THE ESTABLISHMENT OF BLAME AS FRAMEWORK FOR SENSEMAKING IN THE SPACE POLICY SUBSYSTEM: A STUDY OF THE APOLLO 1 AND CHALLENGER ACCIDENTS

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ABSTRACT

This study investigates how the establishment of blame becomes a framework for sensemaking in a national policy subsystem. Using the only two fatal accidents in NASA's manned space flight history as case studies, this dissertation examines how the space policy subsystem responded to these two accidents and the process by which culpability was established. This dissertation extends our knowledge of how the blame dynamic operates within a policy subsystem and how, through this assignment of blame, the policy subsystem and the nation makes sense of these tragic events. Three distinct literatures (i.e. policy subsystems, sensemaking, and blame) are brought together to describe this complex blame environment.

The conclusions of this research are that the membership of the space policy subsystems increases following a disaster; the locus of the blame attribution rhetoric rests with Congress and the media, which are members of the space policy subsystem; those who were blamed for the Apollo 1 and Challenger disasters were from both NASA and the contractor; and their culpability was publicized. The space policy subsystem assigns the blame to its members and the process of blaming becomes the framework by which the Nation makes sense of the disaster.

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A world without blame would not just be a world without punishment; it would be devoid of all forms of institutional behavior, including science and language. There would be nothing left that we would care to call a human society…The language of reason itself is rooted in the language of blame
(Hertzberg, 1975: 501, 504).

CHAPTER I

Introduction: The Meaning of Disaster and Blame-- A Tear in the Fabric of Normalcy

Whenever a disaster occurs, there are inevitably some people who try to use it to settle old scores, imagined or real rivalries or other personal problems.

William Graham, Actin g Administrator of NASA
Los Angeles Times, March 24, 1986

Purpose of the Study

The purpose of this dissertation is to gain an understanding using case study methodology about how the establishment of blame served as a framework for sensemaking in the space policy subsystem following the Apollo 1 and Challenger accidents. Specifically, this dissertation examines how the space policy subsyste used the act of blaming as a framework to make sense of the manned spacecraft disasters by answering the questions:

What happened?

How did it happen?

Why was it allowed to happen?

Who is to blame?

While not the core focus of this dissertation, it is important to consider the role that the media plays as a policy subsystem actor in this complex dynamic of blame establishment. This will be substantiated through the analysis of the print media artifacts that have been archived by NASA.

A secondary purpose of this dissertation will be to document the pre and post-event composition of the space policy subsystem in order to gain a better understanding of the observations by Heclo, Anderson, Howlett, Wamsley, and other scholars who have tried to describe the policy subsystem and the roles of its actors. This dissertation presents two case studies that place the space policy subsystem existent at the time of the Apollo 1 and Challenger accidents in a post-disaster situation in order to determine the process by which the space policy subsystems assigned blame. This research asks if the attribution of blame by the space policy subsystem promotes sensemaking of those disasters. It is in post-disaster situations that the policy subsystem actors interact, coalesce, and struggle to answer the what, how, why, and who questions that the American people ask following a disaster. As Vaughn (1997) tells us, the policy subsystem and the American people want to be convinced that the problems that caused the accidents, whether they be technical or management, were anomalies promulgated by individuals who were identified and replaced. In the case of the Apollo 1 and Challenger accidents, when the space policy subsystem was able to make attributions of blame, the American people were satisfied that the problem was rectified. The space policy subsystem was able to resume its policymaking role and NASA was able to return to the business of manned space flight. A Washington Post reporter reflected this when he wrote:

> *A formal report will point the finger in one direction or the other, everyone will breathe a sigh of relief and the space program will go, as President Reagan has commanded* (Washington Post, February 9, 1986).

Disasters and Blame

From the beginning, humankind has experienced an untold number of natural disasters or "acts of God." Before the advent of the technical means to measure, forecast, and understand naturally occurring phenomenon (e.g. hurricanes, tornado, earthquake), our ancestors blamed an assortment of gods for their misfortune (Perera, 1986; M. Douglas, 1992). In some cases, they would foist the mantle of blame upon a fellow human being in the hope of assuaging the anger of the gods and collectively appeasing them by offering a sacrificial scapegoat (T. Douglas, 1995; Perera, 1986).

In the case of man-made or technological disasters, the legacy of technological failure dates back to the earliest annals of recorded history. Aristotle in his Mechanical Problems wrestled with engineering and technical issues that were prevalent twenty-four centuries ago, chief among them was the discernment of why structures and mechanisms failed (Petroski, 1994). Were the failures attributed to natural forces or was the causal factor found in human error? Neither Aristotle nor any of his students of the Peripatetic School elaborated on the process by which blame was attributed if the cause of the failure was human error. However, there is ample scholarly evidence that the Greeks were knowledgeable as to how to fix blame for both natural and man-made disasters (T. Douglas, 1995:13-14).

In this dissertation, the terms "disaster" and "accident" will be used interchangeably when referring to the Apollo 1 fire and the loss of the space shuttle Challenger. While some may take exception to this interchange of terms, the official government documents and the print media artifacts used in the case studies for both Apollo 1 and Challenger employed both terms when addressing these tragedies. Perrow (1999) informs our understanding of an accident, as it relates to technically complex systems, by defining it as "…a failure in a subsystem, or the system as a whole, that damages more than one unit and in doing so disrupts the ongoing or future output of the system" (1999: 66).

In defining the term "disaster," scholars have defined it as a complex *social* phenomenon (Drabek, 1986). Quarantelli, recognized as an expert in the field of disaster related scholarship, believes that there is not a singular definition that encompasses all of the social constructions of what constitutes a disaster (1998:3). He states: "I have struggled with ho to define and conceptualize the term 'disaster'" (1998:1). Dombrowsky (1998) asserts that a disaster is any natural or man-made event in which there is a collapse of any realization of warning that an event was harmful or fatal. Kreps (1998) understands disasters to be "…non-routine events in societies or their larger subsystems (e.g. regions, communities) that involve social disruptions and physical harm. Among the key defining properties of such events are (1) length of forewarning, (2) magnitude of impact, (3) scope of impact, and (4) duration of impact "(1998: 34). Oliver-Smith (1998) believes that a disaster is "…a process involving the combination of potentially destructive agent(s) from the natural, modified and/or constructed environment and a population in a socially and economically produced condition of vulnerability, resulting in a perceived disruption of the customary relative satisfactions of individual and social needs for physical survival, social order and meaning" (1998: 186). Drabek (1986) claims that a disaster is a bounded episode of high collective stress.

Regardless of how a disaster is defined, Garner (1993) tells us that what people perceive as a disaster is any event that has the capacity to disrupt the *fabric of normalcy* in their daily lives. Douglas and Wildavsky (1982) assert that "Blameworthiness takes over at the point where the line of normalcy is drawn…If a death is held to be normal, no one is blamed" (1985: 35). To illustrate how quickly this fabric of normalcy can be disrupted, within thirty minutes of the explosion of the Challenger, sixty-nine percent of all adults in America had learned about the disaster (Singer and Endreny, 1993: 3). The common denominator in defining the ter "disaster" is that it disrupts what people perceive as "normal" and it is identifiable in social terms (Quarantelli and Dynes, 1977).

Disasters also remind us in a most graphic way that in complex, high-risk systems things can and do go wrong. As Perrow (1999) tells us, it is not a matter of *if* they will go wrong, but *when*. And when they do go wrong, there is a good chance that people will be injured or killed.

To illustrate this point, since 1883, there have been approximately 103 disasters in which a complex, technical system failed (Schlager, 994: xxxiii-xxxvi). As one can deduce from the following graphic, the frequency of technological disasters has increased as society has embraced the benefits and conveniences of technology.

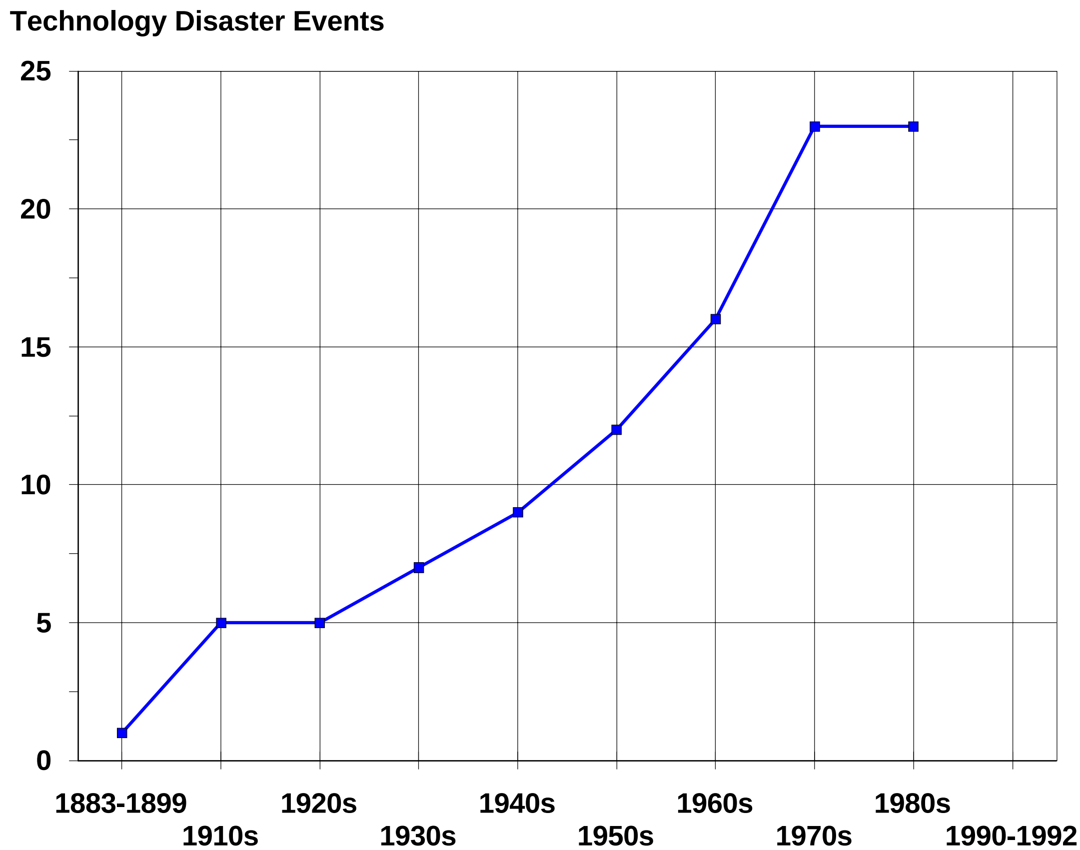

Figure 1: Technological Disasters, 1883-1992

The scope of the technological disasters have been experienced in nearly every technology arena: bridges (Tacoma Narrows Bridge-1940; Vancouver Second Narrows Bridge-1958), dams (Baldwin Hills Da -1963; Teton Da -1976), buildings (Skyline Plaza-1973; Kemper Arena-1979), war machines (Shenandoah airship-1925; U.S.S. *Squalus*-1939), spacecraft (Apollo 1-1967; Soyuz 1-1967), aircraft (Comet-1954; Turkish Airlines DC-10-1974), oil tankers (Amoco *Cadiz*-1978; E xon *Valde* -1989), nuclear power (Kyshty -1957; Three Mile Island-1979), and chemistry (Thalidomide 1950s-1960s; Agent Orange 1961-1971) (Schlager, 1994). Untold thousands have perished due to technological accidents, miscalculations, operator incompetence, and a myriad of other reasons.

Individual and Group Blame

After causative factors in the realm of random chance events have been ruled out, the norm has been to identify an individual or group to take responsibility for the catastrophic event. As Perrow points out, the causative factor of “operator error” has been the predominant finding in sixty to eighty percent of the technological accidents that he studied (1999: 9). The context, of course, of fixing the blame on the operator (e.g. airline pilot, ship captain, control room technician) is that their failure was not the result of intent (i.e. sabotage), but, rather, in their lack of sufficient attention to remedy the problem, thereby permitting the technical system to fail. Perrow challenges this view of assignment of blame in that he believes that due to system complexity, design and tight coupling, failures are inevitable (Perrow, 1999).

When a technological disaster occurs, we find ourselves asking “What happened?” When we believe that we have obtained a certain amount of information about what happened, we then ask ourselves “How did it happen?” The implication of this question defines a trend in our thinking that eventually leads us to ask "Why was it allowed to happen?” The next question that logically follows directs us to the crux of the issue, the establishment of blameworthiness. It is at this point that we ask ourselves “Who is responsible…who is accountable for this accident?” As we attempt to make sense of these traumatic events, external actors, who are members of a policy network (Heclo, 1978) or a policy community (Anderson, 1997) shape how we make sense of the event.

If blame is to be levied, it must serve a purpose (Pfeiffer, 1995: 9-16). That is to say, if NASA is going to be blamed for the Apollo 1 fire or the destruction of Challenger, the act of blaming by Congress, the media, or the American people suggests that there was insufficient proof to blame an individual or group of individuals. Conversely, if there is sufficiency of data to blame an individual (e.g. program manager, engineer), it implies that NASA is not culpable (Pfeiffer, 1995; French, 1979; Stone, 1975). For it is in this process of establishing blameworthiness that the disastrous event makes sense because the answers to the questions of "what happened," "how did it happen," "why was it allowed to happen," and "who is responsible" provide the framework for sensemaking. The culpable person is identified, punished, problem is rectified, and the program continues.

However, the research points to a duality of blame in which the process of blame attribution is experienced linearly. As the "what," "how," and "why" questions are being answered, the blame rhetoric begins to form. In the case of Apollo 1 and Challenger, NASA received an appreciable amount of blame as an organization. The blame rhetoric was primarily found in the answers to the "why" questions: why didn't they know that a ground test in a pressurized oxygen was hazardous? (Apollo1); or, if NASA knew that there was a problem with the field joint seal, why didn't they fix it? (Challenger).

Although the organization receives blame initially, the blame that provides the framework for sensemaking is directed towards the individual or group of individuals.

Problem Statement

A succinct problem statement is provided by Wamsley, who points out that the "politics of disaster are escalating" (Wamsley and Schroeder, 1996: 235) and within this politic of disaster is a framework for post-disaster sensemaking that needs to be described and examined. This dissertation argues that the process that establishes blame provides a such a framework. This dynamic of establishing blame will be studied and described in the context of the policy subsystem because it is in the policy subsystem that the establishment of blame occurs and it occurs quickly. As one media reporter noted, blame "…happens with stunning swiftness after each tragedy" (Kurtz, 1999).

One of the problems identified in the review of the policy subsystem literature is that although there is acknowledgment that policy subsystems experience transformations as a result of external events, especially conflict, the literature is limited in providing studies that highlight the changes in a policy subsystem and the interactions within the policy subsystem that eventually produce constructed meaning that makes sense of an event. This dissertation examines the space policy subsystem in both its pre and post disaster configurations. For the purposes of this research, the pre-disaster space policy subsystem, which exhibits many of the traits associated with the "iron triangle" metaphor (Lowi, 1964; Kingdon, 1983; Anderson, 1984), and how it responds and transforms when political instability and conflict are encountered as a result of a disastrous event such as Apollo 1 or Challenger.

Based on an examination of the public artifacts and official government records, the conflict-laden political environment following a disastrous event is sufficient to cause the boundaries of a limited membership, mutually dependent policy subsystem to erode resulting in the participation of other actors (e.g. media, other governmental agencies, expert witnesses) in the policy subsystem, which transforms it into a policy subsyste similar to that of an issue network (Johnson, 1992; Browne, 1995).

Media archives, official government reports, congressional hearings, and interviews with principals from industry and government about the Apollo 1 and Challenger accidents were studied to determine the process by which the space policy subsystem attributed blame, which then became the means—the framework—by which these disasters could make sense. In other words, the post-disaster "policy quagmire" (Wamsley and Shroeder, 1996) will be examined in order to describe the process by which the space policy subsystem answered the question: "Who is to blame for this disaster?"

The underlying problem of this study is that each of the literatures (i.e. policy subsystems, blame, and sensemaking) have been primarily studied and written about as separate and distinct streams of scholarship and reflection. There is little written where all three of these literatures are combined to answer the question: "How does blame serve as a framework for sensemaking in a policy subsystem?"

In order to answer this question, this dissertation investigates the fundamental issues of when and how the blame rhetoric originates within the policy subsystem. Attendant to this investigation is the examination of the roles that each of the actors plays, especially the media, in the "politics of blame" (Sagan, 1993). While there is abundant scholarship on how the various actors participate in a policy subsystem during the life of a public issue (Howlett and Ramish, 1995; Baumgartner and Jones, 1991; Stein and Bickers, 1995), research into how the subsystem's actors interact to establish blame in order to make sense of a disastrous event is missing in the literature.

Literature Gap

There is an appreciable volume of literature describing the various policy subsystems and the metaphors attendant to them, such as iron triangles, subgovernments, policy whirlpools, policy networks, power networks, power clusters and many others. There is a body of literature that articulates how policy subsystems respond to conflict and other destabilizing events with the concomitant realignment of coalitions and inclusion of external actors. A body of literature is existent which addresses political economy as a framework for understanding policy subsystems. However, there is a gap in describing how a policy subsystem associated with high risk, high technology systems interacts and shapes the construction of meaning through the establishment of blame following a disastrous event. This dissertation addresses and, hopefully, makes a contribution in filling that gap.

Theoretical Grounding

Berger's and Luckmann's (1966) theory of social constructionism informs and provides a theoretical grounding for this dissertation. The key points that are applicable to the dissertation's investigation of the establishment of blame as a framework for sensemaking within the structure of the policy subsystem are found in their treatment of reality construction. They point out that human reality is understood as a social construction (1966: 189) and that language "…constructs immense edifices of symbolic representation" (1966: 40). In other words, reality that we collectively experience is the product of construction through our social interactions.

If we examine these points, we can begin to understand the social dynamic of meaning construction that occurs following a disaster. Berger and Luckmann would say that following the disaster we, as individuals, first try to construct meaning at a personal level. After we a construct a plausible causal story (Stone, 1989), we communicate this story to others aligning ourselves with those that have constructed a story that is similar to our own. One could argue that from this collectively held causal story eaning emerges and as social construction of the event becomes collective, socially constructed reality emerges.

However, we should not lose sight of Berger and Luckmann's assertion that we tend to develop typifications in how we deal with individuals, organizations, and situations. These typifications are patterns of behavior that are shared by members of a community or society. In the case of blame establishment, an argument could be made that our society, as a collectivity, typically responds to an accident or technological disaster by the initiation of an interpretive process that begins with “What happened?” and ends with “Who is responsible?”

Berger and Luckmann tell us that social reality is an interpretative tapestry woven by individuals and groups. Within the policy subsystem, their task is to synthesize and harmonize competing social constructions of reality into one in which a form of legitimation occurs. For instance, in the case of Challenger, while the proximate cause of the explosion could be attributed to an O-ring failure in the solid rocket booster, the ultimate cause was human error in permitting the launch to occur given the known technical deficiencies compounded by the low ambient temperature at the time of launch. Given that this constitutes a version of reality, it would be extremely difficult to legitimate a version of reality to the public that it was just a “normal accident” and it was bound to happen sometime. In this example, the framework by which the event makes sense and meaning is constructed is through the ritualization of blame establishment. The reality is that someone is responsible, therefore someone must be held accountable.

As Deborah Stone (1989: 282) points out, our understanding of events is influenced by ideas that can be created, modified, and vied for by the political actors and the media. Social constructionism offers an explanation of how the media in particular can shape how the public constructs reality. The public is bombarded with images, experts, and commentators whom they have learned to respect and trust. If Tom Brokaw said: “The

Challenger blew up due to a lighting strike", then it must be so because Tom Brokaw is trusted and respected. Nonetheless, most of us can remember how immediately following the Challenger accident, there was a tremendous amount of speculation concerning the causative factors. The American people were fed a constant stream of television news and print media stories from which they could begin to collectively construct meaning.

Within the policy subsystem itself, social constructionism informs our understanding of the roles of the actors. Berger and Luckmann state that roles represent the institutional order in a collectivity of actors (1966: 75). What this suggests is that during periods of stability and normalcy, the space policy subsystem exhibits many of the attributes more similar to that of an "iron triangle." The actors within the space policy subsystem have a symbiotic relationship—mutual dependencies—with the other members (Vaughn, 1990). They depend on each other and these dependencies hold them together and prohibit other actors from joining the policy subsystem. However, following a disastrous event, the policy subsystem experiences the destabilizing influences of conflict and the state of the policy subsystem changes. The symbiosis that existed before the conflict erodes because they are distracted with other issues such as investigations, testimony, and self-preservation. The policy subsystem may change its state from an "iron triangle" into something similar to an issue network (Heclo, 1978) with its expanded membership, lack of discernible leadership, and movement of actors into and out of the policy subsystem. By examining this post-disaster situation through the social constructionist lens, one can understand how relationships that were built upon mutual dependencies can rapidly change into adversarial relationships. For instance, in the space policy subsystem, the relationship between the congressional committees and NASA changed from a cordial, relaxed relationship to one of prosecutor (congress) and defendant (NASA). Instead of developing and implementing policy, the policy subsystem attempts to focus their attention in the post-disaster environment by finding what happened, how it happened, and why it was allowed to happen, and who is to blame.

Berger and Luckmann reflect on the impact that crisis has in a society. They state:

> *While the individual may improvise reality-maintaining procedures in the face of crisis, the society itself sets up specific procedures for situations recognized as involving the risk of breakdown in reality*. (1966:156)

From the social constructionist view, following a crisis, the principal objective and task is that of reality maintenance and adherence to societal rituals of normalcy. How many times following a plane crash, train accident, or some other calamity have we heard that "…while we investigate the cause of this accident, we will continue our nor al schedule." Reality maintenance translates into political advocacy, fiscal and programmatic support, and a myriad of other subsistence issues. If the political elites and the public do not perceive an agency as competent (i.e. engaging the social reality), the repercussions (i.e. political "fall-out) can be devastating.

Limitations of the Study

An important limitation of this study is that the research is directed toward technological or man-made disasters. The characterization of the space policy subsystem's activities following a technological disaster may not lend itself to a generalization or methodological construct that is applicable to a policy subsystem that was impacted by a natural disaster or a technological disaster in which there was no loss of life.

Another limitation of this study is that as a starting point the space policy subsyste shows evidence of two states: it exhibits many of the attributes of an "iron triangle," which then transforms into an issue network due to conflict. What if a policy subsystem's "normal" state is that of a policy domain that may be seen in an agricultural policy subsystem (Browne, 1995)? Does this policy subsystem change its state when conflict is introduced into the subsystem's environment? Does a policy subsyste whose state resembles an "iron triangle" react differently to external conflict than other policy subsystem states? These issues could benefit from additional scholarship, but they are not addressed in this research.

Summary of the Study

This dissertation extends the knowledge of how policy subsystems are impacted by high-visibility disastrous events that are national in scope and how the attribution of blame is a framework by which the policy subsystem and Americans made sense of the disaster. These case studies:

1. Documented the space policy subsystem that was existent prior to each disastrous event.
2. Described the policy subsystem that emerged (evolved) following the accident.
3. Examined the blame rhetoric in public artifacts (i.e. print media), government reports, and congressional hearings and how it emerged in the space policy subsystem.
4. Described how the space policy subsystem changed.
5. Defined the process of blame attribution.

The data suggests that the most influential actors in the blame attribution process following the Apollo 1 and Challenger disasters were the congressional committees and media. Through the language of blame both of these actors in the space policy subsystem attempted to shape how Americans perceived and understood these two national tragedies.

Structure of the Dissertation

A review of the three literatures used in this project are reviewed in Chapter II. Chapter III describes the research design and Chapter IV provides a historical overview of the Apollo 1 and Challenger disasters. Chapter V delineates the results of the analysis of the three sources of information and Chapter VII discusses the conclusions and recommendations.

CHAPTER II
LITERATURE REVIEW

Policy Subsystem Literature

Given that government officials and agencies produce public policy, the means by which this is accomplished has been the focus of study for the last sixty years. In 1938, Ernest Griffith wrote:

> *One cannot live in Washington for long without being conscious that it has whirlpools or centers of activity that focus on particular problems….it is my opinion that ordinarily the relationship among these men—legislators, administrators, lobbyists, scholars—who are interested in a common problem is a much more real relationship than the relationship between congressmen generally or between administrators generally. In other words, he who would understand the prevailing pattern of our present governmental behavior, instead of studying the formal institutions or even generalizations of organs, important through all these things are, may possibly obtain a better picture of the way things really happen if he would study these "whirlpools" of special social interests and problems*. (1938: 182)

J. Leiper Freeman (1965) developed a metaphor to explain how policy issues are allocated to subgroups or subsystems within an overall policy system. Thurber (1996) adds that subsystems "…decentralized power structures with predictable communications patters" (1996: 82) and American politics "…is organized around thousands of subsystems" (1996: 83). The major policy arenas are composed of complex, semiautonomous subsystems that focus on programs. Many of the policy subsystems are "…closed and out of the public eye because it is the most efficient way to make decisions about complex and technical issues" (1996: 85).

Lowi (1964) promoted the idea of the “triangular trading pattern” and later (1969) expanded on this idea by characterizing a policy subsystem in terms of the metaphoric imagery of an “iron triangle.” The characteristics of this “iron triangle” are limited, stable membership among congressional subcommittees, administrative agency, and special interest groups (e.g. industry) who have made a commitment to a specific policy area. The “iron triangle” participants exhibit preferences for making policy in a cooperative, quiet manner and to mitigate perturbations by excluding those who could cause “waves.” This translated into excluding policy experts, academicians, and groups who were or would be adversely affected by a policy (Anderson, 1997: 81). Howlett and Ramesh (1995) add that the “iron triangle” relationships provided the members “…mutual support in the course of constant mutual interaction over legislative and regulatory affairs” (1995: 125). Holland (1996) affirms this view by offering the proposition that these tripartite alliances (e.g. Congressional committees, agency, contractors/interest groups) are effective because there is a minimum of conflict since each of the actors agrees with the basic policymaking goals. Holland’s suggests that the policy subsystem’s maintains a coalition of interests that are secured by a series of exchanges and compromises that benefit the entire policy subsystem.

Heclo argued that the issue was not whether the “iron triangle” was correct or incorrect, but whether it was truly representative of how policy subsystems were structured and how they functioned. Heclo offered an alternative view in the form of issue networks. Within an issue network, the many participants moved into and out of the network. The expanded participant set includes not only the former “iron triangle” actors, but also other interest groups, political activists, policy experts, academics, and “think tanks.” One of the essential attributes of Heclo’s view is that it is not necessary for the participants to have a material stake in the policy issue. They can be members of the network if they have an interest in the policy issue or idea that they would want to contribute or make visible to the other network actors. However, an additional attribute of the issue network is that it is unclear as to who is in charge or which is the predominant or “alpha” actor.

While the “iron triangle” metaphor was a means to understand public policy coalitions that were visible within the various policy arenas (e.g. space, defense, environment), it fell short in explaining how coalitions embraced a wider participation. Heclo (1978) sa the “iron triangle” as an incomplete expression of what really transpired within the numerous policy subsystems. He believed that the “iron triangle” would promote fragmentation within the government and serve as an impediment to effective policy coordination with the overarching policy system.

Skok (1995) resonates with Heclo’s (1978) conception of the policy subsystem as an issue network, but argues that issue network studies are moving the concept towards a structuralist approach (1995: 326). Germane to this dissertation is Skok’s view that the structuralism documented in the study of issue networks is viewed as “…patterns of routinized interactions among participants in a common enterprise” and functions as “outcomes of these interactions for survival of the enterprise” (1995: 326). Within the space policy subsystem, this may be the case before a disaster, but the interactions following the disaster are anything but routinized. Although this point will be discussed in greater detail in Chapter V (Results), the symbiotic relationship in the space policy subsystem before a disaster could be defined in terms of responsibilities and dependencies (Bickers and Stein, 1994):

- NASA is responsible for program management and execution, but is dependent upon Congress for funding;
- Congress provides funding and program authority, but is dependent upon NASA to execute the programs and its contractors and associated interest groups to provide campaign funds;
- The contractors supply products and services to NASA and campaign funds to Congress; but they are dependent upon NASA for funding and the Congress for program approval and funding of the NASA programs.

While the issue network explains the policy process image of disaggregated power with participants flowing in and out of decision making (Heclo, 1978), Skok cautions us that the major weakness of the issue network is the absence of defined roles for each of the subsystem actors and a fragmented structure that does not lend itself to resolving conflicts. In the post-disaster policy subsystem environment, one could make the argument that the policy subsystem, while its porous boundaries and unclear role definition, does possess the attributes of an issue network relative to routinized interactions (i.e. between Congressional committees, agency, contractors, experts, other government agencies, the media) and adhering to the belief that these interactions are necessary for the issue network's survival. In other words, Skok would possibly agree that the common enterprise of the interactions following a disastrous event (e.g. Apollo 1, Challenger) is the establishment of not only what happened and why it happened, but also who it is that should shoulder the blame for the disastrous event. In so doing, the issue network is able to survive as a policy subsystem and resume its pre-disaster policy making activities.

Stein and Bickers (1995) put forward a view that policy subsystems that resemble characteristics of an "iron triangle" insulate themselves from accountability and democratic control. They also suggest that they are no longer given any credence because they are not able to resist the pressures of interest claimants and are essentially irrelevant to a modern understanding of the policy process (1995: 4). They maintain that, in so far as the policy subsystem is susceptible to both external and internal influences, they resemble issue networks (1995: 48). Because the policy subsystem is populated by a number of different actors, "these relationships collectively define the subsystem…no subsystem actor can pursue its own goals without the cooperative behavior of other actors in the subsystem" (1995: 51).

Anderson (1997) builds on Heclo by promoting the notion of a policy community. Like a issue network, the policy community seeks to invite a broader participant population, but it has a discernable leader. Anderson maintains that within the policy subsyste coalitions develop that are predicated on shared norms, problem perception, and policy preferences (1997: 83). Recognizing where a policy is in its life cycle may dictate the structure of the policy subsystem. Anderson asserts that Heclo's issue network may be applicable for new and unstable public policy. As the policy gains visibility and stability, an "iron triangle" or policy community may be an appropriate structural environment by which the policy develops and experiences implementation. Of particular importance are Anderson's thoughts about the influence that conflict has on a policy subsystem. He sees the management of conflict by the policy subsystem as a challenge and that must be addressed by the subsystem actors. The consequence of not managing the conflict, whether it be internal or external, is that the policy issue could disappear because it either falls into the "too-hard-to-do box" or it is politically unpalatable to have to deal with it. In the past, issues such as abortion, term limits, national health care, and other pressing policy issues have disappeared off the national political agenda because of conflict.

Browne's (1995) critique of the "iron triangle" metaphor proceeds from his extensive study of the agricultural policy subsystem. He maintains that traditionally the primary actors in the "iron triangle" have been the Congressional agricultural committees, lobbyists of interest groups, and the executive agency (i.e. Department of Agriculture), but in reality the constituency influences the congressional member's issue advocacy and voting preferences more than that of a special interest group. He adds that the influence of the executive agency is becoming a myth. Browne suggests that policy uncertainties, which are largely spawned and promulgated in the Washington environment, are frequently resolved by the member turning to his/her district to solicit their reaction to the issue. Was it politics or the "folks back home" that motivated Representative Robert Torricelli (D-NJ) to comment after the Challenger disaster: "Once the period of mourning is over, we are going to have a look at who to blame" (Hornblower, Washington Post, February 6, 1986).

Howlett and Ramesh (1998) have been prolific in their contribution to the policy subsystem literature. They see conflict in a different light than Anderson. They see conflict as a consequence of the dynamic that exists within policy subs ystems. Clashes due to self-interest among the actors, debates grounded in ideology and competing worldviews, self-proclaimed experts interacting with special interest groups all make for a viable policy process. Building upon Edelman's (1988) view that problems in discourse and ideology are eventually translated into new beliefs, Howlett and Ramesh maintain that in discerning how these problems are addressed informs us how coalitions are built. These coalitions are composed of two groups: the larger gro up, which possesses some knowledge of the policy issues and constructs the policy discourse; and the smaller group, which has a more detailed knowledge of the issue, is concerned about relationship building with other knowledgeable actors and the promotion of self interest.

Baumgartner and Jones (1991) offer a different view in that the policy subsystem is created to be favorable to a particular industry (e.g. space). In the case of the space policy subsystem, this research will illustrate that the compo sition of the space policy subsystem supports a favorable contractual environment for nation's principal aerospace contractors (e.g. Rockwell International, Lockheed, Martin Marietta). They also note that elite understandings of public policy will likely change over time because of their receptivity to new scientific discoveries and new technologies (1991: 1046). Because of the inherent technical complexity of manned space flight, the space policy subsystem is dominated *technically* by NASA. Baumgartner and Jones note that:

> *Technologically complex issues…can be discussed either in terms of their scientific and engineering details, or in terms of their social impacts. When they are portrayed as technical problems rather than as social questions, experts can dominate the decision-making process* (1991: 1047).

If their argument is placed in the context of this dissertation, what they are suggesting is that a public debate about the dangers of a pure oxygen environment during a manned ground test (Apollo 1) or the elasticity of an O-ring at a certain ambient temperature (Challenger) is preferable to a debate about NASA's managerial competence or the quality of work performed by the contractor. Is the technological debate a "smoke screen" in order to deflect the finger of blame from the agency or the agential individual to that of a technological causal agent that was probabilistically bound to happen? (Perrow, 1999)

Baumgartner and Jones also note that the policy subsystem is composed of a tightly structured system of limited participation that is composed of fluid boundaries that accommodate conflict (1991: 1051). What they fail to explain is how the subsyste responds to not only internal, but also to external stress. Does the subsystem's elastic boundaries become so permeable that they permit the inclusion of additional actors during periods of conflict and stress?

Sabatier and Jenkins-Smith (1993) inform our understanding of policy subsystems by noting that, as the subsystem membership changes, the policy outcomes can be expected to change. The external environment, as in the case of a disaster, may also cause the policy subsystem to experience internal change. This, of course, is an insight that is most useful for this dissertation because it could explain how a disastrous event could cause a policy subsystem to change how it interacts internally with its core actors and externally with other actors seeking membership in the space policy subsystem. Sabatier and Jenkins-Smith observe that as the policy subsystem returns to a degree of normalcy and stability, advocacy coalitions form among the participants who possess specific knowledge of the policy issues (1993: 233-236).

Jenkins-Smith, writing with St. Clair and Woods (1991), speaks to the issue of advocacy coalitions by stating that they adhere to hierarchically structured belief systems (1991: 852). This is an important insight into understanding how the pre-disaster space policy subsystem maintained its cohesion and viability. The subsystem actors embraced a normative structure and ideological orientation, which they believed would benefit not only the policy subsystem, but the larger public (Wamsley. 1985: 17). However, following a disaster, this exogenous event can explain how a policy subsystem changes its composition by permitting other actors to join the subsystem and influence the post-disaster event debate (1991: 854).

Deborah Stone makes an important contribution to the policy subsystem literature because she draws a thread between problems and action, most especially in the agenda setting stage of the policy process. Stone makes the point that if it is caused by a human, then it is amenable to human intervention (1989: 281). This point is useful to this dissertation for it assumes that an event that is perceived as a "problem" has been viewed through a causal lens that filters out "acts of God" or an event that was purely accidental. What is incumbent upon the policy subsystem actors (Stone uses the ter "political actors") is that they compose a causal story about the problem that focuses on the potential harm to the public, negligence, attribution of blame and responsibility in order to claim a right for the government to intervene and stop the harm (1989: 282). These causal stories have both an empirical and a normative dimension and are important for they move a situation from the realm of a "normal accident" (Perrow, 1999) to that of human agency.

Stone maintains that these causal stories are not about right or wrong, but about causation and the assignment of responsibility (i.e. blame). As will be seen in the case of Apollo 1 and Challenger, the causal story that is most useful to the policy subsyste is one in which a plausible account of blame can be associated with a person or group. Stories that are steeped in technical complexity and jargon are not politically useful and are an encumbrance to the construction of the event's meaning. For instance, in the case of the Challenger accident, there was a technical discussion about the lack of elasticity of the primary and secondary rubber O-rings in the solid rocket motor field joint due to the cold temperature that caused the O-rings to take too long to seat before the exhaust gases "blew by" them. This was the technical explanation of what occurred, but most Americans probably better understood the causal story that NASA managers intimidated Morton Thiokol management to reverse their position and recommend the launch of Challenger. The American people may have difficulty in understanding resiliency, but they did know what coercion meant.

Media and the Policy Process

There is a comprehensive media literature that is embedded within the works pertaining to the policy process. London (1993) speaks to the mechanisms by which the media frames political issues. Referring to the work of McCombs and Shaw on this issue of the influence that the press has in our society, it is the media's ability to influence what we think about and we what we ponder rather than telling us how to think. Arthur Heise (1982) tells us that most of the time the media obtains their information not from the Woodward and Bernstein school of investigative reporting, but information that has been provided by the government. Theodore White in his famous The Making of the President states that the press is powerful enough in the U.S. to actually set the political agenda possessing "…an authority that in other nations is reserved for tyrants, priests, parties, and mandarins" (1973: 327).

Wamsley and Shroeder (1996) note that the news media's intrusion and influence within the emergency management subsystem has been increasing. Iyengar and Kinder (1995) tell us that the national evening news influences the formation of public policy, which then impacts the publics' formation of issues, which is then conveyed into public policy arena. "Television news," they maintain," has become America's single most important source of information about political affairs" (1995: 296). Penelope

Ploughman (1997) states that the "…power of the news media is immense and expanding …television is the usual source of news…Government is the pre-eminent newsmaker due to its control over information and resources" (1997: 119).

Wieseltier (1986) comments cynically on the role that the experts employed by the media play in the post-disaster news coverage, which is instrumental in shaping the public's sensemaking of the event and impacts the post-accident policy process:

> *These people are known experts, and television cannot live with them. The speed with which they grasp the news, even before the news is fully known, is astounding…The experts are rarely daunted. They stream before the camera with calm and confidence and condescension.*

In order to illustrate the shaping influence of the media upon the post-accident investigatory, an example from the Challenger case study will be used. As one reporter commented on the Rogers Commission hearings:

> *Several times, before deliberations moved behind closed doors, Commission members were reduced to asking questions based not on the sparse official accounts, but on speculations raised in the news media* (Wilford, New York Times, February 9, 1986).

Ranney makes a contribution to the media-politics literature in his treatment of the role that the mass media communications plays in the democratic political systems. He maintains that nowhere else in the world does the media play such a predominant role in the political process as in the United States (1990: 175). Ranney's observation that television and print media professionals believe that they have an obligation to assume the role of the "peoples' watchdog" (1990: 182). This duty, the media professionals would maintain, is:

> *…not to make it easier for the government to carry out its policies but to keep the people fully informed about what the government is doing—especially what it is doing wrong. Hence, bad news is more important and gets more coverage than good news. Good news…requires no action and serves only to make the citizens complacent, but bad news provides the information and stimulus that citizens need to want to make things better* (1990: 182).

If we accept the premise that the space policy subsystem becomes an issue network (Heclo, 1978) following a disastrous event, Ranney provides the substantiation that the media joins the policy subsystem not only as purveyors of information to the public, but additionally they view themselves with some degree of legitimacy as the "peoples' watchdog." They provide the average American with a voice and presence in the policy subsystem and are the first the cry "Cover Up!" if the other policy subsystem actors attempt to gloss over the answer to the question "Who is responsible?"

Birkland (1997) points out that immediately following a disastrous event the media uses imagery of a disaster instead of attempting to provide appreciable detail as to what happened (1997:10). Of particular importance is Birkland's treatment of describing these events as focusing events, which eventually leads the policy subsystem actors to make sense of the event and the "predictable search for blame that characterizes focusing events" (1997: 145). He asserts that focusing events share the following features (1997: 23-24):

- Events happen quickly with little or no warning. Those that want to elevate an issue on the political agenda use these events to attract popular attention to the issue.
- These events are generally rare and unpredictable and because of their graphic nature, they have tremendous power to influence policy.
- The events affect a large number of people.
- The public and the policy subsystem members learn of the event virtually simultaneously.

Birkland suggests that the media's role in these focusing events is evidenced in two phases. The first phase is that the media immediately reports on the event with attention given to a description of the damage, casualties, etc. The second phase involves the participation in the policy subsystem in that the media forces Congress to give attention to the issue by convening an investigation (1997: 29-30).

Sensemaking Literature

Sensemaking serves as a useful lens for understanding organizational and societal behavior because it is a continuous, social process in which individuals look at elapsed events and select discrete points of reference to weave webs of meaning. The result of sensemaking is an enacted or meaningful environment that is a reasonable and socially credible rendering of what has taken place. This literature informs our understanding of what occurs following a disastrous event. What it suggests is that the only way that people can make sense of a disastrous event is if they can hold a person or group of persons accountable for the event. Again, borrowing from one of the case studies to illustrate this point, the following was written in an editorial following the Apollo accident:

> *Man ties to make sense out of the complex by focusing on simple, understandable things…It would be unfortunate if we laid the blame for the Apollo fire on a faulty wire and let it go at that, for larger questions are involved…(*Boston Herald, April 11, 1967).

Weick (1995) describes sensemaking as a process that is grounded in identity construction, retrospective, enactive of sensible environments, social, ongoing, focused on and by extracted cues, and driven by plausibility rather than accuracy (1995: 17). Sensemaking consists of retrospective interpretations built during interaction and is described by Weick as a developing set of ideas with explanatory possibilities, rather than a body of knowledge (1995: xi). Weick further theorizes that: action precedes thought; there is a primacy of process over substance; circularity rather than linearity in causal relations; and that change rather than stability is the rule in organizations.

Weick also maintains that language associated with the making of sense is unequivocally crucial because “sense is generated by words.” The words that describe an event, not the event itself, are structures that produce sensemaking. The substance of sensemaking is that people use words from a vocabulary that has been embraced by society and they make sense by employing an ideology (Weick, 1995: 107). Using Weick’s substance of sensemaking, he would probably argue that following a disaster such as Apollo 1 or Challenger, the public would use words such as “responsibility,” “accountability,” and “blame” with an ideological grounding in the American notion of fairness. Fairness is an integral component of what one could call American values.

We believe in fair play; fair trials; fair employment practice laws; the Fair Employment Practice Committee; the Fair Labor Standards Act; the fairness doctrine (i.e. a no defunct FCC policy); and the fairness question (i.e. fair distribution of economic benefits in the Federal budget) (Shafritz, 1988: 208-209). Fairness provides the ideological underpinning by which blame becomes a framework for sensemaking: Since someone died as a result of human error, it is only fair that the person who erred should be held accountable. And since that person is held accountable, he/she should be punished.

Weick's view that words are what we use to make sense of situations sheds some light on the role that the media as a "words-generator" plays within the policy subsystem. Douglas (1995) tells us that in ancient social systems (e.g. Hebrew) "Words were forces in their own right and could be used to modify events, create and alter situations and guide behavior" (1995: 30).

Wamsley and Schroeder maintain that news media has always played a dramatic role in politics and the formation of public policy (1996: 236). While television may have an instantaneous impact on the American public, especially during a disaster situation, it is the print media that remains committed to the event throughout its life (Garner and Huff, 1997; Ploughman, 1997). Ploughman offers additional insight into the linkage between sensemaking and the role of the media for she notes in her case studies that the television news media broadcasts what "facts" are available, while the print media has more time to assimilate information, fill in the blanks with background information, and is more dominant during the post-disaster period (1997: 21, 27).

Garner and Huff (1997) again link sensemaking and the role of the media. They assert that the American people rely on the media to tell them how to react to a disaster situation and how to behave. This aspect will constitute an important avenue of inquiry during the review of media artifacts that this dissertation will draw upon. How did the media, which is an actor in the policy subsystem, shape the post-disaster behavior of the American people? Garner and Huff refer to the work of Gamson and Modigliani (1989) concerning the impact that media discourse has on public opinion. Their position is that media discourse is an integral and important part of the process of the public's construction of meaning.

The print media's most powerful ''weapon'' in constructing meaning is the editorial because it reaches a broad segment of a geographical population and one of the editorial's primary purposes is to ''…encourage actions that the paper thinks will benefit the community'' (Sabine, 1981: 54a). London (1993) points out that the most important effect of the media is ''…its ability to mentally order and organize our world for us. In short, the mass media may not be successful in telling us how to think, but they are stunningly successful in telling us what to think about'' (1993: 13). In many cases, the editorials asked the basic questions that have been discussed in this study: what happened, how did it happen, why was it allowed to happen, and who is to blame?

Besides the publisher's desire to sell more newspapers, the print media endeavors to pose the questions that they believe many Americans harbor, but have no forum in which to voice them. While this appears to be a noble motivation, Ploughman (1997) argues that the media's intentions are not grounded in lofty, good-citizen motives, but, rather, they are firmly rooted in the desire to set the agenda for political discourse and selectively construct public meaning and understanding of an event (1997: 120).

Given this scholarship, one can argue that there is a link between sensemaking and the media. If the media can shape the discourse associated with sensemaking, they can also shape the framework by which sense is made; namely, blame. One of the analytical products of this dissertation will be the measurement of blame rhetoric in the print media following the Apollo1and Challenger accidents. Did the media reflect the blame rhetoric that was being espoused by the other policy subsystem actors, or did it instigate a blame discourse?

Of particular importance to our understanding of sensemaking, Starbuck and Milliken state that:

> *...sensemaking has many distinct aspects--comprehending, understanding, explaining, attributing, extrapolating, and predicting, at least...What is common to these processes is that they involve placing stimuli into frameworks (or schemata) that make sense of the stimul* (1988: 51).

Sensemaking belongs to a larger process of organizational adaptation that includes scanning the environment, interpreting, and developing responses.

Starbuck and Milliken (1988) also significantly inform this research by noting that frameworks are necessary for they provide people with a means to establish meaning and interpret events. They state: "Perceptual frameworks categorize data, assign likelihoods to data, hide data, and fill in missing data" (1988: 51). This point is significant for this dissertation for it establishes a linkage between sensemaking and the blameworthiness literatures. The linkage is that, first, the organization's or society's desire to assign culpability or blameworthiness is a framework within sensemaking. Secondly, the linkage of the two literature's addresses how the media and other public actors serve to "fill in the missing data" in order to set the stage for blame to be associated with a specific individual or group of individuals.

Robert Gephart (1993) has drawn together the ideas of blame and post-disaster sensemaking. Gephart uses a textual approach to generate insights into how an organization makes sense of disastrous event and then attributes blame. As he points out, the post disaster events "…unfold over time…they leave archival residue." His research found that organizations in a post-disaster setting will attempt to characterize a person within the organization as a leader who had a causal role, which led to the disaster. This, of course, permits an individual to be blamed, which shifts attention away from the organization.

Rochefort and Cobb (1994) studied the 1992 Los Angeles Riots following the acquittal of O.J. Simpson as a means of understanding problem definition and problem solution. They speculated that problem definition is much more than attributing blame to an individual. What they found that immediately after the riots began, all of the key figures in the Simpson trial were the subjects of blame establishment for the riots. Of course, the media was actively soliciting any view that pointed the finger at someone else. The media first attempted to find those who wanted to define the causal agent as being the jury. When that did not "sell," the quest for the causal agent went from Chief Darrel Gates to Mayor Bradley to the looters to the African-American community to the Hispanic-American. None of the targets of blame could be readily linked to the problem. So when they exhausted the more tangible, "people" targets for the blame, the press then sought out those who believed that public policy was the problem: neglect of race relations, urban problems, domestic social policy. The policy-as-causal-agent strategy did not appear to enlist any advocates, so they turned to Vice President Quail who offered "poverty of values" as the real problem and cause for the riots (1994: 2-3).

One can readily see how the lack of a clear articulation of the problem facilitated blame deflection. It also serves as a means to see how the objects of blame diluted over time from individuals to groups to policy to norms. Rochefort and Cobb turn to H.C. Northcott (1992) to explain the difficulty in attempting to use blame as a framework for sensemaking (especially after a disastrous event) when blame deflection has left the public with an amorphous, normative sounding group of words to relate to as the "problem:"

> *These definitions, explanations, and assertions are constructed to help us make sense of those things and events that we experience and to help us decide how to respond to those experiences. In the face of uncertainty and ambiguity, these social constructions themselves are frequently based on 'fashionable' and therefore changeable assumptions and value judgments*.

Garner and Huff (1997) studied how the public made sense of a disastrous rail accident involving Amtrack's *Sunset Limited*. They found that the public looks to the media to not only tell them what happened, but how they should react to the event (1997: 6). They found that the public depends upon the media to tell them how to behave and how to come to terms with their grief following the disaster. While Garner and Huff did not specifically address the issue, one could argue that if the press is influential enough to shape post-event grief reactions, social mourning, and the establishment of "acceptable" post-event behavior, they are powerful enough to shape the public's anger into demands for accountability. Garner and Huff assert that media discourse is an essential ingredient in the process by which the public constructs meaning. An example of how the media shaped the public's reaction following the Challenger accident, one of the accounts of the accident was that the crew died instantly and painlessly as a result of the explosion. However, as evidence was accumulated, it became clear that the astronauts did not die when the Challenger broke up as a result of dynamic forces. Because of this revelation, one commentator rote:

> *….as long as the astronauts died painlessly, people would accept the tragedy. The truth is that the astronauts were alive and conscious for several minutes after the disaster occurred….They died because of NASA's false economies and incompetence* (Shannon, Philadelphia Inquirer, April 24, 1986).

However, the central problems in sensemaking are associated with the reduction or resolution of ambiguity and how to develop shared meanings so that society or the organization may act or react collectively. In other words, making sense, or constructing meaning from what has been sensed about the environment, is problematic because the information about the environment is ambivalent, and therefore subject to multiple interpretations. Feldman specifically addresses the issue of ambiguity by observing that more information may not be relevant to resolving the ambiguity (1989: 5). Because ambiguous issues have no clear meaning, they must be interpreted and when there is interpretive consensus, it is then possible to make sense of an event.

March and Olsen state that:

> *Individuals try to make sense out of their experience, even when that experience is ambiguous or misleading, and even when that learning does not lead to organizational actions. They impose order, attribute meaning, and provide explanations* (1976: 67)

Feldman is quick to point out that sensemaking does not result in action, but, rather, leads to an understanding that action should or should not be taken or that a better comprehension of the event is necessary (1989: 20).

The Establishment of Blame Literature

> *We punish those who are ignorant…of anything…that they are thought to be ignorant of through carelessness; we assume that it is in their power not to be ignorant, since they have the power of taking care.*
>
> Aristotle
> Nichomachean Ethics, Book III, Ch. 5

The third literature informing this dissertation is that of establishing blameworthiness. The process of blame establishment can be characterized as commencing with many questions beginning with "what" and "how;" soon followed by "why" questions; and ending in "who," as in "who is responsible?" Unfortunately, the person or persons who receive the blame are not always the only culpable parties; however, they generally are the most convenient (Perrow, 1999; Vaughn, 1996).

Pfeiffer's (1995) scholarship in blame attribution is seminal as it pertains to organizations. Pfeiffer explicitly states that the attribution of blame is to assert that a person is morally responsible for some inauspicious event and deserves to be held accountable or responsible (1995:2). In other words, to hold someone responsible usually involves blame.

He maintains that there are three conditions that must be met before blame can be attributed:

1. Something terrible happened that could have been prevented by one or more persons;
2. There was a moral duty for those people to undertake those measures;
3. They could have taken those measures and have no legitimate reason for not doing so.

Pfeiffer asserts a thesis of individual sufficiency. In this thesis, he argues that full knowledge of individual blameworthiness is the point at which the blame is better attributed to the individual than to the organization. His reasons that that there is no appreciable purpose for blaming an organization if there is adequate evidence to blame an individual (1995: 31). Conversely, it is morally justified to blame an organization if there is a significant degree of incompleteness in our understanding of whom to blame (see pp. 16-31). He adds that there is no moral purpose served by blaming the organization for a disastrous event if it is known that specific individuals are culpable.

Pfeiffer posits a second thesis: Individual dependency. In this thesis, Pfeiffer states that it is unjustifiable to blame an organization without evidence that some of its personnel are to some extent blameworthy (1995: 22). If an organization is to be blamed, according to Pfeiffer, then some its individuals must share in the blame. Using Pfeiffer's individual dependency thesis, could one assume that Webb was acknowledging that some of NASA's and North American Aviation's personnel were culpable for the Apollo 1 fire, but not really sure who was responsible? What is key to understanding this thesis is that Pfeiffer underpins this thesis with the notion that there is limited evidence to establish contributory blameworthiness of an individual, but it does not mitigate the organization's possible blameworthiness (1995: 45).

Pfeiffer claims that people (and organizations) select the target of their blame based on both their own purposes and the evidence available (1995: 117). The choice of a particular target of blame results from both the evidence available and one's purpose of blaming. He makes a profound point in that the object (person or group of persons) of the blame can only be understood in light of those purposes. Pfeiffer is suggesting that, whoever is blamed, they possess a symbolic meaning that can only be comprehended in the context of the reason for assigning the blame (e.g. protection of the hierarchy, protection of the organization's image). Those who were blamed for the Apollo 1 and Challenger accidents became arguably scapegoats by which their organizations foisted all of their "evils" and "sins." The term "arguably" is used because Douglas (1995) points out that a scapegoat is one who is innocent of the transgression, but receives the blame nonetheless.

Douglas (1995) suggests that the historical context of the scapegoat is grounded in the belief that evils, disease, and bad feelings can be transferred from one person (organization) to another (scapegoat) by the performance of the appropriate rituals (blame attribution process). As will be discuss in greater detail in Chapter V (Apollo 1 Results) and VI (Challenger Results), those who were held accountable for the manned space flight fatalities in the case studies became the embodiment of procedural errors, technical miscalculations, and managerial incompetence that led up to the accidents. As Douglas (1995) suggests, the scapegoat's punishment must be public; everyone must see that the guilty have been identified, punished, and the evil excised from the community. The more contemporary version of the scapegoating ritual is public exposure followed by censuring by reassignment to an obscure position, resignation, or retirement.

Perrow's (1999) place in this literature presented some challenges. While he approaches "normal accidents" from a strong organizational perspective, he gravitates back to the theme of the time-honored causal agent: the operator. He makes a strong case against making the immediate post-accident assumption that it must be the operator's fault. He states that in high technology, high-risk systems that are tightly coupled (i.e. no slack or buffer or give between two systems; what happens to one, happens immediately to the other) accidents are inevitable; even "normal" (1984: 4). Because many of our high technology systems (e.g. space systems) are complex and tightly coupled, system accidents cannot be avoided and, because of their nature, catastrophic potential exists (1999: 257). There are those principals in the case studies who would have disagreed with Perrow's presumption that failures of complex systems were randomly normal. In a public forum, one government executive stated: "There is no such thing as a random failure. Every failure has a cause" (Time, February 3, 1967).

In this study, Perrow informs our understanding of the attributes of complex and tightly coupled systems. Because of the system attributes of a complex system in which the subsystems are linked together in close operational sequence, failure occurs so rapidly that it is impossible for ground controllers or the crewmembers to intervene and stop the disastrous sequence before the system fails. In other words, in Perrow's vernacular, it is impossible for the ground controllers or the crew to decouple the subsystems that are failing sequentially before the system fails. The idea of tightly coupled system can be visualized as a row of dominoes that are placed on-end next to the other. When the first domino falls, the rest fall rapidly in sequence. The sequence is broken if one can remove a domino from the line. An example of ho ground controllers and crew were able to decouple a failure sequence can be found in the case of Apollo 13. By some luck and quick intervention, the ground controllers and the spacecraft operators were able to examine technical alternatives and implement partial remedies to subsyste failures adequate enough to return to Earth.

As to who should bear the burden of blame for a system failure, Perrow maintains that in the post-accident hierarchy of blame, the elites should be scrutinized first for they are the ones who made the decisions concerning the use of risky technologies, expedited development plans, and the optimistic, politically driven launch schedules. Nevertheless, it is the operator who is executing the decisions made by the elites who receives the blame, thereby permitting the American people to know that the syste found the guilty culprit so they can go to bed at night knowing that their government and its agencies are sound and competent.

Scott Sagan (1993) makes a contribution to the bla e literature for he uses the ter "politics of blame" to describe the process by which the operator is blamed in order to protect the elites. Borrowing from Perrow (1984, 1999), Sagan argues that there are two theories concerning organizations that employ high-risk technology: "high reliability theory" and "normal accidents theory" (1993: 13). The underlying theme in each of these two theories is that of the probability of failure and who is blamed for the failure. Like Perrow, Sagan places the operator at the bottom of the list of culprits. Sagan argues that the operator is generally the first to be blamed in order to protect the interests of those who designed the systems and the leader elites who made the decisions to employ the design (1993: 246). Because of this aberrant blame assignment, there is strong likelihood that the failure will be repeated.

Gregory, Flynn, and Slovic (1995) contribute to the blame literature by observing that a stigmatization process occurs following an accident. One of their primary examples of a technological area that has been stigmatized is that of the nuclear power industry. Because of such accidents as Three Mile Island, the public fears to varying degrees nuclear power plants. They note that a standard of what is right and natural has been violated and because of this violation, the public views nuclear power generation as possessing the potential for risk. Gregory, Flynn, and Slovic make an interesting point that is relevant to this research. If blame could not be attributed to an individual or individuals, NASA and the manned space flight program would be stigmatized in the same manner as the nuclear power industry following Three Mile Island accident.

Shaver (1975) provides insight into the attribution process. Shaver maintains that a person is responsible for what he or she causes and that judgments of responsibility are laden with moral qualities (1975: 95-96). While Shaver's point may be obvious, its importance is found in the conception that the attribution of responsibility is normatively grounded. In both the Apollo 1 and Challenger accidents people died; therefore, someone must be held accountable for their deaths. As we have already noted, in our American society, this is the right and proper thing to do. If the manned space flight program was to ever resume in a credible fashion, an individual or individuals had to be held accountable for the disaster because this is what the American people thought was morally defensible and just. Pfeiffer (1995) affirms this view by stating that the popular ethical view in America is that wrongdoers deserve blame regardless of whether they are punished (1995:10) and Hertzberg believes that "…in practice, we usually kno when a person is to be held responsible (1975: 511).

Singer and Endreny (1993) stress that "In a society like ours, the need to fix responsibility, to locate a cause and preferably an agent, is pervasive…In such a culture the ultimate horror is a disaster without an explanation, an essentially random event" (1993: 104). What they are suggesting is that the United States is a blaming society; we want people to be held accountable for their deeds and misdeeds. Is this an outgrowth of Watergate, the Iran Contra Affair, and other governmental indiscretions? Possibly, but the answer to this question is outside of the scope of this dissertation. Suffice it to say, the Rogers Commission did not "name names" in the body of its findings much to the chagrin of certain members of Congress and, possibly, the American people.

A blame related literature that is especially relevant to this dissertation is that of corporate responsibility. Although the focus of this dissertation is primarily public sector, the corporate responsibility literature informs this research by providing not only an understanding of one of the principal actors within the space policy subsystem (i.e. industry), but it offers lessons relative to private sector accountability that may have application in the public sector. The central theme of Christopher Stone's (1975) work is that we expect individuals to act responsibly in ways that benefits others; why don't we expect corporations to do the same? Of particular importance to this dissertation are his comments concerning the corporation's importance in society. He writes that "…aside from governments and governmental agencies, more and more it is corporations that are effectively the actors in our society" (1975: xi-xii). As we have discussed in our review of the policy subsystem literature, during stable and "uneventful" times, the space policy subsystem is composed of the congressional space subcommittees, NASA, and the space industry. Stone's view of the importance of the corporation can not be overstated for it is industry that actually builds the spacecraft, constructs launch facilities, and operates the myriad of other systems that are necessary to successfully launch a manned spacecraft.

Stone also believes that the mechanism by which corporate motives are developed may transcend even the leadership of the corporation. He states that:

> *…there is no reason to suppose that the motives of a corporation, the way it will respond and adapt to external threats, the way it will scan its environment for information, the way t will calculate and weigh its pleasures against its pains—in sum its decisions and the way it arrives at them—will coincide with those of any one person within it, not even necessarily those of the president* (1975: 7).

Relative to the establishment of personal accountability, Stone states that "Sometimes in moral discourse…we assign obligations to people on the basis of their having assumed some role or status" (1975: 83). Stone's assertion of individual accountability predicated on the individual's role provides insight into why the captain of a naval vessel is always held accountable when his ship is involved in an accident regardless of whether the captain was physically on the bridge or not. The same argument could be made that the "captain" of an agency or corporation should be held to the same standard as a captain of a ship, however, as we will see in our case studies, this is not always the case.

Another authoritative source in the corporate responsibility literature is Peter French (1979), ho has written extensively in the philosophy and business fields. Ensconced in issues of corporate and collective moral responsibility, French argues that an organization can be morally blameworthy for an action even if none of its participants can be blamed. In other words, he believes that the organization possesses personhood akin to the notion that corporations are singular entities under the law. The source of this moral personhood is the organizational culture (e.g. rules, procedures, and customs) by which decision-makers render decisions that guide the organization's actions and policies. Put another way, the organization's moral nature lies in the fact that it is an intentional being capable of decisions and rational internal acts.

While French approaches moral responsibility from the perspective of the private sector corporation, one can argue that his principles can be applied credibly to private and public organizations. French's argument that the organization can be a legitimate moral agent would justify post-event assertions that NASA or its corporate collaborator could collectively be blamed for the death of the crews of Apollo 1 and Challenger. French explicitly holds that organizational acts and the acts of the individual within the organization are causally inseparable (1979: 207-215).

Phillips (1995) asks the same question as French (i.e. “Can organizations be morally liable?”), but he argues that if an organization is to be held morally responsible, it must truly be viewed as an entity and not simply as a sum of the individuals (1995: 557). To place this view in the context of this dissertation, could an agency, as an entity, be blamed singularly and legitimately for a disastrous event? Phillips asserts that "groupthink" is an organizational phenomenon by which individuals, who are involved in a group decision process, are absolved of culpability or moral responsibility. Groupthink is the "…process by which group members internalize collective goals and perceptions that they are incapable of evaluating or changing existing group practices" (1995: 567).

As we will encounter in the Challenger case study, a number of NASA and Morton Thiokol executives were held accountable for the Challenger disaster. As we revie the details of this disaster in Chapters IV and V, we may find ourselves asking this question: Were these NASA and Morton Thiokol executives merely scapegoats protecting agential and corporate elites from being blamed for the Challenger accident? Douglas (1995) would argue that they were not scapegoats because a scapegoat is innocent of wrongdoing. He also examines the notion and practice of scapegoating both in an historical and contemporary context. Historically, scapegoating is an ancient process of transference and disposal of evil. In some ancient cultures, a person was "chosen" (usually from the ranks of the destitute) to bear the sins and guilt of the community and was then executed in order to destroy the sin. In other cultures, the sin-bearer was driven from the community taking the sins and guilt with him or her away from the community. The idea was that evils, disease, and other societal maladies could be transferred from one person to another through appropriate rituals (1995: 3).

In a contemporary practice of scapegoating, Douglas writes:

> *There is…a very strong urge for members of an organization to give a name to what they think is happening. By so doing they create a strong feeling that, to a certain extent, they understand the problem. Thus to blame someone or something for what is happening equally tends to produce a sense of having solved the problem of cause. In the relief which follows, those involved can convince themselves that they can now forget the problem and get on with what they should be doing.* (1995: 192-193).

Since an understanding of blame establishment is crucial to this dissertation, it is essential that we give appropriate treatment to Douglas' views concerning the acceptance of a causal story (see also Stone, 1989), which are ideas about causation and not a search for truth (Stone, 1989: 283).

From a more philosophical perspective, Squire (1968) brings us back to the basics of blame. He states that blame is the opposite of praise, involves only words, and is not dependent upon constituted authority or formal procedures (1968: 54). These rather elementary observations are important for they explain how those who are not in the policy subsystem can make declarations of an individual's blameworthiness; they are just words with no explicit form of sanction associated with them. The point that Squire is making is that there is a demarcation between blaming and punishing. Anyone can blame the program manager for incompetence, but when the agency executive makes or endorses the program manager's blameworthiness punishment is then rendered. One could carry Squire's argument forward by stating that the American people can blame without limit, but it takes a member of the policy subsystem to ratify the declaration of blame in order to impose sanctions (1968: 57-59).

We have all been blamed for something. If we are honest in our recollection of events, we most likely attempted to deflect the blame onto to someone else. Crant and Bateman (1993) argue that people try to take credit for their successes and deflect blame on external causes when they fail. Nonetheless, when blame is assessed, they believe that it means that the individual has exceeded a normative standard in a negative direction. Conversely, when a person accepts his or her culpability, they usually have an opportunity to apologize, which is an expression of remorse for the failure and an acceptance of responsibility for the action. Of course, an apology does not necessarily mean that the punishment or sanction levied as a result of the failure will be mitigated. Crant and Bateman do observe that if there is an external causal agent (e.g. failed engine, malfunction in the warning system), then it is not possible to blame the individual (e.g. pilot, ship captain, control room operator). This point is germane to this dissertation's research objectives because in both case studies (i.e. Apollo 1 and Challenger), the crews were blameless in the disasters that befell them.

McGraw (1991) provides an interesting juxtaposition of how public officials attempt to shape the citizens' perception of political events, but endeavor to avoid blame for negative outcomes. She maintains that there are two types of political accounts that attempt to take the edge off a negative outcome: excuses and justifications. An excuse is an account in which the political actor believes that he or she is fully responsible and, therefore, less or no blame is warranted. A justification is an account in which the consequences are not as undesirable as initially reported and, therefore, less or no blame is warranted (1191: 1135-1136). In the regime of excuses, political actors may attempt to convince the constituency that there were mitigating circumstances; that the responsibility should be diffused to others; or the actor offers a plea of ignorance. The plea of ignorance is not effective when an official is the instrument of his or her own ignorance.

