

TM052-001-1A

**OFFICE OF  
MANNED SPACE FLIGHT**

**APOLLO PROGRAM**

**APOLLO 11  
FLIGHT READINESS REVIEW**

**JUNE 1969**



**PREPARED BY APOLLO PROGRAM OFFICE**

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION**

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APOLLO 11 MISSION

MISSION READINESS ASSESSMENT

June 17, 1969

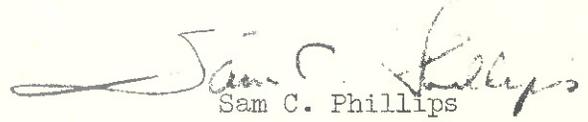
An assessment of the flight readiness of the Apollo 11 Mission System has been accomplished by the Flight Readiness Review conducted at Kennedy Space Center on June 17, 1969.

The Apollo 11 Flight Readiness Review was proceeded by earlier readiness reviews as follows:

Apollo 11 Mission Design Certification Review - Phase I	8 April 1969
Apollo 11 Mission Lunar Surface Operations Demonstration - Phase II	22 April 1969
Apollo 11 Mission Design Certification Review - Phase III	7 May 1969
LC-39 Launch Readiness Review	6 June 1969
CSM-107/LM-5 Pre-Flight Readiness Review	9 June 1969

On the basis of closure of all action items and open work from the above listed reviews, the resolution of all applicable flight anomalies from prior missions and the assessments and supporting documentation presented at the Apollo 11 Flight Readiness Review, the Apollo 11 Mission System is declared to be flight ready for the assigned Apollo 11 Mission. This assessment is also predicated upon the successful completion of space vehicle checkout and closure of all action items and open work listed herein.

Closure of all open items listed in these minutes and any new open items that may occur subsequent to this Flight Readiness Review will be reported in accordance with Apollo Program Directive No. 8A.

  
Sam C. Phillips  
Lt. General, USAF  
Apollo Program Director

SECTION 1.0

APOLLO 11  
FLIGHT READINESS REVIEW  
17 June 1969

AGENDA

	<u>Time</u>	<u>- Speaker</u>
I. <u>REVIEW OBJECTIVES</u>	8:30 - 8:40	Gen. Phillips
II. <u>APOLLO 11 MISSION</u>	8:40 - 9:25	
A. Profile		J. Gurley
B. Mission Rules and Training		C. Charlesworth
III. <u>SPACECRAFT</u>	9:25 - 2:25	(Incl. Lunch)
A. LM		Gen. Bolender
1. Introduction		
2. Issues and Anomalies		
3. Landing Gear Thermal Protection		R. Battey
4. Supplemental Data		Gen. Bolender
5. Summary and Assessment		
B. EMU		R. Smylie
C. Science Equipment and Experiments		A. Calio
D. Cameras		D. Slayton
E. CSM/SLA		K. Kleinknecht
1. Configuration Delta (Apollo 10/11)		
2. Waivers and Deviations		
3. Apollo 11 Related Anomalies		
4. Issues		
5. CSM/SLA/LM Structural Assessment		
6. Supplemental Data		
7. Readiness Recommendation		
F. Spacecraft Readiness Assessment		G. Low
	LUNCH - 12:30 - 1:20	
IV. <u>LAUNCH VEHICLE</u>	2:25 - 3:30	
A. Introduction		L. James
B. S-IC Stage		
1. AS-505 Center Engine and Staging Oscillations		
2. Servo-Actuator Position Indicator Errors		
3. Upper LOX Lines Damage on the Inter Tank Umbilical Carrier		

C. S-II Stage

1. Low Frequency (17-18 Hz) Oscillations
2. PU Computer Resistor Failure

D. S-IVB Stage

1. 1st and 2nd Burn Vibrations
2. Aux. Hydraulics Pump Malfunction
3. APS Module He Leak
4. Redesigned LH<sub>2</sub> Feed Duct Installation

J. Sterett  
L. James

E. J-2 Engine

1. S-II-5 He Regulator Failure (Open UCR)
2. Ignition Phase Timer Failure (Open UCR)

F. IU

1. AS-505 Erratic Signal Strength - CCS Directional Antenna
2. Flight Control Computer Cooling
3. AS-505 ECS Purge Duct-- Loss of Flow Indications at RTG Cooling Nozzle

