-thirds of Americans believed that NASA should allow citizens to pay to travel to space to raise funds for the nation's space

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[173] Ralph M. Hall to Dan Goldin, February 6, 2001, SpaceRef.com, accessed August 15, 2014, http://www.spaceref.com/news/viewpr.html?pid=3786.

[174] Richard Stenger, "John Glenn: Space Tourist Cheapening Alpha," CNN.com, May 3, 2001, accessed February 21, 2015, http://edition.cnn.com/2001/TECH/space/05/03/space.day/.

[175] Paul Recer, "Space Tourist Dennis Tito Used 'Wrong Way' to Get to Orbit, Says NASA Chief," *Ludington (MI) Daily News*, May 3, 2001, B12, Folder 17247, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[176] Hawes, interview.

[177] Alan Ladwig, interview by author, Washington, DC, January 31, 2013.

program, just as Russia did.[178] He also thought NASA should enable access to space to those of lesser means: "I would like to work with NASA to encourage them to fly ordinary people at government expense on the seventh seat of the shuttle so that we can get a cross-section of people…to experience what it's like up there," Tito told the *Today Show*'s Katie Couric.[179] Tito testified before Congress in a House hearing on space tourism that "we need to find ways to include the general public in our human space flight activities," stating that NASA should reinstitute the Space Flight Participant Program:

> There is nothing that intrigues and excites the American public like seeing someone they can relate to achieve and experience great things they consider beyond their reach. Ours is a government of, for and by the people…We need to once again offer our nation's teachers, journalists, creative artists and others an opportunity to experience what is now the sole bailiwick of fighter or test pilots and scientists. The bottom line is that the American people, who pay for the space program, should have every opportunity to share in it.[180]

Congressman Dana Rohrabacher agreed with the idea that NASA could benefit as the Russians did by selling seats on its own spacecraft. But just as NASA hesitated to expand commercial uses of the Shuttle and Station without limit, so too did the agency hesitate to broaden citizens' access to space flight at the expense of a nascent space tourism industry. By the mid-1990s, the independent X-Prize Foundation announced a competition for private individuals and organizations to build spaceships capable of sending humans to space for a prize purse of $10 million. The offering had spurred many enterprising outfits to pursue this goal and start space tourism businesses. Also testifying at the space tourism hearing, Hawes expressed NASA's commitment to "opening up the space frontier for commercial purposes

[178] Ibid.

[179] Tito quoted in Alan Boyle, "Tourist Wants to Work with NASA," MSNBC.com, May 18, 2001, Folder 17247, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[180] Dennis Tito, "Expanding the Dream of Human Space Flight," written testimony prepared for the U.S. House of Representatives, Committee of Science, Subcommittee on Space and Aeronautics, hearing on space tourism, June 26, 2001, SpaceRef.com, accessed February 21, 2015, http://www.spaceref.com/news/viewpr.html?pid=5310.

including tourism" but not to compete with the private sector in this capacity.[181] By the turn of the millennium, NASA was willing to assist companies with their efforts to develop launch vehicles that could allow more people to travel into space but resolved not to take that role from them.[182]

Commemorating the People's Spaceship

As Space Station construction progressed in the early 2000s and constraints bore on how NASA could use the Shuttle, the agency worked to keep the vehicle flying safely and productively and to engage external publics in all the ways it felt appropriate. When it originally developed the Shuttle, the agency anticipated that each orbiter would be able to fly a hundred missions. So-called "Shuttle-huggers" within NASA believed that with appropriate maintenance and upgrades, the vehicles could indeed realize this level of use. While NASA developed plans to implement some upgrades in the late 1990s, the agency concomitantly considered options for safer, more capable and more efficient human and cargo space transportation. Moreover, officials continued to ponder pursuits beyond the Station and low Earth orbit that would take humans perhaps back to the Moon to establish a long-term presence as well as to Mars and beyond – destinations which would require a system with capabilities the Shuttle did not offer to reach.

The disintegration of the Space Shuttle *Columbia* as it streaked across the lower central United States just minutes from its scheduled return to Kennedy Space Center with the crew of the STS-107 research mission on February 1, 2003, hastened the agency's thinking about the future of its human space flight endeavors. The timing and technical causes of the accident differed from the *Challenger*

[181] W. Michael Hawes, written testimony prepared for the U.S. House of Representatives, Committee of Science, Subcommittee on Space and Aeronautics, hearing on space tourism, June 26, 2001, SpaceRef.com, accessed February 21, 2015, http://www.spaceref.com/news/viewpr.html?pid=5313.

[182] NASA, "Frequently Asked Questions about NASA" [NASA webpage that no longer exists], 1996, Box 25, Robert Parker Papers II Subseries, Center Series, Johnson Space Center History Collection, University of Houston-Clear Lake, Houston, TX.

experience: in the case of *Columbia*, upon the Shuttle's ascent, a piece of foam from the external tank struck and compromised the integrity of the reinforced carbon-carbon on the leading edge of *Columbia*'s left wing that was critical to deflecting searing heat as the orbiter reentered Earth's atmosphere. At the same time, both accidents were at least indirectly the consequence of trying to cope with pressures to keep a highly complex technological system operating on schedule and within finite budgets.[183] Indeed, only a few years earlier, NASA's Aerospace Safety Advisory Panel cautioned that the agency was spending inadequate resources and attention on Shuttle safety issues in the long term its quest to keep the program alive while also supporting an aggressive timeline to complete the International Space Station.[184] The panel pointed out in 1999 that *Columbia* had experienced wiring shorts and hydrogen leaks in recent years that had not scuttled missions but could nonetheless serve as "a harbinger of things to come" as the orbiters aged.[185]

According to Michael Cabbage, who was a space beat reporter at the *Orlando Sentinel* at the time of the accident, the *Columbia* incident had a "different feel" than the *Challenger* episode where the general public and media were concerned. It was certainly no less tragic of an event but not quite as jolting: more than anything, the *Columbia* incident seemed to many Americans like a "giant airline accident."[186] This time, the event was not captured on live television. It did not involve the flight of an "ordinary" citizen like schoolteacher Christa McAuliffe.[187] Moreover, the nation had come to face the

[183] For a detailed account of the factors involved in the *Columbia* accident, its relationship to the *Challenger* incident, and its aftermath, see Michael Cabbage and William Harwood, *Comm Check… The Final Flight of Shuttle Columbia* (New York: Free Press, 2004).

[184] Aerospace Safety Advisory Panel, *Annual Report for 1998* (Washington, DC: U.S. Government Printing Office, February 1999).

[185] Aerospace Safety Advisory Panel, *Annual Report for 1999* (Washington, DC: U.S. Government Printing Office, February 2000), 15.

[186] Cabbage, interview.

[187] The mission's inclusion of the first Israeli payload specialist, Ilan Ramon, nonetheless had drawn some additional media attention to the mission.

possibility of a Shuttle disaster almost 17 years to the day prior. Also key to setting the tone for public and media perceptions was that NASA was far more transparent about the accident and the ensuing investigation. The agency had learned painfully from the *Challenger* accident how critical open communication was to its credibility and the trust of political stakeholders, the media, and the public; as soon as NASA officials realized the fate of *Columbia*, they followed their Shuttle contingency plan, establishing an external accident investigation committee the morning of the accident and sharing information publicly as soon as any became available. NASA convened an initial press conference within a few hours of the accident, and senior Shuttle and other agency officials conducted daily press updates for two weeks. NASA invited members of the news media to see accident investigators' progress in laying out salvaged wreckage of *Columbia* on a full-sized grid of the Shuttle in a hangar at Kennedy Space Center.[188] Determined not to overlook any useful ideas, Shuttle officials even invited public suggestions for improving the safety of the vehicles.[189]

While NASA's proactive communications about the *Columbia* accident and investigation saved the agency from the scathing media response it had endured following the *Challenger* incident, the accident surfaced the same mixed sentiments and debates that arose in the *Challenger* aftermath. As with *Challenger*, polling numbers showed an uptick in the percentage of Americans who believed the space program warranted a funding increase, and a drop among those who thought the program deserved less or no funding.[190] Adults and children alike sent letters and emails to NASA encouraging the Shuttle program and human space flight to continue. Milt Heflin, Johnson Space Center flight director chief when the *Columbia* accident occurred, recalled a poignant letter from a man who wished NASA well and

[188] Lisa Malone, interview.

[189] Jonathan Krezel, interview by author, Washington, DC, March 15, 2013.