A more derisive view of how the political actor is supposed to respond to attributions of blame is offered by Reeder (1999). What he suggests is that when is blame is levied the actor must first deny that the incident ever happened. If the denial does not work, the actor then ensures that any evidence linking him or her to the untoward event is wiped out; in other words, covered up. If the press or one's political adversaries discover that a cover-up was attempted, the final step is to blame someone else (1999: 84). While somewhat "tongue-in-cheek," Reeder does capture a time-honored practice among Washington political actors. He notes that recent history tells us that the American people will forgive a person of almost anything (e.g. adultery, lying) short of taking a human life.

The review of the blame literature will conclude with a reflection on Mary Douglas' (1992) scholarship concerning blame, which is from the perspective of an anthropologist. She notes that how we blame and how we administer justice are symptoms of how a society is organized (1992: 5-6). She writes about how American society is always poised to ask the question after some untoward event: "Who's fault is it?" She states:

Of the different types of blaming system that we can find in tribal society, the one we are in now is almost ready to treat every death as chargeable to someone's account, every accident as caused by someone's criminal negligence, every sickness a threatened prosecution. Whose fault? is the first question. Then, what action? Which means, what damages? What compensation? What restitution? And the preventative action is to improve the coding of risk in the domain which has turned out to be inadequately covered. (1992: 15-16)

Discussion of the Literatures

In this chapter, three streams of literature have been reviewed that inform this dissertation: policy subsystems; sensemaking; and blame establishment. The research linkage between blame and sensemaking as an issue for public administration is weak. From its eclectic roots (i.e. psychology and sociology), the blame literature ranges fro scapegoating (Perera, 1986; T. Douglas, 1995) to issues of safety (Sagan, 1993) to complex system failures (Perrow, 1999) to the media's role in blame association (Garner and Huff, 1997) to issues of attributing blame to organizations (Pfeiffer, 1995) to managing blame (McGraw, 1991). The sensemaking literature focused on the context of sensemaking in organizations, as a tool in problem definition, and as a means of understanding disasters.

If the sensemaking and blame literatures are juxtaposed, novel avenues for viewing the rituals of meaning creation and blame association following a disastrous event are created. Given the discussion thus far, sensemaking mechanisms are employed to endow events with meaning (Sackman, 1991) and that one of these frameworks for making sense of disastrous events is the establishment of blameworthiness. The association of blame satisfies the essential criteria of a framework for it enables people to locate, perceive, identify, and label occurrences in their lives and world (Snow, Rochford, Worden, and Benford, 1986 in Weick, 1995).

In the three literatures reviewed, it aids in our understanding of how the policy subsystem experiences shifting coalitions, allegiances, and nodes of influence. One could speculate that at times all of the primary actors in the post-disaster space policy subsystem (i.e. congressional subcommittees, NASA, industry, the media, and expert witnesses) are acting in a synchronous and synergistic manner motivated by a common purpose: to find out what happened and how it happened. However, one could also argue that the coalitions are fragmented, non-inclusive, and temporal, especially when they come to the questions of why it was allowed to happen and who is responsible. As we will see in our examination of the Challenger disaster, the space policy subsyste experienced fragmentation, as evidenced by this comment:

> *Some NASA officials have scrambled to pass off the blame for the* Challenger *disaster. The brass at the Marshall Space Flight Center in Huntsville, Alabama have been trying to point the finger at Kennedy Space Center for botching the assembly of the solid rocket motor. Marshall's bureaucrats are accused of ignoring the warnings of engineers at Morton Thiokol, maker of the solid rocket booster, to postpone the launch because the cold weather could have damaged the o-rings that sealed the segments of the booster* (Thomas, Time, March 24, 1986.

While the age-old adage that politics makes strange bedfellows may be empirically defensible, it may also be a truism that the politics of the post-disaster environment is one in which the policy subsystem rises above partisan politics and doggedly pursues the facts. However, one could also argue that the post-disaster environment is fertile ground for the selection of new and more interesting bedfellows. As William Graha expressed in an editorial, "Whenever a disaster occurs, there are inevitably some people who try to use it to settle old scores, imagined or real rivalries or other personal problems" (Los Angeles Times, March 24, 1986).

Nevertheless, at the nexus of theory and practice, Diane Vaughn (1996) offers a degree a clarity that informs our understanding of the blame dynamic following a disastrous event:

> *But when social control agents attempt to identify responsible individuals, middle managers are most likely to be held accountable because they made the decisions---or failed to make the decisions—that seemed temporally connected to the harmful actions…the NASA case follows the classic pattern for organizational misconduct: middle managers were assigned normative responsibility and left "twisting in the wind," while more powerful administrators—some outside the NASA organization, who had acted years earlier in ways that influenced the outcome—were not* (1996: 409).

CHAPTER III
Research Design

Methodological Grounding

This dissertation seeks to understand how blame is used as a framework for sensemaking following a disastrous event within a national policy subsystem, which, in this study, is the space policy subsystem. The research associated with this project is retrospective and attempts to characterize the dynamics of how the policy subsyste undertakes the establishment of blame in order to makes sense of a disastrous event. The following illustrates the methodological schema used in this dissertation:

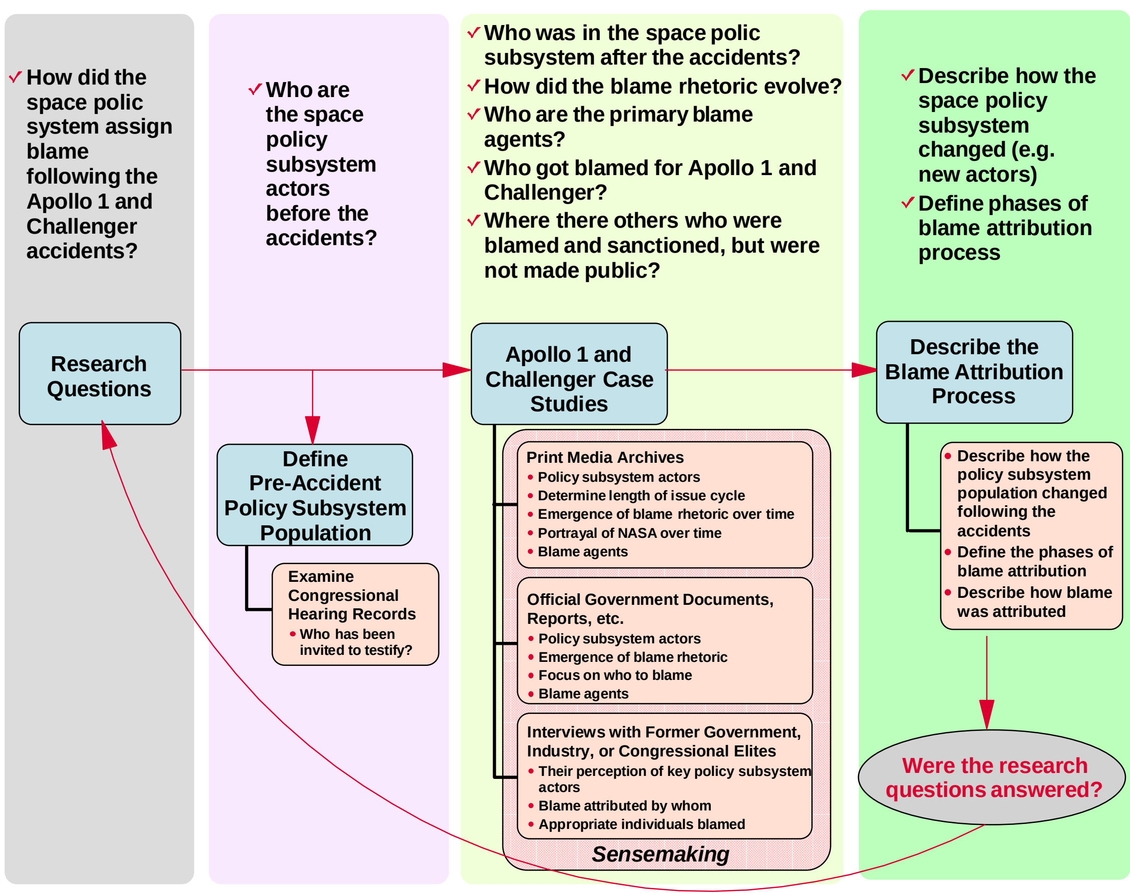

Figure 2: Methodological Scheme

The research question is the most important step in a research project (Yin, 1994: 7). The overarching research question begins with “how:” How did the space policy subsystem assign blame following the Apollo 1 and Challenger accidents? Yin (1994) suggests that a case study that is explanatory in nature is well suited to address a “how” research question. O’Sullivan and Rassell (1995) affir m this view by stating that “Case studies are the preferred strategy if one wants to learn the details about how something happened and why it may have happened” (1995: 33). The value of the case study methodology according to Denzin and Lincoln (1998) is that it is useful in refining theory and pointing to complexities that may necessitate further investigation. In this research project, multiple case studies (i.e. Apollo 1 and Challenger) will be presented in order to to not only define trends of similarity, but identify those that are dissimilar as well.

The overarching question that was addressed in the multiple case studies was: Ho does the space policy subsystem establish blameworthiness as a framework for sensemaking? In order to answer this question, a number of other of questions had to be answered:

- How was the Apollo 1accident different from that of Challenger?
- How was the space policy subsystem structured prior to each of the two accidents? How was space policy subsystem structured during the investigation phase following the accident?
- Was there a consistency in the tone and substance of the post-accident rhetoric within the policy subsystem (i.e. congress, industry, agency, media, experts, etc.)?

- How did the blame rhetoric evolve during the issue cycle?
- Who within the space policy subsystem initiated the "blame game?"
- How did the space policy subsystem identify the individual or individuals that were blamed?
- Who were the individuals identified as accountable following the Apollo 1 and Challenger investigations?

Yin (1994) describes the case study as being comprised of four distinct stages:

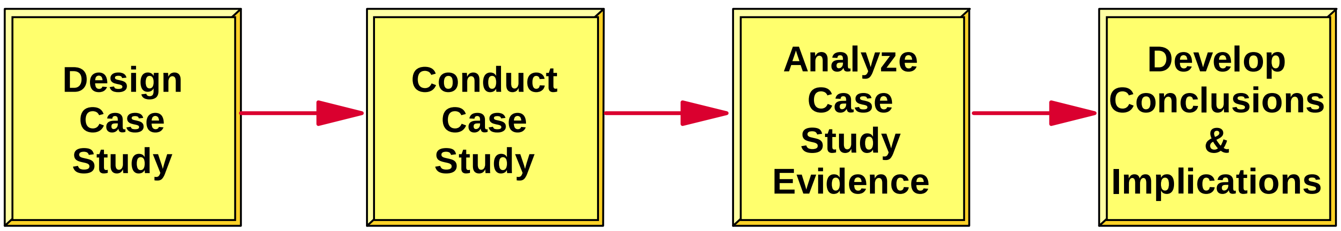

Figure 3: Yin's Four Stages of a Case Study

While Yin (1994) has identified three types of case studies: exploratory, explanatory, and descriptive. The *exploratory* case study, which may begin with a "what" research question, endeavors to develop a relevant hypothesis and suggestions for further scholarship. *Explanatory* case studies may begin with a "how" or "why" question and the objective of this case study methodology is to develop competing explanations for the same events: Did event x lead to event y or has z influenced the x event so that it led to event y? The *descriptive* case study begins with a descriptive theory by the researcher and generally yields a hypothesis of cause and effect.

Stake (in Denzin and Lincoln, 1998: 98-99) maintains that there are three other forms of case study research: interpretive, qualitative, and intrinsic. Stake's *interpretive* case study emphasizes the production of meaning and a thorough commitment to records and artifacts in pursuing meaning. The *qualitative* method focuses on precoded, pretabulated data that is constantly being reinterpreted and discernible patterns are being examined. In the *intrinsic* research design, it directs the researcher to a comprehension of what is important about the case in its own world.

While this research project fits in Stake's interpretive typology, it is principally infor ed by Yin's explanatory case study methodology. Because the dominant case study typology is explanatory, this dissertation will attempt to explain the complex process of blame attribution within the space policy subsystem. However, the interpretive tools of meaning construction will also be useful in the review of the print media archives, official public record, and elite interviews.

Content Analysis

While many view the case study method as only a qualitative technique, Yin (1994) asserts that the case study can accommodate both qualitative and quantitative analysis. In the context of this research project, qualitative data will be used. In a qualitative analysis, content analysis is employed as a modality for observing social artifacts (i.e. print media articles, congressional testimony and reports). Babbie (1975) maintains that content analysis is essentially an operation of coding oral, written, and other forms of communication.

Isaac (1976: 9) cites Borg (1963) when discussing the most common errors in performing a content analysis:

1. The selection of content that is easily attainable but does not represent an unbiased sampling of the material relevant to the research project;
2. A failure to determine the reliability of the analytical procedures;
3. Classification categories lack specificity and comprehensiveness.

Unbiased Sampling

For the purposes of this research project, one hundred percent of all print media artifacts that NASA has in its archives relating to the Apollo 1 and Challenger accidents were used. In the case of Apollo 1, there were 325 articles and for Challenger 998 records. As for the official records, all reports and congressional hearings in the public domain were obtained. Of course, there is the possibility that there were reports and other official documents that could have an impact on this research that were classified or otherwise not released to the public and, therefore, unobtainable. Pertaining to the elite interviews, the bias that is associated with this data collection instrument is that the potential informant must not only be accessible, but willing to discuss events that still may emotionally sensitive.

Internal Validity and Reliability

Yin (1994) presents two cautions in the use of the research methodology that has been proposed (1994:34-36). His first caution is that of internal validity, which restates Borg's (1963) admonition concerning the reliability of the content analysis procedures.

This is germane for this research because of the research objectives ar e to discern causal (explanatory) relationships between the establishment of blame as a framework for sensemaking in the space policy subsystem. If it is incorrectly concluded that blame establishment led to sensemaking without taking into account another aspect, for instance the transformation of the space policy subsystem's from a configuration similar to an "iron triangle" that of an issue network, the research project could be seriously flawed.

Yin's second caution is that of reliability. Since the print media articles will comprise the predominant artifact for content analysis, it will be incumbent on me to delineate in detail the criteria by which the media articles were coded for their degree of blameworthiness. The test of reliability, of course, will be to examine the results of a second evaluator's coding of a five percent sample of the Apollo 1 and Challenger media artifacts. The differential will be reported and discussed in Chapters V (Apollo 1 Results) and Chapter VI (Challenger Results). This was accomplished by providing the evaluator sixteen randomly selected Apollo 1 articles (5% of the total) and fifty Challenger articles (5% of the total) with a scoring sheet and an explanation of the coding methodology, as depicted in this chapter. Following his scoring of the articles, the results were compared and an explanation of the differences was provided.

Study Design

Since this research examines how the space policy subsystem employed the establishment of blame as a framework for sense making, the study design of this dissertation will be grounded in the case study methodology. Yin (1994) states that a case study is the "…preferred strategy when 'how' or 'why' questions are being posed" (p. 1). In the case of this dissertation, the question is: "*How* did the space policy subsystem establish blame as a framework for sensemaking following a disastrous event?"

A procedure that is used in qualitative case study research is triangulation. This is a process by which the researcher uses a number of sources (perceptions) to clarify meaning, thereby minimizing the possibility of misinterpreting the data (Stake in Denzin and Lincoln,1998: 96-97). It also provides the researcher with different perspectives about the same event (Dunn, 1994: 6).

The triangulation procedure utilized for this dissertation entailed information and data concerning Apollo 1and Challenger gathered from:

- Print media artifacts (e.g. newspapers, magazines, periodicals)
- Official government reports and documents (e.g. investigation board reports, congressional committee hearing testimony, internal agency correspondence)
- Interviews with principals from industry and government who have first-hand pre- and post-disaster event knowledge

Gamson and Modigliani tells us that "… edia discourse is part of the process by which individuals construct meaning" (Cited in Garner and Huff, 1997: 8). Since the blame rhetoric that is found in our public artifacts is important in shaping the post-disaster construction of meaning and sensemaking, the media articles were coded with values ranging from 5 (individual or individuals explicitly blamed) to 0 (neutral report; sympathetic in nature; general information about the event). The term “blame” includes synonyms such as “culpable,” “responsible,” “accountable,” and “accused.”

A second analysis of the print media was conducted to document the characterization of the various policy subsystem actors in each article. The analysis identified the subsystem actor or actors in the article and whether the article was favorable, neutral, or unfavorable towards them. One could argue that the data would be skewed since the press rarely reports negatively about itself.

The government documents did not undergo a formal content analysis, but, rather, they were reviewed and blame rhetoric was noted with its associated context (i.e. organizational or individual). Words such as “responsible,” “accountable,” and “culpable,” in addition to words such as “scapegoat,” “goat,” and “blame alerted me to the blame rhetoric that was employed in testimony, hearings, or contained in an official government report or document.

The interviews, which Yin (1994) states is one of the six sources of evidence for a case study, were elite interviews, which Marshall and Rossman (1995) state are interviews that focus “…on a particular type of interviewee. Elite Individuals are considered to be influential, the prominent, and the well-informed people in an organization or community…” (1995: 83). They add that these elites “…are also able to report on an organization's policies, past histories, and future plans, from a particular perspective." (1995: 83). However, Johnson and Joslyn (1986) caution that because elite interviewing is relatively unstructured, it does not absolve the researcher fro adequately preparing himself or herself by studying events and pertinent background material prior to the interview.

Four (4) elite interviewees, who have first-hand knowledge about the events leading up to and after the manned spacecraft accidents being studied, were interviewed:

- Mr. Ralph Rudd, former Executive Vice President, Space Division, North American Aviation (Apollo 1)
- Dr. Rocco Petrone, former Launch Director, Kennedy Space Center, NASA (Apollo 1) and former President of Rockwell International Space Division (Challenger)
- Dr. Hans Mark, former Assistant Administrator of NASA (Challenger)
- Mr. Jeff Bingham, former aide to Senator Jake Garn (R- Utah) (Challenger)

The interviews were open-ended, which left the elite informants with latitude to state their own opinion about the events that transpired before and after the accidents in which they had personal knowledge. The interviews with Messrs. Rudd, Bingham, and Dr. Petrone were accomplished by telephone, although introductory face-to-face meetings with Mr. Rudd did occur in September 1999 and Mr. Bingham in December 1999. The interview with Dr. Mark was conducted face-to-face. For those interviews that were conducted by telephone, permission was gained from the interviewees to record the interviews. Likewise, the face-to-face interviews were also recorded for the sake of accuracy. However, the disadvantage of the recorded interview is that a certain amount of the transcribed interview is not useful (Johnson and Joslyn, 1986). The interviews were edited by this researcher and those portions, which were not related to the subject of this research, were deleted. These edited transcripts are in Appendix A.

As an element of the triangulation methodology, the interviews served a useful purpose because they clarified meaning and addressed ambiguities that likely would have been found in the print and official government records (Stake in Denzin and Lincoln, 1998: 97). As an example of how the interviews clarified meaning, Mr. Ralph Ruud, who was the North American executive responsible for the redesign of the Apollo spacecraft following the Apollo 1 fire, was first interviewed in person on September 23, 1999 and then by telephone on January 13, 2000. While the print edia and the official record indicated that neither NASA nor North American Aviation knew that the use of pure, pressurized oxygen during the Apollo command module ground test was hazardous, it was unclear as to how long they knew it was dangerous. The informant stated that North American Aviation knew two years before the Apollo 1 accident that the test was extremely dangerous; he believed that NASA also knew. This begged the next question: If they knew that it was dangerous, why didn't NASA and North A erican implement more stringent safety measures or redesign the test?

Data Collection: Media Artifacts

The media artifacts were obtained from the History Office at NASA Headquarters and permission was given by the Chief Historian, Dr. Roger Launius, to utilize documents in the History Office's possession concerning Apollo 1 and Challenger accidents. The quantity of print media artifacts that were archived for the Apollo 1 fire amounted to 325 articles (Appendix B) and for Challenger 998 articles (Appendix C) from all of the major news publications that covered the event. One hundred percent of the articles on file were used in this research.

Data Collection: Official Government Documents

The NASA History Office supplied copies of all official investigation and congressional hearing reports. The following Apollo 1 and Challenger post accident documents were obtained:

- Apollo Accident (Part 1), Hearing before the Committee on Aeronautical and Space Sciences, U.S. Senate, 90th Congress (first session), February 7, 1967.
- Apollo Accident (Part 2), Hearing before the Committee on Aeronautical and Space Sciences, U.S. Senate, 90th Congress (first session), February 27, 1967.
- Investigation Into Apollo 204 Accident, Hearings before the Subcommittee on NASA Oversight of the Committee on Science and Astronautics, House of Representatives, 90th Congress (First Session), April 10, 11, 12, 17, 21; May 10, 1967.
- 1968 NASA Authorization (Part 1), Hearings before the Subcommittee on Manned Space flight of the Committee on Science and Astronautics, House of

Representatives, 90th Congress (First Session), February 28; March 1, 2, 7, 8, and 9, 1967.

- 1968 NASA Authorization (Part 2), Hearings before the Subcommittee on Manned Space flight of the Committee on Science and Astronautics, House of Representatives, 90th Congress (First Session), March 14, 15, 16, 20, and 21, 1967.
- Apollo Program Pace and Progress, Staff Study, Subcommittee on NASA Oversight of the Committee on Science and Astronautics, House of Representatives, 90th Congress (First Session), March 17, 1967.
- NASA, "Report of Apollo 204 Review Board," April 5, 1967.
- Towards the Endless Frontier: History of the Committee on Science and Technology, 1959-1979, House of Representatives, Washington, D.C.: Government Printing Office, 1980.
- Investigation of the Challenger Accident, Report of the Committee on Science and Technology, House of Representatives, 99th Congress (Second Session), October 29, 1986.
- Space Shuttle Accident, Hearings before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation, United States Senate, 99th Congress (Second Session), February 18; June 10, 17, 1986.
- Report of the Presidential Commission on the Space Shuttle Challenger Accident, June 6, 1986.

- NASA, Report to the President: Actions to Implement the Recommendations of the Presidential Commission on the Space Shuttle Challenger Accident, July 1986.

Additionally, numerous artifacts (e.g. memoranda, notes) were obtained from NASA's History Office concerning both the Apollo1 and Challenger accidents.

Data Analysis

The content analysis of the media artifact data was tabulated using Microsoft's *Excel* software. From this data matrix, graphical charts were generated to depict the data in either frequency distribution or time series. The data was arrayed either as totals for a given category or on a weekly basis, which was analyzed to identify trends in the development of blame rhetoric.

The data shows how the blame rhetoric emerged as the space policy subsystem and the American people attempted to make sense of the accident. A correlation of the print media, official government record, and the elite interviews not only documents how the blame rhetoric formed as a framework for sensemaking, but it provides us a better understanding of how the space policy subsystem is populated following a disastrous event.

Definition of the Space Policy Subsystem

The methodology employed to define the actors in the space policy subsystem prior to the Apollo 1 and Challenger accidents consisted of reviewing congressional hearing documents in order to determine who testified before the various congressional subcommittees. The assumption was that only those who were members of the pre-accident space policy subsystem would be the predominant witnesses before the congressional space committees and subcommittees.

Relative to the pre-Apollo 1 accident, the following congressional documents were examined:

- "NASA Authorization for Fiscal Year 1966," Hearings before the Committee on Aeronautical and Space Sciences, United States Senate, 89th Congress (First Session), Part 1 (March 8, 9, 10, 11, 12, and 15, 1965).
- "1966 NASA Authorization," Hearings before the Committee on Science and Astronautics, U.S. House of Representatives, 89th Congress (First Session), Part 1 (February 17, 18, 19, 23, 24, and April 13, 1965).
- "1966 NASA Authorization," Hearings before the Subcommittee on Manned Space Flight of the Committee on Science and Astronautics, U.S. House of Representatives, 89th Congress (First Session), Part 2 (March 3, 4, 11, 16, and 17, 1965).
- "1966 NASA Authorization," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Astronautics, U.S.

House of Representatives, 89th Congress (First Session), Part 3 (March 4, 5, 8, 9, 10, 11, 16, 17, 18, 22, 24, 25, and 26 1965).

- "1966 NASA Authorization," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science and Astronautics, U.S. House of Representatives, 89th Congress (First Session), Part 4 (March 2, 3, 4, 9, 10, 11, 16, 17, and 18, 1965).
- "Independent Offices Appropriations, 1966," Hearings before the Subcommittee of the Committee on Appropriations, United States Senate, 89th Congress (First Session, June 16, 1965.
- "Independent Offices Appropriations, 1966," Hearings before the Subcommittee of the Committee on Appropriations, United States Senate, 89th Congress (First Session) (April 5, 6, and 7, 1965).

The space policy subsystem actors prior the Challenger accident were identified fro the following congressional hearing documents:

- "NASA Authorization for Fiscal Year 1986," Hearings before the Subcommittee on Science Technology, and Space of the Committee on Commerce, Science, and Transportation, United States Senate, 99th Congress (First Session) (February 26; March 27, 28; April 3, 4, 1985).
- "1986 NASA Authorization, Volume I," Hearings before the Subcommittee on Transportation, Aviation and Materials of the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (March 5, 1985).

- "1986 NASA Authorization, Volume II," Hearings before the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (February 6, 19, 20, 21, 26, 28; March 5, 6, 7, 26, 1985).
- "Centaur Cost, Schedule and Performance Review," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (May 21, 23, 1985).
- "Space Commercialization: 1985," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (June 18, 19, 20; September 10, 11; October 30, 31, 1985).
- "Assured Access to Space During the 1990s," Joint Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology and the House Armed Services Committee's Subcommittee on Research and Development, House of Representatives, 99th Congress (First Session) (July 23, 24, 25, 1985).
- "NASA's Long Range Plans," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (September 17, 18, 19, 1985).
- "Space Science and the Space Station," Hearing before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and

Technology, House of Representatives, 99th Congress (First Session) (September 24, 1985).

- "Space Science: Past, Present, and Future," Hearing before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, House of Representatives, 99th Congress (First Session) (October 8, 9, 10, 1985).
- "Department of Housing and Urban Development, and Certain Independent Agencies Appropriations for Fiscal Year 1986, Part I," Hearings before the Subcommittee on Housing and Urban Development and Independent Agencies Appropriations of the Committee on Appropriations, United States Senate, 99th Congress (First Session) (March 14, 27, 28, 1985).
- "Department of Housing and Urban Development, and Certain Independent Agencies Appropriations for Fiscal Year 1986, Part 6: National Aeronautics and Space Administration," Hearings before the Subcommittee on Housing and Urban Development and Independent Agencies Appropriations of the Committee on Appropriations, House of Representatives, 99th Congress (First Session) (April 2, 3, 1985).
- "Space Shuttle Requirements, Operations, and Future Plans," Hearings before the Subcommittee on Space Science and Applications of the Committee on Science, Space, and Technology, House of Representatives, 98th Congress (Second Session) (July 31; August 1, 2, 1984).
- "International Cooperation and Competition in Space," Hearing before the Subcommittee on Space Science and Applications of the Committee on Science,

Space, and Technology, House of Representatives, 98th Congress (Second Session) (July 25, 1984).

Media Artifacts Content Analysis Coding Methodologies

Following a thorough review of each article, three variables were discerned and recorded:

- The overall characterization of NASA by the media
- The degree of blameworthiness in each article
- The predominant actors noted in the article

Characterization of NASA

The characterization of NASA was comprised of three assessments: favorable, neutral, or negative. Understanding the characterization of NASA by the media is important because it serves as an "early warning," which tells us that the media is about to posture itself as either an advocate or friend of NASA, its mission, and vision; the factual purveyor of information; or the avenging angel calling the citizens to action demanding that NASA acknowledge its culpability for the disastrous event. As Ranney (1990) points out "…bad news is more important and gets more coverage than good news" (1990: 182). Of course, while the news can be negative, the characterization of NASA can be neutral; that is, the media refrains from "spinning" the bad news in such that NASA appears incompetent, culpable, or both. Nevertheless, as we will see in Chapter V, once the media begins to be the bearer of negative news, they gravitate toward characterizing NASA in negative terms. The best-case scenario of a bad situation is that negative news about NASA is reported in a comprehensive, even-handed, and neutral manner devoid of editorializing and embellishment. Unfortunately, if we believe Ranney, this type of reporting does not sell newspapers.

The NASA characterization assessments are:

- Overall tone of the media artifact was *favorable* to NASA: Value of 3 (green)
    - Positive; upbeat; article affirms NASA goals; sympathetic to victims' families and NASA population in general
    - "...to go forward along the unchartered frontier of space..."
    - "We are going to continue with the space program..."
- Overall tone of the media artifact was *neutral* in its treatment of NASA: Value of 2 (yellow)
    - Fact based and balanced; no overly positive or negative language used to describe NASA or its mission
    - "The first report of a review board on the death of the three Apollo astronauts is to be given today..."
    - "Meeting in closed session, experts searching for the cause of the Apollo fire..."
- Overall tone of the media artifact was *negative* in its portrayal of NASA: Value of 1 (red)
    - Negative; accusatory; language alleging incompetence, cover-ups, negligence

- “Suggesting that the Board’s report might not be full and impartial, Mr. Rumsfeld and a Congressman repeatedly pointed to the fact that six of the board’s eight members were NASA employees.”
- “Taken literally, the dry technical prose of the report convicts those in charge of Project Apollo of incompetence and negligence...How could those in charge of the test ‘have failed to identify it as being hazardous?’”

Blameworthiness Index

The second variable of the content analysis of each article was the establishment of a blameworthiness index. The conceptualization of this index was adapted from Pfeiffer’s (1995) discussion of factors associated with organizational and individual blameworthiness. The following conceptual index of blameworthiness was devised to assess the emergence of a blame rhetoric over the life of the Apollo 1 and Challenger post-accident events:

Blameworthiness Index

Blame Index Value	Description
0	Neutral report; sympathetic in nature; general information about the event.
1	Facts of the event are questioned or established. The question being asked is "**What happened?**"
2	Specific causal factors are being explored. The blanks to the question of "**How did it happen?**" are being filled in by either official statements or speculation (i.e. dangerous oxygen environment or faulty O-rings are surfaced)
3	The media and other actors (e.g. congress) ask "**Why was it allowed to happen?**" Didn't NASA know that the oxygen environment was dangerous? Why wasn't the ground test adjudged to be hazardous? How long has NASA known about SRB O-ring deterioration? Why weren’t corrective measures

	implemented?
4	NASA and/or North American Aviation are blamed for the accident. The "**Who is responsible?**" question is answered at an organizational level.
5	Implications of individual blame appear as editorial comments or Congressional questions that individuals are culpable or that impropriety by an individual is a causal factor for the accident.
6	An individual or individuals are explicitly blamed for the accident. "**Who is responsible?**" at the personal level is answered.

Figure 4: Blameworthiness Index and Description

Predominant Actor Assessment

As has been noted in the discussion thus far, prior to a disaster the attributes of the space policy subsystem can be characterized as possessing the attributes of an "iron triangle" with its stable relationships among its membership based on mutual dependence (i.e. congressional committees, agency, and industry); resistance to wider participation; and promoting its own interests (Anderson, 1997; Bro ne, 1995; Kingdon, 1983). As the space policy subsystem experiences a disastrous event, it becomes unstable and the "boundaries" separating it from other external interested parties erode. The disastrous event transforms the policy subsystem into an issue network with its lack of boundaries and changing actor participation (Heclo, 1978).

In order to investigate the idea that the space policy subsystem experiences expansion of its actor population, each media artifact was coded as to the predominant actors who were noted in the article. The following actors were identified for both the Apollo 1 and Challenger accidents:

- M = Media

- N1 = NASA
- N2 = North American Aviation/Rockwell International
- C = Congress or congressional staffs
- E = Expert witnesses
- I = Individual
- OC = Other contractor
- IB = Investigation board
- P = President or presidential staffs
- OG = Other government (e.g. Department of Defense)
- MM = Martin Marietta
- MT = Morton Thiokol
- LC = Lockheed Corporation
- Pub = Public

Apollo 1 and Challenger Case Study Data Validity Assessment

In order to check the validity of the three levels of content analysis (i.e. Characterization of NASA, Blame Index, and Pre/Post Accident Policy Subsystem Actors) that were performed on the Apollo 1 (n=325) and Challenger (n=998) public media artifacts, a colleague, who is also a doctoral candidate, performed a validity check on a five percent sample of the media artifacts. After randomly selecting and providing a five percent sample of the Apollo 1 (n=16) and Challenger articles (n=50), the evaluator was provided with a score sheet with the media article titles arrayed on the y-axis and the categories for scoring along the x-axis.

The categories for analysis were:

- Characterization of NASA (3 variables)
- Blame Index (6 variables)
- Post-Accident Actors Interacting in the Space Policy Subsyste (14 variables)

The explanation of the analysis categories and variables was copied from Chapter III (Research Design) and provided to the evaluator. The following are the results:

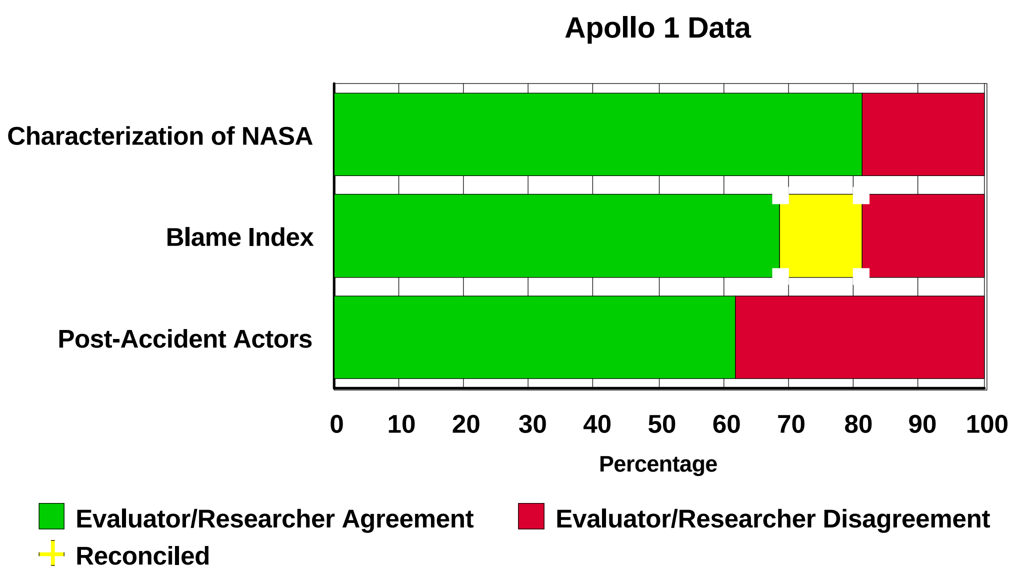

Figure 5: Results of Apollo 1 Validity Check

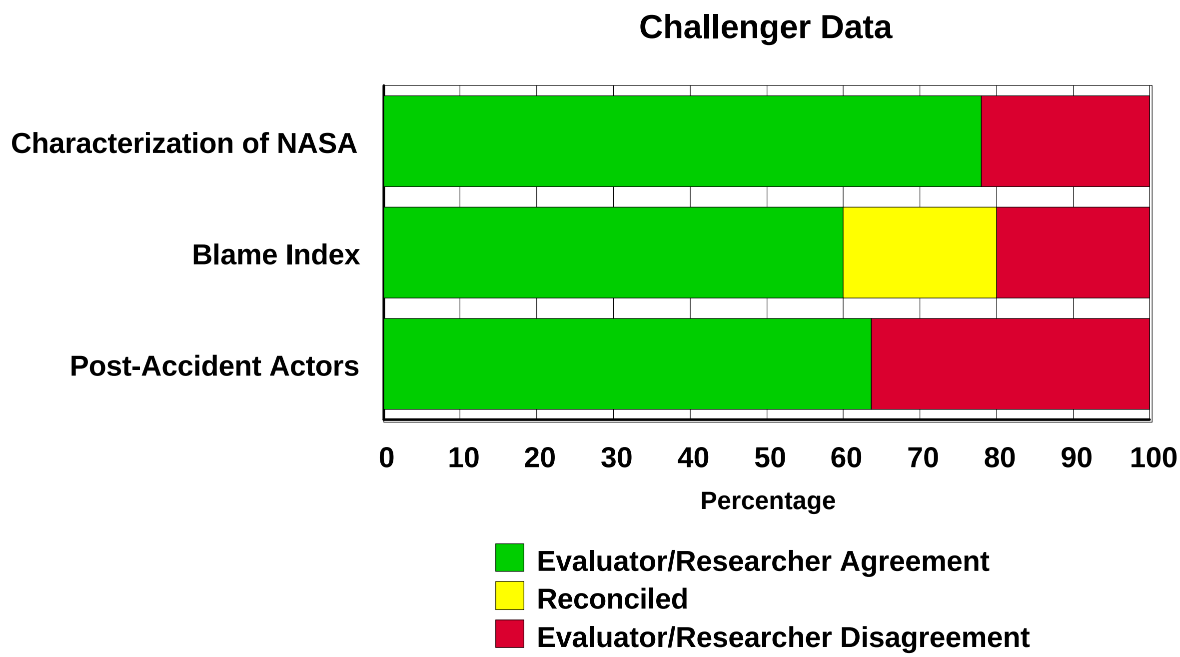

Figure 6: Results of Challenger Validity Check

Apollo I Data

The discussion of the results of the Validity Check will be directed to the *Blame Index* data since it is crucial to the integrity and relevance of this research project. Relative to the Apollo 1 *Blame Index* data, the evaluator and the researcher were in agreement 69% of the cases (i.e. 11 out of 16). In the five cases in which there was disagreement, two of these cases can be reconciled based on a nuance of difference in interpretation. In one case, the evaluator scored an article as 0 ("Neutral, General Report") while the researcher scored it as 1 ("Facts Established"). The content of the article in question (Washington Post, February 2, 1967) could have been legitimately scored either way. The second reconcilable difference is an article scored by the evaluator as 1 ("Facts Established") and by the researcher as 2 ("Causal Factors Explored"). In this article (Washington Post, February 7, 1967), the evaluator interpreted the article as addressing

“What happened?” whereas the researcher saw the article’s focus more as “How did it happen?” In either case, the article addressed both “what” and “how” questions concerning the accident. The remaining three articles that the evaluator and researcher disagreed upon were not reconcilable. However, in all three instances, both the evaluator and the researcher scored the articles as blame specific, but differed as to who the article was blaming: the organization or an individual. In the process of blame attribution, the organization is generally the recipient of blame before an individual or individuals are identified as being culpable. Additional instruction of the evaluator by the researcher could have clarified this very important point that in blame rhetoric there is a clear demarcation between blame levied at the organization and blame attributable to an individual within the organization.

If the reconciled articles are added to those that were agreed upon between the evaluator and the researcher, the reconciled percentage of agreement is 81.3%.

Challenger Data

In the case of the Challenger accident’s *Blame Index*, the evaluator and the researcher were in agreement in 60 percent of the cases (i.e. 30 of 50). Of the twenty cases in which there was a disparate evaluation between the evaluator and the researcher, ten cases can be reconciled or explained. There were four cases in which the evaluator scored the articles as 1 (“Facts Established”), while the researcher scored the same articles as 0 (“Neutral, General Report”). As was evidenced in the Apollo 1 reconciliation of differences between these two blame rhetoric categories (i.e. 0 and 1), there was a modest difference in interpretation between the evaluator and researcher. Each of the articles (Vanity Fair, May 1, 1986; The Sun, May 6, 1986; Washington Post, June 22, 1986; and Washington Times, June 23, 1986) addressed themselves to the facts of the disaster. The researcher saw the articles as general and overarching in nature because they either described the lives of astronauts or addressed the Nation's objectives about manned space flight; the evaluator viewed them in the context of "What happened?" because they always provided an overview of the facts that had been amassed up until the time that the articles were written. In either evaluation of these articles, the line between general facts and "what happened" is blurred. The impact of these differences in the overall depiction and description of the blame attribution process in the case of Challenger is minimal.

There were five cases in which there were differences between the evaluator scoring articles with a value of 1 ("Facts Established") and the researcher scoring these same articles with a value of 2 ("Causal Factors Established"). These five articles (New York Times, February 3, 1986; Wall Street Journal, February 3, 1986; Chicago Tribune, February 12, 1986; Christian Science Monitor, February 12, 1986; and New York Times, February 12, 1986) were written relatively early in issue cycle of the Challenger investigation. In this sampling of articles, there were no articles that simply addressed a "what" (i.e. "Facts Established") or "how" ("Causal Factors Established") question. In each article, they began with a recap of what had occurred based on the information accessible to the media at that time and then speculated about how the explosion occurred. Unlike other articles that were written during this period, which had a singular or predominant “what”, or “how” focus, these five articles could have been defensibly scored with either value. Again, the impact of these differences are minor and would not affect the overall analysis of this research project.

There was only one other difference in scoring that could be reconciled. In a Washington Post article published on June 10, 1986, the evaluator assigned a *Blame Inde* value of 5 (“Implications of Individual Blamed”) while the researcher scored it as 6 (“Individual Blamed”). The first words of the article were: “Sharp criticism of one man, NASA engineer Lawrence B. Mulloy…runs throughout the report on the Challenger accident.” While the Rogers Commission never specifically identified the culpable individuals, it did fault the judgment of Mulloy and others in making the decision the launch the Challenger. The researcher interpreted this article as explicitly blaming Mulloy while the evaluator saw the blame rhetoric as being implicit since the Rogers Commission, which is the foundation of the article, refrained from explicit blame attribution. The difference of implicit or explicit individual blame attribution, in this instance, is narrow and could have been scored either way.

If the reconciled articles are added to those that were agreed upon between the evaluator and the researcher, the reconciled percentage of agreement is 80%.

In the ten articles that could not be reconciled, there was a marked difference in the evaluations between the evaluator and the researcher. In two cases, the evaluator evaluated the articles as 2 (“Causal Factors Established”) while the researcher assigned them a value of 3 (“Why Was It Allowed to Happen?”). These differences can not be explained because the difference in the evaluation is one of saying that the O-ring in the rocket booster is the causal agent (value of 2) as opposed to an article asking the question: “If NASA knew they had a defective O-ring design, why did they continue with the shuttle launch schedule?” (value of 3). In one case, the evaluator scored the article as 4 (“NASA or Contractor Blamed”) and the researcher scored the same article as 3 (“Why Was It Allowed to Happen?”). In seven cases, evaluator and the researcher differed over the assignment of a value of 4 (“NASA or Contractor Blamed) or 5 (“Implications of Individual Blamed”). Although both the evaluator and researcher sa the language of blame in the article, they differed over their interpretation as to whether the blame was directed toward the organization or towards an individual. As previously discussed, it is important in this research project to be able to show how the locus of blame migrates from the organization to that of the individual.

The Validity Check of the *Blame Index* for both the Apollo 1 and Challenger would indicate if the evaluator’s evaluation was utilized in describing the establishment of blame following these two disasters, the results would be very close to that of the researcher’s.

CHAPTER IV

Historical Overview of the Apollo 1 and Challenger

The Apollo 1 and Challenger Disasters

This dissertation does not attempt to provide exhaustive historical treatment of the Apollo 1 and Challenger disasters. There are a number of comprehensive and scholarly works that give each of these manned space flight disasters a thorough revie (Seamans, 1996; Lambright, 1995; Launius, 1998; Vaughn, 1996; Jensen, 1996). This chapter provides the reader with the historical facts of each disaster. In Chapter V, the subsequent investigation and the findings as they pertain to the blame attribution process will be discussed. In order to understand the dynamics of blame attribution within the space policy subsystem, the reader should be offered some detail of the events that serve as the case studies for this dissertation and the proposition that the establishment of blame is a framework by which the policy subsystem and the American people makes sense of the disastrous event. As has been stated previously, if an individual or group of individuals are not found to be held accountable for the disaster, it means that the organization (i.e. NASA) or the space policy subsystem that sustains it is "broken." In the case of manned space flight, which is inherently a high-risk venture, if the space policy subsystem and the American people are not convinced that NASA is competent and worthy of the American people's confidence, then the high-risk venture will be terminated.

In order to review the results of the qualitative analysis, it is important to ground our understanding of the events in an historical context before we examine the public and official artifacts, in addition to the interviews. For if we are to discern the process by which the policy subsystem assigned blame as a framework for sensemaking, we must look through the lens of the event and see what the actors of the space policy subsystem saw.

Manned Space Flight and the Commitment to Lunar Exploration

In his biography of Mr. Ja es Webb, one of NASA's most proactive administrators, Lambright (1995) points out that the manned space flight program was envisaged to be more than an expression of America's national desire to expand the boundaries of space science, it was viewed as a means to trump the Soviet Union's space related ambitions. The Soviet Union had launched the first satellite and they were first to launch a man into space. Nevertheless, as NASA researcher and historian Jeff Bingham points out, President Kennedy's personal affinity to space exploration should not be underestimated or relegated to the status of an afterthought in the telling of this historical story (Discussion with J. Bingham). The President had placed the U.S.' space program on his election agenda and he was determined to keep it on the national agenda. Of course, his personal preference for a strong space program did not diminish the political capital that he could have reaped if the U.S. did beat the Soviet Union in the circumnavigation of the Moon and then land on it.

On April 20, 1961, President Kennedy sent a memorandum to Vice President Johnson in which he asked:

> *Do we have a chance of beating the Soviets by putting a laboratory in space, or by a trip around the moon, or by a rocket to land on the moon, or by a rocket to go to the moon and back with a man? Is there any other space program which promises dramatic results in which we could win?…* (Logsdon, 1995:424).

The essence of Vice President Johnson's response on April 28, 1961 to President Kennedy was that the Soviet Union was ahead of the U.S. "…in world prestige attained through impressive technological accomplishments in space" (Logsdon, 1995: 427). The U.S. could regain its world position if it could land a man on the lunar surface in 1966 or 1967. As Launius points out, President Kennedy not only needed to regain U.S. prestige in the "space race," but he also needed to improve the image of the U.S. following the Bay of Pigs debacle and the construction of the Berlin Wall (Launius, 1998).

President Kennedy needed a project—a vision—that was so grand in scope and scale that only the U.S. could dare to accomplish it. The project was intended to send the Soviet Union a clear message that the U.S. was still in the race and we intended to in.

On May 25, 1961, in his "Urgent National Needs" speech to a Joint Session of Congress, President Kennedy made the commitment to send Americans to the Moon:

> *Space is open to us now; and our eagerness to share its meaning is not governed by the efforts of others. We go into space because whatever mankind must undertake, free men must fully share. I therefore ask Congress…to proved the funds which are needed to meet the following national goals:*

> *First, I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to earth. No single space project in this period will be more impressive to mankind as it makes its judgment of whether the world is free or more important for the long range exploration of space; and none will be so difficult or expensive to accomplish.* (Logsdon, 1995: 453).

Project Apollo

With these words, America's commitment to land on the Moon was born with a sense of purpose and urgency. With these words, the floodgates of the U.S. Treasury opened and filled the coffers of NASA and the American aerospace industry. In Congressional testimony, NASA Administrator James Webb estimated that the cost of placing a man on the Moon was $22.7 billion (Hearings, Committee on Science and Astronautics, House of Representatives, February 28, 1967: 32). In a March 1967 House NASA Oversight Subcommittee Staff Study, the monthly expenditure rate was $260 million (Subcommittee on NASA Oversight, Committee on Science and Astronautics, House of Representatives, March 17, 1967: 9).

In July 1960, while NASA was preparing for the NASA/Industry Program Plans Conference in Washington, D.C., the circumlunar project was in need of a name. Abe Silverstein, who was the Director of Space Flight Development, proposed the mythical god Apollo, which coincided with the precedent that NASA had started by naming its manned space flight projects after Greek mythological gods (Wells, Whiteley and Karegeannes, 1976: 99). In his golden chariot, Apollo would pull the sun across the sky. NASA publicly announced Project Apollo at the July 28-29 Conference.

The Apollo spacecraft was composed of three major assemblies: the command service module; the lunar excursion module; and the Saturn V rocket. The command service module (CSM) was made up of the command module (CM) with its flight controls and habitat for the crew and the service module (SM), which housed the support and propulsion systems, both of which were produced by North American Aviation. The atmosphere within the command module was pure oxygen at 5 pounds per square inch. The lunar excursion module (LEM), which Northrop Grumman designed and built, was the vehicle in which two of the astronauts would descend to the moon and later return them back to the command module.

Figure 7: Launch of Apollo 11

The Saturn V rocket was made up of three stages—S-1C (Boeing), SII (North American Aviation), S-IVB (McDonnell Douglas). With the command service module mated at the top of the "stack," Apollo Saturn was 363 feet tall and weighed 3,000 tons. The Saturn V was the most powerful rocket ever developed by the U.S. up until that time. The first stage was powered by five Rocketdyne F-1 engines, which developed 7.5 millions pounds of thrust and pushed the Apollo Saturn to Mach 1 (i.e. speed of sound) in forty seconds and Mach 9 in the following ninety seconds. As Launius points out, when the first stage was statically fired in Huntsville, Alabama on April 16, 1965, it "…brought home to many that the Kennedy goal was within technological grasp" (Launius 1994: 85).

On November 28, 1961, North American Aviation was awarded a contract to develop the Apollo command service module. Their competition had been the Martin Company, General Dynamics Astronautics, General Electric Company, and McDonnell Aircraft Corporation. As would be later be revealed during the Apollo 1 congressional investigation, North American Aviation was not the first choice of the Source Selection Evaluation Board. The Board's final recommendation stated:

> *The Martin Company is considered the outstanding source for the Apollo prime contractor. Martin not only rated first in Technical Approach, a very close second in Technical Qualification, and second in Business Management, but also stood up well under further scrutiny of the board* (Brooks, Grimwood, and Swenson, 1979).

The Board did add that if the Martin Company was not selected for whatever reason, North American Aviation should be the alternative due to their technical qualification and past experience (e.g. X-15, Navajo, F-100, and F86). NASA Administrator James Webb and his executives chose North American Aviation. Ironically, when North American Aviation's President of Space and Information Systems Division, Harrison Storms, was dismissed following the Apollo 1 disaster, he was replaced by William Bergen of the Martin Company.

As the official and media artifacts will demonstrate, President Kennedy's timetable of landing a man on the Moon by the end of the decade was not only a political statement, it was a goal that would drive every decision that NASA and its contractors made. Later, in the aftermath of the Apollo 1 disaster, many criticized NASA's determination to meet the goal of landing a man on the Moon by the end of the decade set by the late President Kennedy. The following editorial comment captured what many Americans were possibly thinking after the Apollo 1 disaster:

> *There are, after all, some things more important than arriving at the moon on an arbitrary schedule. There are more important things than beating the Russians* (Evening Star, February 1, 1967).

In another critique of NASA's adherence to the Kennedy manned lunar exploration agenda, Walter Lippman wrote:

> *We should get rid of the destructive intrusion of propaganda and public relations. We should abandon the idea of landing a man on the moon by some arbitrary date, and we should put our minds on the use of machines [robotic space vehicles], already spectacularly promising, to increase our knowledge of the moon and the space around it* (Lippman, Newsweek, February 13, 1967).

However, it was the commitment by NASA Administrator James Webb and countless others in government and industry to Kennedy's ambitious vision that propelled NASA through the peaks and valleys of unimaginable technical challenge and through human disaster. It was faithfulness to this vision that made it possible for Neil Armstrong and "Buzz" Aldrin to step foot on the lunar surface on July 20, 1969. The U.S. had finally beaten the Soviet Union, but the victory came at a high price in terms of national fiscal resources and human life. Project Apollo cost the American taxpayers $25.4 billion over its programmatic life and the lives of three astronauts (Garber and Launius, 1998).

The Apollo program ran from January 1967 (Apollo 1) to December 1972 (Apollo 17). During that period, the enormous Saturn V boosters catapulted thirty-three Americans into space. Of these thirty-three astronauts, twenty-seven flew to the Moon of which twelve actually walked on its surface (Curtis, 1992: 92). When Astronauts Schmitt and Cernan of Apollo 17 departed the Moon's surface , their lunar excursion module, Challenger , was left behind. Attached to Challenger was a plaque, which read: "Here Man completed his first exploration of the Moon, December 1972 A.D. May the spirit of peace in which we came be reflected in the lives of all mankind" (Rumerman, 1998: 25).

Apollo 1

Astronauts Lt. Col. Virgil Grissom, Lt. Col. Edward White, and Lt. Cdr. Roger Chaffee were the primary flight crew for the first piloted Apollo mission designated AS-204. During a ground test on January 27, 1967 at Launch Complex 34 at the Kennedy Space Center, the Apollo spacecraft's hatch was sealed and the pure oxygen interior was pressurized to 16.7 pounds per square inch (NASA, Report of Apollo 204 Revie Board, April 1967), per the approved NASA test procedure.

At 6:31:04.7 p.m. Eastern Standard Time (EST), one of the Apollo 1 crewmembers reported that there was a fire in the command module. At 6:31:19 p.m. EST, the command module ruptured due to high temperature and pressure. At 6:31:22.4 p.m. EST, all communication and telemetry between the command module and mission control terminated.

Upon noticing the fire, the crew attempted to extricate themselves from the command module using standard operating procedures. However, the three-part hatch was designed to preclude accidental activation in space, so it took approximately ninety seconds to open. While the crew attempted to open the hatch, the fire was accelerated and intensified by a large amount of flammable materials (e.g. Velcro, netting) in the spacecraft raising not only the temperature, but the pressure as well. The astronauts died of asphyxiation. Within seconds, an external seam of the capsule ruptured sending flames, gas, and debris into the adjoining service structure area. As Dr. Bob Seamans would later comment, it was a miracle that the command module's escape rocket did not detonate. For if it had, it would have killed scores of technicians and destroyed the launch complex and, possibly, the Apollo program (Seamans, 1996: 143). At 12:30 a.m., January 28, 1967, the crew of Apollo 1 was removed from the charred command module.

The first press announcement was issued at 7:30 p.m. on January 27. It simply said:

> *There has been an accidental fire at Launch Complex 34. There is fatality. More will be announced after next-of-kin are notified. The prime crew was in the spacecraft* (A/S 204 Release #1, January 27, 1967).

Shortly after receiving the shocking news, Deputy Administrator of NASA, Dr. Robert Seamans, began laying the groundwork for the establishment of the Apollo 204 Revie Board to investigate the accident.

The U.S. Space Transportation System (STS)

America overcame the disaster of Apollo 1 and conducted twelve manned Apollo missions. On July 20, 1969, Neil Armstrong set foot on the lunar surface. However, as the Apollo lunar exploration program was still in development, NASA began studying the concept of a reusable space vehicle. In February 1967, the President's Science Advisory Committee recommended that a study be commissioned to consider the concept. In September 1969, a Space Task Group convened under the chairmanship of Vice President Ford to assess the alternatives for the U.S.' continued presence in space. After reviewing the options, President Nixon made it clear that the U.S. was not going to continue with the exorbitantly expensive Apollo Space Program. The idea of a reusable shuttle conveyed two benefits: 1. It would be inherently cheaper than the Apollo Program, and 2. It would permit him to defer a decision on a Space Station until the Space Shuttle was developed (Rogers Commission, Report 1, Chapter 1, p.3).

In 1974, Rockwell International (formerly North American Aviation) was contracted by NASA to build a prototype shuttle vehicle. Thousands of *Star Trek* fans wrote NASA and President Ford petitioning him to name the first shuttle *Enterprise*, after the venerable spacecraft in the television series; President Ford so named it in 1976. Following its test program, Enterprise was retired to Dulles Airport where the Smithsonian will be built a museum around it.

NASA subsequently built three operational space shuttle vehicles: *Columbia*, Challenger, and *Discovery*. The essential premise of the shuttle program was that the vehicle and solid rocket boosters launch system would be reusable. When the main engines, which are fed a mixture of liquid oxygen and hydrogen, and the solid rocket motors are ignited, they generate seven million pounds of thrust. After two minutes of flight and reaching an altitude of thirty-one miles, the solid rocket motors are jettisoned and recovered by waiting ships. The main fuel tank continues to supply the shuttle's three engines for approximately five minutes, then it too is jettisoned, but not recovered (Launius, 1994: 112).

Figure 8: Shuttle Launch

The space shuttle program promised U.S. government agencies, satellite manufacturers, research agencies, academic institutions, and other users with an unprecedented degree of access to space. It appeared that the dream possessing the means to insert payloads into orbit and to conduct experiments in space at a reasonable cost was becoming a reality.

As Space Transportation System (STS) mission 51L was on the launch pad, the vision of rapid processing of shuttle vehicles, inexpensive launch costs, and routinized access to space were falling far short of the goal. In the fifty-two months since the first operational shuttle mission, NASA had only twenty-four flights to show for the billions of dollars that had been spent developing and building the Space Transportation System. NASA had sold the space shuttle program to the Administration and to Congress with the idea that NASA would be able to turn the shuttle around in a matter of days and return it to space, thereby generating sufficient revenue to make it a self-sufficient financial venture. However, instead of twenty-five flights a year, NASA had produced only twenty-four flights in approximately 4 ½ years. The pressure to launch more shuttle missions was becoming intense.

NASA's Chief Historian, Dr. Roger Launius, writes:

> *While the system was reusable, its complexity, coupled with the ever-present rigors of flying in an aerospace environment, meant that the turnaround time between flights was several months instead of several days* (1994: 114).

Government and commercial users were exerting pressure because of delayed launches due to system malfunctions and other safety related factors. Flight schedules continued to slip and the launch manifests began to compress and overlap. Launch sequencing numbers became confusing because a latter numbered flight would launch before an earlier numbered mission (i.e. STS-20 launched before STS-19). Thousands of unbudgeted and unforecasted man-hours and millions of dollars in replacement parts were required to keep the three orbiter vehicles in operational condition. Advocates of the program were at a loss to prove that the program met expectations concerning cost effectiveness and reliability. As Romzek and Dubnick (1987) point out, these bureaucratic expectations and political accountabilities proved to be distractions to NASA's management. Because of NASA management's attempts to respond to these institutional demands, they began to overlook and even violate their time-honored rules concerning the safety of manned space flight in an attempt to increase their launch rates.

On April 23, 1986, the New York Times reported that the NASA Inspector General, the General Accounting Office (GAO), and Department of Defense's Defense Contract Audit Agency (DCAA) had conducted a comprehensive audit of NASA and its Centers discovering that billions of dollars had been wasted on poor contracts administrati on and other inefficiencies in the development of the Space Transportation System (STS). While not in the scope of this study to delve into the details of this audit, it referenced a GAO report that had been conducted that compared STS costs that NASA had originally estimated in June 1976 for STS operations with current estimates. A GAO report was found in NASA's archives that addressed this issue. GAO published a study (MASA-82-15) that looked into the projected operational costs of the STS progra based on revised shuttle utilization rates (e.g. rocket boosters from $3.55 million to $6.98 million; external fuel tank from $3.04 million to $6.22 million). The report was sent to the President of the Senate and the Speaker of the House of Representatives o n February 23, 1982 for their deliberations on NASA's Fiscal Year 1983 budget. Even at this point in the life of the shuttle program, NASA planners were being faced with economies of scale that they have not been faced with in prior NASA programs. They saw that as shuttle launches decreased, fixed overhead costs increased and the prices of the expendables (e.g. rocket motors) also increased.

To further this point, Texas A&M University's Department of Philosophy and Department of Mechanical Engineering received a National Science Foundation grant to examine the Challenger accident. The author (unnamed) indicates that there may have been other reasons that were prompting NASA to undertake an ambitious launch schedule. If one recalls that the shuttle's principal mission is to insert payloads into Low Earth Orbit (LEO), many in the U.S., Europe, and elsewhere were asking why an expensive and complex manned vehicle was necessary when the costs of unmanned launch systems were expected to drop dramatically in the near future. For instance, the European Space Agency (ESA) was posturing themselves as competitors in the international launch market. ESA was forcing NASA to think in an entirely new and different way--competitively. NASA was challenged to reinvent its image from a space exploration institution to space transportation. The Administration, Congress, and the American people were looking at the "bottom line" and they were not pleased at what they saw. NASA was in the "red." If NASA wanted to not only maintain its shuttle program, but also to leverage off of it for a subsequent orbiter replacement program, it had to increase the shuttle launch rate.

Challenger

As the Challenger (OV-099) sat on launch pad 39-B in January 1986 at the Kennedy Space Flight Center in Florida, NASA's leadership was attempting to understand the nature and meaning of these new competitive pressures, which were foreign to a research and development organization. According to an official NASA mission objective statements, STS-51L mission was to deploy a Tracking Data Relay Satellite-2 and fly a sensor module to study the tail of Halley's comet, in addition to a number of experiments (NASA, 1988). STS-51L was unique for it was to be the first shuttle mission in which a schoolteacher from the *Teacher-in-Space Project* (TISP) would be aboard. Her mission was to teach the children of the world about the wonders of science.

Challenger's crew consisted of Frances Scobee (Commander), Michael Smith (Pilot), Judy Resnik (Mission Specialist 1), Ellison Onizuka (Mission Specialist 2), Ronald McNair (Mission Specialist 3), Gregory Jarvis (Payload Specialist 1), and Christa McAuliffe (Payload Specialist 2/TISP). Gregory Jarvis, a Hughes engineer, and Christa McAuliffe, the TISP teacher, were not rated astronauts.

NASA's launch schedule called for STS-51L to be the first shuttle mission in 1986, which was becoming known as the *Teacher- in-Space* mission (Vaughn, 1996: 1). NASA mission documents chronicle the sequence of events that slipped the original launch time and date from a warm January afternoon to a cold morning a few days latter.

Challenger was initially scheduled to liftoff at 3:43 p.m. on January 22. However, because mission STS-61C was experiencing delays, the launch window was slipped to January 24. Because the transoceanic abort-landing site in Dakar, Senegal was experiencing inclimate weather, the Challenger launch was further delayed until January 25. Due to the continued bad weather in Senegal, NASA decided to use their emergency-landing site at Casablanca. Because Casablanca was not equipped for night landings, Challenger's launch time was moved to a morning launch. Based on the time required to calculate the ne flight plan, STS-51L was slated to take-off at 9:37 a.m. on January 27. Unfortunately, a piece of shuttle servicing equipment could not be detached fro the shuttle, so they were required to delay the launch until the equipment could be removed. When it was detached, crosswinds exceeded the return-to-launch site parameters at the Kennedy Space Center's Shuttle Landing Facility. The launch was rescheduled for January 28 at 9:37 a.m. As they were preparing for the 9:37 a.m. launch, they experienced another delay due to a faulty piece of monitoring equipment. Finally, Challenger was ready for launch at 11:38 a.m. The temperature was below 32 degrees Fahrenheit.

The accounts of the teleconference between NASA and Morton Thiokol, the booster rocket motor manufacturer, the night before the Challenger launch have been widely reported. Nevertheless, a review of the causal factors for the meeting and the meeting itself are essential in order to appreciate how the blame attribution process focused on some of those who participated in the teleconference. The authoritative source for this teleconference is Volume 4 and 5 of the Report of the Presidential Commission on the Space Shuttle Challenger Accident (hereinafter referred to as the Rogers Commission), which this research project relied upon.

Knowing that the temperature was going to be below 32 degrees, Larry Wear, NASA's booster rocker manager, called Alan McDonald, Director of the Solid Rocket Motors Project, Morton Thiokol, to express his concern about the weather given his knowledge of the problem with O-rings in cold weather. McDonald called his engineers together at their Utah facility and requested that they provide him with an engineering assessment of the O-ring and resultant booster performance in the forecasted cold weather.[1] Since 1977, they had known that they had a joint rotation problem in the booster rocket case. After examining the rocket boosters in the second operation shuttle flight in November 1981, they also knew that their O-rings were experiencing erosion, which would permit the hot propellant gases to through the case. Morton Thiokol had expressed their

[1] The purpose of the O-rings is to preclude hot exhaust gases from escaping outside o the rocket motor case. During assembly at Kennedy Space Center, a heat resistant putty is placed on the inner section of the joint to prevent the gases fro burning through the O-ring. There is also some discrepancy as whether McDonald or Eberling called the meeting.

concerns to NASA about launches below 53 degrees since that was lowest temperature in which the O-rings had been flown. This was also the lowest launch temperature at which they could not prove that it was safe to launch.

Thiokol engineers Roger Boisjoly and Arnold Thompson, who had been on record concerning their reservations about subjecting the boosters to cold weather launch conditions, were invited by McDonald to attend a teleconference with NASA to discuss the issue. Actually, there were two teleconferences between NASA and Morton Thiokol. The first teleconference occurred at 5:45 p.m. (EST) on January 27 at which time Morton Thiokol expressed concern about the performance of the SRB's O-rings in low temperature; Morton Thiokol recommended delaying the launch until noon on January 28. A second teleconference convened at 8:45 p.m. and it was during this teleconference that Morton Thiokol changed its position and recommended launch (Rogers Commission Report to the President, Ch. V, pp. 104-111).
Of the sixteen NASA and eighteen Morton Thiokol participants in the second teleconference, the following are the principal actors:

<u>Morton Thiokol</u>

- Jerald Mason – Senior Vice President, Wasatch Operations
- Calvin Wiggins – Vice President and General Manager, Space Division
- Joe Kilminster – Vice President, Shuttle Project
- Bob Lund – Vice President, Engineering

- Allan McDonald – Director, Solid Rocket Motors Project
- Robert Eberling – Manager, SRM Igniter and Final Assembly
- Roger Boisjoly – Engineer, Structures Section and member of the Seal Task Force
- Arnold Thompson – Supervisor, Structures Section

Marshall Space Flight Center

- Larry Mulloy, Solid Rocket Motor Project Manager
- George Hardy, Deputy Director of Science and Engineering
- Stanley Reinartz, Manager, Shuttle Projects Office
- Judson Lovingood, Deputy Manager, Shuttle Projects Office
- Lawrence Wear, Manager, SRM Projects Office

It was during the second teleconference that Bob Lund from Morton Thiokol presented the company's assessment, which stated that the temperatures anticipated at launch time were outside of their database; he recommended that the launch be delayed until the temperature was at least 53 degrees Fahrenheit. Marshall Space Flight Center managers challenged Morton Thiokol on their interpretation of the data. Mulloy (sarcastically) suggested to Lund that what Morton Thiokol was attempting to establish a new Launch Commit Criteria (LCC) on the eve of the launch. The Commission recorded his comment as "My God, Thiokol, when do you want me to launch, next April?" (Rogers Commission, Vol.