G. LV GSE

1. S-IC Hydraulic Supply and Checkout Unit Pressure Spikes

- H. Significant Configuration Differences  
I. Readiness Assessment

V. LAUNCH COMPLEX

3:30 - 3:50 - E. Mathews

- A. Introduction
- B. Open Item Status
- C. Summary and Assessment

VI. LAUNCH READINESS

3:50 - 4:55 -

A. Space Vehicle Operational Assessment

1. Launch Vehicle
2. Spacecraft
3. Space Vehicle and Complex

I. Rigell  
G. Sasseen  
P. Donnelly

- B. Launch Mission Rules Status
- C. Range Safety Status
- D. Launch Readiness Status

P. Donnelly  
A. Moore  
W. Kapryan

		<u>Time - Speaker</u>
VII.	<u>MEDICAL STATUS</u>	4:55 - 5:20 - C. Berry
VIII.	<u>NETWORK READINESS</u>	
	A. Network Readiness	O. Covington
	B. MCC Readiness	
IX.	<u>FLIGHT CREW READINESS</u>	5:20 - 5:30 - D. Slayton
	A. Training Assessment	
X.	<u>RECOVERY READINESS</u>	J. Hammack
XI.	<u>OPERATIONS SUMMARY</u>	G. Hage
XII.	<u>ACTION ITEM SUMMARY</u>	5:30 - 5:40 - Gen. Phillips

By poll  
Of  
Participants

APOLLO 11  
FLIGHT READINESS REVIEW

SEATING

SCREEN

PODIUM

MSFC  
SEATS 1 THRU 20

KSC  
SEATS 21 THRU 40

- |           |   |    |             |
|-----------|---|----|-------------|
| JAMES     | 1 | 20 | JONES       |
| HUETER    | 2 | 19 | BERRY       |
| WEIDNER   | 3 | 18 | SLAYTON     |
| MIDDLETON | 4 | 17 | KRAFT       |
| KAPRYAN   | 5 | 16 | BOLENDER    |
| ROSS      | 6 | 15 | KLEINKNECHT |
| HAGE      | 7 | 14 | LOW         |
|           | 8 | 13 | TRIMBLE     |

GSFC & DOD  
SEATS 41 THRU 52

MSC  
SEATS 53 THRU 70  
  
-- SECRETARIA--

REES DEBUS MUELLER PHILLIPS KING GILRUTH

71 ----- 75  
(KSC)

76 77 78 79 80  
PRAKTISH OLSON SPEER SMITH LEDERER

81 82 83 84 85  
HUMPHREYS STEVENSON FAGET COVINGTON

86 ----- 90  
(OMSF)

91 ----- 95  
(KSC)

96 ----- 100  
(OMSF)

101 ----- 105  
(OMSF)

106 ----- 110  
(OMSF)

111 ----- 115  
(KSC)

116 ----- 120  
(MSFC)

121 ----- 125  
(OMSF)

126 ----- 130  
(OMSF)

131 ----- 135  
(KSC)

136 ----- 140  
(MSFC)

141 ----- 145  
(MSC)

146 ----- 150  
( \* )

151 ----- 155  
(KSC)

156 ----- 160  
(MSFC)

161 ----- 165  
(MSC)

166 ----- 170  
(MSC)

171 ----- 175  
(GSFC)

176 ----- 180  
(DOD/ \* )

181 ----- 185  
(MSC)

186 ----- 190  
(MSC)

\* To be assigned later.

SECTION 2.0

MISSION OBJECTIVES

PRIMARY OBJECTIVE:

Perform manned lunar landing and return

PRINCIPAL DETAILED OBJECTIVES:

None

SECONDARY DETAILED OBJECTIVES:

Contingency Sample Collection  
Lunar Surface EVA Operations  
EMU Lunar Surface Operations  
Landing Effects on LM  
Lunar Surface Characteristics  
Bulk Sample Collection  
Landed LM Location  
Lunar Environment Visibility  
Television Coverage  
Photographic Coverage  
Lunar Passive Seismology  
Laser Ranging Retro-Reflector  
Solar Wind Composition  
Lunar Field Geology

## SECTION 3.0

### APOLLO 11 MISSION

#### Gen. Phillips' Opening Remarks

Gen. Phillips opened the review and commented about his concern on the problems that arise as a result of human error or oversight. He commented that it is more important than ever to pay attention to detail and be right than to be on time.

One of the biggest concerns is that there is a possibility of a mistake or human error slipping thru the screen that has been built. Everyone should be reminded of the importance of their work and the method of accomplishing it.

Gen. Phillips urged each supervisor to remind their subordinates to report any problems that are noted. Anyone aware of problems should report them.

