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APOLLO APPLICATIONS PROGRAM (AAP)
PAYLOAD INTEGRATION

General Test Plan
Combined Mission, Flights AAP 1/2/3/4

Volume IV
Integration and Prelaunch Checkout Plan

Contract No. NAS8-21004

MARTIN MARIETTA CORPORATION
DENVER DIVISION

FOREWORD

This document is submitted under DRL Line Item 20 of Exhibit C of Contract NAS8-21004 for the use of MSFC. This document is the forty-ninth submitted under this contract.

This is Volume IV of four volumes containing the General Test Plan.

DOCUMENT CHANGE RECORD

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	Revised	Added	Deleted

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1. SCOPE

1.1 Purpose - This plan has been prepared to formally document the results of the Phase C study. The results are presented in terms of test requirements and recommended methods of implementing the requirements. The plan is intended to provide sufficient detail to serve as a basis from which the detailed Phase D test plans may be developed.

1.2 Scope and Applicability - This volume defines test requirements for the flight hardware of AAP 1 thru AAP 4 exclusively. Development and design qualification testing is covered in Volumes II and III of the General Test Plan. This volume presents only the technical test requirements and recommended methods of satisfying these requirements. Methods of documentation, controls, test philosophies, detailed hardware descriptions, etc., are included in Volume I of the General Test Plan.

Detailed facility requirements are covered in a separate Facility Plan.

1.3 Organization - This volume is organized into seven sections as follows:

Section	Title
1	Introduction
2	Flight AAP 1 Integration and Prelaunch Checkout
3	Flight AAP 2 Integration and Prelaunch Checkout
4	Flight AAP 3 Integration and Prelaunch Checkout
5	Flight AAP 4 Integration and Prelaunch Checkout
6	Flight Experiment Test Requirements
7	Flight ATM/Rack Pointing Control System (PCS) Checkout

A general outline of the sections follows:

a. A brief description of the flight hardware.

b. A description of the interfaces.

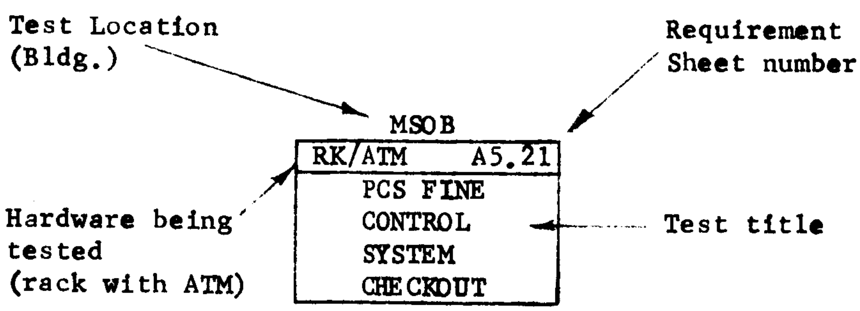
c. Test Requirements - This portion contains a set of test requirement without any attempt to define where or how the requirements are to be satisfied. Definition of responsibility is purposely avoided. Where the requirement is generated by the mating of two carriers, it is listed as a combined requirement.

d. Test Operations - This portion defines the methods of satisfying test requirements and is presented as follows:

1) General Operation Summary - A brief description of test operations at PIF (MSFC) and/or KSC.

2) Time-based Functional Flow - Time-based functional flows are included for Missions AAP 1/2 and AAP 3/4. These flows identify test, test sequence, and time spans. It shows the compatibility of flight hardware and facilities for AAP 1/2 and AAP 3/4 during integrated tests.

3) Functional Flow - The functional flow diagram is an expansion of the time-based functional flow. Each block of the functional flow diagram contains the following information:



Where a number appears in the upper right-hand corner, a requirement sheet is provided. Blocks without numbers indicate either a normal Apollo test, unmodified by AAP requirements, or a function not considered to be a test or checkout operation. These blocks are shown only if they add clarity or illustrate continuity. No attempt has been made to show all normal Apollo functions.

4) Requirement Sheet - The Requirement Sheet contains the following information:

Test title
Flow block numbers
Objective
Location
Personnel
Time span
Agency support
Task description
    Preparations
    Operations
    Criteria for success
Support requirements
    Commodities
    Equipment

It should be recognized that not all of this information is available during the Phase C effort. In many instances, the information is to be supplied (TBS) later, probably in Phase D.

2. FLIGHT AAP 1 INTEGRATION AND PRELAUNCH CHECKOUT

Flight AAP 1 is the first flight of the Apollo Applications Program. Although many details of the final configuration are undefined, the basic hardware upon which this plan has been prepared is presented below.

The launch vehicle consists of an uprated S-IB and an unmodified S-IVB and instrument unit (IU).

The spacecraft consists of an unmodified spacecraft lunar module adapter (SLA) which encloses a lunar mapping and synoptic survey (LM&SS) module, and a modified command and service module (CSM). All but the LM&SS are existing Apollo hardware. The LM&SS consists of a basic MSFC rack structure with SLA attachment surfaces, an MSC center cannister containing a group of mapping and survey esperiments and two docking collars. With the exception of power, which is provided by the CSM primary source, the experiments are basically self-sufficient.

Minor modifications are performed on the CSM consisting basically of additional display and controls, modified docking aids, experiment mounting and storage provisions and some additional data management capabilities.

The CSM experiments can be generally categorized as biomedical having very little interfaces with the CSM systems. During the mission, the CSM transposes, docks to the LM&SS forward docking collar and extracts it from the SLA. Approximately four days of earth mapping, survey and biomedical experiments are performed in this configuration.

The CSM undocks from the LM&SS forward docking collar, transposes and docks with the LM&SS aft docking collar. The LM&SS is then docked to the multiple docking adapter (MDA) of AAP 2 for on-orbit storage. Basically, the LM&SS is passive from this point on, although it remains docked throughout the 23-day orbital work shop (OWS) experiment, the storage period and the subsequent reactivation and extended duration experiment.

The CSM of AAP 1 docks the forward port of the AAP 2 MDA and remains in that position until the end of the 23-day OWS experiment.

The interfaces used as a basis for the test planning efforts in this document are in accordance with the definitions contained in MMC report "General Interface Schematics, S/AA Flights #1 through #4, On-orbit Cluster Configuration," MD-80-0018, dated 3 February 1967.

2.1 Test Requirements - The test requirements described in this section are presented in logical groupings of flight hardware elements. It is not the intent of this section to define test configurations.

2.1.1 Acceptance Test Requirements (Pre-Delivery)

2.1.1.1 CSM - The CSM is not the responsibility of MSFC and the acceptance test requirements are out of scope to this plan. However, as a baseline from which KSC test requirements are derived, it is assumed that all CSM experiment support subsystems and provisions have been installed and checked out by NAA.

2.1.1.2 LM&SS - The LM&SS is the responsibility of MSC and the acceptance test requirements are not defined in this plan. The LM&SS will be subjected to a pre-delivery acceptance test at MSC or at the MSC-appointed contractor's facility.

2.1.1.3 IU, SLA and S-IVB- There are no AAP-peculiar modification to the IU, SLA and S-IVB on Flight AAP 1. Acceptance tests shall be performed in accordance with standard Apollo test plans and procedures.

2.1.2 CSM Pre-Mate Checkout Requirements at KSC

2.1.2.1 Verify CSM systems operability in accordance with standard Apollo checkout procedures.

2.1.2.2 Verify that the installed experiments are compatible with the CSM power, data and communications systems, and that they perform in accordance with the applicable CEI and ICD specifications. (See section 6)

2.1.2.3 Verify CSM to LM&SS power distributor circuits.

2.1.2.4 Verify that the CSM to LM&SS power control signal distribution is in accordance with the applicable specifications.

2.1.3 LM&SS Pre-Mate Checkout Requirements at KSC

2.1.3.1 Verify that no transportation and shipping damage has occurred in accordance with NPC 500-10.

2.1.3.2 Verify that the experiment package positive pressure leakage rate is within allowable limits.

2.1.3.3 Verify that the LM&SS distributor circuits provide power distribution in accordance with the applicable CEI and ICD specification.

2.1.3.4 Verify that the individual LM&SS subsystem perform in accordance with the applicable specification. This requirement will be satisfied by a location change checkout (minimum quantitative testing) of sufficient depth to re-establish confidence in the individual system operability. Quantative checkout has been accomplished at MSC (2.1.1.2)

2.1.3.5 Verify that the LM&SS weight and balance is in accordance with the requirements of the CEI specification.

2.1.3.6 Verify alignment and/or align the experiment cameras in accordance with the applicable CEI and ICD specifications.

2.1.4 LM&SS/CSM Combined Checkout Requirements at KSC

2.1.4.1 Verify LM&SS aft and forward soft and hard docking compatibility. Adjust probes and latches as applicable.

2.1.4.2 Verify docked configuration longitudinal axis alignment in accordance with the applicable ICD requirement.

2.1.4.3 Verify power, D&C and data functional interface compatibility between the CSM and the LM&SS.

2.1.4.4 Verify overall systems compatibility. This includes a requirement to perform a compressed time mission simulation.

2.1.4.5 Verify on-orbit configuration EMI compatibility.

2.1.5 LM&SS/SLA Combined Checkout Requirements at KSC

2.1.5.1 Verify LM&SS to SLA fit and clearance.

2.1.5.2 Verify LM&SS to SLA electrical and fluid access umbilical compatibility.

2.1.6 <u>LM&SS Cluster Interface Checkout Requirements at KSC</u>

2.1.6.1 Verify Displays and Controls (D&C) and power interface compatibility with the MDA of AAP 2.

2.1.7 <u>Space Vehicle AAP Checkout Requirements at KSC</u>

2.1.7.1 Verify launch configuration EMI and RFI compatibility.

2.1.7.2 Verify Spacecraft (S/C) RF system compatibility with the ground tracking stations and mission control.

2.1.7.3 Verify time sensitive experiments after installation at the launch pad.

2.1.7.4 Verify S/C operations and procedures during countdown demonstration test.

2.2 KSC Operations

2.2.1 General Summary

2.2.1.1 S-IVB and IU - No AAP-peculiar modifications have been accomplished on the S-IVB and IU. Prelaunch checkout is in accordance with the normal Apollo flow.

2.2.1.2 SLA - No modifications have been performed on the SLA for Flight AAP 1. Checkout follows the normal Apollo flow with the exception of an LM&SS to lower SLA fit check early in the MSOB flow as described in 2.2.1.4.

2.2.1.3 CSM - The extent of modification performed on the Flight AAP 1 CSM to accommodate the AAP requirements are minor. The CSM follows the normal Apollo flow with the following exceptions:

a. Immediately after the CM to SM mate and interface verification, the installed experiments are checked out for performance and compatibility with the CSM systems. The experiment checkout requirements are defined in section 6.

b. While the CSM is in the altitude chamber the LM&SS to CSM interfaces are checked out as described in 2.2.1.4.

c. The CSM and all other AAP 1 and AAP 2 carriers are electrically mated for a cluster interface compatibility checkout. This test is done with the CSM in the altitude chamber and all other carriers adjacent to the chamber.

d. The AAP 2 MDA is docked to the AAP 1 CSM for a docking collar fit and leak check. The CSM is then released to complete its prelaunch checkout in accordance with the standard Apollo flow.

2.2.1.4 LM&SS - The LM&SS is a new carrier and no comparable Apollo flow exists. This section describes the KSC operations for the LM&SS.

The LM&SS receiving inspection is limited to a damage check of the module. Ship-loose items are subjected to a functional test in accordance with the requirements of NPC 500-10.

Location change checkout of the power distributor, plumbing line and the electrical portion of the stability and control system are verified. Experiments are installed and rough alignment performed.

The LM&SS is moved to the east integration (Stokes) stand where a lower SLA fit and clearance check is performed. This check is performed early in the MSOB flow.

The LM&SS is moved from the MSOB to the Pyrotechnics Installation Building (PIB) where mass property measurements of weight and center of gravity are made. Although some consideration has been given to moving the weight and balance fixture to MSOB, the disadvantage of additional congestion in the MSOB offsets the advantage of eliminating an LM&SS movement.

The LM&SS is returned to the MSOB and raised above the altitude chamber with a crane. The AAP 1 CSM is already in the chamber and has completed its normal Apollo checks. (AAP 1 Prelaunch Checkout Flow). The LM&SS is lowered to the CM and soft and hard docking is accomplished on the aft collar. Longitudinal axis alignment is checked. The LM&SS aft collar is undocked from the CSM. The LM&SS is inverted and the forward docking collar is docked to the CSM. Longitudinal axis alignment is checked. The LM&SS to CSM umbilicals are fit checked. The LM&SS is undocked and lowered to the MSOB main floor adjacent to the chamber. The CSM remains in the chamber. The CSM and LM&SS umbilicals are mated using extension cables. Power, data, communications and D&C interfaces between the two carriers are verified for compatibility. This series of tests culminates in a compressed time mission simulation with EMC monitoring. Consideration has been given to the possibility of performing functional interface tests in the docked configuration but complications and risk involved in operating the LM&SS systems inverted were inhibitive. The electrical umbilical connections between the CSM and LM&SS are removed.

The AAP 2 AM/MDA and interface simulator are positioned outside the altitude chamber. The CSM, LM&SS, AM/MDA and Interface Simulator are electrically connected to the on-orbit cluster configuration. Extension cables are used where needed. All subsystems are activated and interfaces between the cluster carriers are verified for compatibility. This test series culminates in a compressed time mission simulation with EMC monitoring.

The LM&SS is transported from the altitude chamber to the MSOB rack work area where the fine alignment of the cameras is performed.

The LM&SS is transported to the East Integration Stand for S/C buildup, the remaining operations is part of standard Apollo flow.

2.2.1.5 Launch Pad Operations - Generally the launch pad activities are in accordance with the Apollo flow. The following modification to the normal Apollo flow have been identified.

a. A location change system level functional checkout is performed on the LM&SS and CSM modifications.

b. During the normal Apollo RF open loop test, the telemetry and communications systems are energized and compatibility with ground tracking stations verified. EMC monitoring is performed during this test.

c. During the normal Apollo CDDT, AAP peculiar operations and procedures are verified.

d. During the final pre-countdown work period, final S/C servicing and readiness checks are performed.

e. During the countdown the mission critical housekeeping data is monitored.

2.2.2 Prelaunch Checkout and Launch Pad Activities Time-Based Functional Flow Diagram for AAP 1/2 - There is a significant hardware flow interface between elements of AAP 1 and AAP 2 at KSC since checkout of the two flights occurs at approximately the same time. This relationship is illustrated on the Time-Based AAP 1/2 combined flow diagram, (see figure 1). A detailed flow of AAP 1 elements is presented in 2.2.3. The combined flow diagram has been provided to illustrate schedule and facility compatibility. The time span for this flow is based on a 16-hour work day.

2.2.3 Prelaunch Checkout and Launch Pad Activities Flow Diagram - The flow diagram (see figure 2) presents the recommended flow of checkout operations at KSC for the various elements of AAP 1.

The test sheets contained in 2.2.4 describe the AAP test activities accomplished in each block that has a number in the upper right hand corner. Blocks without numbers indicate that no AAP peculiar test activities occur and the blocks are provided for clarity only.

This flow is function sequenced and has no reference to time.

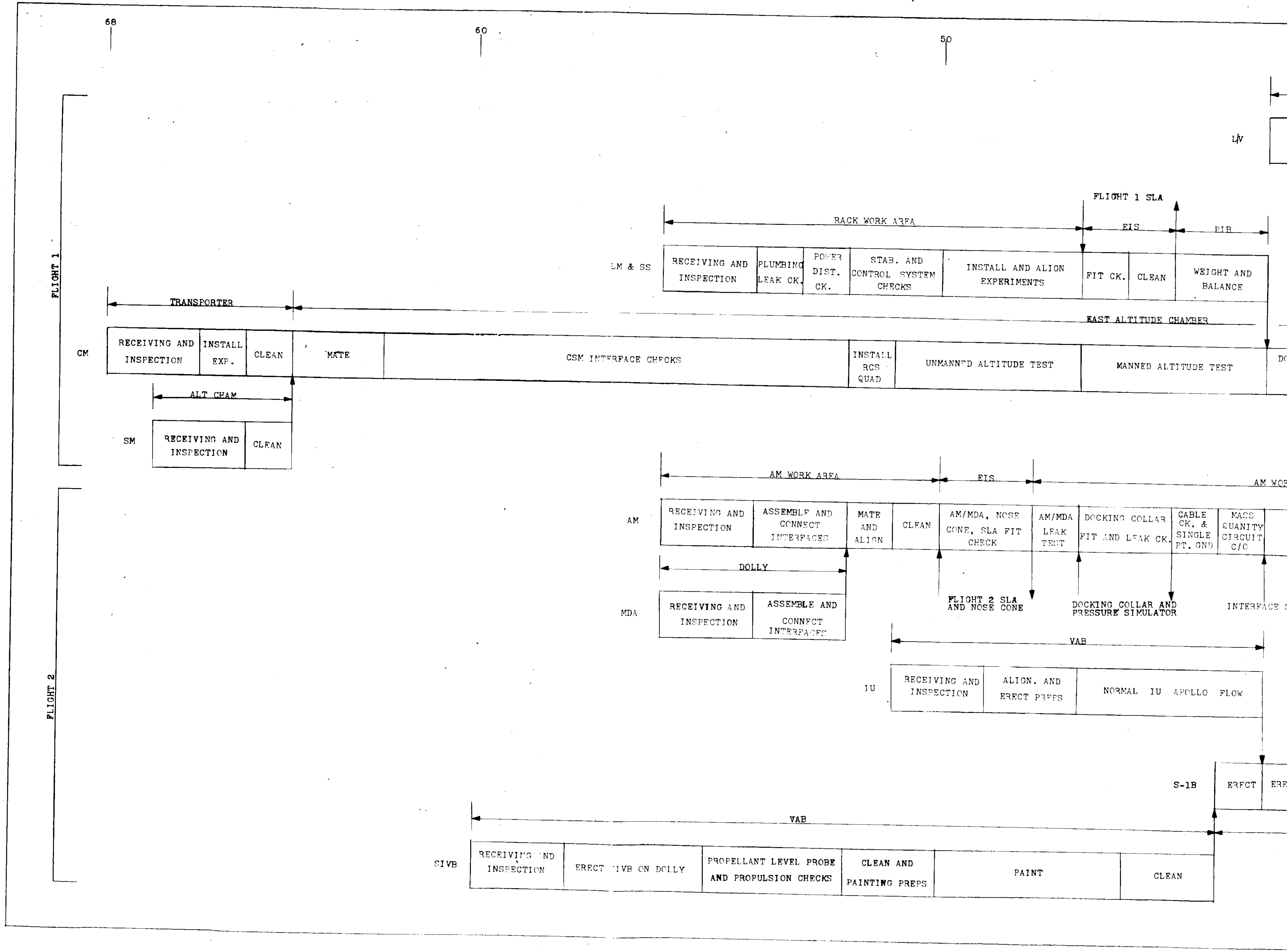
Time function reference should be made to 2.2.2 for interface and timeline requirements.

2.2.4 Test Requirement Sheets - Table I defines specific blocks of the AAP 1 flow diagram for KSC operations. Each sheet is identified by the flow block title and number.

The AAP 1 carriers do not pass through the PIF and are not the responsibility of MSFC. The information available for test planning at KSC is very sketchy and in many cases nonexistent.

The flow diagrams and timelines were built to show continuity and each of flow.

The test requirement sheets are based on available information and the notation, to be supplied (TBS) is used where information is not available.


68
60
50
FLIGHT 1
FLIGHT 2
LV
FLIGHT 1 SLA
RACK WORK AREA
EIS
PIB
LM & SS
RECEIVING AND INSPECTION
PLUMBING LEAK CK.
POWER DIST. CK.
STAB. AND CONTROL SYSTEM CHECKS
INSTALL AND ALIGN EXPERIMENTS
FIT CK.
CLEAN
WEIGHT AND BALANCE
TRANSPORTER
EAST ALTITUDE CHAMBER
CM
RECEIVING AND INSPECTION
INSTALL EXP.
CLEAN
MATE
CSM INTERFACE CHECKS
INSTALL RCS QUAD
UNMANNED ALTITUDE TEST
MANNED ALTITUDE TEST
ALT CHAM
SM
RECEIVING AND INSPECTION
CLEAN
AM WORK AREA
EIS
AM
RECEIVING AND INSPECTION
ASSEMBLE AND CONNECT INTERFACES
MATE AND ALIGN
CLEAN
AM/MDA, NOSE CONE, SLA FIT CHECK
AM/MDA LEAK TEST
DOCKING COLLAR FIT AND LEAK CK.
CABLE CK. & SINGLE PT. GND
MASS QUANITY CIRCUIT C/O
DOLLY
FLIGHT 2 SLA AND NOSE CONE
DOCKING COLLAR AND PRESSURE SIMULATOR
MDA
RECEIVING AND INSPECTION
ASSEMBLE AND CONNECT INTERFACES
VAB
IU
RECEIVING AND INSPECTION
ALIGN. AND ERECT PREPS
NORMAL IU APOLLO FLOW
S-1B
ERECT
VAB
SIVB
RECEIVING AND INSPECTION
ERECT SIVB ON DOLLY
PROPELLANT LEVEL PROBE AND PROPULSION CHECKS
CLEAN AND PAINTING PREPS
PAINT
CLEAN

2

1

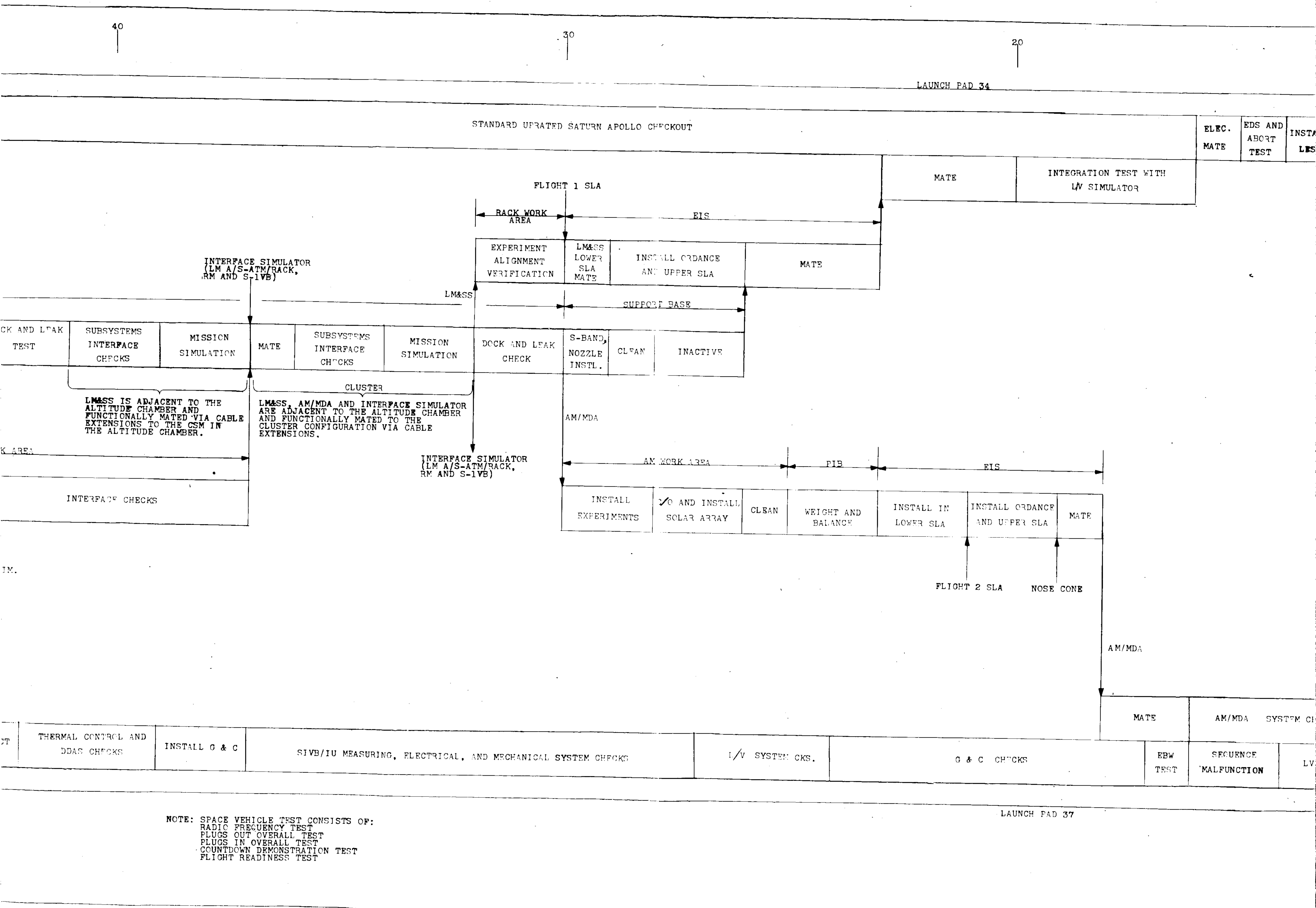
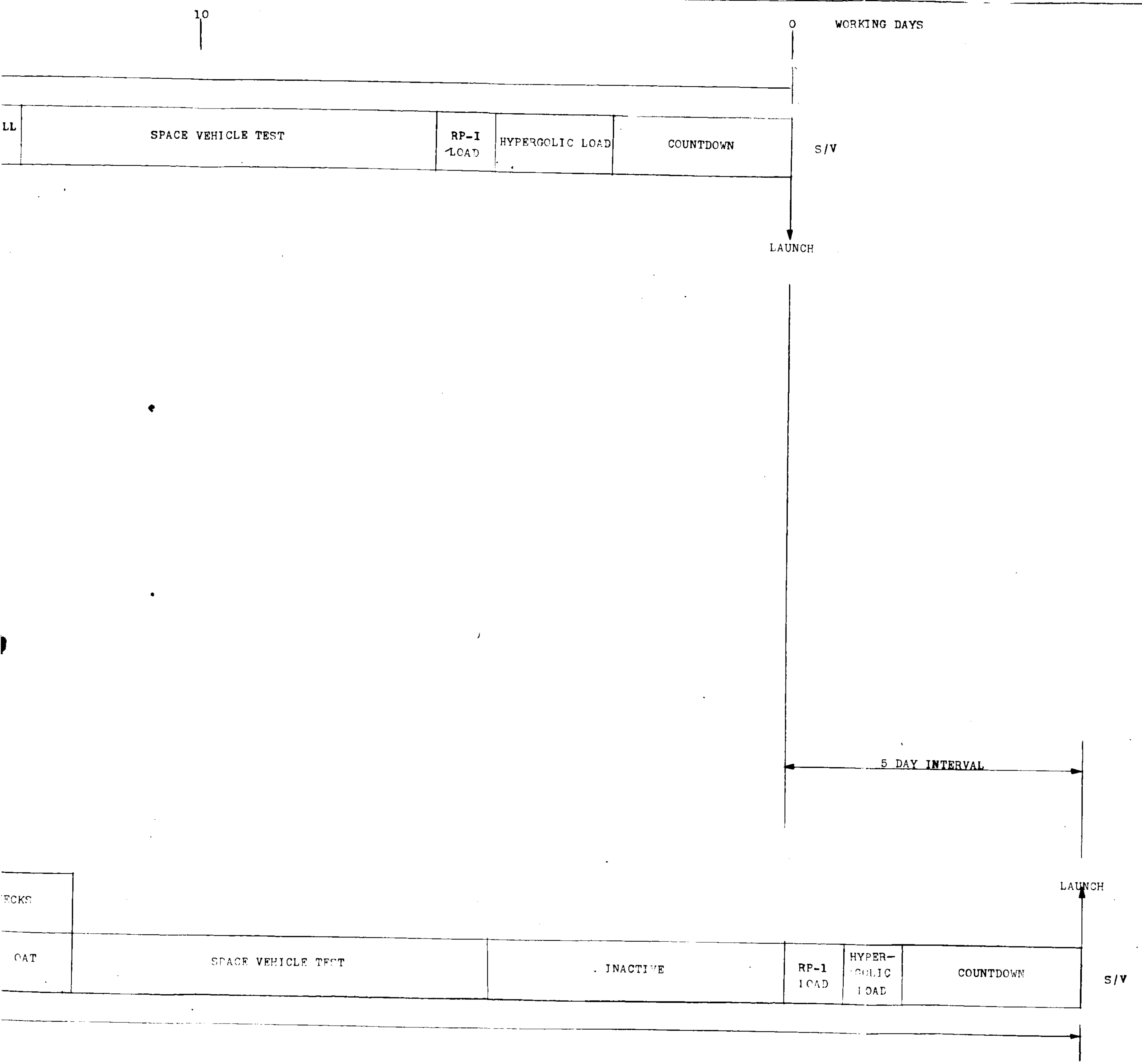


Figure 1. Prelaunch Checkout And Launch Pad Activities Time-Based Functional Flow Diagram For AAP 1/2



PRELAUNCH CHECKOUT AND LAUNCH PAD ACTIVITIES TIME-BASED FUNCTIONAL FLOW DIAGRAM FOR AAP 1/2

DATE: 7 APRIL, 67

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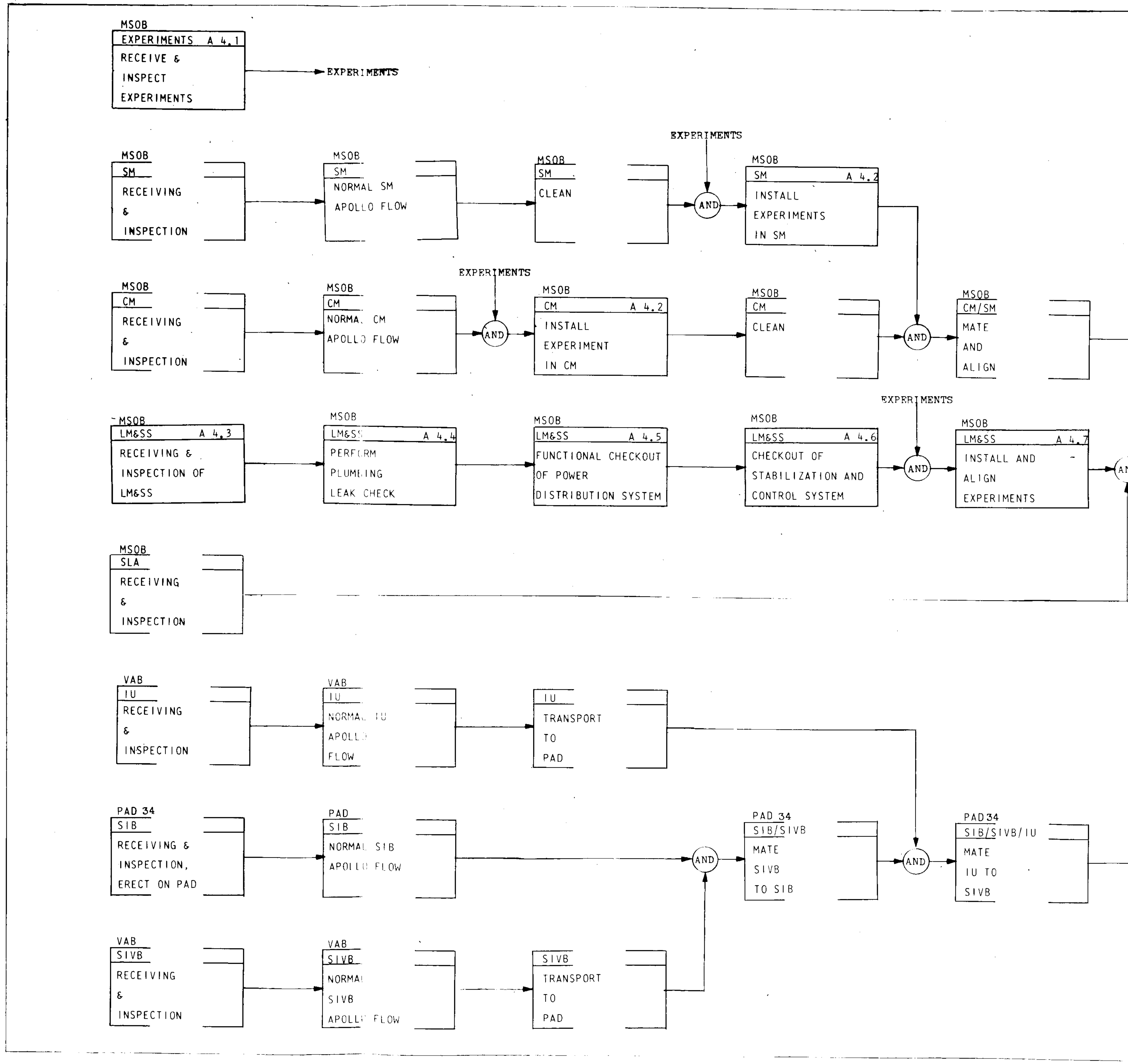
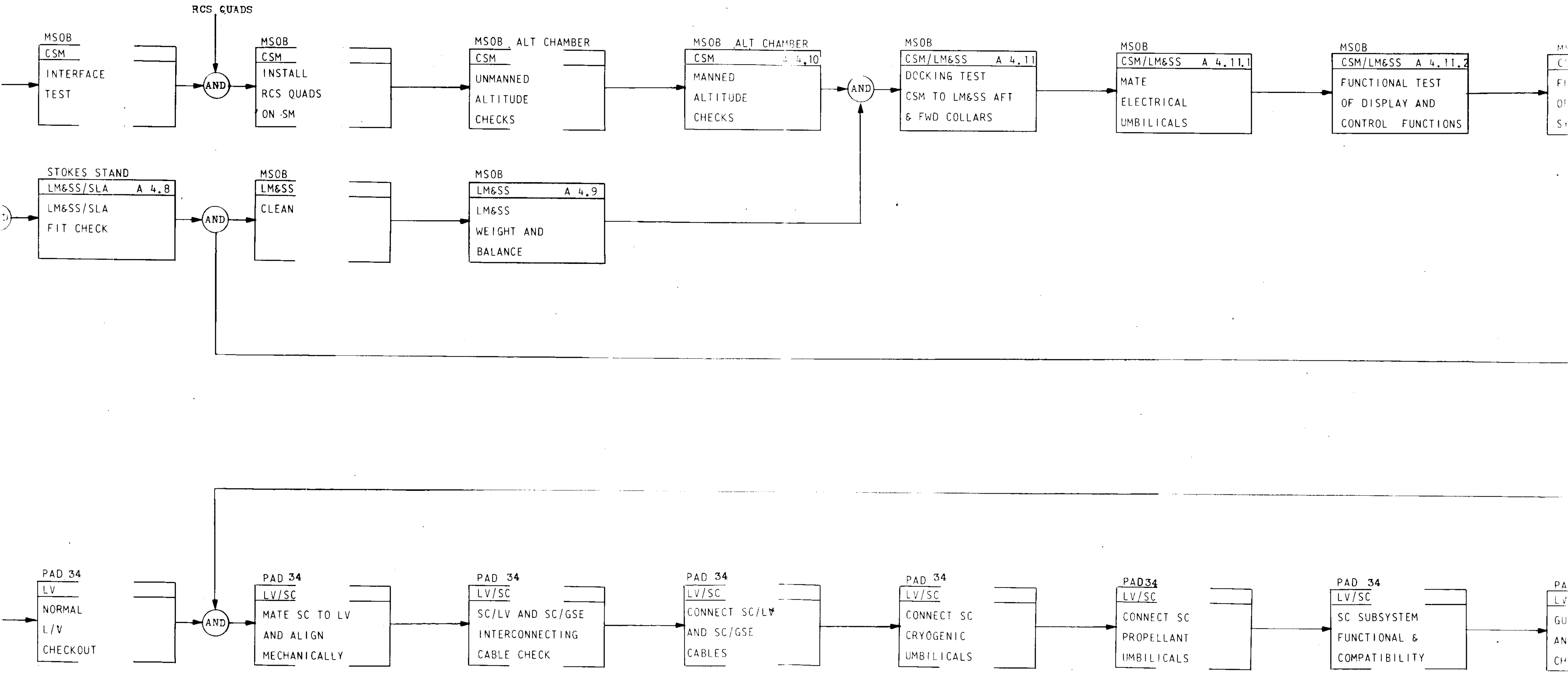



RCS QUADS
MSOB
CSM
INTERFACE TEST
AND
MSOB
CSM
INSTALL RCS QUADS ON SM
MSOB ALT CHAMBER
CSM
UNMANNED ALTITUDE CHECKS
MSOB ALT CHAMBER
CSM A 4.10
MANNED ALTITUDE CHECKS
AND
MSOB
CSM/LM&SS A 4.11
DOCKING TEST CSM TO LM&SS AFT & FWD COLLARS
MSOB
CSM/LM&SS A 4.11.1
MATE ELECTRICAL UMBILICALS
MSOB
CSM/LM&SS A 4.11.2
FUNCTIONAL TEST OF DISPLAY AND CONTROL FUNCTIONS
STOKES STAND
LM&SS/SLA A 4.8
LM&SS/SLA FIT CHECK
AND
MSOB
LM&SS
CLEAN
MSOB
LM&SS A 4.9
LM&SS WEIGHT AND BALANCE
PAD 34
LV
NORMAL L/V CHECKOUT
AND
PAD 34
LV/SC
MATE SC TO LV AND ALIGN MECHANICALLY
PAD 34
LV/SC
SC/LV AND SC/GSE INTERCONNECTING CABLE CHECK
PAD 34
LV/SC
CONNECT SC/LV AND SC/GSE CABLES
PAD 34
LV/SC
CONNECT SC CRYOGENIC UMBILICALS
PAD34
LV/SC
CONNECT SC PROPELLANT UMBILICALS
PAD 34
LV/SC
SC SUBSYSTEM FUNCTIONAL & COMPATIBILITY

2

3

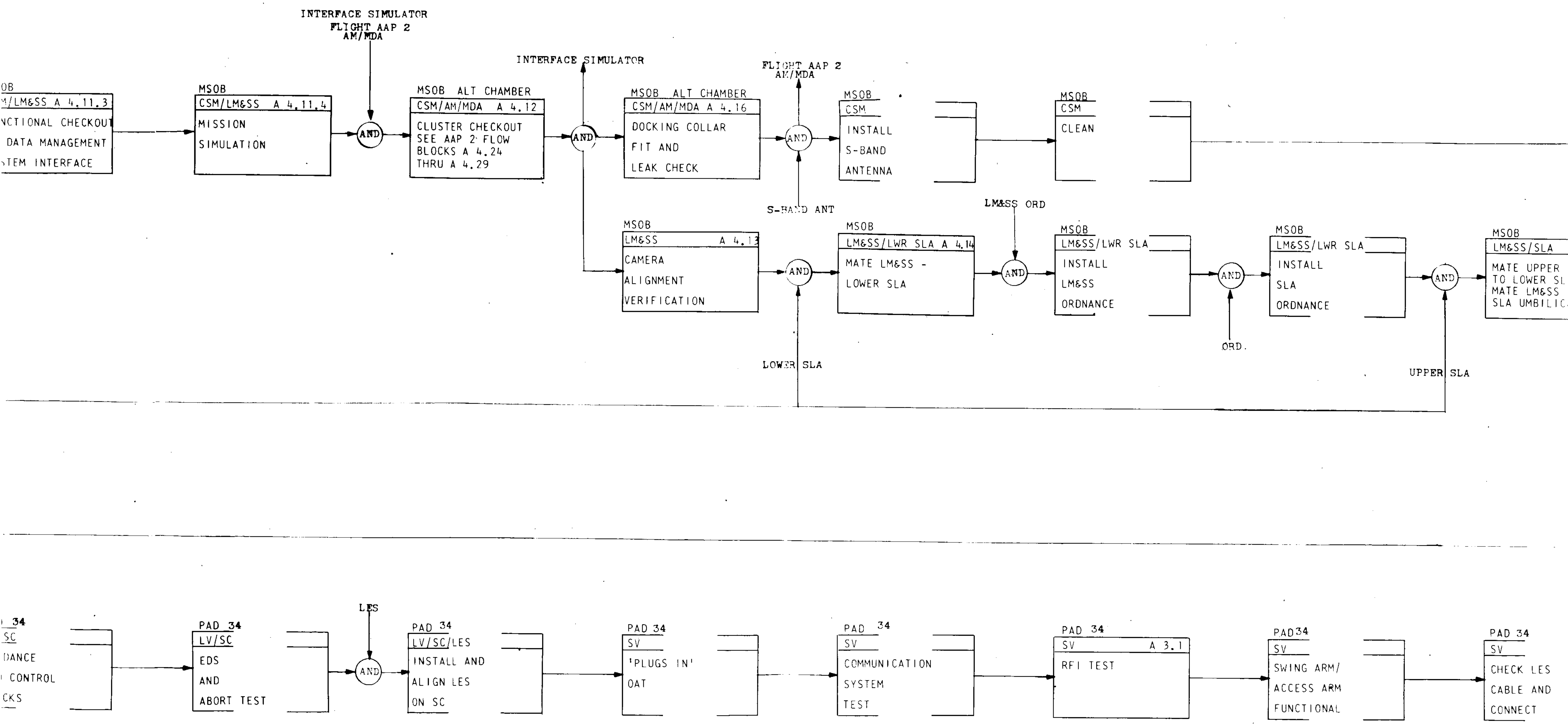
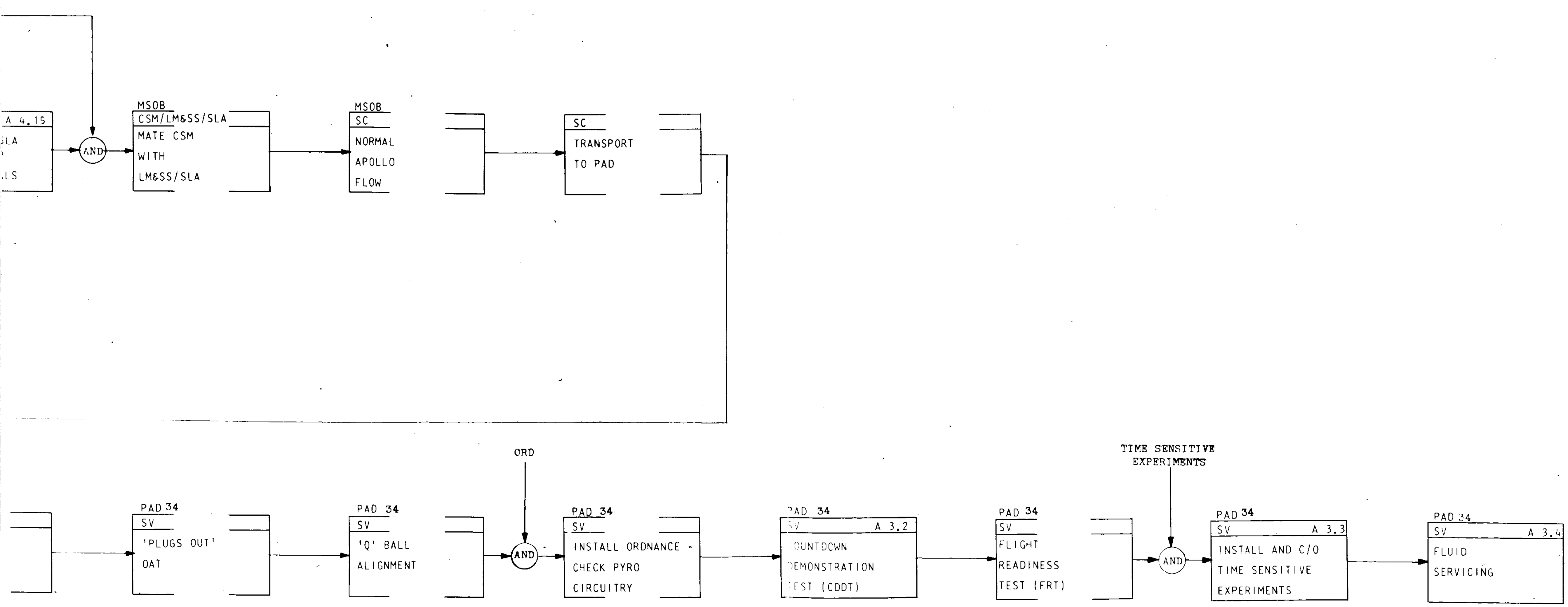


Figure 2. Prelaunch Checkout And Launch Pad Activities Flow For AAP Flight 1


A 4.15
MSOB
CSM/LM&SS/SLA
MATE CSM
WITH
LM&SS/SLA
AND
MSOB
SC
NORMAL
APOLLO
FLOW
SC
TRANSPORT
TO PAD
PAD 34
SV
'PLUGS OUT'
OAT
PAD 34
SV
'Q' BALL
ALIGNMENT
ORD
AND
PAD 34
SV
INSTALL ORDNANCE -
CHECK PYRO
CIRCUITRY
A 3.2
PAD 34
SV
FLIGHT
READINESS
TEST (FRT)
TIME SENSITIVE
EXPERIMENTS
AND
PAD 34
SV
A 3.3
INSTALL AND C/O
TIME SENSITIVE
EXPERIMENTS
PAD 34
SV
A 3.4
FLUID
SERVICING

PAD 34

SV	A 3.5
LAUNCH MONITOR	

PRELAUNCH CHECKOUT AND LAUNCH

PAD ACTIVITIES FLOW FOR AAP FLIGHT #1

DATE: APRIL 7, 67

Table I. Test Requirement Sheets for Figure 2

TEST TITLE: Receive and Inspect Experiments

FLOW BLOCK NO. A4.1

OBJECTIVE: Verify that no shipping damage has occurred.

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: 40 Hrs. (Total)
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying the experiments are reviewed for completeness and accuracy. The experiments are removed from the shipping containers.

OPERATIONS:

A thorough inspection of the experiments is performed. All electrical connectors are inspected for bent pins and foreign particles. Fluid lines are inspected for evidence of damage. No functional checkouts are performed at this time.

CRITERIA FOR SUCCESS:

There shall be no evidence of damage, deterioration or contamination.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling equipment, hand tools.

Table I. Test Requirement Sheets for Figure 2 (Cont.)

TEST TITLE: Install Experiment in the CM and SM

FLOW BLOCK NO. A4.2

OBJECTIVE: Physically mount experiments in the specified carrier.

LOCATION: KSC - MSOB
PERSONNEL TBS
TIME SPAN: 16 Hrs.
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Experiment mounting surfaces are inspected. Final bench checks and calibration are completed. (see section 6 for requirements, constraints and special considerations.)

OPERATIONS:

The experiments are mounted in their appropriate storage areas in the CM and SM. Functional connections are made as required. (see section 6 for requirements.)

CRITERIA FOR SUCCESS:

Experiments shall be installed in accordance with applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling equipment, hand tools.

Table I. (Cont.)

TEST TITLE: Receiving and Inspection of LM&SS

FLOW BLOCK NO. A4.3

OBJECTIVE: Verify that no shipping damage has occurred.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documents accompanying the LM&SS are reviewed for completeness and accuracy. The LM&SS is positioned on its handling dolly in an upright position.

OPERATIONS:

A visual inspection of the LM&SS is performed to verify that no shipping damage has occurred to the structure, mounted S/S, cabling or cabling connectors. The camera mounting surfaces are inspected. Particular attention is given to exposed experiment elements.

CRITERIA FOR SUCCESS:

No transportation damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: LM&SS handling equipment, hand tools

Table I. (Cont.)

TEST TITLE: Perform Plumbing Leak Checks

FLOW BLOCK NO. A4.4

OBJECTIVE: Verify the Integrity of the LM&SS Fluid System

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM&SS is installed in the test fixture. Facility gas is connected to the LM&SS liquid storage fill lines. Verify that environmental and cleanliness controls are adhered to at all times in accordance with the applicable specifications.

