

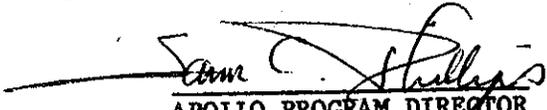
30 September 68

APOLLO PROGRAM DIRECTIVE NO. 46

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FROM:


APOLLO PROGRAM DIRECTOR

SUBJECT : Apollo Mission Rules

OFFICE OF PRIME RESPONSIBILITY: Apollo Operations (MAO)

ACTION : Organizations conducting or supporting Apollo mission operations will participate in the development and execution of Apollo Mission Rules as set forth herein.

REFERENCES: (a) Apollo Program Development Plan, M-D MA 500
(b) Apollo Mission Assignments, M-D MA 500-11

I. PURPOSE

This directive establishes the requirement for the issuance of Mission Rules prior to each Apollo mission. It defines the system to control the flight test and operational decisions necessary to insure maximum crew safety and the highest probability of accomplishing the objectives identified in references (a) and (b).

II. SCOPE AND APPLICABILITY

A. This directive sets forth the general contents and description of the Mission Rules and it establishes the responsibilities for preparation, coordination, and review of the rules for each mission. General rules and definitions to be incorporated in the two separate sets of rules published by KSC and MSC are included as appendices.

B. All Mission Rules will comply with this directive except where specifically exempted by the Apollo Program Director.

C. This directive applies to the Office of Manned Space Flight and to the Manned Space Flight installations. It also provides guidance to the Office of Tracking and Data Acquisition, Goddard Space Flight Center, and to the Department of Defense in their capacities as support organizations for manned space flight missions.

III. RESPONSIBILITY

A. OMSF

The Apollo Program Director is responsible for the overall Mission Rules policy, the OMSF General Rules, and the Definitions as stated herein. The Apollo Mission Director will act for the

Program Director to ensure the preparation and implementation of the Mission Rules and will concur in changes to the rules. The Director, Apollo Operations will assist the Mission Director in his duties and will coordinate headquarters rules inputs and reviews.

B. MSF Centers

Each center will establish procedures governing Mission Rules activities consistent with Section V of this directive. KSC is responsible for preparing the Launch Mission Rules and MSC is responsible for preparing the Flight Mission Rules as stated in Section V. Each center will formally document all inputs to the Mission Rules.

C. Department of Defense

The DOD Manager for Manned Space Flight Support Operations is requested to insure that DOD operation orders for Apollo missions are consistent with the Mission Rules. The DOD support organizations are requested to coordinate on the Mission Rules as indicated in Section V.

IV. MISSION RULES CONTENT

The Mission Rules will consist of procedural statements containing replanned decisions designed to minimize the amount of real-time rationalization required when non-nominal situations occur during the launch countdown, flight, and recovery operations and during pre-launch tests when applicable. They will be composed of a Launch Mission Rules volume and a Flight Mission Rules volume prepared by KSC and MSC respectively. Each volume will include the specific OMSF General Rules and Definitions contained in Appendices A and B of this directive in addition to the information described below.

A. Launch Mission Rules

These shall cover mandatory and highly desirable onboard instrumentation required to collect data for flight control purposes or post-flight evaluation; mandatory and highly desirable onboard instrumentation required to verify that the space vehicle is ready for launch; redline values defining upper and/or lower limits of pressure, temperature, voltage, current, operating time, etc., for any system/subsystem essential to mission success; mandatory and highly desirable range, instrumentation, and other launch support systems required to prepare and launch the space vehicle and for post-flight analysis of launch; launch window restrictions; weather restrictions; range safety rules jointly established by KSC and the Eastern Test Range; launch abort criteria; launch crew and flight crew safety rules; rules

relating to human or medical aspects of launch preparation and launch; hold/cutoff guidelines; and other information as appropriate.

B. Flight Mission Rules

These shall cover mandatory and highly desirable onboard instrumentation for control of the space vehicle after lift-off; space vehicle nominal and non-nominal system/subsystem performance criteria; trajectory and guidance guidelines; flight abort criteria; criteria for selection of alternate missions in real time; mandatory and highly desirable Mission Control Center, range, and MSFN support required for flight operations and for subsequent analysis and evaluation; rules relating to human or medical aspects of manned flight; mission go/no go criteria based on systems and medical considerations; recovery restrictions; launch window rules pertaining to items such as time of lift-off, launch azimuth, recovery, spacecraft performance limitations, etc; and other information as appropriate.