He also noted that walk-through inspections are very important, and should be carried out with the eyes and knowledge, not just the checklist.

#### SECTION 3.1 - MISSION PROFILE SUMMARY - J. Gurley

Mr. Gurley summarized the changes and the less familiar portions of the mission profile. He discussed the operational trajectory changes which were identified as:

1. An additional revolution prior to DOI.
2. July 18 and 21 launch window reduction and built-in mid-course correction to increase translunar time.
3. A bias for LOI targeting to provide a circular orbit at rendezvous.
4. Addition of another lunar revolution prior to TEI.

There was a discussion of the methods used to provide coverage of PDI by the Goldstone 210 foot antenna. It was noted that in order to provide this PDI coverage for a mission launched on July 18th a hybrid trajectory would be used. July 21 mission already uses a hybrid trajectory. Mr. Kraft stated that it was not considered desirable to change the lunar orbit timeline depending on launch day, therefore, the utilization of the hybrid trajectory was recommended.

There was an additional discussion of lunar orbit variation and the biasing of the initial orbit after LOI-2 to a 65 x 55 NM orbit to provide a 60 x 60 NM orbit at rendezvous.

The consumables analysis was presented and there was a discussion of the subject. It was noted by Mr. Kraft that while the ascent propulsion capability was very tight there is considerable  $\Delta V$  potential in the RCS.

SECTION 3.2 - MISSION RULES AND TRAINING - C. Charlesworth

Mr. Charlesworth briefly summarized the status of Mission Rules and Training. He noted that from launch to lunar orbit the Apollo 10 final rules will be utilized.

There will be a review of Mission Rules with Mr. Hage on Friday, June 20, 1969.

It was noted that there still was training to be accomplished but that the results of training to date had been assessed as being very good.

## SECTION 4.0

### SPACECRAFT READINESS ASSESSMENT

#### SECTION 4.1 - LUNAR MODULE

General C. H. Bolender presented the following items relating to the Lunar Module:

The following significant anomalies from previous flights have been closed:

- air in water
- S-band steerable antenna signal strength
- gimbal drive actuator caution and warning alarm
- cabin pressure drop at separation

Flight anomalies still under investigation are as follows:

1. High CO<sub>2</sub> Partial Pressure - An abnormal rise was noted in the CO<sub>2</sub> indication while on the primary LiOH cartridge during the IM-4 flight. Testing continues but to date the anomaly is not explained. The IM-5 mission is adequately protected against an LiOH cartridge failure by the secondary system and a spare cartridge.

2. Low Level Propellant Alarms - Two low level propellant alarms occurred during the IM-4 phasing burn. The second alarm is not explained at this time. IM-5 is configured to use this system for status only (no master alarm). The onboard gaging system and the ground computed levels will be used to determine propellant remaining.

3. Inadvertent Abort Guidance System Auto Mode - Two incidents of unexpected vehicle motion occurred prior to and during staging of IM-4. Flight data show that the vehicle abort guidance control mode transferred from attitude hold to automatic but the crew did not move the switch. Indications are that the problem is in the switch and/or associated wiring. Analysis is continuing to determine if any corrective action or additional testing is required for IM-5.

The following spacecraft issues were presented:

1. Landing Radar Intermittent Lockup During Descent Engine Burns - IM-3 flight data shows intermittent LR lockup during descent engine burns. This was determined to be caused by RF reflections from H-Film burned off the LM base heat shield during descent engine burns. Corrective action is: H-Film has been removed from IM-5 and it is planned that thermal capability will be restored by painting the base heat shield.

2. Exterior Tracking Light - The exterior tracking light was reported non-operative shortly after IM staging on the IM-3 mission. An improved design tracking light has been qualified and is installed on IM-5.

3. IGC Split Shift Pulses to Landing Radar Output Register - During the IM-4 flight readiness radar self test, data was periodically double-shifted. Primary guidance software was revised to reduce the synchronization problem of the IGC with both the landing radar and the rendezvous radar. A modification has been made to the IM-5 landing radar to eliminate the synchronization problem.

4. Gimble Drive Actuator (GDA) - The IM-5 GDA failed to drive on one occasion, for seven seconds after initial command during a test at KSC. The GDA and DECA were replaced but failure analysis indicated both units were operable. Tests showed that the problem was an inherent impedance mismatch between the DECA and the new design GDA's. A 0.1 MF quad redundant capacitor has been installed in IM-5 and subsequent across the extend and retract drive lines between the GDA and the DECA to correct the impedance mismatch.