IV: 822). Hardy stated that he was appalled at Thiokol's recommendation (Rogers Commission, Vol. IV: 673,717; also Vol. V: 24-26).

The Rogers Commission and the congressional hearings would point out that a culture change was clearly evident during the exchange between NASA and Morton Thiokol. The facts of the case are compelling that NASA did change group practices the night before the Challenger launch during the teleconference. The normal NASA prelaunch determination process was changed from "tell me why we should launch" to "tell me why we shouldn't launch." As Heimann (1993) points out, the norm during the preflight readiness review was that if any of NASA's manned space flight centers (i.e. Kennedy, Marshall, Johnson) reported that they were not ready to fly, the launch was aborted. However, Vaughn (1996), who provides a comprehensive examination of the Challenger accident, provides insight into a transformed launch decision structure that were evidenced during the evening teleconference between the NASA centers and Morton Thiokol on January 27:

> *'Shifting the burden of proof' was perceived by the engineers as a deviation from normal practice…the Presidential Commission's report describes procedural irregularities by Marshall managers as a contributing cause of the accident* (1996: 339).

The teleconference was placed on "mute" and the three locations caucused. Thiokol's Jerald Mason set the tone of their meeting by challenging his group that a *management* decision had to be made. With this statement, he excluded Boisjoly and Thompson from the discussion. Repeatedly Boisjoly and Thompson attempted to convey the technical reasons why the launch should be postponed because of the high probability that they would experience a hot-gas blo -by (i.e. hot gas break through the seals before they could seat). There was no response from management, so they returned to their seats. Mason told Lund to "...take off his engineering hat and put on his management hat" (Boisjoly notes in Rogers Commission, Vol. IV: 680). Eventually, all four of Morton Thiokol's managers agreed to reverse their position and recommend a launch of STS-51L.

Morton Thiokol's Kilminster wrote out a new recommendation and then went back on-line. Kilminster told NASA that the cold weather remained a concern, but revealed that their data was inconclusive and offered an *engineering* assessment that a launch was recommended. Boisjoly and Thompson refused to sign the message. NASA ordered the launch and Bob Eberling invited his daughter to come to his office the next day and watch "...a super colossal disaster" unfold on live television (Hoversten, Edmonds, and El Nasser, 1996).

At 11:38 a.m. on January 28, 1986, the Challenger's engines roared to life and the vehicle began a slow ascent. From between .678 seconds and 2.5 seconds, camera evidence clearly showed nine puffs of dark smoke coming from the aft joints of the right motor suggesting that grease, joint insulation, and the rubber O-rings were being burned by the propellant gases. At 59.262 seconds into the ascent, a flame was clearly visible and telemetry noticed a marked reduction in the right booster's chamber pressure; there was a pronounced leak.

As the flame grew, aerodynamic forces directed the plume onto the external tank. At 64.6 seconds, there was evidence that the flame penetrated the external tank and was mixing with leaking liquid hydrogen. At 72 seconds, the lower strut attaching the right solid rocket motor and the external tank was severed. At 73.12 seconds, a large white vapor pattern formed from the side of the external tank as it was failing structurally. The rocket motor hit the ex ternal tank rupturing not only the hydrogen tank, but the oxygen tank as well. The bottom of the external tank failed and, within milliseconds, a huge explosion occurred. The solid rocket motors continued flying in unguided trajectories until the USAF safety officer destroyed them. At this point, Challenger 's velocity was approaching Mach 2 and had reached an altitude of 46,000 feet.

During this catastrophic sequence of events, the Challenger cabin emerged fro the fireball having been torn from the rest of shattered shuttle vehicle. The cabin continued its trajectory until it reached an apogee of 65,000 feet and it then began its descent to the Atlantic Ocean. The Rogers Commission maintained that all crewmembers survived the explosion and some may have been conscious when the cabin disintegrated as it hit the ocean at a velocity of 207 miles per hour.

<u>Comparison of Apollo 1 and Challenger Accidents</u>

In preparation for reviewing the results of the Apollo 1 and Challenger case studies, the following table may be a useful tool in placing these accidents in an historical and political context. This table provides additional insights about the two disasters that occurred to the same agency, but were separated by nineteen years of success and scientific achievement.

	Apollo 1 January 27, 1967	Challenger January 28, 1986
President	Democrat	Republican
House	Democrat	Democrat
Senate	Democrat	Republican
Investigation	Internal NASA	External/Presidential Commission
NASA Administrator	Webb-Strong Public Administrator	Beggs-Under Investigation/Graham (Acting)-No NASA Experience
Investigation Duration	67 days	120 days
Cause of Disaster	Short in wire in pure oxygen environment caused fire in command module	Primary and secondary O-ring in SRB failed due to cold weather; shuttle broke up
Fatalities	3 astronauts	5 astronauts; 1 industry scientist; 1 school teacher
House Hearings	11	10
Senate Hearings	2	3

Table 1: General Comparison of Apollo 1 and Challenger Disasters

CHAPTER V
Results of the Apollo 1 Case Study

This chapter will examine the results of the Apollo 1 case study using the triangulation methodology described in Chapter III (Research Design).

Apollo 1 Pre and Post Disaster Space Policy Subsystem

In the case of the space policy subsystem existent prior to the Apollo 1 fire, twenty-two congressional hearings were examined to ascertain the actors, who were called to testify. The following graphic illustrates the actors that participated in those hearings:

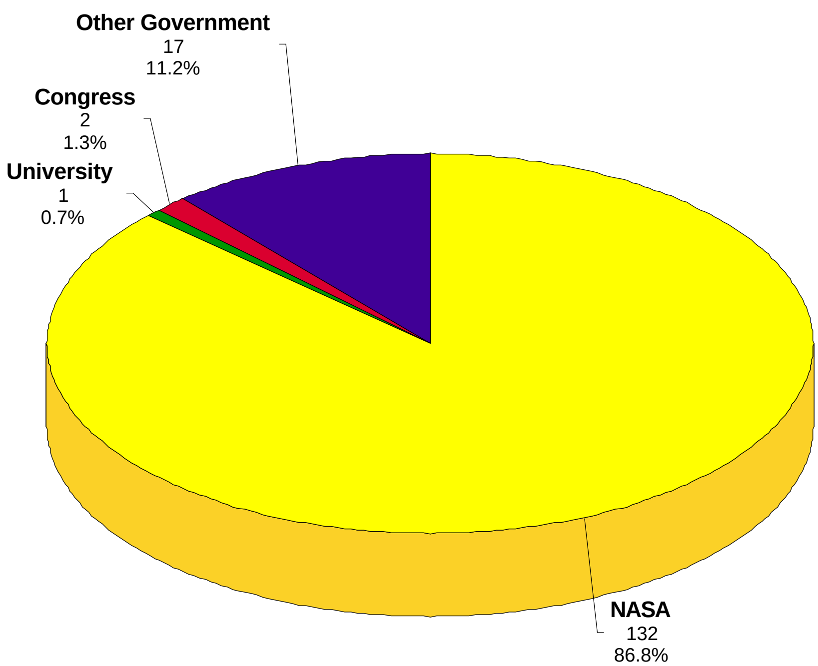

Figure 9: Pre-Apollo 1 Fire Space Policy Subsystem Actors

As can be deduced from this graphic, the majority of those who were called to testify before Congress were NASA employees. The *Other Government* actors were from the Atomic Energy Commission (n=8), National Weather Service (n=2) and Department of Defense (n=7). It can be presumed that although the aerospace industry did not testify before Congress, their ''interests'' in the space policy subsystem were represented by NASA. Evidence of this is seen in NASA's use of and entering into the public record briefings and materials generated by the various Apollo contractors (e.g. North American Aviation, Northrop Grumman) to explain to the Congressional members and staffs the Apollo program and its status.

In the post-Apollo 1 disaster timeframe, the methodology employed to identify the actors were drawn from the media accounts of the events that occurred within the post-disaster issue cycle, which in the case of Apollo 1 was twenty-one weeks beginning during the week of January 23, 1967 and ending effectively during the week of June 19, 1967. For the purpose of this research, the post-disaster issue cycle is defined as the period of time from when the disaster occurred until the issue intensity, as reflected in the media articles that were in NASA's archives, diminished to near zero. As will be shown in the graphical representation of the Apollo 1 data, the media reliably reflected the issue intensity, which was correlated to congressional hearings and the release of reports by NASA and the Apollo 204 Review Board.

The actors represented in the media during post-Apollo1 issue cycle are noted in the following graphic:

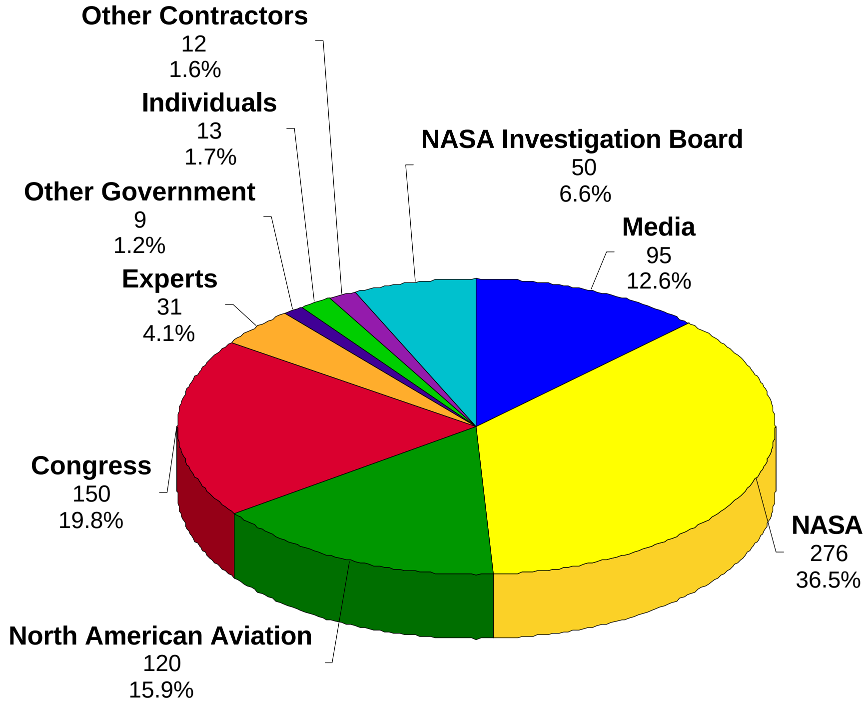

Figure 10: Post-Apollo 1 Actors

The data suggests that the predominant actors in the space policy subsyste during the Apollo 1 issue cycle were NASA (and its investigation board), Congress, the media, and North American Aviation, which supports the assertion that the space policy subsystem transforms from its stable pre-accident state with its restricted membership to a more inclusive configuration, which permits other actors to participate in the space policy subsystem.

If the post-Apollo 1 print media accounts are examined on a time series basis, the number of actors mentioned in the print media by week can be examined:

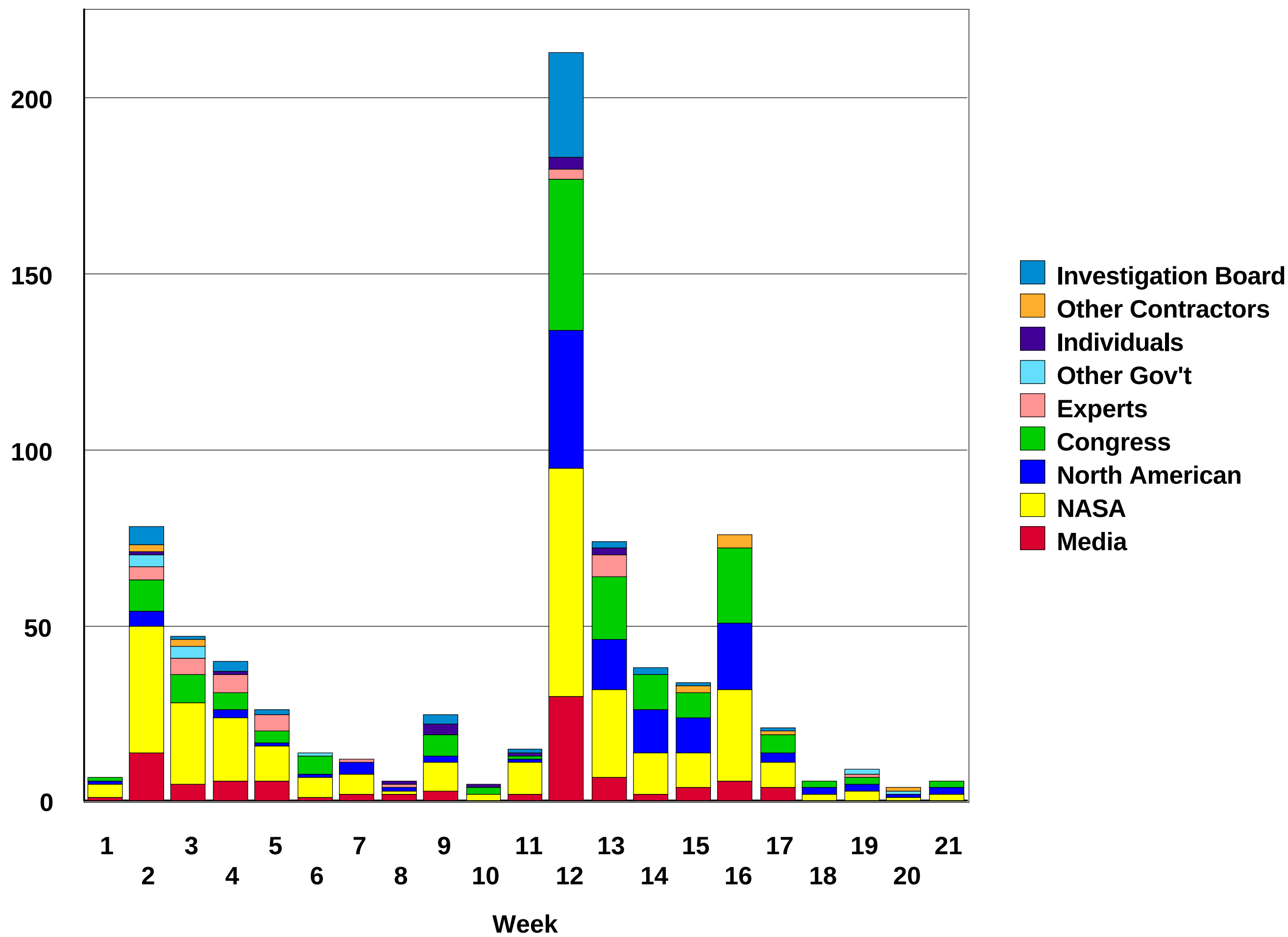

Figure 11: Apollo 1 Actors During Issue Cycle

By arraying the data in time series fashion over the issue cycle, the frequency of an actor's involvement, as noted in the print media articles, can be assessed. In most cases, NASA and its investigation board, Congress, and North American Aviation were the predominant actors. However, it can be noted that the media and other actors also are represented during the issue cycle. For instance, in week 2, there was appreciable actor activity largely attributable to two events:

1. Senator Anderson's questioning of NASA about their use of a 100% oxygen atmosphere during the ground tests.
2. NASA's release of their first interim accident investigation report.

Another ''spike'' in the actor representation data is evidenced in week 12 , which was in response to a number of congressional and agency events:

1. The release of NASA's Apollo 204 Accident Investigation Report. NASA's refusal to release the Phillips Report.
2. The beginning of hearings before the House Committee on Science and Astronautics.

If the actors in the week 12 column of data are examined, the pre -accident policy subsystem actors (e.g. Congress, NASA, industry) are joined by the media and a few other actors to form the post-accident space policy subsystem.

As will be noted in the discussion of the results of the Apollo 1 case study, week 12 was an active period in the post-disaster period and important in the process of blame attribution. The media already sensed that because the formal Revie Board's report did not attribute blame to an individual, NASA would identify a scapegoat to serve that purpose. To illustrate this point, a national aerospace magazine wrote:

> *The review board's bitterest indictment is focused on the total inability of any Apollo technical management personnel to appreciate the gravity of the fire hazards involved before the fatal test. NASA will no doubt offer some sacrificial lamb on this score to propitiate public opinion* (Aviation Week & Space Technology, April 17, 1967).

Media Artifacts: Characterization of NASA During Apollo 1 Issue Cycle

One of the first questions that came to mind in structuring the research questions for the Apollo 1 case study was that of the media's treatment of NASA in their reporting of events following the fire. As explained in Chapter III (Research Design), a qualitative analysis was undertaken in which each print media arti fact in NASA's archives (n=325) was read and given a rating of 3 (favorable), 2 (neutral), or 1 (negative). The results of this analysis are as follows :

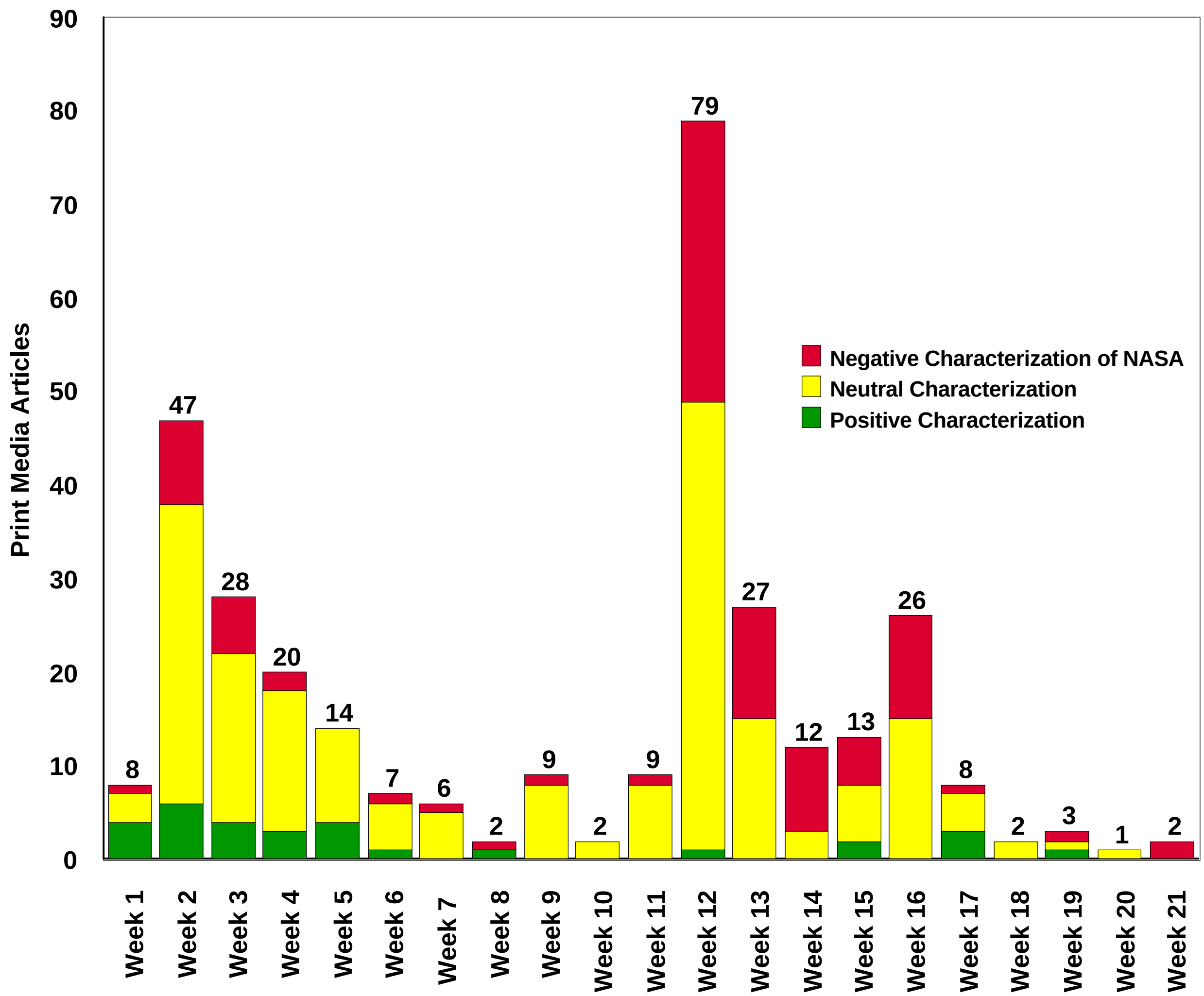

Figure 12: Media Characterization of NASA During Issue Cycle

As can be seen in this chart, the overall characterization of NASA by the media was neutral:

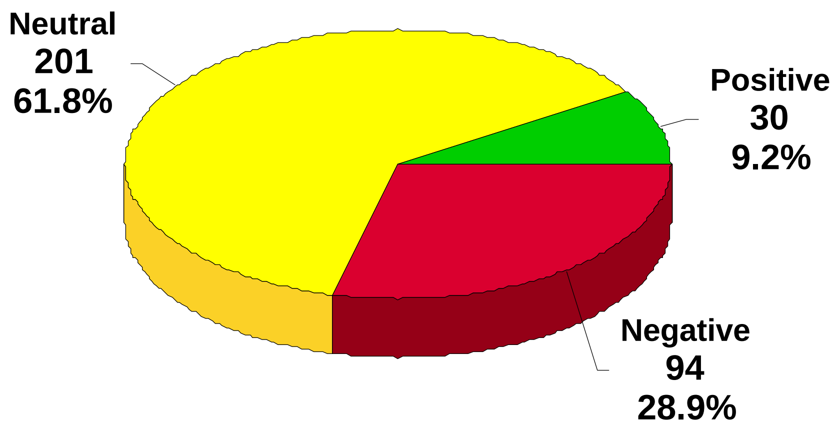

Figure 13: Overall Media Characterization of NASA

Although over 70% of the articles were either neutral or positive, the negative trend that emerged following the release of the report at the end of week 11 by the Apollo 204 Review Board must not be overlooked. The media's coverage of the report began at the beginning of week 12, as did the commencement of the congressional investigation. During the period of week 12 to week 16, the media's characterization of NASA was the most negative:

- Week 12 (n=79): 38% of all articles published were negative
- Week 13 (n=27): 44.4% negative
- Week 14 (n=12): 75% negative
- Week 15 (n=13): 38.5% negative

- Week 16 (n=26): 42.3% negative

Media Artifacts: An Analysis of Blame Rhetoric

Based on the methodology outlined in Chapter III (Research Design), the following data is the product of a qualitative assessment of the media artifacts (n=325) relative to blame rhetoric during the Apollo 1 issue cycle using the content analysis methodology . From a macro perspective, the following chart illustrates the essential distribution of the rhetoric index values from the print media articles written during the Apollo 1 issue cycle:

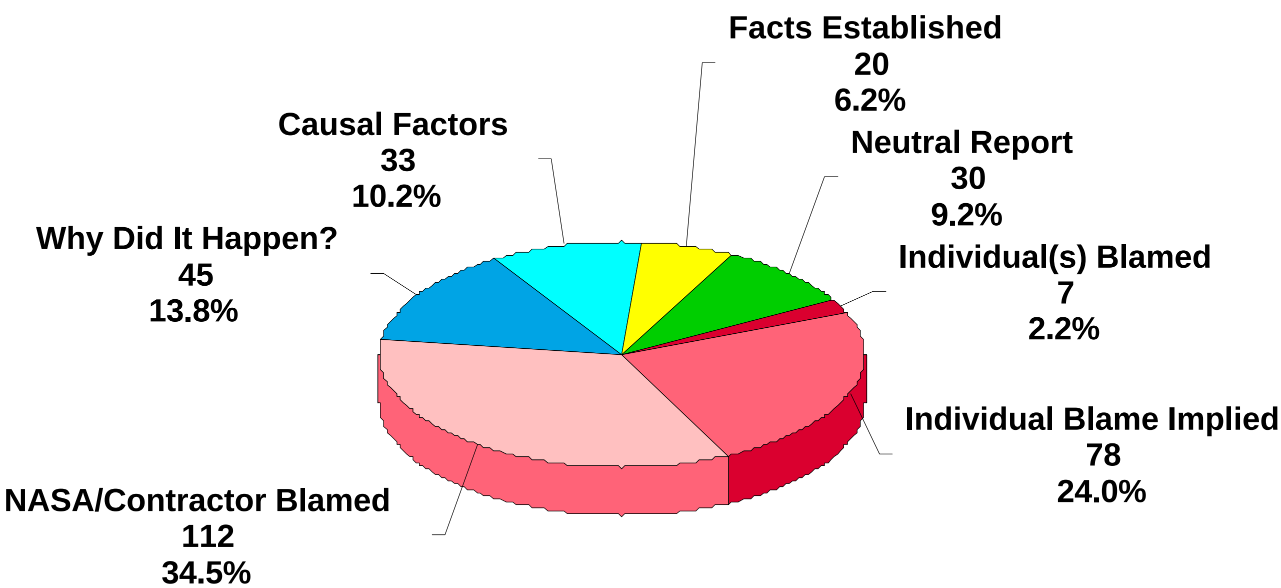

Figure 14: Distribution of Blame Rhetoric

The blame index category of the ***Neutral Report*** were those articles that were more sympathetic in tone and content or affirming of NASA's mission and vision. For instance, in the second week, Time magazine published an article in which they quoted Virgil Grissom as saying that ''If we die, we want people to accept it…The conquest of space is worth the risk of life'' (Time, February 3, 1967) .

In the next level of rhetoric, ***Facts Established***, the media reflects the facts of the event that have been generated by the government agency or other official sources. The text of the articles are devoid of blame attribution language (e.g. responsibility, accountability), however the artifacts address the question of "what happened?". The following article illustrates this category of rhetoric classification : ''The first report of a review board on the death of three Apollo astronauts is be given today to Robert C. Seamans, Jr., Associate Administrator…'' (Washington Post, February 2, 1967).

The category of articles termed ***Causal Factors*** are those articles that examine the issues of how the disastrous event occurred. In the case of Apollo1, the following excerpt exemplifies this category in the blame rhetoric index: "The flash fire that killed three Apollo astronauts will bring about a major overhaul of the life support system that feeds pure oxygen into the Apollo living quarters'' (Washington Post, February 4, 1967).

The next level of blame rhetoric that informs understanding of how the language of blame evolved during the post-disaster issue cycle are those articles that ask ***'Why?*** The context of this category is ''Why didn't NASA know;'' ''If they knew, why didn't they correct the problem?'' This form of rhetoric was used in many of the editorials that were written as more information became known, especially concerning the dangers of using a pure oxygen atmosphere in the command module during ground tests. The following excerpt captures the sense of this category in the blame rhetoric index:

> *…its underestimation of the fire risk was a basic factor in the death of three Apollo astronauts…Why was the risk underestimated ?…Why, as a matter of sound safety practice, were there no emergency procedures set up for the launch pad test?* (New Haven Register, March 5, 1967)

In Figure 14, the data suggests that in approximately 60% of the media artifacts the blame rhetoric was evident at some level (i.e. institutional, implied individual, specified individual). In the case of the ***NASA/Contractor Blamed*** category, the following excerpt was taken from an article that was written in the twelfth week after the Apollo 204 Review Board report was released. This article is representative of the blame rhetoric that was employed at the organizational level:

> *The week began with the National Aeronautics and Space Administration and it principal Apollo spacecraft contractor, North American Aviation, Inc., each volunteering to take some of the blame in what seemed to be an effort to stand together in the face of trouble…But as both committees pressed for difficult answers…the agency and the company seemed more willing to blame the other…each partner is now reaching into the filing cabinets for carefully preserved records that would tend to absolve itself and shift the blame to the other* (New York Times, April 13, 1967).

NASA Administrator James Webb attempted to maintain the focus of the blame at the organizational level. His strategy appeared to be one of directing the blame at NASA, thereby deflecting the establishment of individual blame. His theme was NASA is to blame, chastise us, let us correct the deficiencies, and let us proceed with the lunar exploration mission. This strategy was evidenced in Webb's testimony before Congress following the release of the Apollo 204 Review Board's report:

> *We will take our part of the blame for what we have done or left undone, but I believe this Committee can have confidence that NASA and its contractors have the capability to overcome every deficiency required to proceed and successfully fly the Apollo…* (New York Times, April 11, 1967).

In the fifth category in the blame rhetoric index*,* ***Individual Blame Implied***, the blame dynamic unfolds. The "what," "how," and "why" questions have been addressed and now the "who" is the focus. The media and Congress heard NASA Administrator Jim Webb's words insisting that the blame should be laid upon NASA and North American Aviation, but the Congress and the media believed that *someone* should be held accountable. This level of rhetoric had strong political overtones because it appeared that those who spoke the words of blame were serving notice to NASA and North American Aviation that if they did not produce the guilty parties, the Congress or the media would. The following editorial was written following the release of the report:

> *Although the Board did not fix the precise cause of the fire, and named no persons or group as being responsible, it laid a heavy burden of negligence and poor workmanship on many…That inquiry in Congress will go ahead. Perhaps it will not be content with blame so generally spread* (Evening Bulletin, April 11, 1967).

And in another article,

> *The subcommittee's official title is that of "oversight —that is, its mandate is to ride herd on this enormously costly and sometimes controversial space agency. It can be counted upon to search diligently for a scapegoat, some individual, some group, some flaw that sent astronauts Gus Grissom, Ed White, and Roger Chaffee to their gruesome deaths* (Wall Street Journal, April 10, 1967).

In the last category, ***Individual Blamed,*** the Birmingham News on March 25, 1967 summed up in the article's title what everyone was probably asking: ''Apollo Disaster: Who is at fault ?'' Prior to the release of the Apollo 204 Review Board report, NASA announced on April 5 (week 11) that it was replacing their Apollo Program Manager, Dr. Joseph Shea. The press interpreted Dr. Shea's transfer as NASA's offering to the public of the person responsible for the Apollo 1 fire:

> *Dr. Shea is being replaced by George M. Low…Space agency officials conceded that the change was ''accident-related,'' but denied that it involved any intention to fix the blame for the fire that killed three astronauts…*(New York Times, April 6, 1967).

In another article, the newspaper stated that ''…many insiders viewed the transfer as a kick upstairs preparatory to 'sacrificing' Dr. Shea in expiation of the Apollo tragedy'' (Evening Star, April 12, 1967). Dr. Shea resigned from NASA on July 24, 1967 to become a Vice President at the Polaroid Corporation.

Following the replacement of Dr. Shea, two subsequent events shaped ''management changes'' by NASA's primary Apollo spacecraft contractor, North American Aviation. The Apollo 204 Review Board report was critical of the workmanship and quality control at North American Aviation. During week 14, Congressman Ryan released the Phillips Report, which he had promised Webb that he would do if NASA did not release it. This report, which was really the results of a regular inspection or audit by MG Sam Phillips of the Apollo contractor, was critical of North American Aviation. Senator Mondale had heard about the report and had requested a copy from NASA. Both NASA and North American Aviation disavowed knowledge of a *report*. During week 12, NASA acknowledged that the Phillips report existed, but refused to give a copy to Congress. The press began expressing their displeasure with NASA by using terms such as ''cover-up.'' In one editorial, the issue of a NASA cover-up was raised with implications that extended to Webb himself:

> *Since the Apollo tragedy, the National Aeronautics and Space Administration has been touchy about releasing the full text of the Phillips Report…This sensitivity has led to widespread suspicion—still to be proven unjustified—that somebody was trying to cover-up…Neither the NASA administrator nor the officers and shareholders of North American are being asked to fly the Apollo spacecraft in space…NASA should not be allowed to get away with any attempt to bulldoze questioners or whitewash itself…*(Christian Science Monitor, May 2, 1967).

This modest digression into topics that will be discussed in the next section is important at this juncture for they shaped North American's reaction to these reports and how the media reported the next installment of ''management changes.''

On May 1, 1967 (week 15), the New York Times wrote:

> *North American Aviation Inc. announced today a major shake-up in the management of the division that has been severely criticized for this work on the Apollo spacecraft in which three astronauts died on Jan. 27* (New York Times, May 2, 1967).

Mr. Harrison Storms, President of the Space and Information Division, and Mr. William Snelling, his Executive Vice President, and two other executives were replaced. The guilty parties had been identified. The American people now had answers to the questions: “What happened?”; “How did it happen?” ; “Why was it allowed to happen?” ; and “Who is responsible?”

Time Series Analysis of the Apollo 1 Blame Rhetoric Data

The following chart reflects the blame rhetoric data arrayed over the Apollo 1 issue cycle:

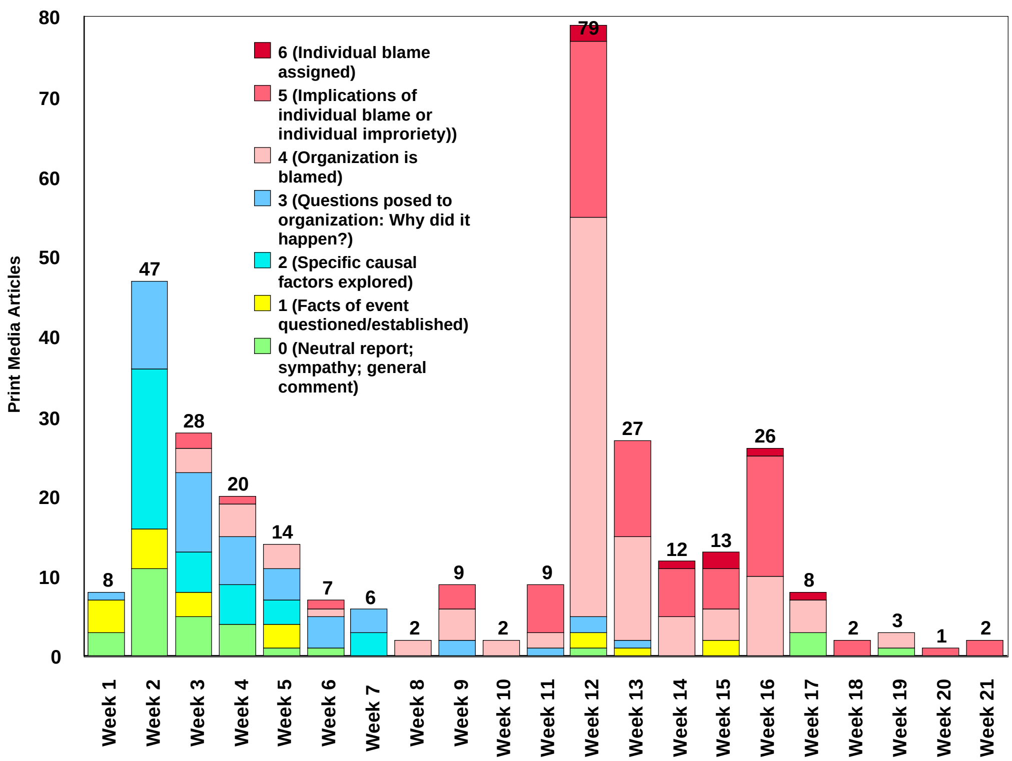

Figure 15: Blame Rhetoric by Week in Issue Cycle

Because the emergence of the language of blame was in response to testimony, reports, or interview comments, the following are some of the events that ‘’drove’’ the blame attribution process:

- **Week 3**: On February 9, Deke Slayton alleged contractor carelessness caused the fire.
- **Week 4**: From testimony that was obtained in closed session, but subsequently released, NASA refuted allegations that they were willing to accept an appreciable amount of risk in order to remain on schedule to place an American on the lunar surface by the end of the decade.
- **Week 5**: Senator Mondale asked Jim Webb for the Phillips Report; Webb maintained that he had not seen it. Inconsistencies and contradictions on the part of NASA began to form.
- **Week 7**: A report was published that NASA had not thought of rehearsing for a potential fire while the astronauts were in the command module.
- **Week 10**: NASA announced that Dr. Joe Shea would be replaced.

  Immediately prior to the release of the final report on April 5, 1967, there was an article that debated whether the Apollo Review Board would blame individuals or the agency:

  > *A final question hangs over the investigation of the fire which killed three Apollo astronauts is whether to blame individuals—or soulless government agencies and corporations…Sources…expect the report to lay the blame primarily on "sins of omission"…presumably someone in NASA signed his name in approval of this document [test plan]…The policy decision for Webb is whether these people or their superiors should be made scapegoats or to spread the blame generally on NASA and its contractors* (Birmingham News, March 25, 1967).

- **Week 11**: Apollo 204 Review Board report released.
- **Week 12**: Press reacted to the report ; NASA refused to release the Phillips Report ; and NASA openly criticized North American Aviation for their workmanship and quality standards.
- **Week 13**: Webb suggested that Congress and NASA share in the blame; Congress declined the offer. Congress alleged that NASA had undertaken a ''snow job'' to protect the guilty individuals.
- **Week 14**: Congressman Ryan (D., New York) released the Phillips Report on April 26.
- **Week 15**: North American Aviation's President of the Space and Information Systems, Harrison Storms, and three other executives are replaced.
- **Week 16**: Senator Margaret Chase Smith confronted Webb on the selection of North American Aviation instead of the Martin Company, whom the source selection board had initially selected as the Apollo prime contractor. Since Webb and his management team selected North American Aviation and it was North American Aviation who was responsible for the Apollo 1 fire, should not Webb and his team also be held accountable?
- **Week 18-20**: Congressional charges of impropriety were leveled against Webb, but he deflected them. Congressman Teague, Chairman of the House Subcommittee on NASA Oversight, said this about Webb, which essentially brought to a close the Apollo 1 issue cycle:

> *I think we are extremely fortunate in having a man of Jim Webb's background, energy, and judgment in this job. He has put together an organization that has accomplished some of the greatest things. This tragedy does not detract from him. In fact, I realize now more what has done* (Business Week, June 1967).

However, as Launius observed, Webb was ''…personally tarred with the disaster…Webb himself never recovered from the stigma of the fire'' (1994: 88).

Apollo 1 Official Records

The methodology by which the blame attribution process was defined within the space policy subsystem was derived from three sources. The data derived fro a qualitative analysis of the media artifacts has been examined, the pro duct of which will be discussed in Chapter VII (Conclusions). The second point in the data triangulation methodology is that of reviewing the official government records. The documents that comprised this assessment were:

- The Phillips Report
- Apollo 204 Review Board Report
- NASA Correspondence
- Hearings Before the Subcommittee on Manned Space Flight of the Committee on Science and Astronautics (Part 1 and 2), House of Representatives (February 28; March 1, 2, 7, 8, 9, 14, 15, 16, 20 and 21, 1967)
- Hearing before the Committee on Aeronautical and Space Sciences (Part 1 and 2), U.S. Senate (February 7 and 27, 1967)

- Towards the Endless Frontier : History of the Committee on Science and Technology, 1959-1979, U.S. House of Representatives

The Phillips Report and the First Session of the Hearings before the Senate's Committee on Aeronautical and Space Sciences

North American Aviation was the prime contractor for the Apollo spacecraft and the Saturn II second stage rocket booster. These two elements of the Apollo Saturn system were critical and the schedule delays that North American Aviation experienced placed the entire Apollo program in a behind schedule condition with its attendant cost overrun. NASA's Apollo Program Director, MG Sam Phillips assembled a team of NASA experts to conduct a survey of North American Aviation's Space and Information Division (S&ID) in December 1965 to determine the cause of the contractor's unacceptable performance. After approximately two weeks of interviews and investigation, MG Phillips wrote a letter to Mr. Lee Atwood, North American Aviation's President.

In his cover letter, MG Phillips informed Mr. Atwood that he was "…definitely not satisfied with the progress and outlook of either program and am convinced that the right actions now can result in substantial improvement of positions in both programs in the relatively near future" (Official Correspondence from MG Phillips to Mr. J. L. Atwood, December 19, 1965). MG Phillips wrote that the conclusions that he and his review team developed were highly critical adding that:

Even with due consideration of hopeful signs, I could not find a substantive basis for confidence in future performance…The gravity of the situation compels me to ask that you let me know, by the end of January if possible, the actions you propose to take.

Lambright (1995) recounts that the Phillips letter to Atwood was toned down appreciably compared to the memorandum that he wrote to Dr. Mueller on December 18, 1965 in which he recommended that Harrison Storms (President of the Space and Information System Division) be removed and replaced with someone who could provide leadership. Phillips noted that Atwood's passive role in the Apollo program was responsible for permitting the poor progra performance to develop (1995: 152).

MG Phillips outlined ten areas in which performance would have to be improved. For detailed treatment of these "recommendations," refer to Appendix D. The significance of MG Phillips' report to Mr. Atwood were both immediate and longer term. In the short term, the effect was North American's acknowledgement that they had management and process problems that had to be corrected or the contract would be let to someone else. However, S&ID management remained in place and they did make progress in correcting the deficiencies that MG Phillips and his team had highlighted. The far term effect was realized on February 27, 1967 when Senator Walter Mondale of the Senate Committee on Aeronautical and Space Sciences asked NASA's Associate Administrator for Manned Space Flight, Dr. George Mueller:

…let me preface this by saying that I have been told, and I would like to have this set straight if I am wrong, that there was a report prepared for

> *NASA by General Phillips, completed in mid or late 1965 which very seriously criticized the operation of the Apollo program for mult -million dollar overruns and for what was regarded as very serious inadequacies in terms of quality control. This report, among other things, was so critical that it recommended the possibility of searching for a second source, and as I am told, recommended Douglas Aircraft…Is there a Phillips Report ?* (Hearings before the Committee on Aeronautical and Space Sciences, United States Senate, 99th Congress, Part 1, February 27, 1967: 125-126).

Dr. Mueller's eventual response was ''I know of no unusual General Phillips report'' (Hearings, Part 1, February 27, 1967: 127). After a discussion about the changes that NASA was considering for the Block II Apollo command module, Dr. Mueller brought up the issue of the Phillips Report with the Chairman of the Committee, Senator Clinton Anderson. Dr. Mueller informed him that General Phillips conducted reviews of all of its contractors on a periodic basis and could not identify the report that Senator Mondale referred (Hearings, Part 1, February 27, 1967: 130-131). Senator Mondale then asked Mr. Jim Webb: ''Could we be supplied with a copy of that February 19 report?" Mr. Webb responded:

> *I would like to take that as a request…and examine it carefully because, obviously, these companies are public companies. What we would be very happy to do is make it available to the Comptroller General…This provides certain measure of control of these reports…I just don't want to say yes until I see the full problem involved in that…*(Hearings, Part 1, February 27, 1967: 131)

It appeared that Senator Mondale did not have the report or he would have known that it was written in December 1965 and not in February. Senator Anderson corrected Senator Mondale and said that it was a November report, so he also had probably not seen it. Regardless of whether they had seen it at this point in the issue cycle, they knew of its existence and possibly the damaging information that it contained. The congressional record suggests that Mr. Webb and Dr. Mueller did not know of its existence as a specific report because NASA regularly conducted audits of its contractors and contractor performance reports were ordinary products of those audits. The record was also supportive of the position that Mr. Webb was protective of his contractors realizing that adverse publicity could effect their stock price and cause his corporate community tremendous financial difficulties and future aversion to bidding NASA programs.

By the time the Phillips report was released by Congressman Ryan on April 26, 1967 (week 14 of the Apollo 1 issue cycle), the Apollo 204 Review Board report had been released for about three weeks. If the graphical data in the previous section is examined, the print media's response to the release of the Phillips report was minimal. One could argue that the American people had been so saturated with Apollo 1 information from the Review Board's report and the media coverage that occurred in week 12 that the impact of the Phillips report was diluted. The findings in the Phillips report were duplicative of what the Review Board found. However, what must be said is that the deficiencies that MG Philips and his team found in December 1965, which allegedly were being addressed by North American Aviation's management, were the same deficiencies that the Review Board found. It is also noteworthy that the week following the release of the Phillips report, North American Aviation announced the replacement of Harrison Storms and three other executives at S&ID.

The final analysis of the Phillips report must be that the quest to obtain the report got more attention than actually obtaining it. Representative Joseph Karth remarked that:

> *I would wager that the Phillips Report got more lines of newspaper space and minutes of television time in two weeks than the economic [benefits] subject has gotten in the last two years or perhaps even the past eight* (New York Times, May 18, 1967).

The impact of the Phillips report had been minimized because NASA had refused to release it to Congress when Senator Mondale had originally asked for it in week 5. Rightly or wrongly, Jim Webb believed that the information in the Phillips report was protected correspondence between an agency and one of its contractors. Webb must have believed that, if he set the precedent to release contractor audit documents to congressional investigators, it would diminish or damage the agency's ability to have a productive relationship with industry, which on occasion requires an adversarial exchange in order to insure that the contractor understands and responds to the agency's requirements. In response to the perception of Webb's protectiveness of NASA and its contractors, one reported quipped: "NASA claims that Congress needs only to know of successes, that failures are an internal matter and are only for NASA and its contractors' eyes" (Birmingham News, May 11, 1967).

Although, Webb personally became the "lightning rod" (Ellis, 1994) for congressional ire with the idea of keeping the blame attribution at the organizational level, he finally accepted the reality that someone in NASA had to carry the mantle of guilt in expiation for the fire. Dr. Joe Shea, as has been discussed, became the offering and this offering was made a week before the Review Board released its report.

Apollo 204 Review Board

On 28 January, Dr. Robert Seamans, Deputy Administrator of NASA, established an eight member Board to investigate the Apollo 1 fire pursuant to NASA policy, which stated that:

> *It is NASA policy to investigate and document the causes of all major mission failures which occur in the conduct of its space and aeronautical activities and to take appropriate corrective actions as a result of the findings and recommendations* (NASA Management Instruction, 8621.1, April 14, 1966).

The Board was chaired by Dr. Floyd Thompson, who was the Director of NASA's Langley Research Center. Also on the board were:

- COL Frank Borman, Astronaut
- Dr. Maxime Faget, Director of Engineering and Development at NASA's Manned Spacecraft Center
- Mr. E. Barton Geer, Associate Chief of Flight Vehicles and Systems Division, Langley Research Center, NASA
- COL Charles Strang, Chief of Missiles and Space Safety Division, Air Force Inspector General, Norton Air Force Base
- Mr. George C. White, Director of Reliability and Quality, Apollo Progra Office, NASA Headquarters

- Mr. John Williams, Director of Spacecraft Operations, at NASA's Kennedy Space Center
- Dr. Robert W. Van Dolah, Research Director for the Explosive Research Center, Bureau of Mines, Department of Interior
- Mr. George Malley, Chief Counsel, Langley Research Center

Their mandate was to:

> *Review the circumstances surrounding the accident to establish the probable cause or causes of the accident, including review of the findings, corrective action, and recommendations being developed by the Program Office, Field Centers, and contractors involved…Consider all other factors relating to the accident, including design, procedures, organization, and management* (Seamans correspondence to the Apollo 204 Review Board, February 3, 1967).

The Board met sixty times between January 28, 1967 and March 31, 1967. On April 5,1967, their final report was submitted to NASA Administrator Ji Webb and on April 9 it was released to the public. Because the Board was populated predominantly by NASA personnel, the media and Congress repeatedly called into question their objectivity and integrity. For instance, one reporter wrote:

> *Allowing the National Aeronautics and Space Administration to continue to investigate itself in last month's Apollo disaster is like turning the Kennedy assassination inquiry over to the Dallas Chamber of Commerce…it is nonsense to allow NASA to investigate itself* (Hines, Evening Star, February 9, 1967).

However, following the release of the final report, the Board was hailed as being objective, fair, and honest for providing the American people with findings and recommendations that cited, among other factors, poor management practices on the part of both NASA and its Apollo prime contractor, North American Aviation.

Apollo 1 Interim Reports

In order to keep the President, Congress, and the American people as informed as possible while the Apollo 204 Review Board conducted its investigation, NASA Administrator Jim Webb tasked Dr. Bob Seamans to provide interi reports on the progress of the Review Board. The interim reports were delivered first to the President, then to Congress, and then to the American people via th e media. Dr. Seamans submitted reports on February 3, February 14, and February 25. While the intention of the interim reports was to inform the American people, they were also meant to let the people know that NASA wanted to get to the truth of what happened. However, as could expected, the media and certain congressional members used the interim reports to fuel the fires of speculation and they began looking for the answers to the questions of "Why?" and "Who?" before they knew the answers to "What?" and "How?". The interim reports provided them with as much information as they needed to get past the "What?" and "How?" questions and begin asking NASA why they did not know that the ground test was hazardous or why did they conduct the test in a spacecraft that had a history of deficiencies. Before these answers could be provided, the media and Congress wanted to know who knew about the test; in other words, who was responsible. The blame game had begun before the final report had been published.

February 3 Interim Report: The gist of the first interim report was that the Review Board still did not know what started the fire. The report stated that in order to conduct a thorough investigation, the Apollo 1 command module had to be demated from the unfueled launch vehicle so it could disassembled and examined. Dr. Seamans included a sequence of events that showed that the astronauts reported a fire, tried to get out, and then died within seconds due to asphyxiation. He noted that there was one sharp cry of pain and then silence. The media "fed" on this imagery for some time. The American people were beginning to understand that the astronauts did not die instantly as NASA had indicated initially; the astronauts experienced second and third degree burns before they died from the smoke and toxic fumes.

February 14 Interim Report: Dr. Seamans' second report addressed the composition of the Review Board and the progress that it was making in mapping the interior of the command module to ascertain the ignition source. He noted that they were investigating how much flammable material was on board and where it was located. The fire inside the command module exhibited directionality in that it appeared to follow a path. Temperatures in the command module varied dependent upon where the oxygen fed flames moved. The temperature varied from 500 degrees to 1,400 degrees Fahrenheit. They believe that the fire lasted for approximately ten seconds.

February 25 Interim Report: The Review Board at this point had developed tentative findings and preliminary recommendations. The Board had over 1,500 personnel from nine government agencies in addition to NASA; thirty-one industrial groups; and several universities participating in the investigation. Based on tests conducted by the investigators, the most likely source of ignition was an electrical short-circuit. The fire began under the seat of Virgil Grisso and traveled up the interior of the command module. The fire fed on the Velcro, nylon netting, and other combustibles. As the temperature increased, so did the pressure. When the interior pressure reached 36 p.s.i., the cabin ruptured. Relative to the risk associated with conducting a ground test in a pure oxygen environment, Seamans wrote:

> *Continued alertness to the possibility of fire had become dulled by previous ground experience and six years of successful manned missions. Ground tests at the pad were classified as especially hazardous only when propellants or pyrotechnics were involved…*(Memorandum from Dr. Robert C. Seamans, Jr. to Mr. James E. Webb, February 25, 1967).

The safety focus was on propellant fires and not on a fire in the command module. The media and congressional members would capitalize on this revelation because NASA should have known that a test in a pressurized, pure oxygen environment was dangerous. As the investigation unfolded, it would become clear that NASA knew that the pure oxygen environment at 16 p.s.i. was extremely volatile, but they never had a problem before so they minimized the risk. This failure on the part of the NASA Apollo program manager to acknowledge the hazardous test condition and for not having appropriate safety measures in place to address a command module fire would later be the rationale to blame Dr. Joe Shea for the fire.

Apollo 204 Review Board Findings, Determinations, and Recommendations

The Apollo 204 Review Board produced eleven findings following their comprehensive review of the accident. For a summary of these findings, determinations, and recommendations of the Apollo 204 Review Board, refer to Appendix E.

In a summary statement, the Board wrote that although they were unable to specifically identify the initiator of the fire, they were able to identify the conditions that caused the fire. These conditions were never addressed by NASA or North American Aviation, because they, when compared to the challenges of flying a spacecraft to the moon, landing on it and then safely returning the crew, were perceived as being mundane:

- A sealed cabin in a pressured oxygen environment
- Extensive use of combustible materials in the command module
- Vulnerable wiring carrying spacecraft power
- Vulnerable plumbing carrying combustible coolant
- Inadequate means for emergency crew escape
- Inadequate rescue and medical capabilities

It is important to note that in the findings, determinations and recommendations the Apollo 204 Review Board refrained from identifying an individual or group of individuals to blame for the fire. In their summary statement about the conditions that caused the fire and how NASA had viewed them as mundane, the Board could have added a sentence that said "…and it was the Program Manager's responsibility to ensure that these mundane issues were adequately accounted for before the test commenced." Nevertheless, no such words appeared anywhere in the report. So concerned was Dr. Thompson about not being involved in blame attribution that in the Preface to the Apollo 204 Review Board report submitted to NASA Administrator Webb Dr. Thompson wrote:

> *The Board is very concerned that its description of the defects in the Apollo Program that led to the condition existing at the time of the Apollo 204 accident will be interpreted as an indictment of the entire space flight program and a castigation of the many people associated with that program. Nothing is further from the Board's intent* (Apollo 204 Revie Board Report, April 5, 1967).

Although the Thompson Board's findings, determinations, and recommendations marked an end of the official NASA investigation, it spelled the beginning of an intensive congressional probe. The congressional inquiry that followed sparked a torrent of blame rhetoric and allegations of malfeasance, impropriety, incompetence and mismanagement, especially by those who wanted to see a relaxation of the lunar exploration program schedule or for those who wanted to see the Apollo program terminated.

Not everyone read the Apollo 204 report with the same sense of searching for the higher causal truths and refraining from engaging the blame attribution process. The dichotomous realities between what the Apollo 204 Review Board thought to be their charter and how the results of their deliberations were interpreted is captured in this editorial published in a national aerospace journal:

> *The review board's bitterest indictment is focused on the total inability of any Apollo technical management personnel to appreciate the gravity of the fire hazards involved before the fatal test. NASA will no doubt offer some sacrificial lamb on this score to propitiate public opinion* (Aviation Week & Space Technology, April 17, 1967).

As Douglas (1995) has pointed out, the act of blaming produces a sense of having solved the problem, which in this case the Review Board stopped short of doing. Therefore, from Douglas' (1995) perspective, the Board's findings and recommendations did not solve the problem because the act of blaming had not occurred. The blaming would then have to be accomplished by someone else.

James Webb attempted to deflect the need to blame an individual by developing a causal story that focused on deflecting the charge that NASA should have known that the ground test was hazardous. On February 25, 1967, Webb provided a statement to a congressional committee in which he recounted a conversation with Astronaut Frank Borman, who was serving on the Revie Board. Borman had told him that there were hazards associated with manned space flight that neither the engineers nor the astronauts understood.

The case could be made in light of Douglas' (1995) assertion that Webb attempted to fabricate a causal story to test the plausibility of suggesting that the ground test oxygen environment problem was unknown. Once NASA understood the problem, they would be able to rectify it and ensure that it would not occur again. However, as the investigation unfolded, it was shown that NASA did understand that the ground test in a pure oxygen environment at 16 p.s.i. was dangerous. Since they had never had an accident during the Mercury and Gemini programs, it was an acceptable risk. If they had accepted the test as a high-risk condition, test procedures would have to have been changed, additional safety systems developed, and the command module design changed. This would have taken time and money, both of which were in short supply.

This was reflected in a remarkable letter from Hilliard Paige, Vice President and General Manager of General Electric's Missile and Space Division, to Dr. Joseph Shea on September 30, 1966. Also remarkable is that this letter never received the publicity that it should have since some have viewed this document as a "smoking gun" (Lambright 1995: 157). The document and related correspondence was found in a sweep of executive files ordered by Webb. Paige warned Shea of the potential hazards of a pure oxygen environment at 5 pounds per square inch, which was the atmosphere of the command module required while in the vacuum of space. Paige wrote:

> *I would like to express my personal concern for the adequacy of currently implemented spacecraft design, fabrication and operations practices relative to the possibility of a fire in an Apollo spacecraft using a 5 psi, 100 percent oxygen atmosphere…I do not think it technically prudent to be*

> *unduly influenced by the ground and flight success history of Mercury and Gemini under a 100 percent oxygen environment. The first fire in a spacecraft may well be fatal…A cabin fire is certainly an unpleasant subject but is better considered now than by the Monday morning quarterbacks should such a misfortune strike the program…* (Personal correspondence from Hilliard Paige to Dr. Joseph Shea, September 30, 1966).

In a handwritten note at the bottom of Dr. Shea's December 5, 1967 response to Mr. Paige, he wrote that "…we think we have enough margin to keep [a] fire fro starting—if one ever does, we do have problems...it's too late to change [the] design…"

As in most "smoking gun" documents, they usually answer the questions "Who knew?" and "When did they know?" However, this document was not discovered until after the investigation was concluded.

Apollo 1 Congressional Investigation

The day after the Apollo 1 fire, Howard Simons of the Houston Chronicle wrote these prophetic words:

> *Congress is certain to react to the fire and NASA's future. The best guess is that those congressmen who have been critical of the nation's space plans all along will use the tragedy to urge a ''go slower'' policy. Similarly, those congressmen who have championed the manned lunar landing w ll urge NASA to move ahead and overcome the troubles…Had the astronauts been lost in space, the national anguish would probably have been greater* (Houston Chronicle, January 29, 1967).

Because NASA is an executive branch agency and it was conducting the investigation of the Apollo1 fire, it was imperative for Congress in their oversight role to also conduct an investigation of the disaster. On January 30, 1967, Congressman George Miller, Chairman of the House Science and Technology Committee assigned Congressman Olin Teague, who was Chairman of the NASA Oversight subcommittee, the responsibility to investigate the Apollo 1 accident. Teague had decided that he would not hold hearings until after the Apollo 204 Review Board had released its report. Teague's decision was quite different from that of Senator Clinton Anderson, Chairman of the Senate Committee on Aeronautical and Space Sciences, who convened hearings on February 7, 1967. This section examines the Apollo 1 hearings of both the House and Senate with the purpose of identifying their role in the blame attribution process.

Hearings Before the Committee on Science and Astronautics, House of Representatives

On February 28, 1967, the Committee convened to discuss with NASA their Fiscal Year 1968 Authorization Bill. In Webb's opening statement, he pledged full cooperation with the Oversight Subcommittee, which would conduct hearings into the Apollo 1 fire following the release of the Board's final report. After a lengthy discussion with the members of the committee about authorization issues, in which there was no mention of Apollo 1 in a substantive way, the Chair recognized Congressman Larry Winn (R-WI). Winn posed the following question to Webb:

> *Mr. Webb, many people in the country are concerned about a possible whitewash by the Board Review, particularly since some of the recent news releases say we may never know the cause of the Apollo accident. I*

> *would wonder if you would care to comment on that, sir?* (Hearing. H.R. 4450, H.R. 6470, March 28, 1967: 33)

What is interesting about this question is that Winn believed that he was speaking for “many people in the country” and his assignment of credibility to the media about their assessment that a cause of the fire may never be found. In response to the question, Webb stated that there were 1,500 people working on the investigation and that Frank Borman, who was an astronaut, would never cover-up problems that could be injurious to himself or his fellow astronauts. Winn returned with a comment that the news media may foster the view that NASA was working “behind the scenes” to promote a cover-up. Webb stated that the investigations were well structured and had strenuous procedures by which the investigators examined the evidence. He affirmed the fact that the investigation needed technical experts to sift through the evidence and not accountants or lawyers. Winn then moved on to other issues. This brief exchange highlighted Webb’s demeanor when faced with contentious issues before a congressional committee.

Hearings before the Subcommittee on Manned Space Flight of the Committee on Science and Astronautics, House of Representatives

This subcommittee met with NASA to discuss the Fiscal Year 1968 Authorization Bill. During the hearing on March 14, the issue of the Apollo 1 fire was broached while Dr. Mueller of NASA was testifying. Congressman Gurney (R-FL) asked him about a report in the <u>Washington Post</u> (March 12, 1967) that alleged that there were 20,000 failures during the testing of the Apollo command module and the launch system. Mueller told him that much of the information that was in the article had been provided to the Senate Space Committee in a closed session, which they in turn released to the media.

In many of the questions that the subcommittee members asked, they derived their information from the print media. Congressman Fuqua (D-FL) asked Mueller about a press report which stated that NASA had debated internally whether they would replace North American Aviation as the Apollo prime contractor. Mueller informed him that North American Aviation had done a credible job, but was experiencing more problems than the other Apollo Saturn program contractors because their tasks were greater and more complex.

Congressman Rouderbush (R-IN) then asked Mueller if another newspaper article was accurate in their story about one of the astronauts expressing pessimism about the safety and reliability of the Apollo. He added that the media account indicated that the astronaut hung a lemon from the command module to make his case. Mueller acknowledged that the crew of Apollo 1 had raised spacecraft quality issues, however the problems had been corrected.

Hearings before the NASA Oversight Subcommittee of the Committee on Science and Astronautics, House of Representatives

On March 22, 1967, in preparation for the Apollo 1 hearings which would convene on April 10, Congressman Olin Teague (D-TX), Chairman of the NASA Oversight Subcommittee, stated in a letter to members of the subcommittee:

> *In view of the recent press coverage concerning alleged statements of inadequacies in the Apollo program, I am inviting any member of the public, including employees of the Federal Government, to submit to the subcommittee for consideration any relevant statement or evidence concerning the subject under inquiry* (cited in Towards the Endless Frontier: History of the Committee on Science and Technology, 1959-79, House of Representatives, 1980: 196).

Teague was true to his word when he said that his intention was to conduct a comprehensive hearing to determine the cause of the Apollo 1 fire. When the Apollo 204 Review Board report was released, Teague, whom Webb considered a close ally of NASA, said that he was outraged and hurt by what he read concerning contractor carelessness and workmanship. He added that the report was an indictment of both NASA and North American Aviation.

One of the first issues addressed by the Subcommittee was the NASA decision with President Johnson's concurrence to conduct an internal investigation rather than recommend a Presidential Commission. Congressman Winn (R-KS) asked Webb if in retrospect in would have been better to have chosen an outside investigation board. Webb stated that he did not believe that it would have better and America would be better for it because the Apollo 204 Review Board identified what had to be done in order for the Apollo program to progress (Hearing, April 10: 21-22).

Congressman Waggoner (R-LA) broached the issue of blame early in the April 10 hearing. He suggested that the purpose of the hearings was to "…find out where we are wrong with the hope that we can correct whatever weaknesses might show themselves in our entire space program" (Hearing, April 10: 27). He follo ed this up with his belief that the subcommittee was not looking for anyone to blame or "…somebody to use for a fall guy." He added that he did not believe that anyone in NASA or in industry would intentionally cause the death of the three astronauts. However, someone was responsible.

The most heated exchanges occurred during the April 11 testimony concerning the Phillips report. Congressman Ryan (D-NY), who was critical of NASA and was receiving appreciable press coverage for doing so, asked Mr. Lee Atwood, President of North American Aviation, if he knew about the Phillips report. Atwood responded: "The Phillips report to whom?" Ryan then asked: "Has that not been discussed with you?" Atwood said: "I have heard of it mentioned, but General Phillips has not given us a copy of any report" (Hearing, April 11: 265). Congressmen Wydler (R-NY) and Rumsfield (R-IL) joined Ryan in trying to get a straight answer from the North American Aviation witnesses. Turning to Mr. Dale Myers, Vice President of North American Aviation, Wydler asked: "Do I understand that no one in North American Aviation has ever seen General

Phillips' report?" Myers responded: "We will have to identify the date or something that will give us an opportunity to check on it." After another question, Teague told the subcommittee:

> *I have heard about the Phillips report. It is my understanding this is nothing more than a group of notes that General Phillips kept in the audit management of working with North American. There really is no Phillips report. You will certainly have a chance to ask General Phillips if he has a report* (Hearing, April 11: 271).

During the evening hearing on April 11, Dr. John McCarthy, Space and Information Division's Director of Research, Engineering, and Testing, was asked by Congressman John Davis (D-GA) to develop another scenario for the cause of the fire other than what had been presented by the Apollo 204 Review Board. McCarthy responded that there was some speculation that Virgil Grissom had kicked a wire loose, which could have arced causing the fire to start. McCarthy reiterated that his comment was strictly hypothetical, but it did not assuage the indignation of many of the subcommittee members. Amid testimonials that Grissom was a courageous American, McCarthy was discredited and his testimony was interpreted as an attempt by North American Aviation to deflect the blame from themselves to an brave American who died courageously for his country. This idle speculation in response to a challenge from a subcommittee member made North American Aviation look guiltier than they already were in light of the released Apollo 204 Review Board's report.

A brief, but interesting, exchange began the hearings of April 12. As Chairman Teague was outlining how the hearings would be conducted for the day and the witnesses that would be called, Congressman Wydler asked the Chairman: "Is there any reason why Mr. Shea isn't here today?" Teague replied: "Yes, there is a very good reason. The chairman didn't call him." Wydler shot back: "May I have his explanation. I understand he was the program director." Teague responded: "It is the prerogative of the chairman to call witnesses. This will be discussed in executive session…" (Hearing, April 12: 275). Wydler made a feeble attempt to continue the debate, but Teague ended it abruptly. Recall that effective April 10, Dr. Shea had been transferred from Manager, Apollo Spacecraft Program Office to Deputy Associate Administrator for Manned Space Flight (Technical) (Memorandum for the Record by Dr. Robert Seamans, April 4, 1967).