[190] Jeffrey M. Jones, "Support for Space Program Funding High by Historical Standards," August 19, 2003, Gallup News Service, accessed February 21, 2015, http://www.gallup.com/poll/9082/Support-Space-Program-Funding-High-Historical-Standards.aspx.

encouraged the agency to "please take us with you" as it prepared to return the Shuttle to flight.[191] Applications for the Educator Astronaut opportunity kept rolling in. Concurrently, questions about the wisdom and purpose of flying humans aboard the Shuttle came up once again in the media. Various articles and editorial cartoons cast the Shuttle as an aged and over-extended vehicle, saddled to Earth orbit as lithe robotic explorers surveyed the Martian surface.[192] The *New York Times* called for NASA to continue with human space flight but instead to redirect its resources to projects aimed at "the sheer thrill of exploration and new discoveries."[193]

Meanwhile, seven months of examining the circumstances around the accident led the Columbia Accident Investigation Board (CAIB) to reach conclusions concerning the accident's causes and to offer recommendations for moving forward with NASA's human space flight program. Coming from the Navy, Air Force, NASA, universities, industry and aviation safety organizations, the CAIB's members strongly supported a return to flight of the Shuttle provided that NASA made technical and managerial changes to reduce the chances for further accidents. In addition to advising near-term fixes, the CAIB also noted that NASA would need to recertify the Shuttle to maximize safety if it were to operate the system beyond 2010. But the CAIB also suggested that the accident's causes were rooted deep in the Shuttle's history. For one, the CAIB noted, NASA had long mischaracterized the Shuttle as operational when it remained an experimental vehicle. In addition, the CAIB placed blame at the level of national leadership, pointing out that NASA's lack of a national mandate compelling it to pursue human space flight since Kennedy's 1961 direction to send humans to the Moon had forced the agency to "participate

[191] Milt Heflin, telephone interview by author, May 3, 2013.

[192] Neal, "Framing the Meanings of Spaceflight in the Shuttle Era," 87. See, for example, James Glanz with William J. Broad, "Has the Space Shuttle Turned into NASA's '76 Dodge Dart?" *New York Times*, January 27, 2004, ProQuest Historical Newspapers: The New York Times, accessed February 21, 2015.

[193] "The Call of Distant Worlds," *New York Times*, February 9, 2003, ProQuest Historical Newspapers: The New York Times, accessed February 21, 2015.

in the give and take of the normal political process" and "gain the support of diverse constituencies."[194] Consequently, the CAIB averred, the Shuttle had suffered from resource constraints and schedule pressures as it carried out the Shuttle and Station programs simultaneously.[195]

NASA and the George W. Bush administration recognized that the nation stood once again at a critical decision point with respect to the future of the Shuttle and NASA's human space flight program. The Shuttle had vastly broadened the scope of the U.S. human space flight program over three decades, serving the nation and its citizens through its unprecedented carrying capacity and other attributes. It was also crucial to the completion of the International Space Station. But it had proven a far more complex system with greater risks than NASA had ever anticipated. Like so many others, space policy officials asked themselves whether continuing to send astronauts on missions into orbit around Earth was worth the risk to human lives.

NASA had long envisioned space activity in low Earth orbit to be part of a progression to send humans to explore worlds beyond and suggested to Bush the possibility of refocusing human missions on this aim. Believing like so many of his predecessors in the presidency in the importance of human space flight to preserving the nation's global stature, Bush found such a pursuit appropriately ambitious. The President, however, also maintained that it would need to be able to be pursued without large budget increases, lest the plan wither, as had the tremendously costly Space Exploration Initiative proposed by Bush's father, President George H.W. Bush. The Shuttle consumed some $2 billion of NASA's $16 billion annual budget. Between the safety and cost issues, NASA and the President decided that it was time to terminate the Shuttle program and create a new vision for space exploration. On January 14, 2004, Bush announced that NASA would pursue a new plan and purpose for human space flight.

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[194] Columbia Accident Investigation Board, *Report Volume I* (Washington, DC: U.S. Government Printing Office, August 2003), 209.

[195] Ibid.

Humans, together with robotic probes, would move beyond Earth orbit to explore the Moon, Mars, and the solar system beyond. Completing the International Space Station and focusing U.S. research aboard it on understanding the impacts of the space environment on human health would remain a critical steppingstone toward realizing this vision. NASA would focus the Shuttle on finishing Station assembly and then retire it thereafter, freeing resources needed to fund the new exploration program.[196]

As NASA commenced studies to realize the new Moon-Mars human space flight policy, the July 2005 launch of STS-114 returned the Shuttle to service and kicked off the final era in the vehicle's long history. Now focused solely on completing International Space Station construction, the vehicle's justification reverted to the purpose NASA human space flight proponents had envisioned for it while the Apollo missions were still flying. The agency no longer depended on securing the active involvement of various external publics to ensure the Shuttle's viability as it once had. NASA flew only career astronauts from that point forward, albeit crews of women and men that were racially, ethnically, and professionally diverse. Meanwhile, Shuttle cargo space was almost entirely devoted to hardware required to build and supply the Space Station. NASA's new administrator, Michael Griffin, terminated the GAS and Hitchhiker payload programs shortly after his arrival in 2005, citing the lack of available room on the Shuttle. The Shuttle was a workhorse of a new kind.

Even so, NASA continued to forge a relationship between external publics and the storied vehicle that conveyed the sense that the Shuttle belonged to all Americans. As Space Station assembly continued and NASA studied options for human exploration of the solar system, the Shuttle remained the primary visible element of NASA's human space flight endeavors. Even as NASA began major campaigns to promote President Bush's vision for space exploration, the reality was that NASA would not have another launcher ready until a few years after the end of the Shuttle program. The agency consequently aimed to

[196] President George W. Bush, *A Renewed Spirit of Discovery: The President's Vision for U.S. Space Exploration*, January 2004, accessed February 21, 2015, http://history.nasa.gov/renewedspiritofdiscovery.pdf.

showcase the Shuttle and capitalize on the vehicle's popularity among citizens to satiate the interests of enthusiasts, sustain the agency's relationship with the education community, and make all Americans aware of the agency's continued commitment to sending people into space. Launch site access became further restricted after the September 11, 2001, terror attacks, but officials continued to invite "non-traditional" publics to see the Shuttle lift off.[197] NASA welcomed interested individuals to participate in recommending potential activities and experiments for Educator Astronauts to complete on the Shuttle or Space Station and attracted tens of thousands within just a few months.[198]

The agency continued to seek to use all available communications media to engage with external publics. With NASA becoming an early adopter of social media, the agency's "tweeting" astronauts provided a new form of public access to the experiences of the space flyers and Shuttle missions and emerged as some of the most "followed" individuals on the social media channel. Beginning in 2009, the agency invited Twitter users and bloggers to the first in a series of "Tweet-ups" (later called "NASA Socials") to allow them to attend Shuttle launches, tour NASA facilities, and meet NASA personnel; officials hoped that by giving these internet communicators access to NASA, the participants would share in the excitement of human space flight and in turn convey their experiences online to new audiences.[199] NASA also encouraged broad public participation in certain cultural aspects of Shuttle and Station missions. In 2009 NASA held an online poll to name a Space Station node and received a tremendous response from a variety of groups eager to sway the vote.[200] The agency ran contests in 2010 to select the

[197] Beth Beck, interview by author, Washington, DC, May 16, 2013; Ladwig, interview, January 31, 2013.

[198] NE/Manager, Flight Projects Office (Debbie Brown Biggs), and NT/Program Executive, Technology and Products Office (Shelley Canright), to N/Associate Administrator for Education, August 6, 2003; NASA, "Join the Earth Crew" webpage, 1993. Both documents located in Folder 19748, NASA Historical Reference Collection, NASA Headquarters, Washington, DC.

[199] Beck, interview, May 16, 2013; NASA, "NASA Hosts Launch and Mission Tweetups for Next Space Shuttle Mission," news release 10-088, April 14, 2010, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/2010/apr/HQ_10-088_STS-132_Tweetups.html.

[200] Most notably, *Colbert Report* host Stephen Colbert encouraged viewers to suggest his surname to NASA. "Colbert" was the top vote-getter by more than 40,000 votes; however, NASA's contest rules allowed the agency the final choice of names, and the agency selected "Serenity," the most popular name among the four NASA had

music to wake up the Shuttle crew on STS-133 as well as to compose original wake-up songs for the STS-134 astronauts. The former contest garnered 2.5 million votes, while the latter received 1,350 submissions from 63 countries.[201]

Although the vehicle's purpose and accessibility had shifted over time, NASA officials desired to honor and commemorate the Shuttle as the people's spaceship up through the program's end, preserving the imaginary that had grown so popular. A few years after Bush called for the Shuttle's termination, NASA began to contemplate what to do with the hardware that would remain after the program ended. The agency developed a special process to allow educational institutions to apply to acquire major elements such as flight trainers, while promoting the availability of individual thermal protection tiles and crew food to schools and museums.[202] What to do with the orbiters, however, warranted unique consideration. While Griffin initially asserted that they should be displayed at NASA centers connected closely with the Shuttle program, the costs associated with preparing and maintaining the displays prompted the agency to seek proposals from museums and educational institutions around the country to take in the orbiters on a cost-sharing basis.[203] NASA would transfer one orbiter, *Discovery*, to the Smithsonian Institution, which by long-term agreement with the agency had the first rights to any NASA artifact. Twenty-one institutions vied for the remaining historical spacecraft. Charlie Bolden, who

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suggested. The agency, however, named an exercise machine aboard the Station, the Combined Operational Load Bearing External Resistance Treadmill (COLBERT), in honor of the television show host.

