

APOLLO PROGRAM DIRECTIVE NO. 20

MA 009-020-1A

TO: DISTRIBUTION

FROM:

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APOLLO PROGRAM DIRECTOR

SUBJECT: Apollo Program Flight Mission Directive for Apollo-Saturn
204A Mission

- REFERENCES:
- (a) Apollo Program Development Plan, MA001.00-1, Chapter 14
 - (b) MSFC Flight Mission Directive, Apollo Saturn 204A and 204B Missions, dated November 15, 1965
 - (c) Mission Requirements for Apollo Spacecraft Development Mission 204A/205, Rev. 1 dated February 16, 1966
 - (d) Apollo Mission Data Specification "D", Apollo Saturn 204A and 204B (no date)
 - (e) AS-204A Spacecraft 012 Reference Trajectory 65-FM-134 dated November 1965

1.0 MISSION PURPOSE

- 1.1 General: The Apollo Saturn 204A Mission is an earth-orbital manned mission of up to 14 days duration. An unmanned backup mission (designated AS-204B) has also been planned for this flight and will be covered by a subsequent Apollo Program Flight Mission Directive.
- 1.2 Purpose: The purpose of the AS-204A Mission is to verify the Block I CSM/Crew Operations during an earth-orbital mission of up to 14 days duration with safe recovery of the astronauts.
- 1.3 Primary Objectives:
- (a) The primary objectives of the AS-204A Mission shall be those identified in the Apollo Flight Mission Assignments, SE 010-000-1. When appearing in the Mission Directive, they may be amplified but not modified, as required by the Centers. The primary objectives are those which are mandatory. Malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to achieve these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

(b) The AS-204A Mission Primary Objectives are as follows:

1. Verify Spacecraft/Crew Operations for a mission of up to 14 days duration.
2. Determine CSM subsystem performance in earth-orbital environment.
3. Evaluate S-IVB and IU Checkout in orbit.
4. Demonstrate the adequacy of the launch vehicle attitude control system for orbital operation.
5. Demonstrate crew/CSM/launch vehicle/mission support facilities performance during long duration earth-orbital mission.

1.4 In-Flight Experiments:

The following in-flight experiments will be performed during the AS-204A flight:

M-003 In-Flight Exerciser
M-004 In-Flight Phonocardiogram
M-005 Bioassays Body Fluids
M-006 Bone Demineralization
M-009 Human Otolith Function
M-011 Cytogenetic Blood Studies
S-005 Synoptic Terrain Photography
S-006 Synoptic Weather Photography
T-003 In-Flight Nephelometer

2.0 GENERAL FLIGHT PLAN

- 2.1 Mission: The AS-204A mission will be an earth-orbital, manned flight of up to 14 days duration. The following summarizes the general flight plan requirements for this mission.
- 2.2 Launch Vehicle Powered Flight: AS-204A will be launched from Launch Complex 34 at Cape Kennedy with an initial flight azimuth of 72° from North. The first stage trajectory will follow that defined for the nominal manned earth-orbital Saturn IB. The launch escape

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tower will nominally be jettisoned approximately 20 seconds after S-IB/S-IVB stage separation command. Approximately 20 seconds after S-IVB ignition, active adaptive guidance is initiated providing the control necessary to insert the vehicle into an initial elliptical earth orbit with a perigee of approximately 85 nautical miles and an apogee of approximately 130 nautical miles. The S-IVB attitude control system will have the capability to provide 4-1/2 hours of attitude control in earth orbit. The S-IVB will establish and maintain the attitude orientation required for separation.

- 2.3 Spacecraft Flight Profile: S-IVB/CSM separation will be accomplished using the SM RCS. CSM separation from the S-IVB will occur not later than the third revolution. The spacecraft flight profile will be based on the mission requirement for a manned earth-orbital mission of up to 14 days duration. The mission includes at least eight SPS starts to evaluate the cold and hot soak SPS performance as well as the G&N and S&C systems performance. The SM RCS will always have the capability to de-orbit at least once during each orbit of the flight. The final or eighth SPS burn will be a de-orbit maneuver for landing in the vicinity of Bermuda approximately 14 days after lift-off.
- 2.4 Recovery: The normal recovery of the CM will be east of Bermuda. Provision will be made to recover the astronauts and the CM following either a normal SPS de-orbit or an SM RCS de-orbit.
- 2.5 Payload Requirement: The weight of the CSM and adapter at launch vehicle spacecraft separation will be approximately 35,300 pounds. The launch vehicle payload capability will exceed the CSM and adapter separation weight requirement by at least the amount required to carry the LES until jettisoned after S-IB/S-IVB separation.
- 2.6 Mission Support Requirements: These requirements will be supplied in "Program Support Requirements" document to be issued by the Operations Support Requirements Office, Mission Operations, OMSF, approximately four months prior to launch.

3.0 CONFIGURATION

- 3.1 Launch Vehicle: The major differences of launch vehicle SA-204 from previous launch vehicles SA-201 and SA-202 are as follows:

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S-IB Stage

- (a) Saturn IB operational propellant tanks, skirts, thrust structure, heat shield and fairings.
- (b) Saturn IB operational lox vent and interconnect system.

S-IVB Stage

- (a) Saturn IB operational aft skirt.
- (b) Reduced LH₂ tank operating pressure from 42 to 39 psi.
- (c) Time delay circuit for propellant depletion engine cut-off.

Instrument Unit

No major hardware differences.

- 3.2 Spacecraft: CSM 012 will be a standard Block I command and service module with all operational subsystems. A production service module LEM adapter (SLA-5) will be used. Because Block I CSM has no LEM interface provisions, LEM is replaced by the structural tie-bar for this mission.