5. S-Band Steerable Antenna Solder Cracks - Solder cracks may exist in IM steerable antenna solder joints which can become electrical opens, causing loss of antenna drive capability and thus possible loss of hi-bit rate data. The RF section of the antenna is not vulnerable to this failure. The antenna performance on the IM-4 flight was satisfactory and S/N 112 now on IM-5 has no history of failure. The revised flight plan for IM-5 allows the Goldstone Station to be used for S-band reception offering a good probability of hi-bit data availability with the IM-5 Omni Antennas. The S-band erectable antenna is provided for use on the lunar surface should that become necessary by S-band steerable antenna failure during the lunar stay.

Mr. R. Battey (MSC) was introduced and presented the following item:

6. Landing Gear Thermal Modification - The IM descent engine ground effects heating exceeds landing gear thermal protection capability. Recent tests have shown totally different shock wave formation as the IM approaches the surface. Significant heating begins at approximately 12 feet instead of 17 inches as previously used for thermal analysis. All major IM-5 landing gear components will have additional thermal protection installed. Most of this additional protection has already been installed on IM-5. Landing radar tests with the new landing gear configuration are in process at Ryan to verify no adverse effects on the radar. Thermal and mechanical tests of the landing gear modifications have been successfully completed.

Mr. Low, in his summary, presented the following item:

7. Inadvertent Computer Restarts - Crew procedure work-arounds are available if a flight rope modification cannot be accomplished in time to support IM-5.

The following IM-5 certification tests are incomplete:

<u>IM-5 Certification Test</u>	<u>Estimated Test Completion Date</u>
-330-119 Water Pressure Regulator	25 Jun 69
-320-004 FWD/AFT Interstage Nut Debris & Shield Tie Down Attachments	1 Jul 69
-360-051 WQMD Transducer	20 Jun 69

General Bolender then concluded the IM presentation by stating that IM-5, upon completion of the open items identified, will fully support the Apollo 11 Mission.

IM-5 Open Work:

Action Required

IM-4 Anomalies - High CO <sub>2</sub> Partial Pressure	- Anomaly Closeout
- Low Level Propellant Alarms	- Anomaly Closeout
- Attitude Excursions Near Staging	- Anomaly Closeout
IM-3 Anomaly - Landing Radar Intermittent Lockup	- Vehicle Modification
LGC/LR Blocking Oscillator Modification	- Final MSC Review
Compatibility of IG Thermal Mods with Landing Radar	- Landing Radar Test
Water Pressure Regulator	- Certification Test
Interstage Nut Debris Shield	- Certification Test
Water Quantity Measuring Device	- Certification Test
DCR Action Items IM-5-10 thru -13 (MAT TWX dtd 6/13)	- Data Submittal-6/25/69

<u>LCD</u>	<u>LFM</u>	<u>Description</u>	<u>ECD</u>
3999	448	Added Fragmentation Protection to Interstage Bolts	- 6/19/69 (Non-hazardous)
3977	439	LR Sharp Corner Protection	- 7/2/69
3499	268	RCS Plume Deflectors - Fit Check	- Complete
		- Installation	- 7/1/69
5059	460	Changes Resulting From C <sup>2</sup> F <sup>2</sup>	- -
5056	459	Replace Stop Switches	- 6/15/69
5048	456	MESA Redundant Lock	- 6/17/69

## SECTION 4.2 - EXTRAVEHICULAR MOBILITY UNIT (EMU)

The differences between Apollo's 9, 10, 11 PLSS and PGA's were outlined and it was established that all PGA changes have been or will be verified by tests. The major modification to the PGA is the arm bearing. Although analysis indicates structural adequacy of the bearing, verification tests are continuing. The flight test suits have been modified to the latest configuration whereas the backup suits remain in the older configuration for contingency use. The OPS indicator light and heater potential failure mode impacts on mission rules. EVA was also considered and it was proposed that the rules provide for continuing EVA with a failed heater.

## SECTION 4.3 - EASEP

EASEP and MESA testing were reviewed and both experiment packages are ready for flight. Specific points were that prelaunch SRC box pressure profiles indicate no leakage and more weight margin is available so that samples will not have to be removed if the boxes are overloaded.

## SECTION 4.4 - CAMERAS

Apollo 11 camera equipment were also reviewed. Problems which have occurred on previous flights can be attributed principally to film roller tensions and magazine geometry. Both of the latter problems are being resolved by use of hi-rel parts and additional quality requirements. In addition, the types of films to be used were discussed and action item 11-T-1 was established.