[201] NASA, "NASA Announces STS-133 Wakeup Song Winners; Face In Space Totals," news release 11-055, February 25, 2011, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/2011/feb/HQ_11-055_Top_40.html; NASA, "NASA Opens Voting for Original Songs to Awaken Next Shuttle Crew," media advisory 11-068, March 29, 2011, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/2011/mar/HQ_M11-068_Original_Song_Contest.html.

[202] James Hull, interview by author, Washington, DC, January 31, 2013; NASA, "NASA Is Expanding Offer for Space Shuttle Tiles and Food," news release 12-304, September 4, 2012, accessed February 21, 2015, http://www.nasa.gov/home/hqnews/2012/sep/HQ_12-304_NASA_Food_Tiles_schools.html.

[203] NASA, Office of Inspector General, *Review of NASA's Selection of Display Locations for the Space Shuttle Orbiters*, August 25, 2011, 3, accessed February 21, 2015, http://oig.nasa.gov/audits/reports/FY11/Review_NASAs_Selection_Display_Locations.pdf.

became the new NASA administrator in 2009, placed greatest priority on locations for the other orbiters that had the highest attendance and regional population as well as access to international visitors.[204] On April 12, 2011, the 30th anniversary of the Shuttle's first flight, Bolden announced the three additional institutions that would receive orbiters – Kennedy Space Center, *Atlantis*; California Science Center, *Endeavour*; and the Intrepid Sea, Air, and Space Museum in New York, *Enterprise*. These institutions, Bolden stated, would "provide the greatest number of people with the best opportunity to share in the history and accomplishments" of the Space Shuttle program.[205]

Before delivering the orbiters to their new homes, some NASA officials pressed to share the Shuttle orbiters in flight, one last time, with people around the country, just as the agency had done nearly three decades prior in touring *Enterprise* around Europe and taking the test orbiter to the World's Fair in New Orleans. Top NASA officials ultimately rejected this year-long "Shutte-palooza" proposal on account of the weather-sensitivity of the orbiters and other potential risks before placing them at their retirement sites.[206] But recognizing that the orbiters would need to be transported to the new locations in some fashion, the agency worked with its partners and authorities in those localities to give the vehicles grand welcomes for all to witness in 2012 and 2013. Millions watched in awe as *Discovery* majestically circled the Washington, DC, area atop the 747 carrier aircraft before landing at Dulles International Airport for transfer to the Smithsonian National Air and Space Museum; as *Enterprise* sailed serenely up the Hudson River by barge to a new home in New York City; as *Endeavour* paraded through the streets of Los Angeles to reach the California Science Center; and as *Atlantis* traversed ten miles across Kennedy Space Center property to the center's visitor complex, where she was greeted with the fanfare of fireworks.

[204] Ibid., 6.

[205] Ibid., 16.

[206] Krezel, interview.

As the crowds thrilled at the sight of the orbiters in their midst during these celebrations, the American citizenry remained far from unanimous on the value of the Shuttle and NASA's human space flight pursuits. Opinion polls taken as Shuttle flights came to an end revealed that more than one-third of Americans did not think the Shuttle had been a prudent national investment.[207] Still others lamented the fact that the vehicle had not opened space to the masses as NASA had projected in the 1970s. At the same time, the Shuttle had galvanized participation from communities ranging from life scientists to educators. Year after year over the Shuttle's lifetime, through its greatest successes and most profound tragedies, more Americans believed the Shuttle program justified its expenses than ever thought the same of the Apollo program, even when Apollo 11's astronauts reached the Moon in 1969.[208] The number of Americans disappointed by the Shuttle program's end outweighed those who felt termination was a good move by nearly three to one, with those who witnessed and attended the orbiter retirement festivities expressing feelings of nostalgia, and many equating the Shuttle era's end to the demise of the American space program.[209] Many visitors to NASA facilities bought up pins, patches, and other Shuttle souvenirs out of concern that soon the space agency soon be closing its doors.[210] As with Apollo, national pride and technological exuberance had much to do with public sentiments expressed at the end of the Shuttle era. But NASA's early adoption of a sociotechnical imaginary of a Shuttle accessible to so many people and its commitment to making available a range of opportunities for citizens to engage with the space

[207] CBS news poll, "The Space Shuttle Program," July 8, 2011, accessed February 21, 2015, http://www.cbsnews.com/htdocs/pdf/JUN11B_1.PDF; CNN/ORC poll, July 21, 2011, accessed February 21, 2015, http://i2.cdn.turner.com/cnn/2011/images/07/21/poll.july21.pdf; Pew Research Center, "Majority Sees U.S. Leadership in Space as Essential," July 5, 2011, accessed February 21, 2015, http://www.people-press.org/2011/07/05/majority-sees-u-s-leadership-in-space-as-essential/.

[208] Roger D. Launius, "Public Opinion Polls and Perceptions of U.S. Human Space Flight," *Space Policy* 19 (2003): 167, 168.

[209] CBS news poll, "The Space Shuttle Program"; David Gergen and Michael Zuckerman, "What Space Shuttle Discovery Has Inspired in Us," CNN.com, April 20, 2012, accessed February 21, 2015, http://www.cnn.com/2012/04/20/opinion/zuckerman-gergen-discovery/; Adam Naids, telephone interview by author, January 23, 2013.

[210] Richard Allen, interview.

transportation system – even though tempered only a short time into its service life – almost certainly had a significant role in producing the Shuttle as an American technological icon.

Chapter Synthesis

Four decades earlier, as the Apollo program wound down, NASA had stood at a transition point, considering how to promote a follow-on human space flight program that would resonate with external publics. Holding up a vision of a space vehicle that would serve a multitude of publics' needs and interests, NASA evolved an assortment of Shuttle engagement opportunities for external publics, whose participation, passive and active alike, became crucial to producing the vehicle as a viable enterprise. As this chapter has shown, the *Challenger* accident derailed NASA's attempts to democratize the Shuttle to a further extent as it reframed the technology as risky rather than well-understood and raised questions about the propriety of a government-run commercial payload launch system, in turn creating limitations on the agency's ability and willingness to seek substantive public involvement. Moreover, broadly serving and engaging various publics with the vehicle came to matter less to the agency as it secured approval for and focused attention on constructing the Space Station. Indeed, in the end, the Shuttle served a new purpose that no longer required legitimization via direct public engagement. NASA officials nonetheless sought to connect the agency's publics with the popular vehicle, believing that visual and virtual avenues for enrolling them remained important for demonstrating accountability, serving extant public interest in human space travel, and spurring awareness of the agency's ongoing and desired new directions for the human space flight enterprise.

Conclusion

From a technical perspective, the Space Shuttle program began as an experimental effort to make the process of sending humans and a wide variety of cargo to space routine and less costly via a partially reusable spacecraft. Such a vehicle, NASA officials reasoned, would extend the human space flight capabilities acquired through the Mercury, Gemini, and Apollo programs while making access to space far more affordable than expendable launch vehicles allowed. For four decades, NASA worked to demonstrate numerous technical requirements that the Shuttle's designers had set for it. NASA publicly characterized the Shuttle as an operational vehicle after flying just four missions, and in many respects convinced officials within the agency and members of the public that in fact truly had become a routine and well understood machine. Indeed, engineers and technicians proved the ability to refurbish the orbiters and launch them many times over. The Shuttle lofted dozens of satellites and space probes to Earth orbit, retrieved some for return to Earth, and repaired others, like the Hubble Space Telescope. The vehicle proved able to carry small experiments as well as full laboratory modules, the Spacelabs, and achieved the purpose NASA had originally envisioned for it, serving as a workhorse to assemble a football-field-sized laboratory – the International Space Station – in Earth orbit. Even in making these wondrous accomplishments, the Shuttle nonetheless remained an experimental vehicle throughout its service life, constantly testing the limits of its performance capabilities and, as two catastrophic accidents revealed, always subject to error and risk.

