Appendix F.

NASA Implementation Overview [F-1]

[F-1] NASA Implementation of the Report of the Presidential Commission on the Space Shuttle Challenger Accident.

THE WHITE HOUSE

WASHINGTON

June 13, 1986

Dear Jim:

I have completed my review of the report from the Commission on the Space Shuttle CHALLENGER Accident. I believe that a program must be undertaken to implement its recommendations as soon as possible. The procedural and organizational changes suggested in the report will be essential to resuming effective and efficient Space Transportation System operations, and will be crucial in restoring U.S. space launch activities to full operational status.

Specifically, I would like NASA to report back to me in 30 days on how and when the Commission's recommendations will be implemented. This report should include milestones by which progress in the implementation process can be measured.

Let me emphasize, as I have so many times, that the men and women of NASA and the tasks they so ably perform are essential to the nation if we are to retain our leadership in the pursuit of technological and scientific progress.

Despite misfortunes and setbacks, we are determined to press on in our space programs. Again, Jim, we turn to you for leadership. You and the NASA team have our support and our blessings to do what has to be done to make our space program safe, reliable, and a source of pride to our nation and of benefit to all mankind.

I look forward to receiving your report on implementing the Commission's recommendations.

Sincerely,

Ronald Reagan

The Honorable James C. Fletcher
Administrator
National Aeronautics and
Space Administration
Washington, D.C. 20546

Figure F-1 – Reagan to Fletcher – 6/86

NASA
National Aeronautics and
Space Administration
Washington, D.C
20546
Office of the Administrator

The President
The White House
Washington, DC 20500

Dear Mr. President:

I am pleased to submit the NASA plan to implement the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident. The Commission has rendered the nation an exceptional service in conducting a comprehensive and thorough investigation. NASA agrees with the recommendations and is vigorously implementing them.

An overview of our efforts, the milestones by which we will measure our progress, and a detailed response to the specific Commission recommendations are provided in the enclosed report. A status report on our implementation program will be submitted in June 1987.

The men and women of NASA appreciate your continued personal support.

Respectfully,

James C. Fletcher
Administrator

Enclosure

Figure F-2 – Fletcher to Reagan – Implementation

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Executive Summary

On June 13, 1986, the President directed NASA to implement, as soon as possible, the recommendations of the Presidential Commission on the Space Shuttle Challenger Accident. The President requested that NASA report, within 30 days, how and when the recommendations will be implemented, including milestones by which progress can be measured.

In the months since the Challenger accident, the NASA team has spent many hours in support of the Presidential Commission on the Space Shuttle Challenger Accident and in planning for a return of the Shuttle to safe flight status. Chairman William P. Rogers and the other members of the Commission have rendered the Nation and NASA an exceptional service. The work of the Commission was extremely thorough and comprehensive. NASA agrees with the Commission's recommendations and is vigorously pursuing the actions required to implement and comply with them.

As a result of the efforts in support of the Commission, many of the actions required to safely return the Space Shuttle to flight status have been under way since March. On March 24, 1986, the Associate Administrator for Space Flight outlined a comprehensive strategy, and defined major actions, for safely returning to flight status. The March 24 memorandum (Appendix A) provided guidance on the following subjects:

- actions required prior to next flight,
- first flight/first year operations, and
- development of sustainable safe flight rate.

The Commission report was submitted to the President on June 9, 1986. Since that time, NASA has taken additional actions and provided direction required to comply with the Commission's recommendations (Appendix B). A summary of the key milestones is included at the end of the Executive Summary.

The NASA Administrator and the Associate Administrator for Space Flight will participate in the key management decisions required for implementing the Commission recommendations and for returning the Space Shuttle to flight status. NASA will report to the President on the status of the implementation program in June 1987.

The Commission report included nine recommendations, and a summary of the implementation status for each is provided:

Recommendation I

Solid Rocket Motor Design: On March 24, 1986, the Marshall Space Flight Center (MSFC) was directed to form a Solid Rocket Motor (SRM) joint redesign team to include participation from MSFC and other NASA centers as well as individuals from outside NASA. The team includes personnel from Johnson Space Center, Kennedy Space Center, Langley Research Center, industry, and the Astronaut Office. To assist the redesign team, an expert advisory panel was appointed which includes 12 people with six coming from outside NASA.