## SECTION 4.5 - CSM-107/SIA-14

Mr. Kleinknecht presented the MSC flight readiness assessment for the CSM and the SIA. The following are the significant comments from the review and are discussed in greater detail in the CSM handout:

1. Sixteen significant configuration differences between 106 and 107 were listed and only the following were discussed:

- a. Forward hatch modified to delete the TG-15000 insulation.
- b. The fuel cell secondary bypass valves have a Block I poppet.

This change has over 600 hours of successful ground testing.

2. All of the eighteen waivers and deviations have been agreed to and none represent any area of technical concern.

3. The following Apollo 10 open anomalies which relate to CSM 106 were reviewed:

- a. Although no changes were recommended for 107, tunnel charge holder retention, the problem is still under review.

- b. Primary Evaporator Operation - Preliminary results from AiResearch testing indicate an intermittent switch. Testing and analysis will continue.

c. Three versions of the gas separator water bag are in development and if one tests successfully it will be flown on 107.

4. Spacecraft Issues:

a. The SPS combustion instability during engine testing for spacecraft 114 was attributed to improper bleed procedures. This is not considered a CSM 107 flight problem because of differences in KSC propellant load/bleed procedures.

b. Spacecraft 108 fuel cell switch on panel 3 had a flicker short. All fuel cell switches on 107 have been validated.

5. The structural assessment team has determined that adequate margins of safety exist for the Apollo 11 Mission.

6. There are no CSM or SLA components which are susceptible to stress corrosion.

7. Fracture mechanics review of pressure vessels indicates no areas of concern.

8. There are no open failures that are considered to have a potential hardware impact on CSM 107.

9. The high gain antenna testing will be waived as on CSM 106. The only testing to be completed is on the water/gas separator bag.

10. The remaining supplemental data, included in the handout, was reviewed and there are no items of concern or schedule impact.

In summary, Mr. Kleinknecht concluded that CSM 107 would be ready and supporting the Apollo 11 Mission after completion of the following open work:

<u>Task</u>	<u>Scheduled Work or Installation</u>
- Additional Velcro in Spacecraft	6/17
- Stowage of C & W Hardware	6/24
- Stowage of Springs and Clips	6/17
- Water/Gas Separation System	7/9
- Sextant Eyepiece Locking System	6/17
- Add Vacuum Hose, Brush and Bag	6/21
- Add 3 - 70MM Magazines	6/21
- New Closeout Panel with Pockets	6/21
- Delete Drogue Stowage Retention Straps	6/21
- Alignment Marks on Tee Adapters	6/24
- Delete Verb Noun List	6/24
- Improve Liquid Cooled Garment Package	6/24
- Check Strut Lock Out Devices	

#### SECTION 4.6 - SPACECRAFT SUMMARY

The Apollo support contractors agreed that pending the resolution of identified problems that the Apollo 11 spacecraft is ready for flight.

George Low then summarized the spacecraft presentations as follows:

1. GFE - The new configuration PGA arm bearing must be qualified prior to flight, and PLSS consumable margins are greater than had been anticipated.
2. IM - The significant problems of the number of IM problems to be resolved are inadvertent IM-4 attitude excursions and steerable high gain antenna qualification.
3. CSM - Resolution of the charge holder retention problem.

#### SECTION 4.7 - ACTION ITEMS

<u>NUMBER</u>	<u>ACTION ITEM</u>	<u>ACTION</u>
11-T-1	Lunar Surface Film	MSC determine the type of film (color or black & white/color) to be used on the lunar surface. Estimated completion date: 19 June 1969.

## SECTION 5.0

### LAUNCH VEHICLE READINESS ASSESSMENT

Mr. Lee James and Mr. James Sterett reported on the launch vehicle related problems and flight anomalies and concluded that the Apollo 11 launch vehicle is ready for launch and is capable of achieving all objectives of the lunar mission. Mr. James emphasized the fact that this launch vehicle carries only operational instrumentation which will limit visibility of any anomalies that might occur.

All COFW's have been completed through endorsement no. 4.

The following is a summary of the topics presented:

#### 1. S-IC Stage

The servo-actuator position potentiometer monitoring system indicates displacement when none exists. The condition appears to be random and has not been duplicated in extensive testing. Workaround procedure has been established with KSC for determining when signal is erroneous and that actuator position is correct to prevent this redline from causing an inadvertent launch delay.

The upper LOX line lost vacuum due to damage during qualification tests. Failure occurred at 570 cycles of bellows. S-IC-6 line will have no more than 161 cycles prior to launch.