The Shuttle entailed an experiment of another kind as well for NASA. It marked the agency's trialing of new philosophies and forms of interaction with American citizens in an effort to demonstrate the value of and legitimize the new human space flight initiative. Engaging with publics outside of the circle of government and industry space policy and program developers had always been a part of the agency's DNA, directed early on by legislation to share its achievements with the citizens of the nation and the world. By publicly displaying its human space flight activities beginning in the 1960s, the agency believed it would demonstrate on a global scale the United States' commitment to democracy vis-à-vis

the totalitarian Soviet empire. At the same time, the agency and its political supporters regarded openness as an appropriate means to remain accountable to American citizens and legitimize this seemingly fanciful and tremendously expensive endeavor which NASA officials had urged Presidents Eisenhower and Kennedy to pursue as a means to counter Soviet space advances even though there had been no social groundswell for the United States respond in precise kind. Embracing a sociotechnical imaginary of an America made stronger and a world made safer by a U.S. human space flight program, NASA officials for the most part envisioned the American people as an undifferentiated citizenry who, dazzled by the spectacle and patriotism of space flight, would come to support the current and future human space flight initiatives. By certain measures they succeeded in that quest: the millions of Americans who took in the breathtaking marvels, read about the astronauts' personal stories in *Life*, and attended NASA Spacemobile demonstrations with their children at least passively substantiated the nation's human space flight program, as NASA construed their interest as support for the endeavor.

In spite of the widespread, zestful interest in America's race to the Moon, operating as though it had one large, attestive public ultimately proved unfruitful for NASA. Apollo's triumph failed for many to make up for the serious social and economic problems the nation faced by the end of the 1960s. Even space scientists attacked human space flight as being a costly, inefficient, and risky way to explore space. At the same time, the Apollo program had served to whet the appetites of space buffs, including NASA personnel, for continued expansion of capabilities to explore space. While some within the Nixon administration and the Congress supported an Apollo follow-on to preserve national preeminence in space and sustain the American aerospace industry, these and other political officials regarded public support as crucial to the government's ability to bestow financial resources on any major enterprise; they recognized that the mixed reactions of the American people could not be ignored for any future national human space flight program to gain traction. With so many people tepid on investing in humans flights to Mars or huge space stations as NASA wanted to undertake, Nixon approved a more modest project: the Space Shuttle. Emulating an airliner more than a space capsule, the nation's first reusable spaceship would be

predicated somewhat less on the idea of improving the global stature of the nation writ large and more on Nixon's and NASA's positing of a new sociotechnical imaginary of a vehicle that would serve affordably the diverse interests of U.S. government agencies and the American people.

Indeed, just as technical knowledge proved essential for NASA and its industry contractors to develop the Shuttle as well as previous human space flight vehicles, agency officials adopted a belief that making the vehicle the answer to a variety of public needs and interests and engaging with external publics in ways meaningful to them would be vital to making the new vehicle viable economically, socially, culturally, and hence, politically. With relatively few Americans pressing for the nation to continue to spend billions of dollars for an Apollo encore, accountability to citizens as taxpayers dictated that NASA articulate why the Shuttle was a good investment for America. NASA sought to find legitimacy in the eyes of the American people in the new era by considering the various publics that comprised the population and devising ways to make the technology responsive to what mattered most to them.

Although the Shuttle's designers held far more conservative views about the extent of the technology's capabilities, NASA's leadership and public affairs officials promulgated an image of a versatile vehicle that promised something for everyone. The agency sought to please business leaders and other pragmatists by explaining that the Shuttle's ability to operate as a "space truck" would transform Earth orbit into a benign and useful environment, fulfilling the needs of various communities and growing American companies all while saving taxpayers money. Agency leaders conveyed to *Star Trek* fans and other space enthusiasts that the Shuttle would initiate an outward journey by humanity to explore and settle within the solar system, beginning the quest by making travel into space comfortable and accessible for almost anyone. Continuing to recognize value in display, NASA also capitalized on the Shuttle's futuristic profile, ability to be toured to almost anywhere, and newly available communications technologies to provide citizens unprecedented access to its space vehicles and astronauts and serve all those who thrilled at the opportunity to witness and participate virtually in the experience of space flight.

But NASA's most notable shift in public engagement came due to the fact that NASA and its industry partners alone could not assure the success of the vision it presented for the Shuttle. Having a huge cargo bay to fill and boasting a benign flight environment for diverse sets of flyers, the agency needed to go beyond displaying and transmitting information about its plans and achievements and also materially involve greater numbers and varieties of people with the vehicle to deliver on its promises. Two-way interactions with external publics were a regular part of doing business for many U.S. federal organizations: for example, regulatory agencies such as the Food and Drug Administration developed regulations and standards to protect citizens based on scientific assessments but also on sundry public inputs; the National Institutes of Health could only conduct clinical trials for disease treatments with patient volunteers. NASA, on the other hand, had evolved a military-oriented top-down, expert-run human space flight program management culture which regarded external publics as audiences to educate and impress. Adopting instead a market-driven approach to human space flight meant no longer being concerned only with solving technical challenges and publicly sharing the results of those efforts but becoming versed in customer relations and serving the needs of many new external publics. NASA's Shuttle managers learned how to transact business agreements worth millions of dollars – and which carried considerable risk – with communications satellite owners, pharmaceutical companies, university researchers, and foreign governments to secure payloads for the Shuttle. Concomitantly, Johnson Space Center officials found themselves developing astronaut diversity recruitment campaigns and training regimens for individuals with no flying or technical backgrounds.

NASA's new perceptions of the roles various publics could play vis-à-vis human space flight and the engagement approaches it developed brought with them the unpredictability that any experiment presents in still other ways. Officials had certain publics in mind when they announced the Shuttle's availability to new users and expanded the professional, gender, racial, and ethnic diversity of the career astronaut corps. But they could not entirely foresee which publics might desire to engage with the Shuttle and so they had to make decisions about whom to involve and how as the sociotechnical imaginary of an

accessible spacecraft that NASA promulgated piqued the interest of different groups of citizens. Various personnel in NASA's space flight, education, and public affairs offices advocated opening the Shuttle to students, artists, and other citizens who expressed interest in flying payloads or themselves aboard the vehicle, showing a willingness to push boundaries and democratize the Shuttle commensurate with the vehicle's known performance capabilities. While external critics often accused the agency of conducting "PR stunts" by inviting diverse groups to participate in the Shuttle program, NASA officials such as Alan Ladwig, Glen Wilson, Michael Smith, and others believed that living up to and legitimizing the promise of a Shuttle capable of transforming access to space required listening to and accommodating wherever possible those interested in participating in that promise's realization. They recognized the Shuttle as a shared public asset and a physical site of public engagement – a people's spaceship through and through – and championed initiatives such as the Shuttle Student Involvement Program, the Nonscientific Payload Program, and the Space Flight Participant Program to bring citizens of all walks of life into the Shuttle program.

As NASA managers accustomed to the "old way" of managing astronaut selections and other facets of human space flight adjusted to this very different conceptualization of the endeavor's purpose and possibilities, dealing with opening the Shuttle to citizens without technical credentials proved to be a great social and cultural challenge for personnel inside the agency. Gaining agency-wide support for such programs was not easy: questions of safety, fairness and priority to career astronauts and professional scientists, and NASA's external image dogged the efforts to stand up dedicated programs to involve "lay" groups with the new space transportation system. Accountability to so many publics required NASA to establish rules to ensure that efforts to engage these new publics with the Shuttle would not jeopardize crew or vehicle welfare, were equally available opportunities, and proved to be an appropriate use of this precious national asset. NASA personnel solicited public comments on some of the proposed regulations for these programs but made the final determinations of what uses of the Shuttle it would condone, drawing lines at activities they felt would discredit the Shuttle as a serious enterprise or otherwise mar the

agency's role and reputation as a keeper of the public trust writ large. In other words, NASA had to balance two somewhat conflicting dimensions of public service: the overarching desire to make the Shuttle an inclusive endeavor and a broader responsibility for safety and stewardship of public resources. Just as NASA was learning about the Shuttle's capabilities with each and every mission it flew and adjusting its protocols accordingly, so too did the agency continuously modify its public engagement approaches as circumstances warranted.

NASA's experimentation with how to accommodate and incorporate a variety of publics in the Shuttle program came to a head in the aftermath of the 1986 *Challenger* explosion. In addition to being a horrific technical disaster, the incident signaled that the technology could not, in fact, achieve all that NASA's sociotechnical imaginary promised and hence also proved tragic for NASA because it challenged NASA's carefully-laid approaches to engaging external publics meaningfully with human space flight. Suddenly, NASA found itself no longer able to brim with technological optimism in its discourse about the Shuttle as it contended with new external perceptions of the risks of human space flight and of the agency's competence to keep astronauts safe. The event also surfaced renewed debates and divisive viewpoints among citizens, the media, and members of Congress about the value of the Shuttle and human space flight. Meanwhile, NASA endured withdrawals of interest from private companies in investing in Shuttle-based research as well as vocalized concerns from proponents of private sector development who regarded the Shuttle as a competitive threat to the growth of an American commercial space industry.