The team has evaluated several design alternatives, and analysis and testing are in progress to determine the preferred approaches which minimize hardware redesign. To ensure adequate program contingency in this effort, the redesign team will also develop, at least through concept definition, a totally new design which does not utilize existing hardware. The design verification and certification program will be emphasized and will include tests which duplicate the actual launch loads as closely as feasible and provide for tests over the full range of operating conditions. The verification effort includes a trade study which has been under way for several weeks to determine the preferred test orientation (vertical or horizontal) of the full-scale motor firings. The Solid Rocket Motor redesign and certification schedule is under review to fully understand and plan for the implementation of the design solutions as they are final-

Figure F-4 – NASA Implementation: Executive Summary – Page 1

ized and assessed. The schedule will be reassessed after the SRM Preliminary Design Review in September 1986. At this time it appears that the first launch will not occur prior to the first quarter of 1988.

Independent Oversight: In accordance with the Commission's recommendation, the National Research Council (NRC) has established an Independent Oversight Group chaired by Dr. H. Guyford Stever and reporting to the NASA Administrator. The NRC Oversight Group has been briefed on Shuttle system requirements, implementation, and control; Solid Rocket Motor background; and candidate modifications. The group has established a near-term plan that includes briefings and visits to review in-flight loads; assembly processing; redesign status; and other solid rocket motor designs, including the Titan. Longer term plans are being formulated by the group including participation in the Solid Rocket Motor preliminary design review in September 1986.

Recommendation II

Shuttle Management Structure: The Administrator has appointed General Sam Phillips, who served as Apollo Program Director, to study every aspect of how NASA manages its programs, including relationships between various field centers and NASA Headquarters. General Phillips has broad authority from the Administrator to explore every aspect of NASA organization, management and procedures. His activities will include a review of the Space Shuttle management structure.

On June 25, 1986, Astronaut Robert Crippen was directed to form a fact-finding group to assess the Space Shuttle management structure. The group will report recommendations to the Associate Administrator for Space Flight by August 15, 1986. Specifically, this group will address the roles and responsibilities of the Space Shuttle Program Manager to assure that the position has the authority commensurate with its responsibilities. In addition, roles and responsibilities at all levels of program management will be reviewed to specify the relationship between the program organization and the field center organizations. The results of this study will be reviewed with General Phillips and the Administrator with a decision on implementation of the recommendations by October 1, 1986.

Astronauts in Management: Rear Admiral Richard Truly, a former astronaut, has been appointed as Associate Administrator for the Office of Space Flight. Several active astronauts are currently serving in management positions in the agency. The Crippen group will address means to stimulate the transition of astronauts into other management positions. It will also determine the appropriate position for the Flight Crew Operations Directorate within the NASA organizational structure.

Shuttle Safety Panel: A Shuttle Safety Panel will be established by the Associate Administrator for Space Flight not later than September 1, 1986, with direct access to the Space Shuttle Program Manager. This date allows time to determine the structure and function of this panel, including an assessment of its relationship to the newly formed Office of Safety, Reliability, and Quality Assurance, and to the existing Aerospace Safety Advisory Panel.

Recommendation III

Critical Item Review and Hazard Analysis: On March 13, 1986, NASA initiated a complete review of all Space Shuttle program failure modes and effects analyses (FMEA's) and associated critical item lists (CIL's). Each Space Shuttle project element and associated prime contractor is conducting separate comprehensive reviews which will culminate in a program-wide review with the Space Shuttle Program Manager at Johnson Space Center later this year. Technical specialists from outside the Space Shuttle program have been assigned as formal members of each of these review teams. All Criticality 1 and 1R critical item waivers have been cancelled. The teams are required to reassess and resubmit waivers in categories recommended for continued program applicability. Items which cannot

Figure F-5 – NASA Implementation: Executive Summary – Page 2

be revalidated will be redesigned, qualified, and certified for flight. All Criticality 2 and 3 CIL's are being reviewed for reacceptance and proper categorization. This activity will culminate in a comprehensive final review with NASA Headquarters beginning in March 1987.