OPERATIONS:

A decay check is performed on all storage vessels and a leak detector check is performed on all connections and fittings internal to the carrier. The necessary solenoids are energized so that all plumbing line connections and fittings are exposed to pressure.

CRITERIA FOR SUCCESS:

Fitting and connections will be free of leaks

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Pressure control console

Table I. (Cont.)

TEST TITLE: Functional Check of Power Distribution Systems

FLOW BLOCK NO. A4.5

OBJECTIVES: Verify LM&SS Power Distribution

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to LM&SS to simulate batteries.

OPERATIONS:

The LM&SS power distribution system is verified. CM control signals are simulated, proper polarity is verified at the experiment and component connectors.

CRITERIA FOR SUCCESS:

Power distribution shall be in accordance with the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Carry near LM&SS GSE, Power control console, control signal simulation.

Table I. (Cont.)

TEST TITLE: Checkout of Stabilization and Control System

FLOW BLOCK NO. A4.6

OBJECTIVE: To verify correct polarity of LM&SS stabilization and control system.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM&SS is positioned in its holding fixture. Ground power is applied to the LM&SS.

OPERATIONS:

TBS - insufficient subsystem definition available.

CRITERIA FOR SUCCESS:

TBS

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table I.(Cont.)

TEST TITLE: Install and align experiments

FLOW BLOCK NO. A4.7

OBJECTIVE: Install experiment and cameras in the LM&SS

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 48 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Camera mounting surfaces are thoroughly cleaned. The tilt-angle of the mounting surfaces are verified.

OPERATIONS:

TBS - experiment mounting definition is not available.

CRITERIA FOR SUCCESS:

TBS

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling equipment, TBS

Table I. (Cont.)

TEST TITLE: LM&SS/SLA fit check

FLOW BLOCK NO. A4.8

OBJECTIVE: Verify LM&SS lower SLA fit and clearance

LOCATIONS: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is already in the east integration stand. The upper SLA is removed.

OPERATIONS:

The LM&SS is lowered to the SLA attach points and secured. The LM&SS to upper SLA clearance is verified after the upper SLA is installed. LM&SS to SLA electrical and fluid access port compatibility is verified.

CRITERIA FOR SUCCESS:

Fit and clearance shall be in accordance with applicable ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table I. (Cont.)

TEST TITLE; LM&SS WEIGHT AND BALANCE	FLOW BLOCK NO. A4.9

TEST TITLE: Weigh and determine center of gravity of LM&SS

LOCATIONS: KSC-PIB
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All LM&SS experiments and subsystems have been installed on the carrier. If experiments are not available they will be simulated.

OPERATIONS:

The LM&SS is weighted and the CG is determined using existing PIB facility GSE that has been modified to accommodate the LM&SS.

CRITERIA FOR SUCCESS:

Weight and CG shall be in accordance with the applicable CEI.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Modified PIB weight and CG GSE, LM&SS Handling Equipment.

Table I. (Cont.)

TEST TITLE: Manned Altitude Test

FLOW BLOCK NO. A4.10

OBJECTIVE: Verify H_2 and 02 fluid transfer lines to be free of leaks and verify any altitude sensitive experiments.

LOCATIONS: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 64 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM is installed in the altitude chamber and power cables, signal cables and fluid transfer lines are connected. The experiment peculiar GSE is connected.

OPERATIONS:

This is a normal Apollo requirement. The AAP peculiar subsystems and experiments are checked out during the Apollo Checkout. All experiments are checked out in accordance with section 6.

CRITERIA FOR SUCCESS:

The AAP modifications and experiments shall be compatible with the environment.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table I. (Cont.)

TEST TITLE: Docking test, CSM to LM&SS Aft and Forward Collar

FLOW BLOCK NO. A4.11

OBJECTIVE: Verify CSM to LM&SS docking compatibility

LOCATION KSC-MSOB (Altitude Chamber)
PERSONNEL TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION:

PREPARATIONS:

The CSM is already in the chamber and has been checked out. ACE S/C GSE is still connected.

OPERATIONS:

The LM&SS is raised above the chamber and lowered to the CM. Soft and harddocking is accomplished. Longitudinal axis alignment is verified. The probes and latches are adjusted. Operation of the optical docking aids are verified.

The LM&SS is undocked, inverted, and the forward collar is docked to the CM. Longitudinal alignment is verified. All umbilicals are fit checked. The LM&SS is undocked and lowered to the MSOB main floor adjacent to the altitude chamber.

CRITERIA FOR SUCCESS:

Docking shall be in accordance with the CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Handling fixture, crane, slings, ACE S/C GSE

Table I. (Cont.)

TEST TITLE: Mate Electrical Umbilicals

FLOW BLOCK NO. A4.11.1

OBJECTIVE: Verify electrical interfaces between CSM and LM&SS prior to power application.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM is in the Chamber. The LM&SS is on the MSOB main floor adjacent to the chamber. The CSM umbilicals are connected to power interface boxes through umbilical extensions.

OPERATIONS:

CSM power is applied from ACE S/C. The CM control panel is activated and signal distribution to the LM&SS is verified by interface box lamp illumination. The interface box is removed, the umbilicals are inspected, and the LM&SS and CSM are functionally mated.

CRITERIA FOR SUCCESS:

Power distribution compatibility shall be verified prior to umbilical mate.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Umbilical pin alignment kit, Interface box.
ACE S/C GSE

Table I. (Cont.)

TEST TITLE:	Functional Test of the Display and Control Functions.	FLOW BLOCK NO. A 4.11.2

OBJECTIVE: Verify operation of display and control circuits

LOCATION: KSC MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All interconnecting cables are mated. The necessary power and commodities are supplied from ground sources to support the LM&SS experiments.

OPERATIONS:

All LM&SS controls are initiated sequentially from the CM control panel. Proper experiment and subsystem power up is verified. Response and measurement signals are monitored on the CM display panel. Control signal distribution is verified.

CRITERIA FOR SUCCESS:

The full capability of the display and control circuits will be verified in accordance with the requirements of the CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE/S/C GSE, DDAS

Table I. (Cont.)

TEST TITLE: Functional Checkout of the Data Management System Interfaces	FLOW BLOCK NO. A 4.11.3

OBJECTIVE: Verify the CSM-LM&SS data management system compatibility

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All umbilicals are connected. The MSOB-PCM ground station link is connected.

OPERATIONS:

All experiments are powered up and operated as required to obtain dynamic measurements. Data is transmitted real time and recorded on the on-board recorder. Data dump operation is verified. All recorded data is evaluated against the applicable specifications.

CRITERIA FOR SUCCESS:

The data management system shall perform in accordance with the applicable CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MSOB-PCM ground station, ACE-S/C GSE, DDAS; remainder TBS

Table I. (Cont.)

TEST TITLE: Mission Simulation

FLOW BLOCK NO. A 4.11.4

OBJECTIVE: Verify on-orbit mission compatibility between the CSM & LM&SS

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All umbilicals are connected. All necessary power and commodity requirements are supplied by ground sources.

OPERATIONS:

A complete mission simulation (4-day) is performed in compressed time and in on-orbit mission sequence. The CSM is under ACE/S/C control, the LM&SS is controlled by LM&SS peculiar carry near GSE. All operations are performed. All experiments and subsystems are exercised. Data is recorded in the MSOB-PCM ground station. EMC monitoring is performed throughout the test sequence.

CRITERIA FOR SUCCESS:

The simulated mission will verify the compatibility of the experiments, LM&SS and CSM.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: ACE/S/C GSE, DDAS, MSOB-PCM ground station, EMC checkout devices, remainder TBS

Table I. Cont.

TEST TITLE: Cluster Checkout	FLOW BLOCK NO. A4.12

OBJECTIVE: Check compatibility between carriers in cluster configuration.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 80 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The preparations and operations are described in 3.3.3, AAP 2, test requirement sheets, A4.24 thru A4.29. (See Table III).

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS: See 3.3.3 (Table III), AAP 2 test requirement sheets, A4.24 thru A4.29.

COMMODITIES:

EQUIPMENT:

Table I. (Cont.)

TEST TITLE: Camera Alignment Verification

FLOW BLOCK NO. A4.13

OBJECTIVE: Perform final critical camera alignment

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Optical flats are attached to the lens of each camera. Additional flats are attached to the rack reference axis.

OPERATIONS:

A theodolite is set up to view the optical flat on the camera and a second theodolite views the flat on the reference axis. The theodolites are autocollimated on the respective flats. The third theodolite is set up to collimate with the other two theodolites. The angle between the camera and the reference axis is obtained and recorded. (See section 6 for experiment list)

CRITERIA FOR SUCCESS:

Critical angle measurements are verified.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: (3) Theodolites, optical flats, theodolite stands.

Table I. (Cont.)

TEST TITLE: Mate LM&SS - Lower SLA

FLOW BLOCK NO. A 4.14

OBJECTIVE: Mate LM&SS to lower SLA

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is mounted in the east integration test stand. The LM&SS is positioned above the SLA lower section. Work platforms are positioned around upper part of lower SLA. LM&SS and lower SLA mating surfaces are cleaned.

OPERATIONS:

The LM&SS is lowered to the lower SLA until the mating pads come in contact with the LM attachment points.

CRITERIA FOR SUCCESS:

Spacecraft assembly

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: LM&SS handling GSE, crane and hand tools

Table I. (Cont.)

TEST TITLE: Mate Upper SLA to Lower SLA
Mate LM&SS SLA Umbilicals

FLOW BLOCK NO. A4.15

OBJECTIVE: Mate Upper SLA to lower SLA and connect interconnecting power cables between the LM&SS and upper SLA

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM&SS is already installed in the lower SLA and the lower SLA is mounted in the East Integration Stand. The upper section is lifted above the lower SLA/LM&SS combination. The mating surfaces are cleaned on both the upper and lower SLA.

OPERATIONS:

The upper SLA is lowered until the mating surfaces make contact. The two sections of the SLA are torqued to the specified value. The umbilicals are connected between the LM&SS and upper SLA. Clearance measurements are made between the LM&SS and the upper SLA.

CRITERIA FOR SUCCESS:

Spacecraft assembly

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane and hand tools

Table I. (Cont.)

TEST TITLE: Docking collar fit and leak check

FLOW BLOCK NO. A 4.16

OBJECTIVE: CSM-MDA Docking collar fit and leak check verification.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The preparations and operations are described in 3.3.3 (Table III) AAP 2, test requirement sheets, A4.30 thru A4.32.

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS: See 3.3.3 (Table III), AAP 2 Test requirement sheets, A4.30 thru A4.32

COMMODITIES:

EQUIPMENT:

Table I. (Cont.)

TEST TITLE: Radio Frequency Interference (RFI) Test

FLOW BLOCK NO. A 3.1

OBJECTIVE: Verify S/C compatibility with the launch RFI environment. Verify communciations compatibility with ground tracking stations.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Perform normal Apollo preparations. Ground power is applied to the LM&SS through the SLA access port.

OPERATIONS:

This test is a normal Apollo requirement. All RF systems are radiating open loop. The S/C communications system compatibility with tracking stations and mission control is verified. Carrier frequency, subcarrier deviation and phase lock are verified. All S/C systems not operating during the boost phase are de-energized and RF compatibility with the launch environment is verified.

CRITERIA FOR SUCCESS:

Compatibility with the launch environment mission control and the ground tracking stations

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: CIF-PCM ground station

Table I. (Cont.)

TEST TITLE: Countdown Demonstration (CDDT)

FLOW BLOCK NO. A 3.2

OBJECTIVE: Demonstrate S/C readiness for launch and perform integrated dress rehearsal of countdown.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The S/C is in flight configuration. This test is performed in conjunction with the Apollo CDDT.

OPERATIONS:

The spacecraft systems are energized and verified during the countdown sequence. All cryogenic tanks are serviced. The time sensitive experiments or their simulators are installed. Open loop RF checks are performed in countdown sequence. The SLA is closed out and the MSS is moved away. The minus time is picked up and countdown is continued until T -10 sec. After CDDT the SC is restored to its pre-test configuration.

CRITERIA FOR SUCCESS:

Complete demonstration of the feasibility of all operations required in the subsequent launch countdown.

SUPPORT REQUIREMENTS:

COMMODITIES: LO_2, LN_2, LH_2

EQUIPMENT: TBS

Table II. (Cont.)

TEST TITLE: Installation and Checkout of Time Sensitive Experiments

FLOW BLOCK NO. A 3.3

OBJECTIVE: Install experiments that are time sensitive and perform post installation checkout

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 4 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Launch pad activities will have progressed to the point where time sensitive experiments may be installed.

OPERATIONS:

Experiments are installed and checked out. (See Section 6 for requirements)

CRITERIA FOR SUCCESS:

TBS

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table I. (Cont.)

TEST TITLE: Fluid Servicing	FLOW BLOCK NO. A 3.4

OBJECTIVE: Load the LM&SS RCS System.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The servicing GSE is connected to the SLA access port

OPERATIONS:

The LM&SS storage spheres are loaded. The LM&SS mass quantity measure system is monitored during the loading operation.

CRITERIA FOR SUCCESS:

RCS spheres will be loaded.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table I. (Cont.)

TEST TITLE: Launch Monitor

FLOW BLOCK NO. A3.5

OBJECTIVE: Perform S/C launch monitoring during last 6 hours before launch.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

TBS

CRITERIA FOR SUCCESS:

S/C mission critical systems shall maintain launch readiness throughout the countdown.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

3. FLIGHT AAP 2 INTEGRATION AND PRELAUNCH CHECKOUT

Flight AAP 2 is the second flight of the Apollo Applications Program. The launch vehicle consists of an uprated S-IB, a modified S-IVB, and a modified IU. The S-IVB and the IU serve a dual role on this flight, acting as both a part of the LV during the boost phase and as part of the spacecraft on orbit.

The spacecraft consists of: The S-IVB with the orbital workshop modifications; the IU with the passivation modification; a modified SLA which encloses an airlock module (AM)/multiple docking adapter (MDA); and a nose cone.

The airlock module, used as a basis for test requirement definition, is the McDonnell version as defined in MAC report E559, and as updated by later configuration definition.

The MDA is the large, 9-foot cylindrical version with five docking ports. The AM/MDA serves as the central interfacing point for the cluster configuration. The structural and functional interfaces are extensive, and a detailed definition of the interfaces in this document would not serve any useful purpose.

The interfaces used as a basis for the test planning efforts in this document are in accordance with the definitions contained in MMC report, "General Interface Schematics, Flights S/AA #1 through #4, On-Orbit Cluster Configuration," MD-80-0018, dated 3 February 1967.

3.1 Test Requirements - The test requirements defined in this section are predicated on the assumption that certain test activities have preceded integration testing. These assumptions are based on AAP program information available at the time of preparation of this plan. In order to clarify the baseline from which the integration test requirements have been derived, these assumptions are presented.

a. The airlock module (AM) has been subjected to a formal qualification program. Functional performance of the AM flight hardware has been verified by pre-delivery manufacturing checkout at McDonnell's facility.

b. The multiple docking adapter (MDA) has been subjected to qualification and pre-delivery manufacturing checkout by the MDA contractor (or MSFC).

c. The IU passivation modification and associated computer program software has been installed and checked out by IBM.

d. The S-IVB internal orbital workshop (OWS) modifications have been qualified and manufacturing tested prior to delivery to KSC. External OWS modifications will be performed at KSC.

e. All experiments have been flight qualified. Predelivery manufacturing tests will be performed by the experiment developer.

f. Intermodule design compatibility will be verified by qualification testing as described in volume III of this plan.

g. Requirements are based on the mission description and configuration definition contained in volume I of this plan.

3.1.1 Acceptance Test Requirements

3.1.1.1 AM Acceptance Test Requirements - The AM is the responsibility of MSC and acceptance test requirements are out of scope to this plan.

3.1.1.2 MDA Acceptance Test Requirements - The MDA is assumed to be an MSFC responsibility. Basically the MDA can be categorized as a nonfunctional interface module between the AM/OWS and the other cluster modules with some limited functional components. As such, the extent of acceptance type testing while separated from the AM, is limited. This section defines the predelivery (MSFC) acceptance test requirements; however, in reality, portions of the MDA are tested for the first time after mating with the AM at KSC and are included in the AM/MDA combined checkout requirements.

3.1.1.2.1 Verify that the leakage rate of the tunnel section and ports of the MDA are within allowable limits. This requirement must be satisfied by a pressure-decay check and docking port hatch leak check.

3.1.1.2.2 Verify that all electrical continuity and isolation is in accordance with the applicable CEI and ICD specifications. Verify that the MDA, when docked will not violate the cluster single-point ground.

3.1.1.2.3 Verify fit and alignment of all liquid and electrical umbilicals and connectors using close tolerance master gauges.

3.1.1.2.4 Verify the operation of the docking mechanical and optical aids in accordance with the applicable CEI and ICD specifications. Verify docking capability and perform applicable probe and latch adjustments.

3.1.1.2.5 Verify that all liquid and gas plumbing lines will withstand operating pressures with a margin of safety as defined by applicable CEI. Verify that there is no leakage at fittings and connections. Verify performance of associated valves.

3.1.1.2.6 Verify that the electrical power distribution circuitry, relay and switching functions are in accordance with the applicable CEI.

3.1.1.2.7 Verify that all sensors installed in the MDA have been calibrated and that all curves are available. Remove, calibrate and re-install sensors as required.

3.1.1.2.8 Verify by proof pressure and leakage that the MDA radiator will withstand operating pressures.

3.1.1.2.9 Verify the fit and clearance of all stored MDA experiments at MSFC.

3.1.1.2.10 Verify functional compatibility of experiments that are functional in the stored configuration.

3.1.1.2.11 Verify that the MDA Display and Control subsystems perform in accordance with the requirements of the applicable CEI.

3.1.1.3 IU Acceptance Test Requirements - It is assumed that the IU portion of the passivation modification will be installed at IBM and will be included in the acceptance test of the IU. Only the delta requirements are defined.

3.1.1.3.1 Verify that IU computer program software changes are in accordance with the CEI and ICD specifications.

3.1.1.3.2 Verify that the valve actuation control signal network and distribution (to OWS) is in accordance with the applicable CEI and ICD.

3.1.1.3.3 Verify that the ground command link operates in accordance with the applicable CEI.

3.1.1.4 S-IVB Acceptance Test Requirements - All OWS modifications are installed prior to the Douglas captive firing except for the following which will be installed and checked out at KSC:

a. Exterior thermal paint patterns

b. Internal electrical cable

c. Bracketry for solar array

d. Flex boot attach hardware

e. Meteoroid array block bracketry.

The acceptance test requirements generated by the Douglas OWS modification are:

3.1.1.4.1 Verify that the 1½-inch pressure line manual valve and 3-inch vent line and hand valve (H_e bottle) and associated plumbing lines and fittings do not leak and that the installation will withstand operating pressures with an adequate margin of safety.

3.1.1.4.2 Verify passivation modification circuit cable continuity, isolation and distribution.

3.1.1.4.3 Verify that the lighting and fire detection provisions are installed in accordance with the applicable CEI specification.

3.1.1.4.4 Verify that the S-IVB to IU passivation modification interface loads are in accordance with the applicable ICD specifications.

3.1.1.5 SLA Acceptance Test Requirements - The SLA is the responsibility of MSC and the acceptance test requirements are out of scope to this plan.

3.1.2 AM Pre-Mate Checkout Requirements at KSC

3.1.2.1 Verify that no shipping and transportation damage has occurred by performing a nonfunctional damage check.

3.1.2.2 Verify that all logs and documentation are accurate and complete.

3.1.2.3 Verify that all ship-loose items at the assembly level or lower, perform in accordance with the design specification. These tests shall be in accordance with the receiving test requirement of NPC 500-10.

3.1.2.4 Verify that the AM assembly process has been accomplished in accordance with the design specification. In satisfying this requirement, in-process tests shall be performed at intermediate points and shall include, but not be limited to:

a. Continuity checks

b. Leak checks

c. Mechanical alignment

3.1.2.5 Verify, prior to the initial AM/MDA mate, that the power and control circuit interface loads and distribution are in accordance with the latest AM/MDA ICD specifications.

3.1.3 <u>MDA Pre-Mate Checkout Requirement at KSC</u>

3.1.3.1 Verify that no shipping or transportation damage has occurred by performing a visual damage check.

3.1.3.2 Verify that all accompanying paperwork is complete and accurate.

3.1.3.3 Verify, prior to initial AM/MDA mate, that the power and control circuit interface loads and distribution are in accordance with the latest AM/MDA ICD specification.

3.1.4 <u>AM/MDA Combined Checkout Requirements at KSC</u>

3.1.4.1 Verify that the AM/MDA power buss returns are grounded at a single point, prior to the initial application of AM/MDA power.

3.1.4.2 Verify that the forward AM compartment, MDA main body and MDA docking port leakage rate is within allowable limits. In meeting this requirement, a pressure-decay check shall be performed and in addition, a leak check shall be performed on each MDA docking port hatch, the AM to MDA interface surface and the forward AM hatch using either the bubble method or the leak rate tester method.

3.1.4.3 Verify that the airlock (AM center compartment) leakage is within allowable limits. In satisfying this requirement, both a pressure decay check and an aft and forward hatch leak check shall be performed.

3.1.4.4 Verify that the individual AM/MDA subsystems perform in accordance with the applicable CEI specification. In satisfying this requirement, the extent of testing shall be that required to re-establish confidence in system operability prior to interface testing (location change checkout). Quantitative testing shall be minimized.

3.1.4.5 Verify intersystem compatibility (overall tests). This requirement may be satisfied by an AM/MDA all systems test or by a mission simulation checkout with other mission elements. This requirement encompasses, but is not limited to:

a. Verification of intersystem functional compatibility when operated under the mission modes and sequences.

b. Verification of experiment compatibility.

c. Verification of electromagnetic compatibility during the on-orbit operation.

3.1.4.6 Verify that the AM/MDA weight and balance (CG) is in accordance with the applicable specification. In satisfying this requirement, the AM/MDA must be complete including all stored experiments. Time sensitive experiments will be simulated by weight and CG simulators if the mass property effects cannot be accurately calculated.

3.1.5 Instrument Unit (IU) Pre-Mate Checkout Requirements at KSC

3.1.5.1 Verify that the IU portion of the passivation modification has been installed in accordance with the applicable CEI and ICD documents. This requirement shall be satisfied by a continuity, signal distribution and network checkout.

3.1.5.2 Verify that the IU computer program software for the passivation modification is complete and accurate prior to usage with the flight hardware.

3.1.6 S-IVB Pre-Mate Checkout Requirements at KSC

3.1.6.1 Verify that the passivation modification continuity is in accordance with the applicable ICD and CEI specifications.

3.1.6.2 Verify that the whip antenna system VSWR and attenuation is in accordance with the applicable specification.

3.1.6.3 Verify that the OWS passivation modification loads are in accordance with the ICD specification.

3.1.7 <u>AM/MDA/OWS Checkout Requirements at KSC</u>

3.1.7.1 Verify that the AM boot to OWS dome fit and alignment is in accordance with the applicable specification.

3.1.7.2 Verify that the AM aft compartment/OWS dome leakage rate is within specified limits. In satisfying this requirement, a pressure decay check shall be performed.

3.1.7.3 Verify functional interface compatibility between the AM/MDA and the S-IVB OWS.

3.1.8 <u>AM/MDA/SLA Checkout Requirements at KSC</u>

3.1.8.1 Verify early in the prelaunch checkout flow that the fit, alignment and clearance between the AM/MDA and the upper and lower SLA are in accordance with the requirements of the applicable ICD specification.

3.1.8.2 Verify that the SLA cryogenic and servicing access ports and umbilicals are in accordance with the applicable specification.

3.1.9 <u>IU/S-IVB Checkout Requirements at KSC</u>

3.1.9.1 Verify total passivation modification performance. In satisfying these requirements, the test must verify the following:

a. Automatic portion of the passivation sequence using the IU computer program.

b. Manual portion of the passivation sequence.

c. Checkout of the ground originated passivation signals through the IU command system.

3.1.10 AM/MDA Interflight Interface Checkout Requirements at KSC

3.1.10.1 Verify that the AM/MDA mechanical interfaces are compatible with the CSM of AAP 1, the CSM of AAP 3, the RM of AAP 3, the LM&SS of AAP 1 and the ATM/Rack of AAP 4. This requirement shall be staisfied by docking demonstrations, fit and alignment checks, and interface pressure checks as applicable to the type of interface.

3.1.10.2 Verify that the AM/MDA functional interfaces are compatible with the CSM of AAP 1, the CSM of AAP 3, the RM of AAP 3, the LM&SS of AAP 1 and the ATM/Rack of AAP 4.

3.1.11 Total Space Vehicle AAP Checkout Requirements at KSC

3.1.11.1 Verify that the S/C is compatible with the boost phase EMC and RFI environment.

3.1.11.2 Verify that the S/C RF communication systems are compatible with the ground tracking stations.

3.2 PIF Operations

3.2.1 General Summary - This section presents the recommended methods of implementing the PIF test requirements on the MDA.

Two of the three MDA sections are fabricated at MSFC. These two sections are the upper MDA, consisting of the five docking ports, and the middle MDA, consisting of a basic cylinder that connects the upper MDA to the MDA radiator section.

Inprocess testing is performed on the upper MDA. The testing is performed to verify the hardline wiring continuity and that the plumbing lines are leak free. The upper MDA is mated to the middle MDA in an MDA handling fixture. The interface plumbing and wiring connections between the sections are inspected and mated.

The MDA is transferred from its holding fixture to the shake table fixture. The MDA is attached to the shake table, spring-mass accelerometers are installed at specified locations. The accelerometer outputs are recorded at the same time the shaker vibration and amplitude are varied over the specified range.

After the low-level vibration test, the MDA welded joints are subjected to X-ray checks to detect any latent manufacturing defects. A dye penetration check may be performed if there is a questionable X-ray result.

Wiring continuity checks are performed to verify end-to-end continuity between the two MDA sections. The display and control circuit in the MDA consists of an MDA pressure transducer and a readout of the RM pressure transducer. An electrical interface simulator is used to simulate interfaces so the display in the MDA can be verified.

The middle MDA section, fluid umbilicals that interface with the MDA radiator section are connected to a pneumatic console. The upper MDA, fluid umbilicals that interface with the RM, LM, and CSM are capped. A gaseous nitrogen/helium mixture is used to pressurize the fluid lines. A leak-rate detector test is performed on all plumbing connectors.

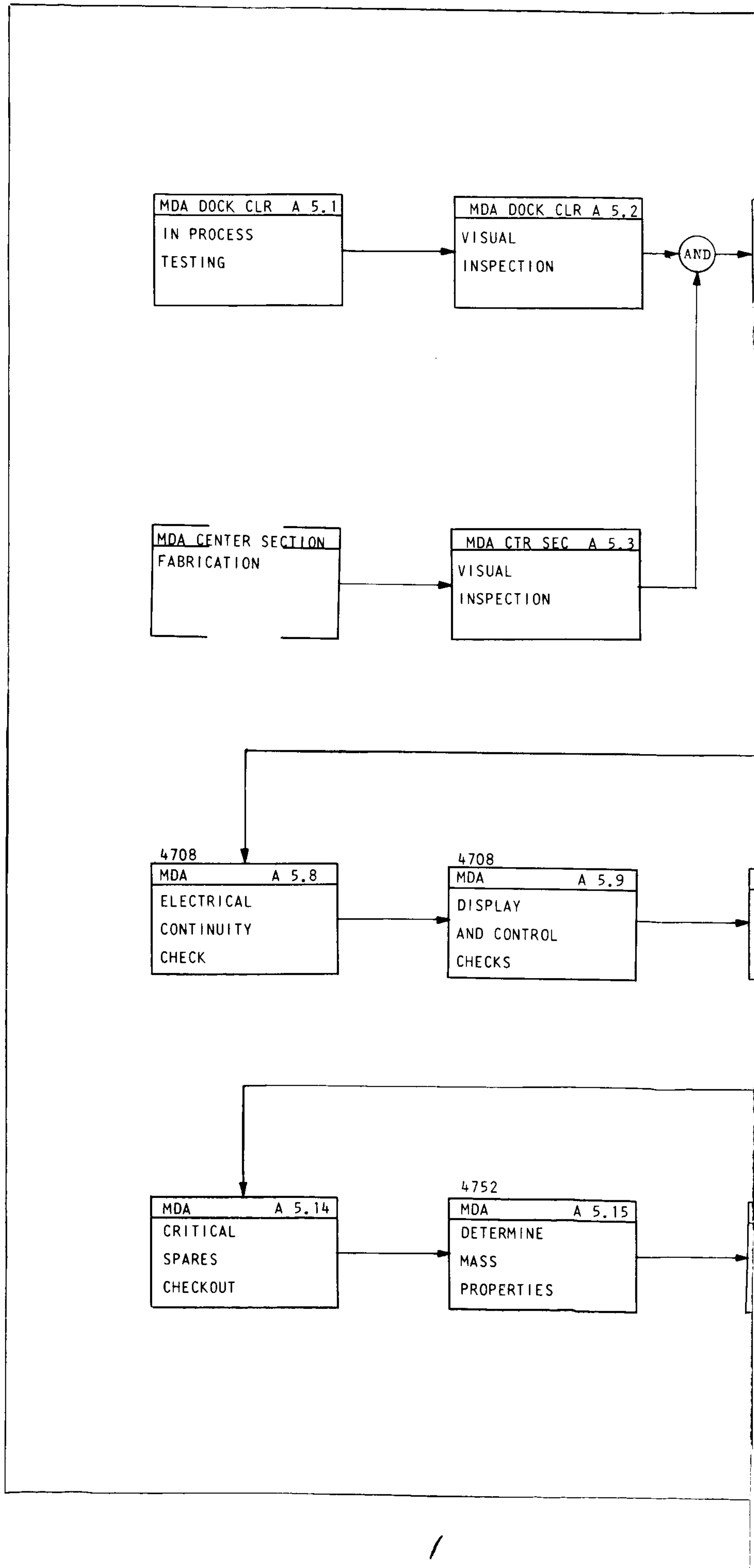
The upper MDA docking port hatches are closed and secured. A MDA radiator master gauge or prototype is attached to the aft opening of the middle MDA. The master gauge is equipped with a gasket to make the connection air tight. The master gauge is provided with a fitting to allow a pressure line connection. The MDA is pressurized to 6 psig with a GN_2/ GH_e mixture. A leak detector check is performed around all hatches and around the middle MDA plate. After stabilization, a pressure decay check is performed over a two-hour time period.

The MDA radiator master gauge is removed from the MDA. A docking collar and pressure simulator is in its dolly and positioned at one of the docking ports. The docking collar and pressure simulator is docked with one of the MDA docking ports and probe and latch adjustments are performed. A mixture of GN_2 and GH_e is used to pressurize the docking collar to 6 psig. A leak rate detector test is performed around the docking collar. A pressure decay test over a time span of two hours is used to evaluate the leak rate. The same test is performed on the remaining four MDA docking ports.

The MDA is rotated and cleaned of all foreign material. Mass property simulators are installed in the MDA to simulate the experiment packages and to evaluate fit and clearance. Weight and balance is determined and the MDA is prepared for shipment.

This summary is based on a mission configuration where all MDA experiments are stored and are not operable from the MDA. Recent studies indicate that it may be feasible and desirable to operate some experiments on the MDA. This would require that actual experiments rather than mass simulators be installed and checked out at PIF.

Critical spare subsystem or assemblies are verified at the system level by replacing actual MDA flight hardware with the available spares. Following the spares checkout, the MDA is reconfigured with the flight hardware that was removed and all systems are reverified prior to shipment to KSC.


MDA DOCK CLR A 5.1
IN PROCESS
TESTING
MDA DOCK CLR A 5.2
VISUAL
INSPECTION
AND
MDA CENTER SECTION
FABRICATION
MDA CTR SEC A 5.3
VISUAL
INSPECTION
4708
MDA A 5.8
ELECTRICAL
CONTINUITY
CHECK
4708
MDA A 5.9
DISPLAY
AND CONTROL
CHECKS
MDA A 5.14
CRITICAL
SPARES
CHECKOUT
4752
MDA A 5.15
DETERMINE
MASS
PROPERTIES

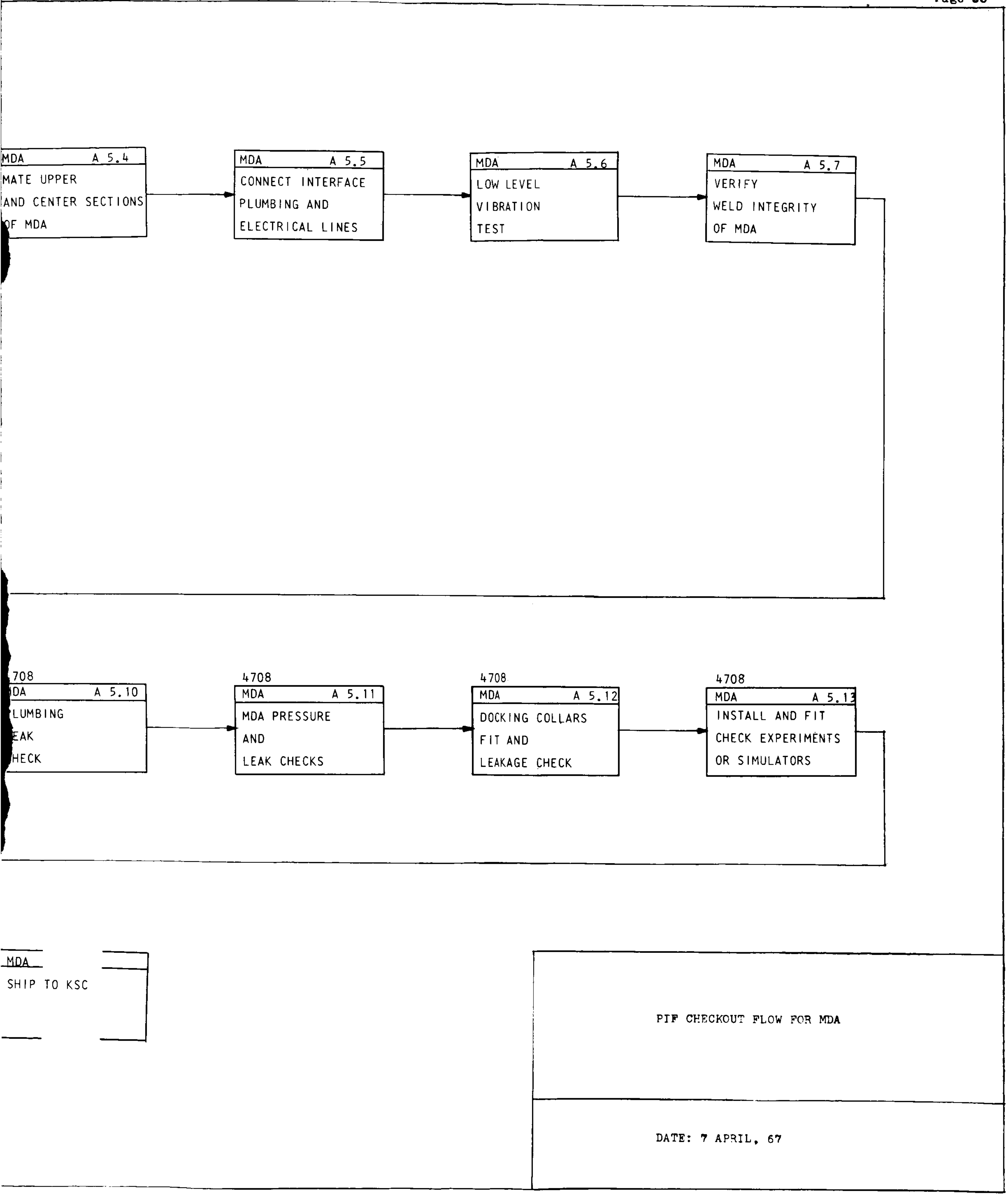


Figure 3. PIF Checkout Flow For MDA

3.2.2 PIF Checkout Flow Diagram for the MDA - The flow diagram (figure 3) is presented to illustrate the recommended method of implementing and satisfying the test requirements at MSFC.

3.2.3 Test Requirement Sheets - Table II defines specific blocks of the AAP 2 flow diagram for MSFC operation. Each sheet is identified by the flow block title and number.

Table II. Test Requirement Sheets for Figure 3

TEST TITLE: In Process Testing

FLOW BLOCK NO. A 5.1

OBJECTIVE: To verify workmanship during MDA docking collar section assembly

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: Continuous through manufacturing
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Tests and inspections are performed after each major assembly process.

OPERATIONS:

During the assembly of the docking collar section, cable harness, and plumbing lines, clearance and fit checks are performed. After plumbing line installation is complete, a leak check is performed to verify all connections. Following the installation of the wiring harness, a continuity and megger check is performed.

CRITERIA FOR SUCCESS:

The assembled carrier will meet the clearance specifications. The plumbing and wiring will conform to the available specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: MDA checkout set, pressure console, pressure lines.

Table II. (Cont.)

TEST TITLE: Visual Inspection of Assembled MDA Docking Collar Section

FLOW BLOCK NO. A 5.2

OBJECTIVE: Verify that the docking collar section is ready to mate with the center section.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The MDA docking collar section is installed in a handling fixture and the work access platform is positioned around the carrier. Environmental and cleanliness controls are adhered to at all times in accordance with the applicable specifications.

OPERATIONS:

A visual check of cable and plumbing routing for clearance and tension is made. A visual inspection of the MDA docking collars is performed to verify the installation of all fasteners.

CRITERIA FOR SUCCESS:
Verify that all docking collar fasteners are installed. Verify routing of plumbing and electrical wiring lines.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MDA docking collar section handling fixture, work access platform

Table II. (Cont.)

TEST TITLE: MDA Center Section Visual Inspection

FLOW BLOCK NO. A5.3

OBJECTIVE: To verify that the center MDA section is ready for mating to the forward section

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The MDA center section is mounted in a dolly. Access ladders are used for entry into the center section.

OPERATIONS:

A visual inspection is made of the wiring harnesses as well as the plumbing lines. Routing and clearance is verified. The attachment points between the MDA and wiring harness and between the MDA and the plumbing lines are checked for damage.

CRITERIA FOR SUCCESS:

The center section is ready to mate.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MDA transportation dolly, access ladder

Table II. (Cont.)

TEST TITLE: Mate Upper and Center Sections of the MDA	FLOW BLOCK NO. A 5.4

OBJECTIVE: Join the upper and center MDA sections

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The center MDA section is mounted in its handling fixture. The upper MDA section is positioned above with an overhead crane. A work access platform is positioned around the top of the center MDA section.

OPERATIONS:
The upper MDA is lowered and attached to the center section. Fit and alignment between the two sections is verified. The interface bolts are torqued to the specified value.

CRITERIA FOR SUCCESS:
Proper mating of the two sections

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MDA handling fixture, overhead crane, work access platform, torque wrench

Table II. (Cont.)

TEST TITLE: Connect Interface Plumbing and Electrical Lines

FLOW BLOCK NO. A 5.5

OBJECTIVE: Functionally mate the upper two sections of the MDA

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Work platforms are installed in the center section. Environmental and cleanliness controls are adhered to at all times in accordance with the applicable specifications.

OPERATIONS:

Interfacing electrical connectors are inspected and connected. Interfacing plumbing lines are inspected and connected. Checks for tension and clearance are performed.

CRITERIA FOR SUCCESS:

Mating of interfacing connections

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Portable work platforms, overhead crane

Table II. (Cont.)

TEST TITLE: Low Level Vibration Test	FLOW BLOCK NO. A 5.6

OBJECTIVE: Vibrate the MDA to verify that no latent manufacturing defects exist

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The MDA is attached to the shaker table by an adapter fixture. Mass accelerometers are connected to the carrier at specified points. The accelerometer outputs are connected to the signal conditioners and displayed on recorders.

OPERATIONS:

The shaker is energized and the frequency and amplitude is varied over the specified range. The accelerometer outputs are recorded to verify amplitude and frequency at selected locations on the MDA structure.

CRITERIA FOR SUCCESS:

No latent manufacturing defects

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Spring-mass accelerometer and associated GSE, hand tools, shaker table, recorder, overhead crane

Table II. (Cont.)

TEST TITLE: Verify Weld Integrity of MDA

FLOW BLOCK NO. A 5.7

OBJECTIVE: To check all welded joints following the vibration test

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The MDA is installed in its handling fixture. A work access platform is positioned around the MDA. The X-ray equipment is verified to be in operational readiness.

OPERATIONS:
The X-ray equipment is positioned so that every weld can be X-rayed. The X-ray pictures are evaluated for flaws. Any questionable weld is dye checked to determine if the weld has a crack. Plumbing lines are checked for rupture and loose fittings.

CRITERIA FOR SUCCESS:

Verify that all welds are flight ready.

SUPPORT REQUIREMENTS:

COMMODITIES: X-ray film

EQUIPMENT: X-ray equipment, dye check equipment, handling fixture, work access platform

Table II. (Cont.)

TEST TITLE: Electrical Continuity Checks

FLOW BLOCK NO. A 5.8

OBJECTIVE: Verify end to end continuity of the MDA cable harness

LOCATION: MSFC - 4708
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All wire harnesses are installed. The MDA sections are electrically mated.

OPERATIONS:
A MDA checkout set is used to verify continuity and adequate isolation. The MDA grounding system is checked.

CRITERIA FOR SUCCESS:

Wiring shall be in accordance with the applicable drawings and specifications

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MDA Checkout Set, VOM, bridge

Table II. (Cont.)

TEST TITLE: Display and Control Checks

FLOW BLOCK NO. A 5.9

OBJECTIVE: Verify display and control functions for correct response

LOCATION: MSFC - 4708
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

External ground power is applied to the MDA distributor.

OPERATIONS:
The MDA pressure transducer and associated circuitry is checked for proper level at ambient. The MDA display of the RM pressure is checked out by applying simulated signals at the electrical interface simulator.

CRITERIA FOR SUCCESS:

D&C operation in accordance with the CEI and ICD specifications

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Interface electrical simulator, ground power console, MDA checkout set

Table II. (Cont.)

TEST TITLE: Plumbing Leak Checks

FLOW BLOCK NO. A 5.10

OBJECTIVE: Leak check all fluid lines, fittings and connectors

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The MDA is in its holding fixture. The necessary GN_2/GH_e supply lines are connected to the middle MDA fluid umbilicals. The upper MDA fluid umbilicals are capped.

OPERATIONS:

The MDA fluid lines are pressurized to the specified value. A leak detector check is performed on all plumbing connectors, fittings and quick disconnects. A pressure decay check is done in accordance with CEI specifications.

CRITERIA FOR SUCCESS:
The leak rate detector results will be within the allowable limits

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2/GH_e mixture

EQUIPMENT: Pneumatic console, pressure lines, pressure gauge, leak rate detector

Table II. (Cont.)

TEST TITLE: MDA Pressure and Leak Check

FLOW BLOCK NO. A 5.11

OBJECTIVE: Leak check MDA and verify compatibility with the radiator section

LOCATION: MSFC - 4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

A master gauge radiator plate is installed on the middle MDA. The upper MDA docking port hatches are closed.

OPERATIONS:
The master gauge radiator plate installation is used to verify bolt hole alingment and fit. In addition, the plate is equipped with a Schrader valve to facilitate pressurization of the MDA.

The MDA is pressurized to 6 psig using a GN_2/GH_e mixture. All five docking port hatches are leak checked. The center MDA to upper MDA interface is leak checked. The MDA to master gauge is leak checked. After pressure stabilization, a one-hour pressure decay check is accomplished.

CRITERIA FOR SUCCESS:

Leakage rates shall be within allowable limits.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2/GH_e mixture

EQUIPMENT: Leak rate detector, master gauge radiator plate, pressure control console, pressure lines, pressure gauges

Table II. (Cont.)

TEST TITLE: Docking Collar Fit and Leakage Check

FLOW BLOCK NO. A 5.12

OBJECTIVE: Fit check each docking port on the MDA and perform leak check

LOCATION: MSFC - 4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The MDA is in its rotational handling fixture. The five docking port hatches are closed. The docking collar and pressure simulator is in its dolly and positioned to one of the docking ports. The dummy radiator plate is removed. The work platform coarse height adjustment is performed.

OPERATIONS:

The docking collar pressure simulator is docked to the MDA port. Probe and latch adjustments are accomplished. Ground pressure is applied to the simulator with the internal valve open allowing simultaneous pressurization of the simulator and the docking port to the closed hatch. A leak check is performed on the closed hatch from inside the MDA and at the interface. Each docking port is checked in the same manner.

CRITERIA FOR SUCCESS:
Docking interfaces and leakage rates shall be in accordance with the requirements of the CEI and ICD.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2/ GH_e

EQUIPMENT: Docking collar and pressure simulator, leak rate detector, ground pressure lines, pressure gauge

Table II. (Cont.)

TEST TITLE: Install and Fit Check Experiments or Simulators

FLOW BLOCK NO. A 5.13

OBJECTIVE: Verify experiment mounting fit and clearance. Prepare for mass property tests.

LOCATION: MSFC - 4708
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All experiments (or experiment simulators) are moved to the test area.

OPERATIONS:

All experiments are installed. If experiments are not delivered to PIF, the experiment prototypes or size/shape/weight simulators are installed for fit and clearance checks. Experiments remain installed for mass property checks in block A5.15.

CRITERIA FOR SUCCESS:

Fit and clearance shall be as defined by applicable ICD specification

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling GSE - TBS

Table II. (Cont.)

TEST TITLE: Critical Spares Checkout	FLOW BLOCK NO. A 5.14

OBJECTIVE: To verify system after major (critical spares) components have been changed.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

After the system has been functionally checked out (mechanical and electrical), major components as identified by the critical items list will be replaced.

OPERATIONS:

Reverify system integrity by functionally checking out system using same test procedures and test equipment.

CRITERIA FOR SUCCESS:

Successful completion of testing by reverification of system, after replacement of major components with spare items.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table II. (Cont.)

TEST TITLE: Determine Mass Properties

FLOW BLOCK NO. A 5.15

OBJECTIVE: Verify that weight and CG is in accordance with specifications

LOCATION: MSFC - 4752
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The MDA is moved to Building 4752.

OPERATIONS:

The MDA is weighed and CG is determined in both the horizontal and vertical position by a three point load cell suspension.

CRITERIA FOR SUCCESS:

Weight and CG is determined.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Weight and balance fixtures, load cells

3.3 KSC Operations - This section presents the recommended method of implementing the test requirements for AAP 2 at KSC. The section is divided into three parts: a narrative summary of the prelaunch checkout flow, a flow block diagram, and a set of test requirement sheets which describe each block of the flow diagram in detail.

3.3.1 General Summary

3.3.1.1 Nose Cone and SLA - The nose cone and SLA follow the normal Apollo flow with the exception of the fit check described in the AM/MDA section (3.3.1.4).

3.3.1.2 S-IVB - The S-IVB follows the normal Apollo flow in the KSC industrial area (VAB) with the following additions:

a. The OWS passivation modification is subjected to a power off verification of interface loads. Continuity and network checks are performed in the VAB.

b. The thermal paint patterns are applied.

c. The OWS passivation mod is checked out with the IU as described under the LP activities.

3.3.1.3 IU - The IU follows the normal Apollo flow with the following additions:

a. The OWS passivation modification is checked out for control signal distribution, interface loads and continuity in the VAB.

b. The IU computer program software is checked out at VAB.

c. The OWS passivation mod is checked out with the S-IVB as described under LP activities.

3.3.1.4 AM/MDA - The AM/MDA has the most significant impact on KSC requirements. No comparable Apollo flow exists.

The AM is received in five sections: four truss members and the tunnel section. Receiving inspection is performed on the individual sections. No functional receiving tests are performed.

The AM members are assembled on the McDonnell provided AM handling dolly which has been modified to accommodate the mated AM/MDA. Inprocess assembly tests included verification of continuity between the truss electrical connections, leak check of the fluid lines and fittings, visual inspections of the machined mating surfaces and mechanical alignment checks.