Throughout these challenges, NASA human space flight proponents continued to aspire to build on the Shuttle program and develop a space station and hence wanted to present a case to the American people, and ultimately the Congress, that this project was worthy and the agency was capable of achieving it. In the quest to balance its ambitions with disparate public, White House, and Congressional views of the Shuttle, however, NASA officials found it increasingly difficult to sustain the vision of an accessible Shuttle. The agency continued to engage publics through discursive, visual, and virtual means but

constricted efforts to involve them as Shuttle users and flyers given the new challenges. Once the Shuttle was finally tasked with International Space Station construction, soliciting physical participation by external publics was not only increasingly difficult but simply mattered less to NASA, as the agency no longer needed to drum up support for the vehicle. President Bush's decision to terminate the Shuttle program following the *Columbia* accident also ended NASA's willingness to develop news ways to involve publics substantively with the Shuttle altogether, although the agency began to solicit academic and corporate experiments to fly aboard the Station. What engagement NASA pursued in the few years before retiring the Shuttle sought to capitalize on the vehicle's popularity and accessibility to foment, serve, and sustain public interest in space flight as the agency entered a period of uncertainty in transitioning to a new chapter in human space activities.

Reconsidering Public Engagement and Institutions' Quest for Technoscientific Legitimacy

Many accounts have been offered by scholars, journalists, and NASA insiders depicting the agency as a support-seeking organization, constantly looking for public and political approbation to secure the resources to pursue the next milestone in space. These assessments are certainly well-founded. For the past half-century, the nation's space agency has, quite understandably, been staffed with legions of individuals who have shared Wernher von Braun's vision of a human progression into the cosmos and have aimed to persuade others to endorse their aspirations. While banned by law from outright lobbying of the Congress, NASA has constantly sought to invoke discourse and display since the agency's origins to legitimize human space flight to enthusiasts as well as skeptics among the American citizenry – all of whom, NASA has recognized, are taxpayers and the electorate of the nation's executive and legislative leadership. From these perspectives, NASA's motivation for pursuing a path toward democratization of space flight as it entered the Shuttle era can be seen as a self-serving quest to boost public understanding and appreciation of, and to rally support for, the Shuttle program and NASA more generally, in keeping with the deficit model of public engagement. Certainly, the evidence presented herein makes clear that

NASA officials aspired to attain and maintain a citizenry of attestive supporters even as it purported to be revolutionizing space flight and enhancing its relevance to external publics.

At the same time, NASA's efforts to engage external publics during the Shuttle era can be viewed more charitably and as something more profound than a sales job. What NASA did entailed stepping out of its comfort zone and adopting a new vision of external publics' significance. It involved listening to the petitions of various publics and acting upon them, thus introducing radical new forms of public participation and public service for the agency that capitalized on the unique attributes of the Shuttle technology. In addition to bringing space flight opportunities to new groups of people and taking steps to respond to the dreams many held that one day space flight would be open to the masses, NASA anticipated that partnering with people with various backgrounds, expertises, and views would humanize, normalize, and make the Shuttle more holistic in its relevance. In other words, NASA's experience with public engagement with the Space Shuttle shows that NASA, and perhaps other institutions focused on technoscientific advancement, do not entirely act to serve their own interests alone but instead can and do sometimes seek to enroll publics in mutually satisfying and beneficial ways. Such moves, as this example shows, can prove crucial to rendering particular initiatives viable.

By the eve of the 1986 *Challenger* flight, NASA had made significant strides, via the Shuttle, to open space to use by publics that had not been materially involved in space flight in NASA's first decade; the agency's sociotechnical imaginary seemed to be coming alive in many respects. But as agency officials discovered from the time they embarked on the Shuttle program and especially after flights began, making space flight "normal" and broadly accessible was not easily achieved. The reality was that space technology was still incredibly complex, slow to prepare for launch, and, as the *Challenger* accident made evident, extremely risky to fly. In the accident's aftermath and in the years that ensured, NASA became caught up in a struggle to satisfy disparate publics' interests while aiming to keep its political stakeholders content so that the agency might pursue even greater ambitions in space. In the midst of

these changes and challenges, NASA proved increasingly less able and less willing to uphold the Shuttle as a spaceship for the people in practice.

A cynical view of this situation is that NASA seemed to offer false hope to American citizens about what the Shuttle could and would do over its lifetime: Shuttle engineers knew early on that the vehicle would be unlikely to achieve the flight rates NASA's top leadership and public affairs staffs promoted, yet these ambitions became the order of the day. Seen differently, however, the picture that emerges is that of an institution ensconced within a democratic government and constantly working to serve the disparate aims of its varied publics while remaining in pursuit of its own beliefs about what priority goals it should pursue, all while confronting an ever-shifting set of social, political, and technological developments. NASA's mixed success in democratizing space flight per the imaginary it initially held for the Shuttle indicates the challenges ahead for connecting external publics with future government space initiatives. It suggests that limits to NASA's ability to democratize space flight more fully can and do exist as it seeks to balance so many disparate interests.

NASA's public visibility and its unique human space flight mission render exact comparisons of the agency's public engagement experiences during the Space Shuttle era to those of any other U.S. government agency virtually impossible. But although surrounded by its own unique set of circumstances, this analysis of NASA's four decades of negotiating how and why to connect various external publics with the Shuttle can serve as a case study providing insights into the possibilities and challenges for other federal organizations considering broadening participation vis-à-vis their own technoscientific projects. Indeed, all agencies, even those that play regulatory functions or which have more tangible missions than NASA, must make decisions that involve trade-offs among service to multiple publics as well as between public service and self-interest. On one hand, agencies have to determine how to remain accountable to the many groups that constitute the nation's citizenry and who will potentially be impacted, positively or negatively, by their choices. On the other, such institutions almost always, like NASA, have their own notions of the public good, preferred operating procedures,

initiatives they would like to pursue, and budgets to justify – all of which they must reconcile with their stature as stewards of taxpayer funding and public trust.

This study thus proffers a rather apologetic and ironic insight: that operating within the American democracy, where a U.S. government agency is obligated to think about how optimally to serve millions while appeasing its political masters in the White House and the Congress, makes "improving" public engagement, democratizing procedures, or seeking legitimacy from external publics for any endeavor incredibly difficult. This is not to say that alternative degrees or forms of public engagement are impossible: indeed, some non-American nations and cultures adhere deeply to a commitment to broad and direct citizen participation in national governance and decision-making. Arenas for public policy debate, however, largely do not exist at the national level in the United States, including for space issues. Instead, the nation's space activities are shaped by elected lawmakers charged with serving the national interest but also concerned with appeasing their electorates in the hopes of remaining in office, technical experts interested in the advancement of science and technology but also in ensuring their own professional success and livelihood, moneyed corporations with the technical abilities to enable space flight but also the motivation of financial profit, and others skilled at making their voices heard loudly. Given these constraints, it is in some respects astounding that U.S. government institutions are at all able to create opportunities for more citizens to participate in their work in various ways as NASA did throughout much of the Shuttle's lifetime.

Scholars, activists, and others concerned with how technoscientific developments and decisions can impact and serve societal interests have tended to regard public engagement and participatory democracy as a "holy grail" for enhancing, if not ensuring, equitable benefits and minimal negative consequences for various publics. Many case studies, particularly in the area of environmental justice and health research, have demonstrated how institutions and experts and "ordinary" citizens have successfully forged collaborative relationships in setting research agendas or deliberating policies and in turn have produced outcomes supporting their mutual interests. Such studies have usually explored the motives of

determined publics and the challenges they faced in trying to engage with credentialed experts and others in positions of power to influence decisions related to issues affecting them. This case study of NASA's engagement of external publics during the course of the Space Shuttle program raises the point that a full understanding of options for engagement between technoscientific institutions and publics requires also examining how, why, and which publics matter from the perspective of institutions as well as what factors drive and constrain those views.

In presenting the many influences at play in shaping a government agency's public engagement approaches, this study highlights in particular the significance of technological choices as well as internal and external perceptions of a technology's possibilities and risks. I have shown through the analysis of NASA's transition from Apollo to Shuttle and in NASA's coping with the *Challenger* accident that institutions' public engagement choices do not exist independently of the technologies they operate or seek to develop. Rather, technological choices combine with articulated public preferences and motivations held by an institution to define the range of possible public engagement formats an agency considers. As NASA's pursuit of and eventual retrenchment from a fully democratized Shuttle program reveals, mediating the option space for interaction with external publics is the sociotechnical imaginary an institution adopts and attaches to the technology in question to legitimize it. Indeed, this study suggests that scholars as well as technoscientific policy and program developers should not overlook the connection between sociotechnical imaginaries and public engagement approaches in evaluating, advocating for, or pursuing democratic involvement in technoscientific matters.