At the evening session of the April 12 hearing, Teague asked the NASA witnesses to tell the subcommittee about the Phillips report. MG Phillips read a carefully crafted statement about his view of the North American Aviation operation when he and his team inspected them in December 1965. Ryan then asked Phillips: "General Phillips, did the notes which you handed to Mr. Atwood in December of 1965 relate to workmanship?" Phillips began to respond when he was interrupted by Teague: "The Chair [Teague] can advise General Phillips he can answer whatever he wants to. If I were in your position and asked that kind of question, I wouldn't answer. If you want to, you can." Ryan objected to the instructions that Teague had given to Phillips to which Teague told him: "You can object all you want. The chairman will make his ruling and he has made it" (Hearing, April 12: 379-383).

Following a brief exchange between Ryan and Phillips about who wrote his statement, Teague advised Ryan that he should submit his questions in writing to NASA and they will respond as they see fit. Ryan then asked Teague to rule on his request that the NASA witness (i.e. MG Phillips) be instructed to provide the notes of the North American Aviation inspection in December 1965. Teague told him that "It is up to the executive branch of the Government."

Eventually Ryan did obtain a copy of the Phillips report. With the help of Willia Hines of the Washington Evening Star, Ryan ran off copies of the document and then called a new conference to distribute them to the media (Toward the Endless Frontier: History of the Committee on Science and Technology, 1959-79, House of Representatives, 1980: 200). Webb finally released the Phillips report to Senator Anderson of the Senate's Aeronautical and Space Sciences Committee and offered Chairman Miller of the House Science and Astronautics Committee to do the same with certain caveats; Miller never accepted the offer.

During the last hearing on May 10, Teague talked about blame and scapegoating:

> *Mr. Administrator [Webb], many Members of Congress asked me if I though NASA was trying to make North American a scapegoat for this accident…It seems to me that in a research and development project of this magnitude we have not done enough to let the American people know*

> *of the many problems that are in the program and what is happening. I think that the impression has been left that North American has been the scapegoat. Would you agree?* (Hearing, May 10: 533).

Mr. Webb responded:

> *…I know of no action that NASA has taken to try to place a disproportionate part of the blame for what happened on North American. I stated in the beginning we would accept our part of the blame and we are prepared to accept your judgment as to what it is* (Hearing, May 10: 533).

What is intriguing in Mr. Webb's response was that he used the word "disproportionate." Based on General Phillips' audit of North American Aviation, there was little doubt in Webb's mind that North American Aviation's poor quality and workmanship was partially responsible for the fire. Conversely, Dr. Shea's "transfer" to Headquarters could be interpreted as Webb's acknowledgement that NASA was also responsible. Although Webb attempted to maintain the locus of blame at the organizational level, it was not until the congressional Apollo 1 investigations began in earnest that individuals would have to be publicly named as being culpable (i.e. Shea for NASA and Storms for North American Aviation).

Although certain members of the subcommittee repeatedly asked for Webb's resignation because of the fire, when the subcommittee hearings ended on May 10, the Oversight Subcommittee was supportive of NASA's continued efforts to place a man on the Moon by the end of the decade. More importantly for NASA, the subcommittee did not attempt to fix individual blame for the accident, but rather endeavored to ensure that NASA knew that technical, process, and organizational changes had to be made if they were to achieve their objective.

Teague concluded the hearings with these words:

> *…I hope that we have painted a fair and honest picture of our space program. I hope we haven't injured anyone that shouldn't have been injured. I hope that we haven't protected anyone that should not have been protected…* (Hearing, May 10: 559).

Hearings before the Committee on Aeronautical and Space Sciences, United States Senate

Chaired by Senator Clinton Anderson (D-NM), the committee met on February 7 and February 27, 1967 to conduct hearings into the Apollo 1 fire. The first hearing on February 7 was in executive session, which means that members of the press or spectators were not allowed to observe. Chairman Anderson gave an overview of the agenda with the focus being an explanation as to why NASA opted to use a pressurized, oxygen atmosphere instead of a two-gas system, which the Soviet Union's spacecraft designers utilized. He also wanted to pursue how possible changes to spacecraft design and testing procedures could affect the overall Apollo program. The witnesses at this session were from NASA and North American Aviation.

Dr. Seamans explained how the Apollo 204 Review Board was composed and the charter that they had to find the cause of the fire and make recommendations for corrective actions. Seamans expressed some concern to Sen. Holland (D-

FL) about how the press would be reporting NASA's activities as the investigation progressed. Seamans stated:

> *We are asking for your forbearance, Senator Holland, as you read the newspapers concerning what we are actually doing, and asking you to rely on information that is provided officially by NASA*…(Hearing, February 7, 1967: 13).

Seamans asked the Committee not to believe everything that they read in the press. If it did not come from NASA, it was not official. A few of the Senators asked Seamans pointedly if he knew what caused the fire; Seamans told the that he really did not know.

As noted in the official hearing record, Dr. Berry (Chief of Center Medical Programs, Manned Space Flight Center, NASA) gave the Committee a thorough explanation of the pure oxygen atmosphere, why it was used and how much testing had been accomplished in such an environment. Mr. James Gehrig, the Committee Staff Director, entered into an extensive dialogue with Dr. Berry relative to the single-gas versus a two-gas system. Gehrig sought to understand NASA's rationale for using the oxygen system by asking if the goal of landing a man on the Moon by the end of the decade had influenced the decision to use the single-gas system. Dr. Berry did not believe that it did. Dr. Berry then provided the physiological explanation of why the single-gas system was preferable to the two-gas variant.

Sen. Smith (R-ME) read Seamans a Washington Post article, which reported that NASA was considering changing to a two-gas system. Seamans told her that the article was not accurate, which is what he cautioned Sen. Holland about previously. Sen. Smith was concerned about the article because Webb had committed to Chairman Anderson that the Committee and NASA would work together. Smith was also agitated that the NASA press release of the first interi report was not delivered to the Committee staff until the day after the press release (Hearing, February 7, 1967: 24-25). This could explain why Sen. Smith was upset with NASA. Because the Apollo I had such a high degree media attention and public interest, the Committee members wanted to be able to offer their insights or vie s regarding NASA's press release *before* it became "old news." Not to minimalize Sen. Smith's position, it was important for the Committee conducting the hearings about the Apollo 1 fire to be just as informed as the press. However, as this editorial co ent points out, in the wake of a disaster, there is a considerable amount of political posturing:

> *In Congress and other official circles there will be much rushing about, a mad reach for the whys and wherefores accompanied always by it-must-not-happen-aga n outcry…All such things are typical of an America stung to action by disaster. Terrific hue and cry barks at the heels of disaster* (New Haven Register, February 2, 1967)

Gehrig continued his examination of the witnesses with the issue of the flammability of materials in the spacecraft receiving particular attention. The newsworthy information that came from this testimony was that in various NASA testing programs there had been three oxygen fires. Two of the fires occurred in September and November, 1962, in which four Navy crewmen in a oxygen chamber received burns. The third incident occurred in April, 1966, but the test chamber was unmanned. NASA's investigation found that ground test equipment and materials in the test chambers were not suitable for a 100% oxygen environment. They also found that they did not have adequate fire detection and fire extinguishing equipment. As would be later reported, the Apollo 1 had the same problems.

The technical discussion about flammable materials and oxygen saturation levels was momentarily interrupted by a question from Sen. Mondale (D-MN):

> *…I am sure that you are painfully aware of the fact that many commentators, I would say classically represented by Walter Lippmann in this week's <u>Newsweek</u>, are claiming that in our effort to beat the Russians to the Moon, we are taking chances with the lives of our astronauts…*(Hearing, February 7, 1967: 48).

Mondale suggested that the NASA had conducted trade-off studies in which they assessed safety factors against weight considerations; the less volatile two-gas system was heavier than the more dangerous single-gas variant. Dr. Mueller told him that the charge was unfounded and that NASA has done everything possible to ensure that Apollo was as safe as possible given the complexity of the system. While it is not certain what Mondale's motivation was for the question, it appears that he was asking what many Americans were probably asking: Is NASA so mission-driven that they would risk astronauts' lives in order to save a fe pounds of weight so they could stuff more experiments into the spacecraft? It was a reasonable question for where they were in the Apollo 1 issue cycle.

The second round of hearings convened on February 27, 1967. The objective of these hearings was to review NASA's second and third interim reports and to discuss changes that could possibly be required in the future Apollo program. Dr. Berry discussed an issue that many people had been asking about both in Congress and in the press: How did the astronauts die? Berry told the Committee that the astronauts died from asphyxiation due to smoke inhalation. He also stated that the astronauts experienced 2nd and 3rd degree burns, but they would not have been life threatening. Chairman Anderson expr essed the vie that "…people are asking many questions about what you have achieved as the final result" (Hearing, February 27, 1967: 66). Anderson addressed a visceral issue that many Americans were thinking about: Did the astronauts suffer? Did the astronauts really burn to death? Berry's testimony put that issue to rest; the astronauts died within ten seconds of the fire and if they felt any pain from the fire, it ended very quickly.

Senator Smith launched into an inquiry about the emergency pr ocedures on the launch pad and whether they were in writing. Mueller stated that there were emergency procedures, but since "…this particular test was not considered a hazardous test, emergency procedures for this particular test did not exist" (Hearing, February 27, 1967: 112). The point that Senator Smith and other members was attempting to understand was whether the Apollo 1 crew could have been extracted in time to save their lives if there had been adequate safety procedures in place.

Senator Cannon (D-NV) asked Dr. Seamans who was responsible for the test: NASA or North American Aviation. Seamans replied:

> *The prime responsibility is NASA's. We must review the procedure prior to the test…However, we do delegate to the contractor the responsibility for a variety of tasks…And we do expect the contractor to think through possible difficulties that could arise in the test, and do insist that he advise us ahead of time when he believes that we are taking undue risks* (Hearing, February 27, 1967: 118).

With this statement, Seamans placed a portion of the accountability for the accident on the shoulders of North American Aviation. As the investigation would later point out, and will be confirmed in the elite interviews, North American Aviation did know that the atmospheric conditions in the command module were dangerous, but there had never been a disastrous event using the pressurized, pure oxygen environment during the Mercury or Gemini testing programs.

The existence of the infamous Phillips report was again raised by Mondale, who persisted in his belief that it was dated February 19. Webb responded that he "…would take it as a request…and examine it very carefully because, obviously, these companies are public companies" (Hearing, February 27, 1967: 131). Webb wanted to preclude the document from being released to the press and, thereby, protecting NASA and North American Aviation from unnecessary media attention.

After a brief discussion of the possible ignition source, the Committee adjourned.

The analysis of this hearing is that it appeared to seek out facts and answer a number of "Why?" questions. There was appreciable dialogue about responsibility, but there was never an overt attempt on the part of the Committee to attribute blame to any individual or group of individuals. The single issue of accountability was expressed in Seamans' response about the test procedures in which he stated that both NASA and the contractor share responsibility. Also, the placement of this hearing in the issue cycle was such that it was early and the Review Board was still sifting through a large amount of data. Even with the benefit of three interim reports written by Seamans following his meetings with the Review Board, there were many unanswered questions. Because there was little definitive data, it was difficult for anyone to credibly speak of attributing blame to an individual or individuals.

Apollo Elite Interviews

The last element of the triangulation of sources to understand how the space policy subsystem attributed blame in order to make sense of the disastrous Apollo 1 fire was the elite interview. Mr. Ralph Ruud, former Executive Vice President, Space Division, North American Aviation, and Dr. Rocco Petrone, former Launch Director, Kennedy Space Center, NASA were interviewed. While there was an appreciable amount of historical content in these interviews, only those portions of the interviews that had a direct bearing on this study were used. The edited transcripts for these interviews can be found in Appendix A.

Interview with Ralph Ruud

Mr. Rudd stated that North American Aviation knew that the ground test of the command module using a 100% oxygen environment was dangerous, he stated: “It was known by the company. As a matter of fact, our people made the objection to NASA at the time…a contracting officer insisted that it had to apply to the 5 percent oxygen and the pressure.” In other words, North American Aviation asked NASA to reconsider conducting the ground test in a pressurized oxygen environment. The NASA contracting officer would not waive that requirement, but sent a letter to North American Aviation that “…in the interests of caution …they felt our [North American Aviation] experience with previous operations that this was satisfactory.” Mr. Ruud added that this fact never came out in any of the congressional hearing or review board findings.

As for blame attribution, Mr. Ruud stated that because NASA had been apprised of the hazardous ground test situation and they made the decisi on to proceed with the test, “…I would have to say that NASA was responsible” for the Apollo 1 fire. He also believes that because Dr. Joe Shea, NASA’s Apollo Progra Manager, “…was making all the decisions,” it was appropriate for him to be held accountable for the fire.

When asked about North American Aviation’s Harrison Storms being forced to resign as a result of the Apollo 1 fire, Mr. Ruud said: “I don’t think anybody fro North American should have gotten the blame.” He stated that North American

Aviation executives did not believe that Harrison Storms was culpable. He was only doing what NASA had directed North American to do. Mr. Ruud also recounted how he had been moved from being the President of the Los Angeles Division of North American Aviation to being the executive vice president at the Space Division. He was transferred to the Space Division because of his manufacturing expertise. The reason for the changes was that "…they [NASA] were very demanding of management to make a change." Because of North American Aviation's dependency upon NASA for continued program funding, NASA made demands upon North American Aviation's management to find a new President of the Space Division, which meant that Harrison Storms' employment was terminated.

Mr. Ruud was asked about the Congressional hearings and if he felt that Congress was interested in finding someone to blame. He attributes the Congressional interest to find someone to blame to Jim Webb. He believes that this is the reason why Webb made the statement that NASA and North American Aviation were responsible for the Apollo 1 fire; "…to get off the hook."

Based on this interview, it appears that NASA, acting as a member of the space policy subsystem, identified the individual within their own agency who would be blamed for the Apollo 1 fire. They also pressured North American Aviation to fire Harrison Storms, who was Shea's industrial counterpart. In the hearings, Congress only embellished upon the actions that NASA had taken.

Interview with Dr. Rocco Petrone

Dr. Petrone's comments about the blame attribution process is from the NASA perspective. Dr. Petrone was in the blockhouse at the Kennedy Space Center sitting next to Astronaut Deke Slayton during the Apollo 204 ground test. They had been having communications problems with the command module. The fire occurred shortly after the test director had picked up the count and called for the pulling of the external power plugs to the spacecraft. Just as the count commenced, Dr. Petrone saw a flash and then about 18 seconds later it was over. When asked if NASA perceived the test as hazardous, he first response was "No" because there was no fuel on board. The pressurized oxygen environment was only something to be cautious of and not deemed a hazardous test. However, he added "Now that was a blind spot."

Dr. Petrone's view about blame was that if there was not a report that attributed blame, then no one was blamed. He remarked that Joe Shea's transfer to NASA Headquarters was not as a consequence of the Apollo 1 fire: "Those shifts probably had to be made just to get new faces on the program. But not from the standpoint of saying this guy was responsible or that guy was responsible." (Note: This contrasts with a statement that was attributed in internal NASA correspondence to Dr. Petrone about Dr. Joe Shea. In a separate conversation, Dr. Petrone acknowledged that he made the following statement: "You [Joe Shea] are a menace and you are to blame for the fire. When you die, I will come and piss on your grave.")

Dr. Petrone suggests that blaming resides with the Congress. He noted that "When something goes wrong, then you go back and look at all aspects of everything." What he was referring to was how Congress brought up the source selection of North American Aviation. He stated that "…it turns out, as you're trying to apportion blame, you find that Congress wants to take names and kick ass."

From these two interviews, there are two competing views about blame and ho should have been blamed. Ruud, who was a North American Aviation executive at the time of the Apollo 1 fire, believes that Shea (a NASA employee) should have been blamed because he was in charge of the program. However, Harrison Storms (a North American employee) should not have been blamed (and fired) because he was only doing what he told to do by NASA. Conversely, Petrone, who was a NASA employee at the time, does not believe that Shea was officially blamed for the fire, even though he personally held Shea accountable for the disaster. The locus of blame, according to Petrone, is Congress.

The media artifacts and the congressional hearings reflect the fact that both NASA and North American Aviation selected one executive each to be replaced. The Thompson Board did not make any recommendations as to who should be held accountable for the fire. Mr. Ruud's remarks inform our appreciation of the blame dynamic within the space policy subsystem for it was NASA who identified their own “scapegoat” and they then demanded that North American Aviation replace Harrison Storms. These two interviews point to the fact that the blame attribution process was contained within the space policy subsystem with the primary actors being NASA and North American Aviation. While Congress' rhetoric was rich in blame language, their impact on the blame attribution process relative to Apollo 1 was minimal.

Apollo 1 Triangulation Results

The triangulation methodology for the Apollo 1 case study examined three sources of data: public media artifacts, official government documents, and elite interviews. The following is a synthesis of the results of these three sources:

- The analysis of the Apollo 1 print media artifacts indicates that the primary post-disaster space policy subsystem actors were NASA, the contractors, Congress, the investigation board, and the media. The print media characterized NASA generally in a neutral manner and their thematic focus during the Apollo 1 issue cycle was that of the editorial. Regarding the blame rhetoric, approximately sixty percent of the articles were related to organizational (i.e. NASA or North American Aviation) or personal blame.
- The official government records, which included the Phillips Report, the Apollo 204 Review Board Report, and Congressional hearing reports, were varied in their blame attribution. The Phillips Report was highly critical of North American Aviation's management, manufacturing, costing,

and other functions; MG Phillips in related correspondence to Jim Webb wanted Harrison Storms (President of the Space Division) replaced. The Apollo 204 Review Board Report did not consider it their mandate to establish culpability. Concerning the House of Representative and Senate hearings, their reaction to the Review Board report was one of concern because Congress had the oversight role which they acknowledged had not been performed. However, during the House hearings, the notion of finding those who were culpable was the only way in which NASA could be assured that another disaster could be avoided. In the Senate hearings, there was never an overt attempt to attribute blame to an individual. However, the question was posed by a Senator to a senior NASA executive: Who was responsible for the Apollo 1 test. The answer: NASA, but the contractor is supposed to think about potential problems.

- The elite interviews show two competing images of the blame attribution process: Mr. Ruud believed that NASA was to blame for the fire, that it was appropriate to replace Dr. Joe Shea, and that NASA had pushed North American Aviation to replace Harrison Storms. Dr. Petrone did not believe that anyone was held officially accountable, but Congress wanted to "…take names and kick ass."

Chapter VI
Results of the Challenger Case Study

Challenger Pre and Post Disaster Space Policy Subsystem

In order to determine if and how the space policy subsystem expanded in its membership following the Challenger disaster, a starting point or pre-disaster space policy subsystem must be defined. The methodology by which this was accomplished was an examination of forty-five congressional hearings fro 1984 and 1985 in order to identify the actors who were called to testify. Fro these hearing records, defining the pre-Challenger accident policy subsyste was then possible. The following graphic illustrates the actors that participated in those hearings:

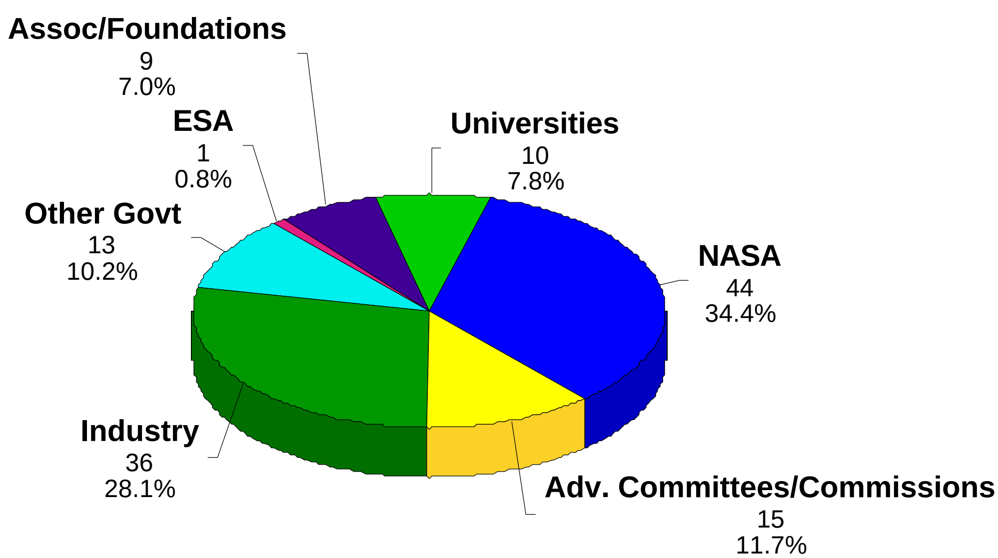

Figure 16: Pre-Challenger Space Policy Subsystem Actors

When the pre-Challenger hearing records were studied, there were a multitude of actors from industry, academia, other government agencies, commissions, and councils. To assume that every person or group who testified is a core member (i.e. primary policy actor) of the space policy subsystem may be overstating their roles in the policy process. Nevertheless, as noted in Figure 16, nearly sixty three percent of the predominant actors during the hearings were NASA and industry, which suggests that they, in addition to the congressional space committees and subcommittees, formed the core of the space policy subsystem. Because of this strong core membership and the mutual dependencies that can be presumed to exist between them, the space policy subsystem exhibits many of the characteristics of the “iron triangle” policy subsystem metaphor.

If the space policy subsystem possesses many of the “iron triangle” characteristics, how can this metaphor account for the inclusion of a myriad of other actors participating in the congressional hearings and policy process? Browne (1995) informs this issue by pointing out that “iron triangle” advocates would argue that this form of policy subsystem is an avenue by which non-players can have an input in the policy process. The data suggests that there were many “outsiders” who were called to testify for a variety of reasons. The “iron triangle” advocates would argue that just because one has been called to testify or in some other manner “flirt” with the policy process, it does not necessarily mean that one is a policy player.

In the post-Challenger period, the media artifacts (n=998) were analyzed within the disaster's issue cycle, which was about twenty-four weeks beginning during the week of January 27, 1986 and ending during the week of July 7, 1986. The following graph illustrates the diversity in those who participated in the post-disaster space policy subsystem:

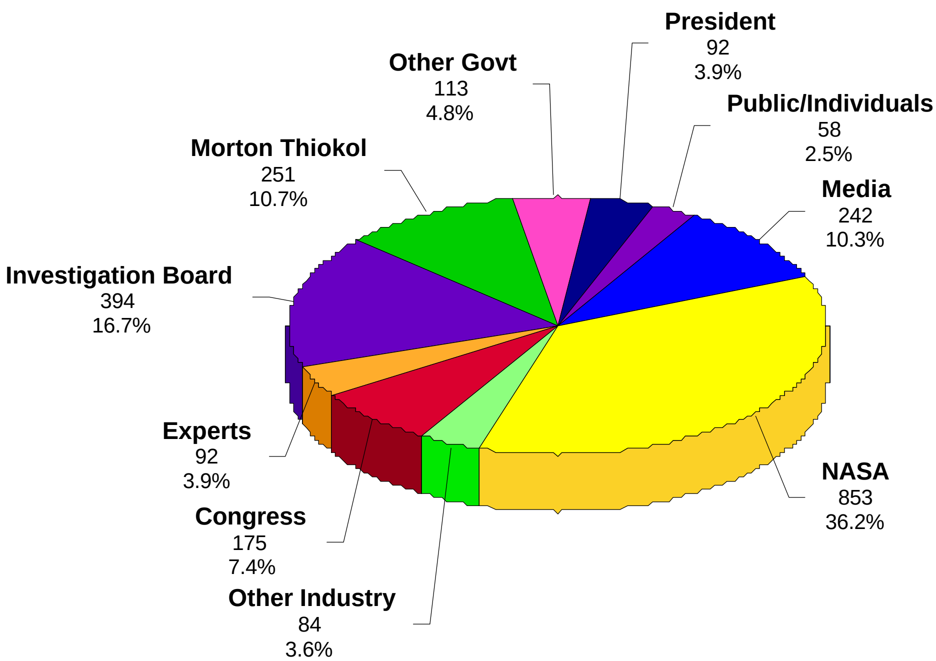

Figure 17: Post-Challenger Space Policy Subsystem Actors

The data suggests that the post-Challenger space policy subsystem expanded and became more fragmented. While the *traditional* pre-accident space policy subsystem actors (NASA, Congress, and the contractors) were statistically represented, the investigation board (16.7%) and the media (10.3%) emerged as significant actors.

The following actor participation data is arrayed over time in order to discern the degree to which the actors, as mentioned in the print media, were involved during the issue cycle. As a point of clarification, this data does not represent the number of articles that were written by week during the Challenger accident issue cycle; this data is the number of actors mentioned in the press by week during the issue cycle:

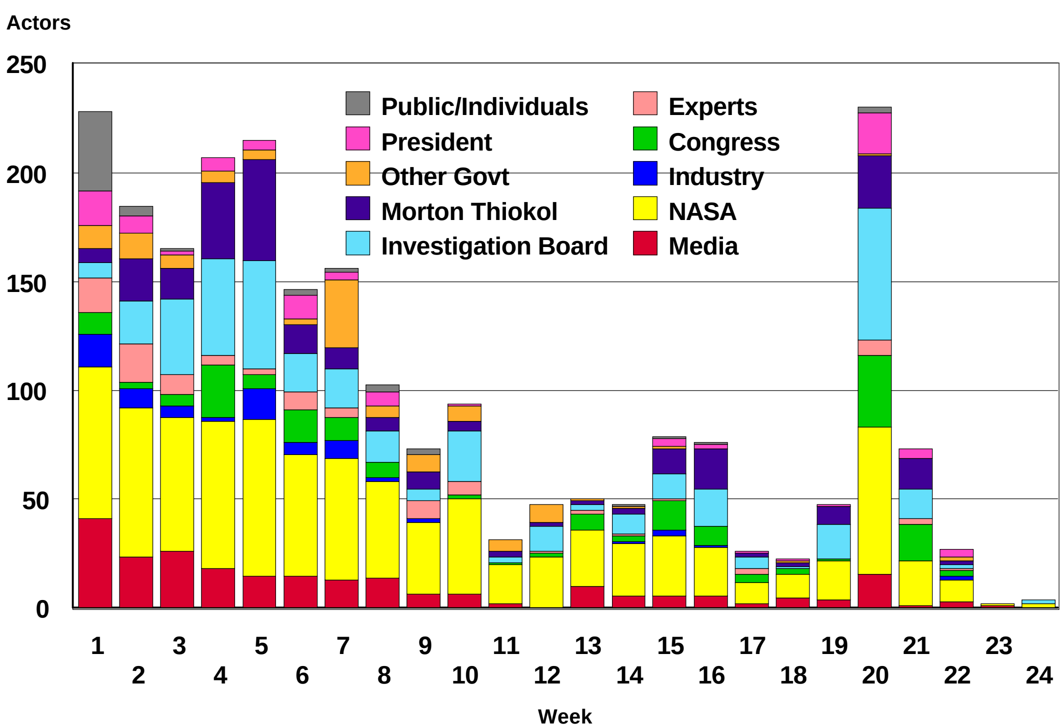

Figure 18: Challenger Actors Mentioned in the Press by Week During Issue Cycle

As can be seen in this depiction of the post-accident actor data, NASA, the media, Congress, and the Investigation Board were the actors most frequently portrayed in the media artifacts. Recalling the Apollo actor participation time series data, there was an increase in actor participation reflected in the media artifacts during week 2 of the issue cycle and then it dropped off until week 12 when the media responded to the release of the Apollo 204 Review Board report. In the case of Challenger, a different actor participation pattern is depicted in the time series analysis. From the beginning of the issue cycle, the media positioned itself as an actor.

One explanation for the high degree of actor participation at the beginning of the Challenger issue cycle was because the Challenger disaster was televised and seen by millions of Americans nearly simultaneously. As one reporter remarked, "Television is unlike any other medium in that it allows millions of people to see and experience the same person or event at the same moment" (Hartford Courant, January 31, 1986). In the case Apollo 1, the media was unable to position itself as an actor early in the accident issue cycle because they were only able to respond to what NASA provided them; the media was reactive. In the case of Challenger, just about everyone in the United States saw the disaster occur. The media became proactive in their engagement of the issue at the beginning of the issue cycle, but the data shows that the media's involvement decreased over time (through week 11). One possible reason for this pattern of reduced media activity as a subsystem actor was that NASA stopped the flow of information to the media. NASA had confiscated all videotapes and film. NASA refused to provide the press with pictures and video of the plume from the right rocket motor because NASA, as explained by Bob Streike, Chief of Shuttle Operations at Kennedy Space Center, did not want the press to "reach a premature conclusion…They'll get cause and effect confused and the media will end up running the investigation for us..." (Florida Today, June 12, 1986). NASA wanted to maintain control of how and when the information would be used. The media's response was predictable and damaging to NASA. One reporter wrote: "NASA's fumbling has…turned a major human and technological loss into a public relations fiasco that could damage the agency's prestige and credibility for years" (Wall Street Journal, February 14, 1986).

The "spikes" in actor participation data in weeks 4 and 5 warrant discussion. It was during these two weeks that a number of disclosures by the Rogers Commission were ade known to the public:

- There was a contentious teleconference between Morton Thiokol, the manufacturer of the solid rocket booster, and NASA about whether to launch the Challenger given the cold temperatures that were forecasted at launch time.
- During an evening teleconference on January 27, NASA pressured Morton Thiokol to reverse their "no launch" recommendation.
- Mr. Jess Moore, Associate Administrator for Space Flight, and other NASA executives were removed from the NASA investigation because of

their involvement in the launch decision. The Rogers Commission believed that NASA's launch decision process may have been flawed.

Media Artifacts: Characterization of NASA During the Challenger Issue Cycle

NASA could have anticipated a " backlash" from the media because of the way in which NASA withheld information or provided conflicting information (see Appendix H for NASA public affairs officers' comments). The data indicates that the print media did not let their "feelings" about NASA taint their characterization of the agency in their reporting.

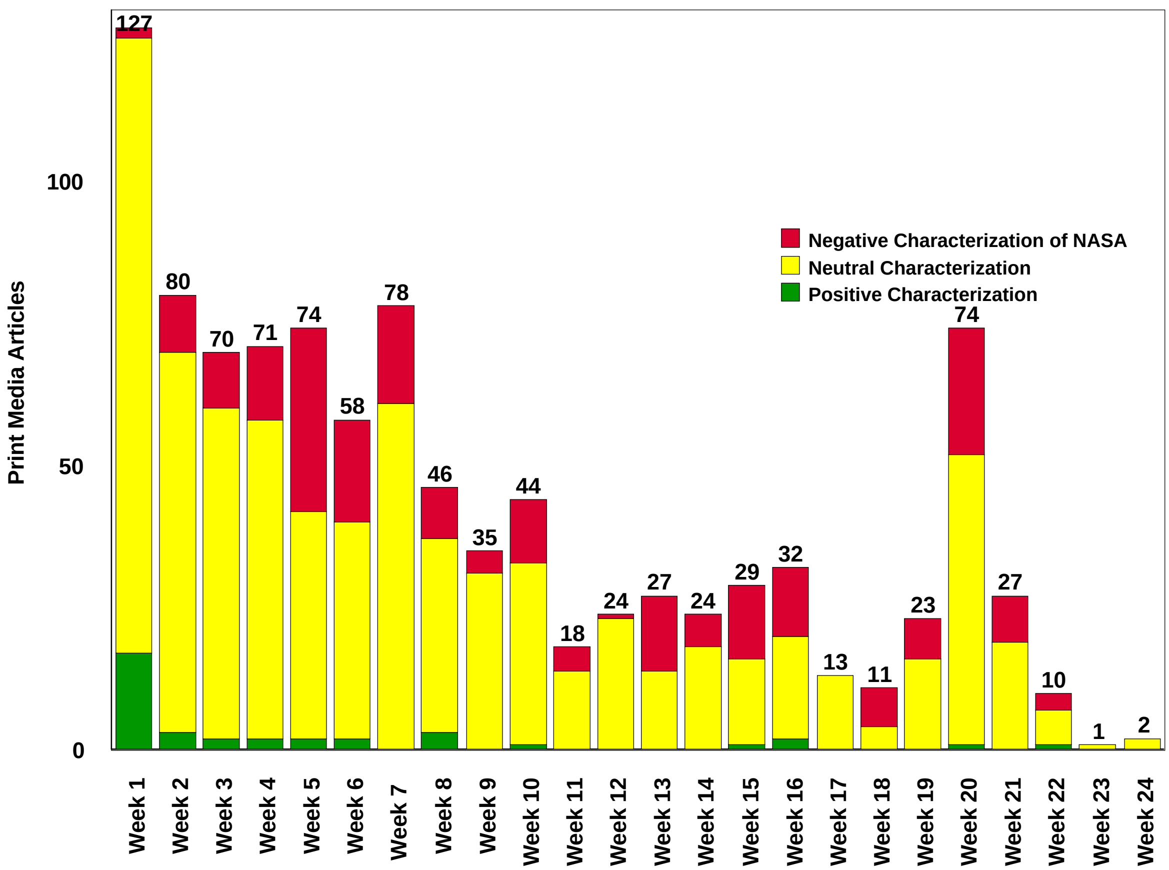

Figure 19: Media Characterization of NASA During the Challenger Issue Cycle

There are four periods in the Challenger issue cycle in which NASA was negatively portrayed in at least forty percent of the articles: Weeks 5, 13, 15, and 18.

- **Week 5 (n=74)**: The media responded to the revelation that Morton Thiokol engineers had recommended to NASA during a teleconference that the Challenger should not be launched until the temperature had risen to at least fifty-three degrees, the lowest temperature for which Morton Thiokol had data on elasticity of the field joint seals. The Commission found that NASA challenged Morton Thiokol and, after a long exchange, Morton Thiokol made a management decision to overrule their engineering staff recommending that the launch could proceed.
  A sampling of the headlines of negative articles that ran during week 5 are: "Why Did NASA Ignore Warnings From Experts?" (Philadelphia Inquirer, February 24, 1986); "Gore Urges Resignation of Two Top NASA Officials" (Christian Science Monitor, February 24, 1986); "A Different NASA: Agency Attitudes Had Shifted" (New York Times, February 26, 1986); and "Engineers Told NASA Challenger Could Explode" (Washington Times, February 26, 1986).

- **Week 13 (n=27)**: The number of articles in which NASA was portrayed negatively in week 13 was only surpassed by week 18. During this week, the media found out that NASA's Inspectors General Office, the General Accounting Office, and Department of Defense's Defense Contract Audit

Agency had conducted an audit of NASA and its Centers. The findings were that NASA had wasted billions of dollars in taxpayer money in inefficient contracting practices and inefficiencies in the operations of the various Centers. Another of the findings was that NASA had consciously diverted funds that were earmarked for safety equipment, facilities, and training for other purposes. The government auditors were also critical of Marshall Space Flight Center and its configuration management of the solid rocket boosters used in the shuttle program. The media also discovered from sources that the Challenger crew cabin was intact following the breakup of the Challenger, which meant that the cre probably survived the explosion and were alive as the cabin continued its trajectory into the Atlantic Ocean. The “spin” that the media placed on this information was that NASA had been hiding these facts from the public. Why?

Headlines that captured these negative characterizations of NASA included: “NASA Wasted Billions, Federal Audits Disclose” (New York Times, April 23, 1986); “NASA Cut or Delayed Safety Spending” (New York Times, April 24, 1986); “Did NASA Conceal Astronaut’s Fate?” (Philadelphia Inquirer, April 24, 1986); and “Flubbing Along” (Washington Post, April 25, 1986).

- **Week 15 (n=29)**: The story of the week came from hearings conducted by the Senate's Subcommittee on Science, Technology and Space. Senator Gore's staff had found that NASA had reduced the number of quality and reliability personnel by as much as seventy percent since the mid-1970s. Gore maintained that the Challenger disaster was the product of NASA's reduced emphasis on quality and reliability. The damning news was that the greatest number of quality and reliability staff reductions was at the Marshall Space Flight Center, which has cognizance over the solid rocket boosters. During these same hearings, Senator Hollings told Admiral Dick Truly, Director of the Shuttle Program, that the nation would not stand for anymore rocket motor failures because of its design. Hollings had suggested that NASA look at an Aerojet proposal to cast the propellant in one piece and then ship the 1.3 million pound rocket motor by barge. Truly balked at the idea. Another newsworthy item that captured the media's attention was Lawrence Mulloy's lateral transfer from Manager, Solid Rocket Booster Project to an "Assistant to the Director" position at Marshall Space Flight Center. They also discovered that Mulloy had placed a launch constraint on shuttle flights in August 1985 due to erosion of the O-rings; five days before the Challenger launch, he lifted the launch constraint.

Some of the headlines of articles that negatively characterized NASA were: "With Challenger, We Lost a Symbol of Authority" (The Sun, May 6, 1986); “NASA Cut Quality Monitors Since ’70” (Washington Post, May 8, 1986); “More Than Bad Luck at NASA” (New York Times, May 9, 1986); and “Hollings, Shuttle Chief Wrangle Over Boosters” (Washington Times, May 9, 1986).

- **Week 18 (n=11)**: While the overall number of articles in NASA’s archives is rather low, seven of the eleven articles were negative towards NASA. In an editorial commenting on President Reagan’s rehiring of Dr. James Fletcher as NASA’s Administrator, it took Fletcher to task for a comment that he made to a gathering of industry executives. Fletcher stated that the problem that NASA is having is with a small segment of the press, which does not share his view of NASA as being a symbol of American aspiration and achievement. The Washington Post’s retort was: “Mr. Fletcher, you’ve got it all wrong. That may be the way it used to be; it’s not the way it is…don’t try to run this glamorous agency by press release any more” (Washington Post, May 27, 1986). This editorial is important because it documented a “sea-state change” in America’s perception of NASA. The post-Challenger situation was not just an issue of image, but of substance. NASA made mistakes; they wasted billions of dollars; they compromised safety for schedule; they were no longer the “fair haired boys” of government agencies. Another story line that captured this sentiment was that NASA’s years of success had made it complacent. In an article entitled “Success Relaxed NASA’s Vigilance,” the reporter shared the view that eventually a shuttle would be lost, but, as one source stated, "We lost [the shuttle] for a stupid reason, because the simplest part of the system failed." NASA's risk assessment process came under attack both in the Commission's deliberations and during Congressional hearings. NASA was being criticized for its single event success syndrome. As John Brizendine, chairman of the NASA Advisory Council, noted in the article, the syndrome is "We've done it, so it's got to be good" (Washington Post, May 26, 1986).

Other headlines during this week included "Engineers Say NASA Pressures Them" (The Sun, May 26, 1986); "44 Shuttle Problems Are Pinpointed" (Washington Post, May 28, 1986); "How to Regain Face in Space" (New York Times, May 28, 1986); and "Play Beat the Press, Again" (Washington Post, May 28, 1986).

If the NASA characterization data is arrayed by overall frequency, it is evident that the print media was generally neutral in their portrayal of NASA:

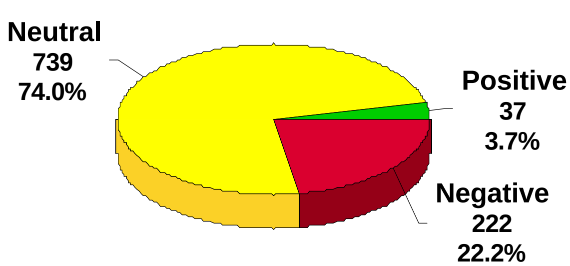

Figure 20: Overall Media Characterization of NASA During Challenger Issue Cycle

Media Artifacts : An Analysis of Blame Rhetoric

The following chart illustrates that approximately six percent of the articles either implicitly or explicitly spoke to individual blame and nearly fifteen percent were about blame attributable to either NASA or its contractors:

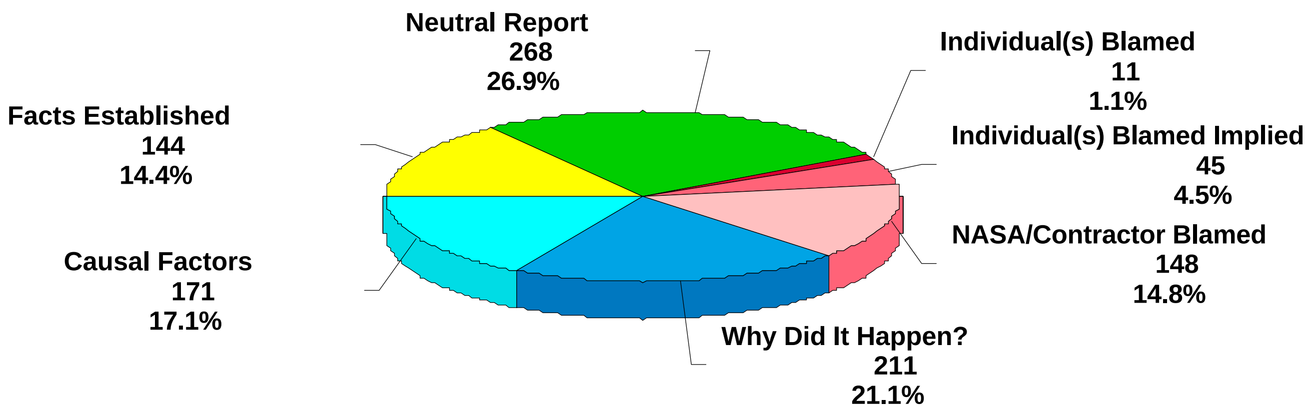

Figure 21: Distribution of Blame Rhetoric

The following blame rhetoric matrix as presented in Chapter III (Research Design). The matrix equates the title of a blame rhetoric title (e.g. Neutral Report) with description of the issues and questions associated with it. The matrix was the basis by which each media artifact was coded as to its absence or presence of blame attribution rhetoric:

Blame Index Value	Description
0	Neutral report: sympathetic in nature; general information about the event.
1	Facts of the event are questioned or established. The question being asked is "**What happened?**"
2	Specific causal factors are being explored. The blanks to the question of "**How did it happen?**" are being filled in by either official statements or speculation (i.e. dangerous oxygen environment or faulty O-rings are surfaced)
3	The media and other actors (e.g. congress) ask "**Why was it allowed to happen?**" Didn't NASA know that the oxygen environment was dangerous? Why wasn't the ground test adjudged to be hazardous? How long has NASA known about SRB O-ring deterioration? Why weren't corrective measures implemented?
4	NASA and/or North American Aviation are blamed for the accident. The "**Who is responsible?**" question is answered at an organizational level.
5	Implications of individual blame appear as editorial comments or Congressional questions that individuals are culpable or that impropriety by an individual is a causal factor for the accident.
6	An individual or individuals are explicitly blamed for the accident. "**Who is responsible?**" at the personal level is answered.

Table 2: Blameworthiness Index

The ***Neutral Report*** (blame index value: 0) articles were those that were more sympathetic towards either the victims, survivors, or NASA. This category included those articles that conveyed the idea about space flight and the space shuttle mission, as reflected in the following quote: "…space travel taps another vein of the national psyche, that deep well where high technology, American kno -how and can-do, and magic mingle together" (Orlando Sentinel, January 30, 1986). Another article that was frequently in this category were those that expressed shock after watching the disaster on television: "…for some reason today's disaster is more shocking. Maybe it's because we all witnessed it"

(Orlando Sentinel, January 30, 1986). Because this was the first flight of the *Teacher-In-Space Program* (TISP), there were a large number of articles about Christa McAuliffe and the contributions that she made as a teacher.

In ***Facts Established*** level in the blame rhetoric index (value: 1), the media told the American people what the government agency was telling them. However, in the case of Challenger, the media along with everyone else were eyewitnesses to the fact that the Challenger exploded killing the crew of five astronauts, an employee from Hughes, and a schoolteacher. One reporter wrote: "How many times do we have to watch that terrible explosion on television?…Do we really have to see all those people crying in Houston?" (USA Today, March 4, 1986).

What appeared to be facts turned out to be wrong as the investigation unfolded. Most Americans believed that the astronauts were killed instantly in the explosion. As in the Apollo 1 situation, when Americans believed that death came swiftly and painlessly, they were able to deal with death in a more reserved manner. However, in Apollo 1 it was learned that the astronauts did not die instantly nor did the Challenger astronauts. Technically, Challenger was not destroyed by an explosion, but by dynamic forces that broke up the spacecraft. When the liquid hydrogen in the main fuel tank escaped into thin atmosphere, it rapidly expanded causing the shuttle to break up. The shuttle's crew cabin also remained intact with its crew still alive (and some presumably conscious) until it impacted in the Atlantic. Many of the "facts" that were established early in the

Challenger issue cycle unraveled and became issues of debate during the Rogers Commission and Congressional deliberations.

The category ***Causal Factors*** (value: 2) are those media articles that addressed specific or possible causes about how the disaster occurred. An interesting article related to causal factors appeared in the Boston Globe the day after the Challenger disaster. It was a short article that reported that on shuttle mission STS-8 on August 30, 1983, which also featured the Challenger, one of the solid rocket boosters came within 2/10 of an inch from burning through the O-ring. The commander of the shuttle mission, Daniel Brandenstein, stated that if the solid rocket motors had continued burning for another 2.7 seconds, the propellant would have burned through and ignited the main fuel tank. It was also reported that a Rockwell International (builder of the shuttle) employee gave an interview in which he played back television footage of the Challenger launch (STS-51L), which showed the flames jetting out of the burnt-through field joint (Boston Globe, January 29, 1986). This suggests that within hours of the disaster, the media, industry, and probably NASA began narrowing down the causal factors for the disaster.

The next level of blame rhetoric informing our understanding of how the language of blame evolved during the Challenger issue cycle are those articles that asked ***"Why?"*** (value: 3). The context of this category in the blame rhetoric are those questions that asked questions such as "Why didn't NASA know that there was a problem with the O-rings in the solid rocket boosters?" More damning to NASA are questions that pointed to responsibility and (eventually) culpability: "If you knew that the O-rings were unreliable, why didn't you fix them?" In both of these questions, the seeds of attribution are present.

The most important question in the Challenger saga could be: "Why was Challenger given a 'go' for launch?" Time magazine raised this question in a issue that was published the day that the Rogers Commission released its report. They asked Jerome Lederer of the *Flight Safety Foundation* to provide an answer:

> *There was social pressure: they had thousands of school kids watching for the first school lesson from space. There was media pressure: they feared that if they didn't launch, the press would unfavorably report delays. And there was commercial pressure: the Ariane was putting objects in space at much lower costs. NASA was also trying to show the Air Force that it could operate on a schedule. The pressures were subtle, but they acted upon them* (Time, June 9, 1986).

Another answer to this basic "Why?" question was provided by a member of NASA's Aerospace Safety Advisory Panel:

> *I think NASA found themselves with a schedule to meet, and they did their damnedest to meet it* (Washington Post, February 13, 1986).

The data suggests that the fourth level in the blame rhetoric index, ***NASA/Contractor Blamed*** (value: 4), the Challenger experience is dramatically different from that of Apollo 1, in which a large number of the articles blamed either NASA or North American Aviation. The relatively low percentage of articles in this category can not be accounted for given that NASA and Morton Thiokol were clearly held accountable for the O-ring design issue and subsequent "go" decision for launch.

The notion of fixing blame is not always pleasant, but the following exemplifies a mind-set within NASA that when something went wrong, the challenge was to fix the problem and not to fix blame:

> *Trying to fix the blame is often counterproductive, the engineers assert, because it may discourage active cooperation with an investigation and encourage biased or slanted presentations of the data. They said that the first goal of the investigation should be to collect information rather than pass judgment or assign responsibility* (Washington Post, March 24, 1986).

The former head of NASA's Solid Rocket Motor program at Marshall displayed no reluctance in fixing the blame:

> *Blame it on Morton Thiokol and Marshall because they should have looked at the joint more carefully* (Del Tischler in The Sun, March 25, 1986)

Returning for a moment to the issue of the low percentage of articles in this blame rhetoric category, an explanation could be found in the small number of articles that were written during week 20 of the issue cycle (i.e. the week that the Rogers Commission report was released). Only seventy-four articles were written during week 20 of which eighty percent were rich in blame rhetoric. Had the print media lost interest in the issue by week 20? The number of articles in week 20 were about the same as the articles written in weeks 2 to 7.

Nevertheless, for those articles that were written in week 20, there was a ample blame rhetoric directed towards NASA and its contractor. The following is a sample of what appeared in week 20:

- *Much of the report, however, focused on two intertwining themes: The failure of NASA and Thiokol officials to take decisive action to correct the seals in the rocket joint, and the failure of NASA middle managers to pass along to top officials critical information about the seals* (Wall Street Journal, June 10, 1986).

- *The commission's harshest judgments were aimed at the Marshall Space Flight Center, in Huntsville, Ala., …The commission called it "disturbing that Marshall had not conveyed "the seriousness of concern" over the O rings to the top shuttle officials at NASA headquarters…(*New York Times, June 10, 1986).

- *The commission revealed, for example, that managers of the National Aeronautics and Space Administration had enough information in hand last August…to require that faulty booster rockets be fixed before the next shuttle flight…Morton Thiokol Inc…not only failed to fix it but opposed suggestions from NASA engineers that the joint be redesigned* (Chicago Tribune, June 11, 1986).

The fifth category in the blame rhetoric index is that ***Individual Blame Implied*** (value: 5). The earliest hint of implied individual blame occurred on February 15 after the Commission had taken testimony from Alan McDonald of Morton Thiokol concerning the teleconference between NASA and Morton Thiokol. Following this testimony, the Commission went into executive session and stated that Jesse Moore, Associate Administrator for Space Flight, and other NASA managers would be removed from the NASA investigation team because of their involvement in the launch decision. Rogers stated that he believed that the launch decision process was flawed and that it would not be appropriate for these NASA managers to investigate events to which they were involved.

On February 18, the Washington Times and other publications reported that Acting Administrator William Graham fired NASA's general manager, Philip Culbertson, because he "…didn't tell Mr. Graham about problems with 'O-rings' implicated in the explosion of the space shuttle Challenger…" (Washington Times, February 18, 1986). While Culbertson was never directly implicated in the Challenger decision, it is possible that he became the scapegoat for Graha and other NASA executives for not knowing about the O-ring problem. The implication is that if Graham had known about the problem, he would have stopped the launch, which he had the power to do as the Acting Administrator.

In late February, a rumor surfaced that the White House had pressured NASA to launch the Shuttle because the President wanted to say something about the mission in his State of the Union Address, which was scheduled for the evening of January 28. The rumor was that Donald Regan, the White House Chief of Staff, told Graham "Get that thing up" (Wall Street Journal, February 27, 1986). Senator Hollings went so far as to request the phone records from the White House staff to check the phone calls that were made the night before the launch. The finger of blame was essentially pointed by Hollings and others in the Senate who believed that some one (i.e. Donald Regan) ordered the launch.

The issue eventually evaporated, as many issues do in Washington. Richard Cook, who was a NASA budget analyst, testified before the Rogers Commission that he told his superiors that if the O-rings eroded during rocket motor ignition and burn, it would destroy the shuttle. Because he was not an engineer and he did not possess professional qualifications to make this assessment, his views were discredited. Cook was later transferred at his request to another government agency.

Although the following material falls outside of the issue cycle for the Challenger disaster (i.e. January 28, 1986 to mid-July 1986), it is informative about ho implications of blame can blossom into much more serious levels of blame. On October 30, 1986, Richard Cook released a statement to the press which alleged that the Challenger launch date was changed to coincide with the President's State of the Union Address and that "NASA followed procedures different fro any previous shuttle mission" ("State ent for the October 30, Press Conference" by Richard Cook). He asserted that the Commission never investigated Graham's role in the launch decision. He went on to charge that the Commission

> *…focused on the actions of mid-level managers, who became, in effect, scapegoats. The Commission created a myth of flawed communications, exonerated top management officials from any responsibility for the accident, and failed to explain why NASA overrode the objections to the cold-weather launch by contractor engineers* (Cook Statement, October 30, 1986).

Cook went so far as to write a letter to Attorney General Edmund Meese asking that he consider assigning a special prosecutor to investigate NASA for "…malfeasance and dereliction of duty with respect to the decision to launch Challenger" (Personal correspondence from Richard C. Cook to Attorney General Edmund Meese, October 30, 1986).

The Rogers Commission received some criticism because it appeared that they were more interested in finding someone to blame rather than establishing the facts. Former NASA Deputy Administrator Bob Seamans stated: "We're putting individuals on trial before we even know the facts." Another former NASA executive stated: "The problem of finding out what went wrong is the paramount one, not who did what to whom…I think that's a mistake" (Christian Science Monitor, March 5, 1986). These remarks were made by former NASA managers who were reflecting the "mind-set" that was prevalent during the Challenger investigation and was existent during the Apollo 1 investigation that the purpose of an investigation is to identify problems, recommend what needs to be fixed, and no one is to blame.

NASA has been and remains a research and development (R&D) agency and not a commercial space operation. As Vaughn (1996) and Launius (1994) maintain, NASA was pressured by the Administration and Congress to bring the Space Transportation System to operational status. Operational status equated to permitting schoolteachers, senators, Saudi royalty, and foreign astronauts to be crewmembers aboard the shuttle. This was the situation that the space shuttle program found itself in—the dangerous void between being truly a R&D endeavor and being perceived for political reasons to be a safe, "commercial" operation. Space shuttle flight was and still is dangerous business. As Admiral Truly once remarked: "The business of flying in space is bold business. We can not print enough money to make it totally risk-free" (Time, April 7, 1986).

Following the release of the Rogers Commission report, Rogers and his tea were commended for their identification of the technical problems associated with the shuttle and their insightful conclusions about the NASA management structure and decision making processes. Nevertheless, there was also varying degrees of criticism levied against the Commission for not identifying who was responsible for the launch decision. The following are examples of such criticism:

- *The* Challenger *commission has turned in a detailed report on what was to blame for the disaster that killed seven astronauts, but it says very little about who was to blame. This may be disappointing—people like to have culprits clearly identified—but the decisions was the right one. The job of pinpointing and censuring errors can be left to others; the Commission's task was to get a faulty system overhauled…* (Chicago Tribune, June 11, 1986).
- *The panel's report is ambiguous on the question of whether officials at NASA Headquarters were deliberately averting their eyes.* (New York Times, June 10, 1986).

In the final category of blame rhetoric, ***Individual Blamed*** (value: 6), those who were specifically blamed either were transferred, resigned, or retired from their positions. If we accept that the consequence for their being blamed is a personnel action of some kind, then the field of those who were held accountable is appreciable in both NASA and Morton Thiokol.

For a chronology of the personnel actions (e.g. transfer, retirement) that resulted from their involvement in the Challenger launch decision, refer to Appendix F.

Those who were blamed were employed in one of two organizations: Marshall Space Flight Center or Morton Thiokol. The blame reached from the most senior executives to mid-level managers of both locations. What is noteworthy, and will be discussed in Chapter VII (Conclusions), was that the blame was not attributed as a result of the Rogers Commission. The locus of the blame rhetoric was in either the media or Congress. However, it was NASA and Morton Thiokol who had to sanction those who were responsible for the decision to launch the Challenger.

Time Series Analysis of the **Challenger** *Blame Rhetoric Data*

The purpose of this chart is to show the emergence of blame rhetoric over time during the issue cycle. The data illustrates the "What," "How," and "Why" questions as they are being addressed in the first fourteen weeks of the Challenger issue cycle. The blame rhetoric emerges initially at the organizational level and then proceeds from implied to explicit individual culpability from week fifteen to twenty. The following time series analysis reflects this emergence of blame rhetoric arrayed over the twenty-four week issue cycle:

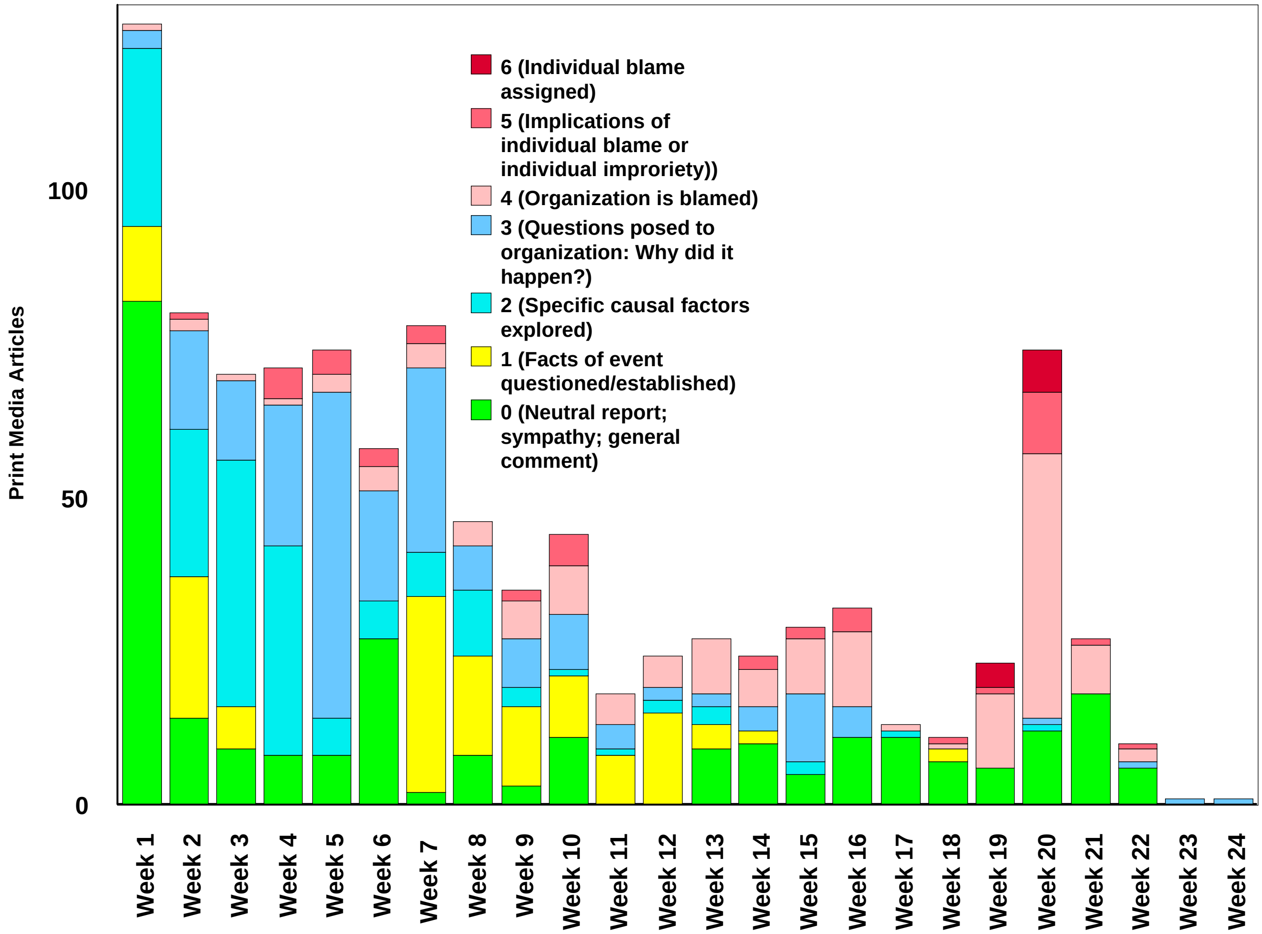

Figure 22: Blame Rhetoric by Week in Issue Cycle

The attribution of blame is a complex process within the policy subsystem. The agency, contractors, congress, and others participate in attributing causal responsibility to one or more persons. The following is a synopsis of the e vents that informed the development of a blame rhetoric:

- **Week 2**:
    - o It was learned that NASA Administrator Jim Beggs did not want Dr. Bill Graham as his Associate Administrator because he lacked

NASA experience. The White House insisted that Graham be appointed; Graham was unquestionably a White House "guy".

- **Week 3**:
    - Aviation Week & Space Technology magazine published a theory explaining that the top of the right booster rocket pivoted into the main tank after the plume from the lower right field joint burnt through the booster motor strut.
    - In the Commission deliberations, Dr. Feynman, a member of the Rogers Commission, conducts an experiment before the Commission in which he subjected a rubber O-ring to ice water to show how the low temperature made the O-ring brittle.
    - Acting Administrator Graham testifies before the Commission that he did not know about the O-ring issue. The "bombshell" occurred when Alan McDonald of Morton Thiokol told the Commission about the contentious teleconference between Morton Thiokol and NASA the night before the Challenger launch.
    - During this event filled week, NASA also released photographs showing dark puffs of smoke coming from the lower field joint of the right solid rocket motor.
- **Week 4**:
    - NASA's General Manager, Philip Culbertson, was relieved by Dr. Graham for not telling him about the O-ring issue (another version

of the story was that Culbertson had authorized the building of a satellite without Graham's permission).

  - o During a Commission hearing on February 18, it was learned that the field joint seals on the solid rocket motors were Criticality 1 items meaning that if they failed the shuttle and its crew would be destroyed.

- **Week 5**:
  - o Morton Thiokol's Roger Boisjoly testified before the Commission that Marshall's Mulloy and Hardy strongly objected to Morton Thiokol's recommendation not to launch.
  - o During the Senate hearings, Senator Hollings (D-SC) stated that the purpose of the hearings is not to look for a scapegoat.
- **Week 6**:
  - o Most of the crews' remains are recovered. Everyone is asking "Did they die instantly?"
- **Week 7**:
  - o In an editorial in the March 11 edition of the Chicago Tribune, they asserted that the Challenger investigation was about to turn into a witch-hunt, not because the public demands it, but because NASA's secrecy was forcing the Nation to it.
  - o NASA told Americans that the astronauts died instantly when Challenger's main fuel tank exploded.

  - Richard Smith of Kennedy Space Center went on record that 98% of the pressure to launch came from the media (television and print).
  - Morton Thiokol announced that Jerald Mason's was relieved of his duties of the space operation and Calvin Wiggins was demoted and reassigned.
- **Week 8**:
  - A Gallop poll showed that eighty percent of Americans believed that the manned space flight program should continue.
- **Week 9**:
  - On March 30, the Washington Post asked: "Did the Media Goad NASA Into the Challenger Disaster?"
- **Week 10**:
  - NASA transferred Stanley Reinantz, who made the decision not to inform his superiors about the Morton Thiokol recommendation not to launch.
- **Week 13**:
  - The rest of crew remains were found along with the crew cabin. Evidence suggested that the crew was alive following the break-up of the Challenger and they may have been aware of their situation. They did not die instantly until their cabin hit the Atlantic.

- **Week 14**:
  - The Rogers Commission questioned whether NASA has been concealing evidence concerning the O-ring issue.
- **Week 15**:
  - Mulloy of Marshall Space Flight Center was transferred laterally to another position. It was learned that Mulloy had placed a launch constraint on future shuttle flights in August 1985 relative to O-ring performance in cold weather. Five days before the Challenger launch, Mulloy removed the constraint leaving the NASA launch team to believe that the problem had been resolved.
- **Week 16**:
  - The Los Angeles Times reported that it had obtained the Rogers Commission conclusions, which were that the solid rocket motor design was flawed and NASA had failed to heed Morton Thiokol's warnings.
  - Charles Locke, Chairman and Chief Executive Officer of Morton Thiokol, made the unfortunate statement that "This shuttle thing will cost us this year ten cents a share" (Wall Street Journal, May 15, 1986). He would later retract these words.
- **Week 17**:
  - President Reagan announced that the U.S. will build a replacement shuttle and the manned space flight program will continue, which

will lead to a manned space station.

- **Week19**:
  - Jerald Mason of Morton Thiokol and Dr. William Lucas of NASA announced their retirements. Morton Thiokol also announced the reassignment of executives Joseph Kilminster and Calvin Wiggins.
- **Week 20**:
  - The Rogers Commission report was presented to the President and released to the public. The blame rhetoric is widespread. Headlines proclaimed that Challenger was an accident that did not have to happen. Others charged that NASA knew about the O-ring problem, but needed Morton Thiokol to be the scapegoat.
  - Dr. Feynman of the Rogers Commission stated that NASA was promoting a fantasy when they maintained that the probability of a solid rocket booster failure was 1:100,000; he argued that the probabilities were closer to 1:100.
  - During the Senate hearings, Senator Hollings stated that Lawrence Mulloy was guilty of "willful gross negligence."
  - NASA was accused being a cult of arrogance.
  - President Reagan makes the statement in a speech that NASA's carelessness grew out of its success.
  - Mulloy told the press that he was disturbed by the accusations that he was to blame for the disaster (<u>USA Today</u>, June 12, 1986).

- **Week 21**:
    - o In testimony before the Senate, NASA Administrator Fletcher told the senators that he has removed those from the chain of command who were involved in the flawed decision to launch Challenger. He added that they would be disciplined, but doubted if the government could realistically charge Mulloy with gross negligence. Hollings changed his mind and believed that Mulloy was just the fall guy and the real culprit for the Challenger disaster was Dr. William Lucas.
- **Week 22**:
    - o Representative James Schaurer (D-NY) during House hearings told Charles Locke, Chairman and Chief Executive Officer of Morton Thiokol: "What Thiokol's management did, before the launching and then to the engineers who told the world about it, was utterly repugnant, just disgraceful….There is a lot of blame to go around, but Thiokol deserves a fat share of it" (<u>New York Times</u>, June 29, 1986).

<u>Challenger Official Records</u>

The official government records reflected the views, opinions, and proceedings of Congress, NASA, and the Presidential Commission charged with the investigation of the Challenger accident. A review of these records also provides a different perspective concerning the blame attribution process within the space policy subsystem. While the print media artifacts were generally accurate in their reporting of the government reports and proceedings, it was essential that the actual reports and hearings be reviewed. It was another means of ensuring that the data used in this research was accurate and valid.