The MDA is received in two sections. Each section is inspected and the upper MDA is mated to the radiator section on the MDA transporter.

The MDA is mated with the AM on the AM handling dolly. Inprocess checks consist of a visual inspection of the mating surfaces and verification of alignment, fit and clearance. Prior to electrically mating the AM and MDA, the interface loads and power and control circuit continuity is verified.

The AM/MDA is transported on the handling dolly to the east integration (Stokes) stand where an AM/MDA/SLA/nose cone fit, alignment and clearance check is performed. Following the fit checks, the SLA and nose cone are released to follow the normal Apollo prelaunch checkout flow.

The area formed by the closed forward AM hatch and the closed MDA docking port hatches is pressurized to approximately 5.7 psig. A pressure decay check is performed and each hatch and the AM to MDA interface is leak checked. The airlock (center compartment) of the AM is then pressurized and a pressure decay and leak check is performed on the forward and aft AM hatches.

Pressure is vented and all AM docking collars are verified for probe and latch adjustment, alignment and leakage using the docking collar and pressure simulator. All but the forward docking port is checked (will be docked with AAP 1 CSM).

The AM/MDA systems are functionally verified (location change checkout) using carry near GSE and interface simulator. This series of tests consist of combined single point ground verification, mass quantity measurement system calibration, power system functional, LSS and thermal control functional, instrumentation calibration and functional, television functional, and D&C verification.

The AM/MDA is moved to the vicinity of the CSM altitude chamber and mated with the AAP 1 CSM in the chamber via umbilical extensions. The LM&SS is also connected to the MDA via marriage cables. The AAP 1 CSM has already been checked out (AAP 1 prelaunch checkout flow). AM/MDA to CSM power, communications and D&C interface checks are performed. Total cluster configuration interfaces are verified by use of an S-IVB/RM/ATM simulator. This series of checkouts culminates in a compressed time cluster mission simulation with all experiments operating in the on-orbit mode and sequence. EMC monitoring is performed throughout the mission simulation. The CSM is controlled by ACE-S/C GSE. The MSOB-PCM ground station is used to record all telemetry data.

The cluster and GSE umbilicals are disconnected. The AM/MDA is moved to the modified AM inverting fixture, inverted and raised above the CSM in the chamber. The AM/MDA is lowered to the CM and soft and hard docking is accomplished. The CM is pressurized to 5 psig and the AM/MDA to 3 psig. Pressure is equalized by the equalization valve and a leak check is performed across the interface. Probes and latches are adjusted.

Pressure is relieved, the AM/MDA is raised clear of the altitude chamber and lowered to the inverting fixture. The AM/MDA is inverted and moved to the handling dolly.

All stored experiments are mounted on the AM/MDA experiment truss. Following receiving inspection on the solar panels, they are installed in the AM. The AM/MDA is rotated and cleaned, weighed and the center of gravity is determined. The completed AM/MDA is moved to the east integration stand where S/C assembly is accomplished in accordance with the normal Apollo flow.

3.3.1.5 Launch Pad Activities - Basically the launch pad activities follow the normal Apollo flow with the following additions:

a. Shortly after the erection of the IU and S-IVB, a system checkout of the OWS passivation, modifications are performed.

b. AM/MDA operations performed at the launch pad include:

- Final calibration of the mass quantity measurement system

- Leak check of cryogenic systems

- ECS and coolant checks

- EVA communication checks

The MSOB PCM ground station is used in conjunction with carry near GSE on the MSS. Transmission is via a parasitic antenna mounted on the MSS.

c. After the mating of the AM boot with the OWS dome, the aft AM hatch is closed and the aft compartment is pressurized. A leak check is performed at the boot to dome interface.

d. During the Apollo RF open loop test, the telemetry and communication systems are energized and compatibility with the ground tracking stations is verified. EMC monitoring is performed during this test.

e. During the precount period, cryogenic servicing is completed, time sensitive experiments and crew provisions are installed, and final housekeeping checks are completed.

3.3.2 Prelaunch Checkout and Launch Pad Activities Flow Diagram - The flow diagram (figure 4) presents the recommended flow of checkout operations at KSC for the various elements of AAP 2.

Time functional reference should be made to 2.2.2 for interface and timeline requirements.

3.3.3 Test Requirement Sheets - The following sheets (Table III) define specific blocks on the AAP 2 flow diagram for KSC operations. Each sheet is identified by the flow block title and number.

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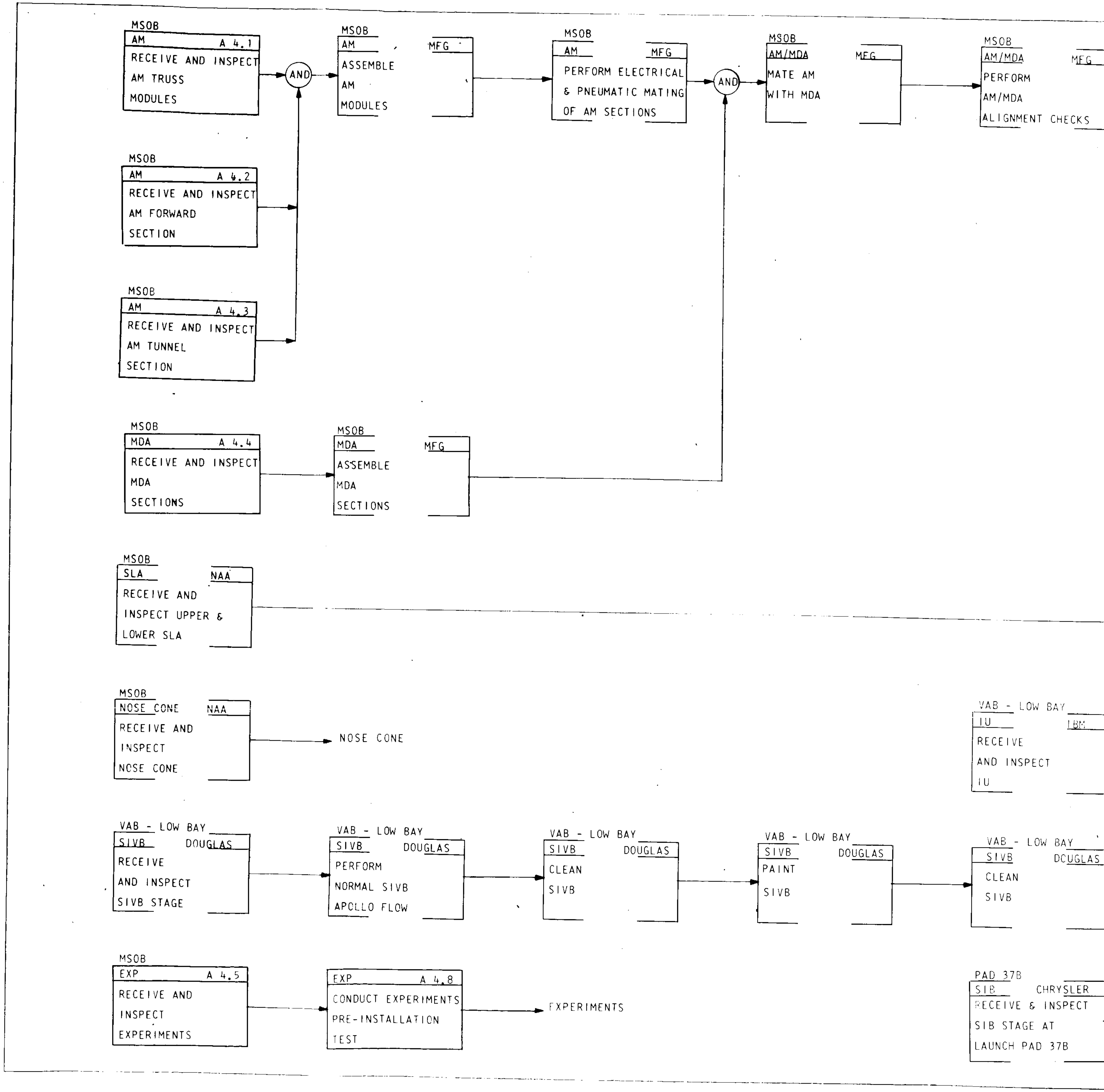

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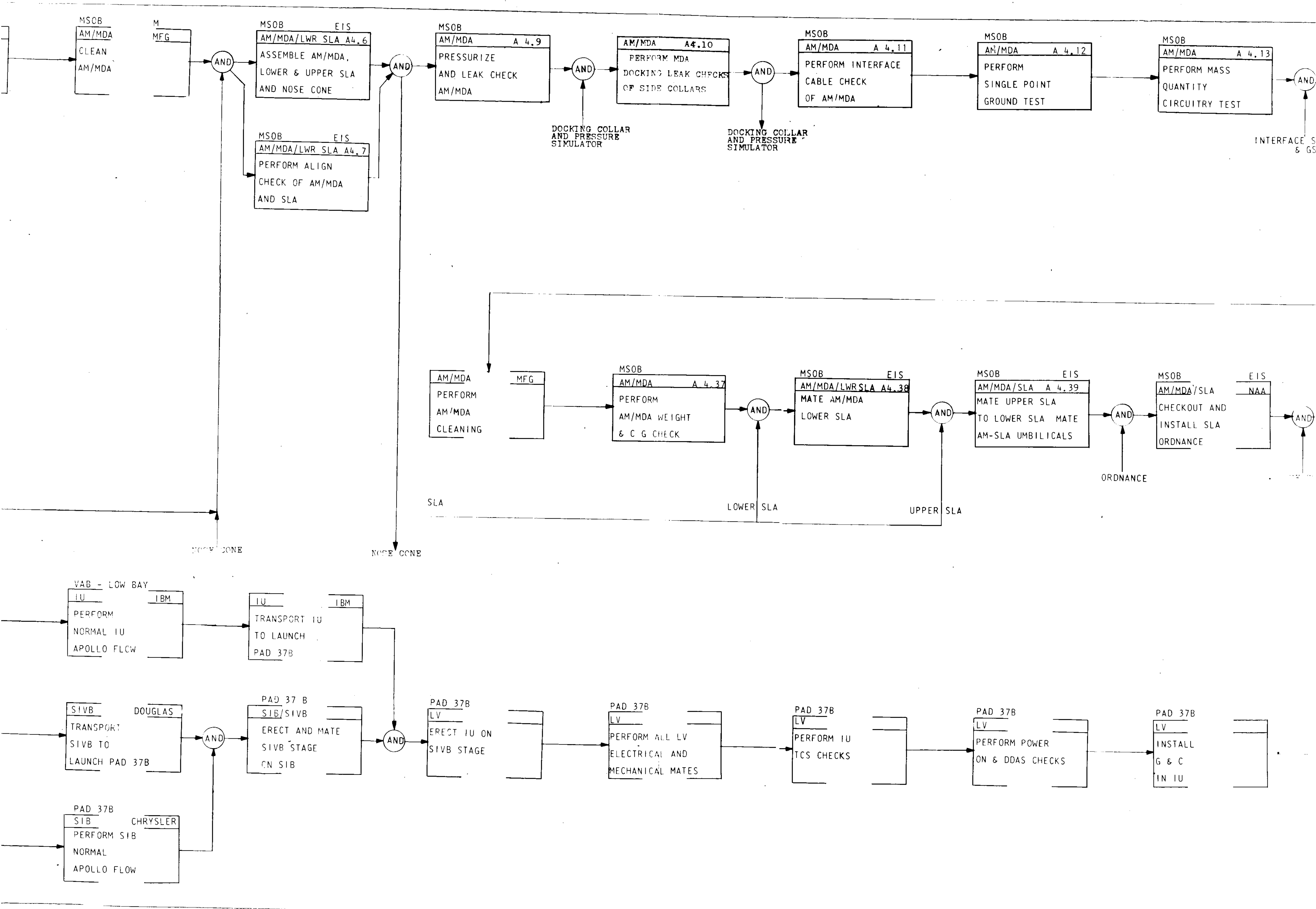

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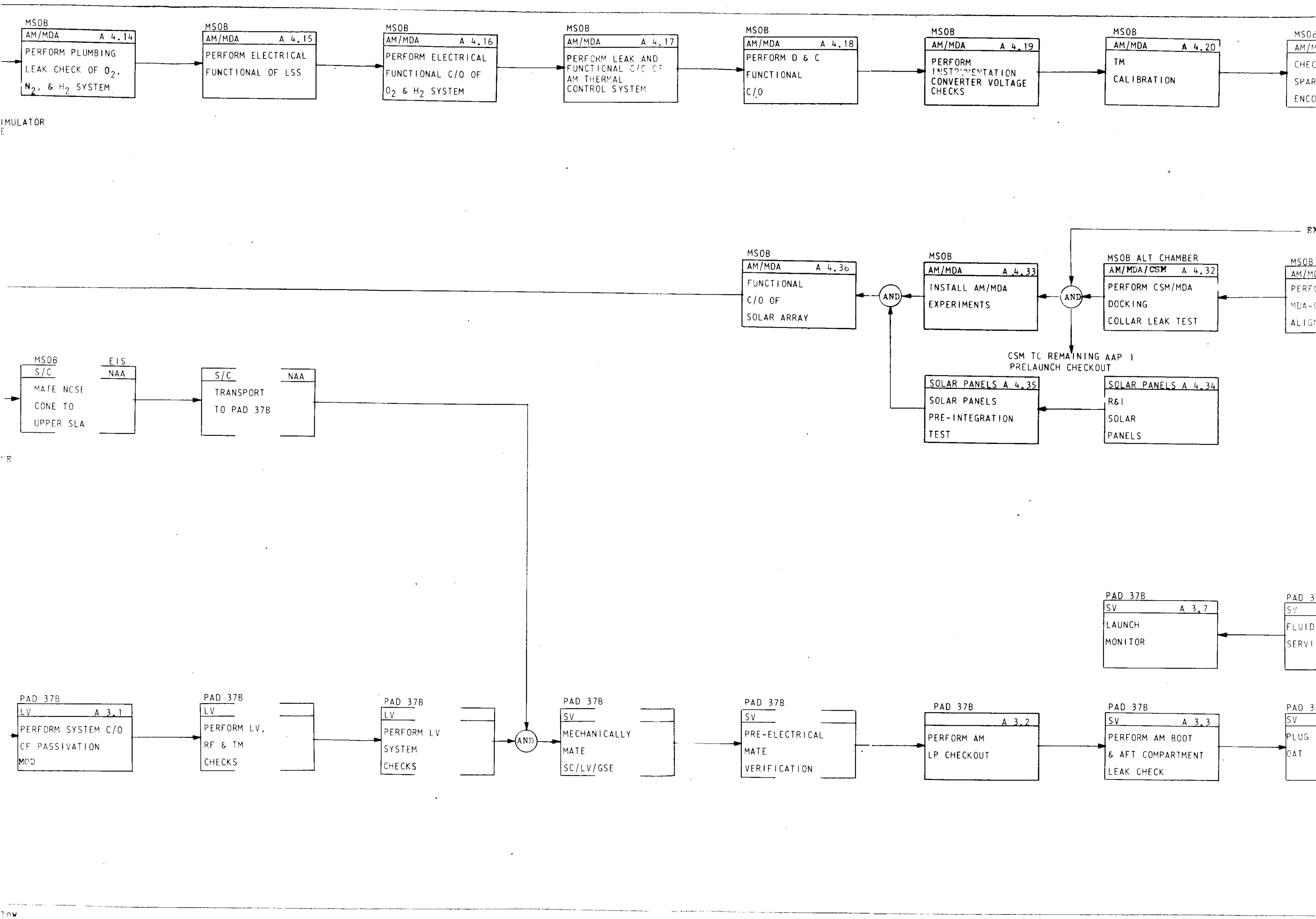
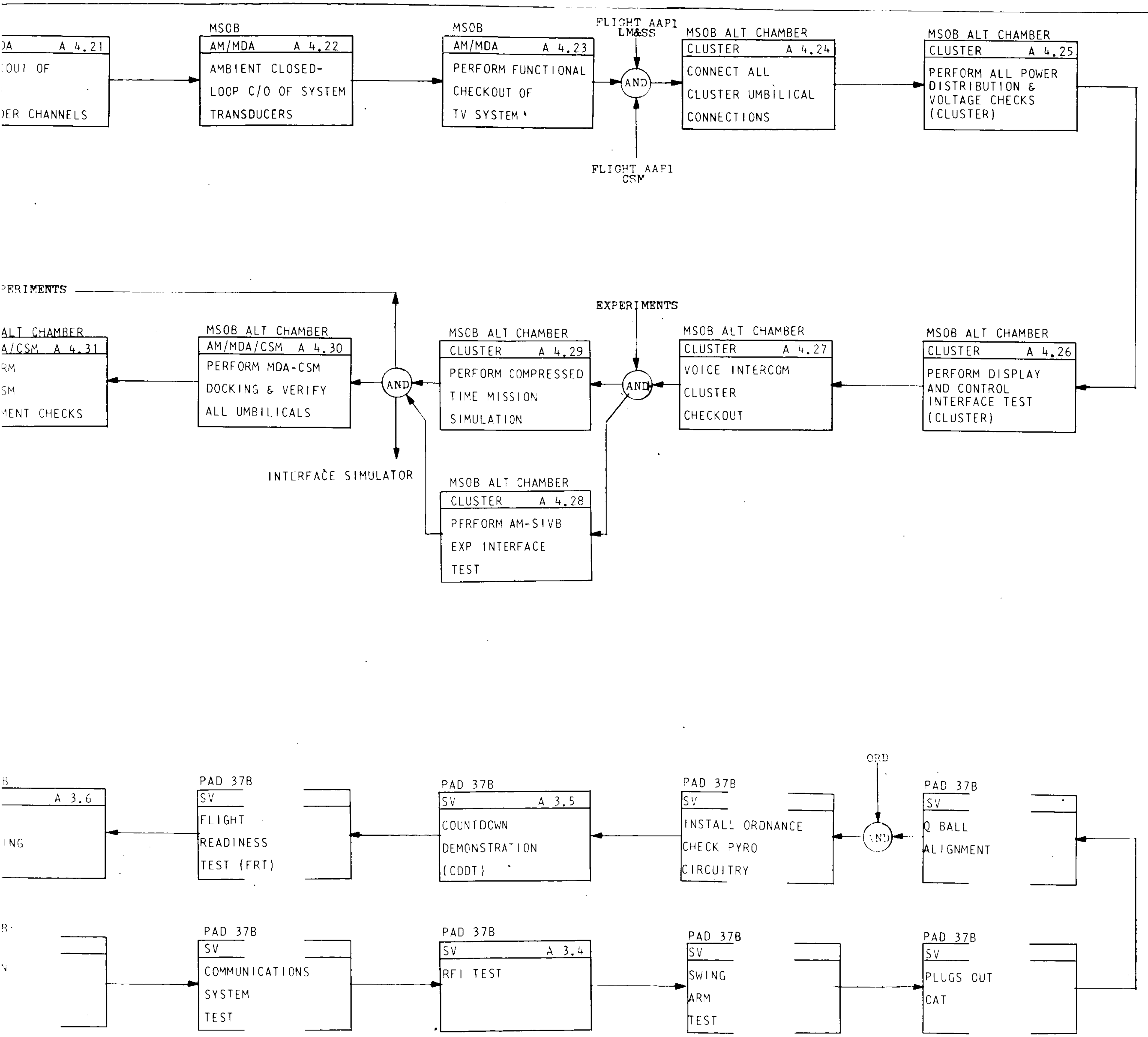
Figure 4. Prelaunch Checkout And Launch Pad Activities For AAP Flight 2

3


MSOB
AM/MDA A 4.14
PERFORM PLUMBING LEAK CHECK OF O_2, N_2, & H_2 SYSTEM
MSOB
AM/MDA A 4.15
PERFORM ELECTRICAL FUNCTIONAL OF LSS
MSOB
AM/MDA A 4.16
PERFORM ELECTRICAL FUNCTIONAL C/O OF O_2 & H_2 SYSTEM
MSOB
AM/MDA A 4.17
PERFORM LEAK AND FUNCTIONAL C/O OF AM THERMAL CONTROL SYSTEM
MSOB
AM/MDA A 4.18
PERFORM D & C FUNCTIONAL C/O
MSOB
AM/MDA A 4.19
PERFORM INSTRUMENTATION CONVERTER VOLTAGE CHECKS
MSOB
AM/MDA A 4.20
TM CALIBRATION
MSOB
AM/M
CHEC
SPAR
ENCO
IMULATOR
E
EX
MSOB
AM/MDA A 4.36
FUNCTIONAL C/O OF SOLAR ARRAY
AND
MSOB
AM/MDA A 4.33
INSTALL AM/MDA EXPERIMENTS
AND
MSOB ALT CHAMBER
AM/MDA/CSM A 4.32
PERFORM CSM/MDA DOCKING COLLAR LEAK TEST
MSOB
AM/MI
PERF
MDA-
ALIG
CSM TO REMAINING AAP 1 PRELAUNCH CHECKOUT
SOLAR PANELS A 4.35
SOLAR PANELS PRE-INTEGRATION TEST
SOLAR PANELS A 4.34
R&I SOLAR PANELS
MSOB
S/C
EIS
NAA
MATE NOSE CONE TO UPPER SLA
S/C
NAA
TRANSPORT TO PAD 37B
PAD 37B
SV A 3.7
LAUNCH MONITOR
PAD 3
SV
FLUID
SERVI
PAD 37B
LV A 3.1
PERFORM SYSTEM C/O OF PASSIVATION MOD
PAD 37B
LV
PERFORM LV, RF & TM CHECKS
PAD 37B
LV
PERFORM LV SYSTEM CHECKS
AND
PAD 37B
SV
MECHANICALLY MATE SC/LV/GSE
PAD 37B
SV
PRE-ELECTRICAL MATE VERIFICATION
PAD 37B
A 3.2
PERFORM AM LP CHECKOUT
PAD 37B
SV A 3.3
PERFORM AM BOOT & AFT COMPARTMENT LEAK CHECK
PAD 3
SV
PLUG
OAT
low



PRELAUNCH CHECKOUT AND LAUNCH
PAD ACTIVITIES FLOW FOR AAP FLIGHT #2

DATE: 7 APRIL, 1967

Table III. Test Requirement Sheets for Figure 4

TEST TITLE:	Receive and Inspect AM Truss Modules, Forward Section and Tunnel Section	FLOW BLOCK NO. A 4.1 thru A4.3

OBJECTIVE: Verify those items under inspection are to the latest engineering configuration and that no damage has occurred during packaging and shipping.
LOCATION: KSC-MSOB (AM work area)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
All documents accompanying the AM modules are reviewed for latest configuration and accuracy. The AM truss modules and forward section are raised from the shipping containers using the overhead crane. Inspection and damage check is performed while suspended. The tunnel section is inspected in the transport dolly.

OPERATIONS:
A visual examination is performed on all modules to assure that no shipping damage has occurred. Special emphasis is given to an inspection of the AM/MDA mating surface, the truss attachment points, the exterior ECS cannister, the exposed components mounted on the equipment trusses, and the electronics module. All units are inspected to latest engineering documentation. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:
Units are in proper configuration and no transportation or shipping damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Handling equipment, transporter, work access platforms, crane, hand tools, and slings

Table III. (Cont.)

TEST TITLE: Receive and Inspect MDA

FLOW BLOCK NO. A 4.4

OBJECTIVE: Verify those items under inspection are to the latest engineering configuration and that no damage has occurred during packaging and shipping.
LOCATION: KSC-MSOB (MDA transporter)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
All documents accompanying the MDA are reviewed for latest configuration and accuracy. The MDA is inspected on the MDA transport.

OPERATIONS:

A thorough visual inspection is performed to assure that no transportation damage has occurred. Plumbing lines and electrical connectors are inspected and mechanical operation of all hatches is verified. The AM/MDA mating surface is examined for damage and cleanliness. MDA is inspected to latest engineering documentation. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:
MDA is in proper configuration and no transportation damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Hand tools, portable lighting, MDA transport, work access platform, handling equipment

Table III. (Cont.)

TEST TITLE: Receive and Inspect Experiments

FLOW BLOCK NO. A 4.5

OBJECTIVE: Verify experiments to acceptance documentation. Verify no damage has occurred during packaging and shipping.

LOCATION: KSC-MSOB (Experiment accommodations area)
PERSONNEL: TBS
TIME SPAN: 40 hours (total)
AGENCY SUPPORT: Principal Investigator

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying the experiments are reviewed for latest configuration and accuracy. The experiments are removed from the shipping containers.

OPERATIONS:

A thorough inspection of the experiments is performed. All electrical connectors are inspected for bent pins and foreign particles. Fluid lines are inspected for evidence of damage. No functional checkouts are performed at this time. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

There shall be no evidence of damage, deterioration or contamination.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling equipment

Table III. (Cont.)

TEST TITLE: Assemble AM/MDA, Lower and Upper SLA and Nose Cone

FLOW BLOCK NO. A 4.6

OBJECTIVE: Verify fit and clearance.

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is in the east integration stand. The AM/MDA is lifted from its transport dolly. All mounting pads are cleaned and inspected. The upper SLA and nose cone are prepared for mating.

OPERATIONS:

The AM/MDA is lowered to the SLA LM attach point. Verification of alignment is performed during this procedure. Carriers are secured at the mounting pads. The upper SLA is lifted with a crane and placed on the lower SLA. Verification of clearance and alignment of carriers is performed. The upper SLA is secured at mounting pads. The nose cone is mounted on the upper SLA and mated.

CRITERIA FOR SUCCESS:

Fit and alignment shall be in accordance with the requirements of ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane, work access platforms, hand tools, AM/MDA transport dolly and slings.

Table III. (Cont.)

TEST TITLE: Perform Alignment Check of AM/MDA and SLA

FLOW BLOCK NO. A4.7

OBJECTIVE: Verify alignment of AM/MDA to SLA.

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with A4.6
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All preparations for this task are performed in flow block no. A4.6.

OPERATIONS:

The critical clearances are verified. Particular attention is given to the clearance getween the MDA ports and the upper SLA and between the exterior profile of experiment and equipment mounted within the annulus space formed by the AM, IU and dome.

CRITERIA FOR SUCCESS:

Clearance shall be in accordance with the requirements of ICD and CEI specifications

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Gauges and work access platform

Table III. (Cont.)

TEST TITLE:	Conduct Experiment Pre-Installation Test	FLOW BLOCK NO. A 4.8

OBJECTIVE: Provide final pre-installation checkout, alignment and calibration of the experiments

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: Principal Investigator or experiment contractor

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

All experiments are checked out in the experiment accommodations area prior to installation. Final calibrations, adjustments and alignments are performed as defined in section 6.

CRITERIA FOR SUCCESS:

Experiments shall perform in accordance with the requirements of ICD and CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table III. (Cont.)

TEST TITLE: Pressurize and Leak Check AM/MDA

FLOW BLOCK NO. A 4.9

OBJECTIVE: Verify that AM/MDA leakage rates are within specifications.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The forward AM hatch is opened and the aft hatch is closed and secured. All MDA hatches are closed. The facility nitrogen lines are connected to the AM fill line. Work and access platforms are positioned around the AM/MDA.

OPERATIONS:

The AM/MDA is pressurized to 5.7 psig and stabilized. A pressure decay check is performed. A leak check is performed on the MDA docking port hatches and the aft AM hatch using the bubble method. The pressure is vented and the forward docking port hatch of the MDA is opened and the forward hatch of the AM is closed and secured. The center compartment of the AM is pressurized and the forward hatch is leak checked. The pressure is vented and the facility pressure line is disconnected. All AM/MDA hatches are closed. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:
Leakage and decay rates shall be in accordance with the requirements of the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: N_2

EQUIPMENT: Pressure control console, work and access platforms, pressure umbilicals, leak detector and hand tools

Table III. (Cont.)

TEST TITLE:	Sequentially Perform MDA Docking and Leak Check Across all Side Docking Collars	FLOW BLOCK NO. A 4.10

OBJECTIVE: Verify that all side docking collars fit, alignment and leakage rates are within specifications

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The AM/MDA combination is located on the handling dolly. A work access platform is positioned around the MDA. The docking collar and pressure simulator is attached to an overhead crane and raised to the MDA side docking port level. All MDA hatches are closed and secured.

OPERATIONS:
The docking collar and pressure simulator is positioned to dock with one of the MDA side docking ports. "X", "Y" and "Z" alignment is verified. Soft and hard docking is accomplished and the MDA docking port is pressurized through the simulator with the MDA hatch closed. A leak check is performed at the interface point. This test is then repeated for all docking ports except the forward port. The simulator is removed and stored at the completion of test. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

MDA docking collar fit, alignment and leakage shall be in accordance with the requirements of the CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: N_2

EQUIPMENT: Work access platform, pressure control console, leak detector, docking collar and pressure simulator, hand tools, and AM/MDA dolly

Table III. (Cont.)

TEST TITLE:	(1) Perform Interface Cable Check of AM/MDA (2) Perform Single Point Ground Test	FLOW BLOCK NO. A 4.11 A 4.12

OBJECTIVE: Verify interfaces prior to electrical mating and verify combined single point ground

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The cable and network checkout unit is installed in series with the power interface between the AM and MDA.

OPERATIONS:
The AM power buss is energized from ground power. AM to MDA power distribution and control is verified by operating the AM control panel and verifying proper power distribution by light indications on the cable and network checkout unit. The AM inverter is energized and phase rotation checks are performed. The checkout unit is removed and the AM/MDA connectors are mated. A combined AM/MDA single point ground test is performed.

CRITERIA FOR SUCCESS:

All power interfaces shall be in accordance with the applicable ICD. Combined AM/MDA single point ground shall be in accordance with the requirements of the CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work platforms, MDA checkout set, cable and network checkout unit, power sequence system control and monitor group*, power system ground control unit* and VOM.

Table III. (Cont.)

TEST TITLE: Perform Mass Quantity Circuitry Test	FLOW BLOCK NO. A 4.13

OBJECTIVE: Calibrate and verify performance of mass quantity measurement system.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Facility H_e lines are connected to the fill lines of the cryogenic storage spheres.

OPERATIONS:

The O_2 probes are meggered and a capacitance bridge is connected to the probes. The O_2 sphere is purged with H_e gas. The internal bridge is calibrated and performance is verified by unbalancing the GSE leg of the bridge. This operation is repeated for the remaining mass quantity measurement circuits in the cryogenic storage spheres. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

The mass quantity measurement circuits shall perform in accordance with the applicable specification. Circuit calibration shall be accomplished.

SUPPORT REQUIREMENTS:

COMMODITIES: H_e gas

EQUIPMENT: Indicator kit, mass quantity*, test console*, pressure control console, work and access platforms, capacitance bridge and meggar.

Table III. (Cont.)

TEST TITLE:	Perform Plumbing Leak Check of O_2, N_2 and H_2 Systems	FLOW BLOCK NO. A4.14

OBJECTIVE: Verify leakage rates of the AM/MDA plumbing system are within specifications.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Facility H_e supply lines are connected to the fill line of the AM O_2, N_2 and H_2 systems. All outlet valves internal to the AM/MDA are closed.

OPERATIONS:

The plumbing lines are pressurized to 5.7 psig and a leak detector check is performed on all connections and fittings internal to the carriers. Interface connectors and quick disconnects are checked for leakage. The necessary solenoids are energized so that all plumbing line connections and fittings exposed to pressure and checked for leakage. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

Plumbing leakage rates shall not exceed the requirements set forth in the CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: H_e gas

EQUIPMENT: Pressure control console, leak rate tester*, and leak detector.

Table III. (Cont.)

TEST TITLE: Perform Electrical Functional of Life Support System (LSS)

FLOW BLOCK NO. A4.15

OBJECTIVE: Verify that all electrical networks associated with the AM/MDA LSS are operable to required specifications.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Facility power is connected to AM/MDA. A dry nitrogen line from pneumatic console to AM O_2, N_2 fill line is connected. The AM display and control panel is manned.

OPERATIONS:

All the electrical hardware and control and monitor circuits associated with Life Support System are checked out for operability and calibration; valves, pressure transducers, electric heaters, solenoids, relays, regulators, cabin fans, heat exchanger, temperature sensors, thermostat and LO_2 detector. Controls originating at the AM panel are operated and responses are verified on the display panel. Visual displays are supplemented with analog recording in the MSOB-PCM ground station.

CRITERIA FOR SUCCESS:

All LSS electrical networks shall function in accordance with applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: Dry GN_2

EQUIPMENT: Power panel, pressure control console, power sequence system control and monitor*, power system ground control unit*, and hand tools.

Table III. (Cont.)

TEST TITLE: Perform Electrical Function C/O of O_2 and H_2 System — FLOW BLOCK NO. A4.16

OBJECTIVE: Verify operation of pressure transducer, flow transducer, and valve operation

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

A dry nitrogen line is connected to the O_2 and H_2 fill valves of the AM. A vent line is connected from the O_2 and H_2 quick disconnects of the AM. The AM power buss is energized. The CM D&C panel is manned.

OPERATIONS:

The O_2 and H_2 gas pressure is provided by ground supply. Transfers are initiated from the AM control panel and the pressure, flow and regulation is monitored on the AM display panel. Valve actuation and cryogenic heater operation is verified. The AM to RM supply transfer system operations is verified. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:
All electrical hardware associated with the AM/MDA O_2 and H_2 systems shall perform in accordance with ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Pressure control, power sequence system control and monitor*, power system ground control unit*, and hand tools.

Table III. (Cont.)

TEST TITLE: Perform Leak and Functional C/O of AM Thermal Control System	FLOW BLOCK NO. A 4.17

OBJECTIVE: Verify the performance of the AM thermal control system

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The coolant reservoirs are charged with the specified coolant.

OPERATIONS:
The operation of the low speed primary coolant loop is verified. All fittings and connections are checked for leakage. The high speed secondary coolant loop is operated and functional performance is verified. Flow rates and regulation are evaluated against the applicable specifications. The radiator by-pass loop and selector valve operation is monitored. Downstream temperatures are recorded under varying heat loads and control and regulation is evaluated. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:
The thermal control system must perform in accordance with the requirements of the applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: Coolant fluid

EQUIPMENT: TBS

Table III. (Cont.)

TEST TITLE: Perform D&C Functional C/O

FLOW BLOCK NO. A 4.18

OBJECTIVE: Verify the AM/MDA D&C system performance

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
Ground power is applied at the AM/MDA power buss. The AM tunnel is manned for activation and monitoring of the D&C panel. The interface simulator is required to simulate control functions of the ATM/Rack, RM, LM&SS, IU/S-IVB and AAP 3 CSM.

OPERATIONS:

All AM/MDA control functions are initiated in sequence and the display panels on the AM/MDA and interface simulator are monitored for correct responses. Control functions from other carriers to AM/MDA are initiated from the interface simulator and the AM display panels are monitored for accurate displays.

CRITERIA FOR SUCCESS:

The AM displays and controls shall perform in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work access platform, MDA checkout set, AM tunnel ladder, interface simulator, power sequence system control and monitor*, power system ground control unit*

Table III. (Cont.)

TEST TITLE: Perform Instrumentation Converter Voltage Checks

FLOW BLOCK NO. A4.19

OBJECTIVE: Verify and adjust converter outputs.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Power is applied to the AM/MDA

OPERATIONS:

The ±24 volt and +5 volt DC-DC converters are activated by the AM/MDA control panel. The converter outputs are checked and adjusted to specified values under a simulated load. Regulation, transients and system noise will be evaluated during this test.

CRITERIA FOR SUCCESS:
Voltage levels and regulation shall conform to design specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work access platform, AM tunnel ladder, load DC-DC converter*

Table III. (Cont.)

TEST TITLE: TM Calibration

FLOW BLOCK NO. A 4.20

OBJECTIVE: Verify performance and calibrate signal conditioner channels

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The instrumentation system is readied for prelaunch checkout. The cables for prelaunch checkout and ground monitoring during flight are connected to a break out box for easy accessibility and monitoring.

OPERATIONS:

Stimulus signals representative of the end instrument output are applied to the appropriate signal conditioner input while the conditioned output signal is monitored. Signal conditioner cards are adjusted while high, low and nominal input stimuli are applied.

CRITERIA FOR SUCCESS:

All signal conditioner channels shall perform in accordance with the requirements of the appropriate CEI specification. Verification that power supply is within calibration.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: DVM, signal generator, variable power supplies, tester-PC cards*, test set-S/C instrumentation*

Table III. (Cont.)

TEST TITLE: Checkout of Spare Encoder Channels

FLOW BLOCK NO. A4.21

OBJECTIVE: Verify functional performance of unused encoder channels

LOCATION: KSC-MSOB (AM Work area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The encoder signal input is disconnected and a breakout box is inserted between the cable and the encoder. The encoder output is monitored in the MSOB PCM ground station via a landline cable and line driver. The AM/MDA power buss is energized from ground power.

OPERATIONS:

0 to 5 volt stimulus signals are applied to the encoder input in 1 volt increments while the system output is monitored in the ground station. Encoding accuracy and channel noise are evaluated. This operation is repeated for each unused channel of the encoder.

CRITERIA FOR SUCCESS:

All unused channels shall perform in accordance with the requirements of the CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Variable precision power supply, breakout box, MSOB PCM ground station, test set S/C instrumentation*, console assembly - TM checkout and control*

Table III. (Cont.)

TEST TITLE: Ambient Closed Loop Checkout of System Transducers

FLOW BLOCK NO. A4.22

OBJECTIVE: Verify PCM output level with transducers at ambient condition.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Excitation voltage is applied to all AM transducers and to measurement system. The MSOB-PCM ground station is connected by a landline link and line drivers.

OPERATIONS:
All AM systems are energized. All AM instrumentation measurements are recorded on analog recorders in the ground station. Recordings are evaluated for proper ambient levels, indication of excessive system noise and trace stability. (Dynamic recordings will be made during mission simulation, block 4.29.)

CRITERIA FOR SUCCESS:
All ambient measurements will be in accordance with the limits defined by appropriate CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MSOB-PCM ground station, console assembly - TM checkout and control*

Table III. (Cont.)

TEST TITLE: Perform Functional Checkout of T.V. System

FLOW BLOCK NO. A 4.23

OBJECTIVE: Verify T.V. System

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Information not available in Phase C and will be supplied at a later date.

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS:

COMMODITIES:

EQUIPMENT:

Table III. (Cont.)

TEST TITLE: Connect all Cluster Umbilical Connections

FLOW BLOCK NO. A 4.24

OBJECTIVE: Prepare for cluster checkout.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The AM/MDA and interface simulator are positioned outside the MSOB altitude chamber with AAP 1 CSM inside the chamber. All carriers, GSE and marriage umbilicals are inspected for bent pins and foreign particles. Umbilical pin alignment is verified.

Note: Upon completion of AAP 1 LM&SS-CSM interface checkout, the LM&SS is reconfigured to support the cluster configuration test.

OPERATIONS:

All electrical and liquid umbilicals are connected to the CSM via marriage cables (umbilical extensions). Carry near GSE is connected to the AM/MDA. The ACE-S/C is already connected to the CSM from previous checkout operations. The interface simulator is mated to the appropriate MDA docking port umbilicals and to the AM-OWS connectors.

CRITERIA FOR SUCCESS:
All cluster connections shall be electrically and mechanically mated. All support GSE shall be connected.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: All GSE required for interface tests, Blocks 4.25 - 4.29

Table III. (Cont.)

TEST TITLE: Perform All Power Distribution and Voltage Checks (Cluster)

FLOW BLOCK NO. A 4.25

OBJECTIVE: Verify cluster power interfaces and circuitry.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
Energize all cluster power busses from ground power. All cluster control switches are set to normal position.

OPERATIONS:
Power transfer from the CSM to the AM/MDA is initiated. Voltage and current measurements are made at the AM/MDA distributor to verify proper voltage levels and phasing. Power is transferred from the ATM rack section of the interface simulator to the AM/MDA and the voltage level and phasing is verified at the AM distributor. Power from the S-IVB solar panels is simulated by the interface simulator and transferred to the AM/MDA power busses. Voltage level and phasing is again verified at the AM distributor.

CRITERIA FOR SUCCESS:
The cluster interfaces shall perform in accordance with the appropriate ICD requirements.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE-S/C, AM/MDA handling dolly, power sequence system control and monitor group*, power system ground control unit*, and interface simulator

Table III. (Cont.)

TEST TITLE: Perform Display and Control Interface Test (Cluster)	FLOW BLOCK NO. A 4.26

OBJECTIVE: Verify cluster D&C interfaces

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 6 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to CSM. Both the CSM and AM are manned. Work access platforms are made available for accessibility. Electrical connection of interface simulator and AM/MDA to CSM are described in A4.24.

OPERATIONS:

All controls on the CSM, AM/MDA and interface simulator (simulation of ATM/Rack/LM A/S, RM and S-IVB) are activated and the corresponding displays verified for accurate response. All cluster displays and controls are verified.

CRITERIA FOR SUCCESS:

All cluster interface D&C shall perform in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work access platforms, power sequence system control and monitor group*, power system ground control unit*, ACE-S/C, interface simulator and MDA checkout set

Table III. (Cont.)

TEST TITLE: Voice Intercom Cluster Checkout

FLOW BLOCK NO. A 4.27

OBJECTIVE: Verify hardline links between the CSM/AM/LM/MDA.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The voice intercom system is connected and simulators for the LM A/S and S-IVB audio centers are installed. The following audio centers are manned: CSM, AM, LM A/S, and S-IVB.

OPERATIONS:

The communications system at each station is powered up. Communication between the CSM-AM is verified for clarity and volume. The communication link between the S-IVB-AM/MDA and the LM-AM/MDA is verified by using the interface simulator to simulate the S-IVB and LM carrier.

CRITERIA FOR SUCCESS:

Audio hardline communications shall perform in accordance with the applicable CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Test station - S/C communications*, headset microphone*, power sequence system control and monitor*, power system ground control unit, and interface simulator.

Table III. (Cont.)

TEST TITLE: Perform AM-SIVB Experiment Interface Tests

FLOW BLOCK NO. A 4.28

OBJECTIVE: Verify OWS experiment compatibility

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 10 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All power is supplied by ground power source. The OWS power cable is activated. All experiments that are non-operative on the AM/MDA truss are removed and connected to OWS power cable. This test is performed in conjunction with the mission simulation.

OPERATIONS:

All experiments that interface with the AM/MDA data management, TV, display and control or electrical power system are energized from the OWS power cable in the mission sequence and in compressed time duration. All CM and AM/MDA systems are energized in mission sequence while buss recordings are made in the PCM ground station. Operability and compatibility are verified. All recordings are evaluated for evidence of power transients, system noise and EMI/RFI.

CRITERIA FOR SUCCESS:

The experiments shall perform in accordance with the requirements of the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Interface simulator and all GSE listed under A4.29.

Table III. (Cont.)

TEST TITLE: Perform Compressed Time Mission Simulation

FLOW BLOCK NO. A 4.29

OBJECTIVE: Verify on-orbit sequence and configuration compatibility.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with A4.28
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

CSM power is provided from the ground source, all experiments are connected as described in A4.28. The CM, AM and interface simulator are manned. CSM is under ACE-S/C control and the AM/MDA is controlled by carry near GSE. The MSOB-PCM ground station is activated.

OPERATIONS:

A complete mission simulation is performed with all on-orbit operations performed in the mission sequence but in compressed time. ATM/Rack, LM A/S, RM, OWS interfaces are simulated. All instrumentation is recorded in the MSOB-PCM ground station. EMC monitoring is performed throughout the mission simulation.

CRITERIA FOR SUCCESS:
Total on orbit compatibility shall be verified in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2, GO_2, GH_2, GH_e, coolant fluid, experiment peculiar commodities

EQUIPMENT: ACE-S/C, experiment peculiar GSE, MSOB-PCM ground station, test station - S/C communications*, headset microphone*, sequence system control and monitor group*, power system control and monitor*, console time reference system*, kit-pyrotechnic checkout*, test set - S/C instrumentation*, console assembly - TM checkout and control*, fluid servicing GSE, and interface simulator

Table III. (Cont.)

TEST TITLE: Perform MDA-CSM Docking and Verify All Umbilicals

FLOW BLOCK NO. A4.30

OBJECTIVE: Verify AM/MDA-CSM docking interfaces.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 12 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The AM/MDA is inverted and lifted using the McDonnell provided inverting fixture and overhead crane. The CSM is already in the altitude chamber.

OPERATIONS:
The AM/MDA is lowered to the CSM using the overhead crane and auxiliary positioner. Soft and hard docking is accomplished and the probes and latches are adjusted. The reactant resupply and electrical umbilicals are dropped and mated to the CSM. Mechanical alignment measurements are taken as described in A4.31.

CRITERIA FOR SUCCESS:

Soft and hard docking shall be in accordance with the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: AM/MDA inverting fixture, AM/MDA handling GSE

Table III. (Cont.)

TEST TITLE: Perform MDA-CSM Alignment Checks

FLOW BLOCK NO. A4.31

OBJECTIVE: Verify longitudinal alignment of CSM and AM/MDA.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Install crew alignment sight on each window of the CSM. The CSM is manned.

OPERATIONS:

The AM/MDA to CSM longitudinal axis alignment is verified. The crew alignment sight is adjusted by visual sighting.

CRITERIA FOR SUCCESS:

The AM/MDA alignment shall be in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table III. (Cont.)

TEST TITLE: Perform CSM-MDA Docking Collar Leak Test

FLOW BLOCK NO. A4.32

OBJECTIVE: Verify CSM-MDA docking collar leak rate is within tolerance.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 12 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The forward MDA docking port hatch is closed.

OPERATIONS:

The CM is pressurized with the CM hatch open allowing concurrent pressurization of the CM and the forward MDA docking collar port. This area is pressurized to approximately 6 psi and a leak check is performed across the docking interface. After pressure stabilization, a two hour pressure decay check is performed.

CRITERIA FOR SUCCESS:

Leakage shall not exceed the limits specified in the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GO_2

EQUIPMENT: Pressure control console, leak detector, ground pressure umbilicals.

Table III. (Cont.)

TEST TITLE: Install AM/MDA Experiments	FLOW BLOCK NO. A 4.33

OBJECTIVE: Store experiments and experiment subsystems in the AM/MDA.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All experiments will be subjected to a final pre-installation inspection, and where applicable, a final bench check and calibration.

OPERATIONS:
All experiments will be mounted in the applicable AM/MDA storage area (See Table IX).

CRITERIA FOR SUCCESS:
All experiments will be stored and secured in launch configuration.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling GSE

Table III. (Cont.)

TEST TITLE: Receive and Inspect Solar Panels

FLOW BLOCK NO. A 4.34

OBJECTIVE: Verify solar panels to acceptance documentation and to latest configuration. No physical damage during shipment.

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: Quality

TASK DESCRIPTION

PREPARATIONS:
All documentation accompanying the solar panels is to the latest configuration. Clean and dust free place of receipt.

OPERATIONS:
Solar Array panels will be inspected for latest configuration and visually inspected to assure no physical damage has occurred during shipment.

CRITERIA FOR SUCCESS:

Proper configuration. No physical damage.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Handling equipment

Table III. (Cont.)

TEST TITLE: Solar Panel Pre-integration Test

FLOW BLOCK NO. A4.35

OBJECTIVE: To verify functional operation of Solar Panels prior to installing in AM.

LOCATION: KSC-MSOB
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The solar arrays are deployed. A sun simulator is positioned so it can stimulate each panel in the array.

OPERATIONS:
Verify proper operation of the solar array by monitoring the output voltage and current.

CRITERIA FOR SUCCESS:
The solar array will perform according to CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Sun simulator, solar array handling equipment

Table III. (Cont.)

TEST TITLE: Functional Checkout of Solar Array

FLOW BLOCK NO. A 4.36

OBJECTIVE: To perform load and continuity checks on AM solar array.

LOCATION: KSC-MSOB (AM Work Area)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The solar array is installed on the AM. The interconnecting cable between the AM and solar array is connected to an interrupt box.