#### 2. S-II Stage

PU computer resistors from a single lot have experienced failures. All modules from S-II-6 which contain resistors from this lot have been replaced and S-II-6 computers are performing acceptably. A failure of this resistor in flight is benign, but could jeopardize mission completion if PU valve is in incorrect position at inopportune flight time. Gen. Phillips observed that we must eliminate PU system problem on future vehicles.

#### 3. S-IVB Stage

Auxiliary hydraulic pump output pressure and flow were low after Apollo 10 second burn cutoff. Ground simulation isolated problem to compensator spring guide failure. S-IVB-506 pump guide was replaced.

A helium leak occurred on Apollo 10 in APS module #1, starting after 6.5 hours GET. This leakage was similar to that observed on Apollo 9. High pressure system o-rings were changed prior to Apollo 10. Similar leakage rates would not impair Apollo 11 Mission, but investigation is continuing.

Fatigue cracks in bellows of LH<sub>2</sub> feed duct have occurred in stage ground testing. Redesigned duct has been installed on S-IVB-506 wherein an added liner protects bellows from flow resonance.

#### 4. J-2 Engine

The cause of the helium bleed regulator failure experience during CDDT on Apollo 10 has not been determined. This failure is the only one of its type and is considered an isolated incident. Regulator integrity will be verified prior to launch commit.

#### 5. Instrument Unit

Erratic signal strength problem from Apollo 10 CCS directional antenna has not been isolated. No mission impact is identified for Apollo 11.

The flight control computer for Apollo 11 will again be flown without coolant since Apollo 10 results were satisfactory.

The ECS purge duct loss of flow at the RTG nozzle on Apollo 10 caused no problem in the IU compartment. Additional clamping and increased torque on clamp has been added at "Y" connection and umbilicals.

#### 6. Vehicle Oscillations

##### a. S-IC

The Apollo 10 launch vehicle first stage exhibited nominal oscillations at both center engine and outboard engine shutdown, with spacecraft response near predictions. Apollo 11 spacecraft response is expected to be slightly greater than Apollo 10 because of the particular shutdown characteristics of the S-IC-6 engines. Based on latest analyses, a minimum stability margin of 6 DB is predicted for Apollo 11 with minimum stability occurring at liftoff.

##### b. S-II

Apollo 10 early center engine cutoff effectively eliminated the marked instability exhibited on both Apollo 8 and 9 missions. Early CECO had no adverse effects during any part of the S-II burn. A stable system is predicted for Apollo 11 based on static firing data from S-II-7, S-II-8, and on Apollo 10 flight data.

A final solution to be used on post Apollo 11 missions has not yet been determined. Stability analysis with latest mathematical model fails to provide stability results consistent with observed flight data.

c. S-IVB Stage

During Apollo 11 first burn, longitudinal oscillations of approximately  $\pm .25G$  were observed at the engine gimbal block. A slight change in oscillatory thrust, derived from chamber pressure, was also evident during this time period. A review of Apollo 8 flight data showed similar thrust oscillations as on Apollo 10, but at approximately 1/2 the G level. MSFC POGO consultants, and MDC conclude that the activity is within the normal J-2 engine uncoupled thrust levels, and does not represent concern for future Apollo missions.

Low frequency, low amplitude vibration was also present throughout Apollo 10 second burn. Shortly after step pressurization, a predominant high frequency oscillation occurred and remained until cutoff. Most probable cause was sequential venting of the dual vent valves in the forward skirt area, which tend to excite the forward skirt ring mode. Tests are planned at AEDC to attempt to duplicate flight data. However, completion of testing is not regarded as an Apollo 11 constraint as there was no adverse effect on either the structural or the venting system.

7. Configuration

The principal configuration difference for this launch vehicle was the reduction of instrumentation from R&D to operational.

8. Open Work

No significant open work was identified.

## SECTION 6.0

### LAUNCH COMPLEX READINESS ASSESSMENT

E. R. Mathews from the KSC Apollo Program Office reported that the Launch Complex 39 and Industrial Area are ready to support the servicing, checkout, and launch of the Apollo 11 Space Vehicle upon closure of the mandatory open items presented.

Two open Category I modifications were reported, both of which will be completed by June 20, 1969.

1. ECP 1158-2                      Provide GHe Blanket Purge for GHe Systems
2. ECP 13684                      Add Pneumatic Reservoir and Check Valve to Industrial Water Pneumatic System

Twenty-four documentation IRN's were also open and will be closed prior to launch.