The official government documents that were examined included:

- The Report of the Presidential Commission on the Space Shuttle Challenger Accident (Rogers Commission)
- Investigation of the Challenger Accident, Report of the Committee on Science and Technology, House of Representatives, October 29, 1986.
- Investigation of the Challenger Accident, Vol. 1, Hearings before the Committee on Science, Space, and Technology, House of Representatives, June 10-12, 17, 18, 25, 1986.
- Investigation of the Challenger Accident, Vol. 2, Hearings before the Committee on Science, Space, and Technology, House of Representatives, June 15, 16, 23, 24, 1986.
- Space Shuttle Accident, Hearings before the Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation, United States Senate, February 18; June 10, 17, 1986.
- Handwritten notes from a meeting among NASA Public Affairs Officers commenting on the post-Challenger public affairs situation.

Rogers Commission Report

On February 3, 1986, President Reagan in Executive Order 12546 appointed a Presidential Commission to "review the circumstances surrounding the accident to establish the probable cause" of the accident and to develop recommendations to correct the deficiencies found pursuant to their investigation" ("Report of the Presidential Commission on the Space Shuttle Challenger Accident," February 3, 1986). Former Secretary of State (Nixon Administration) and former Attorney General (Eisenhower Administration) William P. Rogers was appointed as its chairman and given 120 days to investigate the accident and report its findings to the President.

Secretary Rogers selected twelve Commission members from the military, astronaut corps, and scientific, academic, industrial, and media communities:

- Mr. Neil Armstrong, Vice Chairman and former astronaut
- BG Chuck Yeager, USAF, retired
- Dr. Sally Ride, Astronaut on June 1983 flight of Challenger
- Dr. Albert Wheelon, Senior Vice President, Hughes Aircraft Company
- Mr. Robert Rummel, Former Vice President of Trans World Airlines
- Dr. Arthur Walker, Professor of Applied Physics, Stanford University
- Dr. Richard Feynman, Professor of Theoretical Physics, California Institute of Technology and Nobel Prize winner in physics (1965)
- Dr. Eugene Covert, Professor of Aeronautics and Astronautics, Massachusetts Institute of Technology

- Mr. Robert Hotz, former editor of Aviation Week & Space Technology magazine
- Mr. David Acheson, former Senior Vice President and General Counsel of the Communications Satellite Corporation
- Mr. Joseph Sutter, Executive Vice President, Boeing
- MG Donald Kutyna, Director of Space Systems and Command, Control, and Communications, U.S. Air Force

The Commission was divided into four panels. Mr. David Acheson chaired the prelaunch panel; MG Kutyna, accident analysis; Dr. Sally Ride, operations and planning; and Mr. Joseph Sutter, shuttle development and production. Dr. Alton Keel, who was a former Assistant Secretary of the Air Force for Research, Development and Logistics, was appointed as the Commission's Executive Director. Dr. Keel led a staff of 160 with the mission to analyze the data provided by NASA and generated by the Commission panels.

The Commission perceived its remit to investigate not only the technical causal factors that led to the destruction of the Challenger, but also other factors that they felt contributed to the accident. They delved into NASA's management practices; scrutinized the relationships between NASA Headquarters and its Centers; and the process by which a launch decision was made. In essence, the Rogers Commission expanded their charter from sifting through the physical evidence to sifting through NASA itself.

When the report was submitted to President Reagan on June 6, 1986, the Commission had conducted thirty-five investigative sessions, examined more than six thousand documents, and generated 2,800 pages of transcripts. The following sections address highlights of the hearings, as they pertain to the establishment of blame, and their recommendations.

Rogers Commission Hearings

The most compelling testimony in the two volumes of the Rogers Commission transcripts that led the Commission and others to form opinions about individual culpability was situated in two issues:

- The teleconference the night before the launch of Challenger
- When did NASA and Morton Thiokol know that they had a defective and dangerous O-ring design?

The first mention of the teleconference that can be identified in the Commission's proceedings was during the hearing of February 6, 1986. Dr. Lovingood, who was the Deputy Manager of the Shuttle Projects Office at Marshall Space Flight Center, returned without prompting to a question posed earlier by Dr. Wheelon regarding the temperature on the solid rocket booster and the impact that the cold temperature would have on the field joint seals. Lovingood stated that:

> *We did have a meeting with Thiokol. We had a telecon discussion with the people in Huntsville, people at the Wasatch division [Morton Thiokol], and people at KSC [Kennedy Space Center]. And the discussion centered around the integrity of the O-rings under low temperature. We had the project managers from both Marshall and Thiokol in the discussion. We had the chief engineers from both places in the discussion. And Thiokol*

recommended to proceed on the launch, and so they did recommend launch. We had a meeting where there was some concern about the cold temperatures (Rogers Commission, Vol. IV: 97).

There are two things that are interesting about this testimony: 1. The absence of any mention of Morton Thiokol's initial position not to launch and the heated discussion that led up to Morton Thiokol's recommendation to launch; and 2. There were no follo -up question other than Secretary Rogers asking when the teleconference was conducted.

One of the topics of discussion during the hearings on February 10, 1986, was the "leaking " of information ostensibly by NASA sources to the print media. It was during this period (i.e. week 3 in the issue cycle) that the press became disgruntled with NASA because they were not being provided any information. Mr. Acheson of the Commission commented:

> *In the Washington Post story on Sunday [February 9, 1986], a number of theories of the accident were expounded and illustrated in that story…I assume one or more may have associated internal correspondence…* (Rogers Commission, Vol.IV: 247).

What Acheson proposed was that the Commission review the material before it was given to the press. He assumed, of course, that this information was released by NASA. Graham's testimony does not reveal that he thought that the information was provided unofficially to the media.   The Washington Post article that Acheson referred to was entitled "Forces Go Awry, For 'Accident Chain'" by Douglas Feaver. The article was a news analysis that speculated that there was not a single failure, but a series of failures—an accident chain—that caused the accident. Feaver cites the following events in the accident chain: Pressure on NASA to conduct more launches; the resulting feeling of haste by NASA; sloppiness in NASA's performance; the reliability of the solid rocket motor; reduction of the number of performance and safety-related sensors to increase payload; and the decision to launch despite adverse weather.

As can seen in this testimony, the media in general—and print media specifically—had to generate alternative and unofficial sources of information because NASA could not or would not provide it to them. John Pike of the Federation of American Scientists was quoted as saying that "NASA is a public affairs that has an agency" (New York Times, April 25, 1986).

During the February 10 testimony, Mr. Jesse Moore, Dr. Lucas, and Mr. Mulloy were called to testify. Dr. Sally Ride asked Moore: "Is there any correspondence on potential concern over the operation of the O-ring or the joint?…that's going to be the next question." After Mulloy responded that they had some data about the resiliency of the O-ring at various temperatures, Dr. Lucas added: "I believe also, Larry [Mulloy], that there was a discussion in close proximity to the launch between you and other people and Thiokol." Mulloy went on to explain the teleconference between NASA and Morton Thiokol had been initiated by a concern expressed by Morton Thiokol about the temperature forecasted at launch time. Mulloy stated that Morton Thiokol presented information that the coldest temperature that the O-ring had been exposed to in a launch was fifty-three degrees and "…they wanted to point out that we would be outside of that experience base." Mulloy responded to a few questions from Secretary Rogers and then he said:

> *After hearing the discussion [between NASA and Morton Thiokol], we all concluded that there was no problem with the predicted temperatures for the SRM [solid rocket motor] and I received a document from the solid rocket motor project manager at Thiokol to that effect that there was no adverse consequence expected due to the temperatures on the night of the 27th"* (Rogers Commission, Vol., IV: 294-295).

Alan McDonald of Morton Thiokol, who was in attendance at the hearing, asked permission to make a point. He dropped a "bombshell" when he said:

> *The recommendation at the time from the data that was sent out from Thiokol was not to launch below 53 degrees Fahrenheit because that was our lowest acceptable experience base and did demonstrate some blow-by from a year ago and also we had some data that indicated the poor resiliency of response of the Viton seal to low temperatures…(*Rogers Commission, Vol. IV: 297)

From this revelation by McDonald, a new avenue of inquiry was launched by Secretary Rogers pertaining to the technical issues associated with the O-ring performance in cold weather, who was present during the teleconferences, and who from Morton Thiokol made the decision to reverse their position. During testimony on February 14, 1986, Morton Thiokol executives were given the opportunity to testify. Secretary Rogers offered Mr. Jerald Mason, Vice President and General Manager of the Wasatch Division of Thiokol, the opportunity to provide the Commission documents "…that we don't know about that would be embarrassing to you…You know what's there. Tell us the whole story, if you will" (Rogers Commission, Vol. IV: 609).

Mason described the organization and the chain of command. Wiggins was the general manager of the space division; Kilminster, the program manager of manufacturing, who reported to Wiggins; and McDonald reported to Kilminster. Following this description of the Wasatch organization, Mason was asked who made the technical decision. Mason stated that Lund, who was vice president of engineering, made the recommendation to Kilminster. The purpose of this dialogue between the Commission and Morton Thiokol was to establish who was responsible for rendering a decision to NASA about whether to launch. Secretary Rogers steered the hearing back to the January 27 teleconference when he asked Mason for his rendition about why Morton Thiokol initially was opposed to the launch.

During the dialogue between Morton Thiokol and the Commission members, it became apparent that there was something fundamentally different about the teleconference. Mr. Bob Crippen, an astronaut who had been called to testify, made an important observation when he said:

> *Since the earliest days of the manned space flight program that I've been associated with and Mr. Armstrong has been associated with, our basic philosophy is: Prove to me we're ready to fly. And somehow it seems in this particular instance we have switched around to: Prove to me we are not able to fly. I think that was a serious mistake on NASA's part, if that was the case* (Rogers Commission, Vol. IV: 632).

After some further discussion, Acheson (Commission) asked Arnold Aldrich (Manager of the Shuttle System at Marshall Space Flight Center) who was the most senior NASA official who knew of Morton Thiokol position. Reinartz

(Manager of Shuttle Projects at Marshall) stated that he was the most senior NASA employee who knew, but he did not feel it was necessary to tell his superiors at NASA Headquarters because it did not violate any waivers or constraints for the launch. The Commission also kept coming back to this point not understanding why Reinartz did not tell his superiors that there was an issue about the O-rings. With this testimony, Reinartz essentially identified those fro NASA who would be targeted for blame attribution. In other words, Reinartz said that with him the "buck stopped here."

During the afternoon's testimony of February 14, Roger Boisjoly (Manager of the Structures Section of Morton Thiokol) testified that when Morton Thiokol made their recommendation, George Hardy (Deputy Director of Science and Engineering at Marshall) told the that he was appalled at Morton Thiokol's recommendation, but he would accept it. Boisjoly and Arnold Thompson were the two Morton Thiokol engineers who were opposed to the launch and proceeded to argue their case during the caucus sessions of the teleconference. Boisjoly also made the observation, as did Crippen previously, that in the past "We normally have to absolutely prove beyond a shadow of a doubt that we have the ability to fly, and it seemed like we were trying to prove…that we couldn't fly at this time…" (Rogers Commission, Vol. IV: 676).

Near the end of the testimony on February 14, Dr. Al Keel, the Executive Director of the Commission, asked Allan McDonald (Morton Thiokol) if he had inferred correctly from McDonald's testimony that NASA had applied an unusual amount of pressure on Morton Thiokol to give an affirmative launch decision. McDonald told him that it was a correct inference. Secretary Rogers then asked McDonald if he had signed off on the revised Morton Thiokol launch decision. Mc Donald told that he had not.

On February 15, Secretary Rogers issued a statement in which he asked Acting Administrator Graham to remove any NASA official who was involved in the Challenger launch decision from NASA's investigation. Secretary Rogers' intention was to remove any possibility of conflict of interest or, as he stated, "People shouldn't be put in a position of having to run an investigation which ultimately may challenge the decisions they made" (Washington Times, February 17, 1986). Secretary Rogers' then said that the decision-making process "may have been flawed." In another report, a source close to the investigation stated that: "In the end, I think you will see people failures as well as hardware failures" (New York Times, February 17, 1986). The identification of specific individuals who had responsibility for the decision was becoming clear to the Rogers Commission by week 3 and 4.

During testimony on February 25, Chairman Rogers returned to the question of NASA pressure on Morton Thiokol. McDonald recounted how during previous flight readiness reviews he had to stand before a demanding audience at the Kennedy Space Center and justify why Morton Thiokol (solid rocket boosters) was ready for launch. However, on the night of January 27, he stated that he "…was surprised here at this particular meeting that the tone of the meeting was just the opposite of that. I didn't have to prove that I was ready to fly….we had to prove that it wasn't…I felt that was pressure" (Rogers Commission, Vol. IV: 728-729). McDonald also noted that something else was different; NASA requested a written decision that Morton Thiokol believed that they were ready to fly.

Until they concluded May 2, 1986, the Commission kept coming back to these three issues from different directions: 1. The change in launch decision process ; 2. The pressure that NASA exerted on Morton Thiokol to change its position; and 3. Who made the decision to launch. After nearly 2,800 pages of testimony, seventy witnesses before the full Commission, forty-six panel sessions, and after reviewing 6,300 NASA documents, the Commission reported its findings and recommendations to the President on June 6, 1986. Their bottom line was : This accident should not have happened.

Rogers Commission Findings and Recommendations

Secretary Rogers submitted the Commission's Report to President Reagan on June 6, 1986. They found that the specific cause of the Challenger disaster was "…the failure of the pressure seal in the aft field joint of the right Solid Rocket Motor" (Rogers Commission Report to the President, Chapter IV: 42). They had identified the technical failure that caused the sequence of events that led to the destruction of Challenger and they offered the President sixteen findings and nine recommendations to get the space shuttle program back on track.

Refer to Appendix G for a summary of the Rogers Commission's Findings and Recommendations.

At the end of the Commission's Recommendations, it stated:

> *The Commission applauds NASA's spectacular achievements of the past and anticipates impressive achievements to come. The findings and recommendations presented in this repot are intended to contribute to the future NASA successes that the nation both expects and requires the 21st century approaches* (Rogers Commission Report to the President, Vol. 1, Ch. IX, p. 201).

On September 29, 1988, 975 days after the destruction of Challenger and after spending billions of dollars to implement the changes recommended by the Rogers Commission, space shuttle Discovery launched from the Kennedy Space Center with all five crewmen being veteran astronauts. This first "no rookie" cre returned the U.S. to space (Curtis, 1992: 108).

An important point must be made about the Rogers Commission's findings and recommendations: They did not attribute blame to any individual or group of individuals. The Commission identified the specific, technical cause that led to the destruction of Challenger after they had conducted a thorough review of the physical evidence. They also moved out of the technical realm and conducted a comprehensive review of NASA's management structure pertaining to communications and decision-making, especially launch decisions. However, it did not attribute blame to anyone. In a press conference following the presentation of the Commission's report on June 9, 1986, Rogers defended the Commission's report by stating that:

> *We were not asked to assess blame, and we have not assessed blame. This is a kind of national tragedy that in a sense, a lot of us are to blame for* (Rogers and Strobel, Washington Times, June 10, 1986).

Congressional Hearings

As the Rogers Commission was conducting its hearings, the House's Committee on Science and Technology and the Senate's Subcommittee on Science, Technology, and Space of the Committee on Commerce, Science, and Transportation refrained from conducting hearings with the exception of one hearing by the Senate on February 18. The House hearings convened on June 10, 11, 12, 17, 18, 25 and July 15, 16, 23, and 24, 1986, which resulted in a report of their findings on October 29, 1986. The Senate held hearings on February 18, June 10 and 17, 1986. The following sections specifically examine the language of blame attribution in the House and Senate hearings.

House Challenger Accident Hearings and Report

Acting Chairman of the House Committee on Science and Technology Robert Roe (D-NJ) opened the Committee review of the Rogers Commission report by granting full access of the committee's hearings to the media (e.g. television, radio, and print). The Committee's agenda was to delve into the technical failures that caused the accident; examine NASA's management structure and decision-making processes; and determine how to get the manned space flight program back on track (Hearings, Vol. 1: 1). These hearings resulted in a report, which will also be discussed in this section.

After reviewing the testimony of Secretary Rogers, NASA, industry, and former astronauts in volumes of proceedings, the one question that was asked repeatedly was directed by Chairman Roe to Mr. Garrison, President of Morton Thiokol, during the June 18 hearing:

> *Was Thiokol under pressure by NASA to make a decision regardless of the problems involved to launch? Or did Thiokol un laterally make that decision?* (Hearing, June 18, 1986: 514).

Mr. Garrison's response was that there was a difference of opinion among the technical personnel present, adding that the four Thiokol executives who made the decision to reverse their no-launch recommendation "…felt that they had adequate justification to make the decision." The testimony of the Marshall Space Flight Center and the Morton Thiokol executives was often cautious and laced with caveats and explanation that were not required by the question. Although Chairman Roe often made the point throughout the hearings that the objective of the hearings was to not find blame, but the truth about what happened and why it was allowed to happen. He specifically advised NASA that the members of the Committee would ask penetrating questions and he pointed out that:

> *…because of its [NASA's] great success story Congress has been too shy in finding fault with NASA. As a result of the* Challenger *accident, Congress and NASA must begin a new era, one n which Congress must apply the same strong oversight to NASA that it does to any other Government agency* (Hearing, June 10, 1986: 2).

The following explores the issues of accountability, responsibility, and blame attribution during these hearings:

June 10, 1986

Secretary Rogers and Mr. Neil Armstrong were the principal witnesses. In Congressman Lujan's (R-NM), the ranking minority member of the Committee, opening statement, he stated that: "Should we find evidence of mismanagement, poor judgment, or even negligence, we must take appropriate action" (Hearing, June 10, 1986: 4). However, Lujan did not spell out what "appropriate action" meant. The opening statements of other members also spoke about engineering and management mistakes that were made; NASA's attitude about how the accident was unavoidable; and not only establishing culpability, but renewing the faith of the American people in NASA.

In response to a question from Congressman Lujan, Secretary Rogers reiterated that he did not view the establishment of blame or culpability as being in the Commission's charter. Rogers did acknowledge that during the Commission investigation and hearings "…a lot of information developed as to individuals…a lot of information about particular individuals, many of whom have been transferred already" (Hearing, June 10, 1986: 51). Rogers did add that he did not believe that any one individual or group of individuals should be blamed because he thought the failure was a system failure—a failure of NASA as an organization.

Secretary Rogers responded to a question from Congressman Walker (R-PA) concerning the oversight process and how negative information should have surfaced before it led to a disaster. Rogers stated that everyone should claim a share of the blame for Challenger, not only the current Administration, but the prior Administrations as well. Congress should receive some of the blame for not providing the proper oversight of NASA and for not asking the tough questions. He said that even the press should receive a share of the blame for writing scathing articles about NASA when they "scrubbed" a launch. Walker responded to Rogers by expressing his view that there was a failure in those who were providing policy direction to NASA as well, possibly referring to the President. Rogers retreated a bit from his earlier position by stating that he did not want to get involved in who was to blame for the Challenger disaster (Hearing June 10, 1986: 55-56).

Congressman Sensenbrenner (R-WN) asked Secretary Rogers if the Commission had uncovered any evidence that could be referred to the Justice Department for investigation of criminal negligence. Rogers told him that he did not have any such evidence (similar questioning will be seen in the Senate hearings). Rogers did state clearly that Morton Thiokol executives reversed their position relative to the launch recommendation because "…they were trying to accommodate a major customer [NASA]" (Hearing, June 10, 1986: 58). Congressman Torricelli (D-NJ) picked up the question of criminal negligence by asking Rogers if he would comment on Torricelli's view that, because there was loss of life, criminal negligence could be charged. Rogers dismissed the idea of criminal negligence and the possibility that such a charge could be successfully prosecuted. He added that people made mistakes because of misunderstandings and it was not just Mulloy who made the mistakes.

The line of questioning concerning the exertion of pressure to launch was a theme that was prevalent throughout the hearing. The context of the questioning was that of pressure that NASA may have felt to launch and the pressure that NASA put on Morton Thiokol to render a “go launch” decision. In response to the question of external pressure on NASA, Secretary Rogers commented that pressure can some times be beneficial and it is “…what makes the American system work as well as it does” (Hearing, June 10, 1986: 71). Rogers cautioned that there were other pressures that could overcome an agency’s consideration for safety. He did not elaborate.

June 11, 1986

The second day of hearings afforded the opportunity for NASA to testify. Led by NASA’s new administrator, Dr. James Fletcher, he was joined by Dr. Willia Graham, Deputy Administrator; Admiral Truly, Associate Administrator for Space Flight; Capt. Robert Crippen, astronaut; Mr. Arnold Aldrich, Manager of the National Space Transportation System; and Mr. Dan Germany, leader of NASA’s photo and television analysis team.

In Congressman Walker's (R-PA) opening statement, he expressed concern that NASA would retain those personnel who had "…played key roles in the multiple management failures which led to the accident…"(Hearing, June 11, 1986: 113). In Dr. Fletcher's opening remarks, he referred to Secretary Rogers' comments that the goal of NASA was not punish, but to fix the problems that led to the Challenger disaster. Congressman Dan Fuqua (D-FL) then addressed Fletcher about how the media and others had reported that the relationship between NASA and Congress was too "cozy." Fuqua went to explain for the record that Congress had asked NASA tough questions about their budget and their views of the future. He also pointed out that in the past their relationship had not always been "cozy;" it was often times contentious.

June 17, 1986

On the fourth day of testimony, Morton Thiokol was invited to testify. Led by their Chairman and Chief Executive Officer, Charles Locke, he was joined by Edwin Garrison, President of the Aerospace Group; Joseph Kilminster, Vice President; Carver Kennedy, Vice President of Space Booster Programs; Allan McDonald, Direct of the Solid Rocket Motor Verification Task Force; Roger Boisjoly, Staff Engineer; and Arnold Thompson, Supervisor of Structures Design.

This was an especially acrimonious hearing that began with Congressman Lujan stating that he wanted to know how the key personnel of Morton Thiokol executed their responsibilities. Lujan effectively asked whether the management system was broken or was the system itself flawed. In Congressman Lloyd's (D-TN) opening statement, she did attempt to temper the mood of the hearing by stating that::

> *Pursuing the question of individual criminal negligence and related liability seems to me to serve no useful purpose…I hope no one on this Committee will poison the atmosphere through playing 'who shot John'…* (Hearing, June 17, 1986: 321-322).

The Chairman affirmed this view by Congressman Lloyd by stating: "The Chair is not interested in points of view of placing blame at this point" (Hearing, June 17, 1986: 325).

The acrimony occurred early in the hearing when Congressman Scheuer (D-NY) referred to Mr. Locke's opening statement in which he spoke about the pain and anguish that Morton Thiokol shared with the rest of the nation concerning the Challenger disaster: "Is this what you were referring to when you mentioned to a newspaper correspondent recently and I quote, 'This shuttle thing will cost us 10 cents a share this year'" (Hearing June 17, 1986: 356). Scheuer then asked Locke if the loss of the Challenger and her crew would equate to $20 to $25 a share for "every shareholder in the American company?" Scheuer then told hi

> *…I would say that your statement that this shuttle thing cost us 10 cents a share, has to go down in the annals of history. In 1882 William Vanderbilt, in answer to a newspaper reporter's comment, said "The public be damned." Now for over a century that remark has stood unchallenged and unparalleled for its gross insensitivity, for its banality and tastelessness, but I believe you have finally done it. You have moved Mr. Vanderbilt over in that corporate dealership hall. You have done it* (Hearing, June 17, 1986: 356).

After a technical discussion about O-ring elasticity and temperature, the Committee focused on the issue of how the decision not to launch was overridden. Who was in charge of Morton Thiokol's caucus? Who made the decision to overrule their own experts? During the Rogers Commission hearings, the testimony attributed Jerald Mason with telling Bob Lund, Vice President for Engineering, to take off his engineering hat and put on his management hat. Kilminster confirmed that this statement was made. Lund had supported the position not to launch based on the technical data, but he was also a member of the management team; he had to choose which team he was on and he did. Lund sided with Kilminster, Mason, and Wiggins to reverse the Morton Thiokol position with Kilminster signing the fax that was sent to NASA at the Kennedy Space Center. Kil inster signed it because McDonald, who was at Kennedy, told him that he refused to sign it. Roe again injected himself in the proceedings by reiterating that the purpose of the hearing was "…not necessarily to pinpoint blame but what happened in the management process between the companies involved and NASA…We are trying to get to the point of view that somebody made some decision someplace…" (Hearing, June 17, 1986: 379).

In the afternoon session, executives from NASA's Marshall Space Flight Center in Huntsville, Alabama were greeted by Chairman Roe. The witnesses included Dr. William Lucas, Director of Marshall; Wayne Littles, Deputy Director of Science and Technology; Lawrence Mulloy, Assistant to the Director for Science and Engineering; Jerald Smith, Manager, Solid Rocket Booster Project; Stan

Reinartz, Manager, Special Projects Office; and Bill Sneed, Assistant Director, Policy and Review.

The hearing began with a discussion of the issue of temperature and O-ring test data. Chairman Roe asked Mr. Mulloy if NASA had enough test data to make the decision that was made on the night of January 27. Mulloy stated that in hindsight, they did not. The discussion then shifted to whom in NASA Headquarters knew of the issues that were discussed between NASA and Morton Thiokol the night before the launch. Mulloy testified that he had thought that Reinartz had called Mr. Aldrich, his superior, to apprise him of the concerns that Morton Thiokol had raised. As it turned out, Reinartz did call Aldrich, but he did not discuss the O-ring temperature issue because he did not view it as an issue.

Congressman Lujan confronted Dr. Lucas about the apparent change in NASA culture concerning proving that it was not safe to fly rather than proving that it was safe to fly. Lucas affirmed that it has always been NASA's policy and practice that NASA and its contractors had to prove that it was safe to fly.
The issue of NASA's pressuring of Morton Thiokol to reverse their position again surfaced during the intense questioning of Dr. Graham by Congressman Walker (D-PA). Walker wanted Graham to simply say that he agreed with the Rogers Commission report finding that NASA had pressured Morton Thiokol to change their position. Graham repeatedly stated that he accepted it as their view.

Walker did not want that answer. Finally, Graham stated, “I accept the conclusion that Thiokol reversed their position, particularly as they determined it to be, at the urging of NASA. I believe that is what was stated there.” (Hearing, June 17, 1986: 437-438). Walker was still not satisfied; he wanted to know if NASA had come to the same conclusion. Graham stated that he had not arrived at that conclusion independently. Truly, Lucas, and Mulloy, who were sitting with Graham, all agreed with the Rogers Commission finding that NASA pressured Morton Thiokol to reverse their position.

The balance of the hearings concentrated on who made the decision within Morton Thiokol to change their position and how long did NASA and Morton Thiokol know that the O-ring design was defective. The House hearings covered the same ground as the Rogers Commission. Like the Rogers Commission, Chairman Roe repeatedly stated that the hearings were about finding out happened and who made the decisions; not about fixing blame. However, like the Rogers Commission, those who were culpable were readily identifiable. The last point about the June 17 hearing that will be addressed was Congressman Walker’s directing more of the spotlight of accountability on NASA than Morton Thiokol. As was later brought out in the hearing, the proverbial “buck” stopped at Reinhartz, who was the most senior NASA executive who knew about Morton Thiokol’s reservations, but opted not to apprise the next level of NASA management (i.e. Level II).

Report of the House Committee on Science and Technology

The Committee on Science and Technology of the House of Representatives released their report entitled Investigation of the Challenger Accident on October 29, 1986. In its Introduction, it stated that this report was a review of the Rogers Commission report and the investigation conducted by NASA. The Committee saw their role as the legislative body that had authorized funding for the shuttle program to investigate the causes of the Challenger disaster to ensure that such a disaster did not occur again.

The Committee formulated a number of conclusions. However, the three that deal with responsibility are:

- NASA's objective to schedule twenty-four flights per year created pressure throughout NASA. The Committee, Congress, and the Administration played a role in creating this pressure.
- The failure of the field joint was due to a faulty design and that NASA and Morton Thiokol did not fully understand the operation of the joint. NASA and Morton Thiokol did not respond to the warning signs that the joint design was defective.
- Differing from the Rogers Commission findings, the Committee did not find poor communications between the Centers and Headquarters. They found that the "…fundamental problem was poor technical decision making over a period of several years by top NASA and contractor personnel… NASA and Thiokol technical managers failed to understand

or fully accept the seriousness of the problem."

The Committee asked NASA to revie their conclusions and findings and report back to the Committee by February 15, 1987 with how they planned to implement the Committee's findings.

As members of the space policy subsystem, NASA and the Congress had developed a close relationship over the years marked predominantly by success and scientific achievement. With the Challenger disaster, it forced Congress to examine its relationship with the agency to which it was not only a authorizer of funds, but also an overseer. Without the tension inherent in the separation of powers—in this case, the executive and legislative—problems are created that would not have occurred if the proper checks and balances attendant to the separation of powers had been in place. At the end of the report, the Committee addressed the propensity that we Americans have in making our heroes, whether they be individuals or institutions, "ten feet tall:"

> *Perhaps it is arrogant to dissect and interrogate relentlessly projects and program that bring home repeated A's for achievement and accomplishment. However, all of us—NASA, the Committee, the Congress, the Nation—have learned from the* Challenger *tragedy that it is wisdom to do so, and it is a reflection of respect for the human fallibility that we all possess* (Report, October 29, 1986: 7)

Senate Challenger Accident Hearings

Unlike the ten hearings that the House conducted, the Senate's Subcommittee on Science, Technology and Space held only three days of hearings, the first of which occurred on February 18 (week 4 of the Challenger issue cycle). Of all the official records reviewed in this study, the Senate hearings were the richest in blame rhetoric. While the Rogers Commission and the House Committee on Science and Technology took great pains not to let the proceedings devolve into blaming sessions, the Senate was not so constrained; Senators Hollings, Riegle and Gore appeared to be the most vocal in fixing the blame.

As was the case in reviewing the House hearings, only those portions of the Senate hearings that specifically address responsibility and accountability will be featured in this review.

February 18, 1986

In Senator Slade Gorton's (Chairman of the Subcommittee) opening remarks he stated the he did not want the Subcommittee to duplicate or "second guess" the Rogers Commission, which was involved at the time in taking testimony and conducting a comprehensive investigation. His vision of the Subcommittee's role was to answer the questions that most Americans were asking about the Challenger accident. Senator Gorton (R-MO) outlined four subjects that would form the crux of the Subcommittee's inquiry:

1. The events that led up to the launch and the aftermath.
2. Whether it was possible in the future for the shuttle to safely separate from the rocket motors while they were still burning.

3. When the shuttle program should resume and who should be allowed to fly in it.
4. Whether to build a replacement fourth orbiter vehicle or should the United States rely on unmanned space vehicles.

The witnesses for the February 18 hearing were Secretary Rogers and Mr. Neil Armstrong. The first order of business was that of opening statements. Senator Riegle (D-MI) commended NASA on its achievements, but stated that the causes for the accident must be found and corrected. Senator Hollings (D-SC), the ranking minority member, began his opening statement by stating that the Challenger disaster was avoidable. Hollings then shared with the Subcommittee his views about Presidential Commissions and the fact that they do not always get the necessary information for a comprehensive investigation. What the Challenger inquiry needed was an adversarial proceeding in order to obtain all the data that was necessary to get the answers that were needed. Senator Trible (R-VA) was supportive of finding the problems, fixing them, and resuming the manned space flight program. Senator Gore (D-TN) expressed his view that Congress was supportive of NASA, but not unconditionally. Gore agreed with Secretary Rogers in his decision to preclude NASA executives, who were involved in the Challenger launch decision, to participate in the investigation. Senator Rockefeller (D-WV) made the interesting point that the space shuttle was still in the research and development phase and not an operational space vehicle, as some in the Reagan Administration had maintained. Senator Ford

(D-KY) expressed concern about all of the students who had anticipated learning from the first teacher in space.

In Secretary Rogers' opening statement, he reviewed his remit from the President. Rogers then informed the Subcommittee that he believed NASA's decision-making process "may have been flawed," stressing the word "may." In testimony, Secretary Rogers stated that the Commission would answer three questions: "What happened?;" "Why did it happen?;" and "What should we do to minimize the chances of any recurrence of such a tragedy?" (Hearing, February 18, 1986: 10). The important point in this testimony is that Rogers never asked the question "Who is responsible?"

Following Secretary Rogers' opening statement, Senator Gorton raised the issue of whether anyone in NASA or Morton Thiokol had broached the subject of the cold weather's impact on the shuttle launch. Rogers' response was one of concern about discussing such a complex issue in a public forum. His concern was being "…able to present it in a way that is understandable and that those people affected, some of whom may be adversely affected, are treated fairly" (Hearing, February 18, 1986: 13). Secretary Rogers most likely knew or had a good idea who was going to be held accountable. As Gorton's time came to an end, he asked Rogers if he was ready to pursue the investigation regardless of where it led him and "…whoever may or may not be embarrassed in connection with that." Rogers replied: "There is no question about that" (Hearing, February 18: 14).

During Senator Riegle's questioning of Secretary Rogers, he brought up an interesting issue in that Riegle asked Rogers if it would be possible for some senior staff members to sit in on the Commission's deliberations as "listeners" so that "…we do not end up losing a lot of time..." Rogers took exception to this suggestion by stating that because the Commission was a Presidential Commission, it would violate separation of powers for legislative staffs to sit in on executive sessions. Rogers did promise to send the Subcommittee transcripts of the proceedings as they became available. Riegle's response was that "It seems to me we ought to be able to go down the same road together more or less a the same time" (Hearing, February 18, 1986: 16). Rogers held his ground stating: "This is a Presidential Advisory Commission…we have the right and continue to have the right to hold executive sessions as we see fit" (Hearing, February 18, 1986: 16). Undaunted, Riegle still could not understand why Rogers was reluctant to let the Senate staff sit in on the sessions. Rogers finally told him:

> *…we think that it is very important that this evidence be presented in an orderly fashion and in a way that will not be harmful to individuals, and we are going to try to do it that way* (Hearing, February 18, 1986: 17).

Senator Hollings' examination of Secretary Rogers was unique. Hollings offered Rogers, who was formerly the Attorney General of the United States and a former prosecutor, advise on how to conduct an investigation. His primary counsel was that Rogers needed investigators—"gumshoes"—down at Kennedy, Huntsville, Thiokol, and NASA Headquarters eating lunch with the people, picking up information informally. Rogers reminded Hollings that he had conducted a number of investigations, but Hollings reiterated that Rogers needed “gumshoes” around picking up information. Hollings’ point was that the people who really knew what happened to the Challenger were not the ones that would be called or would volunteer to appear before a Presidential Commission. When Rogers continued to balk at Hollings’ suggestion about the investigators, he told Rogers that if he did not want to do it, the Subco mittee would.

In Senator Gore’s questioning of both Secretary Rogers and Mr. Armstrong, he addressed three issues: The integrity of the O-ring at low temperature; the possible flawed launch decision making process; and who had the responsibility to make the final launch decision. In attempting to discern the cause of the Challenger explosion, Gore stated that he was a representative of the people, who are trying to understand what happened. Gore also knew about the “heated arguments” the night before the launch in which Morton Thiokol “…recommended against going ahead [with the launch] with the temperatures as cold as they were…” (Hearing, February 18, 1986: 26).

As the Rogers testimony was coming to an end, Hollings stated: “And once again, I hope you get your investigators on board, because Aviation Weekly [Aviation Week & Space Technology magazine] will run circles around you if you do not.” Rogers replied: “Yes, sir. We are fortunate to have the past editor for

20-some years of Aviation Weekly on our Commission and we think he as got a lot of access to some of those gumshoes that might be able to help us if we should desire it" (Hearing, February 18, 1986: 32). While a bit humorous, it highlights Hollings' mindset that investigators--and not, as he noted, Nobel Prize winners (i.e. Dr. Feynman)-- were needed to find out why the Challenger and her crew were destroyed. As will be noted in further Senate hearing proceedings, Hollings and others wanted to name names.

Dr. Graham and Mr. Moore of NASA were then called to testify. Senator Gorton asked him: "…did Morton Thiokol officials on the evening before the launch advise that the launch should be postponed because of the effect of cold weather on the seals?" Graham responded: "…there is no simple answer" (Hearing, February 18, 1986: 39). Riegle wanted to know who was in the launch decision-making positions. Moore gave him the "one-over-the-world" answer concerning all of the actors involved in the flight readiness review process. Riegle then asked who the final group of decision makers were. Graham intervened, but continued with the evasive answers. Riegle promised to return to this issue. When it was Hollings' turn to question Graham, he wanted to know about Morton Thiokol's opposition to the launch and he wanted Graham to acknowledge that there was evidence that there was opposition to the launch. Graham stated that the answer to his question was not a simple "yes" or "no." Graham did state that Morton Thiokol had provided to NASA a signed document that recommended a "go for launch." When Gore questioned Graham, he returned to this issue.

Again, Graham sidestepped a straightforward answer citing the complexity of the issue and the process by which the launch recommendations were rendered.

June 10, 1986

Senator Gorton, Chairman of the Subcommittee, convened the hearing following the release of the Rogers Commission report. Secretary Rogers and Mr. Armstrong were again invited to testify and to offer their insights about the findings and recommendations in Commission report, which they had recently released to the President. During Senator Hollings' opening statement, he gave a preview of what would lay ahead for Secretary Rogers when he commented that:

> *…there was almost a zeal to make certain [that] individual responsibility was not fixed. I do not find any individual found responsible…I do think when you fix responsibility, thereupon you promote safety…if there is no responsibility to it, it won't be safe. I just feel someone should be held accountable…*(Hearing, June 10, 1986: 62-63).

In Secretary Rogers' opening statement, he noted that it is the American way to admit one's mistakes, present the facts, make recommendations, and then "get on about your business." Although Rogers remained adamant about not pointing the finger of blame at any one person, he did make the statement that criticized those executives in NASA who claimed they knew nothing of the initial Morton Thiokol "no-launch" recommendation, because they should have known. Rogers also noted that besides mechanical failures, there were management and personal failures, but he did not elaborate: "…most people in NASA have done a wonderful job…This was a failure of the system and maybe a failure of certain individuals. Having said that, I am not sure that we gain anything by attempting to assess blame" (Hearing, June 10, 1986: 67-68).

Senator Danforth (R-MO) made an interesting statement that bears on the study of the space policy subsystem. He observed during his questioning of Secretary Rogers a mutual dependency between NASA and its contractor, Morton Thiokol. Because the contract between NASA and Morton Thiokol was sole source, NASA was reliant upon Morton Thiokol for the solid rocket motors and Morton Thiokol had only one customer to sell the rocket motors. Danforth stated that he thought that because Morton Thiokol was in the process of negotiating a ne contract with NASA, the contractor reversed its "no-launch" position to accommodate its customer.

When Senator Hollings questioned Secretary Rogers, he suggested that NASA had threatened Morton Thiokol with a second source for the solid rocket motors in order to get a lower price. This same threat of a second source—and the financial implications--may have entered into the minds of Morton Thiokol management as they considered their engineers' arguments against launching. Hollings then focused on Mulloy's changing the field joint O-ring from a Criticality 1 (mission failure if the component fails) to Criticality 1R (Criticality 1 with redundancy) without going through the proper procedures. Hollings stated:

> *I find that gross negligence…his conduct was of the type and nature, willful, gross misconduct, when he overrules a Criticality 1 item of the kind and the safety procedures that are inherent…And one of the main culprits is the gentleman, Lucas, out there. I watched him testify with you, and*

> *then he went back and had a news conference and he said we would do the same thing over again. There was no remorse….that tendency not to fix individual responsibility is what bothers me* (Hearing, June 10, 1986: 87).

Hollings went on to say that when the blame is fixed on the people like Lucas, Mulloy, and the people at Morton Thiokol, the space shuttle program will be better off. Hollings went back to Rogers asking why he so reluctant to fix blame to those who were responsible for the Challenger disaster. Rogers doubted if the United States could successfully prosecute anyone for gross negligence and, secondly, fixing blame "would not serve the national interest." Hollings responded that all he wanted to do was to fix responsibility and not really advocating prosecuting anyone. Senator Riegle then picked up the questioning of Rogers by noting, "…if we fix the mechanical problems and we do not fix the people problems we have not done our work" (Hearing, June 10, 1986: 90). Riegle's point was that he wanted to ensure that those people who made the fatal decision to launch Challenger were not in the position to make the same fatal decision in the future. However, what Riegle was really looking for was who at Level 1 within NASA Headquarters knew about the Morton Thiokol "no-launch" recommendation.

After questioning by other members of the Subcommittee, Rogers was again questioned by Senator Hollings about the possible involvement of the White House in causing the launch of Challenger to be delayed ostensibly to coincide with President Reagan's State of the Union address. Rogers stated that he found no evidence of that and he hoped that the rumor would die. Hollings returned to his thoughts about fixing individual blame stating that he believed "…there was individual fault and we will fix it [blame] in our hearings, hopefully, because I think it really promotes safety" (Hearing, June 10, 1986: 104). Hollings disagreed with Rogers' view that it was a system failure more than an individual failure. Hollings made the point that if "no one is fired, no one is dismissed, then there is no one to blame…everybody is responsible and nobody is responsible" (Hearing, June 10, 1986: 107).

Riegle commented on the apparent withholding of information by NASA concerning the imposition of a launch constraint because of O-ring erosion. Rogers confirmed that the Commission happened upon the letter from NASA about the launch constraint when they were reviewing Morton Thiokol correspondence. Riegle believed that possibly twenty or thirty NASA people knew about it, but never offered it to the Commission. This bothered Riegle, as it did Rogers. Riegle and Rogers concluded that it was probably Mulloy who should have brought it to the Commission's attention. After a bit more dialogue, Riegle stated:

> *…I am bothered about that [withholding information], and the people who withheld that information I think ought not to be in responsible positions in the future…how do we guard against that kind of thing happening again, if people who conducted themselves in that fashion are still around?* (Hearing, June 10, 1986: 113).

Rogers took exception to Hollings' and Riegle's efforts to attribute blame to individuals reiterating that the Commission's charter was to examine what happened and make recommendations as to how to correct the deficiencies. He added that if blame has to be assessed "…that it seems to me [it] has to be done by the Administrator at NASA…We are not passing judgment on people. We were not asked to" (Hearing, June 10, 1986: 114).

This day of hearings was telling in two ways: it brought the issue of fixing blame clearly in the open and it brought the pre-disaster space policy subsystem into focus. While the Senate had an oversight role over NASA, it was a comfortable relationship rather that an adversarial one; the same applied to the House Committee on Science and Technology. Among the other members of the space policy subsystem, there was mutual dependency established between NASA and Morton Thiokol, as there was between NASA and Rockwell (i.e. builder of the orbiter vehicle) and other contractors. However, after the disaster, the space policy subsystem found that their relationships had changed, which will be elaborated on in Chapter VII (Conclusions).

June 17, 1986

Dr. Fletcher, the newly appointed Administrator of NASA, was the principle witness at this hearing, the purpose of which was to review NASA's plans to implement to the Rogers Commission's recommendations. Senator Gorton, in his preamble prior to the commencement of the hearing, acknowledged that NASA had shifted from being the press' favored agency to "…one which much of the press is enjoying kicking around… (Hearing, June 17, 1986: 127). Senator

Riegle expressed his view that the Rogers Commission fell short by not identifying which offices in the NASA organization had made mistakes. He furthered noted that the when people make mistakes, like those associated with the Challenger disaster, they forfeit their right to make the same mistakes again.

Senator Hollings in his opening statement returned to his highly opinionated theme that someone must be held accountable for the disaster. He told the Subcommittee and the NASA witnesses concerning the Marshall Space Flight Center "…we do not just clean up that cancer down there…It is a cancer in my opinion. It has been a bad one, and if I had to fix the responsibility, I would fix it on Lucas. I think maybe Mulloy is a fall guy" (Hearing, June 17, 1986: 132).

After Fletcher had made his opening remarks in which he quoted President Kennedy as saying "Our responsibility is not to fix the blame for the past, but to fix the course for the future, " Hollings told him:

> *John Kennedy would have said that without any shuttle disaster, without any capsule fire [Apollo 1]. Our responsibility is to fix the blame for the past in order to fix the course for the future…the proximate cause [of the* Challenger *accident] is not…a flawed process but a violated one…You folks are trying to give the Rogers Commission the good government award. The heck with that. I am trying to get a Space Program that we all can proudly get behind, and we are not going to fashion one of those unless we get through with the Rogers Commission* (Hearing, June 17, 1986: 143-144).

Hollins then invited Captain Bob Crippen, an astronaut, to sit at the witness table. Hollings reiterated that someone was guilty of gross negligence and the syste was not broken, as claimed by the Rogers Commission, only violated. Crippen told him that there was no doubt that NASA had “made a grave error,” but he found it difficult to fix individual blame because he endorsed the view that the management system was broken.

Senator Riegle asked Fletcher about what disciplinary action had been taken against Reinartz and Mulloy for not performing their duties that resulted in the deaths of seven crewmembers. Fletcher told him that they had been removed from the chain of command and “…they will be disciplined in accordance with the procedures that we always follow” (Hearing, June 17, 1986: 170). Riegle wanted specifics as to what punishment had been meted out because “…the public needs to know the answer to that.” Fletcher responded by stating that they have not been subjected to disciplinary action, only removal from the chain of command and the appropriate notations in their personnel records. Riegle interpreted the Commission’s reluctance to fix blame to indicate that it was the NASA’s Administrators job to accomplish that task. Fletcher agreed stating “It is our responsibility to deal with the individuals involved and also with the errors in the system that may come out” (Hearing, June 17, 1986: 174).

Riegle ended the hearing on a positive note:

> *…we want to get things fixed properly so that we can get back into space safely and get back on with the goals that we have to meet as a nation…(*Hearing, June 17, 1986: 188).

It is apparent that the Subcommittee had in some fashion chosen Hollings and Riegle specifically to be the “grand inquisitors.” Occasionally, other members (e.g. Senator Gore) would question the witnesses, but the hearings appeared to have one purpose—blame attribution. They mentioned a number of times that through blame attribution the problems would be addressed and fixed. If those who were responsible for the Challenger disaster were not blamed and removed, the problem remained and another disaster could occur. The locus of the problem from their perspective was Marshall Space Flight Center in Huntsville, Alabama. They were responsible for the design and development of the solid rocket booster and they knew where the technical problems were. Their "sin" was that they had not informed their superiors at NASA headquarters that Morton Thiokol had recommended that the launch of Challenger be postponed until the ambient temperature at Kennedy Space Center was above fifty-three degrees.

These hearings provided demonstrable evidence that the blame rhetoric originates with two of the policy subsystem actors in the post-disaster environment: Congress and the media. This relationship between these two actors in relation to NASA and industry will be discussed in Chapter VII (Conclusions)

NASA Public Affairs Comments

When the Challenger research was being conducted at NASA's History Office, this researcher found a notebook of handwritten notes written during interviews with the public affairs officers from Marshall Space Flight Center, Kennedy Space Center, and Johnson Space Center. Other than the names of the interviewees and their comments, there was no additional information. When these notes were discussed with the NASA archivists, they could not provide any additional information since they were not aware of them. However, after reading through the notes, it was possible to associate a particular individual with a NASA Center. The assumption was that the person conducting the interviews was from NASA Headquarters public affairs staff and the timeframe was either late May or early June 1986 because of comments made concerning the imminent release of the Rogers Commission report, which was on June 6, 1986.

It was decided to include this information because it pertained to two primary actors in the space policy subsystem following the Challenger disaster: NASA and the media. The NASA public affairs officers' edited comments are in Appendix H.

From a public affairs perspective, the Challenger disaster was truly a unique situation because:

> *Everybody knew about the accident long before NASA had any chance to analyze it; the networks were coming up with potential causes an hour or two after the event* (Wall Street Journal, February 14, 1986).

The post-Challenger public affairs effort by NASA was captured in the following headline:

> *NASA, Once a Master of Publicity, Fumbles in Handling Shuttle Crisis* (Wall Street Journal, February 14, 1986).

The importance of this official record is that it forms something similar to a bookend. The views of the NASA public affairs officers are by no means crucial to this study, but they are informative. As noted by these public affairs officers, following a disastrous situation NASA's singular focus should be to get the information out to the American people as quickly and as professionally as possible. If NASA does not provide the information from which Americans can collectively construct meaning, the media will fill in the voids of this construction of meaning with information from "experts" and other sources.

Challenger Elite Interviews

The two individuals who were interviewed about the Challenger disaster were Dr. Hans Mark, former Assistant Administrator of NASA, and Mr. Jeff Bingham, former Chief of Staff for Senator Jake Garn.

Dr. Hans Mark

Dr. Mark was forthright in his reflections on the solid rocket booster O-ring erosion issue. He maintained that NASA and Morton Thiokol were well aware of the problem, but not aware of how serious the problem was. In our discussion about blame, Dr. Mark stated: "…. when you say blamed, the worst thing you can do is criminalize something like this because they will never do anything again." When it was explained that criminal negligence was not being suggested, he maintained that: "I think Beggs [former NASA Administrator James Beggs] is clearly to blame for not holding that review [O-ring erosion review]. I mean, I was out of it, but the review is on record."

The reticence on the part of Dr. Mark to discuss blame was similar to that of Dr. Petrone, who was also a NASA employee during the Apollo 1 disaster. The reason for this is not intuitive to this researcher. Is it a topic that is repulsive to government employees or is it a coincidence that both interviewees, who were reluctant to talk about blame attribution, were also former government executives? While not within the purview of this research, it could be a worthy topic of scholarship in the future.

Dr. Mark did say that his former superior, Mr. James Beggs, was responsible for the Challenger accident because he knew that a review about the solid rocket booster field joint O-ring problem was needed, but he did not call for such a review. This is the first case where the NASA Administrator was blamed specifically for either of the case study disasters. However, Beggs' culpability was never raised in any of the Congressional hearings nor in any media artifacts. This interview was relevant to this research for it provided another perspective from which to understand the blame process. From Dr. Marks' vantage, Beggs knew or should have known about the problem, but did nothing about it. Dr. Marks' understanding of blame attribution is similar to that associated with the Captain of a ship that has been damaged or sunk; the Captain is always responsible regardless of who was on the bridge. As Stone (1975) points out

"…we assign obligations to people on the basis of their having assumed some role or status" (1975: 83).

Mr. Jeff Bingham

Mr. Bingham offers insights from the congressional perspective. While the other interviewees were from either NASA or industry, Mr. Bingham worked for Senator Jake Garn, who flew in a shuttle mission and was an advocate of manned space flight. Mr. Bingham was i mersed in the Challenger disaster investigation and had an in-depth knowledge and relationship with NASA.

In our discussion of the space policy subsystem, he agreed that the principal actors were NASA, industry, and Congress. However, he added that after the accident there were "…so many different axes that wanted to get ground. There were people who came into the picture that literally just wanted to exploit the failure to promote their own ends which is unmanned exploration." The analysis of the print media artifacts supports Mr. Bingham's view because there was an appreciable number of actors who participated in some fashion after the disaster, notably foundations and associations.

When the issue of blame was broached, Mr. Bingham said: "I have a proble with blame because nothing is ever that simple." As we continued our discussion about blame attribution as a pervasive attitude in Congress, he agreed that there is such an attitude, adding "That seems to be the norm, and it's unfortunate I think, and it's a confusion over the role of oversight, what the congressional role is." Mr. Bingham made the point that there is a difference between finding someone responsible and blaming him.

Holding someone responsible equated to finding out what the problem was and fixing it in order to avoid future problems. To blame someone is to "…go out for blood." When asked why some of the congressional members "go out for blood," he responded that it is because they believe this is what their constituents want. When challenged about whether this was really what the American people wanted, he said, "…it's not really the American people they're satisfying, it's the media who are reflecting that thirst for blood." He acknowledged that the media's influence can be formidable, especially after a disaster: "…in the rush of the moment in the immediate aftermath of a disaster, the media has their [public's] attention and they [public] don't make judgments on the media's coverage, at first, until it gets nauseating."

Mr. Bingham was then asked about how the hearings were conducted. The issue that came to mind were the "performances" of Senator Hollings and Senator Riegle during the Senate hearings on Challenger. I stated that "It seems like in the conduct or in the course of the hearing there's always one or two guys that want to…" and Mr. Bingham finished the sentence "grandstand." Mr. Bingham believes that the real "finger pointing" is done by the media and when some of the members of Congress get involved in grandstanding and "finger pointing," they are playing to the media in order for their constituency to see that they are giving their constituents a voice and something is being done in their name.

In comparing the Apollo 1 and Challenger disasters, Mr. Bingham maintained that the American people "…continued to support both Apollo and the shuttle once it became apparent that there was a shopping list of issues that had been uncovered and revealed, maybe one or two people in the periphery had responsibility and culpability."

In this interview, Jeff Bingham presents a different dynamic of blame association that he was most familiar with: Congress and the media. The data for both Apollo 1 and Challenger supports his view that congressional members sometimes "play to the media" for a variety of reasons, one of which is for the "folks back home" in the congressional district or state. The blame dynamic characterized in this interview suggests that blame had not been assigned by NASA or the investigation body. Therefore, in the case of a disaster, a congressional member takes up the cause to find the culpable parties. The media is an accomplice in this endeavor all too willing to print the words of a member's rage and indignation that this disaster occurred and vowing that those who are responsible will be held publicly accountable. The media artifact data and the hearing records substantiate this view.

Challenger Triangulation Results

The print media artifacts analysis pointed to a characterization of NASA that was largely neutral; the thematic focus was on the investigation; about twenty percent of the articles contained some degree of blame rhetoric at the organizational or personal level; and the principal post-disaster policy subsystem actors were NASA, the contractors, Congress, the Rogers Commission, and the media. The official government records were the Rogers Commission Hearings and Report; and the Congressional accident investigation hearings. In the extensive Rogers Commission hearings, early in their deliberations they removed certain NASA executives from NASA's investigation team because of potential conflicts of interest. What emerged in the testimony was that Morton Thiokol initially recommended that the Challenger not be launched until the ambient temperature had increased (i.e. become warmer). Managers from Marshall Space Flight Center pressured Morton Thiokol to reverse their position. Additionally, it was learned that the senior NASA shuttle projects manager at Marshall did not infor his superiors at NASA Headquarters about the Morton Thiokol position. Although the Rogers Commission did not attribute blame to any one individual, it did provide the Congressional committees with plenty of "ammunition" to use against NASA. Although there was mention in the House hearings about possible criminal negligence charges against Mr. Mulloy (NASA) and others, Secretary Rogers dismissed them. The Senate hearings were acrimonious with Senators Hollings and Riegle using a blame-rich rhetoric to specifically blame the Challenger accident on Dr. Lucas (NASA) and Mr. Mulloy (NASA).

The interviews of Dr. Mark and Mr. Bingham were informative with Dr. Mark ultimately blaming former NASA Administrator Jim Beggs for not convening a O-ring review when he knew the issue required it. Mr. Bingham blamed Congress for the blame rhetoric, which they used to obtain media coverage. The media, according to Mr. Bingham, is the real purveyor of blame because they believe this what the people want to read about. If the people have someone to blame and NASA fixes the problems, then the manned space flight program will get back on track.

In this composite view of the three sources in the triangulation methodology, the traditional policy subsystem actors (i.e. Congress, NASA, and industry) with the addition of the media are presented as interacting with the intent to shape not a policy environment, but a blame environment. In the case of Challenger, blame attribution was accomplished by the media and the Congress. The Rogers Commission was silent on who to blame; Morton Thiokol was not about to offer up its people for blame attribution unless they were forced to; NASA attempted to protects its mangers; so that left Congress and the media to raise the intensity of blame attribution to the level in which people were identified and action was taken by NASA and Morton Thiokol as evidenced by the numerous transfers and retirements.

Comparison of the Results of the Apollo 1 and Challenger Case Studies

With the exception of the particularly blame rich rhetoric in the Senate hearings investigating the Challenger disaster, the data does not suggest that political agendas were being played out in the hearing chambers. The tragic circumstances that brought about the congressional hearings were undertaken in a bipartisan spirit among the members in order to understand the circumstances that led to each of the disasters. If this bipartisan spirit had not been prevalent, there would have been a backlash by the American electorate that would have been felt at the ballot boxes if congressional members had attempted to use the investigations to "feather their political nests" or gain politically in some fashion.

The role of the NASA Administrator in shaping the post-event investigation and the manner in which NASA responded to congressional and board hearings is noteworthy. Webb had been the Administrator of NASA since 1961 (i.e. six years before the Apollo 204 fire). H was a strong public administrator and well connected politically. Webb had been through six budget cycles with the Authorization and Appropriation Committees for both the House and Senate. Webb knew the congressional members and he knew how to "sell" NASA 's vision of manned space flight. He consistently received the funding that he needed to keep the Apollo-Saturn program on track to land a man on the Moon by the end of the decade. As one reporter said of Jim Webb, he is "…a salesman so persuasive he could peddle American flags in Hanoi" (St. Louis-Post Dispatch, January 29, 1967).

In the case of Challenger, Jim Beggs became the Administrator of NASA in June 1981 and served in that capacity until the Justice Department began an investigation of his alleged improprieties will an executive at General Dyna ics Corporation (the charges were later dismissed). The Assistant Administrator, Dr. William Graham, whom Beggs did not want as an Assistant Administrator but was forced upon him by the White House, became the Acting Administrator approximately one month before the Challenger disaster. Graham had no prior NASA experience. This was most evident in his lack of relationship with the congressional committees and in some of his early comments about what could not have caused the explosion, one of which were the solid rocket motors. He also lacked the leadership to bring all of NASA's Centers and staffs together into conveying a coherent "party line," as Webb was able to do following the Apollo 1 fire.

If James Webb had been the Administrator at the time of Challenger, would he had been able to persuade President Reagan to let NASA conduct the investigation as it had following Apollo 1? One could argue that Webb would not have been successful because the entire Nation saw the Challenger break-up 72 seconds after liftoff. The event was so horrendous and so public that the stature of the investigation had to be Presidential; it had to be led by an unbiased, nationally known statesman; and the investigation had to be highly visible to the entire Nation. In the final analysis, did it really matter whether NASA conducted the investigation or if it was conducted by a Presidential Commission? Probably not because both had capable and technically competent people and both were under the umbrella of the Executive Branch. Whatever influence the Office of the President wished to exert in the conduct of either investigation (there is no evidence that it did), then it was perfectly capable of doing so. The major difference between the two case studies is that the Apollo 1 investigation was conducted in 67 days and the Challenger investigation in 120 days. This could be attributed to the fact that the Challenger accident was very visible and technically complex in understanding the technical and organizational issues that led to the disaster.

When comparing the Apollo 1 and Challenger investigations, an anonymous NASA engineer was quoted as saying: "If we acted in the first days like Ji Webb did back in '67, this never would have happened" (Washington Times, March 2, 1986). Turning to the qualitative analysis that was performed on the media artifacts for both Apollo 1 and Challenger, the following graphic points out similarities and differences:

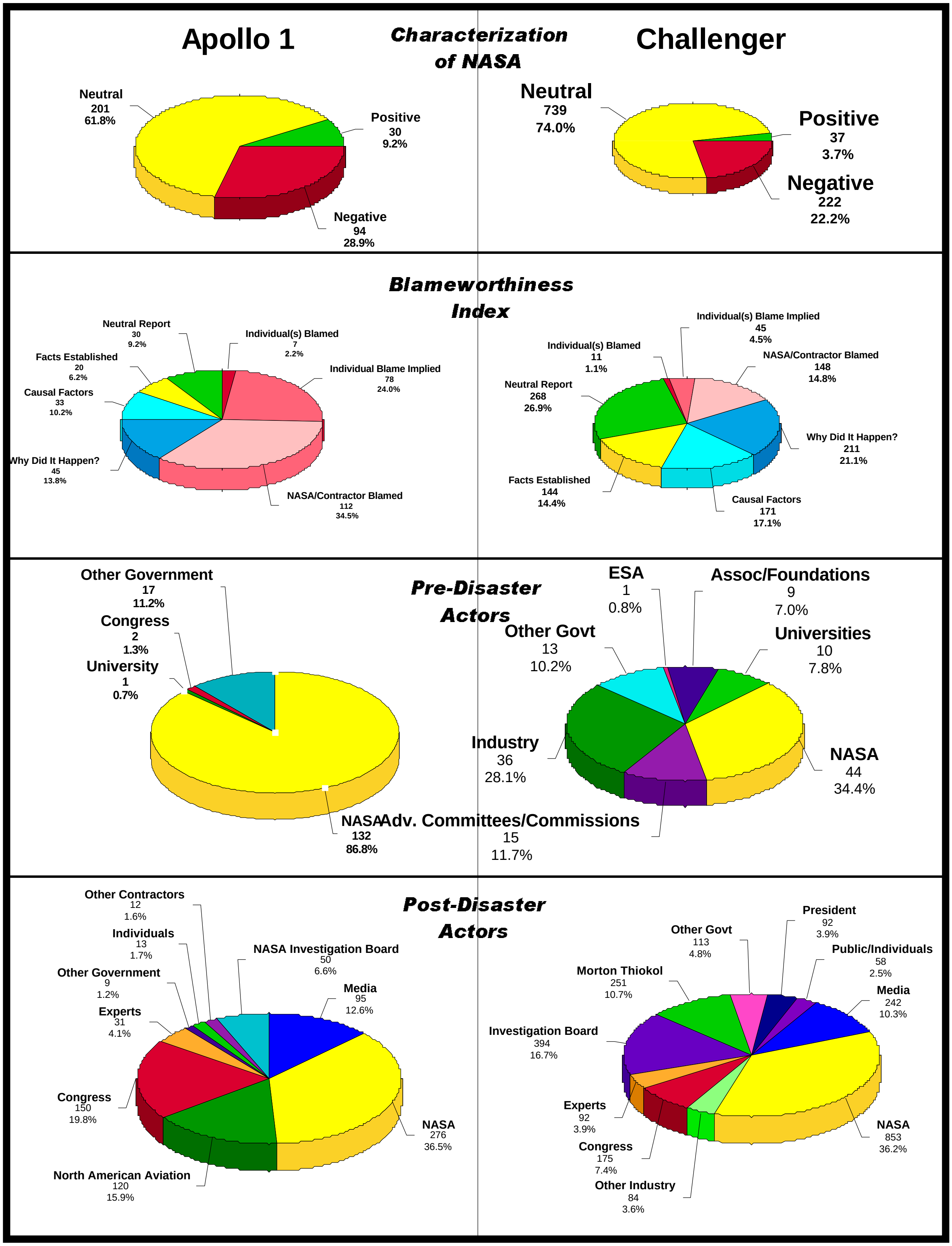

Figure 23: Comparison of Apollo 1 and Challenger Media Artifact Data

The *Characterization of NASA* data indicates that the media's portrayal of NASA after the Apollo 1fire was more negative (28.9%) than during the post-Challenger investigation (22.2%). There may be three possible explanations for this:

1. The media had more official information following the Apollo 1 fire than they did after Challenger. Following the Apollo 1 fire, NASA issued three interim Apollo 1 investigation reports to the Congress and to the media. The reports increasingly revealed NASA's acceptance of risk, which the media and the Congress translated into negative characterizations of NASA.
2. From the fire to the release of the report by the Apollo 204 Review Board, the investigation period was only 67 days compared to the Challenger investigation in which the Rogers Commission took 120 days to release their report. The compressed Apollo 1 investigation period may have kept the media engaged in the issues, whereas in Challenger the media may have lost some interest because of the greater period of time involved in the investigation.
3. The more positive characterization of NASA following Apollo 1 may be due to NASA's appearance of being more cooperative with the press than they were following Challenger.

In the *Blameworthiness Index* data, there are some important differences in the blame rhetoric between the two accidents. In Apollo 1, 60.7% of the articles either blamed NASA or its contractor (i.e. North American Aviation), implied individual blame, or specifically identified an individual to blame. However, in the post-Challenger issue cycle only 20.4% of the articles were blame oriented. Again, an explanation of these differences could be attributed to a statistical anomaly in which there were a large number of articles at the beginning of the Challenger issue cycle that were categorized as *Neutral Report* (26.9%); Apollo 1 *Neutral Report*s accounted for only 9.2% of the articles.

Relative to the actors in the space policy subsystem, there are two data sets: Pre and Post-Disaster. The *Pre-Disaster Actor* data documents the actors in the space policy subsystem before the accident while the *Post-Disaster Actor* population data documents the expansion of the actors in the post-accident space policy subsystem. Following a disastrous event, the argument is that the policy subsystem expands its membership by permitting other actors to participate to some degree within the space policy subsystem. The new actors that participated the most in the space policy subsystem in the post-Apollo 1 environment were the media (12.6%) and the investigation board (6.6%). As for Challenger, approximately 43% of the actors joined the policy subsystem after the accident. The media and the investigation board accounted for 27% of the post-accident actor population.