As recommended by the Commission, the National Research Council has agreed to form an Independent Audit Panel, reporting to the NASA Administrator, to verify the adequacy of this effort.

Recommendation IV

Safety Organization: The NASA Administrator announced the appointment of Mr. George A. Rodney to the position of Associate Administrator for Safety, Reliability, and Quality Assurance on July 8, 1986. The responsibilities of this office will include the oversight of safety, reliability, and quality assurance functions related to all NASA activities and programs and the implementation of a system for anomaly documentation and resolution to include a trend analysis program. One of the first activities to be undertaken by the new Associate Administrator will be an assessment of the resources including workforce required to ensure adequate execution of the safety organization functions. In addition, the new Associate Administrator will assure appropriate interfaces between the functions of the new safety organization and the Shuttle Safety Panel which will be established in response to the Commission Recommendation II.

Recommendation V

Improved Communications: On June 25, 1986, Astronaut Robert Crippen was directed to form a team to develop plans and recommended policies for the following:

- Implementation of effective management communications at all levels.
- Standardization of the imposition and removal of STS launch constraints and other operational constraints.
- Conduct of Flight Readiness Review and Mission Management Team meetings, including requirements for documentation and flight crew participation.

Since this recommendation is closely linked with the recommendation on Shuttle management structure, the study team will incorporate the plan for improved communications with that for management restructure.

This review of effective communications will consider the activities and information flow at NASA Headquarters and the field centers which support the Shuttle program. The study team will present findings and recommendations to the Associate Administrator for Space Flight by August 15, 1986.

Recommendation VI

Landing Safety: A Landing Safety Team has been established to review and implement the Commission's findings and recommendations on landing safety. All Shuttle hardware and systems are undergoing design reviews to insure compliance with the specifications and safety concerns. The tires, brakes, and nose wheel steering system are included in this activity, and funding for a new carbon brakes system has been approved. Runway surface tests and landing aid requirement reviews had been under way for some time prior to the accident and are continuing. Landing aid implementattion will be complete by July 1987. The interim brake system will be delivered by August 1987. Improved methods of local weather forecasting and weather-related support are being developed. Until the Shuttle program has demonstrated satisfactory safety margins through high fidelity testing and during actual landings at Edwards Air Force Base, the Kennedy Space Center landing site will not be used for nominal end-of-mission landings. Dual Orbiter ferry capability has been an issue for some time and will be thoroughly considered during the upcoming months.

Recommendation VII

Launch Abort and Crew Escape: On April 7, 1986, NASA initiated a Shuttle Crew Egress and Escape review. The scope of this analysis includes egress and escape capabilities from launch through landing and will provide analyses, concepts, feasibility assess-

Figure F-6 – NASA Implementation: Executive Summary – Page 3

ments, cost, and schedules for pad abort, bailout, ejection systems, water landings, and powered flight separation. This review will specifically assess options for crew escape during controlled gliding flight and options for extending the intact abort flight envelope to include failure of 2 or 3 main engines during the early ascent phase. In conjunction with this activity, a Launch Abort Reassessment Team was established to review all launch and launch abort rules to ensure that launch commit criteria, flight rules, range safety systems and procedures, landing aids, runway configurations and lengths, performance versus abort exposure, abort and end-of-mission landing weights, runway surfaces, and other landing-related capabilities provide the proper margin of safety to the vehicle and crew. Crew escape and launch abort studies will be complete on October 1, 1986, with an implementation decision in December 1986.

Recommendation VIII

Flight Rate: In March 1986 NASA established a Flight Rate Capability Working Group. Two flight rate capability studies are under way: (1) a study of capabilities and constraints which govern the Shuttle processing flows at the Kennedy Space Center and (2) a study by the Johnson Space Center to assess the impact of flight specific crew training and software delivery/certification on flight rates. The working group will present flight rate recommendations to the Office of Space Flight by August 15, 1986. Other collateral studies are still in progress which address Presidential Commission recommendations related to spares provisioning, maintenance, and structural inspection. This effort will also consider the National Research Council independent review of flight rate which is under way as a result of a Congressional Subcommittee request.