The major exceptions to an operational Block I CSM configuration for the AS-204A mission are as follows:

- (a) R&D instrumentation and telemetry.
- (b) No S-band high gain antenna.

4.0 SUPPORTING TEST CONSTRAINTS

- 4.1 Qualification: All flight critical components of the spacecraft and launch vehicle will be ground qualified and/or certified and acceptance tested prior to launch.
- 4.2 Launch Vehicle: The following major flight stage and acceptance tests will be performed:
 - (a) Manufacturing checkout of S-IB-204, S-IVB-204, and IU.

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- (b) Static test of S-IB-204, S-IVB-204.
- (c) Post static checkout of S-IB-204, S-IVB-204.
- (d) KSC inspection tests of S-IB-204, S-IVB-204, and IU.

The complete Saturn IB ground test program including structural, battleship, all-systems dynamic and facilities checkout will be successfully completed and all major ground test anomalies will be resolved.

4.3 Spacecraft: The following major flight article ground tests will be performed on CSM 012:

- (a) Factory checkout and acceptance tests.
- (b) KSC inspection tests.

In addition, the following major spacecraft ground tests will be performed to support the AS-204A Mission:

- (a) Manned thermal vacuum chamber tests of CSM 008.
- (b) Service module propulsion tests of SM 001.
- (c) Structural tests of SM 004 and CM 004A.
- (d) Post landing qualification tests of CM 007.

All major SC ground test and certification test anomalies critical to the AS-204A Mission will be understood and resolved prior to the AS-204A Mission.

4.4 Prior Flight Missions: All launch vehicle and spacecraft test anomalies resulting from the AS-201, AS-203, and AS-202 Missions which could degrade crew safety or interfere with primary objectives will be fully understood, explained and corrected prior to the flight of AS-204A.

4.5 Design Certification Review (DCR): A DCR will be conducted for the AS-204A Mission to certify the design of the total space vehicle system for flight worthiness and manned flight safety in accordance with Apollo Program Directive No. 6, dated August 12, 1965.

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- 4.6 Certification: A Certificate of Flight Worthiness (COFW as outlined in NPC 500-10) for each stage, IU, and module is required prior to shipment from the factory and after static firing if appropriate. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close-out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 dated January 25, 1966.

5.0 RESPONSIBILITIES

5.1 MSF:

- (a) The Apollo Program Director is responsible for over-all management of the space vehicle development including definition of mission objectives, the flight hardware configuration, supporting ground test constraints, resolution of prior flight test constraints, and the integration and checkout of the space vehicle prior to launch.
- (b) The Mission Operations Director is responsible for coordination of all mission operations planning activity and for insuring that all requirements, plans, schedules, procedures and directives required to conduct the mission are generated. Over-all organizational responsibilities and relations are given in reference (a).

5.2 MSFC:

- (a) MSFC is responsible for the development of the SA-204 launch vehicle and engines and for the associated ground support equipment.
- (b) MSFC is responsible for the stages and stage associated GSE checkout and acceptance, and delivery of the stages and GSE to KSC.
- (c) MSFC is to provide the technical support to KSC as required during the acceptance, prelaunch checkout, and the launch phase of the mission.

5.3 MSC:

- (a) MSC is responsible for the development of the spacecraft for the AS-204A Mission and for the associated spacecraft GSE.

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- (b) MSC is responsible for the factory checkout and delivery of spacecraft modules and associated GSE.
- (c) MSC is to provide the technical support to KSC as required during the acceptance, checkout, prelaunch, and launch phases of the mission.

5.4 KSC:

- (a) KSC is responsible for the development and activation of the launch and checkout facilities.
- (b) KSC is responsible for GSE preparation and prelaunch checkout of the launch vehicle and spacecraft as delegated by the Centers.
- (c) KSC is responsible for the task of physically integrating and checking out the total space vehicle with technical support from MSFC and MSC as required.

6.0 IMPLEMENTATION

The MSFC Mission Directive (reference b) which provides the specific detailed requirements and references necessary to carry out the launch vehicle phases of the mission are considered an integral part of this Mission Directive and are hereby approved.

In lieu of an MSC Mission Directive, the MSC working documents covering mission requirements, specifications and spacecraft trajectory information for the AS-204A Mission (references c, d and e) are considered integral parts of this Mission Directive.

Subsequent changes and future revisions to the MSFC Mission Directive and to the MSC working documents noted above which conflict with the requirements stated herein will require coordination between the Centers and the review and approval of the Apollo Program Director. Other revisions to the MSFC Directive or the MSC working documents will be coordinated between Centers as required with copies submitted to the Director, Apollo Test, Code MAT, for information.

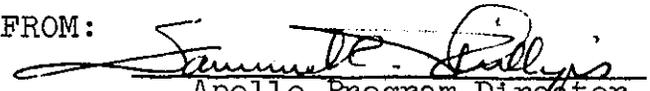
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APOLLO PROGRAM DIRECTIVE NO. 20A

TO : Distribution

FROM:


Apollo Program Director

SUBJECT: Addendum to APO Directive NO. 20 Apollo Program Flight
Mission Directive for Apollo-Saturn 204A Mission

I. Purpose

The purpose of this addendum is to record changes in the AS-204
Primary Mission Objectives listed in the subject directive.

II. Changes

- (1) Change paragraph 1.3(b) 1 APO Directive 20 to read "Verify
Spacecraft/Crew operations."
- (2) Change paragraph 1.3(b) 5 APO Directive 20 to read "Demonstrate
Crew/CSM/launch vehicle/mission support facilities performance
during an earth orbital mission."