CHAPTER VII
Conclusions and Recommendations

The methodology used in this dissertation posed seven questions. This last chapter will answer those questions and make two recommendations will then be made that are relevant to NASA.   The following methodological schema was presented in Chapter III (Research Design):

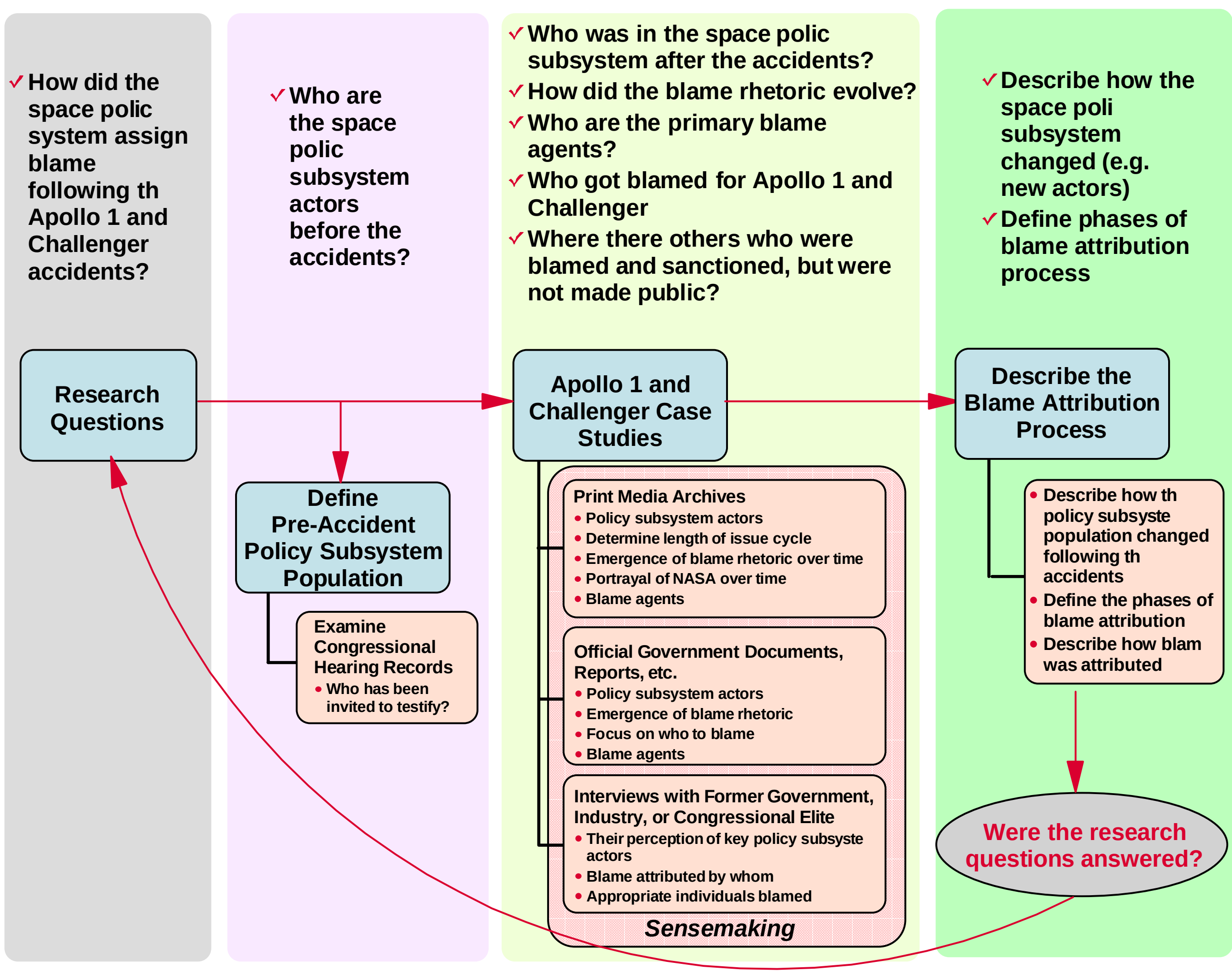

Figure 24: Research Methodology

The research question in this dissertation was: How did the space policy subsystem assign blame following the Apollo 1 and Challenger accidents? However, before that question could be answered, there were a number of iterative questions that had to be addressed first.

Who are the space policy subsystem actors before the accident?

Conclusion 1: In the case of Apollo1, defining the pre-disaster actors was derived from reviewing congressional hearing records in the pre-disaster timeframe (i.e. approximately one year prior to the disaster). The two major actors were NASA and the Congress; there was no record that industry was called to testify in the hearings. NASA used contractor briefings and charts during their testimony to support their case and although the contractors were not present during the actual testimony, their "presence" in the hearings was conveyed by NASA. James Webb, the NASA Administrator, controlled and orchestrated NASA's annual appearances before NASA's authorization and appropriation committees. For these hearings, Mr. Webb wanted the focus to be on NASA because he was then able to control the messages that became the "party line" (e.g. lunar landing by the end of the decade; funding for manned space flight following the Apollo program). The record also indicates modest participation (i.e. testimony) by universities. In the pre-Challenger space policy subsystem, the predominant actors were NASA, Congress, and the contractors; however, there were a number of other actors who exhibited a much greater role than they did in the pre-Apollo 1 space policy subsystem (e.g. universities and associations).

The pre-Apollo 1 and pre-Challenger space policy subsystem were essentially the same core group comprised of NASA, the Congressional committees, and industry. Although the pre-Challenger data suggests that there other actors involved (e.g. universities, associations), they were peripheral to and supportive of the core space policy subsystem; these supporting actors were not members of the space policy subsystem.

In each of these pre-disaster policy subsystems, they exhibit mutual dependency, stable relationships, limited participants, autonomous decision making, and are essentially impervious from interference from the outside (Anderson, 1984; Browne, 1995; Thurber, 1996).

Who was in the space policy subsystem after the Apollo 1 and Challenger accidents?

Conclusion 2: After the Apollo 1 fire, the space policy subsystem was composed of the pre-disaster core group (i.e. NASA, Congress, and industry), but its membership expanded to include the media and the investigation boar d, which was really a NASA function because the Apollo 204 Review Board was populated predominantly by NASA employees. Relative to the post-Challenger policy subsystem, the data indicates that the core actors (i.e. Congress, NASA, and industry) were active throughout the issue cycle. The Rogers Commission was active until they finished their testimony following the release of their report. Besides, the core policy subsystem actors, the media was the most active in the post-disaster space policy subsystem. Why was the media so active? Because Apollo 1 and Challenger were focusing events, which are rare, highly visible, and affect a large number of people (Birkland, 1997). Another attribute of a focusing event is that there is a predictable search for bla e. Because these accidents were focusing events, the media immediately immersed themselves in the search for the answers to the "What happened;" "How did it happen;" "Why was it allowed to happen;" and "Who is to blame" questions in the blame process.

The space policy subsystem, which resembled an "iron triangle" in the pre-accident environment, transformed into an issue network following the Apollo 1 and Challenger disasters. The attributes of an issue network are disaggregated power and movement of actors in and out of the policy process (Heclo, 1978), but the issue network also recognizes that policymaking is dependent upon a regular set of actors who make policy (Browne: 1995). One of the hallmarks of the "iron triangle" metaphor is that its stability relies upon the absence of conflict and consensus among its members (Johnson, 1992; Stein and Bickers, 1995). When there is an external disturbance (e.g. war, disaster), it disrupts the established (i.e. pre-disaster) policy subsystem and leads to a change in its composition and membership (Howlett and Ramesh, 1998). Therefore, when there is a disaster, the space policy subsystem, which resembles an "iron triangle," transforms into an issue network.

How did the blame evolve?

Conclusion 3: The following schematic plots the evolution of blame in the context of the space policy subsystem as an issue network:

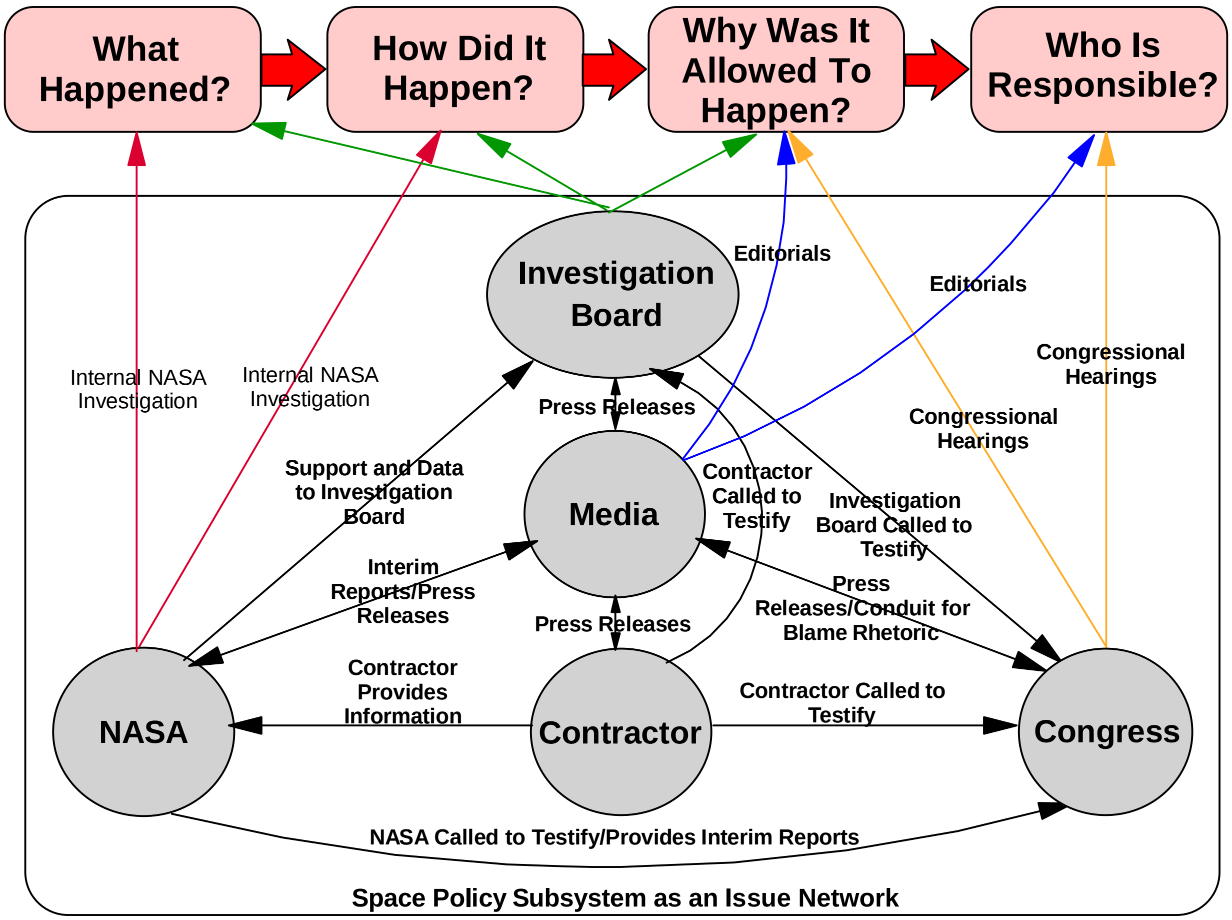

Figure 25: Blame Evolution and Post-Accident Space Policy Syste

The evolution of blame rhetoric results from the ans ers to the questions in the appropriate sequence (i.e. What, How, Why, Who). If Congress, the media, or anyone else jumps from what to who or how to who, there could be a charge that there was a “rush to judgment.” The space policy subsystem as an issue network has been included in order to illustrate the conclusions of this research about how blame evolves and the role that the media plays in the evolution of blame.

The top four blocks are the blame evolution process. Beneath this is the post-accident space policy subsystem with its predominant actors. The bottom ro of actors are the traditional core actors of the pre-accident policy subsystem. Their relationship is no longer one of mutual support and mutual dependency (i.e. bi-directional arrows), as it existed in the pre-accident configuration. The key point in examining the relationship between these actors is that the arrows are unidirectional: the contractor supports NASA, but NASA does not support the contractor; the contractor supports Congress, but Congress does not anticipate or expect campaign contributions or other benefits to be gained from this relationship; NASA support Congress, but Congress does not (during the investigatory period) support NASA.

However, when the media's role in the space policy subsystem is examined, its relationships are bi-directional. It receives press releases and information (occasionally) from NASA and NASA uses the media to disseminate its message to the public. The media talks with the contractor in order to obtain information that it may not have received from NASA and the contractor uses the media to issue press releases, rebuttals, and other messages. The Congress uses the press to convey their press releases, news conferences, and blame rhetoric for their constituency's consumption and the media uses Congress' results of hearings and their blame rhetoric to editorialize in order to attempt to shape the post-accident policy environment and shape how Americans should think about the events.

The media also talks with the investigation board, usually in form of formal press releases and other controlled means to provide information to the public. The key point concerning the media is that it becomes the focal point within the policy subsystem. It creates mutual dependencies with the other actors, which they do not have among themselves. As the schematic illustrates, the investigation board focuses on answering the first three questions, but neither the Apollo 204 Review Board nor the Rogers Commission attempted to address the last question. The media and Congress are the two actors that involve themselves in the attribution of blame in a public forum. In the case of Apollo 1, NASA replaced Joe Shea one week before the Apollo 204 report was released. Nevertheless, NASA attempted to do it quietly and without any public blame attribution. It was the media that equated his transfer within NASA with his selection as NASA's "scapegoat." However, the blame rhetoric in the Congressional hearings and the media following the release of the Apollo 1 report forced NASA to pressure North American Aviation to replace Harrison Storms and three other executives.

Who were the primary blame agents?

Conclusion 4: Congress in union with the media are the primary blame agents.

Who was blamed for the Apollo 1 and Challenger disasters?

Conclusion 5: America has evolved into a society in which every death must have someone held accountable and every serious accident has a cause that is linked in some degree to negligence (Douglas, M., 1992). Additionally, in American society, we have come to believe that if we can fix the blame on someone for a disastrous event, then it proves that the agency, in which we have placed our trust, is not culpable (Douglas, T., 1995). Once we have identified the guilty party, the agency can remedy the technical problem, and then continue the program. Stone (1989) informs this issue by telling us that finding the ultimate truth or cause is not the issue; the issue is fixing moral responsibility through the development of a causal story (1989: 297). The causal story that was articulated on a number of occasions in Congressional hearings was that the causes for the Apollo 1 or Challenger disasters can only be retrospectively made sense of if the individuals who were responsible for the disaster are publicly sanctioned, which translates into replacement or retirement. If they are not replaced, the problems that caused the disaster remain and they will occur again. If they are held accountable, the chances of the problem reoccurring are remote.

For the Apollo 1 fire, *Dr. Joe Shea* was transferred from Manager, Apollo Spacecraft Program to Deputy Associate Administrator for Manned Space Flight (Technical) at NASA Headquarters. At North A erican Aviation, *Harrison Storms*, the President of Space and Information Division; *William Snelling*, Executive Vice President; and two other Space and Information Division executives were replaced.

The attribution of blame for the Challenger accident covered a much greater range of individuals. For NASA:

- *Michael Weeks*, Deputy Associate Administrator for Space Flight, retained his title at NASA Headquarters, but yielded much of his authority to Admiral Truly's deputy.
- *Dr. William Lucas*, Director of Marshall Space Flight Center, took early retirement. During the Senate hearings, Senator Hollings blamed Dr. Lucas specifically for the disaster.
- *Mr. George Hardy*, Deputy Director of Science and Engineering at Marshall, opted for early retirement. Mr. Hardy challenged Morton Thiokol's decision; he said that he was appalled at their decision.
- *Mr. Stanley Reinart* , Manager, Shuttle Projects Office at Marshall was transferred to his former position as Manager, Special Projects.
- *Dr. Judson Lovingood*, Deputy Manager, Shuttle Projects Office at Marshall, was transferred to a position outside of the shuttle program.

- *Mr. Lawrence Mulloy*, Manager of the Solid Rocket Motor Project at Marshall, was transferred to be the Assistant to the Director of Science and Engineering at Marshall and was again transferred to NASA Headquarters as the Deputy Director for Propulsion, Power and Energy. Mr. Mulloy was also critical of Morton Thiokol's decision when they rendered a "no-launch" recommendation. Senator Hollings suggested in the Senate hearings that Mr. Mulloy should be charged with criminal negligence.

Those who were held accountable at Morton Thiokol were:

- *Jerald Mason*, Senior Vice President, Wasatch Operations, took early retirement.
- *Calvin Wiggins*, Vice President and General Manager, Space Division, became the Deputy to the Vice President and General Manager.
- *Joseph Kilminster*, Vice President, Shuttle Project, was reassigned to an unknown position.
- *Bob Lund*, Vice President, Engineering, was able to keep his title, but he had no responsibility for the solid rocket booster program.

Where there others who were blamed and sanctioned, but were not made public?

Conclusion 6: Other than the two unnamed North American Aviation executives following Apollo 1, there is no evidence that others had been blamed for either the Apollo 1 or Challenger accidents. However, Dr. Roger Launius of NASA believes that Mr. Jim Webb was ‘’…personally tarred with the disaster [Apollo 1]…Webb himself never recovered from the stigma of the fire’’ (1994: 88).

Describe how the space policy subsystem changed.

<u>Conclusion 7:</u> The space policy subsystem existed in one of two states: “iron triangle” or issue network. Following the Apollo 1 and Challenger accidents, the space policy subsystem’s state transfor ed from a policy subsystem resembling an “iron triangle” to one resembling an “issue network.”

Two principal characteristics of an “iron triangle” are stable relationships and mutual dependencies among the actors (Vaughn, 1990: 249-250; Anderson, 1997; Browne1995; Stein and Bickers, 1995). Implicit in this statement is the “iron triangle” relies on the avoidance of conflict in order to achieve stability. The “glue” that holds the “iron triangle” together is a positive tension among the members in the form of these mutual dependencies. These dependencies are expectations, demands upon each other, shared goals, and self-interest. The positive tensions within the policy subsystem are strong enough to establish an equilibrium that is capable of repulsing external pressures in the form of actors who want membership in the policy subsystem or wish to represent interests that could be a threat to the internally positive tensions (stability) within the policy subsystem.

The following graphic illustrates this concept:

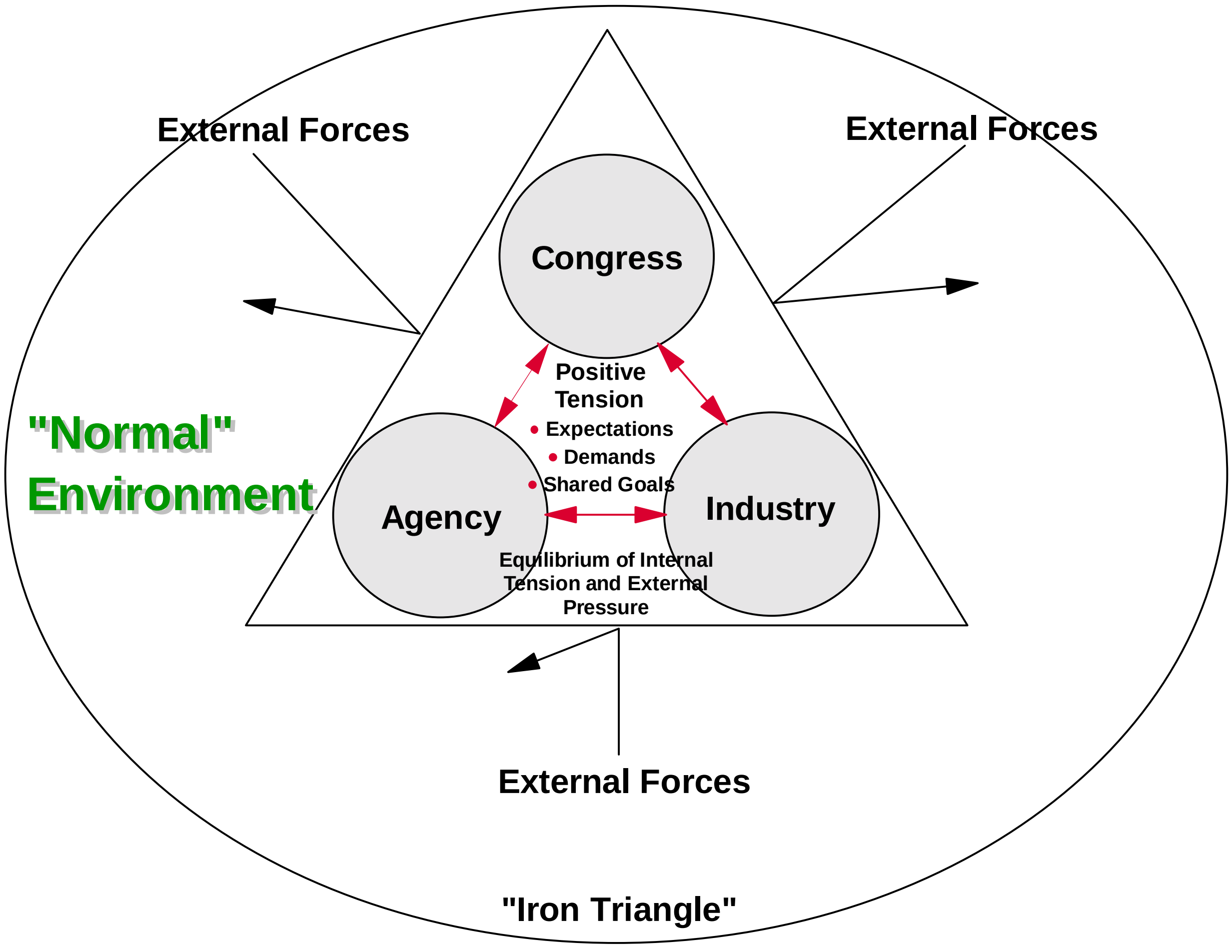

Figure 26: Space Policy Subsystem as an "Iron Triangle" During “Normal” Times

However, when a disaster occurs, the stability of the space policy subsyste dissolves. Because the internal positive tensions of mutual dependency and support erode, the equilibrium that precluded the external actors fro participation in the space policy subsystem is undermined. The boundaries of the “iron triangle” become permeable, which permits the external actors to gain entry into the space policy subsystem. The Congressional, industrial, and agency actors will distance themselves from each other as the investigation process emerges and progresses. They will also distance themselves because the dependencies will quickly evolve into unidirectional relationships in which one actor places demands on another with limited or no bi-directional dependencies during the period of investigation and congressional inquiry.

The following graphics illustrate these points:

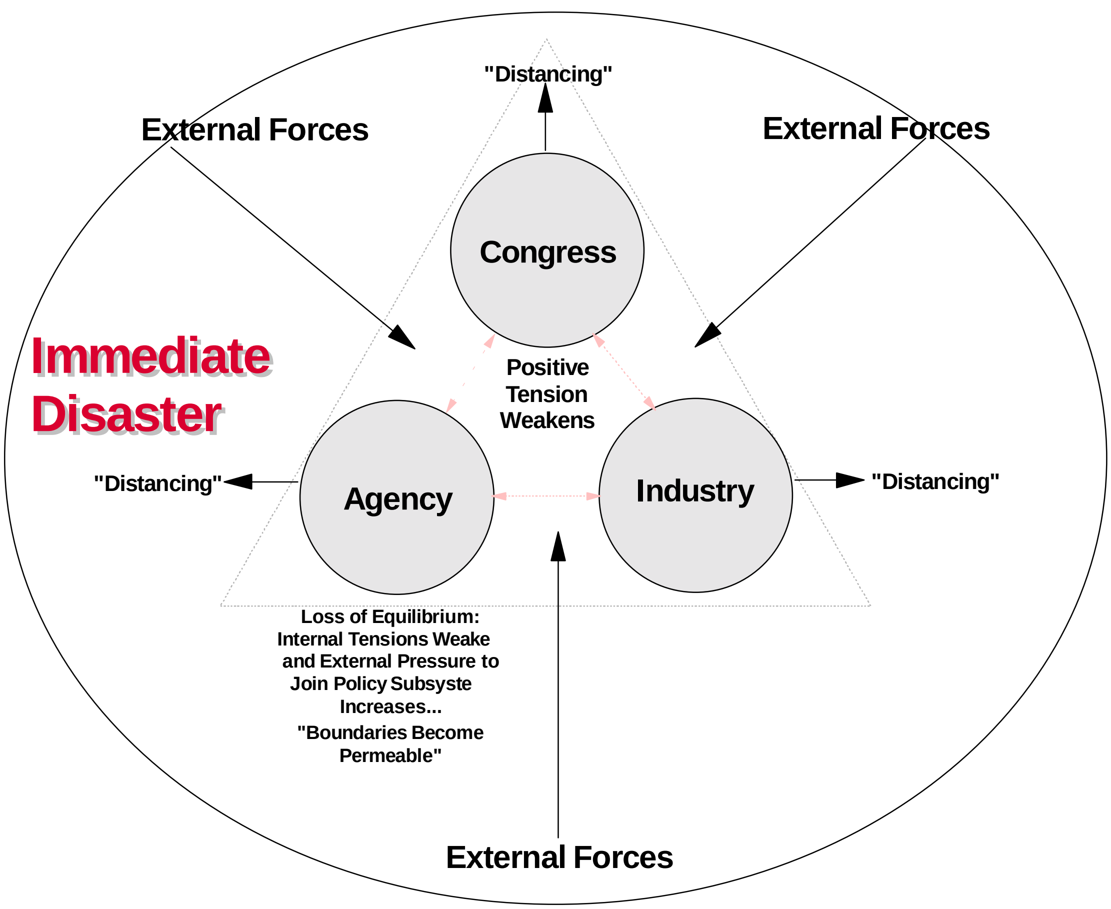

Figure 27: Immediate Post-Disaster Dissolution of "Iron Triangle"

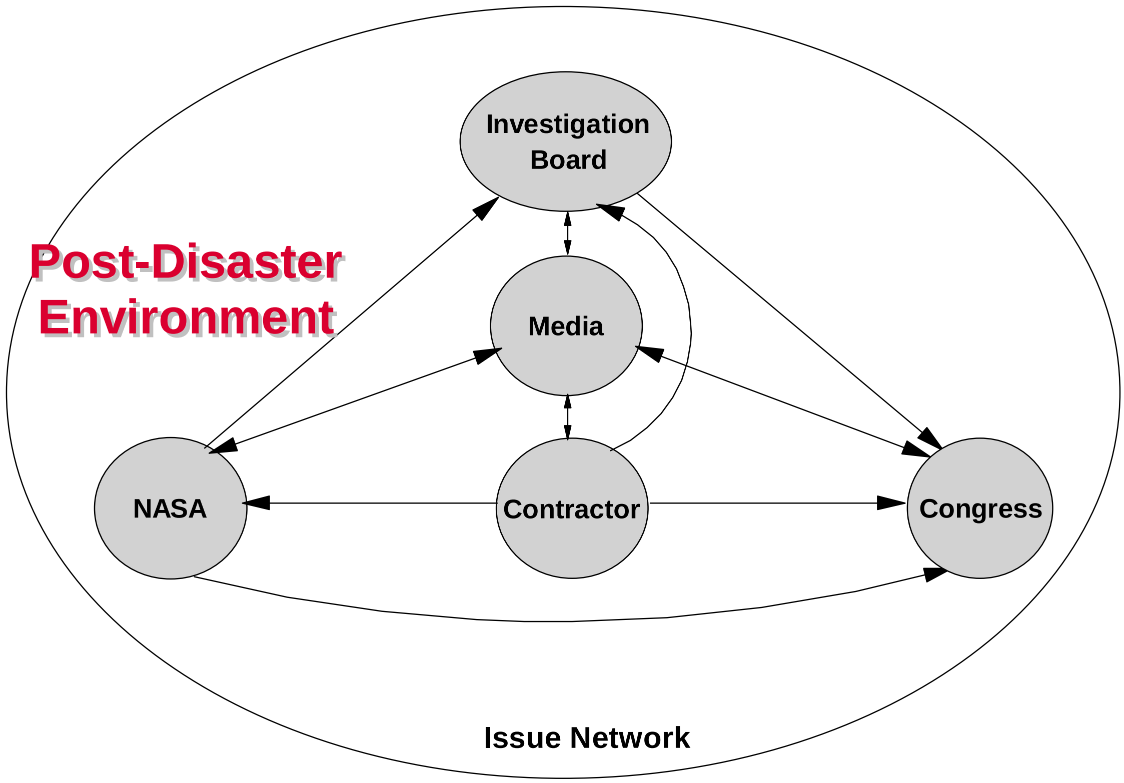

Figure 28: Mature Post-Disaster Space Policy System as an Issue Network

The disastrous event damages the relationships among the core policy subsyste actors (i.e. Congress, agency, and contractor). Congressman Torricelli (D-NJ) affirms this point:

> *When the* Challenger *exploded, many things were lost; and one of them was NASA's traditionally cushy relationship with Congress…The relationship in the future is going to be sharper and more probing…[NASA has] now joined the ranks of every other government agency* (McGinely and Burrough, Wall Street Journal, April 4, 1986).

Define the phases of the blame attribution process

<u>Conclusion 8:</u> The blame attribution process that emerged from the research of the Apollo 1 and Challenger disasters is as follows:

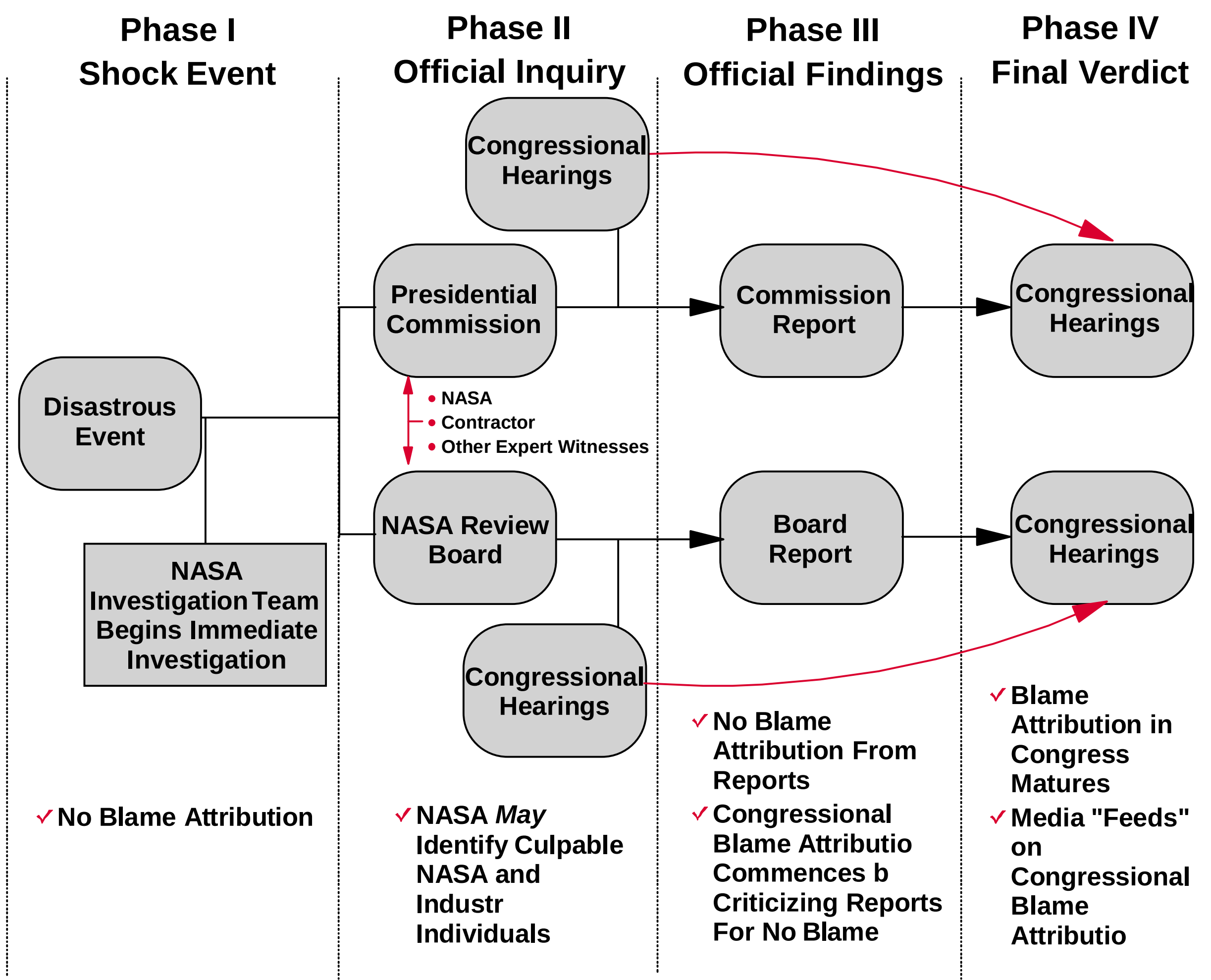

Figure 29: Blame Attribution Phases

Figure 29 outlines the four phases of the blame attribution process. In Phase I, there was little evidence at this point to attribute blame to an individual. In the case of Challenger, a number of NASA and Morton Thiokol engineers kne within hours what the cause of the disaster was; however, they did not have enough information at that time to blame anyone. The time associated with Phase I was about one to three days. During this period, NASA had an investigation team in place within hours of the disaster collecting visual, audio, telemetric and other data. There is evidence that NASA attempted to manage the Apollo 1 and Challenger disasters, but their efforts were fragmented and largely ineffective. One of the principal factors for this ineffective management of the disasters is that their disaster policy were not executable in a "real wo rld" situation. This was especially true following the Challenger accident in which NASA placed appreciable emphasis on the collection of data to support the investigation, but fell short in providing information to the American people through the media.

Phase II began from approximately day three and ended in about two or four months following the disaster. As we saw in the case of Apollo 1, if NASA kne who was responsible from within its own agency, they would probably identify that person during this phase. If Congressional hearings were convened during this phase, they would generally take testimony from the same witnesses that were testifying before either a Presidential Commission or a NASA Revie Board. The information that they garnered from this testimony would be used for hearings that would continue following the release of the commission or board report.

Phase III was a short phase lasting possibly one to five days. It extended fro the release of the report until the Congressional hearings began. Although only a short phase, the blame attribution rhetoric began usually with a criticism of the Commission or the Review Board for failing to identify the culpable party or parties. The press reflected the blame rhetoric in articles and editorials.

Phase IV focused on the congressional hearings, which could take two to four weeks or more. The research was conclusive that during this phase, there would be at least one member of the congressional committee who would have only one purpose: to publicly blame someone for the disaster. Even if the individuals had already been identified and sanctioned in some fashion by NASA and the contractor, Congress would place them before the media and the American people to show them that they (the Congress) had done their job and found the guilty party or parties. The media during Phase IV were aligned with the Congress because it produced fodder for editorials and the inflammatory congressional blame rhetoric helped to sell newspapers.

General Blame Attribution Model

From this research, a general blame attribution model can be developed with application to any policy subsystem that is engaged in a high risk enterprise utilizing high risk technology in which failure can translate into a disaster resulting in loss of life (e.g. military, energy, construction). The following is a general model of the blame attribution process:

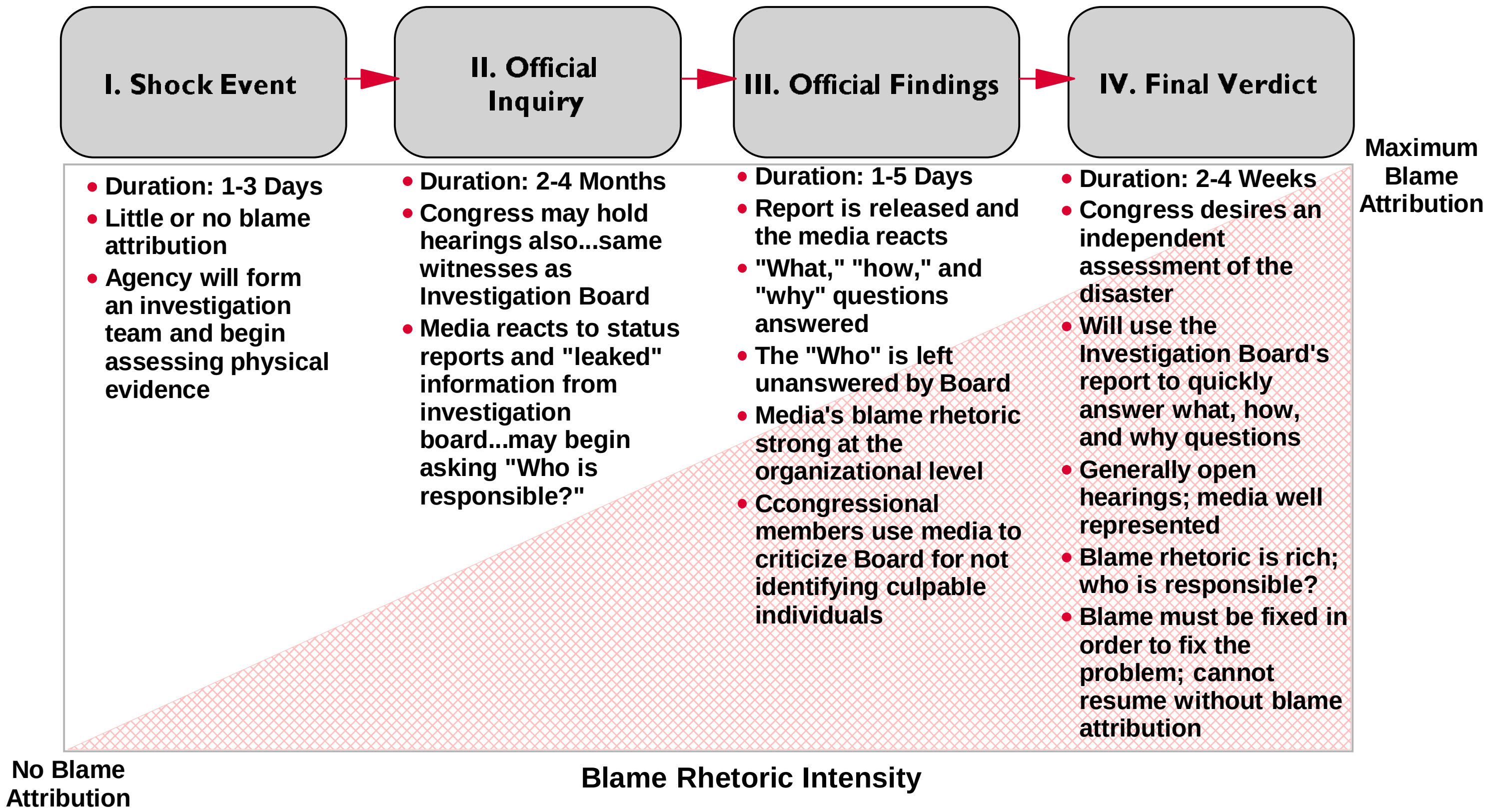

Figure 30: General Blame Attribution Model

The features of this general blame attribution model are:

- The blame attribution process is sequential (i.e. Phase 1, then Phase II, etc.)
- Blame rhetoric increases and the duality of blame is evidenced. The language of blame moves from organizational to the individual as the blame attribution process matures.
- The issue cycle (i.e. from disaster to resumption of normal activities) is approximately five to six months.

- The Congress and the media have a symbiotic relationship: Congress provides information (e.g. data, opinions) to the media; the media provides a means for the member to articulate his/her views into the public forum.
- The agency and the investigation board identify the technical deficiencies and recommend corrective actions. Congress and the media either assign blame or force the agency to assign blame.

Recommendations

Recommendation 1: ***The Role of NASA Public Affairs Following a Disaster***

The media has an active role within the policy subsystem since they are the locus of bi-directional relationships. They are also key participants in the blame attribution process. This co ent is similar to one that was made by a NASA public affairs officer following the Challenger accident. The public affairs officer stated that following a disaster, "The absolute center of the universe for NASA is public affairs." The Administrator of NASA must endorse this view in the form of a policy statement within NASA. When a manned space flight disaster occurs, the focal point of the organization shifts to public affairs. While the engineers and scientists are supporting the investigation, public affairs is in charge of all external relations, all stories, and the release of all information with proper coordination with the investigatory body.

In both Apollo 1 and Challenger, NASA was criticized in the media and in Congress for not telling the American people what happened in a timely manner.

Because of the reluctance to release information, NASA was accused of cover-up. In the case of Apollo 1, the following was written:

> *In the wake of America's first major tragedy in the space program, offic als of the National Aeronautics and Space Administration have exposed themselves to charges that they are covering up…NASA is deliberately withholding facts from the public…NASA's current "no comment" makes a mockery of the United States policy for conducting its space program in full view of the world* (Houston Chronicle, February 3, 1967).

Following the Challenger disaster, this editorial was written:

> *The question that echoes across the land: What have they got to hide? Maybe nothing, but tell that to a nation of post-Watergate doubters* (Milwaukee Journal, February 13, 1986).

If NASA does not provide the information officially, the media (acting for the American people) will find the information from other sources, which may not be accurate or entirely representative of the facts. Because of NASA's reticence to release information, the information that is in the public forum may be inaccurate, which NASA then has to correct. If NASA would write and adopt a post-disaster policy that all of the Centers' public affairs officers participated in developing, the plan would be executable and NASA's image would fare much better. Because there appeared to be no post-disaster public affairs plan in place or it is was not executable in either Apollo 1 or Challenger, the public affairs officers were the targets of ire not only from the media, but also their own NASA employees. It is also recommended that following the adoption of a post-disaster public affairs policy that it be periodically exercised in simulated disaster scenarios.

Of course, NASA's public affairs functions also play a vital role in non-disaster situations. If the media is not kept abreast of events and NASA's motivations, they can become a powerful force in exerting pressures on an agency that prides itself with its positive image. In the case of Challenger, because of repeated launch delays, which were not adequately explained to the press, they became critical of NASA. Richard Smith, who was Director of Kennedy Space Center, stated that "…98% of the pressure to launch the Challenger came fro the news media, which openly criticized the agency [NASA] whenever there was a launch delay" (Washington Post, March 15, 1986).

Recommendation 2: *The Establishment of the Presidential National Commission on Space*

The National Commission on Space is not a new concept. In 1984, a Congressional bill spawned the National Commission on Space, whose purpose it was to develop the future space plan for the United States (Logsdon, 1995: 392). The Commission was led by former NASA Administrator Thomas Paine and the Paine Commission, as it was called, published a report entitled Pioneering the Space Frontier in 1986. After the report was published, the Commission was disbanded.

The purpose of a presidential commission is to investigate an issue of national concern and to make recommendations. They are comprised of responsible and respected citizens who can objectively assess an issue and then make policy recommendations or recommend corrective actions to remedy the situation (Shafritz, 1988: 113).

This researcher's recommendation is that the National Commission on Space be established as a standing Presidential Commission with a two-fold mission: To focus on the national space agenda and make space policy recommendations to the President and to be the independent focal point for manned space flight safety. It is the latter mission that will be discussed.

Within the Commission, an Office of Manned Space Flight Safety would be established with the responsibility to conduct all investigations of injuries or fatalities of astronauts when they are engaged in actual space flight activities or in preparation for manned space flight. This Office would have a similar mission and function to that of the National Transportation Safety Board (NTSB), which, as an independent Federal agency, has the standing remit to investigate every civilian aviation accident in the United States. Like the NTSB, which has approximately five hundred employees, the Office of Manned Space Flight Safety have an employee population of less than one hundred employees, largely due to the relatively low number of incidents and accidents that involve space flight crews. The Office of Manned Space Flight Safety would consist of a permanent civilian Director, a Deputy (civilian or military), a staff of technical investigators, and other support personnel.

The Chairman of the Presidential Commission on Space would have on call Investigation Board members from academia, the astronaut corps, the sciences, engineering, and industrialists who were noted for their contributions to the knowledge, science, and safety of manned space flight. If there was an accident in which there were crew injuries or fatalities, the Investigation Board would immediately be convened and they would have sole jurisdiction to investigate the accident. The Chairman of the Commission on Space would be the Chairman of the Investigation Board.

The Commission would also serve in a capacity similar to that of an Inspector General, in that it would be a means for employees of NASA and its contractors to bring safety issues to the attention of the Commission in a confidential manner. As was experienced in the Apollo 1 and Challenger investigations, there was always an engineer or technician who knew of a safety problem that was a contributing factor in the disaster, but they were either apprehensive in bringing the safety issue to the attention of their management or management failed to react to their issue. The Commission would be the conduit by which safety issues could be surfaced in a non-attribution manner. The Office's staff of technical investigators would then conduct a lo -key inquiry into the employee's allegation. Should they find merit a more thorough investigation, it would be brought to the attention of NASA through appropriate channels.

The employees of NASA and its contractors would be made aware of the Commission's purpose, which would be a resource for them to raise safety issues before another space flight crew was killed or injured.

Statistically, there will be another fatal accident in America's manned space flight program. In 1998, NASA's risk manager and former astronaut, Frederick Gregory, stated that the probability of another disaster is 1 chance in 145 flights. It could happen during the ascent phase; the shuttle could be struck by debris while in low earth orbit; it could have a landing gear failure upon landing. The point is that it is not a matter of "if," but "when." NASA must be prepared to tell the Nation, what happened, how it happened, why it was allowed to happen,…and who is responsible. If this research has accomplished anything, it is that a national policy subsystem cannot restore its "fabric of normalcy" following a disastrous event until these four questions are answered to the satisfaction of the American people. For it is in the answers to these four questions that Americans make sense of such a disastrous event.

Final Thought: The Implications for Public Administration

This dissertation is grounded in three literatures—sensemaking, establishment of blame, policy subsyste -- that inform our understanding of how a national policy subsystem utilizes the attribution of blame as a framework for sensemaking. As this dissertation reaches its conclusion, one further question may be appropriate: What are the implications of these three literatures for public administration?

The sensemaking literature suggests that public administration, as a discipline and a profession, exists in a world in which the construction of meaning is occurring with or without its participation. Either public administration can be an observer or it can be an active participant in the construction of this shared meaning. Public administration must also recognize that sensemaking does not result in action, but in understanding (Feldman, 1989).

Public administration functions in an arena in which it must be proactive, decisive, and possibly innovative in the manner in which it executes public p olicy and manages the public sector. The blame attribution literature highlights the reality that in this complex process of public management, there will be those in the body politic, media, and elsewhere who will seize the opportunity to attribute blame for mistakes that will invariably be made in the administration of the public's business. Either public administration can adopt strategies to avoid blame by taking a less proactive, less innovative role in governance or it can learn to manage the blame process. Another important contribution of the blame literature to public administration is the recognition that the attribution of blame is necessary for the legitimacy of governance. What this suggests is that the public expects—even demands-- that its government will, for the good of the nation, identify and punish those who are responsible for a disastrous event. If a government is to claim legitimacy, it must be able to protect its citizens from not only external threats, but internal ones as well. Incompetent and negligent public and private managers are internal threats and must be held accountable if disastrous events occur as a result of their decisions.

The implications of the policy subsystem literature for public administration are first that public administration is a central actor in the policy process. Secondly, public administration must cultivate relationships with the other members of the policy subsystems for it is in these mutual dependencies that the policy subsystem maintains its structural integrity and identity. The third implication is that internal and external conflicts are inevitable, which suggests that if a policy subsystem is to survive it must learn to manage that conflict.

APPENDIX A

Elite Interview Transcripts

EDITED INTERVIEW WITH JEFF BINGHAM

January 18, 2000

P R O C E E D I N G S

MR. WHIT : Jeff, do you have any objection to this being recorded?

MR. BINGHAM: No, not at all.

MR. WHIT : What was your position with Senator Garn?

MR. BINGHAM: I was his chief of staff. His administrative assistant was the title. I served as chief of staff.

MR. WHIT : And how long were you with him?

MR. BINGHAM: Seventeen years.

MR. WHIT : And you were with him when he was training for his flight on the space shuttle?

MR. BINGHAM: Yes. In fact, I was down in Houston with hi -- over a 6-month period during his training.

MR. WHIT : Getting to Challenger, did the Senator or yourself have any visibility at all on any of the issues associated with the booster, the SRB, or any of the other issues associated that became a part of Challenger investigation?

MR. BINGHAM: Well, in 51-B they had some O-ring burn-through on Jake's flight. So after that, in the after action in the debrief they talked about that anomaly, and they knew it was there but there was no level. It wasn't a crit-1 -- criticality-1 feature at that point. Of course, it became one. So people were aware that there was some kind of problem with the O-rings with occasional blo -by of gasses, but not at any level of concern at that point. That was about a year before Challenger, of course.

MR. WHIT : So was there an appreciable amount of discussion, or was there just an awareness of it?

MR. BINGHAM: An awareness of it. The other thing Jake often talked about was the awareness of risk. He was clear that everybody understood the level of risk involved in that machine flying even in the best of conditions.

(DISCUSSION ABOUT THE IMPACT OF THE CHALLENGER *DISASTER)*

MR. WHIT : It hit the whole country hard because, but it seemed that we'd tried to normalize shuttle flight as being fully operational. Therefore, we can put a teacher on board or civilians or politicians or whomever. Do you think that we kind of set ourselves up for this disaster in a way?

MR. BINGHAM: Well, no question we set up that expectation. But it was more I think the pattern of success, 24 missions prior to that with no problems. It was more that lulled people into complacency.

MR. WHIT : From your vantage on the political side, we had talked about this idea of a policy subsystem, the principal actors that actually make or influence public policy. My idea is that prior to a catastrophic event, the principal players are the congressional committees and subcommittees, industry like the Rockwells and Morton Thiokols and, of course, NASA. But after a disaster you see these walls or these boundaries that contain the policy subsystem become permeable, and then you get all kinds of other actors, the media, the experts, all these other guys come in. Could you comment from your perspective, is that a valid observation?

MR. BINGHAM: Yes. Yes. No doubt. I mean, there are so many different axes that want to get ground. There were people who came into that picture that literally just wanted to exploit the failure to promote their own ends which is unmanned exploration. They were always there. It's not that they're not there, but they take advantage or try to exploit this circumstance. That was clearly the case.

MR. WHIT : So prior to a disaster, when things are as normal as they be in Washington, you got shuttles flying and you have normal budget battles, would you agree that the predominant players are NASA, Congress, and industry?

MR. BINGHAM: Yes. I think that's the case. Occasionally you'll have interests come in. But the primary interests are those. Some are just simply concerned about human life when they came into it, and the media as much as I detested them during that time period, because of what I felt was the exploitation of people whom I knew who had died -- Still have an obligation to expose errors in government. So they had a legitimate role to play. I don't think they know how to play it well -- But it's a legitimate role in our society, in our system. Then it ebbs away not long after -- within 4 to 5 months it's gone again.

MR. WHIT : Yes. So getting back to this issue we talked about before about the association of blame and how, invariably, somebody is going to get blamed. Whether rightly or wrongly, somebody is going to be held accountable, and in Apollo 1 it was Harrison Storms and Joe Shea , I guess got blamed . But in the case of Challenger, with all the people at Morton Thiokol and at Marshall Space Flight Center were they the guys that should have gotten blamed? What are your views about all this blame issue?

MR. BINGHAM: Well, I have a problem with the blame because nothing is ever that simple. Hindsight is always 20-20. Anybody can say, well, you should have, should have known that. That should have meant something to you. There's no way to replicate that. All you can do is the best you can do. You put systems in place. What we did after Challenger, with the safety reviews in NASA, was the right kind of response. That was to intensify the level of effort in safety oversight, basically internal and external. But even with all that you're never going to perfect it. We went through the same sort of thing with Mir. Sensenbrenner wanted to blame Golden for not foreseeing or forgetting -- actually, he really wanted to blame the President. Golden was just the club he wanted to use over Clinton's head. But the same sort of thing was 20-20 hindsight, second guess. They requested every single document in the phase 1 program, copies of it. So they could go through and find the smoking gun, or the memo that warned about this kind of thing happening that was ignored. They were trying to do what they thought the Rogers Commission should have done, and that was just in vain. I happened to be the person who had to pull that together for them, and I put together 10,000 documents and each one had a number on it and a descriptor.

MR. WHIT : You've seen a lot of incidents, not just catastrophic events in space or space related, but all kinds of other failures It seems that there is a pervasive attitude in Congress that when something goes wrong somebody has got to get blamed for it.

MR. BINGHAM: Yes. That seems to be the norm, and it's unfortunate I think, and it's a confusion over the role of oversight, what the congressional role is. And, of course, I worked with Jake and I sort of naturally adopt his viewpoint, and that is you don't try to micromanage things. But you do hold people accountable, and there's that fine line that so many members fail to recognize for political reasons. When oversight becomes political bashing, then it's irresponsible. And the blame game is part of that. Now, there's a difference between blame and responsibility. Oversight, properly done, finds responsibility, looks for patterns and tries to make corrections or to avoid future problems. It doesn't go out for blood. Clearly, the Hill is such a political environment, and it's gotten more so in my observations, even since I was there, but it's always been that way. It's part of the nature of the beast.

MR. WHIT : But why do they have to have the blood?

MR. BINGHAM: Well, they think that's what the constituents want.

MR. WHIT : So they believe or they think that maybe the American people need to have blood?

MR. BINGHAM: Yes, but it's not really the American people they're satisfying. It's the media who are reflecting that thirst for blood. Unfortunately, too many members of Congress take the media seriously and accept their representation of what's needed.

MR. WHIT : Do you think maybe that the body politic perceives the media as being somewhat the voice of the people?

MR. BINGHAM: I think less and less they do. I think whenever they do, they're disappointed very shortly thereafter. It depends on how you stand, depends on where you sit, and that changes from day to day, and the issue changes and the media is going to come down on the wrong side of it for you. I think the people have a skepticism, and a healthy skepticis about the media, but in the rush of a mo ent in the immediate aftermath of a disaster, the media has their attention and they don't make judgments on the media's coverage, at first, until it gets nauseating.

MR. WHIT : So what's the media's agenda then, Jeff?

MR. BINGHAM: Sell papers and get ratings, by and large. There are very few journalists whom I respect as being searchers after truth. There are some, and fortunately some of those have been people who have covered the Space Program, a guy like John Hollinhurst (phonetic) fro CNN, and those guys, but certainly not exclusively.

MR. WHIT : So really, the Congress or some of the members gives the media more credibility and power than they deserve.

MR. BINGHAM: Absolutely. They buy into their media frenzy.

MR. WHIT : And the reason why the members do this, then, is because they think they're satisfying a constituency?

MR. BINGHAM: Well, they recognize, or I think they overemphasize, the impact the media is having on their constituents.

MR. WHIT : But it seems like with each disaster they repeat the pattern.

MR. BINGHAM: Yes. There's not a strong learning curve.

MR. WHIT : It seems like in the conduct or in the course of the hearing there's always one or two guys that want to –

MR. BINGHAM: Grandstand.

MR. WHIT : Yes, they want to grandstand, and they want to find somebody to blame. Because if you go back to Apollo 1 and the Thompson report, the Thompson Commission, they did not point the finger at anybody. They made some overarching assessments, they came up with some recommendations, we got to fix this thing. The Rogers Commission did the same thing. They did not point their finger at anybody. And so where is the finger pointing done? Congress?

MR. BINGHAM: In the public media.

MR. WHIT : The media and Congress. They kind of go back and forth.

MR. BINGHAM: When they do it in Congress, they're playing to the media. That's when they do it. They're making a record and they make sure that even if a camera is not even anywhere in the room in a hearing, they'll do their thing and the media will get a release on it. It's still the media focus. It's doing something for the media. It's media driven. Ho else are you going to define it?

MR. WHIT : So the folks back at home see their senator or representative as being a player.

MR. BINGHAM: Right. They see the press release, and then pretty soon they get a newsletter that summarizes it again.

MR. WHIT : Again, one of my ideas for my research is that following a disaster, especially if there's a loss of life, it seems that really the project or the agency doesn't start to recover and get back to performing its mission until an individual or individuals have been blamed.

MR. BINGHAM: Right. I think like you said, on both the two major space disasters, the focus of the response was what's broken, what needs to be fixed. Who broke it and why did they break it, and what's wrong with the and where are we banish them to. To me, I think that the public bought into that, continued to support both Apollo and the shuttle once that it became apparent that there was a shopping list of issues that had been uncovered and revealed, maybe one or two people in the periphery had responsibility and culpability. But, the focus was on what's our response to these defective procedures, and what are we doing then and putting in place to fix it. I think the confidence came back because it was obvious that we were addressing the issues, and I don't think anybody really wanted blood. I don't think the public necessarily wanted blood. They just wanted to know that NASA was doing something responsible about it.

MR. WHIT : But again, the guys who wanted the blood were the guys in Congress.

MR. BINGHAM: If you listen to Bumpers talk about the space station, he never used facts. He just always used simile, homily, and opinions, and just wasn't interested in the facts. He didn't want to be confused by the facts. Hollings was the same way on that issue. He just had a cause and he wanted to go worry it, and my guess is staff members go nuts when their members do that because they can't justify it. There's no basis for it, and that's why it goes away pretty soon.

MR. WHIT : It sounded like he went after Rogers for not blaming anybody. Then when he was passed that, then he started getting on the Morton Thiokol guys and the guys from NASA down at Marshall.

MR. BINGHAM: He wants to be a watch dog. He likes the image of a watchdog, and that's what that's for.

MR. WHIT : So that was all that was about then, more constituency consumption?

MR. BINGHAM: It really is. That's the image he wants to portray back home. People like his kind of maverick, folksy attitude. He's traded that on his whole career. He's not going to change it now.

(DISCUSSION ABOUT MR. JAMES BEGGS)

MR. BINGHAM: Well, that's a whole interesting issue about that indictment of Beggs. There was a lot of talk about that being a setup, but it was from the point of view that mostly because he just didn't like Graham and sat on his nomination, on his appointment, for 6 months, practically.

MR. WHIT : So I guess there was no love lost between them.

MR. BINGHAM: No. Not at all. Not at all. And how the dynamics of that affected Challenger? I will say one thing that I believe sincerely, and that is if Jim Beggs hadn't been indicted, Challenger would not have happened. We might have had another accident, but we wouldn't have had that one. And Beggs was looking for Graham the morning of the Challenger launch. He saw the ice and he said they should not launch, but he could not find Graham. Graham was up in the Hill watching the launch up there I think in Nelson's office and of course he had had standing instructions not to let Beggs get to him anyway. Beggs told me that years ago. But, he would have stopped that launch. He would have overruled the launch directors.

MR. WHIT : When I was talking to Dr. Petrone, he was at the time president of the space division at Rockwell, he said that he had called and told them not to launch because of the icing and some of the dangers associated with vibration with all that ice around. It didn't seem like anybody wanted to listen.

MR. BINGHAM: Right.

MR. WHIT : Jeff, thank you for taking the time to talk with me this afternoon.

(Whereupon, the PROCEEDINGS were adjourned.)

EDITED INTERVIEW WITH DR. HANS MARK

Monday, November 1, 1999

P R O C E E D I N G S

MR. WHIT : Dr. Mark, do you mind if I record our conversation?

DR. MARK: No. Go ahead.

MR. WHIT : What was your position at NASA?

DR. MARK: I was the Deputy Administrator.

MR. WHIT : Dr. Mark, did the executives at NASA headquarters kno about the field joint seal problem on the sold rocket motor?

DR. MARK: I knew about it. My own part in the chain of events that led to the accident began when I returned to NASA in 1981. I first became aware of the fact that we had a problem with the O-ring seals on the solid rocket motor at the time. The first time I saw this thing was in the second flight, and we said we got a problem.

I didn't know what to do about it, so we just flew again. Then the next time, and this is where my own part in the chain of events that led to the accident began when I returned to NASA early in 1981. I first became aware of the fact that we had a problem with the O-ring seals in the solid rocket motor at a time when our engineering people were questioning whether the field joints on the SRM were going to be safe. That's not quite true. I shouldn't say that. I knew about the blo -by on the second flight. The thing is that, I didn't connect it to the joint rotation at the time.

MR. WHIT : Was Morton Thiokol apprised? They obviously knew that they had an O-ring erosion problem.

DR. MARK: Sure. They knew they had it. During the design of the space shuttle, an effort was made to make as many subsystems as fail-safe as possible. The idea was to design them in such a way that a single-point failure would not have catastrophic consequences. In the case of the field joints, this was accomplished by putting two O-rings in the joint on the theory that if the first one failed, then the second one would do the job. My memory is that the question as to whether the double O-ring system was really fail-safe began to be raised sometime in 1982, in February or March. Mr. L. Michael Weeks, the deputy associate administrator for space flight signed out a memorandum waiving the fail-safe requirement for the field joints in the solid rocket motor. I remember discussing that matter with him at the time and concluding that such a step was justified. I argued that we had more than 100 successful firings of the Titan solid rocket motor with a seal of somewhat similar design containing only one O-ring.

I thought because of the type of precedent that the risk of failure was small. As things turned out, this judgment was not correct because there are several differences between the types. I did not look at these differences with sufficient care at the time. At the same time, we did have other serious problems with the shuttle vehicle. There was the nozzle burn-out and so on, and then I go on to say, this one looks small to me compared to the other parts. The O-ring seal problem did gain my attention again just before I left NASA in 1984. On the tenth flight, STS-41B, we noticed some charring of the O-rings in the lower field joint. This phenomena had been observed once before on the second flight, but when it did not reappear, I thought it was a one-time event.

When we saw it again on the tenth flight, the question was what should be done. The question was should -- was discussed at the flight readiness review for the eleventh flight. And I presided over all these reviews, so I mean, I was completely aware that this thing was going on. After the completion of the flight readiness review I issued an action item asking for a complete review of all the solid rocket motor seals and joints. My intention at the time was to review this problem in the same manner as we had done with the solid rocket motor nozzles when we had problems with nozzle erosion, and so on. Unfortunately, this review was never held. I made the decision to leave NASA about 2 weeks after signing on the action item. So the matter was apparently dropped. The action item was issued on March 30, 1984, and I made the decision to leave NASA in mid-April. The due date for the review was May 30, 1984, and by that time I was a lame duck. The subsequent histories are contained on page 132 of the Rogers Commission report. The people at Marshall Space Flight Center and Thiokol decided they would develop a plan to fix the O-ring problem rather than review the matter with the highest level of NASA management. That's where it got buried.

MR. WHIT : That's where it got buried.

DR. MARK: It was apparently for this reason that nothing was done for 15 months to make NASA management at the headquarters level more aware of the problems that were developing with the O-ring. It is also for this reason, very probably, that Jim Beggs and other high-level officials at NASA could claim they were not aware of any really serious problems with the O-ring. A complete review of the O-ring seal problem was finally held at NASA headquarters on August 19, 1985, 15 months after the original request was made. Even then the most senior person who attended the review was Mr. Weeks.

Neither the NASA administrator nor the associate administrator was aware. I was aware of the problems with the O-ring seals in 1983 and 1984. I felt that it would have been dealt with as it was dealt with in a manner similar to reviews we had for other problems that we were experiencing.

MR. WHIT : They just didn't want to hear about it?

DR. MARK: At the time I did not think the O-ring seal problem was serious. For example, as the rocket motor -- solid rocket nozzle erosion and similar problems we were having with the shuttle main engines. Nevertheless, I felt the time had come to ask serious questions. The question I have asked myself over and over again is whether I would have flown on that day. I was involved in the launch decision of 12 shuttle flights where I had little experience and I cannot remember a single flight when some group of engineers who were responsible for one or another of the subsystems did not advise us to delay the launch.

Sometimes we took their advice and postponed the launch, and other times we went ahead and flew in spite of the advice we were given. The mere fact that a group of engineers approached the launch because they were afraid one or another subsystems would not work was not enough to cancel the launch. In view of this, I do not know whether the recommendation of the Thiokol engineers not to fly would have been enough to persuade me not to launch Challenger on January 28, 1986.

I do have to confess that when I saw the pictures of the ice on the launch pad in the Rogers Commission report I was very surprised that NASA management gave the go ahead to fly. The launch pad structure and the gantry were both completely covered with ice, and there were a great many icicles. Those icicles become missiles when the pad vibrates during takeoff and they can easily damage the vehicle. I was always especially concerned about damage to some of the tiles and the thermal protection systems, and the tubes that carry the liquid hydrogen for the regenerative coolant of the shuttle main engine. Obviously, a rupture of these tubes by flying ice could lead to catastrophe. We cancelled launches with much less ice on the pad that I saw during the years that I had anything to say about whether to launch or not. I would have never flown on that day for that reason alone.

MR. WHIT : On the tenth flight when you had that charring at the field joint, did we have low temperature that day? Is there a correlation between exterior temperature?

DR. MARK: No. I'll tell you what -- I looked at this afterwards, and somewhere I've got a write-up of my own reaction. I think there were really three proximate causes to the problem. One was the cold, and the O-rings obviously don't work as well when it's cold. The second was that during 41-C, I guess it was, we flew through the biggest wind sheer that a flight had ever experienced, and the thing came apart right where you would expect it to come apart. And the third point was that they had trouble assembling that seal.

Now, the Rogers Commission report violated some very, very important principles in accident reports. Namely, they put conclusions into findings. And I read that with great care and I finally said, these guys had some other motive in mind. I think what really happened was is they were told, look, fix this thing so you don't have to fly until the next election. That's my guess.

MR. WHIT : I have over a lot of Challenger data and it seems that there was a time line that they wanted the STS program to get back on.

DR. MARK: And by blaming the whole thing on the design. See, what normally should happen in a situation like this is that you do what you do in an airplane accident. You fly under restricted flight rules, which in this case meant you don't fly when it's cold, you don't fly when you have a high wind sheer, and you sure as hell don't fly when you have trouble putting the thing together.

MR. WHIT : Thus far I have not seen anything in the research where they said "You are to blame for this." It appears that a number of people from Marshall and Morton Thiokol were either reassigned or retired.

DR. MARK: Well, okay, look, when you say blamed, the worst thing you can do is criminalize something like this because they will never do anything again.

MR. WHIT : I agree. I'm wasn't suggesting that they should be held criminally liable.

DR. MARK: I think Beggs is clearly to blame for not holding that review. I mean, I was out of it, but the review is on record.

MR. WHIT : Did Graham know about it?

DR. MARK: I don't know.

MR. WHIT : That would have been Beggs' job, though, to tell Graha about this?

DR. MARK: I made the decision to resign in April '84. Graham was not appointed deputy administrator until November of '85. So Beggs was the one who should have known.

MR. WHIT : Yes. Exactly. So it was Beggs's responsibility to convey that information which he didn't do. Did -- did he share the blame?

DR. MARK: Well, I don't know if he knew. Look, I mean, I presided over the flight readiness reviews. Beggs was there for some and not for others.