OPERATIONS:

Load and continuity checks are performed on the installed solar array. The load check results are compared to the manufacturers specification. A resistance check is made on the AM power distributor.

CRITERIA FOR SUCCESS:

The solar array resistance and load check shall meet the requirements in the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: VOM

Table III. (Cont.)

TEST TITLE: Perform AM/MDA Weight and Center of Gravity Check

FLOW BLOCK NO. A 4.37

OBJECTIVE: Verify AM/MDA weight and CG are in accordance with the design specification.

LOCATION: KSC-PIB
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
All AM/MDA equipment has been installed. Late arriving experiments will be simulated or the mass property effects calculated. The AM/MDA is mounted on the modified AM/MDA weight and balance fixture in an upright position.

OPERATIONS:
The AM/MDA is leveled and weighed in both the vertical and horizontal position. The center of gravity is determined in each position by use of three-point load cell suspension.

CRITERIA FOR SUCCESS:
Weight and CG shall be in accordance with the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Modified PIB weight and CG GSE, AM/MDA handling GSE

Table III. (Cont.)

TEST TITLE: Mate AM/MDA - Lower SLA

FLOW BLOCK NO. A 4.38

OBJECTIVE: Mate AM/MDA to lower SLA

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is mounted in the east integration test stand. The AM/MDA is positioned above the SLA lower section. Work platforms are positioned around upper part of lower SLA. AM and lower SLA mating surfaces are cleaned.

OPERATIONS:

The AM/MDA is lowered to the lower SLA until the AM mating pads come in contact with the LM attach points. LM attachment points are secured.

CRITERIA FOR SUCCESS:

Spacecraft assembly

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: AM/MDA handling GSE, crane and hand tools

Table III. (Cont.)

TEST TITLE: Mate Upper SLA to Lower SLA
Mate AM SLA Umbilicals

FLOW BLOCK NO. A 4.39

OBJECTIVE: Mate upper SLA to lower SLA and connect interconnecting power cables between the AM and upper SLA.

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The AM/MDA is already installed in the lower SLA and the lower SLA is mounted in the East Integration Stand. The upper section is lifted above the lower SLA/AM/MDA combination. The mating surfaces are cleaned on both the upper and lower SLA.

OPERATIONS:
The upper SLA is lowered until the mating surfaces make contact. The two sections of the SLA are torqued to the specified value. The umbilicals are connected between the AM and upper SLA. Clearance measurements are made between the MDA ports and the upper SLA.

CRITERIA FOR SUCCESS:

Spacecraft assembly

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane and hand tools

Table III. (Cont.)

TEST TITLE: Perform System Checkout of the Passivation Modifications

FLOW BLOCK NO. A 3.1

OBJECTIVE: Perform a system level checkout of the IU/SIVB passivation modifications

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The IU and SIVB are mechanically and electrically mated on the LP. The LH_2 and LOX tanks are pressurized to approximately 19 psia. Pneumatic control is provided from the ground source through the disconnect and helium fill module to the pneumatic control module.

OPERATIONS:
The total passivation modification is verified by initiating the sequence from the IU computer program. Valve activation is verified on the LH_2 tank vent, LOX J-2 engine dump, LOX tank vent, cold H_e system vent, J-2 engine H_2 system vent, and the H_e system vent. Manually initiated control signals check the stage control H_e system vent, and the APS H_e pressurant vent. SIVB tank pressure switch operation is verified. The RF initiated commands are checked closed loop.

CRITERIA FOR SUCCESS:
The passivation modification shall perform in accordance with the CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: H_e gas, GH_2

EQUIPMENT: RCA 110A and TBS

Table III. (Cont.)

TEST TITLE: Perform AM LP Checkout

FLOW BLOCK NO. A3.2

OBJECTIVE: Perform location change verification of AM systems

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Portable AM GSE is positioned on the MSS and connected to the AM through the SLA umbilicals to provide electrical power and ground cooling. A parasitic antenna located on the service structure provides telemetry transmission to the MSOB PCM ground station.

OPERATIONS:

Cryogenic servicing GSE is checked for compatibility and the AM cryogenic system is leak checked. Operation of the cryogenic heaters is verified and calibration of the mass quantity measurement systems is checked. ECS and coolant functional checks are performed and a final verification of EVA communications is accomplished.

CRITERIA FOR SUCCESS:

All systems will perform in accordance with the requirements of the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: Ground coolant, GN_2

EQUIPMENT: MSOB PCM ground station, parasitic antenna, indicator kit mass quantity*, power system ground control*, leak rate tester*, kit calibration variable capacitance*, ground heat sink, thermal control pumping and control console.

Table III. (Cont.)

TEST TITLE: Perform AM Boot and Aft Compartment Leak Check

FLOW BLOCK NO. A3.3

OBJECTIVE: Verify the integrity of the AM boot - OWS dome interface

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The AM boot must be secured to the SIVB dome. The aft hatch of the AM is closed.

OPERATIONS:
The aft compartment of the AM is pressurized from facility source to approximately 19 psia. After pressure stabilization is achieved, the pressure is locked up and isolated from ground regulation. A pressure decay check is performed. The AM airlock differential pressure transducer is used to monitor decay rate. The interface point (AM boot to SIVB dome) is leak checked.

CRITERIA FOR SUCCESS:
Leakage and decay rate shall be within the allowable leakage specified in the applicable CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: GH_e

EQUIPMENT: Leak rate tester*, pressure control console

Table III. (Cont.)

TEST TITLE: RFI Test

FLOW BLOCK NO. A 3.4

OBJECTIVE: Verify S/C launch environment RF compatibility, and verify ground tracking station compatibility.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

EMI checkout devices have been installed on the S/C busses. The MSS has been moved away. This test is performed in conjunction with the Apollo SV RF test.

OPERATIONS:
All S/C RF systems are radiating open loop. The SIVB whip antennas are deployed. Telemetry and communications compatibility with the ground tracking stations is verified. Carrier frequency, sync pulses, subcarrier deviation, and phase lock stability are verified. All RF systems not normally radiating during the boost phase are de-energized. The EMI checkout devices are armed and launch environment RFI compatibility is verified. MSOB ground station recordings are evaluated for RFI and the activation of EMI checkout devices.

CRITERIA FOR SUCCESS:

All RF systems shall be compatible with the ground tracking stations. There shall be no evidence of detrimental RFI.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: CIF-PCM ground station, EMI checkout devices

Table III. (Cont.)

TEST TITLE: Countdown Demonstration Tests (CDDT)

FLOW BLOCK NO. A 3.5

OBJECTIVE: Demonstrate S/C readiness for launch and perform integrated dress rehearsal of countdown.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The S/C is complete and in flight configuration. This test is performed in conjunction with the Apollo CDDT.

OPERATIONS:

During the Apollo CDDT, the S/C systems are energized and verified in countdown sequence. Cryogenic tanks are serviced and cold soaked. The time sensitive experiments and life support (or simulators) are installed. Open loop RF checks are performed in the countdown sequence. The SLA area is closed out and the MSS is moved away. The countdown is picked up and continued to T-one minute. After CDDT, the S/C is restored to pre-test configuration.

CRITERIA FOR SUCCESS:

Complete demonstration of the feasibility of all operations required in the subsequent launch countdown.

SUPPORT REQUIREMENTS:

COMMODITIES: LO_2, LN_2, LH_2

EQUIPMENT: TBS

Table III. (Cont.)

TEST TITLE: Fluid Servicing

FLOW BLOCK NO. A 3.6

OBJECTIVE: Load the AM/MDA cryogenics

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The cryogenic servicing GSE is connected to the SLA cryogenic access port.

OPERATIONS:

The AM/MDA cryogenic storage spheres are loaded. The AM mass quantity measure system is monitored during the loading operation.

CRITERIA FOR SUCCESS:

Cryogenic spheres will be loaded.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table III. (Cont.)

TEST TITLE: Launch Monitor	FLOW BLOCK NO. A3.7
OBJECTIVE: Monitor S/C mission critical systems during final countdown. LOCATION: KSC-LP PERSONNEL: TBS TIME SPAN: TBS AGENCY SUPPORT: TBS	
TASK DESCRIPTION PREPARATIONS: TBS OPERATIONS: TBS CRITERIA FOR SUCCESS: S/C mission critical systems shall maintain launch readiness throughout the countdown.	
SUPPORT REQUIREMENTS: COMMODITIES: TBS EQUIPMENT: TBS	

4. FLIGHT AAP 3 INTEGRATION AND PRELAUNCH CHECKOUT

Flight AAP 3 is the resupply and re-activate flight of the cluster configuration mission. The launch vehicle consists of an uprated S-IB, an unmodified S-IVB and a modified IU. The spacecraft is an unmodified SLA, a resupply module (RM) and a modified CSM. The RM is a new module created for the AAP program. It consists of a basic MSFC rack with SLA attach points, life support resupply storage vessels and transfer systems, resupply fuel cell reactiant for the CSM, power distributor circuits (prime power from AM), display and control, sensors, and a UHF/VHF antenna system. Two standard docking collars are provided to facilitate CSM and MDA docking.

The center of the rack is a pressurized cannister containing life support consumables and LIOH filters. The IU is the standard Apollo hardware with a minor modification to facilitate the installation of the S027 X-ray astronomy experiment and supporting circuitry. The CSM modifications are those required to facilitate experiment installation and support, D&C, reactant resupply, and power.

The interfaces used as a basis for the test planning efforts in this document are in accordance with the definitions contained in MMC report "General Interface Schematics S/AA Flights 1 through 4, On-Orbit Cluster Configuration," MD-80-0018, dated 3 February 1967.

4.1 Test Requirements

4.1.1 Acceptance Test Requirements

4.1.1.1 RM Acceptance Test Requirements - In-process testing is considered an integral part of the fabrication process. In-process testing shall consist of continuity checks, megger checks, fit check, clearance checks, and plumbing leak checks.

4.1.1.1.1 Following fabrication, a weld and structure test shall be performed to uncover any latent manufacturing defects.

4.1.1.1.2 Verify the RM antenna system VSWR and attentuation characteristics.

4.1.1.1.3 Verify all electrical continuity and isolation is in accordance with the applicable CEI and ICD specifications.

4.1.1.1.4 Verify leakage rate of the RM center cannister compartment is within the CEI specifications limits. This requirement must be satisfied by a pressure decay check.

4.1.1.1.5 Verify that all fluid plumbing lines will withstand operating pressure. Verify that there is no leakage at any fittings, connections, or quick disconnects.

4.1.1.1.6 Verify the operation of all fluid transfer valves under actual cryogenic flow.

4.1.1.1.7 Verify the operation of both forward and aft docking mechanism. Perform a docking probe and latch adjustment where applicable.

4.1.1.1.8 Verify the RM aft docking collar leak rate is within limits when docked to a docking collar and pressure simulator.

4.1.1.1.9 Verify fit between the RM and a close tolerance SLA master gauge and SLA prototype.

4.1.1.1.10 Verify that the calibration of all flow transducers agree with the available calibration curves.

4.1.1.2 <u>CSM Acceptance Test Requirements</u> - The CSM is the responsibility of MSC and acceptance test requirements are out of the scope of this plan.

4.1.1.3 <u>SLA Acceptance Test Requirements</u> - The SLA is the responsibility of MSC and the acceptance test requirements are out of scope to this plan.

4.1.1.4 <u>IU Acceptance Test Requirements</u> - It is assumed that the IU experiment control circuitry will be installed at IBM, Huntsville, and will be included in the acceptance test of that carrier. The requirements are defined below.

4.1.1.4.1 Verify that the IU program changes are in accordance with the CEI and ICD specifications.

4.1.1.4.2 Verify the correct command is issued to initiate the S-027 experiment cover removal in accordance with the applicable CEI and ICD specifications.

4.1.1.5 S-IVB Acceptance Test Requirements - The S-IVB acceptance test requirements are the same as the standard Apollo flight and are out of scope to this plan.

4.1.2 CSM Pre-Mate Checkout Requirements at KSC - The CSM pre-mate checkout follows the standard Apollo test flow.

4.1.3 CSM/LM A/S Combined Checkout Requirements

4.1.3.1 Verify CSM/LM A/S docking probe and latch adjustments.

4.1.3.2 Verify that the docking port leakage rate is within allowable limits.

4.1.3.3 Verify compatibility of interfacing electrical subsystems such as D&C, power and communications.

4.1.4 CSM/Experiment Combined Checkout Requirements

4.1.4.1 CSM/Experiment interface operations shall be verified in the altitude chamber.

4.1.5 CSM/Cluster Combined Checkout Requirements

4.1.5.1 The checkout requirements consist of function verification of the CSM/cluster interfaces.

4.1.6 CSM/RM Combined Checkout Requirements

4.1.6.1 Verify docking probe and latch adjustments after docking of the two carriers.

4.1.6.2 Verify all display and control interfaces.

4.1.7 RM Pre-Mate Checkout Requirements

4.1.7.1 Verify that no shipping and transportation damage has occurred by performing a nonfunctional damage check.

4.1.7.2 Verify that all accompanying paperwork is accurate and complete.

4.1.7.3 Same as 4.1.1.1.4 and 4.1.1.1.5.

4.1.7.4 Same as 4.1.1.1.10

4.1.8 RM/SLA Combined Checkout Requirements

4.1.8.1 Verify early in the prelaunch checkout flow that the fit, alignment, and clearance between the RM and the upper and lower SLA are in accordance with the requirements of the applicable ICD specifications.

4.1.8.2 Verify that SLA cryogenic and servicing access ports and umbilicals are in accordance with the applicable specifications.

4.1.9 RM/Docking Collar and Pressure Simulator Checkout Requirements

4.1.9.1 Verify probe and latch adjustment of the RM aft docking port.

4.1.9.2 Verify that the docking port leakage rate is within the allowable limits.

4.1.10 RM/Cluster Checkout Requirements

4.1.10.1 Verify the display and control functions in the RM that interface with the MDA.

4.1.10.2 Verify the hardwire communication interface is functionally compatible with the MDA.

4.1.11 Spacecraft AAP Checkout Requirements

4.1.11.1 Verify that the S/C is compatible with the L/V EMC and RFI environment.

4.1.11.2 Verify that the S/C RF communication systems are compatible with the ground tracking stations.

4.2 PIF Operations

4.2.1 General Summary - The inprocess testing required during the Resupply Module fabrication is as follows:

Continuity and megger test on all electrical wiring, leak tests on all plumbing lines, fit and clearance checks between the truss modules, center cannister and resupply spheres.

Following RM fabrication, the carrier is connected on a shake table. Spring-mass accelerometers are mounted on the carrier at specified locations. The accelerometer outputs are monitored, via recorders, during the same time period that the shake table vibration and amplitude is varied over the specified range. The accelerometer recordings are evaluated to determine the maximum amplitude at specified frequencies during the shake test.

The Resupply Module is then positioned on the handling fixture. All RM welded joints are subjected to X-ray checks to determine any manufacturing defects. A dye penetration check will be performed if there is a questioned X-ray result.

The RM antenna system consists of coax cables and an antenna. An RF signal generator is connected to the coax cable and VSWR is measured using commercial VSWR measuring equipment. Attenuation of the antenna system is determined through the use of commercial attenuation measuring equipment.

The AM/MDA electrical simulator is connected through marriage cables to the RM. Power is applied to the RM from the AM/MDA simulator and RM voltage distributor checks are performed. The display console in the RM is verified by simulating an AM/MDA pressure transducer from the AM/MDA simulator.

The center cannister of the RM is sealed and pressurized. A pressure-decay check is performed to determine the leakage rate.

The RM/MDA interface fluid lines are capped, the fluid spheres and plumbing lines are pressurized. A leak rate detector test is performed on all connections and fittings. The plumbing and cannisters are pressurized with a GN_2/GH_e mixture.

The RM is transferred to the cryogenic test facility. Cryogenic fluids are connected to their respective fill lines. The RM/MDA interface fluid connections are connected to approved vent lines. An AM/MDA electrical simulator is connected to the RM to initiate valve operations. All cryogenic transfers are verified using the AM/MDA simulator controls and verifying the instrumentation and display readcuts.

After all cryogenic tests are completed, the storage vessels and lines are drained and purged with dry GN_2.

Both RM docking adapters are fit checked using a docking collar and pressure simulator. Probe and latch adjustments are performed. A docking collar leak check is performed on the RM aft docking port. The RM is fit checked with a lower SLA master gauge to verify attach points compatibility.

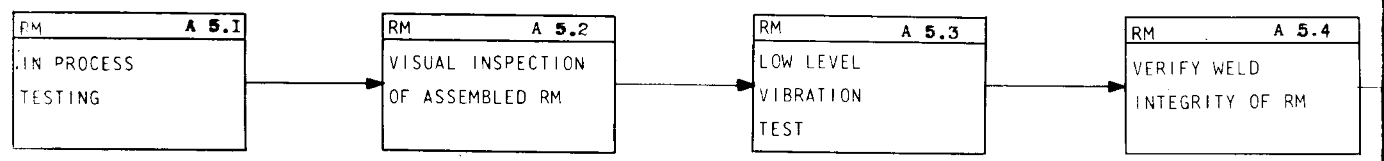
The RM is cleaned and rotated to remove all foreign materials. Mass property simulators are installed in the RM center cannister to simulate food, water and LIOH prior to weight and balance.

Critical spare subsystem or assemblies are verified at the system level by replacing actual RM flight hardware with the available spares. Following the spares checkout, the RM is reconfigured with the flight hardware that was removed and all systems are reverified prior to shipment to KSC.

The RM is installed in the shipping container for shipment to KSC.

4.2.2 PIF Checkout Flow for RM - The functional flow diagram (figure 5) illustrates the recommended flow of checkout activities on the AAP 3 RM at MSFC.

4.2.3 Test Requirement Sheets - Table IV defines specific blocks on the AAP 3 flow diagram for MSFC operation. Each sheet is identified by the flow block title and number.


RM A 5.1
IN PROCESS TESTING
RM A 5.2
VISUAL INSPECTION OF ASSEMBLED RM
RM A 5.3
LOW LEVEL VIBRATION TEST
RM A 5.4
VERIFY WELD INTEGRITY OF RM

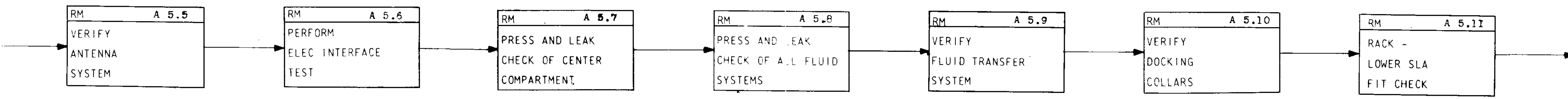
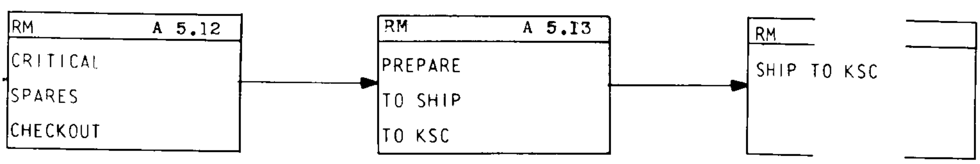


Figure 5. PIF Checkout Flow For RM

2 1 3



PIF CHECKOUT FLOW FOR RM

DATE: 7APRIL, 67

Table IV. Test Requirement Sheets for Figure 5

TEST TITLE: In Process Testing

FLOW BLOCK NO. A5.1

OBJECTIVE: To verify workmanship during RM assembly

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: Continuous thru manufacturing
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The tests are performed after each major assembly process.

OPERATIONS:

During the assembly of the truss, center cannister, and the two docking adapters, a clearance, fit and alignment check is performed. After plumbing and sphere installation, a leak check is performed to verify all connections. Following the installation of the wiring harness, a continuity and megger check is performed.

CRITERIA FOR SUCCESS:

The assembled carrier will meet the clearance specifications. The plumbing and wiring specification will conform to the available ICD.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Ohmmeter, megger, pressure console, pressure lines

Table IV. (Cont.)

TEST TITLE:	Visual Inspection of Assembled RM	FLOW BLOCK NO. A5.2

OBJECTIVE: To verify that all sub-systems are secured to the carrier support structure

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 8 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is installed in a handling fixture and a work access platform is positioned around the carrier.

OPERATIONS:

A visual inspection of all carrier subsystem mechanical interfaces for secured mounting is performed. A visual check of cable and plumbing routing for clearance and tension is made.

CRITERIA FOR SUCCESS:

Verify that all fasteners between the carrier and subsystems are installed.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: RM handling fixture, work access platform

Table IV. (Cont.)

TEST TITLE:	Low Level Vibration Test	FLOW BLOCK NO. A5.3

OBJECTIVE: Vibrate the RM to verify that no latent manufacturing defects exist

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is attached to the shake table. Mass accelerometers are connected to the carrier at specified points. The accelerometer outputs are connected to the signal conditioner and recorded.

OPERATIONS:

The shake table is energized and the frequency and amplitude is varied over the specified range. The accelerometer outputs are recorded to verify amplitude and frequency at selected locations on the rack structure.

CRITERIA FOR SUCCESS:

No latent manufacturing defects exist.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Spring-mass accelerometer and associated GSE, hand tools, shake table, recorder, overhead crane

Table IV. (Cont.)

TEST TITLE: Verify Weld Integrity of RM

FLOW BLOCK NO. A5.4

OBJECTIVE: To check all welded joints following the vibration test

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 32 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is installed in its handling fixture. A work access platform is positioned around the RM. The X-ray equipment is verified to be in operational readiness.

OPERATIONS:

The X-ray equipment is positioned so that every weld can be X-rayed. The X-ray pictures are evaluated for flaws. Any questionable weld is dye checked to determine if the weld has a crack.

CRITERIA FOR SUCCESS:

Verify that all welds are flight ready

SUPPORT REQUIREMENTS:

COMMODITIES: X-ray film

EQUIPMENT: X-ray equipment, dye check equipment, handling fixture, work access platform

Table IV. (Cont.)

TEST TITLE: Verify Antenna System

FLOW BLOCK NO. A5.5

OBJECTIVE: To verify RM antenna system

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 8 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is positioned on its holding fixture. A work access platform is positioned around the RM. The RF signal generator, VSWR equipment, and attenuation equipment is calibrated.

OPERATIONS:

The RF signal generator is inserted in the RM/MDA interface cable. The transmission frequency is applied to the RM antenna system. VSWR is measured using commercial VSWR equipment. Attenuation of the antenna system is determined using commercial attenuation measurement equipment.

CRITERIA FOR SUCCESS:

The attenuation and VSWR will conform to the available specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: RF signal generator, VSWR equipment, attenuation equipment, handling fixture and work access platform

Table IV. (Cont.)

TEST TITLE: Perform Electrical Interface Test

FLOW BLOCK NO. A5.6

OBJECTIVE: To verify power and D&C interface between the RM and AM /MDA

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is connected to an AM/MDA electrical simulator through marriage cables.

OPERATIONS:

Power is applied from the AM/MDA simulator to the RM. RM power distributor checks are performed to verify correct wiring. The pressure transducer in the RM is verified from the simulator at ambient conditions. The RM display of the MDA cabin pressure is verified.

CRITERIA FOR SUCCESS:

Verification that D&C and power distribution in the RM is in accordance with the requirement of the ICD's.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: AM/MDA electrical simulator, marriage cable, power panel

Table IV. (Cont.)

TEST TITLE: Pressure and Leak Check of Center Cannister

FLOW BLOCK NO. A5.7

OBJECTIVE: To determine leak rate of pressurized cannister

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The center cannister hatch is sealed. A facility pressure line is connected to the pressurization valve on the center cannister.

OPERATIONS:

The center cannister is pressurized to approximately 6 PSIG. A leak rate detector check is performed around the hatch. A pressure decay check is performed on the cannister. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

The leak rate will not exceed allowable limits as defined in the CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2/GH_e mixture

EQUIPMENT: Leak rate detector, pneumatic console, pressure lines, pressure gauge

Table IV. (Cont.)

TEST TITLE: Pressure and Leak Check of All Fluid Systems

FLOW BLOCK NO. A5.8

OBJECTIVE: To leak check all resupply fluid containers, plumbing lines, fittings and connections

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is located in its holding fixture. The necessary pressure lines are connected to the RM from the pneumatic console. The pressure lines are needed for the O_2, N_2 and H_2 systems.

OPERATIONS:

The GN_2/GH_e mixture is allowed to pressurize the fluid system of the RM. After allowing the pressure to reach 6 psig, a leak detector check is performed on all plumbing connectors, fittings and quick disconnects. A pressure decay check is performed on all storage spheres. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

The leak rate will meet the specifications allotted for each commodity system.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2/GH_e mixutre

EQUIPMENT: Leak rate detector, pneumatic console, pressure lines, pressure gauge

Table IV. (Cont.)

TEST TITLE: Verify Fluid Transfer System

FLOW BLOCK NO. A5.9

OBJECTIVE: To allow cryogenic fluid to flow from the RM spheres

LOCATION: MSFC (cryogenic facility)
PERSONNEL: TBS
TIME SPAN: 24 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is transported to the cryogenic test facility. O_2, N_2 and H_2 lines are connected from the ground source to the carrier. The MDA electrical simulator is connected to the RM, through marriage cables. The cryogenic interface to the MDA is routed back to the respective fluid supply.

OPERATIONS:

The cryogenic spheres are charged. The valve responses are monitored as the transfer commands from the MDA simulator are initiated. Valve actuations are verified and the flow, temperature and pressure transducers are checked out dynamically. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

Verification of valve response and flow rate monitors.

SUPPORT REQUIREMENTS:

COMMODITIES: GO_2, GN_2, GH_2

EQUIPMENT: AM/MDA electrical simulator, pneumatic console, cryogenic lines, ground power console

Table IV. (Cont.)

TEST TITLE: Verify Docking Collars

FLOW BLOCK NO. A5.10

OBJECTIVE: To fit check and adjust docking probe and Latches

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 20 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is in an inverted position in its holding fixture. A work access platform is positioned around the carrier. A docking collar and pressure simulator is lowered to the RM docking collar. The RM hatch is opened prior to docking.

OPERATIONS:

The docking collar and pressure simulator is docked to the RM and probe and latch adjustments are performed. A pneumatic line is connected to the RM. The cannister and docking collar is pressurized with GN_2 to 6 PSIG. A leak-rate detector check is performed around the docking collar. A pressure-decay check is performed for 2 hours on the configuration and a leak rate is determined. The configuration is separated and the RM is positioned upright in its holding fixture. Once again the docking collar and pressure simulator is lowered, and docking probe and latch adjustments are performed on the forward RM docking collar. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

Interfaces shall be in accordance with requirements of the ICDs

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Docking collar and pressure simulator, overhead crane, pneumatic console, pressure lines

Table IV. (Cont.)

TEST TITLE: RM - Lower SLA Fit Check	FLOW BLOCK NO. A5.11

OBJECTIVE: To fit check the RM with the SLA master gauge

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 10 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is installed in a holding fixture. The RM is attached to an overhead crane and positioned above the SLA. A work access platform is positioned around the top of the lower SLA.

OPERATIONS:

The RM is lowered to the SLA attach points and secured. A fit and clearance check is performed between the RM and lower SLA.

CRITERIA FOR SUCCESS:

Sufficient clearance between the two carriers is verified

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Lower SLA prototype or master gauge, overhead crane, integration stand, work access platform

Table IV. (Cont.)

TEST TITLE: Critical Spares Checkout

FLOW BLOCK NO. A5.12

OBJECTIVE: To verify system after major (critical spares) components have been interchanges

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

After the system has been functionally checked out (mech. and elect.), major components as identified by the Critical Items List will be replaced.

OPERATIONS:

Reverify system integrity by functionally checking out system using same test procedure and test equipment.

CRITERIA FOR SUCCESS:

Successful completion of testing by reverification of system after replacement of major components with spare items

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table IV. (Cont.)

TEST TITLE: Prepare to Ship to KSC

FLOW BLOCK NO. A5.13

OBJECTIVE: To clean and verify that the RM weight and CG are within design specifications. To install the RM in its shipping container.

LOCATION: MSFC

PERSONNEL: TBS

TIME SPAN: 32 Hrs

AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM center cannister is vacuumed clean of all foreign material. The RM is installed on the weight and balance fixture in an upright position. Mass property simulators are installed to substitute for food, water, and LIOH provisions.

OPERATIONS:

The RM is leveled and weighed. In both the vertical and horizontal position, the center of gravity is determined by use of a three point load cell suspension. The RM is installed in its shipping container. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

Verify that the RM weight is compatible to the flight plan

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Load cells, mass property simulators, shipping containers, vacuum cleaner, weight and balance fixture, overhead crane, work access platform

4.3 KSC Operations

4.3.1 General Summary

4.3.1.1 S-IVB - No AAP peculiar modifications have been accomplished on the S-IVB. Prelaunch checkout is in accordance with the normal Apollo flow.

4.3.1.2 IU - The necessary IU modifications required for experiment S-027 are performed by IBM. Prelaunch checkout is in accordance with normal Apollo flow.

4.3.1.3 SLA - No modifications have been performed on the SLA for AAP 3. Checkout follows the normal Apollo flow with the exception of an RM to lower SLA fit check early in the MSOB flow.

4.3.1.4 CSM - CSM modifications are performed at the contractor's facility. All modifications are of a nature that can be incorporated within the normal Apollo flow under the various subsystem tests. CSM modifications will not affect the KSC Apollo flow. However, the CSM does not follow the normal Apollo flow due to AAP 3 test peculiarities. Inserted in the normal Apollo flow are the following tests:

a. AAP 3 CSM - AAP 4 LM A/S docking and interface tests - The LM A/S from AAP 4 is brought to the altitude chamber and docked to the CSM from AAP 3 already in the altitude chamber. The details of this activity are described in 5.3.1.4.

b. AAP 3 CSM - AAP 3 RM Docking and Interface Test - The RM is moved to the altitude chamber where it is docked to the CSM already in the chamber. Interface testing between carriers is also performed.

c. AAP 3 CSM - AAP 3 RM, AAP 4 LM A/S/Rack/ATM, Interface Simulator (LM&SS, AM/MDA & S-IVB) - The CSM is in the east altitude chamber and the LM A/S is in the west altitude chamber. The remainder of the cluster carriers and the interface simulator are positioned outside the east altitude chamber. Electrical interfaces between the carriers are connected in a cluster configuration. Cluster interface tests are performed ending in a compressed time mission simulation.

4.3.1.5 Resupply Module (RM) - The resupply module (RM) is a basic rack modified to resupply commodities needed to extend the flight duration of the cluster mission. This is a new carrier and existing Apollo flow is unavailable. The test flow for KSC operations is described in this section.

The RM receiving inspection test is limited to a damage check of the module. A load check is performed on all RM power interface umbilicals. The RM is then moved to the east integration stand for a RM to lower SLA fit check.

The RM is moved from the east integration stand to the altitude chamber. The RM is lifted above the altitude chamber and docked with the AAP 3 CSM already in the chamber. Soft and hard docking tests are performed between the two carriers. The RM is positioned outside the altitude chamber and mated to the CSM inside the altitude chamber through marriage cables. D&C interface test are then performed between the carriers. Following the interface test, the RM & CSM are separated.

A leak check is performed on the RM cannister, spheres, and plumbing lines. Regulators are functionally verified and flow rates monitored.

A docking and pressure test is performed on the aft RM docking collar. A docking collar and pressure simulator is used to perform this test.

The stored experiments and life support supplies are installed in the RM. The carrier is cleaned and moved to the weight and balance fixture where weight and center of gravity of the RM are determined.

The RM is moved adjacent to the east altitude chamber for a cluster checkout. The details are described in 4.3.1.4 Part C.

Following the cluster checkout, the RM is moved to the east integration stand for spacecraft buildup. The remainder of the RM operations follow the standard Apollo flow.

4.3.1.6 Launch Pad Activities - Basically the launch pad activities follow the normal Apollo flow with the following exceptions:

a. RM subsystem location change checkout

b. Cryogenic servicing of the RM

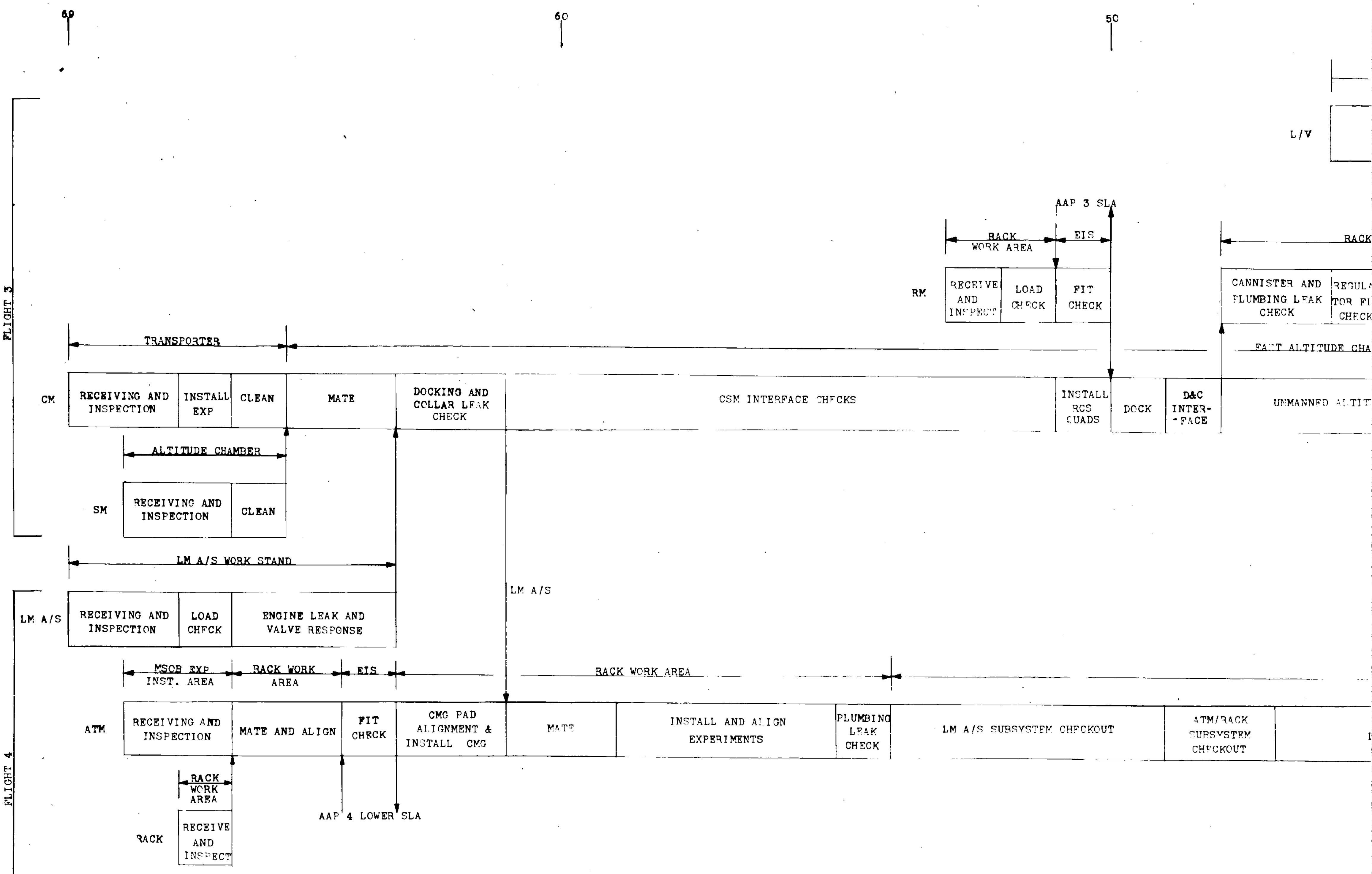
c. RFI testing in conjunction with the Apollo RF test

d. All S/C operations and procedures shall be verified during the Apollo CDDT.

4.3.2 <u>Prelaunch Checkout and Launch Pad Activities Time-Based Functional Flow for AAP 3/4</u> - There is a significant hardware flow interface between elements of AAP 3 and AAP 4 at KSC since checkout of the two flights occur at approximately the same time. This relationship is illustrated on the time-based AAP 3/4 combined flow diagram. See figure 6. A detailed flow of AAP 3 elements is presented in 4.3.3 and a detailed flow of AAP 4 elements is provided in 5.3.2. The combined flow diagram has been provided to illustrate schedule and facility compatibility. The time span for this flow is based on a 16-hour workday.

4.3.3 <u>Prelaunch Checkout and Launch Pad Activities Flow</u> - The flow diagram (figure 7) illustrates the recommended method of implementing the requirements for prelaunch checkout activities at KSC for Flight AAP 3. Time function reference should be made to 4.3.2 for interface and timeline requirements.

4.3.4 <u>Flight 3 Test Requirement Sheets</u> - Table V defines specific blocks of the AAP 3 flow diagram for KSC operations. Each sheet is identified by the flow block title and number.



NOTE: SPACE VEHICLE TEST CONSISTS OF:
RADIO FREQUENCY TEST
PLUGS OUT OVERALL TEST
PLUGS IN OVERALL TEST
COUNT DOWN DEMONSTRATION TEST
FLIGHT READINESS TEST

— — — — — — REPRESENTS UMBILICAL MATE FOR THE LM A/S-C
—— — —— — REPRESENTS UMBILICAL MATE FOR THE LM A/S-C

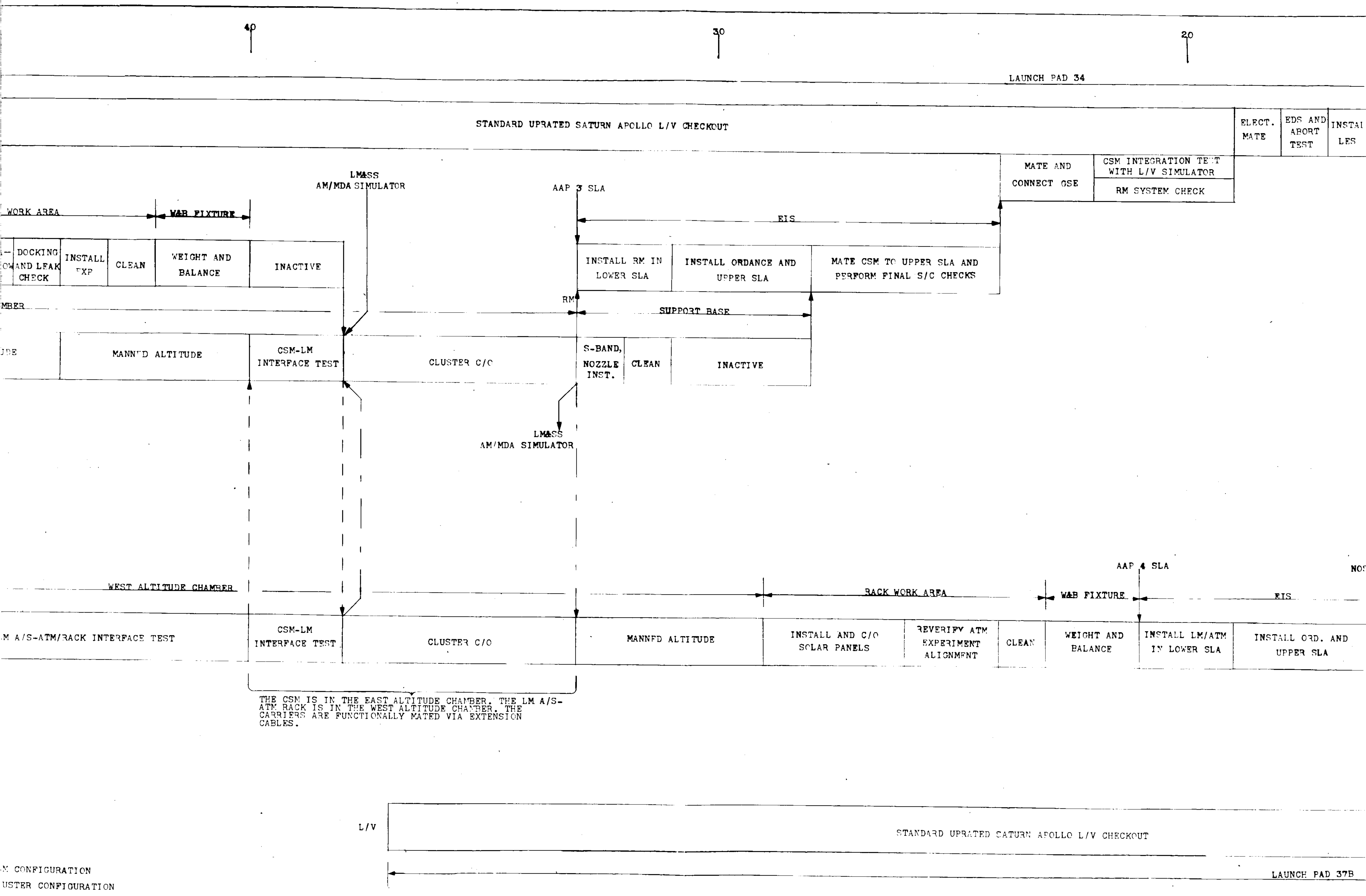
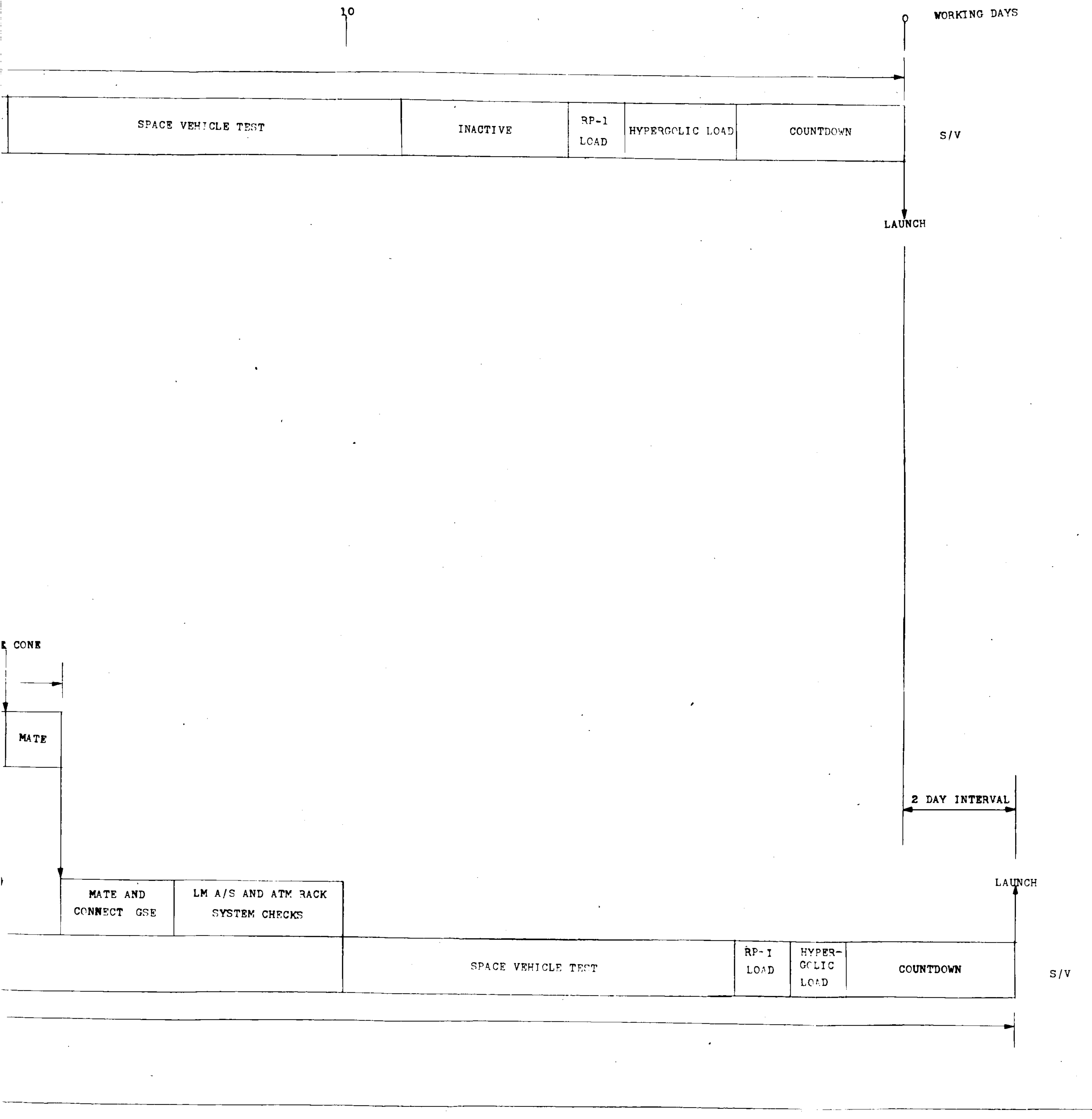


Figure 6. Prelaunch Checkout And Launch Pad Activities Time-Based Functional Flow Diagram For AAP 3/4