V. PREPARATION AND REVISION

A. General

Each MSF installation will develop Mission Rules preparation, revision, and distribution procedures and will distribute copies of the procedures to MA and to the other MSF field installations. The procedures shall include, but not be limited to the following:

1. Information relative to general format and structure of the Launch Mission Rules document and the Flight Mission Rules document.
2. Designation of a single point-of-contact for policy and commitment in processing Mission Rules correspondence and communications received from MA or from other MSF installations.
3. Identification and description of responsibilities of working level operational elements active in developing and processing Mission Rules.
4. Procedures for the development, coordination, and necessary approval action, including designation of approval authorities within the center.
5. Mission Rules review and change procedures including the procedures for obtaining Mission Director's concurrence.

B. Launch Mission Rules

For each mission, KSC will develop and publish Preliminary and Final Launch Mission Rules for the guidance of the Mission Director, Launch Director, and supporting organizations.

1. MSFC will provide documented launch vehicle inputs that will include launch redlines and postflight evaluation instrumentation requirements to KSC for the Preliminary Launch Mission Rules five months (150 days) prior to the current OMSF officially scheduled launch date. MSC will provide documented space vehicle flight control instrumentation requirements, spacecraft launch redlines and post-flight evaluation instrumentation requirements, and prelaunch and launch flight crew medical guidelines to KSC for the Preliminary Launch Mission Rules five months (150 days) prior to the current OMSF officially scheduled launch date. Distribution of Preliminary Launch Mission Rules will be made three and one-half months (105 days) prior to launch and will be updated as required.

2. MSF Centers will provide documented inputs to KSC for the Final Launch Mission Rules two and one-half months (75 days) prior to launch. Final Launch Mission Rules will reflect concurrence by the MSFC Mission Operations Manager and the MSC Director of Flight Operations or his designated representative and will be approved by the KSC Director of Launch Operations with the concurrence of the KSC Apollo Program Manager. Distribution of Final Launch Mission Rules will be made one month prior to launch.

C. Flight Mission Rules

For each mission, MSC will develop and publish Preliminary and Final Flight Mission Rules for the guidance of the Mission Director, Flight Director, Flight Operations Team, and support organizations.

1. MSFC will provide documented launch vehicle inputs to MSC for the Preliminary Flight Mission Rules six months prior to the current OMSF officially scheduled launch date. Distribution of Preliminary Flight Mission Rules will be made four months prior to launch and will be updated as required.

2. MSFC will provide documented inputs to MSC for the Final Flight Mission Rules two months prior to launch. Final Flight Mission Rules will reflect concurrence by the MSFC Mission Operations Manager or his designated representative and the MSC Director of the Apollo Spacecraft Program Office and will be approved by the MSC Director of Flight Operations. Distribution of Final Flight Mission Rules will be made one month prior to launch.

3. DDMS is requested to ensure that operating procedures for Apollo missions are consistent with Mission Rules and include contingency procedures that pertain specifically to recovery operations.

D. Coordination and Review**1. DOD Coordination**

a. Copies of the Launch and Flight Mission Rules and changes thereto will be forwarded directly to DOD Manager for Manned Space Flight Support Operations (Attention: DDMS) and to the Deputy for Range Operations, Eastern Test Range (Attention: ETOOP).

b. Comments by DDMS on the published Mission Rules will be forwarded directly to the Center responsible for their preparation.

c. Comments by ETR will be forwarded to KSC, MSC, and DDMS.

2. Mission Rules Review

a. KSC will conduct a review of the Launch Mission Rules and MSC will conduct a review of the Flight Mission Rules as scheduled by the Mission Director. Following these reviews the Mission Director will conduct a review of the Mission Rules for the Apollo Program Director.

b. General status and specific open items from these reviews will be included in the Flight Readiness Review.

E. Revision

1. Prior to the Flight Readiness Test (FRT) or Countdown Demonstration Test (CDDT), whichever occurs first, the Program Director and the Mission Director will be kept informed of the current Mission Rules through normal coordination and distribution.

2. Changes to Mission Rules following the FRT or CDDT, whichever occurs first, will require concurrence of the Mission Director prior to publication. The only exceptions will be administrative changes that do not affect: flight safety, the accomplishment of test objectives, deviations from the nominal mission, or pre-launch constraints.

3. Changes will be sent by the originating organization to the Mission Director in two copies. One copy will be addressed to his office at KSC and the other to Headquarters, attention MAO.

4. Transmission of the change request may be by Air Mail Special Delivery, Datafax, or verbally if the situation requires.

5. Launch Mission Rules change requests from MSC, MSFC, or internal KSC organizations will be submitted to the Mission Director with information copies to the appropriate KSC offices.