All eight action items from the Launch Readiness Review have been closed as follows:

1. Unqualified Components - The seven Priority II components which experienced test failures during qualification are considered qualified for their present application.
2. Mission Rules - Inconsistent ceiling restriction between Launch and Mission Rules has been resolved as 500' for abort recovery.
3. Range Safety Limit Lines - Have now been defined.
4. Personnel Access - Security procedures established to insure work station access.
5. Photo System Camera Coverage - Low priority camera requirements deleted.
6. Wideband Transmission Lines - Additional wideband lines for Public Affairs were defined.
7. Redundant Air Handling for ACE-S/C - If any single failure occurs, present mechanical and electrical systems will support four ACE stations more than four hours with the addition of one minor electrical mod (CR HQ 1141).
8. Pad A LH<sub>2</sub> Burn Pond - Cause of pipe cracks has been determined, repairs made and provisions added to insure prevention of future problems.

A program for headset validation and operational instructions has been instituted to reduce OIS degradation due to faulty headsets or improper OIS operation. Warnings have also been issued to personnel from other Centers.

No Launch Complex Action Items were generated at the Apollo 11 Flight Readiness Review and LC-39 support is considered ready with the closure of the two mandatory modifications.

## SECTION 7.0

### LAUNCH READINESS ASSESSMENT

#### SECTION 7.1 - LV OPERATIONAL ASSESSMENT - I. Rigell

Mr. Rigell noted that all problems are expected to be closed out prior to CDDT. Open modifications, retests, and workoffs of non-conformances will be completed as pad open time becomes available. All open waiver requests are in the approval cycle with verbal concurrence on all items and only paper closeout needed. Launch critical spares, or suitable workarounds, are scheduled to be available by CDDT. The most recent problem was identified today and involved three printed circuit cards in the DDAS. One card developed a relay failure and the other two appeared to have workmanship problems.

General Phillips commented on the considerable improvement in capability which has been acquired with the DDAS parallel firing room redundancy.

#### SECTION 7.2 - SPACECRAFT PROCESSIONS - T. Sasseen

Mr. Sasseen noted the number of modifications occurring during CSM-107 and LM-5 processing. The number of LM mods showed an appreciable increase over LM-3 and LM-4.

There was a detailed description of a problem involving the LM descent engine switch which was defective after vendor rework. This problem was noted when the engine fired as the switch was armed and could not be shut down with one switch. The problem was identified as a broken pin end making an electrical short in a connector. It has been resolved for Apollo 11.

There was a detailed presentation and discussion of the difficulty with the DTCS which involves the inadvertent closing of relays without any commands being given. This remains unresolved and is thought to be peculiar to LUT 1 and one of three DTCS. Extensive precautions have been planned to launch without damage to the vehicle. Efforts to isolate the fault are being continued by an investigating group.

#### SECTION 7.3 - SPACE VEHICLE READINESS - P. Donnelly

Mr. Donnelly identified the remaining tests and noted the following schedule:

- Pickup the CDDT at midnite June 25
- Wet CDDT - T-0 July 1
- Dry CDDT - T-0 July 2
- If this schedule is held there will be five days contingency.  
With this schedule additional holds may be added to the count.

SECTION 7.4 - LAUNCH MISSION RULES - P. Donnelly

It was stated that a revision to the Launch Mission Rules would be out by June 20. Significant changes were:

- A change to a 500 foot ceiling
- Can now go to the point of ignition and recycle for launch.

SECTION 7.5 - RANGE SAFETY - A. Moore

It was announced that ceiling and visibility restrictions had been removed as long as the 1.16 and 19.18 radars and beacon number 1 on the vehicle are operational. This is a major improvement in launch restrictions.

Range safety limit lines were shown and then was a discussion of possible variable lines which would be swung southward as launch azimuth changed due to holds or other reasons. This will be resolved in discussion between AFETR and NASA.

## SECTION 8.0

### MEDICAL STATUS

Dr. Berry summarized medical tests and preventive medicine program and indicated that they were proceeding on schedule.

He emphasized that anyone having contact with the crew during the last 21 days should be especially careful to avoid crew contamination and be aware of the screening procedures.

There was a discussion of the modified menu for the flight which includes the use of more normal foods.

## SECTION 9.0

### OPERATIONS SUMMARY

Network - It was stated that the Parkes 210 foot dish should be ready to support the flight. The rest of the network is ready to support the mission.

MCC - The MCC had no significant problems and will go on mission status on July 5.