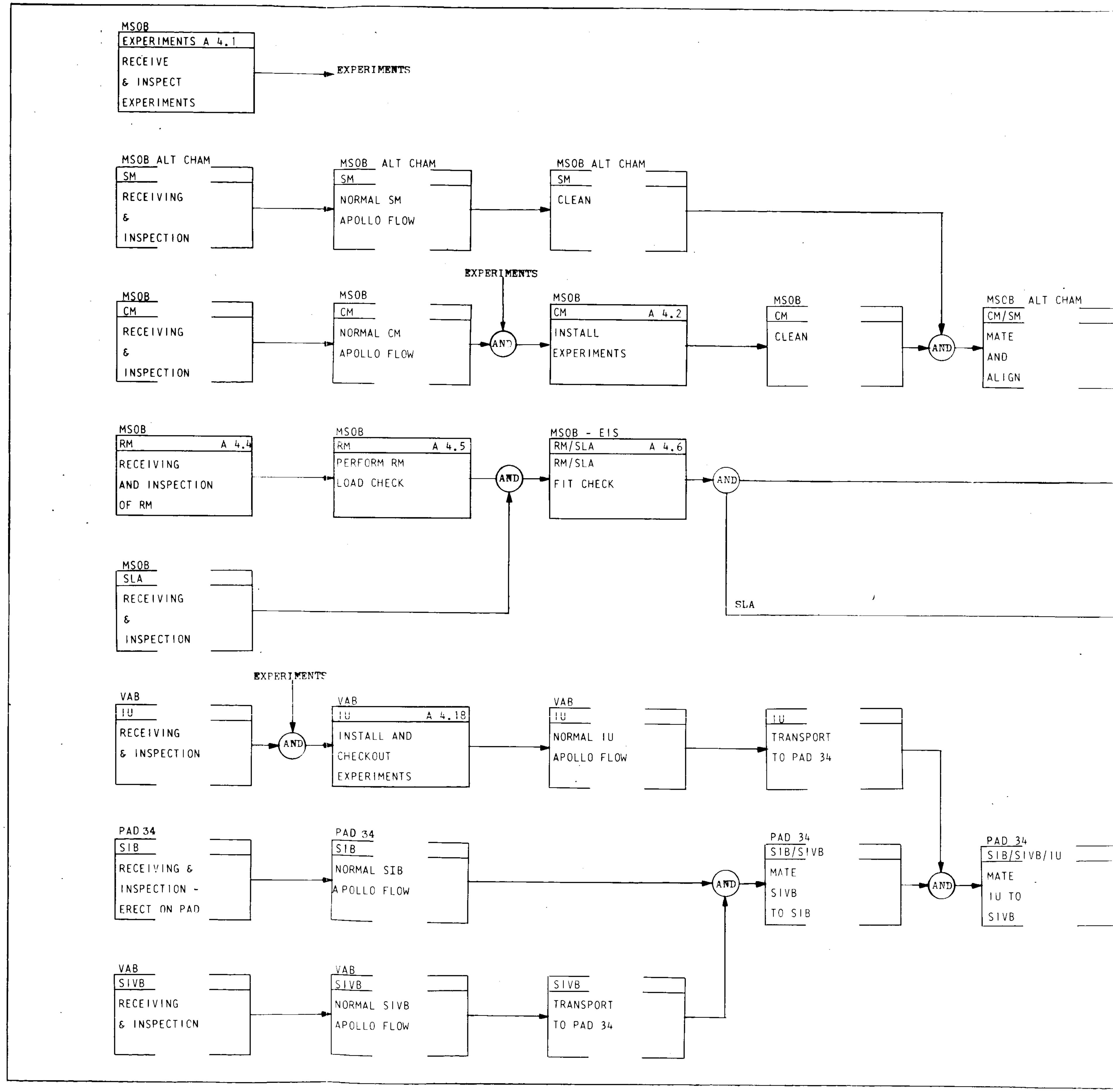


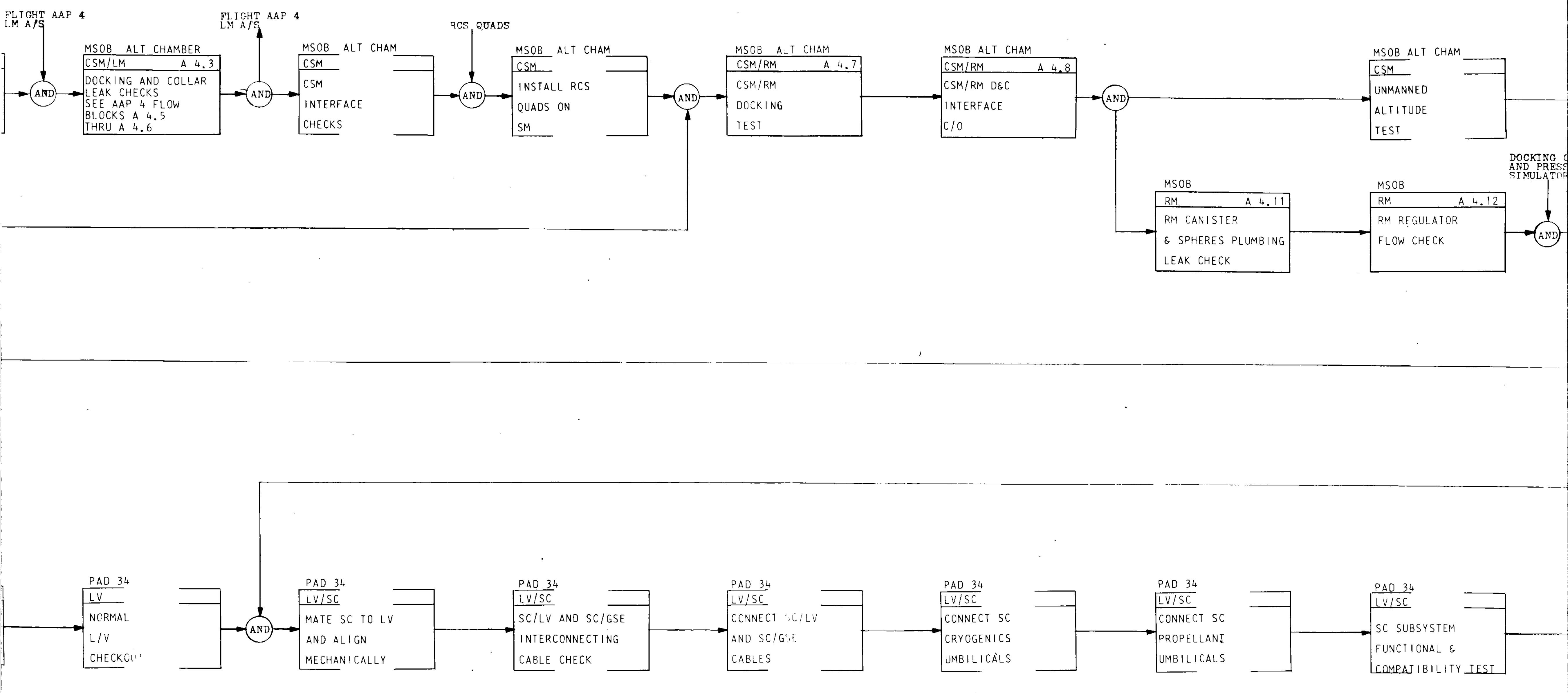
PRELAUNCH CHECKOUT AND LAUNCH PAD ACTIVITIES TIME-BASED FUNCTIONAL FLOW DIAGRAM FOR AAP 3/4

DATE: 7 APRIL, 67

4

5


MSOB
EXPERIMENTS A 4.1
RECEIVE & INSPECT EXPERIMENTS
EXPERIMENTS
MSOB ALT CHAM
SM
RECEIVING & INSPECTION
MSOB ALT CHAM
SM
NORMAL SM APOLLO FLOW
MSOB ALT CHAM
SM
CLEAN
EXPERIMENTS
MSOB
CM
RECEIVING & INSPECTION
MSOB
CM
NORMAL CM APOLLO FLOW
AND
MSOB
CM A 4.2
INSTALL EXPERIMENTS
MSOB
CM
CLEAN
AND
MSOB ALT CHAM
CM/SM
MATE AND ALIGN
MSOB
RM A 4.4
RECEIVING AND INSPECTION OF RM
MSOB
RM A 4.5
PERFORM RM LOAD CHECK
AND
MSOB - EIS
RM/SLA A 4.6
RM/SLA FIT CHECK
AND
MSOB
SLA
RECEIVING & INSPECTION
SLA
EXPERIMENTS
VAB
IU
RECEIVING & INSPECTION
AND
VAB
IU A 4.18
INSTALL AND CHECKOUT EXPERIMENTS
VAB
IU
NORMAL IU APOLLO FLOW
IU
TRANSPORT TO PAD 34
PAD 34
SIB
RECEIVING & INSPECTION - ERECT ON PAD
PAD 34
SIB
NORMAL SIB APOLLO FLOW
AND
PAD 34
SIB/SIVB
MATE SIVB TO SIB
AND
PAD 34
SIB/SIVB/IU
MATE IU TO SIVB
VAB
SIVB
RECEIVING & INSPECTION
VAB
SIVB
NORMAL SIVB APOLLO FLOW
SIVB
TRANSPORT TO PAD 34


FLIGHT AAP 4 LM A/S
MSOB ALT CHAMBER
CSM/LM A 4.3
DOCKING AND COLLAR LEAK CHECKS SEE AAP 4 FLOW BLOCKS A 4.5 THRU A 4.6
FLIGHT AAP 4 LM A/S
MSOB ALT CHAM
CSM
CSM INTERFACE CHECKS
RCS QUADS
MSOB ALT CHAM
CSM
INSTALL RCS QUADS ON SM
MSOB ALT CHAM
CSM/RM A 4.7
CSM/RM DOCKING TEST
MSOB ALT CHAM
CSM/RM A 4.8
CSM/RM D&C INTERFACE C/O
MSOB ALT CHAM
CSM
UNMANNED ALTITUDE TEST
MSOB
RM A 4.11
RM CANISTER & SPHERES PLUMBING LEAK CHECK
MSOB
RM A 4.12
RM REGULATOR FLOW CHECK
AND
PAD 34
LV
NORMAL L/V CHECKOUT
PAD 34
LV/SC
MATE SC TO LV AND ALIGN MECHANICALLY
PAD 34
LV/SC
SC/LV AND SC/GSE INTERCONNECTING CABLE CHECK
PAD 34
LV/SC
CONNECT SC/LV AND SC/GSE CABLES
PAD 34
LV/SC
CONNECT SC CRYOGENICS UMBILICALS
PAD 34
LV/SC
CONNECT SC PROPELLANT UMBILICALS
PAD 34
LV/SC
SC SUBSYSTEM FUNCTIONAL & COMPATIBILITY TEST

2

3

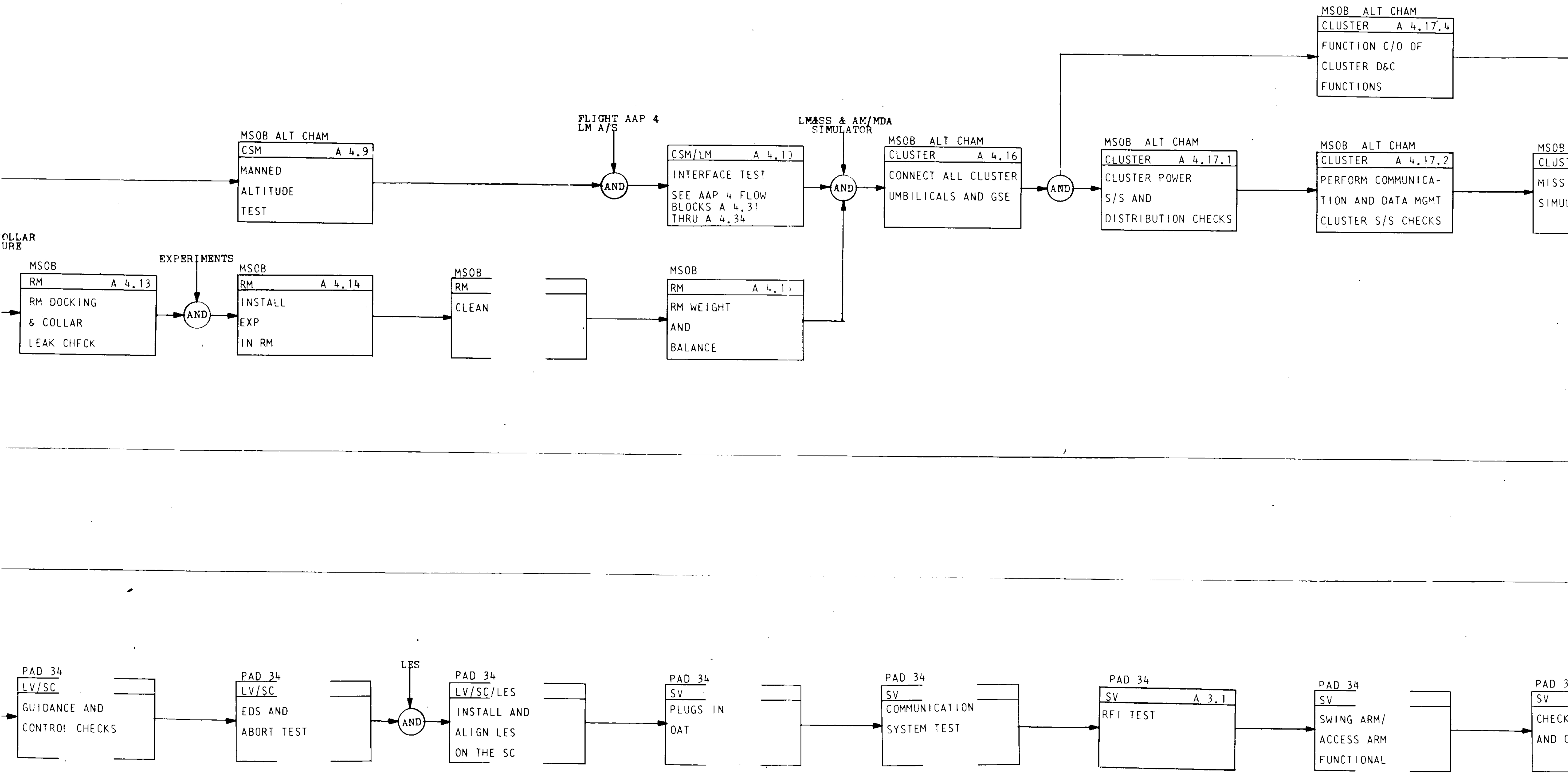
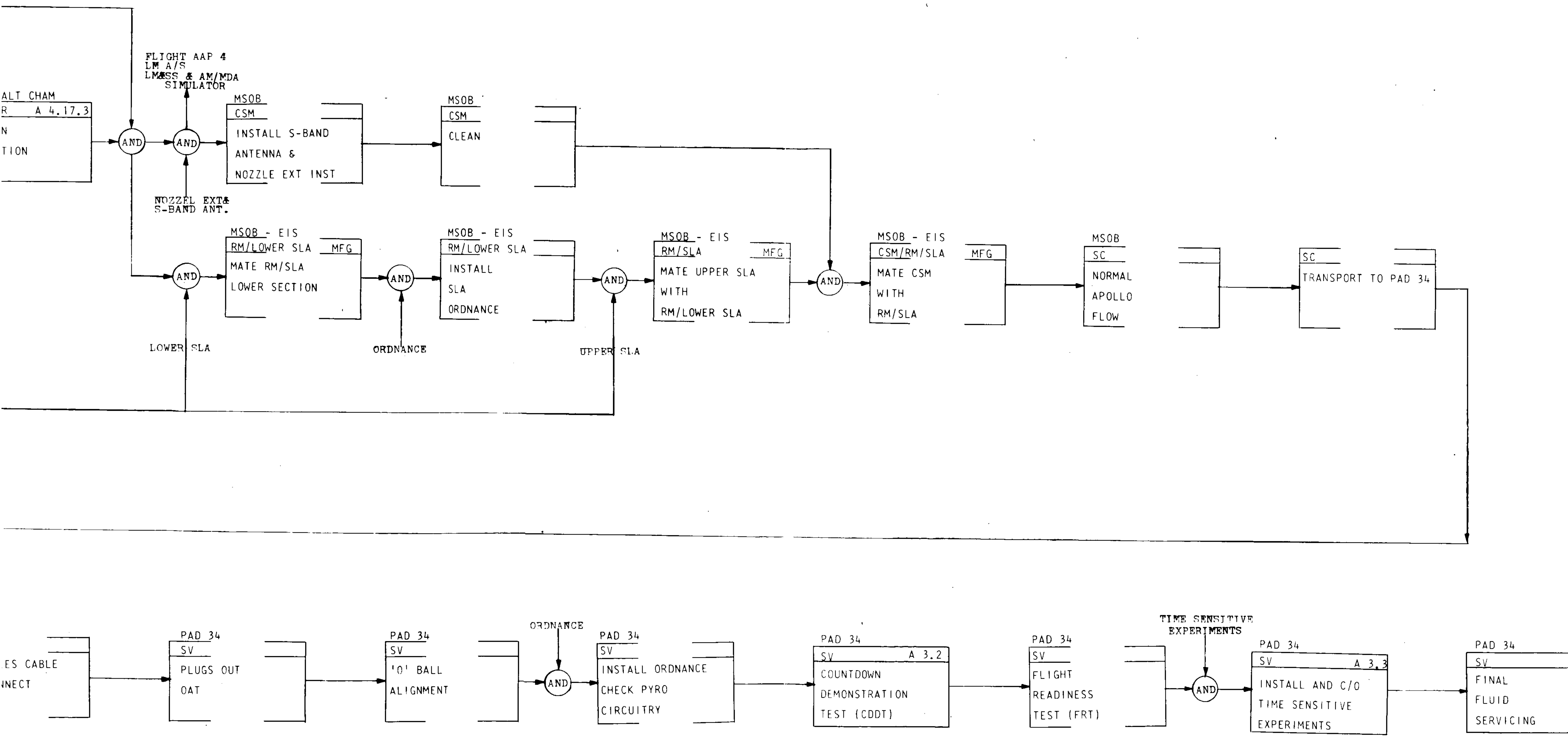


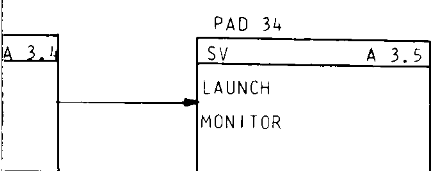
Figure 7. Prelaunch Checkout And Launch Pad Activities Flow For AAP Flight 3



ALT CHAM
R A 4.17.3
N
TION
FLIGHT AAP 4
LM A/S
LM ASS & AM/MDA
SIMULATOR
MSOB
CSM
INSTALL S-BAND
ANTENNA &
NOZZLE EXT INST
MSOB
CSM
CLEAN
NOZZEL EXT&
S-BAND ANT.
MSOB - EIS
RM/LOWER SLA MFG
MATE RM/SLA
LOWER SECTION
MSOB - EIS
RM/LOWER SLA
INSTALL
SLA
ORDNANCE
MSOB - EIS
RM/SLA MFG
MATE UPPER SLA
WITH
RM/LOWER SLA
MSOB - EIS
CSM/RM/SLA MFG
MATE CSM
WITH
RM/SLA
MSOB
SC
NORMAL
APOLLO
FLOW
SC
TRANSPORT TO PAD 34
LOWER SLA
ORDNANCE
UPPER SLA
ES CABLE
NNECT
PAD 34
SV
PLUGS OUT
OAT
PAD 34
SV
'O' BALL
ALIGNMENT
ORDNANCE
PAD 34
SV
INSTALL ORDNANCE
CHECK PYRO
CIRCUITRY
PAD 34
SV A 3.2
COUNTDOWN
DEMONSTRATION
TEST (CDDT)
PAD 34
SV
FLIGHT
READINESS
TEST (FRT)
TIME SENSITIVE
EXPERIMENTS
PAD 34
SV A 3.3
INSTALL AND C/O
TIME SENSITIVE
EXPERIMENTS
PAD 34
SV
FINAL
FLUID
SERVICING
AND

6

7



PRELAUNCH CHECKOUT AND LAUNCH
[illegible] ACTIVITES FLOW FOR AAP
FLIGHT #3

DATE: 7 APRIL, 67

Table V. Test Requirement Sheets for Figure 7

TEST TITLE: Receive and Inspect Experiments

FLOW BLOCK NO. A4.1

OBJECTIVE: Verify experiments to acceptance documentation. Verify that no damage has occurred during packaging and shipping.

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: 40 Hrs (Total)
AGENCY SUPPORT: Principal Investigator

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying the experiments are reviewed for latest configuration and accuracy. The experiments are removed from the shipping containers.

OPERATIONS:

A thorough inspection of the experiments is performed. All electrical connectors are inspected for bent pins and foreign particles. Fluid lines are inspected for evidence of damage. No functional checkouts are performed at this time. Environmental and cleanliness controls shall be adheared to at all times in accordance with applicable specifications.

CRITERIA FOR SUCCESS:

There shall be no evidence of damage, deterioration or contamination

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment handling equipment

Table V. (Cont.)

TEST TITLE: Install Experiments

FLOW BLOCK NO. A4.2

OBJECTIVE: To install the experiments in the CM

LOCATION: KSC-MSOB (CM Transporter)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All experiments will be subjected to a pre-installation inspection, and/or bench checked as defined in section 6.

OPERATIONS:

The experiments are mounted or stored in their assigned positions.

CRITERIA FOR SUCCESS:

The experiments will be installed and secured in a launch configuration.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment handling equipment

Table V. (Cont.)

TEST TITLE: AAP 3 CSM - AAP 4 LM A/S Docking and Collar Leak Check	FLOW BLOCK NO. A4.3

OBJECTIVE: Verify CSM - LM A/S docking interfaces. Verify docking interface leakage rates do not exceed specification requirements.

LOCATION: KSC-MSOB (East Altitude Chamber)

PERSONNEL: TBS

TIME SPAN: 32 Hrs

AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

See AAP 4 KSC flow, Block A4.5 and A4.6 for preparations and operations.

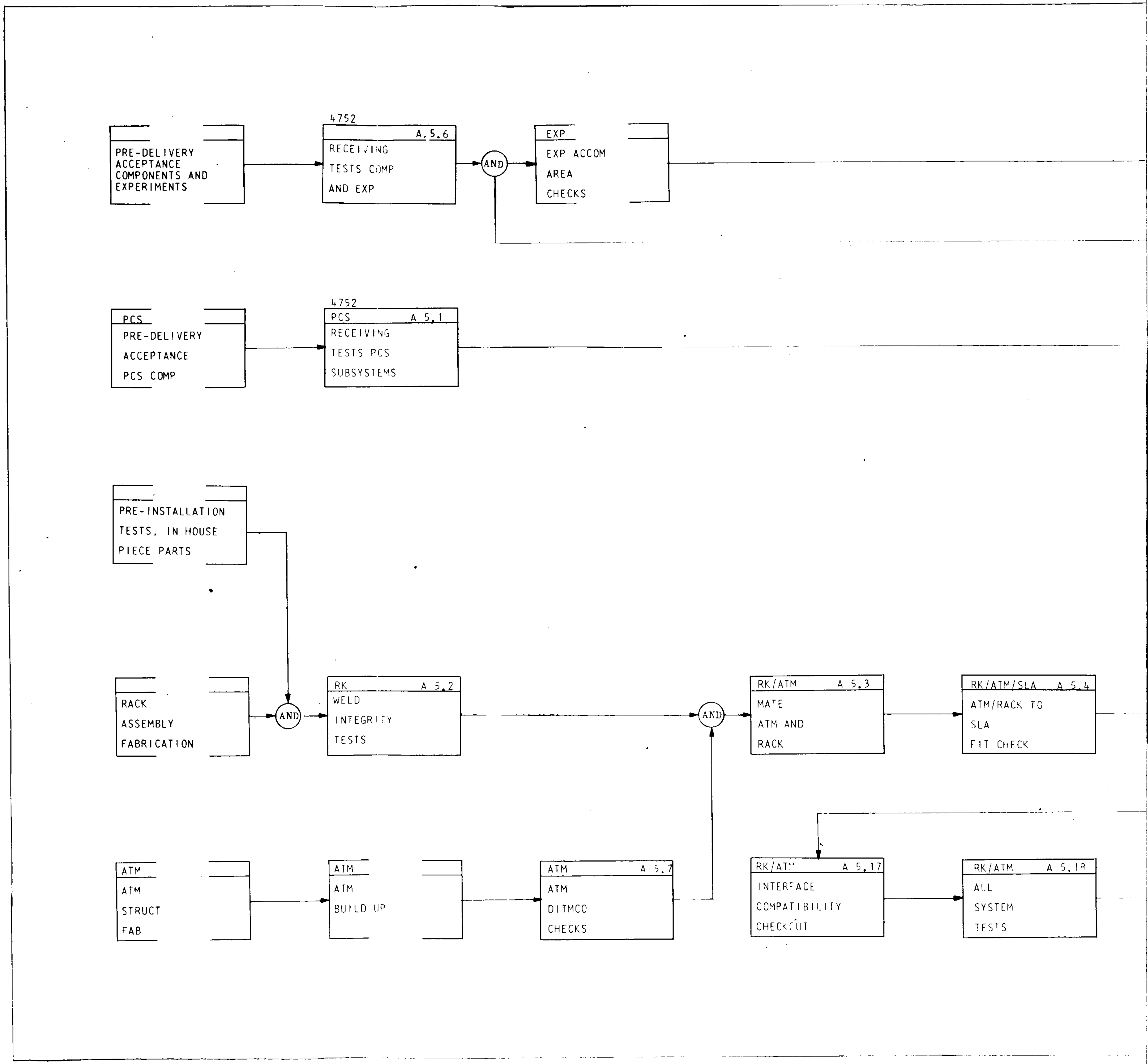
OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS: See AAP 4 RAS Sheets A4.5 and A4.6

COMMODITIES:

EQUIPMENT:


PRE-DELIVERY ACCEPTANCE COMPONENTS AND EXPERIMENTS
4752
A.5.6
RECEIVING TESTS COMP AND EXP
AND
EXP
EXP ACCOM AREA CHECKS
PCS
PRE-DELIVERY ACCEPTANCE PCS COMP
4752
PCS A 5.1
RECEIVING TESTS PCS SUBSYSTEMS
PRE-INSTALLATION TESTS, IN HOUSE PIECE PARTS
RACK ASSEMBLY FABRICATION
AND
RK A 5.2
WELD INTEGRITY TESTS
AND
RK/ATM A 5.3
MATE ATM AND RACK
RK/ATM/SLA A 5.4
ATM/RACK TO SLA FIT CHECK
ATM
ATM STRUCT FAB
ATM
ATM BUILD UP
ATM A 5.7
ATM DITMCO CHECKS
RK/ATM A 5.17
INTERFACE COMPATIBILITY CHECKOUT
RK/ATM A 5.18
ALL SYSTEM TESTS

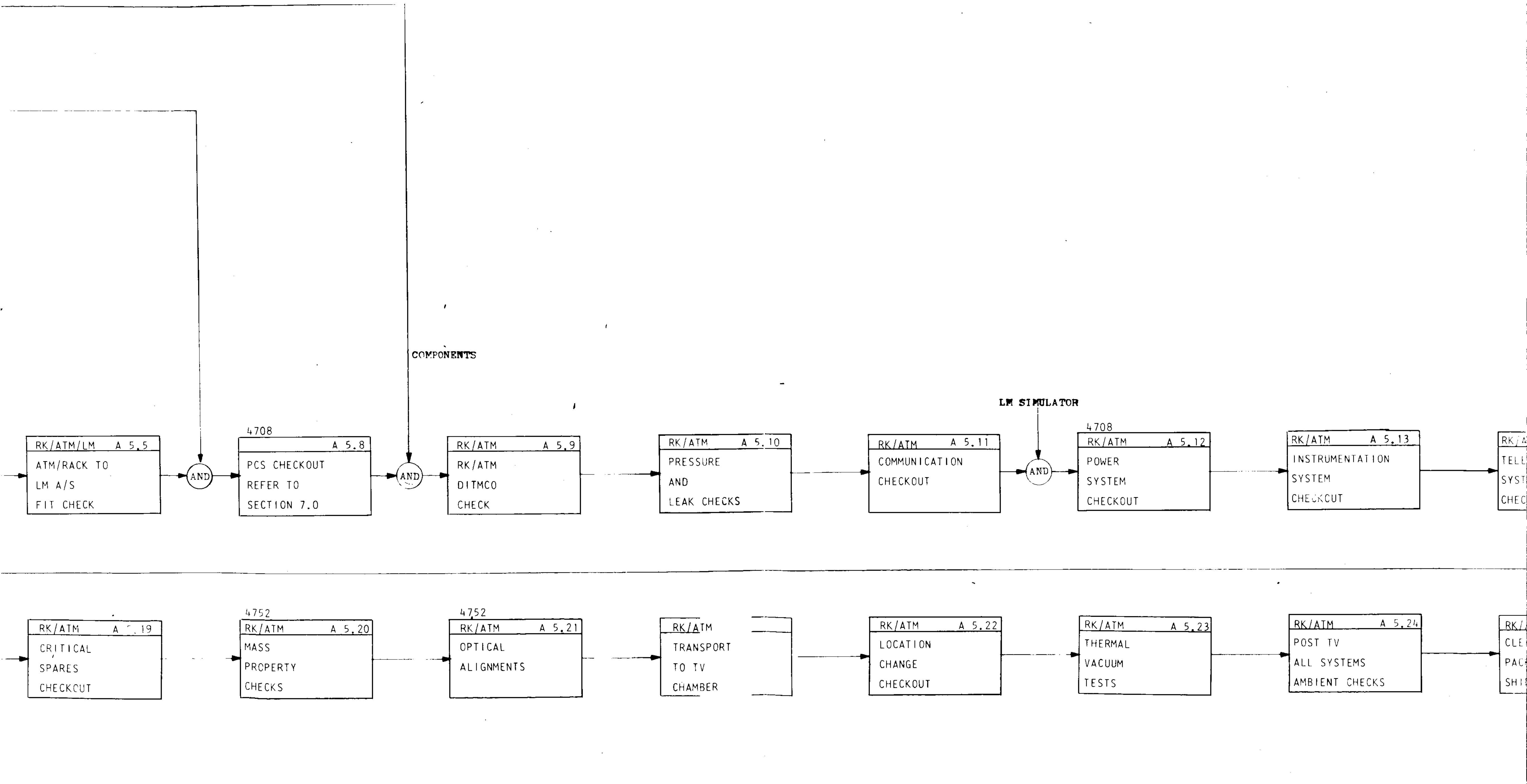
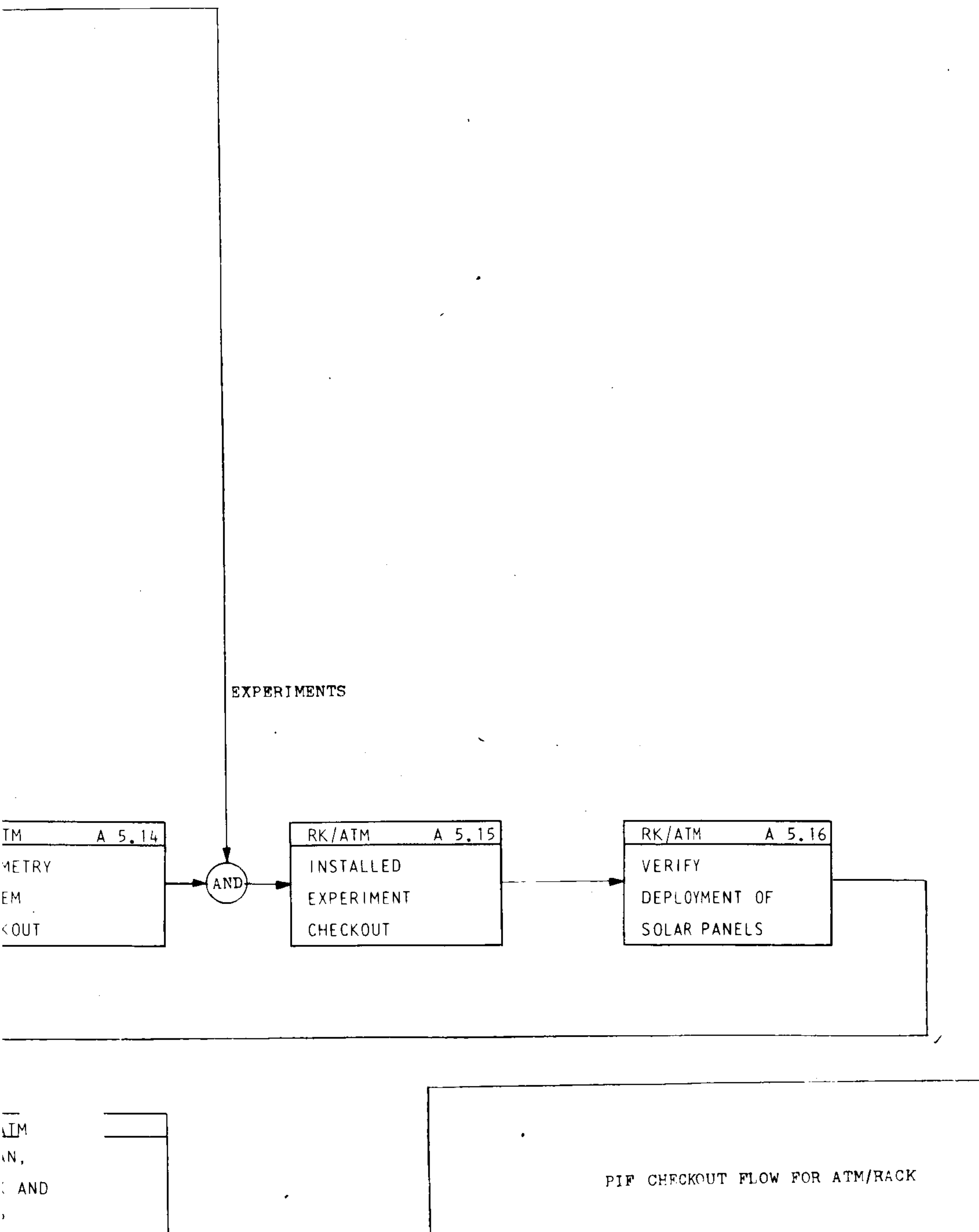


Figure 8. PIF Checkout Flow For ATM/RACK



PIF CHECKOUT FLOW FOR ATM/RACK

DATE: 7 APRIL, 67

Table V. (Cont.)

TEST TITLE: Receiving and Inspection of RM

FLOW BLOCK NO. A4.4

OBJECTIVE: Verify that the RM is to latest engineering configuration and that no damage has occurred during packageing and shipping.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documents accompanying the RM are reviewed for latest configuration and accuracy. The RM is positioned on its handling dolly in an upright position.

OPERATIONS:

A visual inspection of the RM is performed to verify that no shipping damage has occurred to the structure, mounted S/S, cabling or cabling connectors. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

RM is in proper configuration and no transportation damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: RM handling equipment, hand tools

Table V. (Cont.)

TEST TITLE: Perform RM Load Check

FLOW BLOCK NO. A4.5

OBJECTIVE: Verify electrical interfaces of RM by performing continuity of RM umbilicals.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

A checkout box is connected to the RM umbilicals

OPERATIONS:

Through the checkout boxes, continuity is performed from pin to pin, pin to case and pin to ground. End to End continuity is performed.

CRITERIA FOR SUCCESS:

Electrical interfaces shall be in accordance with ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Checkout boxes, VOM

Table V. (Cont.)

TEST TITLE: RM/SLA Fit Check

FLOW BLOCK NO. A4.6

OBJECTIVE: Verify RM/SLA Fit and clearance

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA is installed in the east integration stand. The upper SLA is removed.

OPERATIONS:

The RM is lowered to the SLA attach points and secured. The upper RM to upper SLA clearance is verified after the upper SLA is installed. RM to SLA electrical and fluid access port compatibility is verified.

CRITERIA FOR SUCCESS:

Fit and clearance shall be in accordance with applicable ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane, work access platform, slings, RM transporter

Table V. (Cont.)

TEST TITLE: CSM/RM Docking Test

FLOW BLOCK NO. A4.7

OBJECTIVE: Verify CSM to RM docking compatibility

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM is already in the chamber

OPERATIONS:

The RM is raised above the chamber and lowered to the CSM in an inverted position. Soft and hard docking is accomplished, Probes and latches are adjusted. Operation of the optical docking aids are verified. All umbilicals between the RM & CSM are inspected for damage and a fit checked performed.

CRITERIA FOR SUCCESS:

Docking shall be in accordance with the CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: RM inverting fixture, slings, crane, work access platform

Table V. (Cont.)

TEST TITLE: CSM/RM D&C Interface Checkout

FLOW BLOCK NO. A4.8

OBJECTIVE: To verify the D&C interfaces between the CSM and RM

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is undocked from the CSM and placed outside the altitude chamber. The RM is electrically mated to the CSM through marriage cables. ACE S/C GSE is connected to the CSM.

OPERATIONS:

All controls on the D&C panel of the CSM that interface with the RM are activated and the corresponding display responses verified. All D&C interface checks between the RM and CSM are verified.

CRITERIA FOR SUCCESS:

CSM-RM D&C interfaces shall be in accordance with CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE

Table V. (Cont.)

TEST TITLE: Manned Altitude Test

FLOW BLOCK NO. A4.9

OBJECTIVE: To verify experiments during normal CSM altitude test

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 64 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM is in the altitude chamber configured for normal Apollo manned altitude checkout. The experiment peculiar GSE is connected.

OPERATIONS:

This is a normal Apollo requirement. The AAP peculiar subsystems and experiments are operated during the Apollo checkout.

CRITERIA FOR SUCCESS:

The AAP modifications and experiments shall be compatible with the environment.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment peculiar GSE

Table V. (Cont.)

TEST TITLE: CSM - LM A/S Interface Test

FLOW BLOCK NO. A4.10

OBJECTIVE: Verify CSM - LM A/S interfaces

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 32 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

See AAP 4 KSC flow blocks A4.31 thru A4.34 for preparations and operations

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS: See AAP 4 KSC flow blocks A4.31 thru A4.34

COMMODITIES:

EQUIPMENT:

Table V. (Cont.)

TEST TITLE: RM Cannister, Spheres and Plumbing Leak Check

FLOW BLOCK NO. A4.11

OBJECTIVE: Verify that the RM cannister, spheres, and leakage rates do not exceed the required specifications.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 32 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The resupply module is positioned in its holding fixture. The necessary pressure lines are connected to the RM from the pneumatic console. Provisions are made for pressurizing and monitoring the spheres, plumbing, and cannister.

OPERATIONS:

The spheres and plumbing are pressurized from the pneumatic console. A pressure decay period of 4 hours will be monitored on the pressure gauges located at the pneumatic console. All pressure line connections are leak checked with a leak detector. The cannister is pressurized and a leak detector check is performed and a leak rate is determined.

CRITERIA FOR SUCCESS:

The leak rate will meet the specifications allotted for each commodity container.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Pneumatic console

Table V. (Cont.)

TEST TITLE: RM Regulator Flow Checks

FLOW BLOCK NO. A4.12

OBJECTIVE: To verify flow regulators

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The O_2, N_2 and H_2 spheres are pressurized. The gas output lines are connected to a variable orifice. The flow transducers are powered up and the output is monitored.

OPERATIONS:

The orifice size is varied and the flow rate transducers are calibrated. Care is taken to provide a constant pressure within the spheres for each orifice size.

CRITERIA FOR SUCCESS:

Verification of flow rate monitors.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Pneumatic Console

Table V. (Cont.)

TEST TITLE: RM Docking and Collar Leak Check

FLOW BLOCK NO. A4.13

OBJECTIVE: To verify RM aft docking port with a docking collar and pressure simulator

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is in an inverted position in its holding fixture. The docking collar and pressure simulator is positioned above the RM with a crane. A work access platform is positioned around the RM aft docking collar.

OPERATIONS:

The docking collar and pressure simulator is lowered to the RM aft docking collar. Soft and hard docking is accomplished. Probe and latch adjustments are performed. The docking collar and pressure simulator is pressurized with a facility source and a leak check is performed on the docking interface.

CRITERIA FOR SUCCESS:

Docking shall be in accordance with the CEI and ICD specifications

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Docking collar and pressure simulator, crane, RM inverting fixture, work access platform

Table V. (Cont.)

TEST TITLE: Install Experiment in RM

FLOW BLOCK NO. A4.14

OBJECTIVE: To store experiments in the RM to be used later in the cluster

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM pressurized area has been leak and pressure checked. Pre-installation checkout of experiment are described in section 6.

OPERATIONS:

All experiments requiring a pressurized area are stored in the RM pressurized tube. Care is taken to verify that the experiments are securely attached to the carrier.

CRITERIA FOR SUCCESS:

Experiment installation will not affect the integrity of the carrier

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Experiment handling equipment

Table V. (Cont.)

TEST TITLE: RM Weight and Balance

FLOW BLOCK NO. A4.15

OBJECTIVE: Verify that the RM weight and center of gravity are within design specifications.

LOCATION: KSC-PIB
PERSONNEL: TBS
TIME SPAN: 32 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The RM is mounted on the weight and balance fixture in an upright position.

OPERATIONS:

The RM is leveled and weighted in both the vertical and horizontal position. The center of gravity is determined in each position by use of three point load cell suspension.

CRITERIA FOR SUCCESS:

Verify that the RM weight is compatible to the flight plan.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Weight and balance fixture, crane, RM handling fixture

Table V. (Cont.)

TEST TITLE: Connect All Cluster Umbilicals and GSE

FLOW BLOCK NO. A4.16

OBJECTIVE: Inner-connect all AAP 3 and AAP 4 carrier, electrical simulators and GSE into a cluster configuration for cluster system checkout.

LOCATION: KSC-MSOB (Altitude Chamber)

PERSONNEL: TBS

TIME SPAN: 20 Hrs

AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM and LM A/S/ATM Rack are in the east and west altitude chambers respectively. The RM carrier and interface simulator (LM&SS, AM/MDA, & S-IVB) are placed adjacent to the east altitude chamber.

OPERATIONS:

All umbilicals are inspected for damage. The cluster configuration is obtained by mating all cluster inner-connection umbilicals through marriage cables. ACE S/C GSE is connected to the CSM and LM A/S.

CRITERIA FOR SUCCESS:

Cluster systems compatibility shall be in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C, marriage cables, interface simulator (LM&SS, AM/MDA, S-IVB)

Table V. (Cont.)

TEST TITLE: Cluster Power Subsystem and Distribution Checks

FLOW BLOCK NO. A4.17.1

OBJECTIVE: Verify cluster power interfaces

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 20 Hrs.
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All power is supplied to the cluster by ACE S/C GSE. The CSM and the LM A/S are manned. All other preparations required are described by A4.16.

OPERATIONS:

All modes of cluster power transfer are initiated separately. For each mode, voltage level measurements and phase rotation sequence checks are made at the various distributor points of the cluster. Proper distribution, polarity, phase rotation, voltage levels, transients and noise levels are verified for the cluster configuration.

CRITERIA FOR SUCCESS:

The cluster power interfaces shall perform in accordance with the appropriate ICD and CEI requirements.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE, VTVM, oscilloscope

Table V. (Cont.)

TEST TITLE:	Perform Communication and Data Management Cluster System Checkout	FLOW BLOCK NO. A4.17.2

OBJECTIVE: Verify all communications and data management systems in the cluster configuration.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 32 Hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All antennas on the LM A/S, RM and CSM are coupled to the MSOB ground station. The MSOB-PCM ground station is connected by a land line link and line drivers. The LM A/S and CSM are manned. All power to the cluster is supplied from the ACE S/C GSE.

OPERATIONS: All communication and data management cluster modes are verified. The data mangement systems are activated. All instrumentation measurements are recorded on analog recorders in the ground station. Recordings are evaluated for proper ambient levels, indications of excessive system noise, and trace stability. Dynamic recordings are made during mission simulation, block A4.17.3. Data dump system are verified. Communication systems that have not been used in the data management system checkout are verified. This consists of only voice communications.

CRITERIA FOR SUCCESS:

The cluster communication and data management systems shall be in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE, MSOB ground station

Table V. (Cont.)

TEST TITLE: Mission Simulation

FLOW BLOCK NO. A4.17.3

OBJECTIVE: Verify On-Orbit Sequence and Cluster Configuration Compatibility

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 20 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
Power is applied to the cluster configuration. All experiments are prepared to be activated. The CSM and LM A/S are under control of the ACE S/C GSE. The MSOB-PCM ground station is activated.

OPERATIONS:
A complete mission sequence is performed with all on orbit operations performed in compressed time. All instrumentation is recorded in the MSOB-PCM ground station. EMC monitoring is performed throughout mission simulation.

CRITERIA FOR SUCCESS:
Total orbit compatibility is verified in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT:
ACE S/C GSE, Experiment Peculiar GSE, MSOB-PCM Ground station

Table V. (Cont.)

TEST TITLE: Functional Checkout of Cluster D&C Functions

FLOW BLOCK NO. A4.17.4

OBJECTIVE: To verify all D&C functions in the cluster configuration.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with A 4.17.1 thru A 4.17.3
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The CSM and LMA/S are manned. All other preparation required are described in A 4.16.

OPERATIONS:
The cluster configuration D&C system is checked out concurrent with cluster subsystem and mission simulation tests. Activation of cluster subsystems are controlled from the D&C panels in the carriers or carrier simulators and corresponding displays are verified for accurate response. All controls and displays are verified.

CRITERIA FOR SUCCESS:
Verification of cluster D&C wiring circuits.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE, Interface Simulator (LM&SS, AM/MDA, S-IVB)

Table V. (Cont.)

TEST TITLE: Install and Checkout Experiments	FLOW BLOCK NO. A 4.18

OBJECTIVE: To install and checkout experiments in IU.

LOCATION: KSC-VAB
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
All experiments are subjected to a pre-installation inspection and/or bench check as described in Section 6.

OPERATIONS:
The experiments are mounted in the IU. Alignment of experiment is verified. A post-installation test is performed as described in Section 6.

CRITERIA FOR SUCCESS:
Experiment(s) are installed in IU shall function in accordance with the applicable ICD and CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment Handling Equipment

Table V. (Cont.)

TEST TITLE: RFI Test

FLOW BLOCK NO. A3.1

OBJECTIVE: Verify S/C compatibility with the launch RFI environment. Verify communications compatibility with ground tracking stations.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The MSS has been moved away. This test is performed in conjunction with the Apollo SV RF test.

OPERATIONS:
This test is a normal Apollo requirement. All RF systems are radiating open loop. The S/C communications system compatibility with tracking stations is verified. Carrier frequency, subcarrier deviation and phase lock are verified. All S/C systems not operating during the boost phase are de-energized and RF compatibility with the launch environment is verified.

CRITERIA FOR SUCCESS:
All RF systems shall be compatibile with the launch environment and the ground tracking stations.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: CIF-PCM Ground Station

Table V. (Cont.)

TEST TITLE: Countdown Demonstration Tests (CDDT)

FLOW BLOCK NO. A3.2

OBJECTIVE: Demonstrate S/C readiness for launch and perform integrated dress rehearsal of countdown

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 32 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The S/C is complete and in flight configuration. This test is performed in conjunction with the Apollo CDDT.

OPERATIONS:
During the Apollo CDDT the S/C systems are energized and verified in countdown sequence. Cryogenic tanks are serviced and cold soaked. The time sensitive experiments and life support (or simulators) are installed. Open loop RF checks are performed in the countdown sequence. The SLA area is closed out and the MSS is moved away. The countdown is picked up and continued to T-one minute. After CDDT the S/C is restored to pre-test configuration.

CRITERIA FOR SUCCESS:
Complete demonstration of the feasibility of all operations required in the subsequent launch countdown.

SUPPORT REQUIREMENTS:

COMMODITIES: LO_2, LN_2, LH_2

EQUIPMENT: TBS

Table V. (Cont.)

TEST TITLE:	Installation and Checkout of Time Sensitive Experiments	FLOW BLOCK NO. A3.3

OBJECTIVE: Install experiments that are time sensitive and perform post installation checkout

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
Launch pad activities will have progressed to the point where time sensitive experiments may be installed.

OPERATIONS:
Experiments are installed and post-installation tests are described in Section 6.

CRITERIA FOR SUCCESS:
Experiments shall adhere to the applicable CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table V. (Cont.)

TEST TITLE: Final Fluid Servicing

FLOW BLOCK NO. A3.4

OBJECTIVE: Perform fluid servicing on RM.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: 8 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
The cryogenic servicing GSE is connected to the SLA cryogenic access port. RM cryogenic servicing is performed during normal Apollo S/C servicing.

OPERATIONS:
The RM cryogenic storage spheres are loaded. The RM mass quantity measure system is monitored during the loading operation.

CRITERIA FOR SUCCESS:
Cryogenic spheres shall be loaded in accordance to applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: LH_2, LN_2, LO_2

EQUIPMENT: Normal Apollo Cryogenic Facility

Table V. (Cont.)

TEST TITLE: Launch Monitor	FLOW BLOCK NO. A3.5

OBJECTIVE: Monitor S/C mission critical systems during final countdown.

LOCATION: KSC-LP
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

TBS

CRITERIA FOR SUCCESS:
S/C mission critical systems shall maintain launch readiness throughout the countdown.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

5. FLIGHT AAP 4 INTEGRATION AND PRELAUNCH CHECKOUT

Flight AAP 4 is the fourth flight of the cluster configuration. Its primary objective is astronomical observations. The launch vehicle for Flight 4 is an updated SIB, an unmodified S-IVB, and an unmodified IU.

The spacecraft consists of an unmodified SLA, and MSFC half-rack with ATM, a modified LM ascent stage and a nose cone.

On orbit, the Rack/ATM/LM will dock with one of the side ports of the AAP 2 MDA. The ATM experiments will be performed during the 56-day extended mission in the cluster configuration.

The Rack/ATM is new hardware created for the AAP program. Comparable Apollo hardware does not exist.

The Rack used is the basic MSFC half-rack, with experiment support subsystems and the ECS and life support components normally located on the LM descent stage. The center of the rack is open providing mounting area for the ATM. As used in this plan, the ATM is defined as a telescope mount structure.

The LM ascent stage is the basic Apollo hardware modified to support the requirements of Flight 4. The extent of modifications resulting in add on equipment is relatively minor consisting of display and control for the Rack/ATM experiments, data, life support and gas systems. A cryogenic heat exchanger is added for the O_2 system. External mounting provisions are provided for attaching the Astronaut Maneuvering Unit (AMU).

Several existing LM subsystems may be deleted, however, the requirement is not firm and is of little significance to this plan since it does not create an AAP generated test requirement.