6. Flight Mission Rules revisions will be coordinated with the Mission Director after MSC approval.

7. The Mission Director will officially notify the appropriate center point-of-contact of his concurrence or non-concurrence with each change request.

VI. IMPLEMENTATION

This directive is effective upon receipt and supercedes NMI 8020.9 dated April 12, 1967. Launch and Flight Mission Rules will adhere to the instructions contained herein and will incorporate the OMSF General Rules (Appendix A) and Definitions (Appendix B) as established by this directive.

APPENDIX A

OMSF GENERAL RULES

1. Mission Rules are effective during the launch countdown, flight and recovery operations, and during prelaunch tests when applicable. They are based on mission objectives as stated in the Apollo Flight Mission Assignments Document M-D MA 500-11. Proposed changes to the mission objectives stated in the Mission Assignments Document shall require AA/MSF approval.
2. The Director of Flight Operations and the Director of Launch Operations or their designated representative will insure coordination of their respective mission rule changes with the Mission Director and other appropriate organizations.
3. Following the CDDT or FRT, whichever occurs first, Mission Director approval and concurrence will be required on all rules changes affecting safety, accomplishment of test objectives, deviations from the nominal mission and prelaunch constraints. Concurrence may be obtained verbally if time considerations so dictate.
4. During the conduct of the mission, the Mission Director will be advised of all recommendations that involve changes to: Mission Objectives, Mission Rules, Flight Plan content, or Launch/Flight Safety.
5. Within their respective areas of responsibility, the Command Pilot, the Launch Director, Flight Director, DOD Manager for MSF Support Operations, and the Mission Director may take or recommend any action required for optimum conduct of the mission.
6. The Command Pilot, Spacecraft Test Conductor, Launch Vehicle Test Conductor, Space Vehicle Test Supervisor, Launch Operations Manager, Launch Director, Flight Director, DOD Manager for Manned Space Flight Support Operations, or the Mission Director may request a hold for conditions within their respective areas of responsibility.
7. During the Countdown the Launch Vehicle and Spacecraft Program Managers and appropriate operations managers shall provide technical advice and support directly to the Launch Operations Manager and Launch Director. The latter two will keep the Mission Director fully informed of problems and proposed solutions. During the Flight phase of operations, similar support as required will be provided to the Flight Director and the MSC Director of Flight Operations. The Mission Director will be kept fully informed by these individuals of problems and proposed solutions during the applicable phases of the mission.

8. When time permits, the failure of a mandatory or highly desirable item will be reported to the Mission Director by the Launch Director or the Flight Director. The initial report will include the position or facility that detected the malfunction. Subsequently, the Mission Director will be informed of estimated time to repair and recommended proceed, hold, recycle, or scrub action as it develops.
9. If a mandatory item fails during the countdown, it will be corrected prior to launch, holding or recycling the countdown as necessary. If a mandatory item cannot be corrected to permit liftoff within the launch window, the Mission Director may proceed with the launch after coordination with the appropriate operations and program managers. Generally, the loss of a mandatory item will result in a scrub.
10. As the designated representative of the Program Director, only the Mission Director may scrub the mission. Further, the Mission Director retains the authority to downgrade a mandatory item. The authority shall be exercised as the circumstances dictate after appropriate recommendations from the Program Managers, Launch Director, and Flight Director.
11. Consideration will be given to the repair of any highly desirable item, but in no case will the launch be scrubbed for any single highly desirable item. If two or more highly desirable items fail and/or other aggravating circumstances occur, the Mission Director may scrub the mission after coordination with the appropriate operations and program managers.
12. The countdown will not be held nor the launch scrubbed for failure of desirable items.
13. Whenever possible, the launch site and MCC will verify telemetry readout discrepancies occurring prior to liftoff. If the MCC loses a parameter but the launch site has a valid readout, the MCC will continue on the launch site readout. This is true except for those mandatory parameters (listed in the Flight Mission Rules) upon which mission rules action is taken. In this case, a hold may be called to evaluate the problem.
14. The countdown will continue where possible concurrently with correction of an existing problem.
15. Prior to liftoff, the Launch Director will be responsible for all actions in the event of launch site emergencies except for recovery operations of spacecraft and crew resulting from a pad abort.
16. The Launch Operations Manager may send an abort request from the time the launch escape system is armed until the space vehicle reaches sufficient altitude to clear the top of the umbilical tower. The criteria for sending an abort request will be established in the Launch Rules.