At the same time that this work demonstrates that sociotechnical imaginaries can be a powerful concept for guiding and examining an institution's perceptions of public roles and relevance, this study of the Shuttle concomitantly shows that such visions can be quite frail, subject to resistance and constant revision based on a variety of external developments as well as changes in internal and external perceptions of a technology's benefits and risks. The challenges of finding a broadly acceptable sociotechnical imaginary seem particularly formidable for expensive and risky technologies, no matter

how captivating the vision: in addition to enduring skepticism from the outset, such imaginaries can be difficult to implement successfully. This finding opens the question of whether and how NASA and other institutions can develop stable sociotechnical imaginaries to substantiate their technological choices and enroll many publics in them.

In addition, this work speaks to the value and implications of conceptualizing and engaging publics in a variety of ways. NASA's willingness to pay attention to the specific interests and aspirations of various publics influenced the agency's public engagement choices and in turn positioned some citizens to play significant roles as contributors to the Shuttle program substantively as well as culturally. While government institutions, including NASA, have often thought of outside publics as audiences at best to persuade and win over as supporters to their objectives, this study suggests that institutions and those who evaluate their aims and performance ought to give attention to alternative means of valuing publics. Indeed, establishing legitimacy for particular technoscientific decisions might happen more readily for institutions if their officials considered how publics do or could shape and otherwise contribute to such initiatives. Such an approach may be vital when publics are divided on the propriety of particular choices, just as Americans have been in expressing their approval of NASA's human space flight endeavors since the 1960s.

Whither NASA's Vision and Role for Publics Going Forward?

Now that the Shuttle orbiters and related hardware have taken their places as museum pieces around the country, NASA finds itself once again at the brink of a new human space flight era along with novel prospects for engaging with American citizens. With International Space Station assembly finally completed in 2011, the space agency is working to solicit users from the academic and commercial sectors, as it had during the early Shuttle era. Meanwhile, human exploration of the solar system remains in the planning stages. Will NASA make human space flight central to fulfilling the needs and interests

of various publics? How, if at all, will NASA's publics prove relevant as the agency prepares to send humans to explore new worlds? As what kinds of resources, if any, will those outside of the agency's aerospace industry partners serve in the new era?

A decade has passed since President George W. Bush announced the new vision for space exploration and these questions remain to be answered. Indeed, NASA has had a difficult time defining the roles of individuals outside of the traditional sphere of space program developers since ending the Shuttle program beginning work to send astronauts to points beyond Earth orbit. The inability to characterize NASA's relationships with external publics at this juncture is somewhat understandable in that one cannot make conclusive assertions while the ambitious new program remains in development. NASA has taken steps to enroll external publics in its new human space flight endeavors in some ways similar to those it employed during the Shuttle era. At this point, however, it is evident that there are substantive and political limitations bearing directly and indirectly on the agency's ability, and even willingness, to connect with publics. Building on the complexities NASA encountered in the post-*Challenger* period in democratizing the Shuttle, these circumstances call into question what role, if any, the nation's publics will play in legitimizing and participating in government-sponsored human space flight.

When President Nixon announced his approval of the Space Shuttle, he did so in a way that ensconced the Shuttle in the pragmatic needs as well as the lofty aspirations of a wide range of Americans. President George W. Bush, too, recognized the importance of remaining accountable to the nation's citizenry and laid out what seemed to be a politically elegant plan for a new human space flight era in 2004. The Bush vision for space exploration aimed to keep human space flight alive by cancelling the Shuttle, eliminating a safety risk and freeing budget resources for the development of what NASA anticipated would be more robust and more capable spacecraft. Proposing to send humans along with robots beyond the confines of low Earth orbit, NASA calculated, would further reduce risks and ameliorate ongoing tensions between human space flight advocates and opponents in the space science

community by framing exploration as a common goal to be conducted together. Bush also aimed to broaden enrollment in the initiative by calling on participation by international and commercial entities. Meanwhile, the plan demonstrated good stewardship of invested resources by continuing with the International Space Station while continuing to sustain the viability of that element by attracting academic and private sector users. In addition, the Bush administration's resolve to send astronauts to explore new worlds was, no doubt, one that excited space flight enthusiasts and inspired many others who thought that the United States would have by then achieved such heights. Although created with virtually no input from external publics, NASA and the Bush administration believed the plan's attributes would appeal broadly to American citizens.

Since Bush rolled out this vision for space exploration, NASA and space policy developers have been exceptionally focused on building awareness among the American citizenry of its new aspirations for human space flight, clearly desiring to enroll various publics as attestive supporters using consumer-product, deficit model approaches to public engagement. Sean O'Keefe looked to marketing companies to help "brand" and foster positive public opinion of the agency, while a commission stood up by the Bush administration to recommend how NASA should implement the new vision for space exploration contended that the agency would need to fill a perceived gap in public understanding and invest in communicating why this pursuit was so important.[1] NASA also launched a massive campaign to inform external publics about the initiative. NASA administrator Michael Griffin stood up a communications planning office tasked with developing "new and innovative ways to engage and inform a broader cross-section of the American public about NASA activities through the development of new technology and tools, enhanced outreach mechanisms and key partnerships" with the goal of "increasing public awareness and understanding of NASA and its missions a wide variety of specialized and targeted resources,

[1] President's Commission on Implementation of United States Space Exploration Policy, *Report of the President's Commission on Implementation of United States Space Exploration Policy: A Journey to Inspire, Innovate, and Discover* (Washington, DC: U.S. Government Printing Office, June 2004), 44.

information, and messages."[2] Through that office, NASA began to contemplate more strategically than it ever had with whom it communicated and how, conducting its own polls and focus groups in an effort to understand public preferences and working to develop messages about its plans to appeal to various publics.[3] Through public service announcements, exhibits, online chats with astronauts, social media, gaming, and other activities designed to appeal to specific publics, NASA has sought to share its new focus for human space exploration with and garner interest among an expanding list of communities, ranging from car racing fans to quilters.[4] Members of Congress who backed NASA have encouraged and in some cases directed the agency to take measures aimed at educating and enhancing appreciation of the agency's activities by the American people.[5]

Even with these many communications activities continuing, NASA seems somewhat committed to increasing substantive public involvement in this next phase of human space flight. Like many other federal agencies and other technoscientific institutions have done in the past few years, agency officials are increasingly recognizing the value of partnerships with external organizations and also individuals to bringing new technical ideas into the agency. NASA has embraced the concept of crowdsourcing to some degree and has offered citizens opportunities to contribute technological solutions to particular problems related to human space flight. In 2005 NASA secured approval from the Congress to offer monetary prizes for solutions to problems specified by the agency and has since made awards to a citizen inventor

[2] NASA, "New Office of Communications Planning," internal memo, June 30, 2006, SpaceRef.com, accessed March 1, 2015, http://www.spaceref.com/news/viewsr.html?pid=21194.

[3] Cabbage, interview; James Hartsfield, interview; Doug Peterson, interview by author, Houston, TX, June 10, 2013; Alotta Taylor, interview by author, June 24, 2014.

[4] See, for example, NASA, "From Rockets to Race Cars, NASA Returns to NASCAR," news release 10-033, April 26, 2010, http://www.nasa.gov/centers/langley/news/releases/2010/10-033.html, and NASA, "NASA Astronaut Karen Nyberg Invites Quilters to Contribute a Star Block," news release 13-320, October 31, 2013, http://www.nasa.gov/press/2013/october/nasa-astronaut-karen-nyberg-invites-quilters-to-contribute-a-star-block/#.VQXfAmNPX5k.

[5] See, for example, National Aeronautics and Space Administration Authorization Act of 2005, Public Law 109-155, *US Statutes at Large* 119 (2005): 2905, and National Aeronautics and Space Administration Authorization Act of 2008, Public Law 110-422, *US Statutes at Large* 122 (2008): 4790.

for improvements to the flexibility of astronaut gloves and to computer coders for designing an algorithm to maximize the Space Station's ability to gather power through its solar arrays.[6] In 2013 the agency held a competition for secondary school students to design radiation shielding for a sensor to fly on the first test flight of the capsule to take humans to destinations beyond Earth orbit.[7] Although participatory opportunities are still relatively small in number where human space flight is concerned, NASA's 2014 Strategic Plan, meanwhile, asserts that the agency regards individual citizens as partners in its work, just as it does aerospace companies, academics, and foreign space agencies.[8]

Even as NASA undertakes efforts to share its new human space flight direction with American citizens and involve them in exploring space, the extent to which external publics will play crucial roles in shaping and legitimizing the enterprise remains unclear. The Shuttle experience revealed limits to NASA's ability to democratize human space flight more fully over the vehicle's service life. Creating the present uncertainty are a variety of factors, some of which are familiar from the Shuttle era and others specific to the new period. One of the critical elements that buoyed the Shuttle from the start and allowed many citizens to consider it relevant, at least through the *Challenger* accident if not longer, was the agency's adoption of a sociotechnical imaginary for the Shuttle that fulfilled a wide range of concrete societal and individual interests and aspirations. NASA's new human space flight program lacks a defined guiding imaginary which allows various publics to relate to the programs in ways important to them.