NASA strongly supports a mixed fleet to satisfy launch requirements and actions to revitalize the United States expendable launch vehicle capabilities.

Additionally, a new cargo manifest policy is being formulated by NASA Headquarters which will establish manifest ground rules and impose constraints to late changes. Manifest control policy recommendations will be completed in November 1986.

Recommendation IX

Maintenance Safeguards: A Maintenance Safeguards Team has been established to develop a comprehensive plan for defining and implementing actions to comply with the Commission recommendations concerning maintenance activities. A Maintenance Plan is being prepared to ensure that uniform maintenance requirements are imposed on all elements of the Space Shuttle program. This plan will define the structure that will be used to document (1) hardware inspections and schedules, (2) planned maintenance activities, (3) maintenance procedures configuration control, and (4) maintenance logistics. The plan will also define organizational responsibilities, reporting, and control requirements for Space Shuttle maintenance activities. The maintenance plan will be completed by September 30, 1986.

A number of other activities are underway which will contribute to a return to safe flight and strengthening the NASA organization. A Space Shuttle Design Requirements Review Team headed by the Space Shuttle Systems Integration Office at Johnson Space Center has been assigned to review all Shuttle design requirements and associated technical verification. The team will focus on each Shuttle project element and on total Space Shuttle system design requirements. This activity will culminate in a Space Shuttle Incremental Design Certification Review approximately 3 months prior to the next Space Shuttle launch.

In consideration of the number, complexity, and interrelationships between the many activities leading to the next flight, the Space Shuttle Program Manager at Johnson Space Center has initiated a series of formal Program Management Reviews for the Space Shuttle program. These reviews are structured to be regular face-to-face discussions involving the managers of all major

Figure F-7 – NASA Implementation: Executive Summary – Page 4

Space Shuttle program activities. Specific subjects to be discussed at each meeting will focus on progress, schedules, and actions associated with each of the major program review activities and will be tailored directly to current program activity for the time period involved. The first of these meetings was held at Marshall Space Flight Center on May 5-6, 1986, with the second at Kennedy Space Center on June 25, 1986. Follow-on reviews will be held approximately every 6 weeks. Results of these reviews will be reported to the Associate Administrator for Space Flight and to the NASA Administrator.

On June 19, 1986, the NASA Administrator announced termination of the development of the Centaur upper stage for use aboard the Space Shuttle. Use of the Centaur upper stage was planned for NASA planetary spacecraft launches as well as for certain national security satellite launches. Major safety reviews of the Centaur system were under way at the time of the Challenger accident, and these reviews were intensified in recent months to determine if the program should be continued. The final decision to terminate the Centaur stage for use with the Shuttle was made on the basis that even following certain modifications identified by the ongoing reviews, the resultant stage would not meet safety criteria being applied to other cargo or elements of the Space Shuttle system. NASA has initiated efforts to examine other launch vehicle alternatives for the major NASA planetary and scientific payloads which were scheduled to utilize the Centaur upper stage. NASA is providing assistance to the Department of Defense as it examines alternatives for those national security missions which had planned to use the Shuttle/Centaur.

The NASA Administrator has announced a number of Space Station organizational and management structural actions designed to strengthen technical and management capabilities in preparation for moving into the development phase of the Space Station program. The decision to create the new structure is the result of recommendations made to the Administrator by a committee, headed by General Phillips, which is conducting a long range assessment of NASA's overall capabilities and requirements.

Finally, NASA is developing plans for increased staffing in critical areas and is working closely with the Office of Personnel Management to develop a NASA specific proposal which would provide for needed changes to the NASA personnel management system to strengthen our ability to attract, retain, and motivate the quality work force required to conduct the NASA mission (Appendix C).