For the purpose of this plan, the Rack/ATM is integrated at Huntsville, but the LM A/S is shipped directly to KSC and is not integrated at Huntsville.

The basic Rack/ATM systems which are discussed in this section include:

a. Pointing Control System (PCS) consisting of the control moment gyros, solar sensors, rate package, PCS electronics, vernier gimbals and star tracker.

b. Structure consisting of the half-rack and ATM experiment package.

c. ECS & LSS, consisting of the radiator, experiment heaters, thermal shield, LOX system, GOX system, and water.

d. Power consisting of solar array panels, rechargeable batteries, battery charger and regulator.

e. Instrumentation and telemetry consisting of a saturn type system located on the half rack.

f. Experiment equipment carried on the Rack/ATM as described in section 6.

The interfaces used as a basis for the test planning efforts in this document are in accordance with the definitions contained MMC report, "General Interface Schematics, S/AA Flights #1 through #4, On-Orbit Cluster Configuration." MD-80-0018 dated 3 February 1967.

5.1 Test Requirements

5.1.1 Rack/ATM qualification tests

5.1.1.1 All Rack/ATM components shall be individually qualified to withstand the launch and on-orbit environments and performance requirements of Flight 4.

5.1.1.2 All experiments shall be delivered as GFP indicating that flight qualification requirements have been satisfied.

5.1.1.3 All subsystem and integrated carrier qualification and verification tests shall be completed in accordance with the requirements of Volumes II and III of this test plan.

5.1.2 Rack/ATM component acceptance test requirements

5.1.2.1 All components and experiments are subjected to a pre-delivery acceptance test at the supplier facility. All in-house manufactured components shall be subjected to pre-installation acceptance testing prior to incorporation into the next higher assembly level.

5.1.2.2 Components, assemblies and subsystems procured from individual suppliers shall be subjected to receiving inspection and/or receiving tests in accordance with the requirements of NPC 500-10.

5.1.3 Rack/ATM Inprocess Assembly Tests - At intermediate points in the Rack/ATM fabrication and assembly cycle, the following inprocess tests shall be performed:

5.1.3.1 Verify the rack structural integrity. This requirement includes weld integrity checks, mechanical structural alignment and clearance checks and machined surface visual inspections. Proof loading of the flight rack shall not be a requirement, provided that proof loading of a flight configured prototype has preceded the flight hardware test, and all welded joints have been X-rayed or dye penetrant checked.

5.1.3.2 Verify the cable harness integrity after installation and before connection to the components. This requirement shall be satisfied by a DITMCO or Hughs analyzer type continuity and meggar check.

5.1.3.3 All pressure line and pressure component installations (gas and liquid) shall be subjected to proof pressure and leak checks after installation and prior to movement from the assembly area.

5.1.3.4 The RF installation and the rack/ATM-LM interface coaxial cable shall be verified in the assembly area. This requirement shall be satisfied by a system VSWR and attenuation check.

5.1.4 Rack/ATM System Level Quality Assurance (Acceptance) Test Requirements

5.1.4.1 Verify power system performance in accordance with the rack/ATM CEI specifications. Satisfaction of this requirement includes but is not limited to the following:

a. Distributor circuit checks

b. Switching and control network checks

c. Polarity checks

d. Noise, ripple, regulation

e. Battery charger operation

f. Solar cell control

g. Buss load checks

5.1.4.2 Verify instrumentation system performance in accordance with the CEI specification. Satisfaction of this requirement shall include but not be limited to:

a. Camera functional performance

b. Television system performance

c. Transducer calibration

d. Instrumentation end to end checks

e. Signal conditioner checkout and calibration

5.1.4.3 Verify telemetry system performance in accordance with the CEI specification. This requirement includes but is not limited to verification of:

a. Power output

b. Carrier frequency, subcarrier deviation, sync, phase lock

c. Land line link checkout

d. Open loop checkout

5.1.4.4 Verify thermal control system performance in accordance with the CEI specification. This requirement shall be satisfied in two parts:

a. An ambient environment system level performance test of the experiment heaters and the active coolant system.

b. A flight-configured thermal vacuum test to verify total system capability including the passive system.

During the thermal vacuum test, all flight components shall be installed including the flight type batteries. The solar panels shall be simulated by a short panel of sufficient length to provide Rack ATM shadowing.

5.1.4.5 Verify structure assembly in accordance with the requirements of the CEI specification. This requirement includes:

a. Verification of the SLA attachment point compatibility by use of a master gauge.

b. Verification of the LM mating surface using the flight LM or a master gauge.

c. Verification of the stowed solar panel fit and clearance.

d. Checkout of the solar panel deployment mechanism (solar panels off but mass simulated).

5.1.4.6 Verify total PCS system performance. Test Requirements for the PCS are described in section 7.

5.1.4.7 Verify experiment optical alignments. This requirement includes the following alignment checks in accordance with the CEI and ICD specifications.

a. Television camera to:

S052 coronograph
S053 Spectroheliograph
S054 Telescope
S055 Spectrograph
S056 Telescope
Film cameras
Sun sensor

b. Every experiment to each of the other experiments

c. Sun sensor to:

S052 Coronograph
S053 Spectroheliograph
S054 Telescope
S055 Spectrograph
S056 Telescope
S/C axis

d. Star tracker to S/C axis

5.1.4.8 Verify functional performance of the installed experiments using the experiment developer provided GSE.

5.1.4.9 Verify total Rack/ATM system compatibility. This requirement includes a compressed time mission simulation before and after thermal vacuum testing. The mission simulation must include:

a. Full on-board instrumentation recordings

b. EMC monitoring throughout the mission sequence

c. Verification of all mission operations in sequence but using compressed time

d. Operation of all subsystems and experiments

e. Functional checkout of PCS

f. RF open loop transmission

5.1.4.10 Verify that the Rack/ATM mass properties are in accordance with the requirements of the CEI specification. This requirement includes:

a. Determination of the weight of the Rack/ATM

b. Determination of the center of gravity of the Rack/ATM

Mass properties tests must be performed with all hardware installed. The stowed position solar panel mass properties may be simulated. Deployed solar panels mass property effects shall be derived from engineering analysis.

5.1.5 Rack/ATM MSFC (PIF) Integration Checkout Requirements

5.1.5.1 Verify the Rack/ATM functional interface compatibility in accordance with the applicable ICD specifications. This requirement may be satisfied in conjunction with acceptance testing (5.1.4) or as a separate series of tests.

Telemetry, communications, data management, power, display and control and environmental control interfaces with the LM shall be verified by use of a flight-configured LM prototype or an LM interface simulator.

5.1.6 Rack/ATM Pre-Mate Checkout Requirements at KSC

5.1.6.1 Verify that no shipping damage has occurred.

5.1.6.2 Verify that the Rack/ATM systems are operable prior to mating with the LM A/S. Basically this checkout will be to the level necessary to re-establish confidence in flight readiness. Quantitive testing shall be minimized but shall be of sufficient quantity to establish trends. The test shall include verification of interface loads, power, data, communications and PCS.

5.1.6.3 Verify the Rack/ATM to lower SLA fit, clearance and alignment.

5.1.6.4 Re-verify the experiment, sun sensor, star tracker, camera and TV camera alignments.

5.1.7 <u>LM A/S Pre-Mate Checkout Requirements at KSC</u>

5.1.7.1 Verify that no shipping damage has occurred.

5.1.7.2 Verify system operability prior to mating with the Rack/ATM by a location change checkout of interface loads, thermal control, communications, data, LSS and stability and control.

5.1.7.3 Verify the AAP 3 CSM to LM mechanical interfaces. This requirement shall be satisfied by a soft and hard docking. Both the CSM and the LM shall be pressurized and the interface shall be leak checked.

5.1.7.4 Verify that the AAP 3 CSM to LM interfaces are compatible. Power, communication, and D & C interfaces shall be verified.

5.1.8 <u>Rack/ATM/LM Combined Checkout Requirements at KSC</u>

5.1.8.1 Verify the combined grounding system compatibility.

5.1.8.2 Verify the functional interfaces between the Rack/ATM and the LM A/S.

5.1.8.3 Verify total systems performance and compatibility at ambient and at simulated altitude.

5.1.8.4 Verify the solar panel control circuitry.

5.1.8.5 Verify that the mass properties have not changed since the MSFC weight and balance checks. (This requirement exists only if the Rack/ATM of LM has been modified.)

5.1.9 <u>Rack/ATM/LM to Cluster Interface Checkout Requirements at KSC</u>

5.1.9.1 Verify D&C, emergency power, voice communications, coaxial hardline to RM antennas, and life support interfaces from LM A/S to AAP 2 MDA.

5.1.10 <u>Space Vehicle AAP Checkout Requirements at KSC</u>

5.1.10.1 Perform a location change checkout of the rack/ATM/LM. Verify the LM GSE and data links.

5.1.10.2 During the Apollo RF open loop test verify S/C compatibility with the ground tracking stations and mission control center. Verify that the S/C is compatible with the LP RFI environment.

5.1.10.3 During the Apollo countdown demonstration test, verify all spacecraft operations and procedures including cryogenic and hypergolic servicing.

5.1.10.4 Monitor critical S/C and experiment measurements during prelaunch and countdown.

5.2 PIF Operations

5.2.1 General Summary - The basic half-rack is manufactured at Huntsville. The inprocess assembly test requirements on the rack structure is satisfied during intermediate assembly points.

All welds are X-rayed and when applicable subjected to dye penetrant checks. The assembled rack is proof-loaded to design limits. Before installation of the rack subassemblies and the center ATM, the Rack/SLA attachment points are verified using a master gauge. The LM/Rack mating surface is verified using either the LM prototype or a master gauge. The decision to perform these fit checks on the half rack prior to the completion of assembly is based on the following logic:

a. The half-rack is easier to handle and there is less risk of incurring damage.

b. The fit check is valid, since the only critical fit and clearance with the SLA is at the attach points. Unlike the AM/MDA of Flight 2, there is little concern with clearance in the upper SLA.

The components of the Rack subsystems, and the experiments are received, and, as applicable, subjected to receiving tests in accordance with the requirements of NPC 500-10.

The Rack subsystems, with the exception of the fine PCS components, are installed on the Rack.

The inprocess assembly tests on the Rack consist of cable harness continuity and megger checks, post installation pressure line and fitting leak checks, and antenna system VSWR and attenuation checks.

Checkout of the PCS system is performed and details for this test are described in section 7.

Prior to power application in the QA test area, a verification is made of the power system grounding and loads. The Rack/ATM is powered up using facility power source. Distributor checks, switching and control network checks, buss noise checks, polarity and regulations checks are performed. The battery charger operation is verified and the solar cell control is checked out. Buss loads are verified. Power transfer and internal power operations are not performed at this time, but are verified in the all-systems test.

Following the power system verification, each system is checked out independently prior to all-systems tests. This series of checkouts includes:

a. Instrumentation Checks - The camera and televisions systems are operated and the performance is verified. All instrument transducers are calibrated. An end-to-end instrumentation verification is performed using an external stimulus. The signal conditioners are calibrated.

b. Telemetry System - Power output is verified. Carrier frequency, sub-carrier deviation sync, phase lock and the pulse train is checked. Both the land line link and the RF open loop is verified.

c. Thermal Control- The operation of the experiment heaters is checked. The active coolant system is functionally verified. Verification of the passive system as well as dynamic checkout of the active system will be acccomplished in a thermal vacuum chamber.

d. Experiments - The ATM experiments are powered up and the operation is verified utilizing self contained instrumentation and display capabilities, supplemented by experiment peculiar GSE.

e. Mechanical - The stowed position solar panel fit and clearance is verified using the actual solar panels. Battery fit checks are performed. The solar panel deployment mechanism is activated and verified with the solar panels installed.

f. Interfaces - The LM simulator is used to verify the LM to rack interfaces of telemetry, data, power, D & C and environmental control.

After all systems have been checked out independently, a series of overall tests is performed. This series of checkouts includes:

a. Verification of power transfer and full load operation on internal power using rechargeable flight batteries. Solar array power is simulated from ground source.

b. Open loop RF radiation tests with EMC monitoring.

c. A compressed-time-mission simulation is performed utilizing the mission sequences. Full instrumentation recordings are made. The TM system is radiating open loop. The fine PCS system is operating open loop while the vernier system is operating closed loop.

Critical spare subsystem or assemblies are verified at the system level by replacing actual Rack/ATM flight hardware with the available spares. Following the spare checkout, the Rack/ATM is reconfigured with the flight hardware that was removed and all systems are reverified prior to shippment to KSC.

Following the overall tests, the Rack/ATM assembly is moved to Building 4752 where weight and center of gravity measurements are performed.

Optical alignment measurements are accomplished in this building. The following alignment relationships are measured using theodolites and optical flats:

a. Sun sensor to S/C axis

b. TV camera to each experiment

c. Each experiment to every other experiment

d. Sun sensor to experiments

e. Star tracker to S/C axis

The Rack/ATM is shipped to an off-site thermal vacuum chamber. The geometric complexity of the Rack/ATM section, which is presented to solar radition, is such that it is extremely desirable to perform the test in a chamber having full solar simulation with a beam of about 17 feet and large enough to accommodate fully deployed solar panels.

Preliminary investigation indicates that the availability of such a chamber is doubtful, and it is assumed that this test will be performed in a smaller chamber using an IR heat source. Partial solar panels or simulators are installed to provide the necessary shadowing effects.

Prior to the thermal vacuum test, a location change checkout of the Rack/ATM is accomplished at ambient. The GSE and data links are verified.

During the thermal vacuum test all systems are operating. The Rack/ATM is on internal power. Display and control is from the LM simulator located outside the chamber. On board instrumentation is supplemented by test thermocouples. All data is landlined to a PCM ground station for recording.

After the thermal vacuum test, a final mission simulation is performed at ambient before the Rack/ATM is removed from the chamber. The Rack/ATM is shipped directly from the off-site facility to KSC.

5.2.2 PIF Checkout Flow for ATM/Rack - The flow diagram (figure 8) presents the recommended MSFC checkout sequence for the ATM/Rack. No attempt has been made to show all inprocess inspection checks.

5.2.3 Test Requirement Sheets - Table VI defines specific test blocks of the AAP 4 flow diagram for MSFC operations. Each sheet is identified by the flow block title and number.

Table VI. Test Requirement Sheet for Figure 8

TEST TITLE:

RECEIVING TEST, PCS SUBSYSTEMS

FLOW BLOCK NO. A
A5.1

OBJECTIVE: Verify that the PCS subsystems are to latest engineering configuration have not been damaged during shipment and function according to specifications.

LOCATION: MSFC-4752
PERSONNEL: TBS
TIME SPAN: 48 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:
All documentation accompanying the PCS subsystems are to the latest configuration and accuracy. The subsystems are removed from their shipping containers and visually examined for damage. Preparations for functional testing is then performed.

OPERATIONS:
A functional receiving test is performed in accordance with the component assembly level requirements of NPC 500-10. Subsystems include CMG's, PCS electronics, rate sensing package, sun sensor, star tracker, cable harnesses.

CRITERIA FOR SUCCESS:

All systems shall conform to the applicable CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Receiving bench check equipment, solar disc simulator (light source), VOM test fixtures for star tracker, CMGs and rate gyros.

Table VI. (Cont.)

TEST TITLE: Weld Integrity Checks

FLOW BLOCK NO. A5.2

OBJECTIVE: Verify quality of rack welds.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The assembled rack without subsystems or ATM package is moved to the X-ray area.

OPERATIONS:

All welded joints are X-rayed. The pictures are evaluated and a dye penetrant check is performed on any questionable areas.

CRITERIA FOR SUCCESS:

No indicationt of weld faults or flaws.

SUPPORT REQUIREMENTS:

COMMODITIES: X-ray film dye penetrant

EQUIPMENT: X-ray machine

Table VI. (Cont.)

TEST TITLE:	Mate ATM and Rack	FLOW BLOCK NO. A 5.3

OBJECTIVE: Structurally and functionally mate the rack and ATM.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The ATM build up and inprocess assembly checks are complete. The rack fabrications and weld checks are complete.

OPERATIONS:

The ATM is mated with the MSFC half-rack. Fit, clearance and alignment checks are accomplished.

CRITERIA FOR SUCCESS:

The rack and ATM are mated and fit, clearance and alignments are in accordance with the CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane, handling GSE

Table VI. (Cont.)

TEST TITLE:	ATM/Rack to SLA Fit Check ATM/Rack to LM A/S Fit Check	FLOW BLOCK NO. A5.4 A5.5

OBJECTIVE: Verify rack compatibility with the SLA attach points.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack/ATM assembly is moved to the quality test area. The SLA prototype is placed in the test fixture.

OPERATIONS:

The prototype upper SLA is removed. The flight Rack/ATM is lowered to the lower SLA attach points and secured. Fit, alignment and clearance checks are performed. If a prototype LM has been provisioned for quality testing, the LM is mated with the rack/ATM and fit and alignment checks are completed. If a LM A/S is not available, the fit check is performed using a master gauge.

CRITERIA FOR SUCCESS:

Rack/ATM to SLA and LM A/S fit and clearance shall be in accordance with the applicable ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane, handling GSE.

Table VI. (Cont.)

TEST TITLE: Receiving Tests Components and Experiments

FLOW BLOCK NO. A5.6

OBJECTIVE: Verify that components and experiments are to the latest engineering configuration, have not been damaged during shipment and functions according the specifications.

LOCATION: MSFC-4752
PERSONNEL: TBS
TIME SPAN: 40 hours (Total)
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying components and experiments are to the latest configuration and accuracy. Components and experiments are removed from their shipping containers and visually examined for damage. Preparation for functional testing is then performed.

OPERATIONS:

A functional receiving test is performed on each component in accordance with the requirements of NPC 500-10. All experiments are subjected to pre-installation checkout as defined in Section 6 of this appendix.

CRITERIA FOR SUCCESS:

Components and experiment performance shall conform to the requirements for the applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Standard commercial bench check equipment (Lab), experiment peculiar GSE. Reference Section 6.

Table VI: (Cont.)

TEST TITLE: ATM Ditmco Checks

FLOW BLOCK NO. A5.7

OBJECTIVE: Verify ATM wire harness integrity prior to mating the rack.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The ATM build up must be completed. All components are disconnected from the cable harnesses.

OPERATIONS:

A Ditmco (or Hughes analyzer) type checkout is performed on the ATM cable harnesses to verify continuity and proper isolation prior to mating the rack. A grounding system check and resistive load check is performed.

CRITERIA FOR SUCCESS:

Continuity and isolation shall be in accordance with the ATM specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: VOM, resistance bridge, Ditmco circuit analyzer or Hughes analyzer.

Table VI. (Cont.)

TEST TITLE: PCS Checkout	FLOW BLOCK NO. A 5.8

OBJECTIVE: To checkout PCS System

LOCATION: MSFC-4708
PERSONNEL:
TIME SPAN: 88 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS: Refer to section 7.

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT:

Table VI. (Cont.)

TEST TITLE: Rack/ATM Ditmco Checks

FLOW BLOCK NO. A 5.9

OBJECTIVE: Verify combines rack/ATM cable harness integrity.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack build up is complete. The rack/ATM is mated. PCS cable harnesses are installed. All components are electrically disconnected.

OPERATIONS:

A Ditmco (or Hughes analyzer) test is performed on the combined rack/ATM harnesses. Continuity and isolation checks are performed. The combined rack/ATM grounding system is verified.

CRITERIA FOR SUCCESS:

Wire harness continuity and megger checks shall be in accordance with the ICD.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: VOM, resistance bridge, Ditmco or Hughes analyzer.

Table VI. (Cont.)

TEST TITLE: Pressure and Leak Checks

FLOW BLOCK NO. A 5.10

OBJECTIVE: Verify that fluid line and storage vessel leak rates do not exceed the required specifications.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All plumbing lines and storage vessels are pressurized by facility source.

OPERATIONS:

The plumbing lines and storage vessels are pressurized to 5.7 PSIG and a leak detector check is performed on all connectors and fittings internal to the ATM/Rack. Cleanliness and environment controls are maintained.

CRITERIA FOR SUCCESS:

The fluid pressure lines, storage vessels, fittings and connection leak rates shall be within the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2, GH_e

EQUIPMENT: Pressure control console, facility pressure source and umbilicals.

Table VI. (Cont.)

TEST TITLE: Communications Checkout

FLOW BLOCK NO. A 5.11

OBJECTIVE: Exercise the communications system to verify the capability of the receiver and transmitter using dummy antennae.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: 16 hrs
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

With the ATM/rack installed in the handling fixture, and with all communications electronics equipment in place except antennae. The VHF/UHF omni antennae will be simulated by dummy antennae. Power for the communications system will be supplied.

OPERATIONS:

Using a signal generator a stimulus will be applied to the receiving dummy antenna and the signal will be reviewed at the ASAP recorder.

Using the same equipment a stimulus will be applied to the experiment sensors and verified on the ground PCM recorder. Using the Coax Switching equipment both antennae will be checked out in the transmitting mode and receiving mode. All data will be transmitted to PCM ground station in real time and play back.

CRITERIA FOR SUCCESS:

Communications system shall perform in accordance with the requirements of the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Signal Generator, Dummy Antennae, Coax Connectors and Cable, PCM Ground Station, Ground Power Supplies

Table VI. (Cont.)

TEST TITLE: Power System Checkout

FLOW BLOCK NO. A5.12

OBJECTIVE: Verify power system prior to subsystem checkout.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The MSFC provided rack/ATM checkout GSE is connected. Ground power source is used for this test. The LM A/S electrical simulator is connected to the Rack/ATM.

OPERATIONS:

The power system performance is verified. Distributor checks, switch and control networks checks and polarity verification are accomplished prior to application of power to other subsystems. With the power system operating under a full load, system noise, regulation, switch transients and buss load measurements are accomplished. The operation of the battery charger and regulator is verified.

CRITERIA FOR SUCCESS:

The power system performance shall be in accordance with the requirements of the CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MSFC provided rack/ATM peculiar GSE-TBS, LM A/S simulator

Table VI. (Cont.)

TEST TITLE: Instrumentation System Checkout

FLOW BLOCK NO. A5.13

OBJECTIVE: Checkout the rack/ATM instrumentation system prior to use with other systems.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Rack/ATM peculiar GSE is connected.

OPERATIONS:

The film and television cameras are operated and functionally checked out.

The instrument transducers are calibrated and an end to end checkout is performed applying stimulus to the transducer where feasible, and providing a simulated transducer output signal where stimulus is not possible. Signal conditioner adjustments are accomplished.

CRITERIA FOR SUCCESS:

The instrumentation system shall perform in accordance with the requirements of the applicable spec.

SUPPORT REQUIREMENTS:

COMMODITIES: Film

EQUIPMENT: Rack/ATM peculiar instrumentation GSE, LM A/S simulator

Table VI. (Cont.)

TEST TITLE: Telemetry System Checkout

FLOW BLOCK NO. A5.14

OBJECTIVE: Verify functional performance of the telemetry system prior to overall tests.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Rack/ATM peculiar GSE is connected. A land line link to the building 4708 PCM ground station is provided. Ground power is used.

OPERATIONS:

Transmitter power output is verified. The telemetry system is verified both open loop radiation and through the land line link. Carrier frequency, sync pulses, subcarrier deviation and phase lock stability is verified.

CRITERIA FOR SUCCESS:

Telemetry system performance in accordance with the requirements of the applicable specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Land line data link, rack/ATM peculiar GSE-TBS, antenna couplers, LM A/S simulator

Table VI. (Cont.)

TEST TITLE: Installed Experiments Checkout

FLOW BLOCK NO. A5.15

OBJECTIVE: Perform individual post installation checkout of experiments prior to all system tests.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 24 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All support subsystems have been checked out.

OPERATIONS:

The individual experiments are checked out in accordance with the requirements of Section 6.

CRITERIA FOR SUCCESS:

Performance in accordance with the CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment peculiar GSE provided by experiment developer - TBS

Table VI. (Cont.)

TEST TITLE: Verify Deployment of Solar Panels

FLOW BLOCK NO. A5.16

OBJECTIVE: Verify operation of mechanical and deployment mechanisms.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

GSE is connected from previous checkouts. The area is cleared of obstructions to solar panel deployment.

OPERATIONS:

The solar panels are fit checked in the stowed position. Clearance and alignment is verified. The solar panels are removed and solar panel simulators are installed (blank solar panel frames). The deployment mechanism is activated and the solar panel frame deployment is verified. Panel retraction is checked out.

CRITERIA FOR SUCCESS:

Solar panel deployment in accordance with the applicable specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Solar panel simulator (frames), LM simulator, rack/ATM peculiar GSE-TBS.

Table VI. (Cont.)

TEST TITLE: Interface Compatibility Checkout

FLOW BLOCK NO. A5.17

OBJECTIVE: Verify functional interface compatibility with the LM A/S.

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM simulator is connected. All power is supplied from ground facility.

OPERATIONS:

Utilizing the LM simulator to complete the circuits, the rack/ATM portion of the telemetry, data, power and D&C interfaces are verified. All LM originated controls are initiated and rack/ATM response is verified. All rack/ATM display functions are checked on the LM display panel. Emergency power switching is initiated and response is verified. ECS control shall be verified.

CRITERIA FOR SUCCESS:

The rack/ATM to LM interface compatibility shall be in accordance with requirements of the ICD.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: LM simulator

Table VI. (Cont.)

TEST TITLE: All System Tests

FLOW BLOCK NO. A5.18

OBJECTIVE: Verify Inter-system Compatibility

LOCATION: MSFC-4708
PERSONNEL: TBS
TIME SPAN: 20 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM simulator is connected. All power is supplied by ground facility. EMC checkout devices are installed.

OPERATIONS:

A complete compressed time mission simulation is performed in the on-orbit sequence. All subsystems and experiments are powered. The rack/ATM is operating on facility power. The antenna systems are radiating open loop. Full instrumentation recordings are made as well as LM simulator display monitoring. EMI monitoring is performed. The PCS system is not operating for this tests.

CRITERIA FOR SUCCESS:

All recording, visual displays and EMC devices shall indicate all systems compatibility with no detrimental interactions.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: EMC checkout devices, LM simulator, rack/ATM peculiar GSE-TBS, experiment peculiar GSE-TBS, star simulator, solar disc simulator, PCM ground station.

Table VI. (Cont.)

TEST TITLE: Critical Spares Checkout

FLOW BLOCK NO. A5.19

OBJECTIVE: To verify system after major (critical spares) components have been interchanged.

LOCATION: MSFC
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

After the system has been functionally checked out (mech. & elect.) major components as identified by the critical items list will be replaced

OPERATIONS:

Re-verify system integrity by functionally checking out systems using same test procedure and test equipment.

CRITERIA FOR SUCCESS:

Successful completion of testing by re-verification of system, after replacement of major components with spare items.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VI. (Cont.)

TEST TITLE: Mass Property Checks

FLOW BLOCK NO. A 5.20

OBJECTIVE: Determine rack/ATM mass properties

LOCATION: MSFC-4752
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack/ATM is moved to the mass property area in building 4752.

OPERATIONS:

The rack/ATM is leveled and weighed. Center of gravity measurements are made in both the vertical and horizontal position by use of three point load all suspension.

CRITERIA FOR SUCCESS:

Verify weight and CG is compatible with engineering calculations and flight requirements.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Load cells, mass property simulators, weighing fixture

Table VI. (Cont.)

TEST TITLE: Optical Alignments

FLOW BLOCK NO. A5.21

OBJECTIVE: Determine that critical experiment alignments are within allowable limits.

LOCATION: MSFC-4752
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack/ATM is positioned on the facility isolated floor. Optical flats are installed on the camera, scope and experiment lenses. Theodolites are positioned on the isolated floor.

OPERATIONS:
Using two theodolites per alignment the following line of sight angles are verified to be within limits:

a) Angle between TV camera and the coronograph, the spectroheliograph, telescopes and film cameras;
b) Angle between each experiment - coronograph, telescopes, spectroheliograph and cameras;
c) Angle between sun sensors and TV camera;
d) Angle between sun sensor and each experiment;
e) Star tracker to S/C axis.

CRITERIA FOR SUCCESS:

All alignments shall be within the limits defined by the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Theodolites (minimum of 2), mounting stands, optical flats

Table VI. (Cont.)

TEST TITLE: Location Change Checkout

FLOW BLOCK NO. A5.22

OBJECTIVE: Re-establish confidence in system operability after movement. Verify new location GSE and data links.

LOCATION: Off-site chamber
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack/ATM is installed in the thermal vacuum chamber. All support GSE is connected. Test thermocouples are installed. The chamber is prepared for test.

OPERATIONS:

The rack/ATM is subjected to a location change checkout of the subsystems and experiments. The GSE and data links are verified. IR source locations are determined.

CRITERIA FOR SUCCESS:

All rack/ATM systems shall operate in accordance with CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: LM simulator, test thermocouples, rack/ATM peculiar GSE-TBS, thermal vacuum chamber GSE.

Table VI. (Cont.)

TEST TITLE: Thermal Vacuum Test

FLOW BLOCK NO. A5.23

OBJECTIVE: Prove the active and passive thermal control system.

LOCATION: Off-site chamber
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The rack/ATM is in the chamber. All GSE is connected. Test batteries are installed. Partial solar panel simulators are deployed. The IR sources are positioned. Test thermocouples are installed.

OPERATIONS:

The thermal control system is evaluated under simulated thermo altitude environment by a series of all system tests culminating in a compressed time mission simulation. All flight instrumentation data is recorded. Supplemental data is obtained from test instrumentation. All tests are run on internal battery power. Solar panel power is simulated. The PCS system is operating open loop. Control and display is from the LM simulator.

CRITERIA FOR SUCCESS:

The TC system shall perform in accordance with the requirements of the CEI spec under thermo vacuum environment.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: LM simulator, test thermocouples, rack/ATM GSE-TBS, experiment peculiar GSE-TBS, thermal vacuum chamber support GSE

Table VI. (Cont.)

TEST TITLE: Post Thermal Vacuum All Systems Ambient Test

FLOW BLOCK NO. A5.24

OBJECTIVE: Final systems verification after thermal vacuum test and prior to shipment to KSC.

LOCATION: Off-site chamber
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All thermal vacuum tests are complete.

OPERATIONS:

The rack/ATM systems are subjected to a series of all system checks while still in the chamber. The purpose is to verify that no systems deterioration has occurred as a result of the TV tests. At the conclusion of this check, the rack/ATM is prepared for shipment to KSC. It is not returned to MSFC.

CRITERIA FOR SUCCESS:

Systems shall be ready for shipment to KSC.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: LM simulator, rack/ATM peculiar GSE-TBS

5.3 KSC Operations

5.3.1 General Summary

5.3.1.1 SIVB and IU - No AAP peculiar modifications have been accomplished on the S-IVB and IU. Prelaunch checkout is in accordance with the normal Apollo flow.

5.3.1.2 SLA - No modifications have been performed on the SLA for Flight 4. Checkout follows the normal Apollo flow with the exception of a rack/ATM to lower SLA fit check early in the MSOB flow.

5.3.1.3 Nose Cone - A standard Apollo nose cone is used to replace the CSM for Flight 4. Checkout follows the normal Apollo flow.

5.3.1.4 LM A/S - The LM A/S mated with the rack/ATM is a new configuration and requires a new flow for the LM A/S. The LM A/S receiving inspection is limited to a damage check of the module. No functional receiving test is performed. The LM A/S is moved to the A/S test fixture in the MSOB. Power buss resistance and static loads are measured. The unmodified LM reaction control system (RCS) is functionally checked out in accordance with existing procedures.

The LM A/S is moved to the MSOB altitude chamber and raised above the chamber. The CSM for AAP 3 is already in the chamber (AAP 3 prelaunch checkout flow). The LM A/S is lowered to the CM and soft and hard docking is accomplished. Longitudinal axis alignment is checked. The LM A/S and CM are pressurized. Docking interface leakage rates are checked. The LM A/S is undocked and moved to the MSOB rack work area where it is mated to the ATM/Rack.

5.3.1.5 Rack/ATM - The Rack and ATM receiving inspections are limited to a damage check of the modules. Following receiving inspection, the Rack and ATM are mated in the MSOB rack work area. The LM/Rack/ATM are moved to the east integration stand where it is fit checked with the lower SLA. Upon completion of this check, the rack/ATM is moved to an MSOB rack work area where the CMG mounting pads are verified for alignment. The CMGs are then installed.

5.3.1.6 LM A/S Mated to Rack/ATM - The vast number of interfaces between the rack/ATM and the LM A/S, and the fact that they have not previously been mated, places a requirement on the KSC operations for a prelaunch combined carrier systems test.

The rack/ATM is mated to the LM A/S in the MSOB rack work area. Electrical interfaces are verified and umbilicals are mated. Experiments are installed and rough alignment is performed. Upon completion of this test, all plumbing lines are checked for leaks. The LM A/S - rack/ATM is moved to the West Altitude Chamber. The Rack/ATM and LM A/S subsystems are individually tested. Following the LM A/S and rack/ATM subsystem functional testing, a combined LM A/S - rack/ATM subsystem interface checkout is performed. This checkout includes thermal control, pointing control, data management, communications and experiment subsystem checkout with the display and control of the LM A/S providing system control and monitoring.

With the LM A/S - rack/ATM in the West Altitude Chamber and the AAP 3 CSM in the East Altitude Chamber, the LM-CSM interfaces are connected via marriage cables. Power, communications and display and control subsystem interfaces are then verified. Upon completion of the above test, the umbilicals are disconnected and the carriers are prepared for a cluster interface test, as described in section 4.3.1.4 Part C.

After cluster interface test, an LM A/S - rack/ATM manned altitude test is performed in the West Altitude Chamber. The LM A/S - rack/ATM is then moved to the MSOB Work Area where the rack/ATM solar panels are installed in the stowed position and electrical control checks performed.

Final rack/ATM experiment alignment is verified. Both carriers are cleaned and a weight and balance check is performed. The remaining MSOB operation follows normal Apollo flow, which consists of S/C build-up before shipment to the launch pad.

5.3.1.7 Launch Pad Activities - Basically the launch pad activities follow the normal Apollo flow with the following exceptions:

a. LM A/S - rack/ATM subsystem location change checkout.

b. Cryogenic Servicing of the rack/ATM.

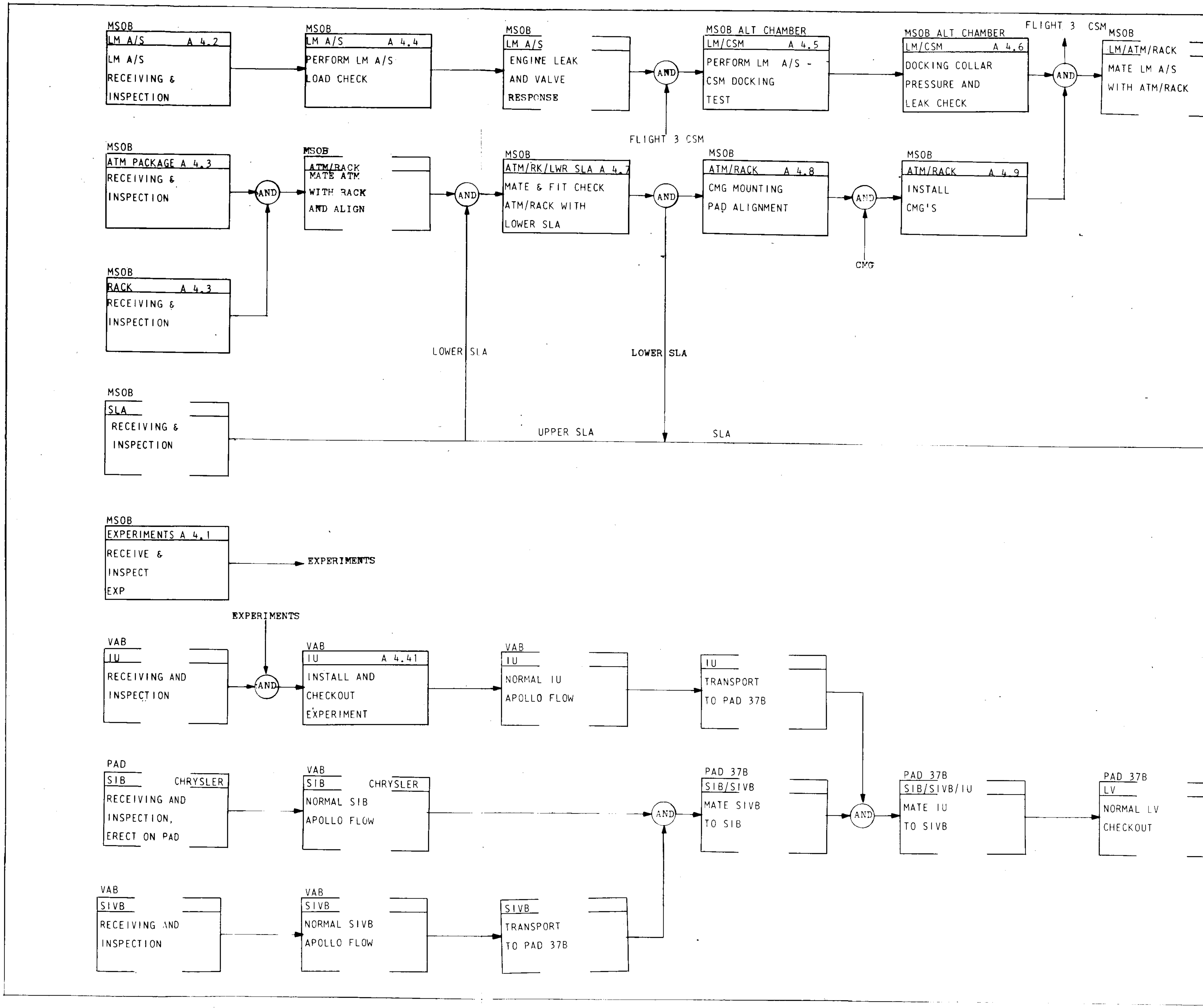
c. RFI testing in conjunction with the Apollo RF test.

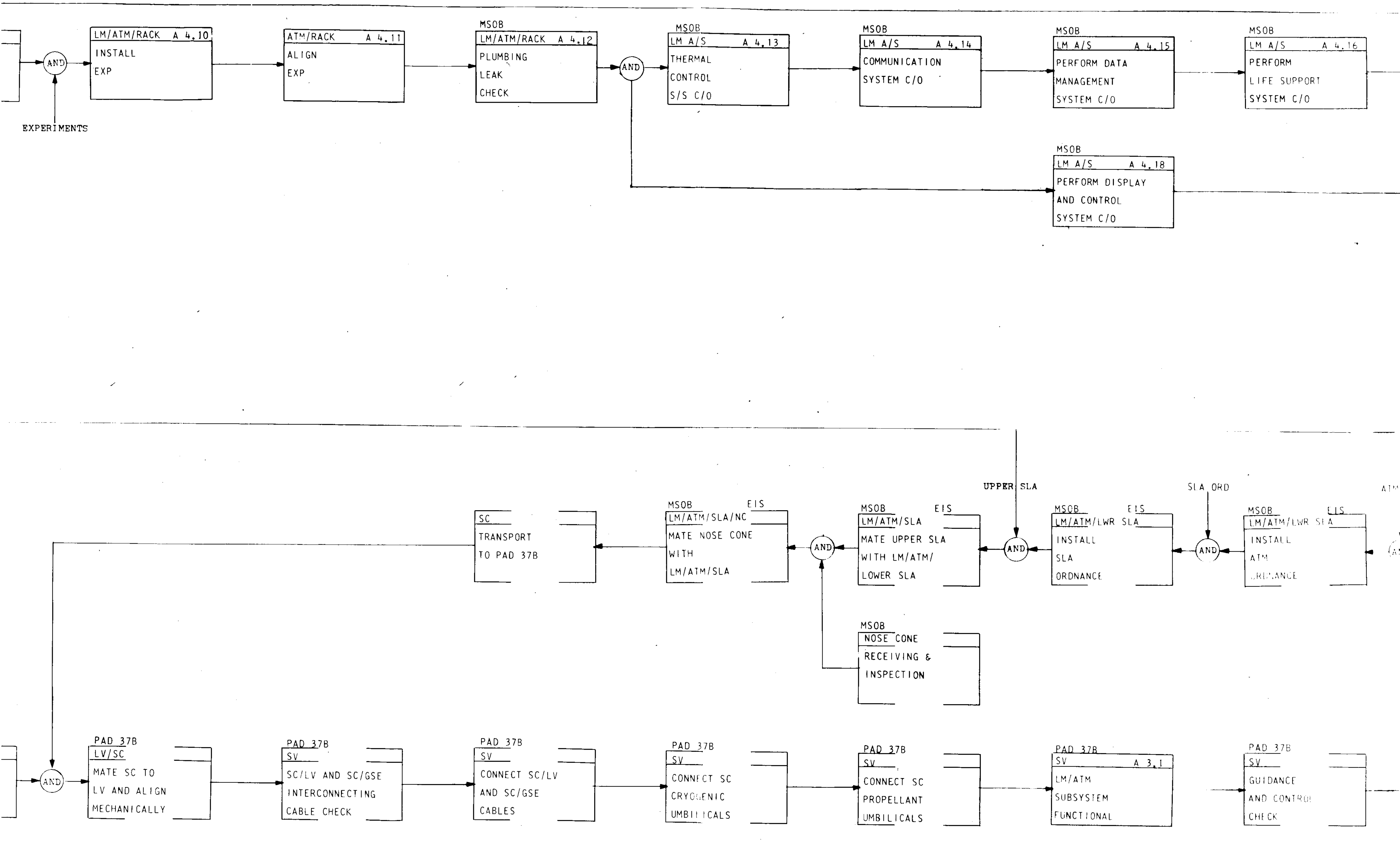
d. All S/C operations and procedures shall be verified during the Apollo CDDT.

5.3.2 Prelaunch Checkout and Launch Pad Activities Flow - The flow diagram (figure 9) presents the recommended flow or checkout operation at KSC for the various elements of AAP 4.

Time function reference should be made to 4.3.2 for interface and timeline requirements.

5.3.3 Test Requirement Sheets - Table VII contains test description sheets for the numbered blocks of the flow diagram (see figure 9). Table VII defines specific blocks of the AAP 4 flow diagram for KSC operations.