While NASA officials have attempted to reach out and make many communities aware of the agency's aspiration to send humans to Mars, they have been hard pressed to articulate such an enterprise's

[6] National Aeronautics and Space Administration Authorization Act of 2005, Public Law 109-155, *US Statutes at Large* 119 (2005): 2910-2912. The National Aeronautics and Space Act of 1958 was subsequently amended to codify NASA's prize authority.

[7] NASA, "High School Students Create Winning Design for NASA's First Flight of Orion," news release 14-119, April 25, 2014, http://www.nasa.gov/press/2014/april/high-school-students-create-winning-design-for-nasas-first-flight-of-orion/#.VQXmPGNPX5k.

[8] The author was involved with developing this language.

benefits. They have often focused on the "what" of their plans – the hardware, the technical goals, the milestones, and the dates – rather than conveying *why* those plans are worthy and *whom* they will serve and engage. Countless NASA press releases document the incremental progress the agency and its contractors are making on a new human space launch system but are devoid of any social context.[9] Where NASA has in recent times tried to articulate its value proposition, the agency has invoked many of its previous arguments for human space flight, linking the endeavor to national greatness and promises of scientific discovery, economic benefits, and inspiration to a new generation of students. Even so, these rationales do not seem to convince the majority of Americans of the value of sending handfuls of human and robot explorers to the Moon and Mars; according to public opinion polls, support for human missions to Mars has hovered in the 40- to 51-percent range since Bush's 2004 declaration.[10] As a 2014 National Research Council Report that considered the nation's future in human space flight noted, national prestige arguments are rooted in the Cold War era and have "especially limited public salience" today.[11] Some wonder why NASA continues to try and play such a strong role in human space flight when private companies are working to develop capabilities to send paying passengers to Earth orbit and to land humans on Mars and potentially other locations in space.[12]

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[9] See, for example, NASA, "NASA's Orion Spacecraft Is Ready to Feel the Heat," news release 14-153, June 5, 2014, accessed March 1, 2015, http://www.nasa.gov/press/2014/june/nasas-orion-spacecraft-is-ready-to-feel-the-heat/, and NASA, "RS-25 Engine Testing Blazes Forward for NASA's Space Launch System," news release 15-007, January 9, 2015, accessed March 1, 2015, http://www.nasa.gov/press/2015/january/rs-25-engine-testing-blazes-forward-for-nasas-space-launch-system/.

[10] National Research Council, *Pathways to Exploration: Rationales and Approaches for a U.S. Program of Human Space Exploration* (Washington, DC: National Academies Press, 2014), 88-89.

[11] National Research Council, *Pathways to Exploration*, 3. The report asserts, however, that these rationales, when taken together with the more aspirational rationale of a human desire to explore, argue for continuing the nation's human space flight program. Ibid., 2-3.

[12] See, for example, Clay Dillow, "The Final Frontier: Universal Space Travel," CNBC.com, [2014], accessed March 1, 2015, http://www.cnbc.com/id/101911569; Peter Wade, "Boeing Wants to Send You into Space with NASA," September 18, 2014, accessed March 1, 2015, http://www.fastcompany.com/3035926/fast-feed/boeing-wants-to-send-you-into-space-with-nasa; Christopher Hooton, "Space X's Elon Musk: NASA? 2035? I'll Put Man on Mars in the Next 10 Years," *The Independent*, June 18, 2014, accessed March 1, 2015, http://www.independent.co.uk/news/science/spacexs-elon-musk-ill-put-man-on-mars-in-the-next-10-years-9546600.html; Joel Achenbach, "Going to Mars: Billionaire Dennis Tito Plans Manned Mission with Possible 2017 Launch," *Washington Post*, November 20, 2013, accessed March 1, 2015,

The Shuttle experience revealed that developing a sociotechnical imaginary with broad and lasting appeal for a space pursuit has particularly unique and extreme challenges. In addition to the technical challenges associated with actually realizing visions involving complex space technologies as well as the other factors that tugged at NASA's ability to democratize the Shuttle more fully, the reality is that people's opinions – including even those of some members of Congress – on government funding of space initiatives are highly divided due to the nature of space flight as conducted by the U.S. government. On one hand, space flight has captivated many Americans and has hardly proven objectionable from a moral standpoint. On the other, even if a relatively small piece of the federal budget, it is a tremendously expensive, slow, and risky enterprise with unclear returns. The romanticism associated with sending humans to Mars captures the imagination and thrills space enthusiasts, but it is a much tougher sell to pragmatists and others who pause at the idea of committing several billions in tax dollars annually for many years with only prospective or intangible returns. Part of NASA's struggle to articulate a storyline for human exploration of the Moon, Mars, and other solar system destinations that connects these initiatives with societal values thus resides in the fact that space exploration exists in a liminal zone where human rational thought and emotional desire collide with one another. The results of opinion polls over time evince this split concerning the value of human space flight: Americans have generally thought favorably of NASA and its programs but far fewer want to pay for it, particularly when they have difficulty identifying its tangible value. One cannot overlook the fact that this apparent fickleness among Americans, tied to the exorbitant cost of space flight, makes NASA's ability to engage all individuals to their satisfaction exceedingly difficult.

But even if NASA articulated a sociotechnical imaginary for human exploration of the solar system that resonated with many external publics, there is another challenge to NASA's ability to engage them broadly and meaningfully as the agency moves forward in the post-Shuttle era. The significance of

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http://www.washingtonpost.com/national/health-science/going-to-mars-billionaire-dennis-tito-plans-manned-mission-with-possible-2017-launch/2013/11/20/b859bc76-51e8-11e3-9fe0-fd2ca728e67c_story.html.

external publics' roles and values in shaping the endeavor and ensuring that it is truly a product of and designed to serve the American citizenry is proving increasingly tenuous as political stakeholders and parochial interests play increasingly dominant parts in setting the direction of NASA's programs.[13] Presidents and Congresses fear retrenching from an endeavor that has come to be equated with national greatness, while the aerospace industry and members of Congress with strong NASA and aerospace industry presences in their states and districts have come to depend on the enterprise economically and thus seem to be committed to making decisions for the program based on satisfying their own special interests. Elected officials do not seem to care to consider broadly how the nation's citizens feel about human space flight. Meanwhile, NASA is constantly measured by these players, the media, and other external publics against the rapid, stunning success it brought to the nation in the 1960s. With these entrenched stakeholders and stakes in place, human space flight is practically guaranteed to continue to be funded as a project of the U.S. government vis-à-vis NASA. From this perspective, whether external publics serve as attestive supporters for the program has no bearing on the endeavor's continuation.

There is a paradox in this fact, however. Although special interests and broader geopolitical concerns about the United States' global image have created an assurance that the nation will continue to send humans into space and that NASA will maintain a central role in this effort, the commitment of sums of billions of dollars annually to this endeavor has not assured its forward momentum. It took NASA only nine years to send humans to the Moon, but the agency does not expect to reach Mars until the 2030s. Overcoming the monumental technological hurdles associated with keeping astronauts safe and healthy on a journey to a world five million miles away, versus 250,000 miles from Earth, is a major part of the explanation. But the reality is also that in the 1960s, NASA was far less encumbered by budget constraints and disparate political interests and the need to compromise than it is today. Execution of

[13] Consider, for example, legislation which directed NASA to develop specific new launch and crew-carrying space vehicles, implicitly to be built by established aerospace corporations: National Aeronautics and Space Administration Authorization Act of 2010, Public Law 111-267, *US Statutes at Large* 124 (2010): 2813-2819.

Kennedy's mandate was thus far simpler not only technically but also politically than is the ability of NASA to reach Mars today.