Figure F-8 – NASA Implementation: Executive Summary – Page 5

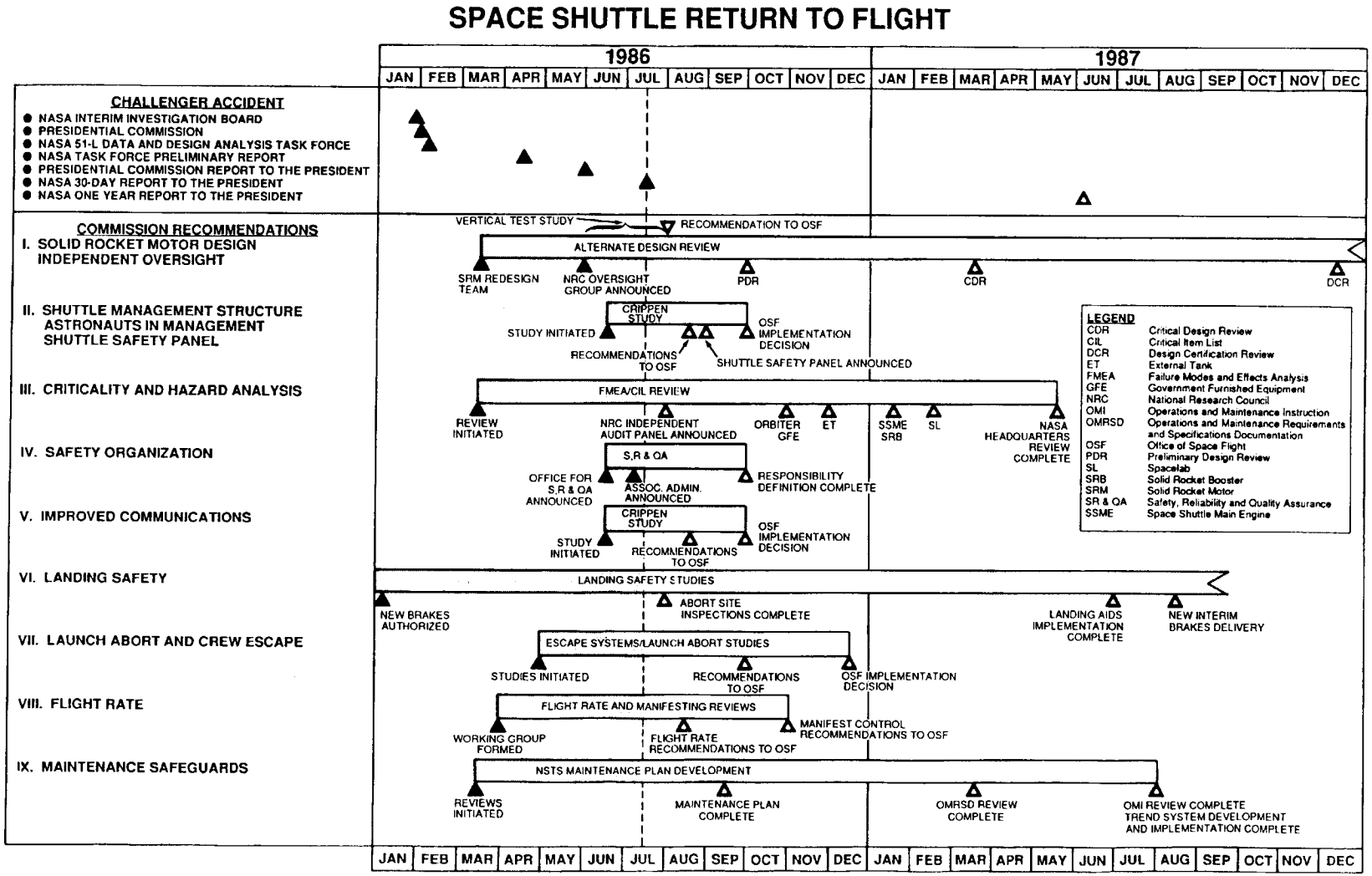


Figure F-9 – Space Shuttle Return to Flight

NASA

National Aeronautics and
Space Administration

Washington, D.C.
20546

Office of the Administrator

TO: M/Associate Administrator for Space Flight

FROM: A/Administrator

SUBJECT: Presidential Commission Recommendations Action Plan

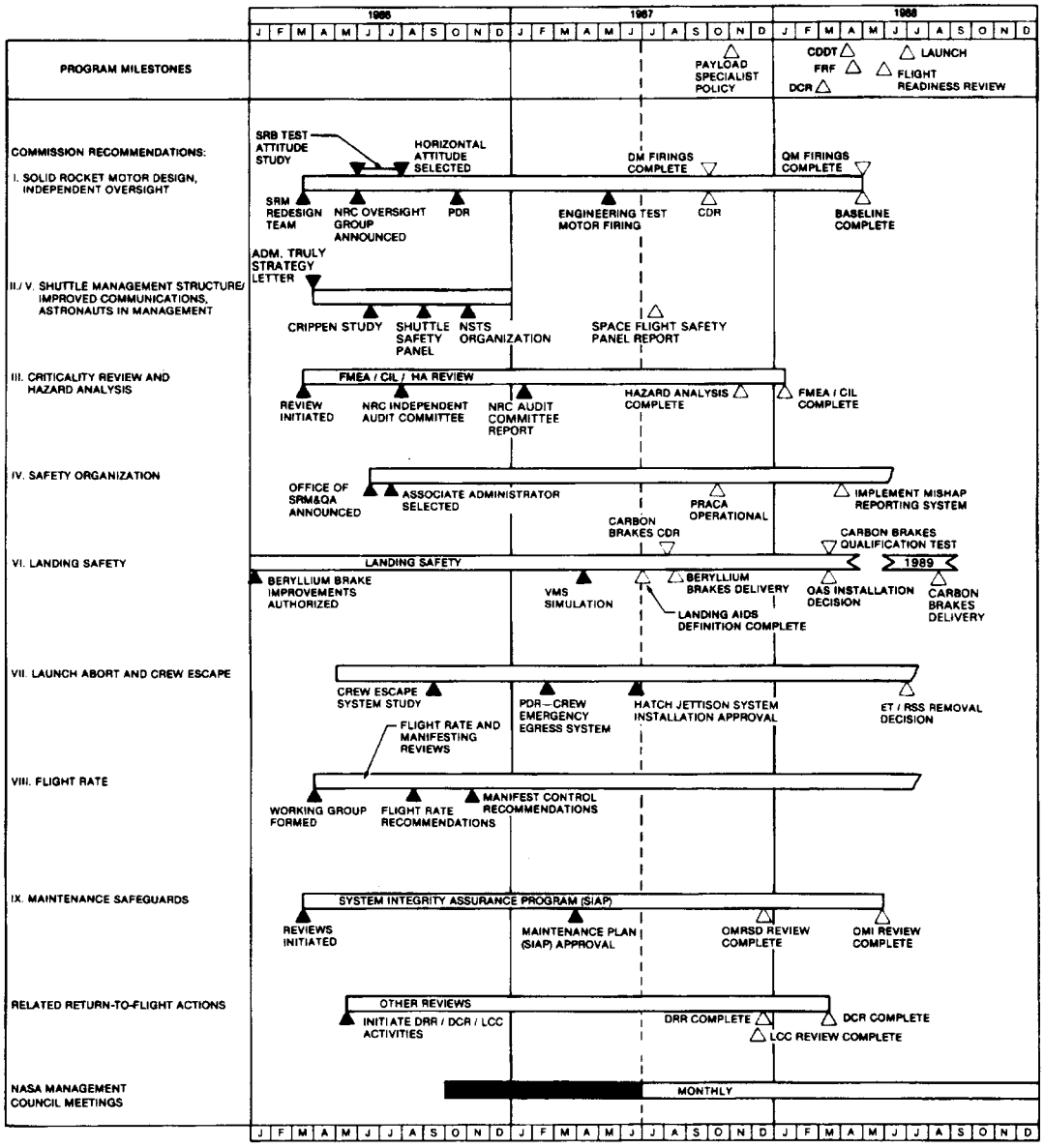
The President has reviewed the report from the Commission on the Space Shuttle CHALLENGER accident and on June 13 directed NASA to undertake a program to implement its recommendations as soon as possible. The President directed me to report to him in 30 days on how and when the Commission's recommendations will be implemented. This report should include milestones by which progress in the implementations process can be measured.