Flight Crew - The flight crew was reported as being comfortable on being able to hold the schedule.

Recovery - No problems were identified and the recovery posture was good.

#### Mission Director's Summary

Mr. Hage stated that MSC has been asked to look at the feasibility of impacting the ascent stage on the moon. Qualified approval has been given by OSSA. Further coordination will be done by Dr. Mueller to obtain final approval of the scientific community.

## SECTION 10.0

### APOLLO 11 Q&RA READINESS ASSESSMENT

Based on the analysis of hardware reliability, on quality assurance actions, and on the associated joint MAR/Center activities conducted prior to the FRR, the Apollo 11 Mission hardware is considered acceptable contingent upon the closeout of open discrepancies, failures and certifications, including both those discussed at the FRR and those of lesser significance being worked by the Centers and Contractors.

Q&RA engineering personnel have maintained close liaison with Center FRR activities and with end item engineering activities to follow problem closeout. This follow-up will be maintained for the closeout of open FRR action items and items requiring assurance of verification described in the Apollo 11 Q&RA Flight Readiness Assessment Report dated June 10, 1969.

## SECTION 11.0

### GENERAL PHILLIPS' SUMMARY

General Phillips stated that the action items and open work were all clearly identified and proper action is being taken for completion. The following items were then noted not as an enumeration of the action items/open work, but as a listing of significant concerns to pursue:

1. New arm joints in the astronauts suits.
2. Apollo 10 IM attitude perturbations after staging.
3. Luminary software procedural change or rewired rope.
4. KSC digital test command system.
5. Use of all color film versus mixed black and white and color film on lunar surface.
6. Critical integrated simulations remaining for crew training.

General Phillips concluded by stating that his only remaining concern is that all persons connected with the mission retain their thoroughness in all aspects of their work in order to eliminate the possibility of human errors. He urged all organizations to communicate this thought to all concerned.

He then expressed his thanks to all participants for a thorough FRR and stated that we appear to be in good shape to conduct a successful mission.

APOLLO 11  
CERTIFICATION OF FLIGHT WORTHINESS (COFW) ENDORSEMENT STATUS

	<u>NO. 1</u>	<u>NO. 2</u>	<u>NO. 3A</u>	<u>NO. 3B</u>	<u>NO. 4</u>	<u>NO. 5</u>	<u>NO. 6</u>	<u>NO. 7</u>	<u>NO. 8</u>
	<u>DESIGN REVIEW</u>	<u>MFG C/O</u>	<u>DEFINITION OF OPEN WORK TO BE TRANS. TO KSC</u>	<u>ACCEP. OF OPEN WORK TO BE TRANS. TO KSC</u>	<u>FIRING C/O</u>	<u>TURNOVER OF HDWE KSC</u>	<u>CERT. OF HDWE CONFIG. &amp; LAUNCH OPS DOCUMENT</u>	<u>MOD &amp; C/O AT KSC</u>	<u>FINAL CERTIFICATION</u>
AS-506									
S-IC	19 JUL 67	15 AUG 68	19 FEB 69	N/A(1)	N/A(1)		17 JUN 69		
S-II	20 OCT 67	24 MAY 68	7 MAR 69	1 MAY 69	7 MAR 69	14 MAY 69	12 JUN 69		
S-IVB	8 FEB 68	8 FEB 69	7 JAN 69	N/A(1)	N/A(1)	18 APR 69			
IU	20 JUN 68	7 MAR 69	N/A(2)	N/A(2)	N/A	14 MAY 69	16 JUN 69		

	<u>NO. 1</u>	<u>NO. 2</u>	<u>NO. 3</u>	<u>NO. 4</u>
	<u>CONFIG DEF. &amp; MFG C/O</u>	<u>LAUNCH SITE REC. INSP.</u>	<u>PRE-LAUNCH VEH. MATING &amp; C/O</u>	<u>PRE-LAUNCH S/V C/O</u>
S/C				
CSM 107	19 JAN 69	23 APR 69	23 APR 69	16 JUN 69
IM-5	25 JAN 69	23 APR 69	23 APR 69	16 JUN 69
SLA-14	10 JAN 69	N/A	N/A	N/A
LES	19 JAN 69	N/A	N/A	N/A
Spacesuit	TO BE SIGNED ON COMPLETION OF PIA			

N/A - Not Applicable  
 (1) - S-IC-6 and S-IVB-506 signed the old endorsement #3. New endorsement #3 will be implemented on AS-507.  
 (2) - S-IU will implement the new endorsement #3 on AS-507.