MR. WHIT : Did you ever think of calling Graham and talking to hi about it?

DR. MARK: About what? A year and a half later I had no notion -- I -- you know, I -- all I knew is that we saw it once more and that I wrote the memo about it. I did not know that they had -- that the situation had gotten worse, and so I had no reason. I'll tell you what did happen, interestingly enough. Graham called me sometime in December before the -- the flight that Bill Nelson was on, the one before Challenger, was supposed to be launched before Christmas. And Graham called me and told me what was happening at the Cape. He had just gotten sworn in, and he felt queasy about it. And I said, "Bill, those people have launch fever. Cancel the goddamn launch. Cancel it. Just don't give any reasons. Cancel it." I did that three or four times when I was deputy administrator. If my stomach didn't feel right about a launch, you just cancel it. Okay. So he did that. And then they got it off in January.

MR. WHIT : You were involved in one of the big issues that was raised during the commission hearings about the alleged pressure to maintain a tough launch schedule.

DR. MARK: Look, I never worried about that. If somebody said you must launch, I'd say not until I'm f_______ well ready, period.

MR. WHIT : Were there people putting pressure to maintain the schedule?

DR. MARK: Yeah. But there should be, you know, otherwise it doesn't work. But then you have to press back and say, look, we're not ready technically to do it, and we don't do it. The question is, do you resist the normal kind of pressure to say get on with it, you know, you've delayed it twice, get on with it. We always resisted that.

MR. WHIT : Okay.   ell, sir, I thank you very much for taking the time this afternoon to share your Challenger story with me.

(Whereupon, the PROCEEDINGS were adjourned.)

EDITED INTERVIEW WITH DR. ROCCO PETRONE
Monday, January 17, 2000
P R O C E E D I N G S

MR. WHIT : Dr. Petrone, is it OK with you if I tape this interview?

DR. PETRONE: Fine.

MR. WHIT : As we have talked about previously, I am examining the process by which blame is attributed following disastrous events. But before we talk about Apollo 1, can you tell what your position was at NASA during the Apollo program?

DR. PETRONE: Yes. I was the Apollo Saturn program manager. Then I became launch director in 1966. We shifted from building the facilities and we activated them, and then started to become operational, and I took over the launch director. I was the Apollo Saturn program manager fro the early '60s to '66. Then in the summer of '66 I took over as launch director.

MR. WHIT : I've read the accounts of the Apollo 1 fire, can you give me an idea about how fast it occurred? Were you in the block house when it occurred?

DR. PETRONE: Yes. I was sitting right next to Deke Slayton, and it had been a lengthy afternoon. The guys got in about 1:00 as I recall, 1:00 or 1:30, and we had a series of starter problems. And there was always a problem with communication. It had to do with the wiring system on the ground. It was a three-wire, two- wire system. And complex 34 had a system, which I really now I forget some of the details of it. I remember it was three-wire, two-wire, and you couldn't always make connections. So that was frustrating. It went through the tunnel, because we had -- the spacecraft people with their test room were separate from the block house. So you had the spacecraft talking to the block house and talking to the -- it's called Ace control. And you had a connection there in which the sound wasn't always the best. So that had been part of the delay.

And it was around 6:25 when we picked up the count. I forgot. It wasn't -- it was just a few minutes before the plugs would have been pulled, and the plug -- you actually pulled the plug and you isolate the spacecraft. And in that time, as my memory serves me now, we had the TV camera, one right on the door looking through the porthole. Then there were TV cameras around the spacecraft, just looking at various connections and wires. So I could see on my TV in front of me two or three views of the spacecraft, plus the porthole. And Deke and I had just been talking about the program and what was going to be happening in the year, because this was January the 26th, was it? Anyway, it was late January, but we were talking about the year ahead.

And then we picked up the count, so we -- everyone got ready for the activity. And all of a sudden, there was -- I saw a flash on the screen, like white. I didn't know what it was, of course, at the time. I just saw it on my -- my screen in front of me. Then I also noticed, within a few seconds, the cables started to shake. I saw the cables shake, I saw the flash. I really didn't hear anything. I did not hear a thing, although I had the loop on, but I had a number of loops, so I could monitor both the vehicle and the count on the ground and so on. And it sort of -- that seeing the cables move, it sort of -- well, I can't say what it did to me. It gave me a certain feeling, but I didn't understand it. And that was all in that instant, it took place. I think it was something like 18, 29 seconds. The command module reached the pressurization point that blew out the bottom part. When it blew it, it split it.

Although you couldn't see it, but there was pressure coming out there, and that was what was moving the cables. So there was about 18 seconds or so for the pressure to build up to be above the burst pressure of the of the cabin in which the stuff came out. And in that time, there's just seconds going on. You're trying to get a grasp of what's going. The spacecraft test conductor, he was talking to the guys, but at that time, there were no, really, words exchanged, although there is something on record that there was a statement of "Fire" or words that sounded like that. And then it became just one of trying to react. There was a pad crew. They were North American. They went in and tried to open up the hatch. Now, the very bad part of the situation was, it was an inward-opening hatch.

And there was no way you could have opened it, not with the pressure inside. The pressure let go, and then you had to pull out what's called a boost protective cover, and then the hatch had to be, in effect, moved inward. There was no pressure in there at the time. And from there, it just obviously took a very sad outlook.

I think it took a couple of minutes, 2 or 3 minutes or so, longer to get that hatch opened. And I heard a guy say, "I can't see the crew." And the picture on the TV now showed the hatch through the porthole from the television camera looking at the hatch, and it was very dark. And he said, "I can't -- I can't see the crew." There's smoke in there and everything. I told the camera operators to turn the picture off. And that was it.

MR. WHIT : Was the test that you were engaged in on AS-204 perceived to be hazardous?

DR. PETRONE: Hazardous?

MR. WHIT : Yes.

DR. PETRONE: No. In the sense that we didn't have any fuel on board. And therefore it was classified non-hazardous. Now, the fact that you had oxygen environment, we knew that you had an alert there. We didn't consider it hazardous. We vacated all the nitrogen out of the spacecraft, take the air out, putting oxygen in, going up to about 16 psi of oxygen. And we did not consider it hazardous. Now, that was a blind spot.

MR. WHIT : Yes. I think I mentioned to you before, I found that letter from Hilliard Paige from General Electric that he had sent to Dr. Shea -- did I mention that to you?

DR. PETRONE: I don't think so.

MR. WHIT : Have you ever heard of that letter?

DR. PETRONE: No. You have to tell me more.

MR. WHIT : This letter was written on September 30, 1966, and it was from Hilliard Paige, who was the vice president and general manager of General Electric Missile and Space Division.

DR. PETRONE: Yes.

MR. WHIT : He says, "I would like to express my personal concern for the adequacy of currently implemented spacecraft design, fabrication and operations practices relative to the possibility of a fire in an Apollo spacecraft using 5 psi 100 percent pure oxygen atmosphere." And then he talks about how long it takes to dump the co mand module of the oxygen in the event of a fire.

DR. PETRONE: You know, the 5 psi, that's normally true at altitude. On the ground, you got to go to 16.

MR. WHIT : Exactly, which makes it even worse.

DR. PETRONE: That's right. It's not only tripled, it's probably 10 times worse.

MR. WHIT : Yes. And he says, "I do not think it technically prudent to be unduly influenced by the ground and flight success history of Mercury and Gemini under a 100 percent oxygen environment. The first fire in a spacecraft may well be fatal."

DR. PETRONE: Yes.

MR. WHIT : Paige continued: "A cabin fire is certainly an unpleasant subject, but is better considered now than by Monday morning quarterbacks, should such a misfortune strike the program."

DR. PETRONE: No, I did not know of that letter.

MR. WHIT : As we talked a little bit about the other day, one of the issues that I am examining in my dissertation is how blame is attributed following disastrous events. And we talked about how Dr. Shea appeared to have been blamed for the Apollo 1 fire on NASA side and Harrison Storms on the North American Aviation side. Do you think that was justified?

DR. PETRONE: Well, I really never saw blame apportioned. I don't -- are you aware of any report?

MR. WHIT : No, sir.

DR. PETRONE: Well, you see, I mean, there wasn't any report said that this guy or that guy is responsible.

MR. WHIT : No, sir. In fact, the Thompson Report made a point of not attributing blame to anybody.

DR. PETRONE: Correct. And that's the way it was left. Now, there were some actions taken where there was a shift made at Houston where George Lowe took over the spacecraft program when Shea went to Washington and so on and so forth. Those shifts probably had to be made just to get new faces on the program. But not from a standpoint of saying this guy was responsible or that guy was responsible.

MR. WHIT : Yes. I think that was kind of the popular interpretation, that when Dr. Shea -- I guess when it happened, I guess it happened rather quickly. He left Houston then went to headquarters in some job there, and then Harrison Storms just sort of dropped off the net.

DR. PETRONE: Yes, and then Bergen (phonetic) took the position, yeah.

MR. WHIT : After the report has already been released and Congress was grilling Mr. Webb, they brought up the point that the source selection evaluation board had originally selected the Martin Company to build the command module.

DR. PETRONE: You know, that was all peripheral and side issues. It had nothing to do with what –

MR. WHIT : Yes. That's the remarkable thing about it. That’s my point. Webb was trying to get the Apollo program back on track and then somebody brought up the issue about the source selection board.

DR. PETRONE: Very uch so. When you have something go wrong, everything is up for grabs. And that's the point, that it happens -- you know, almost the same thing happened on Challenger.

MR. WHIT : Yes.

DR. PETRONE: When something goes wrong, then you go look at all aspects of everything. Things that you had put to bed years ago come back, and they're reviewed and reviewed in hindsight. You see, it turns out, as you're trying to apportion blame, you find that the Congress wants to take names and kick ass. A thing as big as Apollo, with 400,000 people working on it, with billions being spent every year, could hardly come down to where one man screwed up. Do you follow me? Normally, you've got checks and balances. You've got second opinions. There's rarely a chance where a man can push a button and screw it up himself.

MR. WHITE: This is exactly my point; it doesn't have to be rational. In fact, it isn't rational.

DR. PETRONE: Well, not when you are apportioning blame. But fortunately, we had an administrator that kept the reins in his hands. The same thing happened with the Challenger, that as you started to look and start questioning things, you didn't let all these side issues lead you astray.

MR. WHIT : Yes. What was your role in the Challenger situation?

DR. PETRONE: Well, at that time, now, I had left NASA in 1975. And I was out for 6 years doing other work, and in '81, I joined North American. In fact, I took the position that Storms and Bergen had. I got the space division. And responsible for designing and building and operating the shuttle.

MR. WHIT : You make an interesting point about Mr. Webb keeping the reins on the Apollo 1 investigation, inasmuch as he was able to convince President Johnson to let NASA run an internal review.

DR. PE RONE: Well, that was a key point.

MR. WHIT : Yes. Even though he was criticized, when the report was finally filed and it was fairly critical of NASA. It didn’t sound like Mr. Webb was too happy with the report, but it did vindicate the internal NASA review.

DR. PETRONE: Well, look, I want to tell you something. Webb did not know what was going into the report. His hands were totally above it. He said, "You go do the report. Here it is for you to do. You're charged with doing it. I'm going to wait." He saw the report for the first time on Sunday afternoon, and I was sitting right next to him. 5:00 in the afternoon, as I recall. And he looked at it. I mean, when I say "sitting next to him," I happened to be right behind him. And as I told you, at the time we were looking at the report with Webb and his staff and so on, the word came through the press guy that my God, Congress's reaction to the report was that if this is what they've told; could you imagine what they're hiding? Well, we weren't hiding a goddamn thing.

MR. WHIT : Switching to your North American days and to Challenger and again going back to the question I asked you before about Apollo, it seemed that the guys that got blamed for the Challenger situation, were the guys at Morton Thiokol and Marshall.

DR. PETRONE: When the temperature went down, they didn't understand what the hell was going on with the temperature. Now, should they have? The answer is yes, if you're going to launch in that temperature. I took the position I didn't want to launch that morning because of the ice. I had been at the Cape for probably 3 or 4 days, and that was what? I forget. I think on a Sunday, I think I flew back to California, because there were things piling up here, and I was almost certain they weren't going to launch the next day because of the temperature.

They had the water running, and they figured, "Well, in order not to let the water freeze in the pipes, we'll let it drizzle, where she'll flow, and there will only be warm water coming out." But it got so cold that night the goddamn faucets all froze, all the firefighting nozzles. And the next morning, I remember got a call, it was like 3:00 in the morning. They called me fro down at Kennedy; I was in California then. And I said, "What is it like?" They said, "It's all frozen." Well, it's no surprise. And they said, "Well, they're going to want a decision by 6:00 [a.m.] or so whether we could launch." So I hustled out and got over there. And when I saw the pictures, there was just no way we were going to launch. My God, there was all these icicles hanging down. The problem with icicles is, it would be the vibration of the launch, and then the vacuum or the aspiration as the exhaust goes into the nozzles. You're going to suck that stuff right into the bird. So that was my concern.

MR. WHIT : Yes.

DR. PETRONE: Yes.

MR. WHIT : Thank you very much, sir, for taking the time to talk with me about Apollo 1 and Challenger. If I need a clarification or whatever, can I give you call?

DR. PETRONE: Okay.

(Whereupon, the PROCEEDINGS were adjourned.)

EDITED INTERVIEW WITH RALPH RUUD

Thursday, January 13, 2000

P R O C E E D I N G S

MR. WHIT : Mr. Ruud, do you have any objection to me recording our conversation?

MR. RUUD: No, go ahead.

MR. WHIT : For the record, what was your position while you were at Rockwell?

MR. RUUD: Well, at the time of the Apollo, I was moved over there fro the corporate office and given a position as executive vice president. And the reason for that was, they had their problems, and we had the fire in the capsule on the stand. And as such, they [NASA] were very demanding of management to make a change. And I have had, of course, a lot of experience with both the Saturn itself and also parts of Apollo, but primarily with Huntsville on the engine and so forth. So I was fairly familiar with most of the people, including von Braun and so forth. And that association came about when I had to do a kind of study -- I was the senior consultant at -- no, I guess I was still active at that time. I was still active corporate vice president of operations.

MR. WHIT : And this was following the fire?

MR. RUUD: This was right after the fire, yes.

MR. WHIT : Just out of curiosity, how many years did you have with -- I guess it was North American Aviation and then eventually Rockwell?

MR. RUUD: Sixty years in total, 43 years as an employee and 17 years as a consultant. I told them I didn't want to do it any more after that period of time. That as 1991, I think. And I could have continued, I guess, consulting. But I felt that I was losing my ability to be effective because over that period of time, change of people and change of process. It's a lot to keep up with, technically.

MR. WHIT : MR. RUUD, I came across a memo in the archives from a guy named Mr. Hilliard Paige rom General Electric. It was dated like September of '65 or thereabouts. Excuse me, September '66. Did you ever see that memo?

MR. RUUD: No. I don't recall the name.

MR. WHIT : Mr. Paige had written the memo to Dr. Joe Shea in which he stated that he was very concerned about the ground tests of the command module in a 100 percent oxygen environment.

MR. RUUD: Pure oxygen, yeah.

MR. WHIT : Yes, at 5 psi, and he thought that the risks of the fire were high and likely fatal if one did occur. Was this something that was fairly well known or considered at the time?

MR. RUUD: It was known by the company. As a matter of fact, our people made the objection to NASA at the time, and I think that's in the records of Lee Atwood's history that a contracting officer insisted that it had to apply to the 5 percent oxygen and the pressure. So it was overruled, and it was our decision that decided, based on our experience with the X-15s, that this was not a good way to go. But they ruled it, and then the contracting officer sent a letter out that in the interests of caution and so forth, that they felt our experience with previous operations that this was satisfactory. That never came out in the Senate investigation.

MR. WHIT : No, it didn't.

MR. RUUD: But Lee somehow discovered that later on, and he brought this to their attention, but this was probably 10 or 15 years later.

MR. WHIT : Yes, because it seemed that Joe Shea -- because, like I said, the gentleman from General Electric brought up the point, just as you've mentioned, that in Gemini and Mercury, we had gotten away with it, and nobody had gotten hurt.

MR. RUUD: That's right. Yes.

MR. WHIT : Therefore, he was uncomfortable even with that precedent. He said that if there was a fire that it would surely be fatal.

MR. RUUD: Uh-huh.

MR. WHIT : But I think there was a handwritten note at the bottom fro Dr. Shea that basically said, look, we've got a schedule to maintain and can not afford to change he design.

MR. RUUD: Yes. The company had raised the issue about the oxygen. It wasn't our fault, but we were paying for it, because NASA pretty much kept off of it; they did everything right and we did everything wrong.

MR. WHIT : That brings me to the issue that I'm writing about, which is how the blame got assigned. And just by looking at the record, it looked like Dr. Shea from NASA and Harrison Storms from North American took the blame.

MR. RUUD: Yes.

MR. WHIT : At the time that it happened, did everything think okay we've got the two guys from NASA and North American who were responsible; therefore, let's get on with the Apollo program? What was the sentiment at the time?

MR. RUUD: Well, we as a company didn't feel that way, that Stormy should be canned. Stormy had a mannerism that was pretty aggressive sort of a guy, but a very capable engineer and could get things done. He was my chief engineer earlier when I was president of the L.A. division.

MR. WHIT : Do you think that he alone from North American should have gotten blamed?

MR. RUUD: I don't think anybody from North American should have gotten blamed. We were a pretty conscientious concern, and any time any of us even indicated that it would be better and safer and so forth, that's the way to go, forget the cost. That's the way I was brought up in the company. I certainly operated that way, and I think everyone else did.

MR. WHIT : Well, again, nobody likes to point the finger and nobody likes to say this is the guy that's responsible for the deaths of those three astronauts. But the reality is, it seems that there's a history, regardless if it's a space disaster or any other disaster.

MR. RUUD: Got to find a goat [scapegoat].

MR. WHIT: Yes. Somebody is going to get blamed for it.

MR. RUUD: Yes.

MR. WHIT: Who was responsible for it, then? I'm not trying to put you on the spot. I've tried to figure it out myself.

MR. RUUD: Only the fact that the hazard of this particular setup was a question from the standpoint of safety, and it was brought to the attention of NASA, and NASA made a decision, I would have to say that NASA was responsible.

MR. WHIT: So Joe Shea being the program manager for the Apollo should be held accountable or should it have gone higher than that?

MR. RUUD: I don't think so. He was making the decisions. He had the authority to make the decisions.

MR. WHIT: MR. RUUD, when I was looking through the record of the immediate post-event investigation, and when Mr. Webb was before Congress, it appears that what he tried to do was say "Look, NASA is responsible. North American Aviation is responsible. We made some mistakes. We underestimated some things. We didn't take into account some issues. Yes, it was too bad that they died, but we fixed the problem. Let's get on with it." It appeared that Congress was the body that really wanted to blame somebody. Did you get that sense during the events themselves, that Congress was more interested in finding somebody to blame than anybody else?

MR. RUUD: I kind of attributed that to Webb. And to get off the hook.

MR. WHIT: So he was going to look for somebody to blame, so Congress wouldn't get him?

MR. RUUD: Well, that was his testimony before Congress But that issue of these letters, neither one of these issues came up at the time. If it had, it would have made a lot of difference.

MR. RUUD: I was at the corporate office, and we had the Phillips review, you know. He made the study of the problems over there. It famously became known as the Phillips report. And as we sat around the executive table at the corporate offices at the time, we went around the room asking the responsibility, and most of the people said they were there to help support, but that they weren't responsible.
When it came to me, I said I felt responsible, if I'm supposed to be so smart. And Atwood says, "No, no, no, you're not responsible."

MR. WHIT: Because I read the Phillips report. That brings up an interesting point, sir, that during the hearings, I guess, it was one of the senators got wind of this Phillips report.

MR. RUUD: That the report existed.

MR. WHIT: Yes. And I guess there was a lot of foot-dragging by NASA.

MR. RUUD: Yes. It was not intended that that should ever be exposed that way, because constructively, you point these things out, and then you have a chance to respond to them and take action and so forth. But it had to have blown up in Congress, and of course, it became pretty much a national event.

MR. WHIT: Yes, sir. It seemed like it got a lot of press. I guess the spin was that NASA was trying to suppress evidence or incriminating information. But at the time or immediately thereafter, did North American really perceive that as a report or just as a normal program office function?

MR. RUUD: Well, it was a serious one, because it had national notoriety as such. But we acted on it on the basis of seeing if we had done anything wrong in what we had done. And we conscientiously worke d to correct it. And we had the astronauts and people down at the space division at the time where everything was reviewed from the standpoint of what would cause a fire, and it looked like anything under that set of conditions of 16 psi and pure oxygen, that anything would burn.

MR. WHIT: Now, sir, you said you were at Rockwell as a consultant through '91. Did you get involved in Challenger at all?

MR. RUUD: Yes.

MR. WHIT: Could you offer just some of your thoughts about Challenger? It's the same line of inquiry about the SRB field joints. Could you just give me your thoughts about what occurred?

MR. RUUD: Well, I was on the committee, as a matter of fact, vice chairman. Joe McNamara was chairman. He and I worked together.

MR. WHIT: Which committee is this, sir?

MR. RUUD: This was the committee that the company set up to investigate ourselves, if there was anything that we could discern or discover, and to make that report back to Huntsville.

MR. WHIT : Okay.

MR. RUUD: And we made a thorough study about welds and all that sort of thing, where his influence came from. And Joe made the final report back to NASA on that, which was an investigation of the safety of the engine and all that sort of thing that we had in the Saturn. But nothing came of that except that that was our inside study of the situation to see if there was anything that we could do that we hadn't been doing which we all -- as a matter of fact, that's the way the company always operated.

MR. WHIT : I read the co mission report, the Rogers Commission report in the aftermath of Challenger. And they came up with all the recommendations about management and communications. But the Rogers Commission did not specifically point the finger at anybody, because Secretary Rogers said that it wasn't his charter blame anybody. And again, we go back to the Congress.

MR. RUUD: Yes.

MR. WHIT : And it seemed like the guys from Morton Thiokol and those middle managers down at Marshall took the blame. At the time, from your perspective about what was happening, did you think they blamed the right people?

MR. RUUD: I think so. I think there is a case, again, of the pressure deal. There had been some indication about the seal being less effective when it was at reduced temperatures.

MR. WHIT : Yes, sir.

MR. RUUD: And this had been brought to the attention of somebody. And I think even that particular launch, it was made an issue of, and somebody overruled it.

So yes, I think that was one of these things you could have gotten away with, but they didn't.

MR. WHIT   : Just again, from being so immersed in the culture of North American and also probably NASA, when things like this happen, because I think invariably things like this are going to happen in the future for whatever reason, does it serve any useful purpose to try to point the finger at somebody?

MR. RUUD: No. I think what you end up doing is making an investigation and determining where the cause was and what do you do to correct it.

MR. WHIT   : Sure.

MR. RUUD: If, of course, somebody violated something that was in a way criminal, that would be one thing. But if you do it with the best intentions, it should stop there.

MR. WHIT   : Again, sir, I really appreciate you taking the time to chat with me. Thank you.

(Whereupon, the PROCEEDINGS were adjourned.)

APPENDIX B
Apollo 1 Print Media Artifacts

Date	Publication	Location	NASA Rating	Blame Index	Theme	M	N1	N2	C	E	OG	IND	OC	IB
1/28	The Kansas City Star	Kansas City	3	1	6	1	1							
1/29	News Sun	Florida	2	0	4									
1/29	News Sun	Florida	2	1	4									
1/29	News Sun	Florida	1	3	7		1	1						
1/29	Houston Chronicle	Houston, TX	3	0	4									
1/29	Houston Chronicle	Houston, TX	3	1	1		1		1					
1/29	The Times Picayun	New Orleans	2	0	4									
1/29	St. Louis Post Dispatch	St. Louis	3	1	1		1							
1/30	Houston Post	Houston, TX	3	0	4									
1/30	Houston Post	Houston, TX	2	1	2	1	1							1
1/30	Miami Herald	Miami, FL	3	1	6	1	1							
1/31	Chicago Tribun	Chicago	1	1	1		1			1				
1/31	Houston Post	Houston, TX	2	0	4									
1/31	Houston Post	Houston, TX	2	0	4									
1/31	Houston Post	Houston, TX	2	0	4									
1/31	Houston Post	Houston, TX	1	2	5		1							1
1/31	Los Angeles Times	Los Angeles, CA	3	2	6	1	1							
1/31	The Times Picayun	New Orleans	2	2	6	1	1							
2/1	The Sun	Baltimore, MD	2	2	8		1		1					
2/1	Chicago Tribun	Chicago	1	3	6	1	1							
2/1	New York Times	New York	2	2	2		1		1					
2/1	World Journal Tribun	New York	2	2	5		1					1		
2/1	World Journal Tribun	New York	2	2	8		1	1		1				
2/1	New York Times	New York	1	3	8		1							
2/1	Philadelphia Inquirer	Philadelphi	1	3	6	1	1							
2/1	Washington Post	Washington DC	2	0	4									
2/1	Washington Post	Washington DC	2	0	4									
2/1	Washington Post	Washington DC	2	1	1	1								
2/1	Evening Star	Washington DC	2	2	6	1	1							
2/1	Washington Post	Washington DC	2	2	8		1		1					
2/1	Evening Star	Washington DC	2	3	8		1		1					
2/2	The Sun	Baltimore, MD	2	2	2						1			
2/2	The Sun	Baltimore, MD	2	2	1		1							1
2/2	Chicago Sun Times	Chicago	1	3	6	1	1							
2/2	New Haven Register	New Haven, CT	2	2	6	1	1		1		1			
2/2	World Journal Tribun	New York	2	0	4									
2/2	New York Times	New York	2	2	5		1							1
2/2	Washington Post	Washington DC	2	0	1		1							
2/2	Washington Post	Washington DC	2	1	9		1		1					

2/2 Washington Post	Washington DC	2	2	8		1			1	1		
2/3 Houston Chronicle	Houston, TX	1	3	6	1	1						
2/3 Milwaukee Journal	Milwaukee, WI	3	0	4								
2/3 Time	National	2	2	2		1		1				
2/3 The Times Picayun	New Orleans	1	3	6	1	1			1			
2/3 St. Louis Post Dispatch	St. Louis	3	0	4								
2/3 Evening Star	Washington DC	2	2	1		1						
2/3 Washington Post	Washington DC	2	3	5		1		1				
2/4 The Sun	Baltimore, MD	2	2	9		1						1
2/4 Chicago Tribun	Chicago	2	2	7		1	1				1	
2/4 Business Week	National	3	0	6	1	1						
2/4 Nature	National	1	3	6	1	1		1				
2/4 Evening Bulletin	Philadelphi	2	3	8		1	1				1	
2/4 Washington Post	Washington DC	2	2	8		1						
2/4 Washington Post	Washington DC	2	2	9		1						
2/5 New York Times	New York	2	3	8		1	1					
2/6 New York Times	New York	2	2	5		1						1
2/6 Washington Post	Washington DC	3	0	4								
2/6 Washington Dail	Washington DC	2	1	6	1	1						
2/7 The Sun	Baltimore, MD	2	2	5		1		1				
2/7 Washington Post	Washington DC	2	2	8		1				1		
2/8 Evening Bulletin	Philadelphi	2	3	8		1			1			
2/8 Evening Bulletin	Philadelphi	1	5	5		1			1			
2/8 Houston Post	Houston, TX	2	0	4								
2/9 World Journal Tribun	New York	3	1	1		1						
2/9 Evening Star	Washington DC	1	3	6	1	1						
2/9 Evening Star	Washington DC	1	4	5	1	1						
2/10 Milwaukee Journal	Milwaukee, WI	2	1	5		1		1				
2/10 Christian Science Monitor	National	2	2	8	1	1				1		
2/10 Time	National	3	3	1		1			1			
2/10 Wall Street Journal	National	2	3	1		1						
2/10 Evening Star	Washington DC	1	5	7					1		1	
2/11 Editor and Publisher	National	1	3	6	1	1						
2/11 World Journal Tribun	New York	2	4	7					1		1	
2/11 Washington Post	Washington DC	2	2	5		1		1				
2/12 The Sun	Baltimore, MD	1	3	5		1		1				
2/12 Chicago Tribun	Chicago	2	3	5		1		1				
2/12 Los Angeles Times	Los Angeles, CA	2	3	5		1		1				
2/12 New York Times	New York	3	0	2		1						
2/12 New York Times	New York	2	0	1		1						
2/12 New York Times	New York	2	0	4								
2/12 New York Times	New York	2	4	8		1		1		1		
2/12 Sunday Bulletin	Philadelphi	2	3	8		1						
2/12 Sunday Star	Washington DC	2	3	5		1		1				
2/13 Newsweek	National	2	3	8		1						

2/13 Newsweek	National	2	3	8	1	1			1			
2/13 US New & World Report	National	1	4	8	1	1	1	1	1			
2/13 World Journal Tribun	New York	3	0	1		1						
2/13 Evening Bulletin	Philadelphi	2	3	8		1			1			
2/13 Washington Daily News	Washington DC	2	2	5		1		1				
2/13 New York Times	New York	3	0	2								
2/15 Alexandria Gazetter	Alexandria, VA	1	4	8	1	1		1				
2/15 New York Times	New York	2	0	5		1						
2/15 Evening Bulletin	Philadelphi	2	4	7	1	1	1					
2/16 The Sun	Baltimore, MD	2	2	9		1						
2/16 Miami News	Miami, FL	2	3	8	1	1						
2/16 New York Times	New York	2	2	5		1		1				
2/16 Washington Daily News	Washington DC	2	2	9		1						
2/16 Washington Post	Washington DC	2	2	9		1						
2/16 Evening Star	Washington DC	2	5	7	1	1		1	1			
2/18 The Sun	Baltimore, MD	2	3	9		1						1
2/18 Evening Bulletin	Philadelphi	2	3	5		1			1			1
2/19 World Journal Tribun	New York	3	0	1							1	
2/19 Washington Post	Washington DC	2	4	5		1						1
2/20 The Sun	Baltimore, MD	2	2	1		1			1			
2/20 Newsweek	National	2	3	8	1	1						
2/20 Wall Street Journal	National	2	4	6	1	1		1				
2/21 The Sun	Baltimore, MD	3	1	5	1				1			
2/21 The Times Picayun	New Orleans	2	3	1	1	1						
2/21 Philadelphia Inquirer	Philadelphi	2	3	6	1	1						
2/21 Washington Post	Washington DC	2	2	5	1				1			
2/22 The Sun	Baltimore, MD	2	3	5		1		1				
2/22 Evening Bulletin	Philadelphi	3	0	4								
2/22 Evening Star	Washington DC	2	1	5				1				
2/23 The Sun	Baltimore, MD	3	1	1		1			1			
2/23 New York Times	New York	2	2	5		1			1			
2/26 The Sun	Baltimore, MD	2	4	9		1	1					
2/26 Washington Post	Washington DC	2	4	5		1						1
2/28 World Journal Tribun	New York	2	3	5		1		1				
2/28 Evening Star	Washington DC	2	5	7		1	1	1				
3/1 The Sun	Baltimore, MD	2	3	1		1		1				
3/1 New York Times	New York	2	3	8		1		1				
3/3 New York Times	New York	3	0	4								
3/3 Huntsville Times	Huntsville, AL	2	3	1		1		1		1		
3/5 New Haven Register	New Haven, CT	1	4	8	1	1						
3/6 Evening Bulletin	Washington DC	2	3	1		1						
3/6 Evening Star	Washington DC	2	3	6	1	1						
3/8 World Journal Tribun	New York	2	3	5		1	1					
3/8 Evening Star	Washington DC	2	4	5		1	1		1			
3/10 Evening Tribun	San Diego	1	4	8	1	1						

3/12	Washington Post	Washington DC	2	4	7		1	1				
3/13	Technology Week	National	3	4	6	1						
3/15	Evening Star	Washington DC	1	4	8	1	1	1		1	1	
3/24	Boston Globe	Boston, MA	2	3	8		1		1		1	
3/24	Houston Chronicle	Houston, TX	1	5	8		1		1		1	
3/24	New York Times	New York	2	4	5		1		1			
3/24	Evening Bulletin	Philadelphi	2	3	5				1			
3/24	Washington Post	Washington DC	2	5	8		1		1		1	
3/25	Birmingham News	Birmingham, AL	2	5	8	1	1	1	1			1
3/25	Newsday	National	2	4	5		1					1
3/26	Denver Post	Denver, CO	2	4	5	1	1					1
3/26	Detroit News	Detroit, MI	2	4	8	1	1	1				
3/30	Evening St r	Washington DC	2	4	8		1		1			
4/2	Sunday Star	Washington DC	2	4	5		1		1		1	
4/3	Newsweek	National	2	5	5		1	1				1
4/5	Evening Star	Washington DC	2	3	5	1	1					
4/5	Evening Star	Washington DC	2	4	5		1		1		1	
4/6	The Sun	Baltimore, MD	2	5	3		1					
4/6	Wall Street Journal	National	2	5	3		1					
4/6	New York Times	New York	2	5	3		1					
4/6	Evening Bulletin	Philadelphi	2	5	3		1					
4/6	World Journal Tribun	Washington DC	1	4	8	1	1					
4/6	Washington Post	Washington DC	2	5	3		1					
4/10	The Sun	Baltimore, MD	1	4	8		1	1	1			
4/10	The Sun	Baltimore, MD	2	4	9		1					1
4/10	Plain Dealer	Cleveland, OH	2	4	6	1						1
4/10	Milwaukee Journal	Milwaukee, WI	2	4	6	1						1
4/10	Wall Street Journal	National	2	4	9		1	1	1			1
4/10	New York Times	New York	2	4	9		1	1	1			1
4/10	New York Times	New York	2	4	9							1
4/10	World Journal Tribun	New York	2	5	5		1		1			1
4/10	Evening Star	Washington DC	2	0	5							1
4/10	Washington Post	Washington DC	2	1	9							1
4/10	Evening Star	Washington DC	2	3	8	1	1		1			
4/10	Evening Star	Washington DC	1	4	8		1	1	1			1
4/10	Evening Star	Washington DC	2	4	9		1	1				1
4/10	Washington Daily News	Washington DC	2	4	6	1	1					
4/10	Washington Post	Washington DC	2	4	9		1	1				1
4/10	Washington Post	Washington DC	2	4	9							1
4/10	Washington Post	Washington DC	2	4	9							1
4/10	Washington Post	Washington DC	2	4	8	1	1					
4/10	Evening Star	Washington DC	1	5	9	1	1		1			
4/11	The Sun	Baltimore, MD	2	4	9				1	1		1
4/11	Birmingham News	Birmingham, AL	2	4	6	1	1					1
4/11	Boston Herald	Boston, MA	3	4	9		1					1

4/11	Chicago Sun Times	Chicago	1	4	6		1	1	1			
4/11	Chicago Tribun	Chicago	1	4	8		1		1			
4/11	Detroit News	Detroit, MI	1	4	6	1	1					1
4/11	Detroit News	Detroit, MI	1	4	6	1	1					1
4/11	Los Angeles Times	Los Angeles	1	5	6	1	1					
4/11	Newsday	National	1	4	8		1	1	1			
4/11	New Haven Register	New Haven, CT	1	5	6	1	1					
4/11	New York Times	New York	1	4	8		1		1			
4/11	New York Times	New York	1	4	6	1	1	1				
4/11	World Journal Tribun	New York	1	4	6	1	1		1			
4/11	New York Times	New York	2	4	8	1	1					
4/11	Evening Bulletin	Philadelphi	2	4	6	1	1					
4/11	Philadelphia Inquirer	Philadelphi	2	4	6	1	1	1				
4/11	Patriot Ledger	Quincy, MA	1	4	6	1	1			1		1
4/11	St. Louis Globe-Democrat	St. Louis, MO	1	4	6	1	1					1
4/11	Evening Star	Washington DC	1	4	6	1	1					
4/11	Washington Daily News	Washington DC	1	4	8		1	1	1	1		
4/11	Evening Star	Washington DC	2	4	7			1	1			1
4/11	Washington Post	Washington DC	2	4	8		1		1			1
4/12	The Sun	Baltimore, MD	2	4	9		1	1	1			
4/12	Boston Globe	Boston, MA	1	5	9							1
4/12	Boston Traveller	Boston, MA	1	5	6	1	1		1			
4/12	Christian Science Monitor	National	2	4	6	1	1	1				
4/12	The Times-Picayun	New Orleans	2	4	6	1	1					
4/12	New York Times	New York	2	1	5			1				
4/12	World Journal Tribun	New York	2	5	5		1	1	1			
4/12	New York Times	New York	2	6	7			1	1			
4/12	Evening Bulletin	Philadelphi	2	5	5		1	1	1			
4/12	Philadelphia Inquirer	Philadelphi	2	5	6		1		1			
4/12	St. Louis Post-Dispatch	St. Louis, MO	1	4	6	1	1	1	1			
4/12	Evening Star	Washington DC	2	5	5		1		1			
4/12	Evening Star	Washington DC	2	5	5		1	1	1			
4/12	Washington Daily News	Washington DC	2	5	5		1	1	1			
4/12	Washington Post	Washington DC	2	4	5			1	1		1	1
4/12	Washington Post	Washington DC	2	4	5			1	1		1	1
4/13	The Sun	Baltimore, MD	1	5	7		1	1	1			
4/13	Houston Post	Houston, TX	2	4	6	1	1		1			
4/13	Christian Science Monitor	National	1	4	6	1	1	1				
4/13	New York Times	New York	1	4	8		1		1			
4/13	World Journal Tribun	New York	1	4	6	1	1	1				
4/13	Evening Bulletin	Philadelphi	2	4	6	1	1	1	1			
4/13	Washington Post	Washington DC	1	5	5		1		1			
4/13	Evening Star	Washington DC	2	5	3		1					
4/13	Baltimore Sun	Baltimore, MD	2	4	6	1	1	1				1
4/13	Christian Science Monitor	National	1	4	5		1	1				

4/13	Evening Star	Washington DC	2	5	5		1	1	1		1	
4/14	New Haven Register	New Haven, CT	2	5	5		1	1	1			
4/14	New York Times	New York	2	5	7		1	1	1			
4/14	The Sun	Philadelphi	2	5	7		1	1	1			
4/14	Evening Bulletin	Philadelphi	2	6	7		1	1	1			
4/14	Washington Post	Washington DC	2	5	7		1	1	1			
4/15	New York Times	New York	1	5	6	1	1	1				
4/15	New York Times	New York	1	5	9		1	1	1			1
4/16	Boston Sunday Glob	Boston, MA	2	4	8		1	1	1			
4/16	New York Times	New York	1	4	6		1		1			
4/16	New York Times	New York	1	4	9	1	1	1	1			1
4/16	Sunday Bulletin	Philadelphi	2	3	8		1					1
4/17	Chicago Tribun	Chicago	2	4	5		1		1	1		
4/17	Aviation Week & Space Technolog	National	2	5	6		1					1
4/17	Evening Bulletin	Philadelphi	2	3	9		1	1	1	1		1
4/17	Evening Star	Washington DC	2	4	5		1		1	1		
4/17	Washington Post	Washington DC	2	5	5		1		1	1		
4/18	New York Times	New York	1	5	5		1	1	1			
4/18	Evening Bulletin	Philadelphi	2	4	8		1					
4/18	Evening Star	Washington DC	2	4	1		1	1	1			
4/18	Evening Star	Washington DC	2	4	8	1	1	1	1			
4/18	Washington Post	Washington DC	1	5	5		1		1	1		
4/19	Boston Globe	Boston, MA	1	4	6	1	1	1				
4/19	Boston Globe	Boston, MA	1	4	6	1	1	1				
4/19	New York Times	New York	1	4	6	1	1					
4/19	Evening Star	Washington DC	1	4	8		1	1	1			
4/19	Washington Post	Washington DC	2	4	6	1	1					
4/19	Washington Post	Washington DC	1	5	7		1	1	1			
4/20	Christian Science Monitor	National	2	4	8		1		1			
4/20	Evening Star	Washington DC	1	4	8		1	1	1			
4/20	Evening Star	Washington DC	2	5	8		1	1	1			
4/21	The Sun	Baltimore, MD	1	5	5		1	1	1			
4/21	The Sun	Baltimore, MD	2	5	5		1		1		1	
4/21	Life	National	2	1	9		1					
4/21	Time	National	1	4	6	1	1	1				
4/21	New York Times	New York	2	5	5			1	1			
4/22	The Sun	Baltimore, MD	2	5	5		1		1	1		
4/22	Evening Bulletin	Philadelphi	1	5	8	1	1	1				
4/22	Washington Post	Washington DC	1	5	5				1		1	
4/24	US News & World Report	National	1	4	9	1	1	1	1			
4/24	Newsweek	National	1	6	6	1	1	1	1			1
4/25	Evening Bulletin	Philadelphi	2	5	7		1	1				1
4/26	Evening Star	Washington DC	1	5	7		1	1	1			
4/27	The Sun	Baltimore, MD	1	5	7		1	1	1			
4/27	New York Times	New York	1	5	5		1	1	1			

4/27	Washington Post	Washington DC	1	4	5		1	1	1		
4/28	The Sun	Baltimore, MD	1	4	5		1	1	1		
4/30	New York Times	New York	2	5	5		1	1	1		
4/30	Washington Post	Washington DC	1	4	8		1	1			
4/30	Washington Post	Washington DC	2	4	7		1	1	1		
4/30	Sunday Star	Washington DC	1	5	7		1	1	1		
5/1	Space Age News	Los Angeles, CA	3	1	6	1	1		1		1
5/1	Space/Aeronautics	National	3	1	6	1	1				
5/1	Electronics	National	2	5	1		1	1	1		
5/1	Washington Daily News	Washington DC	1	4	6	1	1	1	1		
5/2	Christian Science Monitor	National	1	5	6	1	1	1	1		
5/2	New York Times	New York	2	6	3			1			
5/3	New York Times	New York	1	5	7		1	1		1	
5/4	Chicago Sun Times	Chicago	1	4	7		1	1		1	
5/4	New York Times	New York	2	5	3			1			
5/4	Evening Star	Washington DC	1	4	7			1	1		
5/4	Washington Post	Washington DC	2	5	3		1	1	1		
5/5	The Sun	Baltimore, MD	2	4	7		1		1		
5/5	Washington Post	Washington DC	2	6	3		1	1			
5/9	Seattle Times	Seattle, WA	2	4	1		1	1		1	
5/9	Evening Star	Washington DC	2	4	1		1		1	1	
5/9	Washington Post	Washington DC	2	5	7		1	1			
5/10	New York Times	New York	2	5	6		1	1	1	1	
5/10	Evening Bulletin	Philadelphi	2	5	10		1		1		
5/10	Evening Star	Washington DC	1	4	10	1	1	1	1		
5/10	Washington Post	Washington DC	1	5	1		1	1	1	1	
5/10	New York Times	New York	2	5	6	1	1	1	1		
5/10	Washington Daily News	Washington DC	2	4	10		1	1	1		
5/11	The Sun	Baltimore, MD	1	5	10		1	1			
5/11	Birmingham News	Birmingham, AL	1	5	8		1		1		
5/11	Chicago Sun Times	Chicago	1	4	8		1	1	1		
5/11	Houston Chronicle	Houston, TX	1	5	8		1		1		
5/11	Minneapolis Tribun	Minneapolis, MN	2	4	7		1	1	1		
5/11	Minneapolis Tribun	Minneapolis, MN	2	5	10		1	1	1		
5/11	New York Times	New York	1	5	6	1	1	1	1		
5/11	New York Times	New York	1	5	10		1	1	1		
5/11	Evening Bulletin	Philadelphi	2	4	8	1	1				
5/11	Washington Post	Washington DC	1	4	8		1		1		
5/12	Boston Globe	Boston, MA	1	4	6	1	1	1	1		
5/12	Newsday	National	2	5	6		1	1	1		
5/12	Time	National	2	6	7		1	1			
5/12	New York Times	New York	2	5	10		1	1	1		
5/12	Washington Post	Washington DC	2	5	10		1	1	1		
5/13	The Sun	Baltimore, MD	2	4	1		1	1	1		
5/14	New York Times	New York	1	5	6	1	1		1		

5/15	Electronics	National	3	0	6	1	1						
5/15	Newsweek	National	2	6	3			1				1	
5/16	Christian Science Monitor	National	2	4	1		1	1					1
5/17	Evening Star	Washington DC	1	4	8		1		1				
5/18	The Sun	Baltimore, MD	3	0	1	1	1		1				
5/18	New York Times	New York	3	0	1	1	1		1				
5/18	Washington Post	Washington DC	2	4	8		1		1				
5/19	Time	National	2	4	6	1	1	1	1				
5/23	Evening Star	Washington DC	2	5	10		1	1	1				
5/24	New York Times	New York	2	5	10		1	1	1				
6/1	Business Week	National	3	0	8		1		1				
6/1	Evening Star	Washington DC	2	4	8		1	1	1		1		
6/2	Evening Star	Washington DC	1	4	5		1	1		1			
6/11	Houston Chronicle	Houston, TX	2	5	8		1	1			1	1	
6/12	Evening Star	Washington DC	1	5	7		1	1	1				
6/13	Washington Post	Washington DC	1	5	7		1	1	1				

APPENDIX C
Challenger Print Media Artifacts

Date	Publication	Location	NASA Rating	Blame Inde	Theme	M	NI	N2	C	E	IB	MT	OG	OC	P	IND	PUB	MM	LC
1/29	Boston Globe	Boston	2	2	2		1	1											
1/29	Chicago Tribune	Chicago	2	1	4	1											1		
1/29	Chicago Tribune	Chicago	2	2	2		1			1									
1/29	Chicago Tribune	Chicago	2	0	11										1				
1/29	Chicago Tribune	Chicago	2	0	4		1												
1/29	Chicago Tribune	Chicago	2	0	1		1												
1/29	Chicago Tribune	Chicago	3	0	4	1											1		
1/29	Dail	Miami	2	0	13	1	1			1					1				
1/29	Dail	Miami	2	0	6	1	1												
1/29	Democrat	Tallahassee	2	0	6	1	1								1		1		
1/29	Herald Examiner	Los Angeles	2	2	5		1		1										
1/29	Herald Examiner	Los Angeles	2	1	4		1												
1/29	Herald Examiner	Los Angeles	2	0	11										1				
1/29	Herald Examiner	Los Angeles	2	0	7		1							1				1	
1/29	Herald Examiner	Los Angeles	2	0	4		1												
1/29	Herald Examiner	Los Angeles	2	0	4											1			
1/29	Herald Examiner	Los Angeles	2	0	4											1			
1/29	Herald Examiner	Los Angeles	2	0	1		1	1						1					
1/29	Herald Examiner	Los Angeles	3	1	1		1			1									
1/29	Huntsville Times	Huntsville	2	0	6	1	1												
1/29	Huntsville Times	Huntsville	2	0	4	1	1												
1/29	Mobile Register	Mobile	3	0	6	1	1												
1/29	Orlando Sentinel	Orlando	2	0	6	1													
1/29	Orlando Sentinel	Orlando	2	0	1	1	1												
1/29	Orlando Sentinel	Orlando	3	0	6	1													
1/29	Post-Herald	Birmingham	2	0	6	1	1												
1/29	USA Toda	National	2	2	2		1	1				1						1	
1/29	USA Toda	National	2	2	12		1			1			1						
1/29	Washington Post	Washington D.C.	2	2	2		1												
1/29	Washington Post	Washington D.C.	2	0	4												1		
1/29	Washington Post	Washington D.C.	2	0	4											1			
1/29	Washington Post	Washington D.C.	2	0	4												1		
1/29	Washington Times	Washington D.C.	2	4	7		1					1						1	
1/29	Washington Times	Washington D.C.	2	3	3		1										1		
1/29	Washington Times	Washington D.C.	2	2	8		1												
1/29	Washington Times	Washington D.C.	2	1	2		1	1				1						1	
1/29	Washington Times	Washington D.C.	2	0	13	1	1												
1/29	Washington Times	Washington D.C.	2	0	11										1				
1/29	Washington Times	Washington D.C.	2	0	11		1								1				
1/29	Washington Times	Washington D.C.	2	0	4												1		

1/29	Washington Times	Washington D.C.	2	0	4		1						
1/29	Washington Times	Washington D.C.	2	0	4	1							1
1/29	Washington Times	Washington D.C.	2	0	2		1				1		
1/29	Washington Times	Washington D.C.	2	0	1	1							
1/30	Florida Toda	Florida	2	2	5		1						
1/30	Florida Toda	Florida	2	2	5		1		1				
1/30	Florida Toda	Florida	2	2	5		1		1				
1/30	Florida Toda	Florida	2	1	12		1			1			
1/30	Florida Toda	Florida	2	1	12		1					1	
1/30	Florida Toda	Florida	2	1	5		1						
1/30	Florida Toda	Florida	2	0	13	1							
1/30	Florida Today	Florida	2	0	11						1		
1/30	Florida Toda	Florida	2	0	4		1	1					
1/30	Florida Toda	Florida	2	0	4							1	
1/30	Florida Toda	Florida	2	0	4								1
1/30	Florida Toda	Florida	2	0	4								1
1/30	Florida Toda	Florida	2	0	4								1
1/30	Florida Toda	Florida	2	0	1		1	1					
1/30	Florida Toda	Florida	2	0	1		1						
1/30	Florida Toda	Florida	3	2	1	1	1	1					
1/30	Florida Toda	Florida	3	0	4							1	
1/30	Florida Toda	Florida	3	0	1							1	
1/30	Miami Herald	Miami	2	2	12		1						
1/30	Miami Herald	Miami	2	2	5								
1/30	Miami Herald	Miami	2	0	4							1	
1/30	Miami Herald	Miami	2	0	1								
1/30	Miami Herald	Miami	2	2	12		1			1			
1/30	Miami Herald	Miami	2	2	8		1						
1/30	Miami Herald	Miami	2	0	11						1		
1/30	Miami Herald	Miami	2	0	6	1							
1/30	Miami Herald	Miami	2	0	4							1	
1/30	Miami Herald	Miami	3	0	6								
1/30	Orlando Sentinel	Orlando	2	2	12		1			1			
1/30	Orlando Sentinel	Orlando	2	2	5		1		1				
1/30	Orlando Sentinel	Orlando	2	2	5		1	1					
1/30	Orlando Sentinel	Orlando	2	1	12		1			1			
1/30	Orlando Sentinel	Orlando	2	0	4								1
1/30	Orlando Sentinel	Orlando	2	2	5		1		1				
1/30	Orlando Sentinel	Orlando	2	2	5		1						
1/30	Orlando Sentinel	Orlando	2	2	1		1						
1/30	Orlando Sentinel	Orlando	2	0	13	1							
1/30	Orlando Sentinel	Orlando	2	0	6	1							
1/30	Orlando Sentinel	Orlando	2	0	6	1							
1/30	Orlando Sentinel	Orlando	2	0	4							1	
1/30	Orlando Sentinel	Orlando	2	0	4								1

1/30	Orlando Sentinel	Orlando	2	0	4	1										1
1/30	Orlando Sentinel	Orlando	2	0	4	1										
1/30	Orlando Sentinel	Orlando	2	0	4	1										1
1/30	Orlando Sentinel	Orlando	2	0	1	1	1									
1/30	Orlando Sentinel	Orlando	3	0	6	1										
1/30	Orlando Sentinel	Orlando	3	0	6	1										
1/30	Orlando Sentinel	Orlando	3	0	6	1										
1/30	Orlando Sentinel	Orlando	3	0	1	1	1									
1/31	Chicago Tribune	Chicago	2	2	5	1	1		1	1						
1/31	CSM	National	2	2	12		1									
1/31	CSM	National	3	0	1	1		1								1
1/31	Florida Toda	Florida	2	0	4										1	
1/31	Hartford Currant	Hartford	1	0	13	1										
1/31	Miami Herald	Miami	2	2	5		1		1							
1/31	Miami Herald	Miami	2	1	8		1		1							
1/31	Miami Herald	Miami	2	0	4	1										
1/31	Miami Herald	Miami	2	0	4											1
1/31	Miami Herald	Miami	2	0	4										1	
1/31	Miami Herald	Miami	2	0	1											1
1/31	Miami Herald	Miami	2	0	1				1							
1/31	Miami Herald	Miami	3	0	6	1										
1/31	Miami Herald	Miami	3	0	1		1					1				
1/31	Orlando Sentinel	Orlando	2	0	6	1										
1/31	Philadelphia Enquirer	Philadelphia	2	2	12		1									
1/31	USA Toda	National	3	0	14										1	
1/31	Washington Times	Washington D.C.	2	1	12		1					1				
1/31	WSJ	National	2	1	12		1					1				
1/31	WSJ	National	2	0	1		1	1						1		1
2/1	New York Times	New York	2	3	5		1		1	1	1		1			
2/1	New York Times	New York	2	3	5		1									
2/1	New York Times	New York	2	2	12		1					1				
2/1	New York Times	New York	2	2	5		1	1		1						
2/1	New York Times	New York	2	0	11									1		
2/1	New York Times	New York	2	2	5		1			1						
2/1	New York Times	New York	2	0	14	1										
2/1	New York Times	New York	2	0	11									1		
2/1	New York Times	New York	2	0	4		1							1		
2/1	Washington Post	Washington D.C.	2	1	5		1		1	1						
2/1	Washington Post	Washington D.C.	2	0	11									1		
2/2	Champaigne-Gazette	Champaign	2	0	6	1	1									
2/2	Washington Post	Washington D.C.	1	3	6	1	1									
2/2	Washington Post	Washington D.C.	3	0	6	1										
2/3	New York Times	New York	2	2	7	1	1									
2/3	New York Times	New York	2	2	5		1									
2/3	New York Times	New York	2	1	12		1					1				

2/3	New York Times	New York	2	1	12		1										
2/3	New York Times	New York	2	2	5	1	1										
2/3	Washington Post	Washington D.C.	1	3	6	1	1										
2/3	Washington Post	Washington D.C.	2	0	4										1		
2/3	Washington Post	Washington D.C.	2	2	5	1	1										
2/3	WSJ	National	2	2	5	1	1			1							
2/4	USA Toda	National	2	1	5		1										
2/5	Chicago Tribune	Chicago	2	1	5		1					1					
2/5	Chicago Tribune	Chicago	2	2	8		1		1		1						
2/5	Chicago Tribune	Chicago	2	2	7		1				1						1
2/5	CSM	National	2	2	5				1								
2/5	New York Times	New York	1	3	6	1	1	1	1								1
2/5	New York Times	New York	1	2	8		1		1		1						
2/5	New York Times	New York	2	1	12		1					1					
2/5	Philadelphia Enquirer	Philadelphia	2	2	5		1		1								
2/5	Philadelphia Enquirer	Philadelphia	2	0	4							1					
2/5	Philadelphia Enquirer	Philadelphia	2	1	12		1			1							
2/5	The Sun	Baltimore	2	0	4		1									1	
2/5	The Sun	Baltimore	2	2	12		1		1		1						
2/5	USA Toda	National	2	1	12	1	1					1					
2/5	USA Toda	National	2	2	5						1						
2/5	USA Toda	National	2	1	5		1			1				1			
2/5	Washington Post	Washington D.C.	1	3	8		1	1				1		1			
2/5	Washington Times	Washington D.C.	2	0	4										1		
2/5	Washington Times	Washington D.C.	2	2	5		1			1							
2/5	Washington Times	Washington D.C.	2	1	12		1					1					
2/5	WSJ	National	3	1	8	1	1										
2/6	Chicago Tribune	Chicago	2	5	10	1				1							1
2/6	Chicago Tribune	Chicago	2	3	8		1		1		1						
2/6	Chicago Tribune	Chicago	2	1	12		1			1		1					
2/6	Chronicle	San Francisco	2	0	6	1	1										
2/6	CSM	National	2	1	12		1		1			1					
2/6	New York Times	New York	1	3	6	1	1										
2/6	New York Times	New York	2	3	5		1		1								
2/6	New York Times	New York	2	2	5		1		1								1
2/6	New York Times	New York	2	1	12	1	1										
2/6	The Sun	Baltimore	2	3	8		1		1		1						
2/6	The Sun	Baltimore	2	1	12		1			1				1			
2/6	The Sun	Baltimore	3	0	6	1	1							1			
2/6	USA Toda	National	2	1	5		1			1							
2/6	USA Toda	National	2	0	12		1										
2/6	USA Toda	National	2	1	12		1										
2/6	USA Toda	National	2	1	12		1										
2/6	Washington Post	Washington D.C.	2	4	7		1	1			1		1				
2/6	Washington Post	Washington D.C.	2	3	7		1				1						

2/6	Washington Post	Washington D.C.	2	2	12		1		1									
2/6	Washington Post	Washington D.C.	2	0	6	1	1											
2/6	Washington Times	Washington D.C.	2	1	5		1		1									
2/6	Washington Times	Washington D.C.	2	1	12		1			1	1			1				
2/6	Washington Times	Washington D.C.	2	0	6	1	1											
2/6	WSG	National	2	3	8		1		1		1							
2/6	WSJ	Washington D.C.	2	4	10										1			
2/7	Chicago Tribune	Chicago	2	2	5				1	1							1	
2/7	New York Times	New York	1	3	6	1	1							1				
2/7	New York Times	New York	2	2	5		1			1	1							
2/7	New York Times	New York	2	2	5		1			1								
2/7	New York Times	New York	2	2	5		1			1	1							
2/7	Philadelphia Enquirer	Philadelphia	2	2	5		1			1	1							
2/7	The Sun	Baltimore	2	2	5					1	1							
2/7	The Sun	Baltimore	2	1	12		1				1							
2/7	USA Toda	National	2	3	5		1			1	1							
2/7	USA Toda	National	2	1	4	1												
2/7	USA Toda	National	2	0	12		1											
2/7	Washington Post	Washington D.C.	2	0	12		1											
2/7	Washington Post	Washington D.C.	2	2	5		1			1	1			1				
2/7	Washington Times	Washington D.C.	2	3	5		1	1		1	1					1		
2/7	WSJ	National	2	2	5	1	1											
2/7	WSJ	National	3	0	1	1	1											
2/9	New York Times	New York	1	3	6				1									
2/9	New York Times	New York	1	3	6		1			1								
2/9	New York Times	New York	1	3	5		1			1								
2/9	New York Times	New York	1	2	13	1	1											
2/9	New York Times	New York	2	0	4	1	1											
2/9	New York Times	New York	2	0	4	1	1											
2/9	New York Times	New York	2	1	12		1					1						
2/9	Washington Post	Washington D.C.	2	3	8	1	1	1	1		1		1	1				
2/9	Washington Post	Washington D.C.	2	1	12		1					1						
2/10	Aviation	National	1	2	8		1				1							1
2/10	Aviation	National	2	2	5	1	1		1		1	1	1	1				
2/10	Aviation	National	2	2	5					1				1				
2/10	Chicago Tribune	Chicago	2	3	5		1			1								
2/10	New York Times	New York	2	4	4										1			
2/10	New York Times	New York	2	2	12		1											
2/10	New York Times	New York	2	0	4	1	1											
2/10	New York Times	New York	2	0	4	1	1											
2/10	Philadelphia Enquirer	Philadelphia	2	3	8	1	1			1	1							
2/10	USA Today	National	2	3	5		1			1								
2/10	USA Toda	National	2	2	5		1		1		1							
2/10	USA Toda	National	2	2	5					1								
2/10	USA Toda	National	2	2	2	1												

2/10	USA Toda	National	2	1	12							1		
2/11	New York Times	New York	1	2	8		1		1	1				
2/11	New York Times	New York	2	2	13	1								
2/11	New York Times	New York	2	2	13	1	1			1				
2/11	New York Times	New York	2	0	4		1							
2/11	New York Times	New York	2	0	4		1							
2/11	New York Times	New York	2	0	4		1							
2/11	New York Times	New York	2	2	13	1	1							
2/11	New York Times	New York	2	2	5		1			1	1			
2/11	The Sun	Baltimore	2	3	8		1	1	1					
2/11	The Sun	Baltimore	2	0	4		1							
2/11	USA Toda	National	1	3	5	1	1			1		1		
2/11	USA Toda	National	2	3	5	1				1				
2/11	USA Toda	National	2	2	5		1			1				
2/11	Washington Post	Washington D.C.	2	2	13	1	1	1						
2/11	Washington Times	Washington D.C.	2	2	5	1	1			1	1		1	
2/11	WSJ	National	2	2	13	1	1							
2/12	Chicago Tribune	Chicago	2	2	5	1	1			1				1
2/12	CSM	National	2	2	5	1	1			1				
2/12	New York Times	New York	2	2	13	1	1			1				
2/12	New York Times	New York	2	2	5		1			1				
2/12	Philadelphia Enquirer	Philadelphia	2	2	5		1			1				
2/12	Sentinel	Orlando	2	0	6	1	1							
2/12	USA Toda	National	2	2	5		1			1				
2/12	WSJ	National	2	3	5		1			1				
2/13	Chicago Tribune	Chicago	1	2	8		1	1	1			1		
2/13	Chicago Tribune	Chicago	2	2	5		1			1				
2/13	CSM	National	2	2	5		1			1	1			
2/13	Milwaukee Journal	Milwaukee	1	3	6	1	1							
2/13	New York Times	New York	1	2	8		1							
2/13	New York Times	New York	2	2	5		1			1				
2/13	New York Times	New York	2	2	8	1	1			1	1			
2/13	Philadelphia Enquirer	Philadelphia	2	2	8		1			1				
2/13	The Sun	Baltimore	2	2	8	1	1			1				
2/13	USA Toda	National	2	2	5		1				1			
2/13	Washington Post	Washington D.C.	1	2	8		1				1			
2/13	Washington Post	Washington D.C.	2	2	8		1							
2/13	WSJ	National	2	2	8		1			1				
2/14	Chicago Tribune	Chicago	2	2	8		1							
2/14	CSM	National	2	2	12		1					1		
2/14	Daily News	Los Angeles	3	3	6	1	1							
2/14	New York Times	New York	1	2	8	1	1							
2/14	New York Times	New York	2	2	5		1			1	1			
2/14	Philadelphia Enquirer	Philadelphia	2	3	8		1			1				
2/14	Salt Lake Tribune	Salt Lake Cit	2	3	6	1	1	1		1				

2/14	The Sun	Baltimore	2	2	5		1				1			
2/14	USA Toda	National	2	2	14							1		1
2/14	USA Toda	National	2	2	5		1							
2/14	Washington Post	Washington D.C.	2	2	5	1	1			1	1	1		
2/14	Washington Times	Washington D.C.	2	2	5		1				1			
2/14	WSJ	National	1	3	8	1	1		1	1	1			
2/14	WSJ	National	2	2	5		1				1			
2/16	New York Times	New York	1	3	8		1			1				
2/16	New York Times	New York	2	2	12		1						1	
2/16	New York Times	New York	2	3	5		1			1	1			
2/16	New York Times	New York	2	0	7		1					1		
2/16	Washington Post	Washington D.C.	3	0	6	1	1							
2/17	Business Week	National	1	2	8		1		1		1			
2/17	New York Times	New York	2	2	5		1							
2/17	New York Times	New York	2	5	8		1				1			
2/17	New York Times	New York	2	5	8		1			1	1	1		
2/17	New York Times	New York	2	2	12		1						1	
2/17	New York Times	New York	2	2	8		1	1			1	1		
2/17	Philadelphia Enquirer	Philadelphia	2	2	12		1				1			
2/17	The Sun	Baltimore	2	2	12		1				1			
2/17	The Sun	Baltimore	2	2	8		1				1	1		
2/17	USA Toda	National	2	2	12		1		1		1			
2/17	USA Toda	National	2	2	5		1							
2/17	Washington Post	Washington D.C.	2	0	3		1							
2/17	Washington Post	Washington D.C.	3	0	6	1	1				1			
2/17	Washington Times	Washington D.C.	2	5	8		1				1			
2/18	CSM	National	2	5	5		1				1			
2/18	New York Times	New York	2	2	12		1		1		1			
2/18	New York Times	New York	2	2	5		1							
2/18	Philadelphia Enquirer	Philadelphia	2	2	7		1				1	1		
2/18	Philadelphia Enquirer	Philadelphia	2	2	5		1							
2/18	The Sun	Baltimore	2	2	12	1	1				1			
2/18	USA Toda	National	2	2	12	1	1							
2/18	USA Toda	National	2	2	5		1		1		1	1		
2/18	Washington Post	Washington D.C.	2	3	9	1	1				1	1		
2/18	Washington Post	Washington D.C.	2	2	5		1				1			
2/18	Washington Times	Washington D.C.	2	5	8		1							
2/18	WSJ	National	2	2	12		1		1			1		
2/18	WSJ	National	2	0	7						1	1		
2/19	CSM	National	2	3	5		1		1		1			
2/19	New York Times	New York	2	3	8		1		1		1	1		
2/19	New York Times	New York	2	2	5		1		1		1			
2/19	Philadelphia Enquirer	Philadelphia	1	4	7			1		1				
2/19	Philadelphia Enquirer	Philadelphia	2	2	5	1	1		1		1	1		
2/19	The Sun	Baltimore	2	2	5				1		1			