The Office of the Administrator assumes responsibility for recommendation number 4 on safety organization. I have previously announced NASA's establishment of the Office of Safety, Reliability, and Quality Assurance to answer this recommendation. The Office of Space Flight is directed to take the action for all other Commission recommendations and to prepare the NASA report to the President.

I plan to report to the President on July 11, 1986. Please status me on your progress on a weekly basis.

James C. Fletcher

Figure F-10 – Letter from Fletcher to AA for Space Flight – 6/86



KEY					
CDDT	Countdown Demonstration Test	FMEA	Failure Modes and Effects Analysis	PDR	Preliminary Design Review
CDR	Critical Design Review	FRF	Flight Readiness Firing	PRACA	Problem Reporting and Corrective Action
CIL	Critical Items List	HA	Hazard Analysis	QM	Qualification Motor
DCR	Design Certification Review	LCC	Launch Commit Criteria	RSS	Range Safety System
DM	Development Motor	NRC	National Research Council	SRB	Solid Rocket Booster
DRR	Design Requirements Review	OAS	Orbiter Arresting System	SRM	Solid Rocket Motor
ET	External Tank	OMI	Operations and Maintenance Instruction	SRM&QA	Safety, Reliability, Maintainability, and Quality Assurance
		OMRSD	Operational Maintenance Requirements Specification Document	VMS	Vertical Motion Simulator

Figure F-11 – Space Flight Return to Flight

NASA

National Aeronautics and
Space Administration

Washington, D C.
20546

Reply to Attn of M

TO: Distribution

FROM: M/Associate Administrator for Space Flight

SUBJECT: Strategy for Safely Returning the Space Shuttle to Flight Status

This memorandum defines the comprehensive strategy and major actions that, when completed, will allow resumption of the NSTS flight schedule. NASA Headquarters (particularly the Office of Space Flight), the OSF centers, the National Space Transportation System (NSTS) program organization and its various contractors will use this guidance to proceed with the realistic, practical actions necessary to return to the NSTS flight schedule with emphasis on flight safety. This guidance is intended to direct planning for the first year of flight while putting into motion those activities required to establish a realistic and an achievable launch rate that will be safely sustainable. We intend to move as quickly as practicable to complete these actions and return to safe and effective operation of the National Space Transportation System.

Guidance for the following subjects is included:

- o ACTIONS REQUIRED PRIOR TO THE NEXT FLIGHT
- o FIRST FLIGHT/FIRST YEAR OPERATIONS
- o DEVELOPMENT OF SUSTAINABLE SAFE FLIGHT RATE

ACTIONS REQUIRED PRIOR TO THE NEXT FLIGHT:

Reassess Entire Program Management Structure and Operation

The NSTS program management philosophy, structure, reporting channels and decision-making process will be thoroughly reviewed and those changes implemented which are required to assure confidence and safety in the overall program, including the commit to launch process. Additionally, the Level I/II/III budget and management relationships will be reviewed to insure that they do not adversely affect the NSTS decision process.

Figure F-12 – Truly Strategy Letter – Page 1

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Solid Rocket Motor (SRM) Joint Redesign

A dedicated SRM joint design group will be established at MSFC, with selective participation from other NASA centers and external organizations, to recommend a program plan to quantify the SRM joints problem and to accomplish the SRM joints redesign. The design must be reviewed in detail by the program to include PDR, CDR, DCR, independent analysis, DM-QM testing, and any other factors necessary to assure that the overall SRM is safe to commit to launch. The type and content of post-flight inspections for the redesigned joints and other flight components will be developed in detail, with criteria developed for commitment to the next launch as well as reusability of the specific flight hardware components.

Design Requirements Reverification

A review of the NSTS Design Requirements (Vol. 07700) will be conducted to insure that all systems design requirements are properly defined. This review will be followed by a delta DCR for all program elements to assure the individual projects are in compliance with the requirements.