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17. From lift-off to tower clear, the Launch Director and Flight Director will have concurrent responsibility for sending an abort request. The criteria for sending an abort request during this period will be established in the Launch and Flight Rules respectively.
18. Where possible, all manual abort requests from the ground during flight will be based on two independent indications of the failure. Crew abort action will normally be based upon two cues.
19. The Launch Operations Manager will inform MCC when the space vehicle clears the umbilical tower by saying "Clear Tower" over one of the loops from KSC to MCC.
20. In the event of non-catastrophic space vehicle collision with the umbilical tower or other contingencies which do not require immediate action, the Launch Operations Manager will continue to evaluate the extent of the damage and provide information to the Flight Director for any action necessary after umbilical tower clearance.
21. Complete ground control of the space vehicle is assumed by the Flight Director when the space vehicle reaches sufficient altitude to clear the top of the umbilical tower.
22. In the MCC, the Flight Director, Flight Dynamics Officer, and Booster Systems Engineer will have the capability to send an abort request signal. The criteria for sending an abort request will be established in the Flight Rules.
23. The Command Pilot may initiate such inflight action as he deems essential for crew safety.
24. Flight crew safety shall take precedence over the accomplishment of mission objectives.
25. In the event of communications loss between the Manned Space Flight Network and the spacecraft, the Command Pilot will assume responsibility for mission conduct as described within the Flight Rules.
26. The Flight Director, through the Recovery Coordinator, will provide the DOD Manager for Manned Space Flight Support Operations the predicted location and time of splashdown.
27. The DOD Manager for MSF Support Operations is responsible for recovery and command and control of DOD Recovery Forces. Recommendations, guidelines and requirements as set forth by NASA will be considered to effect safe and expeditious recovery of the flight crew and spacecraft.

APPENDIX B

DEFINITIONS

REDLINE: A redline value is a maximum and/or minimum limit of a critical parameter necessary to identify vehicle, system, and component performance and operation. Redline values will be established such that further degradations of the system or component could lead to a failure to accomplish the primary mission.

REDLINE FUNCTION: A redline function is a parameter that has been identified to monitor the functioning of a unit to insure the operational performance of that unit is acceptable to meet the primary mission. Redline functions are mandatory.

OBJECTIVES:

Primary Objective: A statement of the primary purpose of flight. When used in Center control documentation, the primary objective may be amplified but not modified. Detailed test objectives will be generated and amplified to fulfill each primary objective.

Principal Detailed Test Objective: A detailed test objective which must be accomplished prior to the lunar landing mission. Any principal detailed test objective not satisfactorily completed on the assigned mission can be attempted on a subsequent mission without major impact.

Mandatory Detailed Test Objective: A principal detailed test objective which must be satisfactorily completed on the assigned mission. Failure to do so would unduly compromise subsequent flight schedules and/or require subsequent space vehicle reconfiguration.

Secondary Detailed Test Objective: A detailed test objective which would provide significant data or experience but which is not a prerequisite to the lunar landing mission.

MANDATORY (M): A mandatory item is a space vehicle or operational support element that is essential for accomplishment of the primary mission, which includes pre-launch, flight, and recovery operations that insure crew safety and effective operational control as well as the attainment of the mandatory detailed test objectives.

HIGHLY DESIRABLE (HD): A highly desirable item is a space vehicle or operational support element that supports and enhances the accomplishment of the primary mission and is essential for the accomplishment of the principal detailed test objectives.

DESIRABLE (D): A desirable item is a space vehicle element or operational support element that is not essential for the accomplishment of the primary mission.

COUNTDOWN: The period of time starting with launch vehicle power up for the launch (or simulated launch) which includes service structure removal, launch vehicle cryogenic tanking, spacecraft closeout, and the terminal count.

HOLD: Interruption or delay of the countdown for any reason such as: unfavorable weather, repair of hardware, or correction of conditions unsatisfactory for launch or flight.

HOLD-POINT: A predetermined point where the countdown may be conveniently interrupted.

PROCEED: Continue in accordance with prescribed countdown procedures.

RECYCLE: The countdown is stopped and returned to a designated point or as specified in the Launch Mission Rules.

SCRUB: The countdown is terminated to be rescheduled.

CUT-OFF: The automatic or manual command to stop the launch sequence after initiation of the "automatic launch sequence."

LIFT-OFF: The event determined by the Instrument Unit umbilical disconnect signal and is the point in time when plus time commences.

ABORT: Mission termination by unscheduled intentional separation of the spacecraft from the launch vehicle prior to orbital insertion.

EARLY MISSION TERMINATION: Unscheduled intentional mission termination at or after orbital insertion.

MEASUREMENT: A measurement is a specific data channel of instrumentation monitoring a single function.

INSTRUMENTATION: Instrumentation is the equipment that acquires, transmits and monitors data for performance evaluation of space vehicle and operational support items.