MSOB
LM A/S A 4.2
LM A/S RECEIVING & INSPECTION
MSOB
LM A/S A 4.4
PERFORM LM A/S LOAD CHECK
MSOB
LM A/S
ENGINE LEAK AND VALVE RESPONSE
AND
FLIGHT 3 CSM
MSOB ALT CHAMBER
LM/CSM A 4.5
PERFORM LM A/S - CSM DOCKING TEST
MSOB ALT CHAMBER
LM/CSM A 4.6
DOCKING COLLAR PRESSURE AND LEAK CHECK
FLIGHT 3 CSM
MSOB
LM/ATM/RACK
MATE LM A/S WITH ATM/RACK
MSOB
ATM PACKAGE A 4.3
RECEIVING & INSPECTION
MSOB
ATM/RACK
MATE ATM WITH RACK AND ALIGN
MSOB
ATM/RK/LWR SLA A 4.7
MATE & FIT CHECK ATM/RACK WITH LOWER SLA
MSOB
ATM/RACK A 4.8
CMG MOUNTING PAD ALIGNMENT
MSOB
ATM/RACK A 4.9
INSTALL CMG'S
CMG
MSOB
RACK A 4.3
RECEIVING & INSPECTION
LOWER SLA
LOWER SLA
MSOB
SLA
RECEIVING & INSPECTION
UPPER SLA
SLA
MSOB
EXPERIMENTS A 4.1
RECEIVE & INSPECT EXP
EXPERIMENTS
EXPERIMENTS
VAB
IU
RECEIVING AND INSPECTION
VAB
IU A 4.41
INSTALL AND CHECKOUT EXPERIMENT
VAB
IU
NORMAL IU APOLLO FLOW
IU
TRANSPORT TO PAD 37B
PAD
SIB CHRYSLER
RECEIVING AND INSPECTION, ERECT ON PAD
VAB
SIB CHRYSLER
NORMAL SIB APOLLO FLOW
PAD 37B
SIB/SIVB
MATE SIVB TO SIB
PAD 37B
SIB/SIVB/IU
MATE IU TO SIVB
PAD 37B
LV
NORMAL LV CHECKOUT
VAB
SIVB
RECEIVING AND INSPECTION
VAB
SIVB
NORMAL SIVB APOLLO FLOW
SIVB
TRANSPORT TO PAD 37B



LM/ATM/RACK A 4.10
INSTALL
EXP
EXPERIMENTS
ATM/RACK A 4.11
ALIGN
EXP
MSOB
LM/ATM/RACK A 4.12
PLUMBING
LEAK
CHECK
AND
MSOB
LM A/S A 4.13
THERMAL
CONTROL
S/S C/O
MSOB
LM A/S A 4.14
COMMUNICATION
SYSTEM C/O
MSOB
LM A/S A 4.15
PERFORM DATA
MANAGEMENT
SYSTEM C/O
MSOB
LM A/S A 4.16
PERFORM
LIFE SUPPORT
SYSTEM C/O
MSOB
LM A/S A 4.18
PERFORM DISPLAY
AND CONTROL
SYSTEM C/O
SC
TRANSPORT
TO PAD 37B
MSOB EIS
LM/ATM/SLA/NC
MATE NOSE CONE
WITH
LM/ATM/SLA
MSOB EIS
LM/ATM/SLA
MATE UPPER SLA
WITH LM/ATM/
LOWER SLA
UPPER SLA
MSOB EIS
LM/ATM/LWR SLA
INSTALL
SLA
ORDNANCE
SLA ORD
MSOB EIS
LM/ATM/LWR SLA
INSTALL
ATM
MSOB
NOSE CONE
RECEIVING &
INSPECTION
PAD 37B
LV/SC
MATE SC TO
LV AND ALIGN
MECHANICALLY
PAD 37B
SV
SC/LV AND SC/GSE
INTERCONNECTING
CABLE CHECK
PAD 37B
SV
CONNECT SC/LV
AND SC/GSE
CABLES
PAD 37B
SV
CONNECT SC
UMBILICALS
PAD 37B
SV
CONNECT SC
PROPELLANT
UMBILICALS
PAD 37B
SV A 3.1
LM/ATM
SUBSYSTEM
FUNCTIONAL
PAD 37B
SV
GUIDANCE
CHECK

2
3

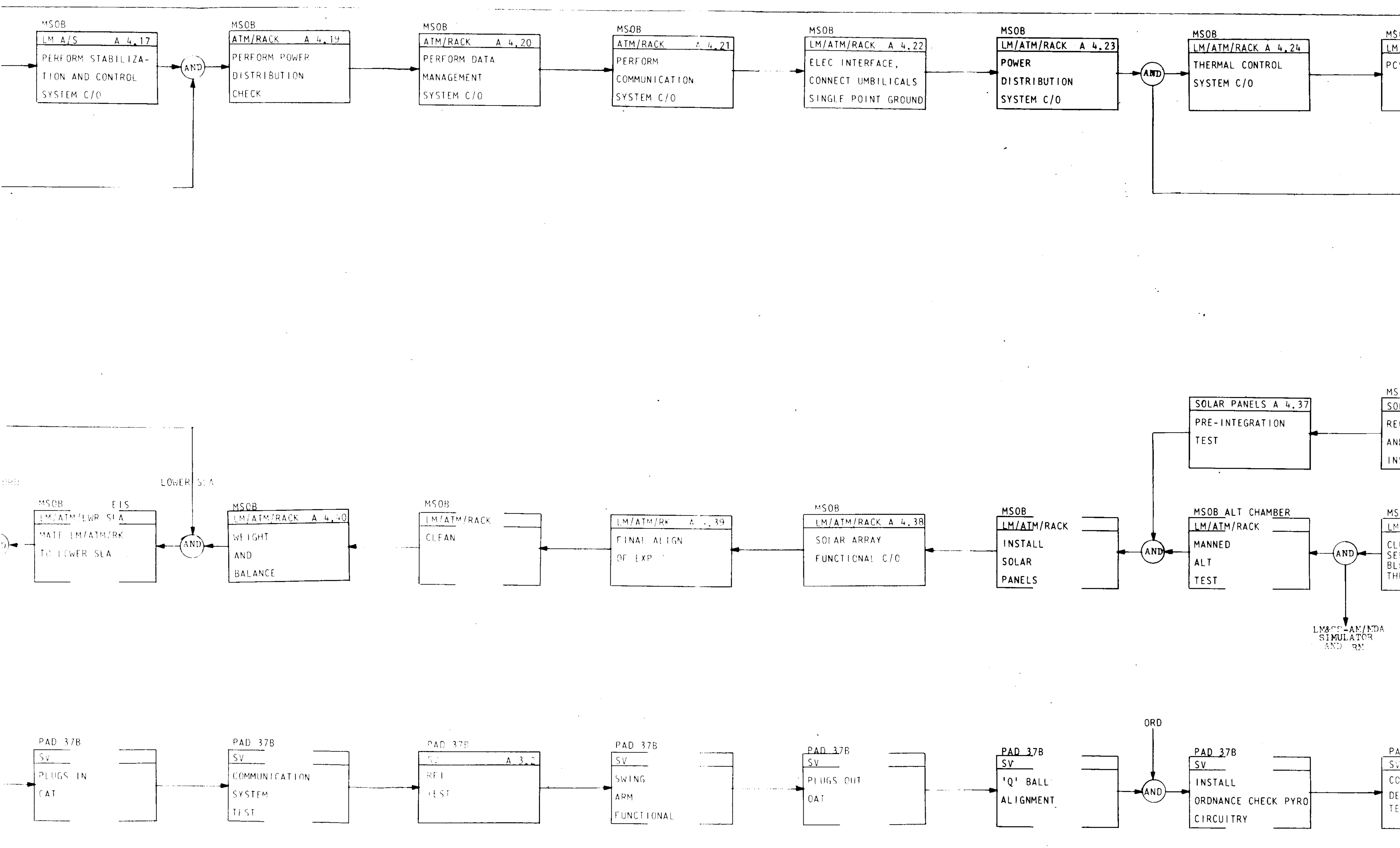
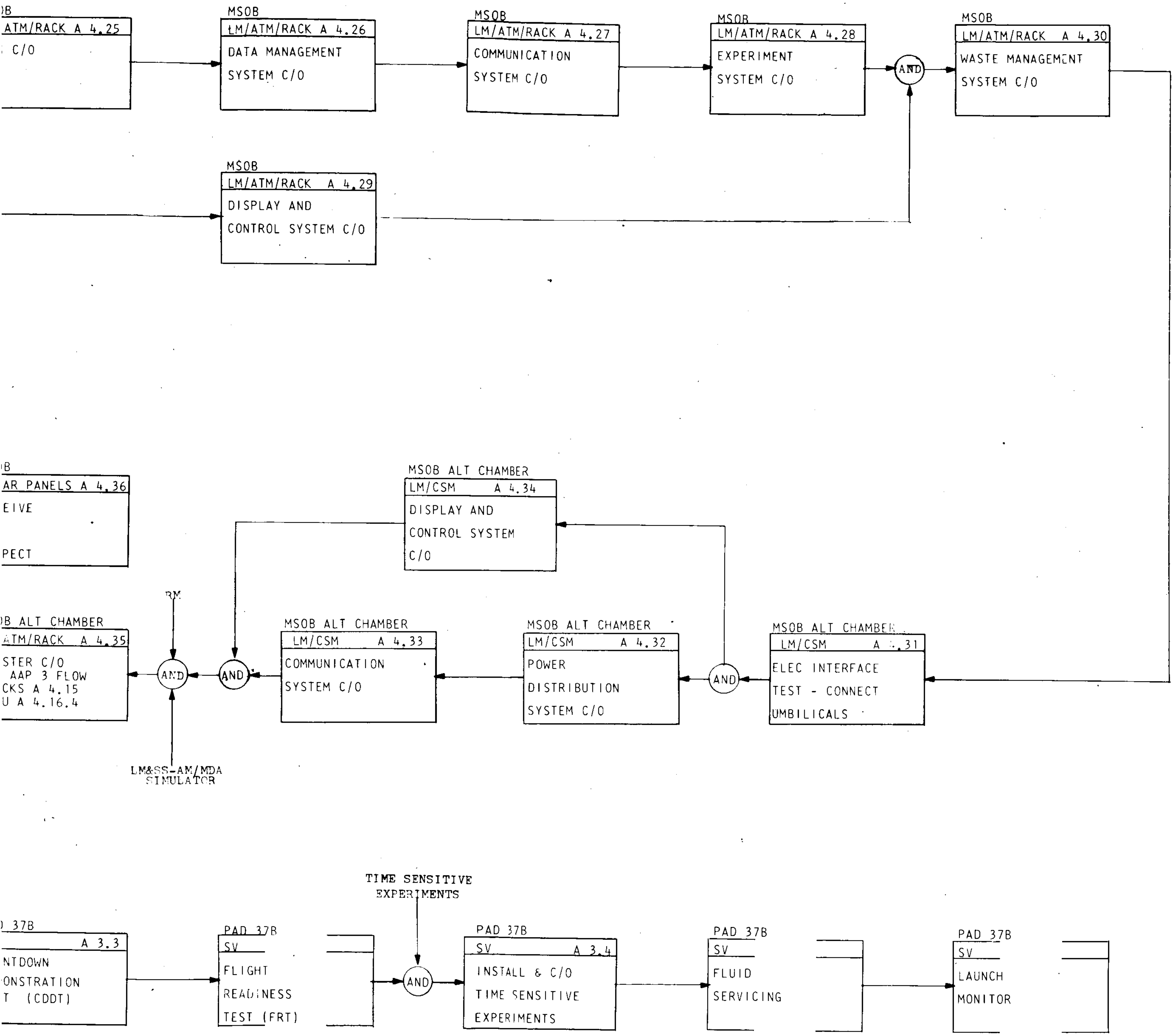


Figure 9. Prelaunch Checkout And Launch Pad Activities Flow For AAP Flight 4



PRELAUNCH CHECKOUT AND LAUNCH
PAD ACTIVITIES FLOW FOR AAP FLIGHT #4

DATE: 7 APRIL, 67

Table VII. Test Requirement Sheets for Figure 9

TEST TITLE: Receive and Inspect Experiments

FLOW BLOCK NO. A 4.1

OBJECTIVE: Verify that no damage has occurred during packaging and shipping.

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: 40 hours (total)
AGENCY SUPPORT: Principal Investigator

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying the experiments are reviewed for latest configuration and accuracy. The experiments are removed from the shipping containers.

OPERATIONS:

A thorough inspection of the experiments is performed. All electrical connectors are inspected for bent pins and foreign particles. Fluid lines are inspected for evidence of damage. No functional checkouts are performed at this time. Environmental and cleanliness controls shall be adhered to at all times in accordance with applicable specifications.

CRITERIA FOR SUCCESS:

There shall be no evidence of damage, deterioration or contamination.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment handling equipment.

Table VII. (Cont.)

TEST TITLE: LM A/S - R&I

FLOW BLOCK NO. A 4.2

OBJECTIVE: Verify that the LM A/S is to the latest engineering configuration and that no damage has occurred during packaging and shipping.

LOCATION: KSC-MSOB (LM A/S Work Stand)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documents accompanying the LM A/S are reviewed for latest configuration accuracy. The LM A/S is inspected on the LM A/S work stand.

OPERATIONS:

A thorough visual inspection is performed to assure that no transportation damage has occurred. Plumbing lines and electrical connectors are inspected. The LM A/S - CSM and LM A/S - Rack ATM mating surfaces are inspected for damage. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

LM A/S is in proper configuration and no transportation damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: LM A/S, work access platform, handling equipment, hand tools, portable lighting.

Table VII. (Cont.)

TEST TITLE:	Rack and ATM - R&I	**FLOW BLOCK NO. A 4.3**

OBJECTIVE: Verify that the Rack and ATM is to the latest engineering configuration and that no damage has occurred during packaging and shipping.

LOCATION: KSC-MSOB (Rack Work area and experiment accommodation area)

PERSONNEL: TBS

TIME SPAN: 16 hours

AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documents accompanying the Rack and ATM are reviewed for latest configuration accuracy. The Rack is inspected in the Rack Work Area and the ATM is inspected in the experiment accommodations area.

OPERATIONS:

A thorough visual inspection is performed to assure at no transportation damage has occurred. Plumbing lines and electrical connectors are inspected. The Rack ATM-LM A/S mating surface is examined for damage and cleanliness. Cleanliness and environmental controls are maintained.

CRITERIA FOR SUCCESS:

Rack and ATM are in proper configuration and no transportation damage has occurred.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Rack ATM transport, work access platform, handling equipment, hand tools, portable lighting.

Table VII. (Cont.)

TEST TITLE:	Perform LM A/S Load Checks	FLOW BLOCK NO. A 4.4

OBJECTIVE: Verify LM A/S power buss interface compatibility prior to mate.

LOCATION: KSC-MSOB (LM A/S Work Stand)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Checkout boxes are connected to the LM A/S umbilicals.

OPERATIONS:

Power buss resistance and static loads are measured and verified to be in accordance with the applicable interface specifications. Power distribution and sequence is verified.

CRITERIA FOR SUCCESS:

Power interfaces shall be in accordance with ICD specs.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE: Perform LM A/S - CSM Docking Test

FLOW BLOCK NO. A 4.5

OBJECTIVE: Verify LM A/S and CSM Docking Interfaces.

LOCATION: KSC-MSOB (Alt. Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

AAP 3 CSM is already in altitude chamber.

OPERATIONS:

The LM A/S is raised above the chamber and lowered to the CSM in the inverted position. Soft and hard docking is accomplished. Probes and latches are adjusted. Operation of optical docking aides are verified, umbilicals between the carriers are inspected for damage and a fit check performed.

CRITERIA FOR SUCCESS:

Docking interfaces shall be in accordance with the applicable CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: LM A/S inverting fixture, slings, crane, work access platform.

TEST TITLE: Docking Collar Pressure and Leak Check

FLOW BLOCK NO. A 4.6

OBJECTIVE: Verify that the CSM-LM A/S docking interface leakage rates do not exceed specification requirements.

LOCATION: KSC-MSOB (Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All hatches are closed and secured. The LM A/S and CSM are pressurized to 5.0 psi above ambient. The tunnel pressure is increased to slightly less than that in the cabins.

OPERATIONS:

A pressure decay test is performed to determine leakage rates. The hard latches are disengaged and the pressure decay test is repeated in the soft dock configuration. Upon completion of pressure test, the tunnels and cabins are depressurized and the probe and drogue are re-installed.

CRITERIA FOR SUCCESS:

Combined leakage rates shall be within the limits defined by the ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Crane, pressure console, leak detector.

Table VII. (Cont.)

TEST TITLE: Mate and Fit Check ATM/Rack With Lower SLA

FLOW BLOCK NO. A 4.7

OBJECTIVE: Verify ATM/Rack - SLA Fit and Clearance

LOCATION: KSC-MSOB (East Integration Stand)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The lower SLA of AAP 4 is placed in the east integration stand. The upper SLA is removed.

OPERATIONS:

The ATM/Rack is lowered to the LM attach points and secured. Clearance between the ATM/Rack and lower SLA are verified.

CRITERIA FOR SUCCESS:

Fit and clearance shall be in accordance with applicable ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Crane, rack handling fixture, hand tools, work access platform

Table VII. (Cont.)

TEST TITLE: CMG Mounting Pad Alignment

FLOW BLOCK NO. A 4.8

OBJECTIVE: Verify CMG Mounting Pads are Aligned

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

TBS

CRITERIA FOR SUCCESS:

CMG pad alignment shall be in accordance with applicable ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Theodolites, optical flats, CMG mounting pad alignment fixture

Table VII. (Cont.)

TEST TITLE: Install CMG's

FLOW BLOCK NO. A 4.9

OBJECTIVE: Install CMG's in their ATM/Rack mounting pads

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

TBS

CRITERIA FOR SUCCESS:

CMG interfaces shall be in accordance with the applicable ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: CMG handling equipment, hand tools, work access platforms.

Table VII. (Cont.)

TEST TITLE: Install Experiments in ATM/Rack - LM A/S

FLOW BLOCK NO. A 4.10

OBJECTIVE: Install experiments and experiment subsystems in ATM Rack - LM A/S

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 20 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All experiments will be subjected to a final pre-installation inspection and where applicable a final bench check and/or calibration is performed. (Reference section 6. for requirements.)

OPERATIONS:

Reference section 6. for experiment installation and checkout requirements.

CRITERIA FOR SUCCESS:

All experiments will be installed and secured in launch configuration.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment handling GSE, TBS

Table VII. (Cont.)

TEST TITLE: ATM/Rack Experiment Alignment

FLOW BLOCK NO. A 4.11

OBJECTIVE: Perform a rough alingment of ATM/Rack Experiments early in the MSOB Flow

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 44 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Theodolites and optical flats are used in preparation for experiment alignment.

OPERATIONS:

The following ATM/Rack experiment alignments are performed using theodolites and optical flats:

(a) Sun sensor to S/C axis
(b) T.V. to each experiment
(c) Each experiment to every other experiment
(d) Sun sensor to each experiment
(e) Star tracker to S/C axis

CRITERIA FOR SUCCESS:

ATM/Rack experiments alignment shall be in accordance with the applicable ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Theodolites and optical flats

Table VII. (Cont.)

TEST TITLE: LM/ATM/Rack Plumbing Leak Check

FLOW BLOCK NO. A 4.12

OBJECTIVE: Verify that the leak rates of the LM/ATM/Rack plumbing do not exceed specifications.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM/ATM/Rack is in the rack work area. The necessary pressure lines are connected to the LM/ATM/Rack from the pneumatic console. Provisions are made for pressurizing and monitoring plumbing.

OPERATIONS:

The LM/ATM/Rack plumbing is pressurized from the pneumatic console. A pressure decay period of 4 hours will be monitored on the pressure guages located at the pneumatic console. All pressure line connections are leak checked with a leak detector.

CRITERIA FOR SUCCESS:

The leak rates of the LM/ATM/Rack plumbing will be within the ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: GN_2

EQUIPMENT: Pneumatic console, leak detector, work access platform.

Table VII. (Cont.)

TEST TITLE:	LM A/S Thermal Control Subsystem C/O	**FLOW BLOCK NO. A** 4.13

OBJECTIVE: To functionally verify the LM A/S thermal control system.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C GSE is connected to the LM A/S. The LM A/S thermal control reservior is charged with the specified coolant fluid. The LM A/S is supplied with ground power. The LM is manned.

OPERATIONS:

The thermal control circulation pump is energized. The system is checked for leaks. Inlet and outlet temperatures are monitored by transducers. Pressure transducers are monitored.

CRITERIA FOR SUCCESS:

The LM A/S thermal control subsystem shall operate in accordance with the CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: Coolant fluids, TBS

EQUIPMENT: Coolant console, ACE S/C GSE

Table VII. (Cont.)

TEST TITLE: LM A/S Communication Systems C/O

FLOW BLOCK NO. A 4.14

OBJECTIVE: Perform a functional checkout of the LM Communication System.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C GSE is connected to the LM A/S. Ground power is applied. The LM A/S is manned.

OPERATIONS:

The LM A/S communications system is checked out in accordance with the normal Apollo procedures. The only delta to the communications system is the switching modification to facilitate cluster configuration communications. The switching operations are verified during the Apollo checkout.

CRITERIA FOR SUCCESS:

Operation of the antenna switching circuits will be in accordance with the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE

Table VII. (Cont.)

TEST TITLE: LM A/S-Perform Data Management System C/O

FLOW BLOCK NO. A 4.15

OBJECTIVE: Verify operation of the LM data management system.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C is connected to the LM A/S. Ground power is applied to the LM A/S. The LM A/S is manned for data management operations.

OPERATIONS:

The operation of the data management system is verified by a location change checkout. Quantitative testing has been accomplished at Grumman. This test is limited to the end to end checks required to re-establish confidence in system operability prior to subsequent interface checks. Ambient system housekeeping data is recorded and evaluated.

CRITERIA FOR SUCCESS:

Data management system shall operate in accordance with the appropriate CEI.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C

Table VII. (Cont.)

TEST TITLE: LM A/S - Perform Life Support System C/O

FLOW BLOCK NO. A 4.16

OBJECTIVE: Leak Check O_2, N_2 plumbing lines and manifold in LM A/S

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C GSE is connected to the LM A/S. N_2 facility lines are attached to the LM A/S sphere fill lines. Ground power is applied to the LM A/S.

OPERATIONS:

The LM, O_2 and N_2 lines are pressurized and a leak detector check is performed on the LM A/S, O_2 and N_2 system. The O_2, N_2 transfer solenoids are energized to allow flow from the MDA interface quick disconnects. A leak check is performed on the transfer plumbing lines. Operation of the LM A/S pressure control system is verified over the specified range of pressure.

CRITERIA FOR SUCCESS:

There shall be no O_2 and N_2 system leakage. The transfer solenoid will function and the pressure control system will perform over the pressure range in accordance with the requirements of the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES GN_2

EQUIPMENT: ACE S/C GSE, pneumatic console

Table VII. (Cont.)

TEST TITLE:	LM A/S-Perform Stabilization and Control System C/O	FLOW BLOCK NO. A 4.17

OBJECTIVE: Verify operation of the LM A/S stability and control system.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C GSE is connected to the LM A/S. Facility power is applied to the carrier. The RCS valve responses are monitored via ACE S/C recorders.

OPERATIONS:

The attitude control system is energized and allowed to stabilize. External torques are applied to the system and the RCS valves are monitored for correct response. The stabilization system response to external torques is evaluated. Basically this test is performed in accordance with existing Apollo procedures.

CRITERIA FOR SUCCESS:

End-to-end polarity of the stabilization and control system shall be in accordance with the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: ACE S/C GSE

Table VII. (Cont.)

TEST TITLE:	LM A/S-Perform D&C Checkout	FLOW BLOCK NO. A 4.18

OBJECTIVE: Verify D&C control functions on LM A/S

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with LM A/S Subsystem Test
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

ACE S/C GSE is connected to the LM A/S. Ground power is applied to the LM A/S. The LM A/S is manned for D&C operations.

OPERATIONS:

All LM A/S controls and displays are verified in conjunction with subsystem checkout. LM A/S to rack interface functions are verified by use of a checkout box.

CRITERIA FOR SUCCESS:

LM A/S display and control shall be in accordance with the requirements of the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: ACE S/C GSE

Table VII. (Cont.)

TEST TITLE:	Perform Power Distribution Check on Rack/ATM	FLOW BLOCK NO. A 4.19

OBJECTIVE: Verify the power distribution circuitry on the Rack ATM

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to the power distribution buss of the Rack/ATM. Work access platforms are placed around the carrier for easy access.

OPERATIONS:

Voltage and current measurements are made at the Rack/ATM distributor to verify porper voltage levels and phasing. The power up controls are energized sequencially while input power connectors are verified.

CRITERIA FOR SUCCESS:

Rack ATM power distribution shall be in accordance with the requirements of the CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: VTVM, Breakout boxes

Table VII. (Cont.)

TEST TITLE:	Rack ATM - Perform Data Management C/O	FLOW BLOCK NO. A 4.20

OBJECTIVE: Verify data management system

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 12 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to the Rack ATM power buss. The DDAS output of Mod 301 is connected through coaxial cable to ESE.

OPERATIONS:

The Rack ATM data management system calibration signals are applied to the multiplexers. The Mod 301 PCM/DDAS module provides a 600 KHZ FM modulated carrier signal to the DDAS ground receiving equipment. This signal is monitored to verify the functional operability of the data management system.

CRITERIA FOR SUCCESS:

The ATM/Rack data management system shall operate in accordance with the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: PCM ground station

Table VII. (Cont.)

TEST TITLE:	Rack ATM - Perform Communications System C/O	FLOW BLOCK NO. A 4.21

OBJECTIVE: Verify communications system

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 12 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is supplied to Rack ATM panel buss.

OPERATIONS:

The Rack ATM data management system is activated with no inputs to the multiplexers applied except the internal calibrated signal. The VHF/FM transmitter is activated and the output is monitored. Data dump is activated and the output is monitored. The antenna system is verified for coaxial switching of antennas. Audio communications are verified. Command decoder uplink operation is verified.

CRITERIA FOR SUCCESS:

Communication system shall perform in accordance with the requirements of the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE:	LM/Rack ATM Electrical Interface Test-Mate Umbilicals and Perform a Single Point Ground Test	FLOW BLOCK NO. A 4.22

OBJECTIVE: Verify interface prior to mating and verify combined single point ground

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 Hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

A cable check box is connected to the ATM/Rack umbilical connector. Ground power is applied to the ATM/Rack panel.

OPERATIONS:

The rack to LM power interface load and resistance is verified. Power is applied from ground source and interface distribution is verified by light indications on the checkout box. All umbilicals are inspected for damage, pin alignment and cleanliness prior to mating. After electrical mating, combined single-point ground is verified.

CRITERIA FOR SUCCESS:

All power interfaces shall be in accordance with the applicable ICD. Combined single point ground shall be in accordance with the requirement of the CEI and ICD specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Cable checkout box, TBS

Table VII. (Cont.)

TEST TITLE: Perform Power Distribution Check

FLOW BLOCK NO. A 4.23

OBJECTIVE: Verify LM A/S - Rack/ATM power interfaces

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM A/S and Rack/ATM are connected electrically. A work access platform is positioned around the LM A/S stage.

OPERATIONS:

Power transfer from the Rack/ATM to the LM A/S is initiated. Voltage measurements are made at the LM A/S distributer to verify proper voltage levels, distribution and sequence. Analog recordings are made of the buss voltages and currents. Transfer transients noise, and switching transients are evaluated.

CRITERIA FOR SUCCESS:

The power interface shall perform in accordance with the appropriate ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work access platform, VTVM, oscilloscope

Table VII. (Cont.)

TEST TITLE:	LM A/S - Rack/ATM Thermal Control Checkout	FLOW BLOCK NO. A 4.24

OBJECTIVE: Functionally verify thermal control system.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The thermal control system is charged with water glycol. Ground power is applied to the Rack/ATM. A work platform is positioned around the carrier for easy access. The LM A/S stage is manned for the test operation.

OPERATIONS:

The thermal control system pump is energized and the coolant medium is allowed to circulate. LM A/S and Rack/ATM interface plumbing lines are checked for leaks. The Rack/ATM cold plate connections are also leak checked. Flow rate is checked and compared to the alloted specification. Inlet and outlet temperatures are recorded via transducer outputs for varying heat loads. Pressure measurements are monitored and compared to tolerance values.

CRITERIA FOR SUCCESS:

The thermal control system shall perform in accordance with the applicable CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: Water glycol

EQUIPMENT: Work access platform, TBS

Table VII. (Cont.)

TEST TITLE: LM A/S/Rack/ATM-Perform PCS C/O

FLOW BLOCK NO. A 4.25

OBJECTIVE: Verify the PCS system performance

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

TBS

OPERATIONS:

TBS

CRITERIA FOR SUCCESS:
The PCS shall conform to the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE:	LM A/S/Rack/ATM-C/O of Data Management System	FLOW BLOCK NO. A 4.26

OBJECTIVE: Verify the LM A/S/Rack/ATM data management system

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to the Rack/ATM power buss. Excitation voltage is applied to all Rack/ATM transducers. The Rack/ATM data management communication system is used in conjunction with the measurement system. The MSOB-PCM ground station is connected by a land line link and line drivers. The LM A/S is manned.

OPERATIONS:

All Rack/ATM systems are energized. All Rack/ATM instrumentation measurements are recorded on analog recorders in the ground station. Recordings are evaluated for proper ambient levels, indication of excessive system noise and trace stability. (Dynamic recordings will be made during mission simulation testing.) The LM A/S display and control C/O is accomplished in conjunction with the Rack/ATM data management checkout.

CRITERIA FOR SUCCESS:

All ambient measurements will be in accordance with the limits defined by appropriate CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: MSOB-PCM Ground Station, TBS

Table VII. (Cont.)

TEST TITLE:	LM A/S/Rack/ATM - Perform Communications System C/O	FLOW BLOCK NO. A 4.27

OBJECTIVE: Verify all communication modes

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All antennas on the LM A/S and Rack/ATM are coupled to MSOB ground station. Power is supplied from the ground power console. The LM A/S is manned.

OPERATIONS:

The communication systems are powered up. All voice and biomedical modes are activated and outputs from the communication system are monitored at MSOB ground station. The LM A/S display and control checkout is accomplished in conjunction with the communication checkout.

CRITERIA FOR SUCCESS:

Audio communications shall perform in accordance with the applicable CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: PCM ground station

Table VII. (Cont.)

TEST TITLE:	Functional C/O of Experiment Systems	FLOW BLOCK NO. A 4.28

OBJECTIVE: To verify carrier/experiment compatibility

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All power is supplied from ground sources. The LM A/S stage is manned.

OPERATIONS:

Installed experiments are checked out in accordance with the requirements of section 6.

CRITERIA FOR SUCCESS:

The experiments shall perform in accordance with the requirements contained within applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE: Perform Display and Control C/O

FLOW BLOCK NO. A 4.29

OBJECTIVE: Verify Rack/ATM - LM A/S D&C System

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with LM/Rack/ATM Subsystem Test
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground checkout power is applied to Rack/ATM. The LM A/S is manned. Work access platforms are positioned for accessibility.

OPERATIONS:

The Rack/ATM/LM ascent stage D&C system is checked out concurrent with its subsystem and experiment functional testing. Activation of the various subsystems are controlled from the D&C panels in the LM A/S and the corresponding displays are verified for accurate response. All controls and displays are verified.

CRITERIA FOR SUCCESS:

All D&C shall perform in accordance with the applicable ICD and CEI specification.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Work access platform, TBS

Table VII. (Cont.)

TEST TITLE:	Functional C/O of Waste Management System	FLOW BLOCK NO. A 4.30

OBJECTIVE: Verify that the leakage rate of the waste management system is within tolerance.

LOCATION: KSC-MSOB (West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

A pressure controlled gaseous He/N_2 supply will be coupled to the waste management system. The selector valve within the waste management system will be adjusted to permit the gas to completely fill the system.

OPERATIONS:

All waste management system lines and fittings shall be leak checked.

CRITERIA FOR SUCCESS:

No leakage of the waste management system..

SUPPORT REQUIREMENTS:

COMMODITIES: He and N_2 mixture

EQUIPMENT: Leak rate detector, pneumatic console

Table VII. (Cont.)

TEST TITLE: LM A/S - CSM Electrical Interface Test and Mate Umbilicals

FLOW BLOCK NO. A 4.31

OBJECTIVE: Verify correct power on CSM/LM interface cables

LOCATION: KSC-MSOB (CSM in East Altitude Chamber, LM A/S in West Altitude Chamber)
PERSONNEL: TBS
TIME SPAN: 4 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM is inside the east chamber and LM A/S is in the west chamber. A cable check box is inserted in the CSM interface connector. Ground power is applied to the CSM. All CSM control switches are in the normal position. The CSM is manned.

OPERATIONS:

The CSM to the LM A/S power is switched on and distribution and polarity is verified on the cable check box. All CSM-LM A/S control functions are verified for the signal on the correct umbilical pins. After verification, the checkout box is removed and the umbilicals are inspected for damage, pin alignment and cleanliness prior to mating, thru marriage cables.

CRITERIA FOR SUCCESS:

Interface shall be in accordance with the requirements of the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Cable checkout box

Table VII. (Cont.)

TEST TITLE: CSM/LM A/S Perform Power Distribution Checks

FLOW BLOCK NO. A 4.32

OBJECTIVE: Verify the CSM-LM A/S power interfaces

LOCATION: KSC-MSOB (Same as A4.31)
PERSONNEL: TBS
TIME SPAN: 14 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The CSM/LM A/S are connected via marriage cables. The CSM busses are energized with ground power. All CSM control switches are set in the normal position. The CSM and LM A/S are manned.

OPERATIONS:

Power transfer from the CSM to the LM A/S initiated. Voltage level measurements are phase rotation sequence checks are made at the LM A/S distributer. The CSM control functions affecting the LM A/S are initiated and verified at the LM A/S distributer. Proper distribution, polarity, phase rotation and levels are verified.

CRITERIA FOR SUCCESS:

The LM A/S-CSM interfaces shall perform in accordance with the appropriate ICD requirements.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: VTVM, oscilloscope

Table VII. (Cont.)

TEST TITLE: Communications System

FLOW BLOCK NO. A 4.33

OBJECTIVE: Verify CSM - LM A/S Audio Communications System Compatibility

LOCATION: KSC-MSOB (Same as A 4.31)
PERSONNEL: TBS
TIME SPAN: 14 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Same preparations as A 4.32

OPERATIONS:

The communication systems of the CSM and LM A/S are power up. The voice communications between these carriers are activated. The functional operations of the communication system are verified. The CSM - LM A/S display and control C/O is accomplished in conjunction with this test.

CRITERIA FOR SUCCESS:

Verify CSM - LM A/S audio communication system shall perform in accordance with the applicable CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE:	CSM/LM A/S Display and Control System C/O	FLOW BLOCK NO. A 4.34

OBJECTIVE: Verify D&C interface functions

LOCATION: KSC-MSOB (Same as A 4.31)
PERSONNEL: TBS
TIME SPAN: Done in conjunction with the CSM/LM A/S Subsystem Checkout
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Ground power is applied to the CSM. The CSM inside the East Chamber is connected to the Rack/LM/AS in the West Chamber by marriage extension cables.

OPERATIONS:

CSM power is transferred to the LM/Rack by CM control. Appropriate displays on the CM panel are monitored. After verification of the power-up of the LM A/S the total CM display and control system is checked out by sequential operation of all controls while simultaneously monitoring the corresponding display.

CRITERIA FOR SUCCESS:

The CM D&C shall perform in accordance with the requirements of the applicable CEI and ICD specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE: Cluster C/O	FLOW BLOCK NO. A 4.35

OBJECTIVE: Verify subsystems and interfaces in the cluster configuration

LOCATION: KSC-MSOB (Alt. Chamber)
PERSONNEL: TBS
TIME SPAN: 80 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

See AAP 3 Flow at KSC (Blocks A 4.16 through A 4.17.4)

OPERATIONS:

See AAP 3 Flow at KSC (Blocks A 4.16 through A 4.17.4)

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS:

COMMODITIES:

EQUIPMENT:

Table VII. (Cont.)

TEST TITLE:	Receive and Inspect Solar Panels	FLOW BLOCK NO. A 4.36

OBJECTIVE: Verify that no shipping damage has occurred

LOCATION: KSC-MSOB (Experiment Accommodation Area)
PERSONNEL: TBS
TIME SPAN: TBS
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All documentation accompanying the solar panels are reviewed for completeness and accuracy. The solar panels are removed from the shipping containers.

OPERATIONS:

A thorough inspection of the solar panels is performed. No functional checkout is performed at this time..

CRITERIA FOR SUCCESS:

There shall be no damage deterioration or contamination to the solar panels.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE:	Solar Panel Pre-Integration Test	FLOW BLOCK NO. A 4.37

OBJECTIVE: To verify functional operations of Solar Panels prior to installation

LOCATION: KSC-MSOB
PERSONNEL: TBS
TIME SPAN: 8 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The solar panels are deployed. A sun simulator is positioned so it can stimulate each cell in the panel.

OPERATIONS:

Verify proper operation of the solar panels by monitoring the output voltage and current.

CRITERIA FOR SUCCESS:

The solar panels will perform according to CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Sun simulator, solar panel handling and holding fixture

Table VII. (Cont.)

TEST TITLE:	Functional C/O of Solar Array	FLOW BLOCK NO. A 4.38

OBJECTIVE: To perform load and continuity checks on Rack ATM solar array.

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 48 hours (includes installation)
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The solar array is installed on the Rack. The interconnecting cable between the Rack and solar array is connected to an interrupt box.

OPERATIONS:

Load and continuity checks are performed on the installed solar array. The load check results are compared to the manufacturer's specification. A resistance check is made on the LM A/S power distributor.

CRITERIA FOR SUCCESS:

The solar array resistance and load check shall meet the requirements in the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: TBS

TEST TITLE: Final ATM/Rack Experiments Alignment	FLOW BLOCK NO. A 4.39

OBJECTIVE: Perform a final alignment of ATM/Rack Experiments

LOCATION: KSC-MSOB (Rack Work Area)
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Same as for Rough Alignment Block No. A 4.11

OPERATIONS:

CRITERIA FOR SUCCESS:

SUPPORT REQUIREMENTS:

COMMODITIES:

EQUIPMENT:

Table VII. (Cont.)

TEST TITLE:	Perform LM A/S Rack Weight and Center of Gravity Check — FLOW BLOCK NO. A 4.40
OBJECTIVE:	Determine weight and center of gravity
LOCATION:	KSC-PIB
PERSONNEL:	TBS
TIME SPAN:	32 hours
AGENCY SUPPORT:	TBS

TASK DESCRIPTION

PREPARATIONS:

All LM A/S/Rack/ATM equipment has been installed. Late arriving experiments will be simulated or the mass property effects calculated.

OPERATIONS:

The LM A/S/Rack/ATM is weighted and the CG is determined using existing PIB facility, GSE and methods modified to accommodate the LM A/S/Rack/ATM.

CRITERIA FOR SUCCESS:

Weight and CG shall be in accordance with the applicable CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: Modified PIB weight and CG GSE, LM A/S/Rack/ATM handling GSE.

Table VII. (Cont.)

TEST TITLE:	Install and Check Out Experiment in IU	FLOW BLOCK NO. A 4.41

OBJECTIVE: Physically mount experiments in IU and perform functional checkout

LOCATION: KSC-VAB
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

All experiments are subjected to a pre-installation inspection and/or bench check, as described in section 6.

OPERATIONS:

The experiments are mounted in the IU. Alignment of experiment is verified. A post-installation test is performed as described in section 6.

CRITERIA FOR SUCCESS:

Experiments installed in IU shall function in accordance with the applicable ICD and CEI specifications.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: Experiment handling equipment

Table VII. (Cont.)

TEST TITLE:	LM A/S - ATM/Rack Subsystem Functional	FLOW BLOCK NO. A 3.1

OBJECTIVE: Verify carrier subsystem.

LOCATION: KSC-PAD 37B
PERSONNEL: TBS
TIME SPAN: 48 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The LM A/S and Rack/ATM are connected to their respective umbilicals at Pad 37B. The signal recorders in the blockhouse are calibrated.

OPERATIONS:

The LM A/S and Rack/ATM subsystems are energized and functionally verified thru ground measuring recorders. The LM A/S subsystems include the stabilization and control system, thermal control, power, data and communications. The ATM/rack subsystems that are verified are PCS, experiments, thermal control, data and communications.

CRITERIA FOR SUCCESS:

The subsystems are verified to operate within the red line limits as specified by the subsystem contractor.

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

TEST TITLE: RFI Test

FLOW BLOCK NO. A 3.2

OBJECTIVE: Verify all space vehicle RF system performance and RFI compatibility in launch environment.

LOCATION: KSC-LP 37B
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

EMI checkout devices are installed on all pyrotechnic circuitry. The MSS is moved away from the SV. This is an Apollo test.

OPERATIONS:

The RF systems are activated and open loop radiation tests are performed with the range station and/or MSOB ground station. Carrier frequency, sync pulse, and phase lock stability are checked. RFI compatibility with the total SV in the launch configuration is verified.

CRITERIA FOR SUCCESS:

The S/C shall be compatible with the launch environment and ground tracking station..

SUPPORT REQUIREMENTS:

COMMODITIES: None

EQUIPMENT: EMC devices

Table VII. (Cont.)

TEST TITLE: CDDT

FLOW BLOCK NO. A 3.3

OBJECTIVE: Demonstrate S/C readiness for launch, perform integrated dress rehearsal of countdown..

LOCATION: KSC-LP 37B
PERSONNEL: TBS
TIME SPAN: 32 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

The S/C is in flight configuration. This is an Apollo test.

OPERATIONS:

The spacecraft systems are energized and verified during the Apollo countdown sequence. All cryogenic tanks are serviced. The time sensitive experiments or simulators are installed. Open loop RF checks are performed in countdown sequence. The SLA is closed out and the MSS is moved away. The minus time countdown is picked up and countdown is continued until T -10 sec. After CDDT the S/C is restored to its normal configuration.

CRITERIA FOR SUCCESS:

Complete demonstration of the feasibility of all operations required in the subsequent launch countdown..

SUPPORT REQUIREMENTS:

COMMODITIES: LO_2, LN_2, LH_2

EQUIPMENT: TBS

Table VII. (Cont.)

TEST TITLE:	Install Time Sensitive Experiments	FLOW BLOCK NO. A 3.4

OBJECTIVE: Install all experiments that are time sensitive

LOCATION: KSC LP 37B
PERSONNEL: TBS
TIME SPAN: 16 hours
AGENCY SUPPORT: TBS

TASK DESCRIPTION

PREPARATIONS:

Pre-installation checkout is performed on all time sensitive experiments. (Reference section 6, for requirements)

OPERATIONS:

Install all time sensitive experiments in their respective carriers. (Reference section 6. for installation and post-installation checkout requirements.)

CRITERIA FOR SUCCESS:

All time sensitive experiments will be installed in launch configuration

SUPPORT REQUIREMENTS:

COMMODITIES: TBS

EQUIPMENT: TBS

6. EXPERIMENT TEST REQUIREMENTS

At the present time, there are approximately 177 candidate experiments for the total program. Since the program is still in the definition phase, the experiment groupings per flight are changing on a day by day basis. In order to complete the Phase C planning task, a baseline grouping has been established for Flights AAP 1 thru 4. Requirements are based on this grouping and will not be updated during Phase C to show subsequent changes.

Table VIII shows the baseline of 58 experiments for Flights AAP 1 thru 4, identifying the carrier, location at launch, and the on-orbit operating location.

The amount of information available on the individual experiments is limited. Most of the experiments are still in the conceptual stage and very few actual development efforts have been initiated. The extent of test requirement definition is directly proportional to the extent of experiment definition available. Consequently, it is felt that this area needs extensive effort at a later date when experiment configurations begin to firm up.

All experiment test requirements defined in this plan are based on the configurations and performance descriptions contained in the following documents:

a. MMC document "Experiment Data Handbook (Preliminary) ED-2002-4", dated October 1966.

b. MMC "Experiment Analysis Forms", Volumes 1, 2, 3. (Updated continuously).

Table VIII. Experiment, Flights and Location

	AAP 1										AAP 2										AAP 3								AAP 4						NOTES
	LOCATION AT LAUNCH					OPERATING LOCATION					LOCATION AT LAUNCH					OPERATING LOCATION					LOCATION AT LAUNCH				OPERATING LOCATION				LOC. AT LAUNCH			OPER. LOC.			
EXP. NO.	CM	SM	LM&SS	SLA	IU	CM	SM	LM&SS	SLA	IU	AM	MDA	SLA	IU	S-IVB (OWS)	AM	MDA	SLA	IU	S-IVB (OWS)	CM	SM	RM	IU	CM	SM	RM	IU	RACK/ATM	LM	IU	RACK/ATM	LM	IU	
M401			X					X																											1
E00 A			X					X																											
E00 B			X					X																											
E00 D			X					X																											
S065	X					X																													
S006	X					X																													
S005	X					X																													
M052	X					X														X															
D017	X					X																													
T003	X					X														X															2
S009		X					X																												
S018	X					X																													
T002	X					X																													
S017			X					X																											3
M439	X					X																													
M487												X				X				X															
D019												X								X															4
D018											X	X								X															
M050												X								X															4
M052	X					X														X															4
M051												X								X															4
M053												X								X															4
M054												X								X															

Table VIII. Experiment, Flights and Locations (Cont.)

EXP. NO.	AAP 1 LOCATION AT LAUNCH					AAP 1 OPERATING LOCATION					AAP 2 LOCATION AT LAUNCH					AAP 2 OPERATING LOCATION					AAP 3 LOCATION AT LAUNCH				AAP 3 OPERATING LOCATION				AAP 4 LOC. AT LAUNCH			AAP 4 OPER. LOC.			NOTES
	CM	SM	LM&SS	SLA	IU	CM	SM	LM&SS	SLA	IU	AM	MDA	SLA	IU	S-IVB (OWS)	AM	MDA	SLA	IU	S-IVB (OWS)	CM	SM	RM	IU	CM	SM	RM	IU	RACK/ATM	LM	IU	RACK/ATM	LM	IU	
M018												X								X															4
M055													N/A						N/A																
D020												X								X															4
D012											X	X							EVA																
M466												X								X															
M486												X								X															
D021												X							EVA																
T020												X								X															
M469												X		X					X	X															4
M489											X									X															
M488												X								X															
D022												X							EVA																
M479												X								X															
M493												X								X															4
T017												X							EVA																
T021												X							EVA																
M492												X								X															
M464												X								X															
T003	X																			X															
M052																				X	X					X									
S015																					X					X									
S061																					X					X									

Table VIII. Experiment, Flights and Locations (Cont.)

	AAP 1										AAP 2										AAP 3								AAP 4						NOTES
	LOCATION AT LAUNCH					OPERATING LOCATION					LOCATION AT LAUNCH					OPERATING LOCATION					LOCATION AT LAUNCH				OPERATING LOCATION				LOC. AT LAUNCH			OPER. LOC.			
EXP. NO.	CM	SM	LM&SS	SLA	IU	CM	SM	LM&SS	SLA	IU	AM	MDA	SLA	IU	S-IVB	AM	MDA	SLA	IU	S-IVB (OWS)	CM	SM	RM	IU	GM	SM	RM	IU	RACK/ATM	LM	IU	RACK/ATM	LM	IU	
T004																							X				X								
S027																								X											
S063																								X				X							
S019																					X				X										
S054																													X			X			
S055A																													X			X			
S056																													X			X			
S055B																													X			X			
S055C																													X			X			
S053A																													X			X			
S052																													X			X			
S053B																													X			X			
D012																													X	X			EVA		
S020																													X			X			
T022																															X			X	
M423																															X			X	

NOTES:
1. Film retrieval to be accomplished on Flight AAp-2.
2. Scheduled for AAP-2 Flight.
3. Scheduled for AAP-4 Flight.
4. An experiment reactivated from AAP-2 Flight.

6.1 <u>Flight AAP 1 Experiments</u> - The experiments for Flight 1 are carried into orbit and operated in orbit on three basic carriers - the LM&SS, the CM, and the SM.

The LM&SS experiments on this flight are:

a. M401 - Lunar mapping photography

b. E00A - Metric cameras

c. E00B - IR Imager

d. E00D - Microwave Radiometer

e. S017 - X-ray astronomy

The CM of Flight 1 will contain the following experiments:

a. S065 - Multiband terrain photography

b. S006 - Synoptic weather photography

c. S005 - Synoptic terrain photography

d. M052 - Bone and muscle changes

e. D017 - CO_2 reduction

f. T003 - In-flight nephelometer

g. S018 - Micro meteoroid

h. T002 - Manual navigation system

i. M439 - Star horizon auto tracking

A single experiment is stored and operated in the SM. Data is retrieved by EVA and returned in the CM.

a. S009 - Nuclear emulsion

The primary objective of the Flight 1 experiments is to test and evaluate photographic equipment in earth orbit for subsequent lunar mapping and survey missions. Secondary objectives are to evaluage navigation aids, and to continue the evaluation of space environment effects on man.

The test requirements for the individual experiments for Flight AAP 1 are shown on the experiment requirement sheets in 6.1.1. Table IX summarizes these checkout requirements. A check in the mission simulation column of Table IX indicates experiments to be operated and checkout during mission simulation with the CSM and LM&SS functionally mated. (See AAP 1 Flow Diagram at KSC).

6.1.1 Flight AAP 1 Experiment Test Requirement Sheets - Table X contains test description sheets for the Flight 1 experiments.

Table IX. Flight AAP 1 Experiment Test Requirement Summary

EXP. NO.	Pre-Delivery Acceptance	Pre-Installation Bench Check	Post-Installation Alignment	Post-Installation Functional	Operate (Load Only) During Mission Simulation	LP Checkout	LP Servicing	LP Housekeeping Monitor
E00A	X	X	X		X		X	X
E00B	X	X	X		X		X	X
E00D	X		X	X	X			
S005	X	X						
S006	X	X						
S009 **	X	X					X	X
S017	X				X	X	X	X
S018	X							
S065	X	X						
M052 *	X				X			
M401	X	X	X	X	X		X	
M439 *	X	X	X		X			
T002	X	X						
T003 *	X				X			
D017	X			X	X			X

* Insufficient information available for complete evaluation.

** To be accomplished by a project scientist team.

Table X. Flight AAP 1 Experiment Test Requirement Sheets

EXPERIMENT TITLE: EXPERIMENT NO.

Metric Cameras E00A

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: At KSC

INSTALLATION CONSTRAINTS: Clean lens and load film prior to camera installation on LM&SS. Must be stored in protective area until used.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery component acceptance test will be done at experiment developer's facility. A system level test of all cameras, film take-up system, central electronics unit, control panel and radar altimeter for fit and functional operation will be in accordance with CEI specifications. Cleanliness and environmental controls shall be maintained.

POST INSTALLATION CHECKOUT:

Visually check plugs for bent pins and infractions. Perform continuity and megger of all cables and bore sighting of camera. Align unit with fixed axes of LM&SS.

LAUNCH PAD REQUIREMENTS:

Verify film and lens cover installation. Verify that lock mechanism is employed to protect the equipment during launch. Film temperature will require launch pad monitoring.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Infrared Imager E00B

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: At KSC

INSTALLATION CONSTRAINTS: Clean lens and load film prior to camera installation on LM&SS. Film and camera must be stored in protective area until used.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery checkout and acceptance test at experimenter developer's facility. At KSC the I.R. IMAGER will be loaded with film and operated. Film is developed and evaluated. Load unit with film, clean lens, install lens caps. Cleanliness and environmental controls shall be maintained.

POST INSTALLATION CHECKOUT:

Align unit with fixed axis of LM&SS. Verify Scanner pointing to NADIR and have unobstructed field of view. No post installation checkout.

LAUNCH PAD REQUIREMENTS:

Verify film and lens caps installation. Verify lock mechanism is employed to protect the equipment during launch. Film temperature will require launch pad monitoring.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Microwave Radiometer E00D

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: At KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance at component supplier facility. Verify all electrical interfaces with carrier subsystems prior to installation of experiment in its respective place.

POST INSTALLATION CHECKOUT:

The Microwave Radiometer will be operated and checkout in conjunction with the checkout of the LM&SS payload Module The Radiometer must be oriented to the NADIR with pointing accuracy of $\pm$ 1 degree. Verify pointing unit is aligned to fixed axis of LM&SS.

LAUNCH PAD REQUIREMENTS:

GSE Support and Facilities:

1 - Test cables for trouble shooting and checkout.
2 - Signal generator.
3 - Handling fixture.
4 - Focus jigs for checking alignment of mount with LM&SS axis.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Synoptic Terrain Photography S005

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC prior to S/C Assembly

INSTALLATION CONSTRAINTS: Clean lens, load film prior to camera installation in CM.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance test at experiment developer's facility. At KSC, the camera will be loaded with film and operated. Developed film will be evaluated. Camera must be loaded, lens cleaned and lens cover installed prior to installation in the CM.

POST INSTALLATION CHECKOUT:

Hand held Hasselblad camera with no functional interfaces with CM system. No post-installation checkout required.

LAUNCH PAD REQUIREMENTS:

No launch pad checkout or servicing requirements.

GSE Support and Facilities:

1 - For film temperature control a large ice box will be required.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Synoptic Weather Photography S006

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC prior to S/C Assembly

INSTALLATION CONSTRAINTS: Clean lens, load film prior to camera installation in CM.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Same as S005.