2/19	USA Toda	National	1	3	8	1	1		1				
2/19	USA Toda	National	2	3	5		1	1		1	1		
2/19	USA Toda	National	2	2	12		1					1	
2/19	USA Toda	National	2	0	12		1						
2/19	Washington Post	Washington D.C.	1	3	8		1	1		1			1
2/19	Washington Post	Washington D.C.	2	2	5	1	1			1	1		1
2/19	Washington Times	Washington D.C.	2	3	5	1	1	1		1			
2/19	WSJ	National	2	3	8	1	1	1		1	1		
2/19	WSJ	National	2	2	5		1	1					
2/20	Chicago Tribune	Chicago	2	2	5		1	1		1	1		
2/20	CSM	National	1	3	8		1	1		1	1		
2/20	New York Times	New York	1	3	8		1	1		1			
2/20	New York Times	New York	2	3	5		1			1	1		
2/20	New York Times	New York	2	3	3	1	1				1		
2/20	New York Times	New York	2	2	12		1					1	
2/20	Philadelphia Enquirer	Philadelphia	2	2	12		1			1	1	1	
2/20	The Sun	Baltimore	2	3	3		1				1	1	
2/20	USA Toda	National	1	3	7	1	1			1	1		
2/20	Washington Post	Washington D.C.	1	3	5	1	1	1		1	1		1
2/20	Washington Post	Washington D.C.	2	0	3		1						1
2/20	Washington Times	Washington D.C.	1	3	3		1			1	1		
2/20	WSJ	National	1	3	3		1			1	1		
2/21	New York Times	New York	2	2	7		1	1			1		
2/21	New York Times	New York	2	2	5		1			1	1		
2/21	New York Times	New York	2	2	3		1				1		1
2/21	Philadelphia Enquirer	Philadelphia	2	2	7	1	1	1			1		
2/21	The Sun	Baltimore	2	3	3		1			1	1		
2/21	USA Toda	National	2	2	5		1				1		
2/21	Washington Post	Washington D.C.	1	0	6	1	1						1
2/21	Washington Post	Washington D.C.	2	3	7		1			1	1		
2/21	Washington Post	Washington D.C.	2	2	7	1	1	1		1	1		
2/21	Washington Times	Washington D.C.	2	0	3		1	1			1		
2/21	WSJ	National	3	3	6	1	1			1			
2/23	New York Times	New York	1	3	8		1	1					
2/23	New York Times	New York	1	3	6	1	1			1	1		
2/23	New York Times	New York	2	3	5		1			1	1		
2/23	New York Times	New York	2	2	5	1	1		1	1		1	
2/23	New York Times	New York	2	0	3		1						
2/24	Chicago Tribune	Chicago	2	3	5		1			1	1		
2/24	CSM	National	1	3	3		1	1					
2/24	New York Times	New York	2	3	5		1				1		
2/24	New York Times	New York	2	2	12		1					1	
2/24	New York Times	New York	2	2	5		1		1	1	1		
2/24	Newsweek	National	1	3	8	1	1			1		1	
2/24	Philadelphia Enquirer	Philadelphia	1	3	6	1	1			1	1		

2/24	USA Toda	National	2	3	5		1			1		1		
2/24	USA Toda	National	2	3	6	1	1				1			
2/24	USA Toda	National	2	3	5	1	1						1	
2/24	USA Toda	National	3	0	6	1	1							
2/24	USA Toda	National	3	0	13	1	1							
2/24	Washington Post	Washington D.C.	2	3	8		1					1		
2/24	Washington Post	Washington D.C.	2	3	5		1				1	1		
2/24	WSJ	National	2	0	3		1				1	1		1
2/24	WSJ	National	2	0	3		1					1		
2/26	Chicago Tribune	Chicago	1	3	7		1				1	1		
2/26	CSM	National	1	3	7		1				1	1		
2/26	New York Times	New York	1	3	7		1				1	1		
2/26	New York Times	New York	1	4	8		1				1	1		
2/26	New York Times	New York	2	2	7	1	1					1		
2/26	Philadelphia Enquirer	Philadelphia	1	3	7		1				1	1		
2/26	The Sun	Baltimore	1	3	7		1	1			1	1		
2/26	The Sun	Baltimore	1	3	8		1			1	1	1		
2/26	Washington Post	Washington D.C.	1	3	7		1				1	1		
2/26	Washington Times	Washington D.C.	1	3	7		1				1	1		
2/26	Washington Times	Washington D.C.	2	0	8		1		1					
2/26	WSJ	Washington D.C.	1	3	7		1				1	1		
2/26	WSJ	Washington D.C.	1	3	7		1					1		
2/27	Chicago Tribune	Chicago	2	3	10	1								1
2/27	Chicago Tribune	Chicago	2	3	8		1		1		1	1		
2/27	Los Angeles Times	Los Angeles	2	3	8		1				1	1		
2/27	Los Angeles Times	Los Angeles	2	3	5		1		1		1	1		
2/27	Los Angeles Times	Los Angeles	2	3	7		1	1						
2/27	New York Times	New York	1	3	10		1				1	1		
2/27	New York Times	New York	1	3	8		1				1	1		
2/27	Philadelphia Enquirer	Philadelphia	1	3	8		1				1	1		
2/27	The Sun	Baltimore	2	3	11	1	1							1
2/27	The Sun	Baltimore	2	3	8		1				1	1		
2/27	USA Toda	National	1	3	8		1				1	1		
2/27	USA Toda	National	2	2	5		1				1			
2/27	USA Toda	National	2	3	8		1				1	1		
2/27	Washington Post	Washington D.C.	1	3	8		1				1	1		
2/27	Washington Post	Washington D.C.	1	3	7		1				1	1		
2/27	Washington Post	Washington D.C.	2	5	11		1							1
2/27	Washington Post	Washington D.C.	2	0	6	1	1				1			
2/27	Washington Times	Washington D.C.	2	3	8		1				1	1		
2/27	WSJ	National	2	5	11	1								1
2/27	WSJ	National	2	3	8		1				1	1		
2/27	WSJ	National	2	3	8		1				1	1		
2/28	Chicago Tribune	Chicago	2	3	7		1	1			1			
2/28	CSM	National	2	3	7		1	1						

2/28	New York Times	New York	1	3	8		1	1			1	1					
2/28	New York Times	New York	1	3	7		1	1			1	1					
2/28	Philadelphia Enquirer	Philadelphia	2	3	7		1	1			1						
2/28	The Sun	Baltimore	1	3	5		1	1			1	1					
2/28	USA Toda	National	1	3	8		1				1	1					
2/28	USA Toda	National	1	3	1		1		1		1						
2/28	USA Toda	National	2	3	7		1	1			1						
2/28	Washington Post	Washington D.C.	1	4	6	1	1				1						
2/28	Washington Post	Washington D.C.	1	3	7		1	1			1	1					
2/28	Washington Post	Washington D.C.	1	4	5		1				1	1					
2/28	Washington Times	Washington D.C.	2	2	5		1	1			1						
2/28	WSJ	National	2	3	7		1	1									
2/28	WSJ	National	2	3	7		1	1			1	1					
3/2	Chicago Tribune	Chicago	1	3	8	1	1	1			1	1					
3/2	Chicago Tribune	Chicago	2	5	8		1				1	1					
3/2	New York Times	New York	1	5	5	1	1										
3/2	New York Times	New York	1	3	8		1				1	1					
3/2	New York Times	New York	2	3	5		1				1	1					
3/2	New York Times	New York	2	0	3		1										
3/2	Philadelphia Enquirer	Philadelphia	2	2	12		1						1				
3/2	Washington Post	Washington D.C.	2	0	3		1										
3/2	Washington Times	Washington D.C.	1	3	8	1	1		1								
3/3	CSM	National	2	0	1		1			1							
3/3	New York Times	New York	2	0	1		1		1								
3/3	Philadelphia Enquirer	Philadelphia	1	3	8		1					1		1			
3/3	USA Toda	National	2	5	10		1		1						1		
3/3	USNWR	National	1	4	5	1	1				1	1					
3/3	USNWR	National	1	3	5	1	1		1		1						
3/3	Washington Post	Washington D.C.	3	0	8	1	1		1								
3/3	WSJ	National	2	0	8		1		1					1			1
3/4	Chicago Tribune	Chicago	2	0	1		1										
3/4	CSM	National	2	3	6	1	1	1		1	1						
3/4	New York Times	New York	2	0	1		1										
3/4	New York Times	New York	2	2	12		1						1				
3/4	Newsweek	National	1	4	8		1			1	1	1			1		
3/4	Philadelphia Enquirer	Philadelphia	2	0	1		1										
3/4	The Sun	Baltimore	2	0	8		1				1				1		
3/4	The Sun	Baltimore	2	0	1		1										
3/4	USA Toda	National	1	3	6	1	1				1	1					
3/4	USA Toda	National	1	3	6	1	1		1		1						
3/4	USA Toda	National	1	0	6	1	1										
3/4	USA Toda	National	2	0	1		1										
3/4	USA Toda	National	2	0	4											1	
3/4	USA Toda	National	2	0	6	1											
3/4	USA Toda	National	2	0	4		1										

3/4	Washington Post	Washington D.C.	2	0	1		1									
3/4	Washington Times	Washington D.C.	1	0	1		1									
3/4	Washington Times	Washington D.C.	2	0	1		1									
3/4	Washington Times	Washington D.C.	3	0	6	1	1									
3/4	WSJ	National	2	0	1		1									
3/5	Chicago Tribune	Chicago	2	0	1		1									
3/5	CSM	National	2	5	6	1	1				1					
3/5	The Sun	Baltimore	1	3	10		1		1			1		1		
3/5	Washington Post	Washington D.C.	2	0	1		1		1	1					1	
3/5	Washington Times	Washington D.C.	1	3	8		1		1							
3/5	WSJ	National	1	5	8		1				1					
3/5	WSJ	National	2	2	8		1						1			
3/6	Chicago Tribune	Chicago	2	3	5		1	1			1				1	
3/6	New York Times	New York	2	3	5		1		1		1					
3/6	Philadelphia Enquirer	Philadelphia	2	3	5		1			1	1	1				
3/6	The Sun	Baltimore	2	3	5		1			1	1	1				
3/6	USA Toda	National	2	2	5	1	1				1					
3/7	Chicago Tribune	Chicago	2	3	8		1		1			1				
3/7	New York Times	New York	2	0	3		1		1						1	
3/7	Philadelphia Enquirer	Philadelphia	2	0	3		1		1						1	
3/7	The Sun	Baltimore	2	2	5	1	1			1		1				
3/7	The Sun	Baltimore	2	0	3		1		1			1			1	
3/7	USA Toda	National	1	4	8		1						1			
3/7	USA Toda	National	2	0	3		1								1	
3/7	Washington Post	Washington D.C.	2	3	5	1	1				1	1				
3/7	Washington Times	Washington D.C.	2	0	3		1		1						1	
3/7	WSJ	National	2	0	3		1				1				1	
3/8	Houston Post	Houston	1	3	8		1									
3/8	Press-Citizen	Des Moines	2	2	5		1				1					
3/8	USA Toda	National	1	3	8	1	1					1				1
3/9	Chicago Tribune	Chicago	1	3	8	1	1									
3/9	The Sun	Baltimore	1	4	8		1									
3/9	The Sun	Baltimore	1	3	5		1				1	1				
3/9	The Sun	Baltimore	2	2	5		1			1						
3/9	Washington Post	Washington D.C.	1	3	8		1									
3/10	Chicago Tribune	Chicago	1	3	8		1				1					
3/10	CSM	National	1	3	8		1				1					
3/10	New York Times	New York	1	3	8		1			1						
3/10	New York Times	New York	2	1	5		1						1			
3/10	New York Times	New York	2	1	12		1						1			
3/10	Newsweek	National	2	1	6	1	1				1					
3/10	Philadelphia Enquirer	Philadelphia	2	1	12		1						1			
3/10	The Sun	Baltimore	1	3	8		1									
3/10	The Sun	Baltimore	2	1	12		1				1		1			
3/10	USA Toda	National	2	3	14		1				1	1				1

3/10	USA Toda	National	2	1	12		1					1		
3/10	USA Toda	National	2	1	12		1					1		
3/10	USA Toda	National	2	1	5		1					1		
3/10	USNWR	National	1	4	8		1			1	1			1
3/10	Washington Post	Washington D.C.	2	1	12		1					1		
3/10	Washington Post	Washington D.C.	2	3	5		1			1				
3/10	Washington Times	Washington D.C.	2	1	12		1					1		
3/10	WSJ	National	1	3	8		1			1				
3/10	WSJ	National	2	1	12		1					1		
3/10	WSJ	National	2	1	12		1					1		
3/11	Chicago Tribune	Chicago	1	4	6	1	1							
3/11	Chicago Tribune	Chicago	1	3	8	1	1							
3/11	Chicago Tribune	Chicago	2	1	5	1	1					1		
3/11	Chicago Tribune	Chicago	2	1	5		1					1		
3/11	New York Times	New York	2	3	5	1	1							
3/11	New York Times	New York	2	1	12		1							
3/11	New York Times	New York	2	1	5	1	1					1		
3/11	Philadelphia Enquirer	Philadelphia	2	1	5		1					1		
3/11	The Sun	Baltimore	2	1	12		1					1		
3/11	The Sun	Baltimore	2	0	4		1							
3/11	Washington Post	Washington D.C.	2	1	12	1	1					1		
3/11	Washington Times	Washington D.C.	1	3	5		1			1	1			
3/11	Washington Times	Washington D.C.	2	1	5		1							
3/11	WSJ	National	2	1	12		1					1		
3/12	Chicago Tribune	Chicago	1	3	5		1	1						
3/12	Chicago Tribune	Chicago	2	1	5		1		1			1		
3/12	Chicago Tribune	Chicago	2	1	12		1					1		
3/12	CSM	National	2	3	8		1	1						
3/12	New York Times	New York	1	3	6	1	1							
3/12	New York Times	New York	1	3	6		1		1		1			
3/12	New York Times	New York	2	2	12		1			1		1		
3/12	New York Times	New York	2	2	5		1						1	
3/12	Philadelphia Enquirer	Philadelphia	2	3	8		1	1			1			
3/12	The Sun	Baltimore	1	3	5	1	1			1				
3/12	The Sun	Baltimore	2	3	8		1	1						
3/12	The Sun	Baltimore	2	1	12		1					1		
3/12	USA Toda	National	2	3	5		1			1				
3/12	USA Toda	National	2	3	5	1	1			1				
3/12	USA Toda	National	2	2	12		1					1		
3/12	USA Toda	National	2	2	8		1	1						
3/12	Washington Post	Washington D.C.	2	0	1		1							
3/12	Washington Post	Washington D.C.	2	3	8		1	1						
3/12	Washington Times	Washington D.C.	2	3	8		1	1						
3/12	WSJ	National	1	3	5		1	1						
3/13	Chicago Tribune	Chicago	2	1	8		1	1						

3/13	New York Times	New York	2	1	12		1					1			
3/13	The Sun	Baltimore	2	3	11		1							1	
3/13	The Sun	Baltimore	2	1	12		1					1			
3/13	Washington Post	Washington D.C.	2	5	3						1				
3/13	Washington Post	Washington D.C.	2	3	5										
3/13	Washington Times	Washington D.C.	2	1	12		1					1			
3/13	WSJ	National	2	5	3						1				
3/13	WSJ	National	2	3	7		1				1				
3/14	Chicago Tribune	Chicago	2	2	11		1							1	
3/14	Chicago Tribune	Chicago	2	1	12		1					1			
3/14	New York Times	New York	2	5	3						1				
3/14	New York Times	New York	2	1	12	1	1					1			
3/14	Philadelphia Enquirer	Philadelphia	2	4	5		1			1	1				
3/14	Philadelphia Enquirer	Philadelphia	2	1	12		1					1			
3/14	The Sun	Baltimore	2	3	5		1	1							
3/14	USA Toda	National	1	3	5		1			1					
3/14	USA Toda	National	2	3	5		1	1							
3/14	Washington Post	Washington D.C.	2	2	12		1					1			
3/15	Washington Post	Washington D.C.	2	2	5	1	1			1					
3/15	Washington Post	Washington D.C.	2	1	5		1			1		1			
3/16	New York Times	New York	1	3	6	1	1		1						
3/16	New York Times	New York	2	3	5		1			1					
3/16	Washington Post	Washington D.C.	1	4	8		1								1
3/17	New York Times	New York	2	4	5		1			1					
3/17	New York Times	New York	2	1	12		1					1			
3/17	Philadelphia Enquirer	Philadelphia	2	1	12		1								
3/17	The Sun	Baltimore	1	3	6	1	1			1	1				
3/17	The Sun	National	1	4	8	1	1								
3/17	USA Toda	National	2	1	12		1					1			
3/17	Washington Post	Washington D.C.	2	4	5		1			1	1				
3/17	Washington Post	Washington D.C.	2	1	12	1	1					1			
3/17	WSJ	National	2	1	12		1								
3/18	Chicago Tribune	Chicago	1	3	8		1								
3/18	Chicago Tribune	Chicago	3	3	6	1	1	1		1					
3/18	New York Times	New York	2	1	12		1					1			
3/18	The Sun	Baltimore	1	3	8		1								
3/18	Washington Post	Washington D.C.	2	1	5		1			1	1				
3/19	New York Times	New York	2	1	5		1								
3/19	Philadelphia Enquirer	Philadelphia	2	2	5		1			1			1		
3/19	The Sun	Baltimore	2	2	7					1	1				
3/19	USA Toda	National	2	2	5		1								
3/19	Washington Post	Washington D.C.	2	2	5		1								
3/19	WSJ	National	2	2	8		1			1					
3/20	Chicago Tribune	Chicago	2	2	5		1			1					
3/20	New York Times	New York	1	0	13	1	1								

3/20	New York Times	New York	2	2	7		1				1	1					
3/20	New York Times	New York	2	1	12		1										
3/20	Philadelphia Enquirer	Philadelphia	2	1	12		1				1						
3/20	The Sun	Baltimore	2	1	12		1										
3/20	The Sun	Baltimore	2	0	13	1											
3/20	USA Toda	National	1	3	8	1	1		1								
3/20	Washington Post	Washington D.C.	2	3	5		1	1				1					
3/21	Chicago Tribune	Chicago	2	2	11		1		1					1			
3/21	CSM	National	2	2	11		1		1		1			1			
3/21	New York Times	New York	2	2	11		1		1					1			
3/21	Philadelphia Enquirer	Philadelphia	2	2	11	1	1		1					1			
3/21	USA Toda	National	2	1	12		1										
3/21	Washington Times	Washington D.C.	2	3	5		1		1					1			
3/21	Washington Times	Washington D.C.	2	1	12		1										
3/21	WSJ	National	1	0	5		1				1						
3/21	WSJ	National	2	1	12		1						1				
3/22	National Journal	National	1	0	8	1	1				1			1			
3/23	Denver Post	Denver	3	0	13	1	1									1	
3/23	Denver Post	Denver	3	0	13	1	1									1	
3/23	New York Times	New York	2	1	12		1										
3/23	New York Times	New York	2	0	13	1	1									1	
3/23	The Sun	Baltimore	2	1	4	1	1										
3/23	The Sun	Baltimore	2	0	13	1	1									1	
3/23	Washington Post	Washington D.C.	1	4	5		1					1					
3/24	CSM	National	2	3	5		1					1					
3/24	Electronic Eng Times	National	1	4	5		1			1			1				1
3/24	Electronic Eng Times	National	2	4	5		1			1							1
3/24	New York Times	New York	2	1	12		1						1				
3/24	Newsweek	National	1	3	8	1	1				1						
3/24	Philadelphia Enquirer	Philadelphia	2	1	12		1						1				
3/24	Time	National	1	4	5		1			1			1				
3/24	USA Toda	National	2	1	12		1			1			1				
3/24	USNWR	National	1	3	8	1	1										
3/24	Washington Post	Washington D.C.	2	5	5					1	1				1		
3/24	Washington Post	Washington D.C.	2	1	12		1										
3/24	WSJ	National	2	3	5		1					1					
3/25	Chicago Tribune	Chicago	2	0	6	1	1										
3/25	Los Angeles Times	Los Angeles	2	2	5		1						1				
3/25	Sentinel	Orlando	2	5	6	1	1			1		1					
3/25	The Sun	Baltimore	2	4	5		1			1	1	1					
3/25	USA Toda	National	2	1	12		1										
3/26	Chicago Tribune	Chicago	2	4	9		1				1	1					
3/26	New York Times	New York	2	1	4		1										
3/26	Philadelphia Enquirer	Philadelphia	2	3	9		1				1						
3/27	Chicago Tribune	Chicago	2	1	4		1										

3/27	The Sun	Baltimore	2	1	4		1								
3/27	USA Toda	National	2	3	1		1								
3/27	USA Toda	National	2	1	4		1								
3/27	Washington Post	Washington D.C.	2	1	4		1								
3/28	Chicago Tribune	Chicago	2	4	6	1	1								
3/28	Florida Toda	Florida	2	1	12		1								
3/28	New York Times	New York	2	2	3		1					1			
3/28	Washington Post	Washington D.C.	2	2	3		1					1			
3/29	New York Times	New York	2	1	12		1						1		
3/29	New York Times	New York	2	0	4	1									1
3/30	New York Times	New York	2	3	5		1	1		1	1	1			
3/30	New York Times	New York	2	1	12		1						1		
3/30	New York Times	New York	2	0	1		1								
3/30	Washington Post	Washington D.C.	2	3	13	1	1								
3/31	New York Times	New York	2	1	12		1								
3/31	USNWR	National	2	0	8	1	1								
3/31	Washington Times	Washington D.C.	2	1	12		1								
4/1	New York Times	New York	2	0	8		1			1					
4/1	New York Times	New York	2	1	12		1						1		
4/1	Washington Journalism Review	Washington D.C.	2	0	13	1									
4/1	Washington Post	Washington D.C.	1	0	8	1	1								
4/2	Chicago Tribune	Chicago	1	4	9		1				1				
4/2	New York Times	New York	2	1	12		1				1		1		
4/2	Philadelphia Enquirer	Philadelphia	2	1	12		1						1		
4/2	The Sun	Baltimore	2	1	12		1						1		
4/2	USA Toda	National	2	1	12		1				1				
4/2	Washington Post	Washington D.C.	2	1	12		1						1		
4/2	WSJ	National	1	0	8	1	1				1				
4/3	New York Times	New York	1	0	8	1	1								
4/3	New York Times	New York	2	5	3		1				1	1			
4/3	New York Times	New York	2	0	1		1			1					
4/3	New York Times	New York	2	1	12		1						1		
4/3	New York Times	New York	3	0	1		1								
4/3	USA Toda	National	2	3	5		1				1				
4/3	USA Toda	National	2	0	1		1			1					
4/3	Washington Post	Washington D.C.	2	5	3		1				1	1			
4/3	Washington Times	Washington D.C.	2	5	3		1				1				
4/4	Chicago Tribune	Chicago	2	5	3		1				1	1			
4/4	Chicago Tribune	Chicago	2	3	9		1				1				
4/4	CSM	National	2	3	9		1				1				
4/4	Houston Post	Houston	1	4	14		1			1		1			
4/4	New York Times	New York	1	4	9		1				1				
4/4	New York Times	New York	2	2	11		1		1					1	
4/4	New York Times	New York	2	3	9		1				1				
4/4	Philadelphia Enquirer	Philadelphia	2	3	9		1				1				

4/4	The Sun	Baltimore	2	1	12		1					
4/4	The Sun	Baltimore	2	5	3		1			1	1	
4/4	USA Toda	National	2	3	9		1			1		
4/4	Washington Post	Washington D.C.	2	3	9		1			1		
4/4	Washington Times	Washington D.C.	2	4	9		1			1		
4/4	WSJ	National	1	3	8		1	1				
4/4	WSJ	National	2	3	9		1			1		
4/4	WSJ	National	2	0	9		1			1		
4/6	Chicago Tribune	Chicago	1	4	8		1			1		
4/6	Houston Chronicle	Houston	1	0	1		1		1			
4/6	Miami Herald	Miami	1	4	8	1	1			1		
4/6	The Sun	Baltimore	2	4	9		1			1		1
4/6	Washington Post	Washington D.C.	1	4	8	1	1		1			
4/7	New York Times	New York	2	3	5		1			1		
4/7	Time	National	2	3	6		1					
4/7	Washington Post	Washington D.C.	2	3	8	1	1	1				
4/8	Washington Post	Washington D.C.	2	1	12		1					
4/9	New York Times	New York	1	4	5		1				1	
4/9	Philadelphia Enquirer	Philadelphia	1	4	5		1			1	1	
4/9	USA Toda	National	1	4	5		1					
4/9	Washington Post	Washington D.C.	1	4	5		1					
4/10	Chicago Tribune	Chicago	2	1	5		1					1
4/10	CSM	National	2	4	5		1					1
4/10	New York Times	New York	2	1	5		1					1
4/10	USA Toda	National	2	1	5		1					1
4/10	USA Toda	National	2	1	5	1	1					
4/10	USA Toda	National	2	1	4		1					
4/10	Washington Post	Washington D.C.	2	1	5		1					1
4/10	Washington Times	Washington D.C.	2	1	5		1					1
4/11	USA Toda	National	2	3	8		1					
4/11	Washington Post	Washington D.C.	2	2	9		1			1		
4/14	New York Times	New York	2	1	12		1					
4/14	Philadelphia Enquirer	Philadelphia	2	4	8		1					
4/14	USA Toda	National	2	4	7		1				1	
4/14	Washington Post	Washington D.C.	2	1	12		1					
4/15	Chicago Tribune	Chicago	2	1	12		1			1		
4/15	New York Times	New York	2	1	12		1			1	1	1
4/15	Philadelphia Enquirer	Philadelphia	2	1	12		1			1		1
4/15	The Sun	Baltimore	2	1	12		1			1		1
4/15	USA Toda	National	2	1	12		1			1		1
4/15	Washington Post	Washington D.C.	2	1	12		1					1
4/15	Washington Times	Washington D.C.	2	1	12		1			1		1
4/15	WSJ	National	2	1	12		1					1
4/16	CSM	National	2	4	9		1	1	1	1		
4/16	Washington Times	Washington D.C.	2	2	5		1			1		

4/16	Washington Times	Washington D.C.	2	1	12		1							
4/16	WSJ	National	2	2	5		1							
4/17	Chicago Tribune	Chicago	2	1	12		1							
4/17	New York Times	New York	2	3	5		1				1			
4/17	The Sun	Baltimore	2	3	5		1				1			
4/17	WSJ	National	2	1	12		1				1			
4/18	USA Toda	National	1	4	5		1							
4/18	Washington Post	Washington D.C.	2	1	12		1							
4/20	New York Times	New York	2	1	4		1						1	
4/20	USA Toda	National	2	4	8		1				1			
4/21	Chicago Tribune	Chicago	2	1	4		1							
4/21	Newsweek	National	2	1	5		1				1			
4/21	Philadelphia Enquirer	Philadelphia	2	2	5		1				1			
4/21	Washington Times	Washington D.C.	2	2	5		1							
4/21	WSJ	National	2	1	12		1							
4/22	USA Toda	National	2	1	5	1	1							
4/22	USA Toda	National	2	0	4		1							
4/23	Milwaukee Journal	Milwaukee	2	0	8	1	1							
4/23	New York Times	New York	1	4	10		1	1	1					1
4/24	CSM	National	1	4	10		1		1	1				
4/24	New York Times	New York	1	4	8	1	1		1				1	
4/24	Philadelphia Enquirer	Philadelphia	1	4	10	1	1							
4/24	The Sun	Baltimore	1	4	10		1		1					
4/24	USA Toda	National	1	4	8		1					1		
4/25	Chicago Tribune	Chicago	2	3	5		1				1			
4/25	CSM	National	1	4	10		1		1					
4/25	New York Times	New York	1	4	6	1	1							
4/25	New York Times	New York	1	3	5	1	1							
4/25	Philadelphia Enquirer	Philadelphia	2	0	4		1							
4/25	USA Toda	National	2	0	4		1							
4/25	Washington Post	Washington D.C.	1	0	6	1	1		1					
4/25	Washington Post	Washington D.C.	1	4	6	1	1			1				
4/25	Washington Post	Washington D.C.	1	0	6	1	1		1					
4/25	Washington Post	Washington D.C.	2	0	4		1							
4/26	Chicago Tribune	Chicago	2	0	4		1							
4/26	New York Times	New York	1	0	10	1	1		1					
4/26	Washington Post	Washington D.C.	2	2	5		1							
4/28	Washington Times	Washington D.C.	1	4	10		1		1					
4/29	New York Times	New York	2	0	4		1							
4/29	Philadelphia Enquirer	Philadelphia	2	0	4		1							
4/29	The Sun	Baltimore	2	1	4		1							
4/29	USA Toda	National	2	0	4		1							
4/29	Washington Post	Washington D.C.	2	0	13	1	1							
4/29	Washington Times	Washington D.C.	2	0	4		1							
4/30	New York Times	New York	2	5	9	1	1				1			

4/30	Philadelphia Enquirer	Philadelphia	2	1	12		1								
4/30	The Sun	Baltimore	2	3	5		1			1					
4/30	Washington Post	Washington D.C.	2	0	4		1					1			
5/1	Birmingham News	Birmingham	2	4	5		1			1					
5/1	Chicago Tribune	Chicago	1	4	5		1			1					
5/1	Herald Examiner	Los Angeles	2	0	1		1			1					
5/1	Sentinel	Orlando	2	0	13	1	1								
5/1	USA Toda	National	2	3	5		1			1					
5/1	Vanity Fair	National	2	0	13	1	1								
5/1	Washington Times	Washington D.C.	2	3	5		1								
5/2	Huntsville Times	Hunstville	2	5	3	1	1			1	1				
5/2	Philadelphia Enquirer	Philadelphia	1	4	5		1			1	1				
5/2	Washington Post	Washington D.C.	2	0	4		1								
5/2	WSJ	National	1	4	5		1			1					
5/4	Miami Herald	Miami	1	3	8	1	1	1	1				1		
5/4	Washington Post	Washington D.C.	1	4	8		1				1				
5/5	Chicago Tribune	Chicago	1	5	5		1			1					
5/5	Defense News	National	2	3	7						1		1		
5/5	USA Toda	National	3	0	8	1	1								
5/6	The Sun	Baltimore	1	0	6	1									1
5/7	The Sun	Baltimore	2	3	8	1	1								
5/8	New York Times	New York	1	2	8		1	1		1					
5/8	New York Times	New York	2	3	8	1	1	1							
5/8	The Sun	Baltimore	2	3	8		1	1							
5/8	Washington Post	Washington D.C.	1	3	8		1	1			1				
5/8	WSJ	National	2	4	9		1			1					
5/9	Chicago Tribune	Chicago	1	4	8		1	1							
5/9	CSM	National	2	3	5		1	1		1					
5/9	Los Angeles Times	Los Angeles	2	0	8		1	1		1					
5/9	New York Times	New York	1	4	6	1	1					1			
5/9	New York Times	New York	1	0	1		1	1						1	
5/9	New York Times	New York	2	3	11		1	1						1	
5/9	USA Toda	National	2	3	8		1	1			1				
5/9	Washington Post	Washington D.C.	2	3	11		1	1						1	
5/9	Washington Times	Washington D.C.	1	3	8		1	1			1		1		
5/9	WSJ	National	2	3	11		1	1						1	
5/10	New York Times	New York	2	0	6	1	1								
5/10	Washington Post	Washington D.C.	2	5	3		1				1				
5/11	Los Angeles Times	Los Angeles	2	5	3		1			1	1				
5/11	New York Times	New York	1	4	5		1			1	1				
5/11	New York Times	New York	1	4	8		1			1	1				
5/11	Philadelphia Enquirer	Philadelphia	1	4	5		1			1	1				
5/11	The Sun	Baltimore	1	4	5		1			1	1				
5/11	The Sun	Baltimore	2	4	8		1		1	1					
5/11	Washington Post	Washington D.C.	1	4	5		1			1	1		1		

5/12	Chicago Tribune	Chicago	1	3	5		1				1				
5/12	CSM	National	1	3	3		1					1		1	
5/12	CSM	National	3	0	6	1	1								
5/12	CSM	National	3	0	6	1	1								
5/12	Los Angeles Times	Los Angeles	2	4	9		1				1				
5/12	Star-News	Chicago	1	3	5		1				1				
5/12	WSJ	National	1	4	5		1				1	1			
5/13	New York Times	New York	1	4	7		1				1	1			
5/13	New York Times	New York	1	4	6	1	1					1			
5/13	New York Times	New York	1	4	8		1				1	1			
5/13	Washington Post	Washington D.C.	1	4	6	1	1				1	1			
5/13	Washington Post	Washington D.C.	1	4	6	1	1				1	1			
5/13	Washington Post	Washington D.C.	2	0	1		1						1		
5/14	Chicago Tribune	Chicago	2	0	1		1		1						
5/14	Los Angeles Times	Los Angeles	2	3	8		1		1			1			
5/14	New York Times	New York	2	0	7		1		1		1	1			
5/14	Philadelphia Enquirer	Philadelphia	1	0	8		1		1						
5/14	The Sun	Baltimore	2	0	1		1		1						
5/14	USA Toda	National	2	0	1		1		1						
5/14	Washington Post	Washington D.C.	2	0	7		1					1			
5/14	Washington Times	Washington D.C.	1	5	6	1						1			
5/14	Washington Times	Washington D.C.	2	3	8		1		1			1			
5/14	WSJ	National	2	0	7		1		1		1	1			
5/14	WSJ	National	2	5	7		1				1	1			
5/15	New York Times	New York	2	4	9		1				1				
5/15	The Sun	Baltimore	2	4	9		1				1		1		
5/15	WSJ	National	2	4	3		1				1	1			
5/16	Philadelphia Enquirer	Philadelphia	2	4	7		1		1		1	1			
5/16	Sentinel	Orlando	1	4	8		1	1				1			1
5/17	Chicago Tribune	Chicago	2	5	10		1				1				
5/17	Washington Post	Washington D.C.	2	5	10		1				1	1			
5/18	New York Times	New York	2	0	4		1								
5/19	Chicago Tribune	Chicago	2	0	4		1								
5/20	Los Angeles Times	Los Angeles	2	0	5		1				1				
5/20	Washington Post	Washington D.C.	2	0	5		1		1		1				
5/20	Washington Post	Washington D.C.	2	0	4		1								
5/20	Washington Times	Washington D.C.	2	0	4		1								
5/21	Philadelphia Enquirer	Philadelphia	2	0	5		1				1				
5/21	USA Toda	National	2	0	7				1			1			
5/21	Washington Times	Washington D.C.	2	0	5		1				1				
5/22	Washington Times	Washington D.C.	2	2	10					1	1				
5/23	CSM	National	2	4	1		1		1		1				
5/23	CSM	National	2	0	1	1				1					
5/23	The Sun	Baltimore	2	0	1		1		1				1		
5/23	Washington Post	Washington D.C.	2	0	13	1	1								

5/26	The Sun	Baltimore	1	0	10		1			1	1		
5/26	Washington Post	Washington D.C.	1	4	8	1	1	1					
5/27	Washington Post	Washington D.C.	1	0	6	1	1						
5/28	New York Times	New York	1	0	6	1	1						
5/28	New York Times	New York	2	0	8		1						
5/28	Washington Post	Washington D.C.	1	0	13	1	1						
5/28	Washington Post	Washington D.C.	1	0	8		1						
5/28	Washington Post	Washington D.C.	2	1	12		1					1	
5/28	WSJ	National	2	0	8		1						
5/29	Editor & Publisher	National	1	1	13	1	1						
5/29	Washington Post	Washington D.C.	2	5	10		1	1			1		1
6/3	CSM	National	2	0	6	1	1	1					
6/3	Philadelphia Enquirer	Philadelphia	2	0	4		1						
6/3	The Sun	Baltimore	1	5	9		1			1			
6/3	The Sun	Baltimore	2	6	3		1				1		
6/3	Washington Post	Washington D.C.	1	4	9		1			1	1		
6/3	WSJ	National	2	0	3		1				1		
6/4	Chicago Tribune	Chicago	2	0	9		1			1			
6/4	CSM	National	1	4	9		1			1			
6/4	CSM	National	2	4	9		1			1	1		
6/4	Los Angeles Times	Los Angeles	1	4	9		1			1			
6/4	New York Times	New York	2	6	3						1		
6/4	New York Times	New York	2	4	9		1			1			
6/4	New York Times	New York	2	4	9		1			1			
6/4	New York Times	New York	2	6	3						1		
6/4	Philadelphia Enquirer	Philadelphia	2	4	9		1			1			
6/4	Washington Times	Washington D.C.	1	4	6	1	1			1			
6/4	WSJ	National	1	4	9		1			1	1		
6/4	WSJ	National	1	4	9		1			1			
6/4	WSJ	National	2	6	3						1		
6/6	Washington Post	Washington D.C.	2	0	14					1			
6/8	New York Times	New York	2	4	9		1			1			1
6/8	New York Times	New York	2	0	6	1				1			
6/8	Washington Post	Washington D.C.	2	4	9	1	1			1			
6/9	New York Times	New York	1	0	5		1	1		1			
6/9	Philadelphia Enquirer	Philadelphia	1	4	9		1			1			1
6/9	The Sun	Baltimore	1	4	9		1	1		1	1		
6/9	Time	National	2	4	9		1		1	1	1		1
6/9	Time	National	2	0	6	1				1			
6/9	USA Toda	National	1	4	6	1	1			1			
6/9	USA Toda	National	2	4	9		1			1			
6/9	USA Toda	National	2	4	6	1	1			1			
6/9	USA Toda	National	2	0	14			1	1	1			
6/9	Washington Times	Washington D.C.	2	4	9		1			1			
6/9	WSJ	National	2	4	9		1			1			

6/10	Chicago Tribune	Chicago	2	5	9		1	1		1	1		1	
6/10	CSM	National	1	4	9		1	1	1	1				
6/10	New York Times	New York	1	4	6	1	1			1			1	
6/10	New York Times	New York	1	4	9	1	1	1	1	1			1	
6/10	New York Times	New York	1	4	9		1			1	1			
6/10	New York Times	New York	2	5	9		1	1		1				
6/10	The Sun	Baltimore	2	4	9		1	1	1	1	1			
6/10	USA Toda	National	2	4	9		1	1		1				
6/10	USA Toda	National	2	4	7					1	1			
6/10	USA Toda	National	2	4	9		1			1	1			
6/10	USA Toda	National	2	0	9					1				1
6/10	USA Toda	National	2	0	6		1	1		1			1	
6/10	USA Toda	National	2	6	9		1			1	1			
6/10	USA Toda	National	3	0	11		1			1			1	
6/10	Washington Post	Washington D.C.	1	4	6	1	1	1		1				
6/10	Washington Post	Washington D.C.	2	5	9		1			1	1			
6/10	Washington Post	Washington D.C.	2	4	9		1	1		1				
6/10	Washington Post	Washington D.C.	2	4	9		1	1	1	1				
6/10	Washington Post	Washington D.C.	2	6	9		1			1				
6/10	Washington Post	Washington D.C.	2	4	11		1						1	
6/10	Washington Post	Washington D.C.	2	4	5		1			1			1	
6/10	Washington Times	Washington D.C.	1	4	9		1			1			1	
6/10	WSJ	National	2	4	9		1			1	1		1	
6/10	WSJ	National	2	4	6	1	1			1	1			
6/11	Chicago Tribune	Chicago	2	5	6	1	1			1	1			
6/11	Chicago Tribune	Chicago	2	0	9		1	1		1				
6/11	CSM	National	1	4	7	1	1				1	1		
6/11	CSM	National	2	4	6	1	1	1		1				
6/11	New York Times	New York	2	5	9		1	1		1	1			
6/11	New York Times	New York	2	4	11		1	1					1	
6/11	New York Times	New York	2	4	7					1	1			
6/11	New York Times	New York	2	4	9		1			1				1
6/11	The Sun	Baltimore	1	4	9		1	1		1				
6/11	USA Toda	National	2	6	9		1	1		1				
6/11	USA Toda	National	2	3	8		1			1				
6/11	Washington Post	Washington D.C.	1	6	9			1		1				
6/11	Washington Post	Washington D.C.	2	4	6	1	1	1			1			
6/11	Washington Post	Washington D.C.	2	0	9					1				1
6/11	WSJ	National	1	4	9		1			1	1			
6/12	CSM	National	1	4	9		1			1				
6/12	CSM	National	2	4	1		1			1				
6/12	Florida Toda	Florida	2	0	13	1	1							
6/12	New York Times	New York	2	4	9		1	1		1	1			
6/12	Philadelphia Enquirer	Philadelphia	2	4	9		1	1						
6/12	The Sun	Baltimore	1	5	6	1	1	1		1				

6/12	The Sun	Baltimore	2	2	9		1	1		1		
6/12	USA Toda	National	2	6	9		1			1		
6/12	Washington Post	Washington D.C.	1	6	6	1	1	1		1		
6/12	Washington Post	Washington D.C.	2	5	9		1	1		1	1	1
6/13	Chicago Tribune	Chicago	2	6	9		1			1	1	
6/13	CSM	National	1	4	8		1	1			1	1
6/13	New York Times	New York	2	5	5		1	1			1	
6/13	Philadelphia Enquirer	Philadelphia	2	0	11		1	1				1
6/13	The Sun	Baltimore	2	4	8		1					
6/13	The Sun	Baltimore	2	4	8		1	1			1	
6/13	WSJ	National	1	4	8		1	1			1	
6/14	Washington Post	Washington D.C.	2	4	5		1			1		
6/14	Washington Post	Washington D.C.	2	0	11		1			1		1
6/15	New York Times	New York	1	4	6	1	1			1		1
6/15	New York Times	New York	1	0	1	1	1		1			
6/15	New York Times	New York	1	5	8		1	1		1		
6/15	New York Times	New York	2	5	9		1			1		1
6/15	The Picayune	Picayune (MS)	2	4	6		1			1		
6/16	Newsweek	National	2	0	6		1	1		1		
6/16	WSJ	National	2	0	11		1			1		1
6/17	New York Times	New York	1	0	4		1			1		
6/17	Washington Post	Washington D.C.	1	0	4		1			1	1	
6/18	Boston Globe	Boston	1	4	8	1	1			1		
6/18	Boston Globe	Boston	2	4	6		1	1		1		
6/18	Chicago Tribune	Chicago	1	0	4		1					
6/18	Chicago Tribune	Chicago	2	4	7		1	1			1	
6/18	New York Times	New York	2	4	5		1	1			1	
6/18	Philadelphia Enquirer	Philadelphia	1	5	5		1	1		1	1	
6/18	Philadelphia Enquirer	Philadelphia	1	0	4		1					
6/18	USA Toda	National	1	4	5		1	1				
6/18	Washington Post	Washington D.C.	1	4	5		1	1			1	
6/18	Washington Times	Washington D.C.	2	4	7			1			1	
6/18	WSJ	National	2	4	7			1			1	
6/19	Chicago Tribune	Chicago	2	0	7		1	1		1	1	
6/19	New York Times	New York	2	0	7		1	1		1	1	
6/19	New York Times	New York	2	0	5		1		1			
6/19	Philadelphia Enquirer	Philadelphia	2	0	7		1	1		1	1	
6/19	USA Toda	National	2	0	7			1		1	1	
6/19	Washington Times	Washington D.C.	2	0	1		1					1
6/19	Washington Times	Washington D.C.	2	0	7			1		1	1	
6/19	WSJ	National	2	0	7						1	
6/20	CSM	National	2	0	1		1			1		
6/20	Los Angeles Times	Los Angeles	2	0	7			1			1	
6/21	Los Angeles Times	Los Angeles	2	0	1		1	1				1
6/22	Washington Post	Washington D.C.	2	0	1		1	1	1	1		1

6/23	New York Times	New York	1	4	6	1	1								
6/23	Newsweek	National	2	0	6		1			1				1	
6/23	USNWR	National	1	5	8	1	1	1		1					
6/23	Washington Times	Washington D.C.	2	0	11		1						1	1	
6/24	USA Toda	National	2	0	1		1		1			1			
6/24	Washington Times	Washington D.C.	2	0	1		1					1			
6/25	Philadelphia Enquirer	Philadelphia	2	0	11		1							1	
6/26	Washington Times	Washington D.C.	3	0	6	1	1								
6/28	New York Times	New York	2	4	7		1				1		1		
6/29	New York Times	New York	1	5	7		1	1			1				
7/1	Glamour Magazine	National	2	0	1	1	1								1
7/8	CSM	National	2	4	1		1			1					
7/11	CSM	National	2	3	5		1			1					

APPENDIX D
Phillips Report's Improvements for North American Aviation

- **Overall Performance**: The overall characterization of North American Aviation's performance on the Apollo command module and Saturn II was unacceptable because of their failure to meet cost, schedule, and performance goals.
- **Corporate Interest**: North American Aviation corporate interest, which was mentioned previously, was considered passive relative to what NASA expected in all the performance parameters. MG Phillips added that "…we do recommend that the Corporate Office sincerely concern itself with ho well S&ID is performing to customer requirements…" (p. 9)
- **Organization and Manning**: The review team believed that S&ID was over manned in both programs. They further recommended that the division reexamine how they structured their Engineering, Manufacturing, Quality, and Program control operations. The issue of the Progra Manager's authority was also broached. MG Phillips was careful to point out that how S&ID structures its organization to fulfill the requirements of the contract is a management prerogative and NASA is not attempting to tell them how to organize themselves. However, the point that was being made was that the organizational structure was highly inefficient and, therefore, costly.
- **Program Planning and Control**: The team simply stated that this function at S&ID did not exist. Each program manager accomplished his

own planning, budgeting, and scheduling. They were not coordinated and integrated.

- **Logistics**: While the Phillips team acknowledged that S&ID's logistics function was adequately staffed, there was no agreement between the division and NASA as to what was required to support the program (e.g. logistics plan, maintenance manuals).
- **Engineering**: This was the most damning area of review and which would later be revealed as being a causal factor in the Apollo 1 fire. Engineering accountability was lacking in that it was difficult to identify who was responsible for output. S&ID's system engineering capability was adjudged to be inadequate from the interpretation of NASA's technical requirements to the actual drawing release of the item or component. An ineffective drawing release process led to delays in hardware deliveries. Configuration management, which is a highly structured process that documents all changes to a design, was not being adhered to by S&ID's engineering functions.
- **Cost Estimating**: The estimation of costs associated with work tasks needs improvement and a process for "scrubbing" the estimates to eliminate "cushion" needs to be developed. Once these estimates are consolidated for a specific task, management needs to involve itself in reviewing the estimate. The final issue in this category is that the final product the S&ID submits to NASA does not reflect NASA's requirement, but what S&ID needs to support a level of their effort. Process and

discipline must be established in concert with the conferral of the appropriate authority to the Program Manager to accept or reject the estimates that are submitted to him. This issue in the Phillips Report drove many who read it to question how much fiscal inefficiency was existent in the Apollo program and who in North American Aviation was accountable.

- **Manufacturing Work Force Efficiency**: This section of the Phillips Report was the most provocative for it cites poor workmanship as evidenced by the high rejection rates on manufactured items. The media would later pay particular attention to the fact that when the Apollo spacecraft were shipped, they had "…thousands of hours to complete…" (p. 16). As the Apollo 204 Review Board proceedings will reflect, investigators found ample proof of poor workmanship in the manufacture and integration of the Apollo 204.
- **Quality**: Another finding of the Phillips team that would be reflected in the Apollo 204 Review Board report is that of unsatisfactory quality control procedures and processes. As the Phillips team noted, "NAA [North American Aviation] quality is not up to NASA required standards" (p. 16). What they found was that a large number of deficiencies got past S&ID inspectors, but were caught by NASA quality inspectors. MG Phillips noted that this, along with the other issues, is principally a management issue.

- **Other Issues**: The Phillips Report highlighted additional issues that were not included in the other categories. MG Phillips stated unequivocally that S&ID must show more initiative in executing the program and not wait for specific instructions from NASA. S&ID must also develop planning tools in order to not only address the immediate tasks, but assess what is required for future activities; crisis management is not a viable management style. S&ID must assign responsibility for open issues and unresolved problems to specific individuals and their progress towards completion tracked by management. Contracts administration was also cited as an area that needs attention, especially in definitizing existing subcontractual activity.

APPENDIX E
Apollo 204 Review Board Findings, Determinations, and Recommendations

- **Finding 1**: A momentary power failure; evidence of electrical arching; but no single source of the fire was identified.

  Determination: Likely initiator of the fire was an electrical arch near the Environmental Control Unit. No evidence of sabotage

- **Finding 2**: The Apollo Command Module had a number of combustible materials in the pure oxygen, 16.7 pounds per square inch atmosphere.

  Determination: The test was very hazardous.

  Recommendation: Combustible material in the command module must be restricted.

- **Finding 3**: The fire caused an increase of command module cabin pressure which ruptured the command module. The crew died of asphyxia due to inhalation of toxic gases. A contributing factor of the death of the three astronauts was burns.

  Determination: The astronauts became unconscious and then rapidly died as a result of the toxic gases.

- **Finding 4**: Because of the high cabin pressure, the co   mand module inner hatch could not be opened until the command module structure ruptured.

Determination: The crew could not exit the command module before they became unconscious.

Recommendation: Crew egress must be simplified.

- **Finding 5**: The organization responsible for the planning and conduct of the test had failed to identify it as a hazardous test. There were no contingency plans to extract the crew from the command module in the event of fire. There were no emergency procedures; there was inadequate emergency equipment; emergency and rescue personnel were not in attendance; the spacecraft work level and gantry would not permit rapid evacuation.

  Determination: Inadequate safety precautions were not established nor observed.

  Recommendation: Management monitor safety during all test and ensure adequate safety procedures; all emergency equipment be reviewed for adequacy; test and gantry personnel should be trained for emergency procedures; service structures be modified to permit emergency operations.

- **Finding 6:** There were frequent communication failures during the test prior to the fire.

  Determination: The communication system was unsatisfactory.

  Recommendation: Improve the communication system reliability as soon as possible and before the next manned flight; conduct a design review of the spacecraft communication system.

- **Finding 7:** Differences existed between the Ground Test Procedures (issued on January 26) and the In-Flight Check Lists (issued on January 27).

  Determination: These differences did not contribute to the accident. Test personnel, however, were not familiar with the test procedures prior to use.

  Recommendation: Publish the Test Procedures and Pilot's Checklist that represent the command module configuration in sufficient time for adequate preparation and participation of the test organization.

- **Finding 8:** The fire in Apollo 204 was simulated in a full-scale mockup.

  Determination: The use of a full-scale mockup in flight configuration can be used to determine fire risks.

  Recommendation: Full-scale mockups be used to determine risk of fire.

- **Finding 9:** The Environmental Control System provides the command module with a pure oxygen atmosphere.

  Determination: This presents a hazardous atmosphere if combustible materials are not limited.

  Recommendation: Determine the fire safety of flight configured command module by conducting full-scale mockup tests; conduct studies in the use of a two-gas atmosphere.

- **Finding 10:** There were numerous design, workmanship and quality control deficiencies in the command module (e.g. numerous failures of the Environmental Control System; coolant leakages at solder joints; corrosive and combustible coolant; deficiencies in the electrical wiring; no vibration test of the flight configured command module; design and procedures require disconnecting of electrical connections while powered; no fire protection design procedures.

  Determination: Deficiencies created a hazardous condition and these deficiencies would endanger future manned space flight operations.

  Recommendation: Review the design of the Environmental Control System for functionality and integrity and minimize fire risk; modify design of solder joints; eliminate the hazardous effects of the coolant; revie specifications, manufacture, and inspection of wiring bundles; vibration test the flight-configured command module; eliminate the need to disconnect the power when the power is on; examine the most effective manner to extinguish a spacecraft fire and provide the crew with auxiliary breathing systems to protect them from smoke and toxic gases.

- **Finding 11:** There were numerous problem areas in the operating procedures (e.g. Number of open items were not known at the time of the shipment of the Apollo 204 command module; procedures for the pre-test constraint list were not followed; pre-launch test requirements were not followed; non-certified equipment was installed in the command module; there were discrepancies between North American Aviation and NASA concerning the amount of flammable materials in the command module; test specifications had not been updated.

Determination: Insufficient response to program requirements changes due to problems in program management and relationships between the NASA Centers and the contractors.

Recommendation: Make maximum effort to clarify and understand organizational responsibilities in order to have a fully coordinated and efficient program.

APPENDIX F
Chronology of Personnel Moves Resulting from Their Involvement in the Challenger Launch Decision

- **March 13, 1986**: Two executives from Morton Thiokol, who overruled their engineers' recommendation not to launch during the January 27 teleconference, were either stripped of some responsibility or demoted. Jerald ***Mason***, Senior Vice President of Morton Thiokol's Space Division, "…will yield responsibility for space operations." Calvin ***Wiggins***, Vice President and General Manager of Space Division, was demoted to Deputy to the Vice President and General Manager (Wall Street Journal, March 13, 1986).

- **April 3, 1986**: Stanley ***Reinantz***, Shuttle Projects Manager at Marshall Space Flight Center, "…has been relieved of those duties [shuttle projects office] and returned to a position he formerly held, manager of special projects…" The NASA press release that was referred in the media report added that Reinantz had requested the transfer for "health and personal reasons" (The Sun, April 4, 1986). Reinantz admitted before the Rogers Commission that he failed to tell Level II NASA management that Morton Thiokol had initially recommended against the launch because of the cold temperatures.

- **May 9, 1986:** NASA announced that Lawrence ***Mulloy***, Manager of the Solid Rocket Motor Project at Marshall Space Flight Center, would be laterally transferred to a new position at Marshall as the assistant to the Director of Science and Engineering (Washington Post, May 10, 1986). Mulloy took a strong position against the Morton Thiokol's initial recommendation not to launch the Challenger on January 28.

- **May 9, 1986:** George ***Hardy***, Deputy Director of Science and Engineering at Marshall Space Flight Center, retired after thirty-three years of government service.

- **June 2, 1986**: Jerald ***Mason*** (Morton Thiokol) announced early retirement effective on June 30, 1986.

- **June 3, 1986**: President Reagan nominated Dr. Graham, the Acting Administrator of NASA, to be the White House Science Advisor. Although Graham was never officially implicated (or blamed) for the accident, it is interesting that the White House made the announcement in the midst of other personnel actions of those who were implicated (Wall Street Journal, June 3, 1986).

- **June 4, 1986**: Dr. Willia ***Lucas***, Director of the Marshall Space Flight Center, announced his retirement.

- **June 4, 1986**: Morton Thiokol's chief spokesman announced another personnel move in which Joseph ***Kilminster***, Vice President for Space Booster Programs, "…will be reassigned at a later date. I don't know what the position will be" (New York Times, June 4, 1986). Kilminster's signed the "MTI Assessment of Temperature Concern on SRM-25 (51L) Launch," in which he stated "MTI recommends STS-51L Launch Proceed on 28 January 1986" (Morton Thiokol document sent to Marshall Space Flight Center and Kennedy Space Center at 9:45 MST on January 27, 1986). Morton Thiokol again announced the retirement of Jerald ***Mason*** quoting Mason as saying that "This action is taken in accepting my responsibility as senior manager at Wasach."

- **June 13, 1986**: It is interesting to note that in a internal memorandum fro Admiral Truly to the Associate Administrator for Aeronautics and Space Technology, dated June 13, 1986, he wrote:

  Recent activities resulting from the January Challenger *accident have created the need to reassign several Office of Space Flight employees. I would like to request your ass stance in the reassignment and placement of an MSFC employee, Mr. Lawrence B. Mulloy* (Internal Memorandum, June 13, 1986).

  On 13 June, Mr. Raymond Colladay, the Associate Administrator for Aeronautics and Space Technology, then wrote a memorandum to the

Administrator of NASA seeking his concurrence in offering ***Mulloy*** the position of Deputy Director, Propulsion, Power, and Energy Division, at NASA Headquarters (Internal Memorandum, June 13, 1986).

While these were the more publicized personnel actions associated with the Challenger launch decision, there were others who were also affected. For instance, Judson ***Lovingood***, who was the Deputy Manager for Shuttle Projects at Marshall, was transferred to a position outside of the shuttle program. Michael ***Weeks***, who was the Deputy Associate Administrator for Space Flight at NASA Headquarters, yielded much of his authority to a deputy reporting to Admiral Truly. From Morton Thiokol, Bob ***Lund***, who was Vice President of Engineering, was able to keep his title, but he no longer had any responsibility for the solid rocket booster program.

APPENDIX G
Rogers Commission Findings

Findings:

- A propellant gas leak from the right solid rocket motors aft field joint penetrated the External Tank, which caused the break up of the Challenger and loss of her crew.

- There were no other causes in either the shuttle or its payload that contributed to the loss of Challenger; there was no sabotage.

- There is no evidence that any other flight element was shipped to the launch site that fell outside design specifications.

- Launch site activities were not a factor in the accident.

- The right solid rocket motor segments were assembled using approved procedures. Where the field joint (which failed) joined two rocket motor segments, they found the rocket motors out-of-round. The Commission was uncertain if this could have been a contributing factor.

- The ambient temperature was 36 degrees, which was 15 degrees colder than the next coldest launch.

- It is not known if the other field joint seals experienced the same resiliency problems as the lower right field joint that failed.

- During rocket motor ignition, pressure build up as the motor is burning, and vehicle motions, the gap between the tang and clevis will open as much as .017 inches at the secondary O-ring and .029 inches at the primary O-ring.

- O-ring resiliency is directly related to temperature.

- Experimentation showed that the mechanism by which the O-ring seals is through the application of gas pressure to high-pressure side of the O-ring.

- The O-rings seat properly by the timely application of motor pressure.

- Of the twenty-one launches that occurred in temperatures of 61 degrees or higher, four showed signs of erosion or motor gas blo -by. In temperatures below 61 degrees, in each launch the O-rings showed signs of erosion or blo -by.

- There is the possibility that there was water in the clevis since it rained as the Challenger sat on the launch pad. The water could have frozen thereby inhibiting proper secondary seal performance.

- Puffs of smoke were observed coming from the field joint of the right solid rocket motor at ignition.

- The smoke from this aft field joint was the first sign of failure of the O-rings.

- At fifty-eight seconds into the flight, a flame was visible from the ruptured field joint. As the Challenger continued to climb and was subjected to wind sheer and other flight loads, the severity of the leak increased.

Recommendations:

- **Recommendation I**: The design of the Solid Rocket Motor must be changed. This recommendation encompassed not only the issue of redesigning or eliminating the joint, but also the certification and testing process by which the new design should be subjected. The Commission also recommended the National Research Council establish an independent oversight committee to ensure that the Commission's recommendations are implemented.

- **Recommendation II**: The Commission found a conflict that NASA's shuttle program managers felt more loyalty to their respective Centers than the overarching shuttle organization. The Commission suggested that the responsibility of the program manager be reassessed and the requisite authority and accountability be vested in the program manager. The Commission also suggested that astronauts should also be given the opportunity to participate in NASA management positions. Associated with this recommendation, the Commission recommended the establishment of a STS Safety Advisory Panel, which would report to the Shuttle Program Manager.

- **Recommendation III**: NASA and its principal contractors should revie Criticality 1, 1R, 2, and 2R items. They further suggested that the National Research Council appoint an Audit Panel to verify that this recommendation is accomplished.

- **Recommendation IV**: The Commission as adamant that NASA establish an Office of Safety, Reliability, and Quality Assurance that would be led by an Associate Administrator. The Commission stressed that this office must be independent of other NASA activities and functions. It must be unencumbered from the organizational politics and be able to objectively convey safety and reliability issues to the NASA Administrator.

- **Recommendation V**: This recommendation focused on the Marshall Space Flight Center. They observed that Marshall had a propensity for “management isolation,” which led to the failure to provide the information necessary to make an informed decision to launch the Challenger. The recommendation was broad in that it suggested that NASA should look at changing personnel, the organization, indoctrination, or all three. The Commission also suggested that Flight Readiness Reviews be recorded and the commander of the shuttle flight should attend the Flight Readiness Review.

- **Recommendation VI**: The Commission found that tires, brake, and nose wheel steering system must be improved. They found that the landing system was lacking in safety margin, especially if the shuttle crew had to land at an abort landing site. Concern had been expressed by shuttle pilots that landing at Kennedy could be hazardous due to the condition of the runway and occasional cross wind conditions that stressed the landing gear.

- **Recommendation VII**: The launch abort and crew escape issue was germane to the Challenger accident. Since the Commission maintained that the Challenger crew survived the explosion of the main fuel tank and subsequent break-up of the orbiter, the question remained if the crew has some means of bailing out of the damaged crew cabin, could they have survived. The Commission recommended that the NASA investigate an escape system for controlled gliding flight and increase the shuttle’s range in the event that two or three of the shuttle's engines fail.

- **Recommendation VIII**: The shuttle flight rate that NASA felt pressed to maintain was a contributing factor in the Challenger accident. Thus, the Commission recommended that the nation's reliance on a single source of launch capability be avoided and NASA formulate a launch rate that is consistent with its capabilities and availability of assets.

- **Recommendation IX**: Criticality 1 items are those that mean loss of spacecraft and crew in the event of failure. The Commission suggested that NASA implement a maintenance inspection plan for all Criticality 1 items and end the practice of "cannibalizing" parts from a shuttle that is not flying to maintain one that is.

APPENDIX H
NASA Public Affairs’ Comments Concerning Post-Challenger Public Affairs Environment

The following are the highlights of the interviews with the public affairs officers who were responsible for providing the media and the American people with the information that they required in order begin the process of making sense of the tragedy:

- Hugh Harris (Kennedy Space Center)
    - All of the public affairs video tapes were confiscated within thirty minutes of the explosion; he did not believe that management was aware of the effect of their actions.
    - NASA was in danger of losing its image.
    - Emotional climate was beyond the bounds of sensibility. Modest speculation resulted in overblown emotional articles in the newspapers..
    - Public affairs decisions were taken out of the public affairs function.

- Jim Ball (Kennedy Space Center)
    - To the front-line troops, the feeling was one of the commanding officers hiding in the bunker having run out of ammunition, flanks exposed and troops being left to die.
    - He had the intuitive feeling from the start that there were forces beyond public affairs that were controlling public affairs.

- Bob Ruhl (Marshall Space Flight Center)
    - o At the very beginning of the Rogers Commission, it seemed that Secretary Rogers was sympathetic towards NASA, but NASA's arrogance seemed to create a change in the Commission's mood.
    - o Guidance from NASA Headquarters was sparse and there was no unified policy. Without policy and no NASA officials willing to talk to the media, public affairs "often took a thrashing" from the media.
    - o The Wall Street Journal, Chicago Tribune, New York Times, Los Angeles Times, and the Associate Press have been deliberately negative; it's been a real awakening how the press can twist [the story]
    - o When the public affairs finally found someone to talk, they found out that these people had grudges and they received a lot of attention.
    - o When NASA personnel were being reassigned as a result of the investigation, there were no reasons given.
    - o NASA Headquarters send "twisted signals;" affected public affairs credibility internally and externally.

- Ed Medal (Marshall Space Flight Center)
    - o There was not a clear-cut public affairs policy from NASA Headquarters. When guidance as received was oftentimes counter to NASA policy.

- The loss of Challenger was the “single worst event.”

- Lyn Cywanowicz (Marshall Space Flight Center)
    - Marshall should have had its own spokesman instead of referring all questions to NASA Headquarters. Some of the questions Marshall could have answered.
    - There was no coordination among the Centers. If a reporter went to all three Centers, he would find information.
    - In the past, the public affairs philosophy was that if there was bad news “we get it out quickly.” In post-Challenger, NASA hid the bad news and then denied doing it. The media wanted to depict NASA in a positive way, but “we denied them any news and still persisted in believing what we were doing was the correct thing to do.”

- Tim Tyson (Marshall Space Flight Center)
    - In the first hectic hours after the accident, there was no direction. If there was a plan, it seemed “to go out the window.”
    - Headquarters should have taken the lead as far as direction. Marshall was “hung out to dry for far too long.”
    - When Challenger blew up it was though “it went into a hole in the sky.” We should have said the crew was dead, found the cre cabin first, and then find the bodies.

- “We were never prepared for this.” Under the NASA Act, there are certain responsibilities that we have under law and we violate the and our managers violated them.
- “I keep thinking what was it that we did right and I can’t think of a single thing.”

- John Taylor (Marshall Space Flight Center)
  - The perception was that no one was home in Headqu arters.
  - Dr. Lucas (Director of Marshall Space Flight Center) agreed to interview with the press corps. It turned out to be brutal. Lucas was asked several point blank questions about the launch decision process; Rogers was infuriated with Lucas’ reported remarks.

- Doug Ward (Johnson Space Center)
  - The issue of the press was never seen as the paramount issue with the NASA Administrator. It was Jim Webb and Chris Craft who were the type of leaders who did realize the importance of seizing the initiative and providing a media spokesman.

- Barb Schwartz (Johnson Space Center)
  - Can’t understand why we didn’t tell the public that the crew had been lost.

- NASA officials and astronauts used the public affairs office as a scapegoat; they said PAO would not let them talk.
- NASA employees are being treated as criminals; it was an accident.
- During the Challenger investigation, NASA didn't have an administrator and Johnson Space Center did not have a director.

- Brian Welch (Johnson Space Center)
  - System fell apart immediately. We should have announced that the crew was dead within twenty minutes.
  - In a situation like this, the "absolute center of the universe for NASA is public affairs." We had a failed launch; the Mission Control Center wasn't in control; there was nothing for them to control.
  - The most critical function for NASA at that time was public affairs—they was simply nothing else going on.
  - Public affairs was not allowed to do their job. How was this coup allowed to happen? How is it possible for the Acting Adminstrator, a man who had been on the job for less than a month, to overthro twenty-five years worth of experience. Public affairs abdicated its responsibilities.

- Terry White (Marshall Space Flight Center)
  - On about day three, there was influx of “young turks” with Pulitzer’s in their heads. You could tell they were the types who had done investigative stories and they had been placed here to do that.
  - In Apollo 204, we weren’t quite in the same league. This –51L (Challenger) was in living color to the whole world. The Apollo 204 fire took a little time to unfold and General Sam Phillips had briefings and releases which allowed information to come out. I think we were somewhat inhibited by the Commission’s involvement. In the previous two episodes (Apollo 204 and Apollo 13), we did in-house and it seemed somehow unnatural to defer to the Commission. We hid behind the curtain of deferral and no comment.

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