Complete CIL/OMI Review

All Category 1 and 1R critical items will be subjected to a total review with a complete reapproval process implemented. Those items which are not revalidated by this review must be redesigned, certified, and qualified for flight. The review process will include a review of the OMI's, OMRSD's, and other supporting documentation which is pertinent to the test, checkout, or assembly process of the Category 1 and 1R flight hardware. KSC will continue to be responsible for all OMI's with design center concurrence required for those which affect Category 1 and 1R items. Category 2 and 3 CIL's will be reviewed for reacceptance and to verify their proper categorization.

Complete OMRSD Review

The OMRSD will be reviewed to insure that the requirements defined in it are complete and that the required testing is consistent with the results of the CIL review. Inspection/retest requirements will be modified as necessary to assure flight safety.

Launch/Abort Reassessment

The launch and launch abort rules and philosophy will be assessed to assure that the launch and flight rules, range safety systems/ operational procedures, landing aids, runway configuration and length, performance vs. TAL exposure, abort weights, runway surface, and other landing related capabilities provide an acceptable margin of safety to

Figure F-13 – Truly Strategy Letter – Page 2

the vehicle and crew. Additionally, the weather forecasting capability will be reviewed and improved where possible to allow for the most accurate reporting.

FIRST FLIGHT/FIRST YEAR OPERATIONS

First Flight

The subject of first flight mission design will require extensive review to assure that we are proceeding in an orderly, conservative, safe manner. To permit the process to begin, the following specific planning guidance applies to the first planned mission:

- o daylight KSC launch
- o conservative flight design to minimize TAL exposure
- o repeat payload (not a new payload class)
- o no waiver on landing weight
- o conservative launch/launch abort/landing weather
- o NASA-only flight crew
- o engine thrust within the experience base
- o no active ascent/entry DTO's
- o conservative mission rules
- o early, stable flight plan with supporting flight software and training load
- o daylight EDW landing (lakebed or runway 22)

First Year

The planning for the flight schedule for the first year of operation will reflect a launch rate consistent with this conservative approach. The specific number of flights to be planned for the first year will be developed as soon as possible and will consider KSC and VAFB work flow, software development, controller/crew training, etc. Changes to flight plans, ascent trajectories, manifest, etc., will be minimized in the interest of program stability. Decisions on each launch will be made after thorough review of the previous mission's SRM joint performance, all other specified critical systems performance and resolution of anomalies.

In general, the first year of operation will be maintained within the current flight experience base, and any expansion of the base, including new classes of payloads, will be approved only after very thorough safety review. Specifically, 109 percent thrust levels will not be flown until satisfactory completion of the MPT testing currently being planned, and the first use of the Filament Wound Case will not occur with the first use of 109 percent SSME thrust level. Every effort will be made to conduct the first VAFB flight on an expeditious and safe schedule which supports national security requirements.

Figure F-14 – Truly Strategy Letter – Page 3

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DEVELOPMENT OF SUSTAINABLE SAFE FLIGHT RATE

The ultimate safe, sustainable flight rate, and the buildup to that rate, will be developed utilizing a "bottoms-up" approach in which all required work for the standard flow as defined in the OMRSD is identified and that work is optimized in relation to the available work force. Factors such as the manifest, nonscheduled work, in-flight anomaly resolution, mods, processing team workloads, work balancing across shifts, etc., will be considered, as well as timely mission planning, flight product development and achievable software delivery capability to support flight controllers and crew training. This development will consider the availability of the third orbiter facility, the availability of spares, as well as the effects of supporting VAFB launch site operations.

THE BOTTOM LINE

The Associate Adminstrator for Space Flight will take the action for reassessment of the NSTS program management structure. The NSTS Program Manager at Johnson Space Center is directed to initiate and coordinate all other actions required to implement this strategy for return to safe Shuttle flight.

I know that the business of space flight can never be made to be totally risk-free, but this conservative return to operations will continue our strong NASA/Industry team effort to recover from the Challenger accident. Many of these items have already been initiated at some level in our organizations, and I am fully aware of the tremendous amount of dedicated work which must be accomplished. I do know that our nation's future in space is dependent on the individuals who must carry this strategy out safely and successfully. Please give this the widest possible distribution to your people. It is they who must understand it, and they who must do it.

Richard H. Truly

Figure F-15 – Truly Strategy Letter – Page 4