To that point, since Bush made his announcement, debate has swirled among NASA, the Bush and now the Obama White House, and the Congress about the destinations humans should explore and the hardware needed to take them there. While in agreement in regarding the human program as a symbol of national stature, these decision-makers cannot seem to settle on a clear path forward for human space flight because all of these choices have implications for what companies, localities, and communities will benefit from the contracts and grants to be awarded to achieve them. As a result of the sparring among these players, NASA is able to fund International Space Station operations but with few resources left for the research that constitutes its reason for existence. In addition, the agency is following Congressional direction and developing a new launcher and capsule system capable of ferrying crews to the Moon and destinations beyond but has little available to invest in technologies needed to support human flights. Further, before heading to Mars, NASA is planning to send astronauts to study an asteroid moved robotically into orbit around the Moon; the program was developed as a means of making the effort doubly valuable for human exploration supporters as well as scientific studies, although many planetary scientists and even some human space flight enthusiasts outside of NASA believe the costs outweigh the merits. These compromises keep major contracts in place but ensure very slow progress toward – and in some respects are seemingly out of touch with – the pursuit of human landings on Mars.

After five decades of human space flight advances, four of which spanned the Shuttle's lifetime, NASA is now caught in a quandary: it wishes to fulfill its aspirations to go further in space flight but must work with and within the constraints imposed by increasingly entrenched political stakeholders and has to achieve these aims on a budget that foresees no appreciable growth in the coming years. The agency has tried desperately to tell American citizens of its plans, still optimistic that remaining relevant and accountable to them will somehow lead to the unlocking of financial resources to make a robust human space flight program possible. But in the absence of concrete direction and developments, how can the

agency reasonably expect to captivate public interest, let alone strong advocacy? Indeed, NASA administrator Charlie Bolden has lamented the inability to "sell" a convincing story about human space flight without a "tangible" like the Shuttle.[14] NASA's December 2014 test of its new human launch system at least provided an indication of progress, but the next launch milestone will not occur for another three years.

Given the situation I have just described, I do not see widespread public enthusiasm materializing for NASA's new human flight initiative. Nor do I see it mattering to NASA's bottom line: that many powerful elected representatives of the U.S. government are pushing through space policy decisions that serve the specific interests of their local electorates calls into question what those outside of their jurisdictions think. Moreover, is persuading publics to accept NASA's goals even the most ideal way to engage publics for the good of the program as well as for citizens themselves? The Shuttle experience illuminated the possibility of recognizing American citizens not just as armchair fans, voters, and taxpayers but also as key contributors to the project's essence – powerful allies and resources for success. For all of the Shuttle's foibles and the challenges NASA endured in providing access to it, part of what made the Shuttle so widely-recognized, and even beloved, was the vision that NASA proffered for it as a vehicle that would accomplish so much for so many. During the early Shuttle era, several NASA personnel demonstrated their willingness to heed the aspirations of members of the public and accommodate them as best they could. NASA did not succeed in making the Shuttle a democratized spaceship to the degree it had projected, but the agency took account of public interests and capabilities and entwined them with a flying machine that produced a memorable and commendable start. That type of responsiveness alone can and did go far in giving people a sense of connection with the space program which manifested itself somewhat in polls but more overtly in terms of excitement expressed by the

[14] Dan Leone, "Bolden: Capabilities-Based Approach Is All NASA Can Afford," *Space News*, October 22, 2013, accessed March 1, 2015, http://www.spacenews.com/article/civil-space/37808bolden-capabilities-based-approach-is-all-nasa-can-afford.

millions who encountered the Shuttle in one way or another. That mutual substantiation between the human space flight program and American citizens, however, has been waning.

Indeed, if NASA intends to continue with human space flight and to make this enterprise productive and broadly relevant, the Shuttle experience offers some important considerations for the agency to remain in touch with American citizens as it moves forward. Perhaps the agency would do better, for itself as well as in serving various publics, to rethink what it means to have a citizenry that "supports" space exploration, just as it did to some degree in the Shuttle era. Rather than thinking in terms of garnering appreciation for NASA's achievements and hence somehow in turn securing federal resources to accomplish more, NASA should consider two alternative "currencies" for support. One is the degree to which NASA's publics are satisfied with the ways in which the agency involves and otherwise engages them in its pursuits. The other is the degree to which NASA involves citizens as direct contributors to the space program. NASA could define successful public engagement and assess its performance according to these metrics. Rather than seeking a public that is universally enthusiastic about space exploration – an unrealistic expectation, to be sure – NASA could count "support" as the extent to which it connects its ambitions meaningfully and purposefully with citizens living in the early 21st century. Doing so, I contend, requires NASA to look beyond display and discourse alone (although are likely to be engagement forms that continue to satisfy some) and to invite external publics to participate in a wide variety of aspects of space exploration.

NASA finds itself today in the midst of a world in which social and political hierarchies are flattening as computer networks physically connect and empower individuals to believe in their own abilities to create social and technological change. Computer coders working from their own homes are now solving problems for cash awards offered by government institutions and corporations. Bird enthusiasts collect and analyze scientific data to help better predict species migrations. Others play online games that can help researchers map the human brain and understand the basis of particular diseases.

How science and technological innovation happen is rapidly evolving and expanding to involve legions of publics hitherto uninvolved in these pursuits.

In the space sector alone, amateur astronomers have for decades proven their ability to make discoveries of celestial objects previously unknown to humans. New private efforts with plans to revive dormant science spacecraft, mine asteroids, explore the Moon, and even establish settlements on Mars have appeared in recent years. So many people want to *do* in the domain of space exploration. The agency has begun to harness the ingenuity of American citizens and others around the globe to some degree, offering assorted prizes and challenges to spur its space research and technology development pursuits. But the agency can still do much more to involve external publics with human space flight, even before astronauts leave Earth to visit far-flung solar system destinations. Perhaps citizens could assist in selecting landing targets on Mars. Also, just as NASA reconsidered who ought to comprise its astronaut corps in the Shuttle era, citizens could help agency officials consider what professions and characteristics the new space travelers should encompass to ensure the missions prove as broadly meaningful as possible. In addition, partnerships with external organizations could help NASA attain a wide public reach while conserving its limited resources. Such opportunities could not only bring tangible technoscientific solutions into the agency but also offer individual and organizational participants a bona fide means of involvement and, as partners with NASA, a stake in NASA's program.

As I have suggested elsewhere, the agency could, in fact, consider putting questions concerning the future of human space flight to external publics for discussion and debate.[15] Indeed, in addition to thinking of external publics as co-creators of technologies to support human exploration of the solar system, NASA ought to contemplate inviting citizens to provide views to shape various aspects of it. The agency has relied on public opinion polls and citizens' observed reactions and expressed feedback to get a

[15] Amy Paige Kaminski, "Can the Demos Make a Difference? Prospects for Participatory Democracy in Shaping the Future Course of U.S. Space Exploration," *Space Policy* 28, no. 4 (2012): 225-233.

sense of public attitudes, but these sources of public response do not necessarily reveal citizens' preferences and values connected with space exploration. NASA, the White House, and the Congress have on just a few occasions formally sought to find out what types of projects the public would like to see the agency conduct in the future with the intent of assessing how well its policies and programs match public interests. By establishing regular, accessible avenues for receiving public views and a commitment to considering those provided, the agency could perhaps establish a sociotechnical imaginary – or imaginaries – for human exploration of the solar system that has meaning for many. NASA's commissioning of a consortium of academic and informal science education institutions to hold two forums in 2014 to solicit public views on the agency's stated plans to search for potentially hazardous asteroids and to tow an asteroid into orbit around the Moon for astronauts to examine indicates that the agency may be willing to move in this direction.[16]

Revising current processes and considerations in space policy development to incorporate more players into decision making would no doubt add complexity to an already complicated decision space.[17] It has risks to traditional space policy makers as well: how would these decision-makers cope with preferences that ran afoul of their own senses of the national good and parochial interests? Perhaps most notably, there is the very real potential that the outcome of public participation in human space flight policy development could result in calls for the shrinking of budgets or doing away altogether with human space flight. How would NASA and traditional space policy makers address those views?

One thing is clear: the impending slowdown of national achievements in human space exploration bodes well for no one in the long term. Even the aerospace companies and local regions buoyed by human space flight contracts could come under fire from parts of the Congress uninvolved with the

[16] NASA, "Informing NASA's Asteroid Initiative: A Citizen Forum," August 28, 2014, accessed March 1, 2015, http://www.nasa.gov/content/informing-nasa-s-asteroid-initiative-a-citizen-forum/. The author was a part of the planning process for these forums.

[17] Kaminski, "Can the Demos Make a Difference? Prospects for Participatory Democracy in Shaping the Future Course of U.S. Space Exploration."

program if the returns are not evident. At the very least, greater public involvement would ensure that the debate surrounding the United States' future in space would be a rich one and a democratic one, evoking the ideal of a people's space program that was embodied in the Shuttle several decades ago. If embraced with enthusiasm by traditional players and NASA's external publics alike, it may nudge the nation closer to a space exploration program that its citizens will stand behind – and participate as partners in – as a meaningful future in the cosmos.

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