POST INSTALLATION CHECKOUT:

Same as S005.

LAUNCH PAD REQUIREMENTS:

Same as S005.

GSE Support and Facilities:

1. For film temperature control a large ice box will be required.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Nuclear Emulsion S009

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Flight equipment must be stored at a temperature between 30°F and 50°F. Must be kept from radioactive and x-ray exposure. Special handling procedures. Install emulsion 24 hours prior to launch.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Will be accomplished using special AGE and carried out by pre-assigned project scientists not to exceed 3. They will be responsible for package from time of delivery until the end of flight mission.

POST INSTALLATION CHECKOUT:

None

LAUNCH PAD REQUIREMENTS:

Special handling procedures and housekeeping required.

GSE Support and Facilities:

1 - Aerospace Ground Equipment will be used in testing the flight equipment.

Table X. (Cont.)

EXPERIMENT TITLE: X-Ray Astronomy

EXPERIMENT NO. S017

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Environmental control will be required for cameras and film. Special handling procedures. The experiment must be installed parallel to the vehicle axis.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery component acceptance test will be at experiment developer's facility. System level environmental testing of hardware will be performed by A S & E, using nearby facilities.

POST INSTALLATION CHECKOUT:

Facilities will be required to checkout the equipment in the vehicle while installed in the launch tower. Provisions for a PCM assembler and encoder, a tape recorder and VHF transmitter with up to 30 minutes recording time are required.

LAUNCH PAD REQUIREMENTS:

Protection for sensor package. Temperature sensitive packages.

GSE Support & Facilities:

1 - Facilities will be required for checking out the equipment in the vehicle while installed in the launch tower.
2 - Special handling fixtures.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Micrometeorite Collection S018

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Flight and backup collectors delivered to launch site 24 hours prior to launch. Kept in clean environment prior to storing aboard Spacecraft.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance at component supplier facility. No pre-installation checkout requirements at KSC.

POST INSTALLATION CHECKOUT:

None

LAUNCH PAD REQUIREMENTS:

None

GSE Support & Facilities:

Collector returned to experimenters in sealed, clean containers for analysis.

EXPERIMENT TITLE: EXPERIMENT NO.

Multi-Band Terrain Photography S065

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC Prior to S/C Assembly

INSTALLATION CONSTRAINTS: Clean lens, load film prior to camera installation in CM. Film and cameras must be stored in protective area until use.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance test at experimenter developer's facility. At KSC the camera will be loaded with film and operated. Evaluate developed film. Camera must be loaded, lens cleaned and lens cover installed prior to installation in the CM..

POST INSTALLATION CHECKOUT:

Hand held Haselblad camera with no functional interfaces with CM system. No post-installation checkout required.

LAUNCH PAD REQUIREMENTS:

No launch pad checkout or servicing requirements.

GSE Support & Facilities

1 - A Facility should be provided for film storage both before and after flight to maintain film temperature from +45° to +85°F.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Bone and Muscle Changes M052

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: At KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The waste management system, consisting of urine and body mass measurement equipment, urine collection and processing unit, and fecal cannisters, will have pre-delivery acceptance at component supplier facility. No pre-installation checkout requirements at KSC.

POST INSTALLATION CHECKOUT:

None

LAUNCH PAD REQUIREMENTS:

No launch pad servicing requirements. No housekeeping identified at this time.

GSE Support & Facilities:

1 - Facilities for blood, urine, and fecal sample collection and dietary control must be available at all astronaut locations for the last 15 days of pre-flight. X-Ray facilities are required as well.

Table X. (Cont.)

EXPERIMENT TITLE: Lunar Mapping Photography

EXPERIMENT NO. M401 (EJ0505)

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: MSC installation. Late arriving experiment installation prior to block 4.13 at KSC.

INSTALLATION CONSTRAINTS: Mounting surface cleanliness is critical. Special handling required. Radiation and thermal shielding of camera and film package is required in section I of SM.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance test at experiment developer's facility. Functional bench check in experiment accommodation area at KSC of the survey camera, mapping camera, programmer, V/H sensor and/or radar altimeter in accordance with CEI. Clean lens prior to installation.

POST INSTALLATION CHECKOUT:

Cable continuity and meggar on initial installation. Camera, radar altimeter, V/H sensor alignment to S/C axis. During LM&SS to CSM interface checks the CM display and controls will be verified with the experiment package. Automatic program must be verified at system level. Sequential operation during docked LM&SS/CSM mission simulation.

LAUNCH PAD REQUIREMENTS:

Verify camera program and film installation (loading at MSOB prior to S/C assembly). Possibility of some housekeeping monitoring, but no firm identification.

GSE Support & Facilities

1 - Camera handling equipment
2 - Cable extenders checkout tool
3 - Megger
4 - ohm meter

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Star Horizon Auto Tracking M-439

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Camera system will be mounted in Section I of Service Module. This section will be shielded for radiation and thermal effects on camera and film.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-installation acceptance will be accomplished on component level testing at supplier's facility. Verify all electrical interfaces with carrier subsystem prior to installation of experiment in its respective place. At KSC the camera will be loaded with film and operated. Develop film and evaluate.

POST INSTALLATION CHECKOUT:

System level testing required after installation in CM and after alignment to CM axis. This will be performed in manual override position. During normal operation camera operation is automatic.

LAUNCH PAD REQUIREMENTS: Verify film loaded, lens caps installed. Lock mechanism employed to protect the equipment during launch. Film temperature will require launch pad monitoring.

GSE Support and Facilities - Equipment will be needed to check camera alignment and system electrical continuity.

Table X. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Manual Navigation Sightings T002

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Special handling procedures

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance at component supplier. A functional test of Sextant will be run at MSOB utilizing the Battery Charger and Test Unit. This will prepare for flight the power source of the Sextant. Proper preparation of the battery for use requires initial exercising to fully utilize its life capabilities. Proper handling must be insured.

POST INSTALLATION CHECKOUT:

None

LAUNCH PAD REQUIREMENTS:

None

GSE - Support & Facilities - A battery charger and test unit are required for checkout of the Sextant.

Table X. (Cont.)

EXPERIMENT TITLE: In-Flight Nephelometer

EXPERIMENT NO. T003

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: At KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance at component supplier's facility. Pre-installation checkout requirements at KSC cannot be determined due to insufficient information - TBS.

POST INSTALLATION CHECKOUT:

None at this time - TBS

LAUNCH PAD REQUIREMENTS:

None at this time - TBS

Table X. (Cont.)

EXPERIMENT TITLE: Solid Electrolyte Carbon Dioxide Reduction

EXPERIMENT NO. D017

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-1

POINT OF INSTALLATION: MSC or NAA

INSTALLATION CONSTRAINTS: The equipment package will be built into the CM

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance at component supplier facility. No pre-installation checkout requirements at KSC.

POST INSTALLATION CHECKOUT:

Immediately after installation, the system will be checked out by the experimenter utilizing a monitor console fabricated in-house by experimenter. This test will consist of a normal operation of the experiment for a period of one to two hours, in which all parameters must be monitored in-house by experimenter. An integrated test of the entire vehicle system at NAA facilities. This test is a four-hour operation and will require the telemetry system to have been checked out.

LAUNCH PAD REQUIREMENTS: A final prelaunch check of the experiment at the launch site will require a full four hours test in which all parameters are monitored. Five housekeeping measurements (pressure and temperature) will require launch pad monitoring.

GSE Support & Facilities - (1) Portable Monitor Console; (2) CO_2 available at the NAA and launch site.

6.2 Flight AAP 2 Experiments - All of the experiments for Flight AAP 2 are carried in the AM/MDA during the boost phase with the exception of M469 - ST-124 removal and disassembly.

The primary objective of Flight 2 is to evaluate the habitability of the OWS and to evaluate its usefulness for conducting corollary experiments while on-orbit.

The test requirements for the individual experiments for Flight 2 are shown on the experiment requirements sheets in Section 6.2.1. Table XI summarizes these checkout requirements.

6.2.1 Flight AAP 2 Experiment Test Requirement Sheets - Table XII contains test description sheets for Flight 2 experiments.

Table XI. Flight AAP 2 Experiment Test Requirement Summary

EXP. NO.	Pre-Delivery Acceptance	Pre-Installation Bench Check	Post-Installation Alignment	Post Installation Functional	Operate During Mission Simulation	LP Checkout	LP Servicing	LP Housekeeping Monitor
M487	X	X						
D019	X	X						
D018	X	X						
M050	X	X			X			
M052	X				X			
M051	X	X			X			
M053	X	X			X			
M054	X	X			X			
M018	X	X			X			
M055	X	X						
D020	X							
D012	X	X					X	X
M466	X	X						
D021	X	X			X		X	
T020	X	X						
M469								
M489	X	X						
M488	X	X					X	X
D022	X	X					X	X
M479	X	X					X	X
M493	X	X			X			
T017	X	X		X	X			
T021	X	X		X	X			
M492	X							
M464	X	X		X	X	X		
T003	X				X			
M486	X	X						

Table XII, Flight AAP 2 Experiment Test Requirement Sheets

EXPERIMENT TITLE: Crew Quarters

EXPERIMENT NO. M487

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The tape recorder and motion picture camera will be functionally bench checked prior to installation in the MDA.

POST INSTALLATION CHECKOUT:

The equipment is stored in the MDA and will not be removed for operation until orbit is obtained.

LAUNCH PAD REQUIREMENTS:

None

Table XII. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Suit Donning and Sleep Analysis D019

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The camera and tape recorder are functionally bench checked prior to installation in the MDA. The equipment is used for photographing space suit donning and voice recordings.

POST INSTALLATION CHECKOUT:

None. The equipment is stored in the MDA for operation in the OWS.

LAUNCH PAD REQUIREMENTS:

None.

Table XII. (Cont.)

EXPERIMENT TITLE: Integrated Maintenance

EXPERIMENT NO. D018

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The camera and tape recorder are functionally bench checked prior to installation in the MDA. The equipment is used for evaluating the ability of the astronauts to perform certain functions.

POST INSTALLATION CHECKOUT:

The experiment is installed in the MDA for later use in the OWS.

LAUNCH PAD REQUIREMENTS:

None.

Table XII. (Cont.)

EXPERIMENT TITLE: Metabolic Cost of In-Flight Tasks

EXPERIMENT NO. M050

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The experiment subsystems consist of a flowmeter, mouthpiece, gas analyzer, and associated electronics. The system will receive a bench check at KSC, MSOB. The experiment is C/O at MSOB with a SIVB simulator during AAP-2 mission simulation test. The interface with the OWS includes power and data management.

POST INSTALLATION CHECKOUT:

The subsystems are stored in the MDA to be operated later in the OWS.

LAUNCH PAD REQUIREMENTS:

None.

Table XII. (Cont.)

EXPERIMENT TITLE: Bone and Muscle Changes

EXPERIMENT NO. M052

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS: Reference M052 - Test Description Sheet for AAP-1 in Section 6.1.1.

PRE-INSTALLATION CHECKOUT:

POST INSTALLATION CHECKOUT:

LAUNCH PAD REQUIREMENTS:

Table XII. (Cont.)

EXPERIMENT TITLE: Cardiovascular Function

EXPERIMENT NO. M051

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The experiment timer, ECG assembly, ultraviolet lamp, and blood pressure measuring assembly will be verified in the lab at KSC. The interface with the OWS consists of a power connection for the ECG equipment and TM connectors for ECG and blood pressure measurement. These interfaces are checked during MSOB AAP-2 mission simulation.

POST INSTALLATION CHECKOUT:

None.

LAUNCH PAD REQUIREMENTS:

None.

EXPERIMENT TITLE: Human Vestibular Function

EXPERIMENT NO. M053

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP-2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The experiment system consists of a T.V. camera, fiber optics, OTG, VTG, bite board, GMLC, and a tape recorder. The hardware is received at KSC and functionally bench tested. The experiment OWS interface consists of a power connection.

POST INSTALLATION CHECKOUT:

None. The equipment is stored in the MDA to be used later in the OWS.

LAUNCH PAD REQUIREMENTS:

None.

Table XII (Cont.)

EXPERIMENT TITLE: Neurological Study

EXPERIMENT NO. M054

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The experiment subsystems are: EEG assembly, two EOG assemblies, KKG assembly, ZPN assembly and a tape recorder. These subsystems are checked upon arrival at KSC in the biomedical laboratory. The experiment has a power interface with the OWS.

POST INSTALLATION CHECKOUT:

None. The experiment subsystem is stored in the MDA for later use in the OWS.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
Vectorcardiogram	M018

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: NONE

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Checkout of the experiment subsystem will require the biomedical laboratory at KSC. The experiment has a power interface with the OWS.

POST INSTALLATION CHECKOUT:

None. The experiment is stored in the MDA for later use on the OWS.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Time and Motion Study M055

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The experiment consists of taking motion pictures of the astronauts performing various tasks. The camera is functionally bench checked upon arrival at KSC.

POST INSTALLATION CHECKOUT:

None. The camera is stored in the MDA for later use in the OWS.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE:
Evaluation of Alternate Restraints for Mobility and Maintenance

EXPERIMENT NO.
D020

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
The experiment consists of Velcro slippers, skin restraint, support platform, and carpet for platform. The camera and tape recorder used in experiment D018 are used in this experiment. The experiment is inspected upon arrival at KSC.

POST INSTALLATION CHECKOUT:
None. The experiment is stored in the MDA for later use in the OWS.

LAUNCH PAD REQUIREMENTS: N/A

Table XII (Cont.)

EXPERIMENT TITLE: Astronaut Maneuvering Unit

EXPERIMENT NO. D012

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
A leak check is performed on all plumbing. Power distribution is checked and power supply activated. All subsystems are tested. This includes communications, propulsion, Flight Control, oxygen supply, power supply, and abort alarm subsystems.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Space Suit and Lunar Surface Experiment Hardware — M466

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Store EMU and hard suits in pressurized area.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Visual damage test and functional tests of EMU, ALGE, ALSEP and Litton Hardsuit are performed. All instrumentation, used in conjunction with this experiment, that is not part of the carrier subsystems is also tested.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Astronaut Extravehicular Activities and Hardware Evaluation M486

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: TBS

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
Before flight stowage of the equipment used in this experiment, a functional test will be performed on those items that are functionally operated in orbit. For items that cannot be functionally operated, a visual check is performed for damage.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: Expandable Airlock

EXPERIMENT NO. D021

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
The airlock is pressurized and the leak check is performed. Power distribution is checked and power applied to airlock. Deployment thrusters are functionally verified. All data sensors are tested in conjunction with the TM and communication systems. All Displays and Controls are verified.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: Jet Shoes

EXPERIMENT NO. T020

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The jet shoe system is tested for leaks. All controls are activated and system responses verified to be correct.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: Removal of Components from the Stabilizer Platform, ST124M and Associated Equipment	EXPERIMENT NO. M469

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
Verify that all tools are not damaged, and are ready for on-orbit use.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Heat Exchanger Service M489

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: TBS

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: TBS

POST INSTALLATION CHECKOUT: TBS

LAUNCH PAD REQUIREMENTS: TBS

Table XII (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
High Pressure Gas Expulsion	M488

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: TBS

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: TBS

POST INSTALLATION CHECKOUT: TBS

LAUNCH PAD REQUIREMENTS: TBS

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Expandable Structure for Recovery D022

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS:
The expandable structure will be deployed within one week prior to launch.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
The expandable structure is inflated with O_2, following deployment simulation. The camera needed to support the experiment is functionally bench checked. The power needed for deployment is verified to be present at the carrier umbilical.

POST INSTALLATION CHECKOUT:

None. The structure and support equipment is stored in the AM at the launch pad.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE:

Zero Gravity Flammability

EXPERIMENT NO.

M479

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
The experiment subsystems are: combustion chamber; camera with film and mounting bracket; H_2, CO_2, CF_3 Br gases with tanks; valves; regulators, tubing; and electrical controls. A strip recorder is required for recording pressures in the combustion chamber. The experiment is functionally checked prior to installation. Calibration of flowmeters, pressure transducers, and recording system is required prior to installation.

POST INSTALLATION CHECKOUT:
None. The experiment and support subsystems are stored in the AM prior to launch.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: Electron Beam Welder

EXPERIMENT NO. M493

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Checkout and calibration of the electron beam gun and tooling is required. Checkout of motion picture camera is performed prior to storage in the carrier.

POST INSTALLATION CHECKOUT:

None. The experiment is stored in the MDA for later use in the OWS.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
Meteoroid Impact and Erosion	T017

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Examine glass impact panels for damages. Verify that the deployment mechanisms operate correctly.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Meteoroid Velocity T021

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS:
As this equipment is sensitive, the apparatus should be mounted as late as possible prior to launch.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
All electronics associated with this experiment are verified on a system level test using simulated sensor inputs. Calibration of the timing circuits are performed at this time. Outputs from the encoder are monitored for correct response to simulated input signals. Interface is verified to be correct between flight electronics and: flight sensor, and carrier data management system, carrier power, and display and control systems.

POST INSTALLATION CHECKOUT:

None. Experiment is stowed in MDA prior to launch.

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
Tube Joining in Space	M492

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

The equipment used in this experiment is the same as that of experiment M493. The pre-installation checkout is described in the experiment write up of M493.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: None

Table XII (Cont.)

EXPERIMENT TITLE: In-Flight Nephelometer

EXPERIMENT NO. T003

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 2

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

See T003 test description sheet for AAP 1 in 6.1.1.

PRE-INSTALLATION CHECKOUT:

POST INSTALLATION CHECKOUT:

LAUNCH PAD REQUIREMENTS:

6.3 Flight AAP 3 Experiments - The experiments for Flight 3 are installed in three different carriers during the boost phase. In two instances, the operating location is not the same as the boost phase storage location.

The following experiments are installed in the CM:

M052 - Bone and muscle change (only those elements necessary to reactivate the experiment initially installed on Flight 1)

S015A- Survival of living organisms

S061 - Potato respiration

S063 - U.V. horizon photography

The IU will contain one experiment:

S027 - X-ray astronomy

One experiment will be mounted on the RM:

T004 - Frog otolith

The primary objective of Flight 3 is to resupply and reactivate the OWS from Flight 2, and to subsequently evaluate the effects of extended duration missions on man and living organisms. Secondary objectives are to further evaluate the photographic equipment evaluation initiated on Flight 1, and to support the astronomy experiments to be performed with Flight 4 equipment.

The test requirements, by experiments, are provided on individual writeup sheets. These requirements are summarized in Table XIII.

6.3.1 Flight AAP 3 Experiment Test Requirement Sheets - Table XIV contains test description sheets for Flight 3 Experiments.

Table XIII. Flight AAP 3 Experiment Test Requirement Summary

Experiment Number	Pre-Delivery Acceptance	Pre-Installation Bench Check	Post-Installation Alignment	Post-Installation Functional	Operate During Mission Simulation	LP Checkout	LP Servicing	LP Housekeeping Monitor
M052	X				X			
S015A	X	X				X	X	X
S061	X	X				X	X	X
S063	X	X		X			X	X
S019	X	X						
S027	X	X						
T004	X	X				X	X	X

Table XIV. Flight AAP 3 Experiment Test Requirement Sheets

EXPERIMENT TITLE: Frog Otolith

EXPERIMENT NO. T004

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS:

Frog in life capsule installed at T-9 hours. Temperature and pressure controlled.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance test of support system, life capsule, centrifuge. Functional checkout at KSC prior to installation. Frog preparation by bio lab personnel.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS:

Launch pad installation of the life capsule. Post-installation monitoring of bio sensors on frog. Housekeeping monitoring of life capsule.

Table XIV (Cont.)

EXPERIMENT TITLE: Bone and Muscle Changes

EXPERIMENT NO. M052

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

See 6.1.1, M052 Test Description Sheet for AAP 1

PRE-INSTALLATION CHECKOUT:

POST INSTALLATION CHECKOUT:

LAUNCH PAD REQUIREMENTS:

Table XIV (Cont.)

EXPERIMENT TITLE: | EXPERIMENT NO.

Influence of zero-g on single human cell | S015

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION:
Support system and mounting provisions at NAA. Life capsule and cell at KSC.

INSTALLATION CONSTRAINTS:
Installation of life capsule between T-12 and T-6 hours. Environmental conditioning.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:
Pre-delivery acceptance of support system. Life capsule preparation in bio lab by Dallas County Hospital District (DCHD) personnel. Pre-installation checkout per DCHD #3525 attachment B, installation per DCHD #3525 attachment C.

POST INSTALLATION CHECKOUT:
Post-installation checkout by DCHD personnel. Requirement TBS.

LAUNCH PAD REQUIREMENTS:
Life capsule installation between T-12 and T-6 hours. Monitor cell bio **measurements** after installation. Life capsule housekeeping monitoring after installation.

Table XIV. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

Potato Respiration S061

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION:

KSC

INSTALLATION CONSTRAINTS:

Shock mounted, temperature controlled, protected from radiation source.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Pre-delivery acceptance test of supporting systems and provisions. Potato preparation by lab personnel (activated 14 days before launch).

POST INSTALLATION CHECKOUT:

TBS

LAUNCH PAD REQUIREMENTS:

Launch pad installation of potato capsule. Servicing of O_2 and distilled water.

Table XIV. (Cont.)

EXPERIMENT TITLE: X-Ray Astronomy

EXPERIMENT NO. S027

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION: MSFC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Bench check prior to installation at MSFC

POST INSTALLATION CHECKOUT:

Functional checkout of sensors and detectors

LAUNCH PAD REQUIREMENTS:

Calibration of detectors

Table XIV. (Cont.)

EXPERIMENT TITLE:

UV Horizon Photography

EXPERIMENT NO.

S063

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 3

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Bench check experiment system

POST INSTALLATION CHECKOUT:

None

LAUNCH PAD REQUIREMENTS:

Film kept refrigerated while on ground

6.4 Flight AAP 4 Experiments - The experiments for flight 4 are located on three carriers at lift-off: The ATM/Rack, the LM, and the IU.

The following experiments are carried on the ATM/Rack:

S054	- X-ray spectrographic telescope
S055A	- U.V. spectrometer
S056	- X-ray telescope
S055B	- U.V. spectroheliometer
S055C	- H. Telescope
S053A	- U.V. coronal spectroheliograph
S052	- White light coronagraph
S053B	- U.V. spectrograph
S020	- U.V. X-ray solar photography

The IU will carry two experiments:

T022	- Heat pipe
M423	- Hydrostatic gas bearing

One experiment, D012 AMU, will be carried on the LM A/S (external mount).

The primary objective of Flight 4 is solar astronomy. Secondary objectives are to evaluate the use of the AMU and to perform some technology evaluations.

Flight 4 experiment test requirements are described on individual experiment sheets. These requirements are summarized on Table XV.

6.4.1 Flight AAP 4 Experiment Test Requirement Sheets - Table XVI contains test description sheets for Flight 4 experiments.

Table **XV.** Flight AAP 4 Experiment Test **Requirement Summary**

Experiment Number	Pre-Delivery Acceptance	Pre-Installation Bench Check	Post-Installation Alignment	Post-Installation Functional C/O	Operating During Mission Sim.	LP Functional C/O	LP Servicing Required	LP Housekeeping Monitor
S054	X	X	X		X		X	
S055A	X	X	X		X		X	
S056	X	X	X		X		X	
S055C	X	X	X		X		X	
S053A	X	X	X		X		X	
S052	X	X	X		X		X	
S053B	X	X	X		X		X	
D012	X	X					X	X
T022	X	X		X				
M423	X	X		X		X	X	X

Table XVI. Flight AAP 4 Experiment Test Requirement Sheets

EXPERIMENT TITLE: EXPERIMENT NO.

X-ray Telescope S054

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Alignment tolerances are critical and the instruments should not be subjected to sudden forces. All optics should be protected. Radiation sources are kept at a minimum so as not to expose the camera film. Temperature of instruments is controlled at all times.

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: The X-ray telescope camera is functionally operated. A solar simulator is used as a stimulus to the flame detector and camera assembly. All controls are activated and all modes of operation performed. All display signals are verified.

POST INSTALLATION CHECKOUT: Boresighting alignment of the X-ray telescope camera is performed. Before electrically mating the instrument to the ATM Rack, interfaces are verified. After electrical mating, power is applied and camera functionally operated. All controls and displays are verified.

LAUNCH PAD REQUIREMENTS: Before film is installed, the system is turned on and the Display and Control Panel on the LM A/S is observed for normal operation. The system is turned off and film is installed in the camera.

Table XVI. (Cont.)

EXPERIMENT TITLE: Ultraviolet Spectrometers

EXPERIMENT NO. S055A

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Same as S054

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: A solar simulator is used as a stimulus. The system is functionally operated by the proper controls and all displays monitored. The signal output of the photodetectors are also monitored.

POST INSTALLATION CHECKOUT: Boresighting alignment of the ultraviolet spectrometer is performed. Electrical interfaces are verified before mating the instruments to the ATM Rack. After electrical mating, power is applied and the ultraviolet spectrometer functionally operated. All controls are activated and displays monitored.

LAUNCH PAD REQUIREMENTS: The system is turned on and the Display and Control Panel of the LM A/S observed for normal operation.

Table XVI. (Cont.)

EXPERIMENT TITLE: X-ray Telescope

EXPERIMENT NO. S056

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Same as S054

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: A solar simulator is used as a stimulus. The system is functionally operated by the proper controls and all displays monitored. The signal outputs from the two proportional counters are monitored. Both the active and quiet modes of operation are verified.

POST INSTALLATION CHECKOUT: Boresighting alignment of the X-ray telescope is performed. Electrical interfaces are verified before mating the instruments to the ATM Rack. After electrical mating, power is applied and the X-ray telescope functionally operated. All controls are activated and displays monitored. Data from the proportional counters are recorded by on-board recorders and transmitted to ground. The system is turned on and the Display and Control Panel of the LM A/S observed for normal operation. The system is turned off at the completion of system verification and film installed in the camera.

Table XVI. (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
Ultraviolet Spectroheliometer	S055B

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Same as S055A

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Same as S055A

POST INSTALLATION CHECKOUT:

Same as S055A

LAUNCH PAD REQUIREMENTS:

Same as S055A

Table XVI. (Cont.)

EXPERIMENT TITLE: H. Telescope

EXPERIMENT NO. S055C

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS:

Same as S055A

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT:

Same as S055A

POST INSTALLATION CHECKOUT:

Same as S055A

LAUNCH PAD REQUIREMENTS:

Same as S055A

Table XVI. (Cont.)

EXPERIMENT TITLE: U.V. Coronal Spectroheliograph

EXPERIMENT NO. S053A

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Camera operation is verified. Cable check of LM/ATM/experiment interface is performed to verify correct wiring of command functions.

POST INSTALLATION CHECKOUT: Perform alignment verification of the optical system. Verify scan mode on the g-rating, thermal control interface, and camera operation on internal power. Load film.

LAUNCH PAD REQUIREMENTS: Temperature control for the experiment is required to keep the experiment between 70° and 80°F.

Table XVI. (Cont.)

EXPERIMENT TITLE:	EXPERIMENT NO.
White Light Coronagraph	S052

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Perform alignment of camera optics so that the image forms on the plane of the film.

POST INSTALLATION CHECKOUT: Alignment of experiment to the carrier. Verify thermal control interface. Functional checkout of the experiment on carrier power. Load film.

LAUNCH PAD REQUIREMENTS: None

Table XVI. (Cont.)

EXPERIMENT TITLE: U.V. Spectrograph

EXPERIMENT NO. S053B

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Alignment of the camera optics. Verify operation of the camera's grating mechanism.

POST INSTALLATION CHECKOUT: Perform alignment of experiment with the LM rack. Verify thermal interface with the carrier. Verify operation of experiment on internal power and load film.

LAUNCH PAD REQUIREMENTS: None

Table XVI. (Cont.)

EXPERIMENT TITLE: AMU (Astronaut Maneuvering Unit)

EXPERIMENT NO. D012

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Pre-delivery acceptance test at contractor facility. Full functional checkout at KSC prior to installation. Additional definition to be supplied.

POST INSTALLATION CHECKOUT: No post-installation checkout requirements.

LAUNCH PAD REQUIREMENTS: H_2, O_2 and N_2 servicing at the launch pad. Housekeeping monitoring of pressures and temperatures required after servicing.

Table XVI. (Cont.)

EXPERIMENT TITLE: EXPERIMENT NO.

U.V. X-ray Solar Photography S020

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: Storage temperature must be less than 50°F

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Bench check the U.V. X-ray camera. Verify experiment/ATM/Rack interfaces prior to installation. Load film.

POST INSTALLATION CHECKOUT: Checkout of TM-ground station compatibility.

LAUNCH PAD REQUIREMENTS: None

Table XVI. (Cont.)

EXPERIMENT TITLE: Heat Pipe

EXPERIMENT NO. T022

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Functional checkout of heater and thermocouple operation.

POST INSTALLATION CHECKOUT: None

LAUNCH PAD REQUIREMENTS: Verify TM/ground station compatibility. This includes data reception by the ground station as well as experiment control from the ground station.

Table XVI. (Cont.)

EXPERIMENT TITLE: Hydrostatic Gas Bearing

EXPERIMENT NO. M423

INSTALLATION INFORMATION

FLIGHT ASSIGNMENTS: AAP 4

POINT OF INSTALLATION: KSC

INSTALLATION CONSTRAINTS: None

CHECKOUT & SERVICE REQUIREMENTS

PRE-INSTALLATION CHECKOUT: Bench checks of AB5 gyro system

POST INSTALLATION CHECKOUT: Functional checkout of high-low inlet pressure switch. Checkout of gyro system operation. Verification of tape recorder dump and ground station compatibility.

LAUNCH PAD REQUIREMENTS: Prelaunch checkout, a post-installation checkout may be part of pad operation.

7. ATM/RACK POINTING CONTROL SYSTEM CHECKOUT

This section describes the recommended checkout of the Pointing Control System at MSFC. The checkout described is based on the most economic method of testing to prove system reliability. The best method of testing the PCS system is by means of a rate table and a special purpose computer to simulate the ATM/Rack and/or the Cluster Inertia and Dynamic Properties. In this method, a closed-loop test can be performed for both the fine and vernier modes, thus providing a complete system test where the response of both modes can be monitored. The approach taken in this section is to provide an alternative method of testing that is much less expensive and able to provide information necessary to determine system reliability.

The Fine System is tested in an open-loop check which essentially consists of volts input, versus torque output measurements of the servo loop. These characteristics will be checked against theoretical characteristics to determine response of the system.

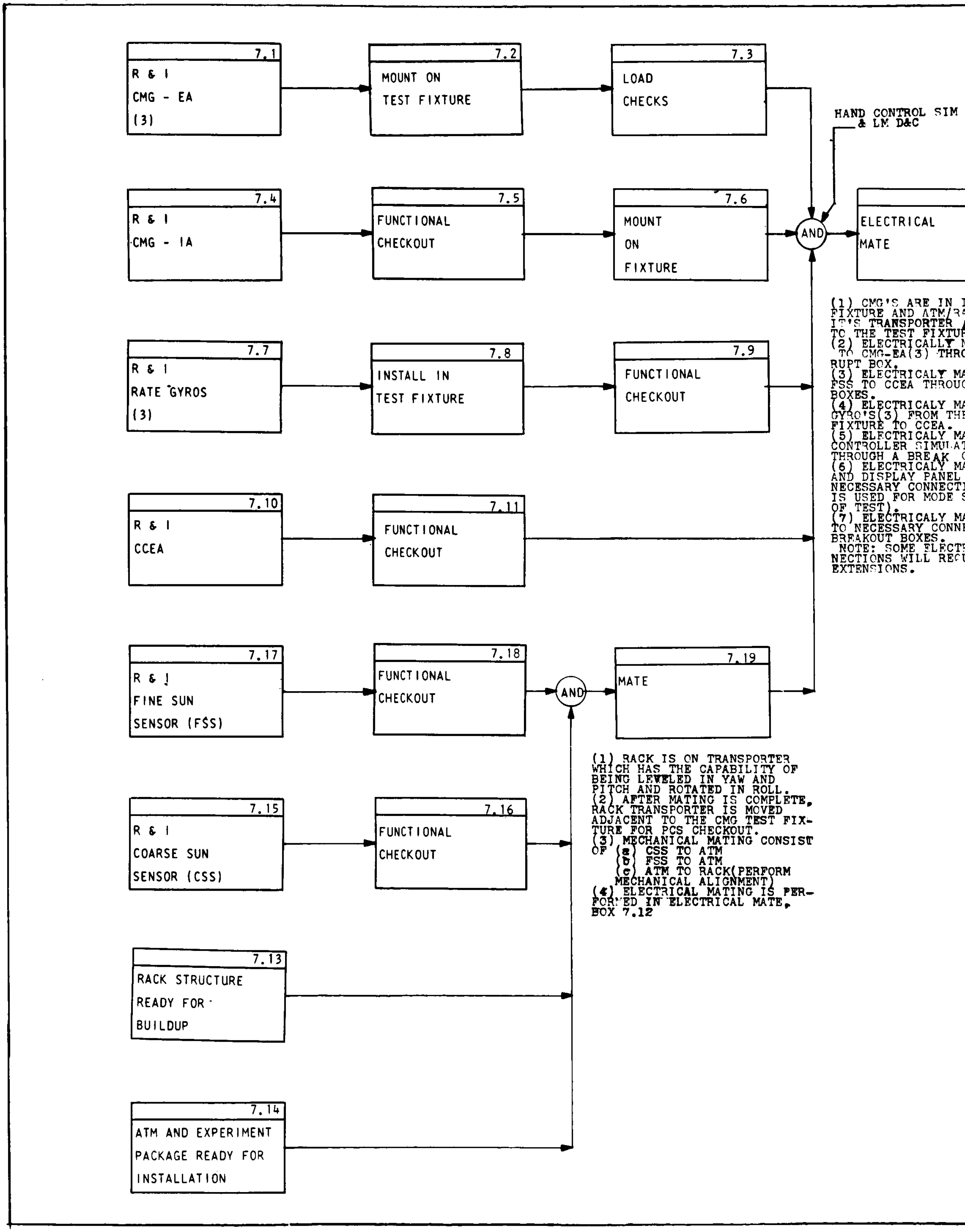
The vernier system is tested in a closed-loop configuration. System response is evaluated by monitoring on analog recorders, the inputs and outputs of the vernier servo loops.

7.1 Test Description - A detailed test flow diagram of the ATM/Rack PCS functional checkout is shown in figure 10. The following test requirements are based on the flow diagram.

The control moment gyros (CMGs) are received at the PIF. Following inspection, the CMGs are installed in the CMG test fixture. (Test fixture requirements are described in 7.1.3). Critical circuit load checks are performed before applying power.

The CMG inverters, after passing thru receiving and inspection, are subjected to a functional checkout. Following voltage and phasing measurements, the inverters are mounted in a location accessible to the CMG fixture.

The rate gyros pass through receiving and inspection and are installed on a test fixture. The rate gyros are calibrated by exposing them to various components on earth's rate. This is accomplished by changing the aximuth of the test fixture on which the rate gyros are mounted.


7.1
R & I
CMG - EA
(3)
7.2
MOUNT ON
TEST FIXTURE
7.3
LOAD
CHECKS
HAND CONTROL SIM
& LM D&C
7.4
R & I
CMG - IA
7.5
FUNCTIONAL
CHECKOUT
7.6
MOUNT
ON
FIXTURE
AND
ELECTRICAL
MATE
(1) CMG'S ARE IN
FIXTURE AND
IT'S TRANSPORTER
TO THE TEST
(2) ELECTRICALLY
TO CMG-EA(3)
RUPT BOX.
(3) ELECTRICALY
FSS TO CCEA
BOXES.
(4) ELECTRICALY
GYRO'S(3) FROM
FIXTURE TO CCEA.
(5) ELECTRICALY
CONTROLLER
THROUGH A BREAK
(6) ELECTRICALY
AND DISPLAY PANEL
NECESSARY
IS USED FOR MODE
OF TEST).
(7) ELECTRICALY
TO NECESSARY
BREAKOUT BOXES.
NOTE: SOME
NECTIONS WILL
EXTENSIONS.
7.7
R & I
RATE GYROS
(3)
7.8
INSTALL IN
TEST FIXTURE
7.9
FUNCTIONAL
CHECKOUT
7.10
R & I
CCEA
7.11
FUNCTIONAL
CHECKOUT
7.17
R & I
FINE SUN
SENSOR (FSS)
7.18
FUNCTIONAL
CHECKOUT
AND
7.19
MATE
(1) RACK IS ON TRANSPORTER
WHICH HAS THE CAPABILITY OF
BEING LEVELED IN YAW AND
PITCH AND ROTATED IN ROLL.
(2) AFTER MATING IS COMPLETE,
RACK TRANSPORTER IS MOVED
ADJACENT TO THE CMG TEST FIX-
TURE FOR PCS CHECKOUT.
(3) MECHANICAL MATING CONSIST
OF (a) CSS TO ATM
(b) FSS TO ATM
(c) ATM TO RACK(PERFORM
MECHANICAL ALIGNMENT)
(4) ELECTRICAL MATING IS PER-
FORMED IN ELECTRICAL MATE,
BOX 7.12
7.15
R & I
COARSE SUN
SENSOR (CSS)
7.16
FUNCTIONAL
CHECKOUT
7.13
RACK STRUCTURE
READY FOR
BUILDUP
7.14
ATM AND EXPERIMENT
PACKAGE READY FOR
INSTALLATION

7.12

T'S TEST
CK IS ON
DJACENT
E.
ATE CCEA
JGH INTER-

TE CSS AND
H INTERRUPT

TE RATE
IR TEST

TE HAND
OR TC CCEA
JT BOX.
TE CONTROL
TO THE
ONS (THIS
ELECTION

TE CMG-IA
CTIONS THRU

ICAL CON-
IRE CABLE

7.20 — VERIFY ELECTRICAL AND MECHANICAL CAGING OF CMG GIMBALS

(1) OUTER GIMBAL-0°, 45° & 90°.
(2) INNER GIMBAL 0°.
(3) MONITOR & RECORD LINER RESOLVER OUTPUTS.

7.21 — VERIFY CAGING AND RSVR READOUT OF ATM & EXPER PACKAGE

(1) MONITOR RESOLVER OUTPUT.
(2) LEAVE IN CAGE POSITION.

7.22 — SERVO LOOP CALIBRATION (FINE MODE)

(I) FINE PCS ENERGIZED
 (a) CMG'S, RATE GYRO
(II) MONITOR AND RECORD
 (a) TEMPERATURE SENSORS
 (b) VIBRATION SENSORS
 (c) CMG WHEEL VOLTAGE, RPM, CURRENT AND POLARITY
 (d) RATE GYRO WHEEL VOLTAGE, RPM, CURRENT AND POLARITY.
 (e) TELEMETRY CHECKS
 (f) 4.8 KC EXCITATION
(III)
 (1) KNOWN RATE IS APPLIED TO RATE GYROS.
 (2) READOUT CMG TORQUES ON TEST FIXTURE.
 (3) MONITOR INPUT VOLTAGE TO CMG-EA
 (4) COMPARE INPUT VOLTAGE TO CMG-EA VS TORQUE OUTPUT TO SUPPLIED CALBRIATION CURVES.
(IV)
 (1) APPLY HAND CONTROL VOLTAGE IN CONJUNCTION TO RATE GYROS.
 (2) SAME AS SECTION III-2, 3 & 4. (NOTE: THIS WILL VERIFY SUMMING NETWORK IN THE CCEA).

7.23 — MOUNT RATE GYROS ON ATM/RACK

(1) REMOVE RATE GYROS FROM THEIR TEST FIXTURE
(2) MOUNT YAW AND PITCH RATE GYROS ON ATM PACKAGE AND ROLL RATE GYRO ON THE RACK
(3) PERFORM MECHANICAL ALIGNMENT
(4) PERFORM ELECTRICAL CONNECTIONS

7.24 — APPLY STIMULUS TO COARSE SUN SENSORS

(1) MEASURE CMG-EA VOLTAGE INPUT AT BREAKOUT BOX
(2) READOUT CMG-EA TORQUE ON TEST FIXTURE
(3) COMPARE INPUT VOLTAGE TO CMG-EA VS. TORQUE OUTPUT TO SUPPLIED CALIBRATION CURVES.
(4) CCEA INPUT VOLTAGE VS. CMG-EA INPUT VOLTAGE IS ALSO COMPARED TO SUPPLIED CALIBRATION CURVES.

7.25 — ENERGIZE YAW RATE GYROS

(1) MONITOR YAW RATE GYRO PARAMETERS
(2) POSITION RACK UNTIL YAW RATE GYRO SEES NO EARTH RATE (RACK IS ON TRANSPORTER THAT HAS YAW AND PITCH LEVELING AND ROTATIONAL FREEDOM IN ROLL)
(3) UNCAGE ATM AND EXPERIMENT PACKAGE IN YAW.

7.26 — VERIFY YAW VERNIER SYSTEM LOOP RESPONSE

I (1) APPLY STIMULUS TO FINE SUN SENSOR
 (2) RECORD INPUT VOLTAGE TO YAW CHANNEL SUMMER ON ANALOG RECORDER (TAP OFF VOLTAGE AT BREAKOUT BOX.)
 (3) RECORD OUTPUT VOLTAGE ON ANALOG RECORDER (TAP OFF VOLTAGE ON OUTPUT RESOLVER)
 (4) VERIFY SYSTEM RESPONSES
II (1) APPLY YAW HAND CONTROL INPUT.
 (2) REPEAT STEPS 2,3, and 4
 (3) CAGE ATM AND EXPERIMENT PACKAGE IN YAW
 (4) RUN-DOWN YAW RATE GYRO

7.27 — ENERGIZE PITCH RATE GYRO

REPEAT STEP 7.25 FOR PITCH RATE GYRO

7.28 — VERIFY PITCH VERNIER SYSTEM LOOP RESPONSES

REPEAT STEP 7.26 FOR PITCH VERNIER SYSTEM LOOP.

7.29 — VERIFY ROLL VERNIER SYSTEM LOOP RESPONSES

(1) APPLY INPUT SIMULUS WITH HAND CONTROL TO ROLL ATM DRIVE LOOP
(2) UNCAGE ATM IN-ROLL
(3) RECORD INPUT VOLTAGE TO ROLL CHANNEL SUMMER (TAP OFF BREAKOUT BOX) ON ANALOG RECORDER.
(4) RECORD OUTPUT VOLTAGE OF ROLL VERNIER SYSTEM ON ANALOG RECORDER (TAP OFF VOLTAGE ON OUTPUT RESOLVER)
(5) VERIFY SYSTEM RESPONSES
(6) CAGE ATM AND EXPERIMENT PACKAGE IN ROLL

7.30 — INSTALL ALL PCS HARDWARE ON ATM/RACK

(1) REVERIFY SYSTEM AFTER INSTALLATION

7.31 — REFER TO SEC 5.0 FOR REMAINDER OF AAP 4 PIF FLOW

PIF CHECKOUT FLOW FOR THE PCS

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Figure IC. PIF Checkout Flow For PCS

2 1 3

The Command Control Electronic Assembly (CCEA) passes through receiving and inspection and is subjected to a functional checkout.

Both the coarse sun sensor (CSS) and fine sun sensor (FSS) are subjected to a functional checkout following receiving and inspection. The sensors are installed on the ATM. The ATM is then installed in the Rack.

The Rack is positioned on its test fixture adjacent to the CMG test fixture. All interconnecting cables are connected between the pointing control system (PCS) and the carrier with interrupt boxes installed in the following cables:

a. CCEA to CMG-EA

b. CSS to CCEA

c. FSS to CCEA

d. LM Hand-control simulator to CCEA

e. CMG inverter to CMG

ATM/Rack caging commands are initiated and caging is verified by observing the ATM pivot resolver outputs. The pivot remains in the caged position for the fine mode checkout.

The electrical and mechanical CMG caging modes are verified. The inner gimbals are caged at zero degrees. Verification of the outer gimbal caging at 0, 45, and 90 degrees is performed. The outer gimbals are returned to the zero-degree caged position before applying wheel power.

7.1.1 Fine Mode Checkout - The ATM/Rack is needed in this mode to allow for a phasing check of the roll telescope resolver. A mode select simulator is connected so that the various PCS modes of operation can be verified.

The CMG, rate gyros, and PCS fine mode electronics are energized. During CMG and rate gyro run-up, voltage, current, and RPM readings are monitored. Vibration and temperature measurements are monitored during the PCS operations. The rate gyros are on the test fixture and positioned so that a known component of earth's rate is felt. A voltmeter is inserted into the interrupt box to measure CMG-EA input voltages. The resulting torques on the CMG test fixture are recorded. The rate gyros are positioned for different earth rate inputs and the CMG-EA input voltages and torque outputs are recorded. The resulting calibration data is compared to the theoretical data.

In addition to the constant rate gyro input, voltage is applied via the hand control circuit. A calibration curve is obtained by varying the hand-control setting, recording the CMG-EA input voltage, and the torque outputs on the test fixture. The rate gyro are repositioned to sense a different component of earth's rate and the hand-control setting is once again varied. The CMG input voltages and torque outputs are recorded.

The preceding test is used to obtain a calibration curve as well as to verify the CCEA summing network. The rate gyros are de-energized and removed from their test fixture. The roll rate gyro is mounted on the Rack, and the pitch and yaw rate gyros are mounted on the ATM.

7.1.2 Vernier Mode Checkout - The mode select simulator is used to select the vernier mode. Then a simulated input is applied to the CSS. The CSS output, the CMG-EA input, and the CMG test fixture torques are measured and recorded. The CSS input stimulus is varied to obtain a different CSS output. The output, input, and torque are remeasured and recorded again to obtain the calibration data. The CSS is de-energized, and the CMGs are caged and de-energized.

7.1.2.1 Yaw - The shorting bar is removed from the FSS interrupt box to disable the pitch loop. The yaw rate gyro is energized, and voltage, current, and RPM, are monitored.

The Rack is positioned by turning the Rack test fixture until the yaw rate gyro is insensitive to earth's rate. The ATM gimbal is uncaged and an input stimulus is applied to the FSS in yaw.

An analog recorder is used to record the voltage output from the FSS, the yaw rate gyro and the ATM pivot resolver. The voltages from the application of the stimulus to the resulting steady-state condition are recorded and evaluated for loop response.

The fine sun sensor stimulus is removed. The input to the telescope resolver loop in yaw is applied from the hand-control simulator as an impulse function. The loop response is checked using the same approach as before, where instead of recording the FSS output, the impulse function from the hand control simulator is recorded. The ATM gimbal is caged.

7.1.2.2 Pitch - For vernier pitch loop checkout, 7.1.2.1 is repeated. Then, the rate gyros are de-energized.

7.1.2.3 Roll - The ATM pivot is uncaged. An impulse function is applied from the hand-control simulator to roll channel summing network. The impulse function, and the resolver output are recorded for loop response evaluation. The ATM gimbal is caged and the PCS system is de-energized.

7.1.3 Test Fixture Requirements - The test fixture requirements necessary to perform the preceding tests are as follows:

7.1.3.1 CMG Test Fixture

a. Surfaces capable of mounting three CMGs in an orthognal configuration.

b. Test fixture capable of measuring torques about the outer gimbals of the three CMGs.

7.1.3.2 Rate Gyro Test Fixture

a. Surfaces capable of mounting three rate gyros so that their input axes are parallel.

b. Test fixture capable of positioning rate gyros to allow sensing of earth's rate components, or complete freedom from sensing of earth's rate.

7.1.3.3 ATM/Rack Test Fixture

a. Test fixture capable of transporting ATM/Rack.

b. Test fixture having leveling capability.

c. Test fixture having rotational freedom in roll

7.1.4 PIF Checkout Flow for ATM/Rack Pointing Control System - The flow diagram (figure 10) shows the recommended MSFC checkout sequence for the ATM/Rack pointing control system.