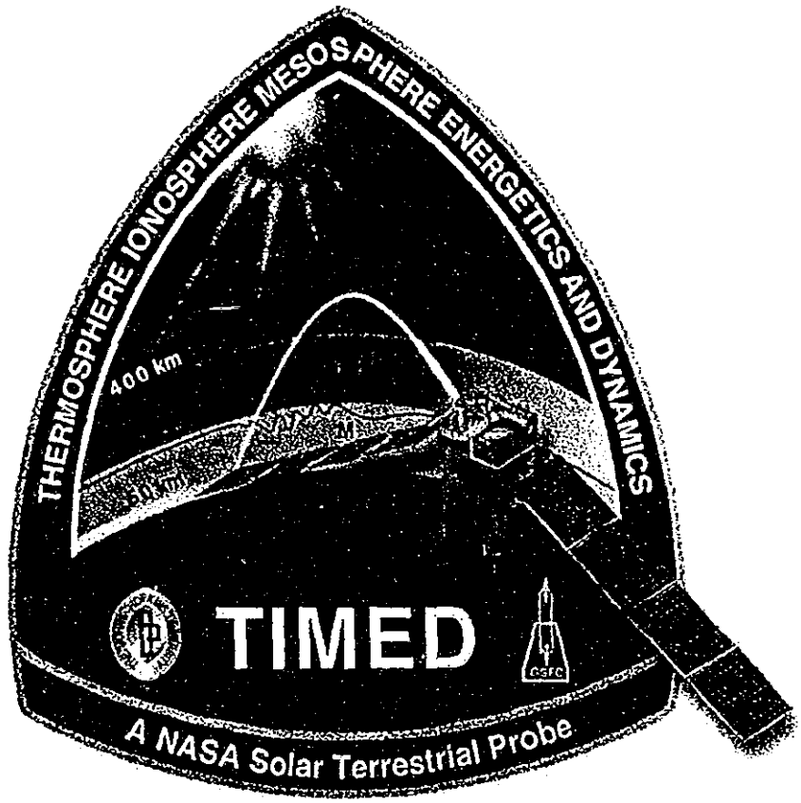
TIMED

THERMOSPHERE • IONOSPHERE • MESOSPHERE
• ENERGETICS • DYNAMICS



LAUNCH SITE TEST PLAN
(REV 00)

JHUAPL 7363-9054

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Prepared by:
The Johns Hopkins University
Applied Physics Laboratory

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1.0 INTRODUCTION

1.1 SCOPE

This Launch Site Test Plan (LSTP) outlines the Thermosphere, Ionosphere, Mesosphere - Energetics and Dynamics (TIMED) pre-launch activities at Vandenberg Air Force Base (VAFB). This document is written to show the overall test flow from the receipt of the spacecraft and ground support equipment (GSE) at VAFB through launch, and the return of the GSE to the Johns Hopkins University Applied Physics Laboratory (JHU/APL).

The TIMED operations will be conducted at two major sites. The primary sites are the Spaceport System International (SSI) Integrated Processing Facility (IPF) and the Space Launch Complex (SLC-2W). The spacecraft will be processed at the IPF, and the launch operations will be conducted at SLC-2W. The entire TIMED processing and launch activity schedule is to be completed approximately 6-8 weeks after arrival at VAFB.

The referenced test procedures and plans contained in the beginning of this document cover in detail the electrical, mechanical and safety controls at the processing and launch facilities.

All figures in this document are the latest version at the time this plan was prepared; updated versions of the drawings, if any, may be obtained from the TIMED APL Program Office.

1.2 TIMED SYSTEM OVERVIEW

TIMED is the first science mission in the Solar Connections Program as detailed in NASA's Strategic Plan. APL manages the TIMED project for NASA. TIMED will launch on a Delta II 7920 Medium Expendable Launch Vehicle (MELV), co-manifested with the Jason (TOPEX-Poseidon Follow-On) spacecraft.

The TIMED spacecraft serves as a platform for four instruments that measure the basic state parameters and energy balance of the Mesosphere, Lower Thermosphere, and Ionosphere (MLTI) region of the atmosphere; focusing on the region from 60-180 km in altitude. The TIMED orbit of 625 km altitude (circular) and 74.1 degree inclination provides the four TIMED instruments with global coverage and allows the orbit plane to precess such that measurements can be made of the MLTI region over all temporal zones (times of day). The rate of precession is selected to provide an integral number of precessions over a year so that the second year of measurements roughly parallels the measurements taken in the first year; this helps separate seasonal variations from other effects. The instruments consist of the following:

- GUVI - The Global Ultraviolet Imager (GUVI) is a nadir pointed instrument located within the payload attach fitting which scans between horizons with a limb overscan on the +Y side of the spacecraft. GUVI helps understand the disposition of energy into this region from the UV wavelengths of sunlight and particle precipitation into the polar auroral zone.
- TIDI - The TIMED Doppler Interferometer (TIDI) gathers light using four telescopes pointing +/- 45 degrees from the velocity vector of the spacecraft. Each telescope scans in

one axis to view from the earth's limb to the upper atmosphere. TIDI measures the wind velocities in this region.

- SABER - The Sounding of the Atmosphere using Broadband Emission Radiometry (SABER) instrument looks at the limb perpendicular to the TIMED spacecraft orbit plane on the cold side of the spacecraft. The instrument measures infrared emissions which are used to infer temperatures, pressures, and density of various atmospheric constituents.
- SEE - The Solar Extreme-Ultraviolet Experiment (SEE) which views perpendicular to the orbit plane on the sunward side and which can move in elevation to view the sun at any elevation from the limb to directly overhead. The instrument helps characterize the most variable component of the sun's energy as a measure of energy input into this critical part of the earth's atmosphere.

TIMED will be initially integrated at APL, environmentally qualified at the Goddard Space Flight Center (GSFC), and launched from VAFB. Figure 1.2-1 shows the in-orbit configuration and Figure 1.2-2 is a block diagram of the spacecraft and subsystem components. Figure 1.2-3 shows the Delta II 7920 launch vehicle (LV) with fairing deployed to show the TIMED and JASON spacecraft and vehicle second stage. Launch is scheduled for 18 October 2000.

Figure 1.2-1: The TIMED Spacecraft

Figure 1.2-2: The TIMED System Block Diagram

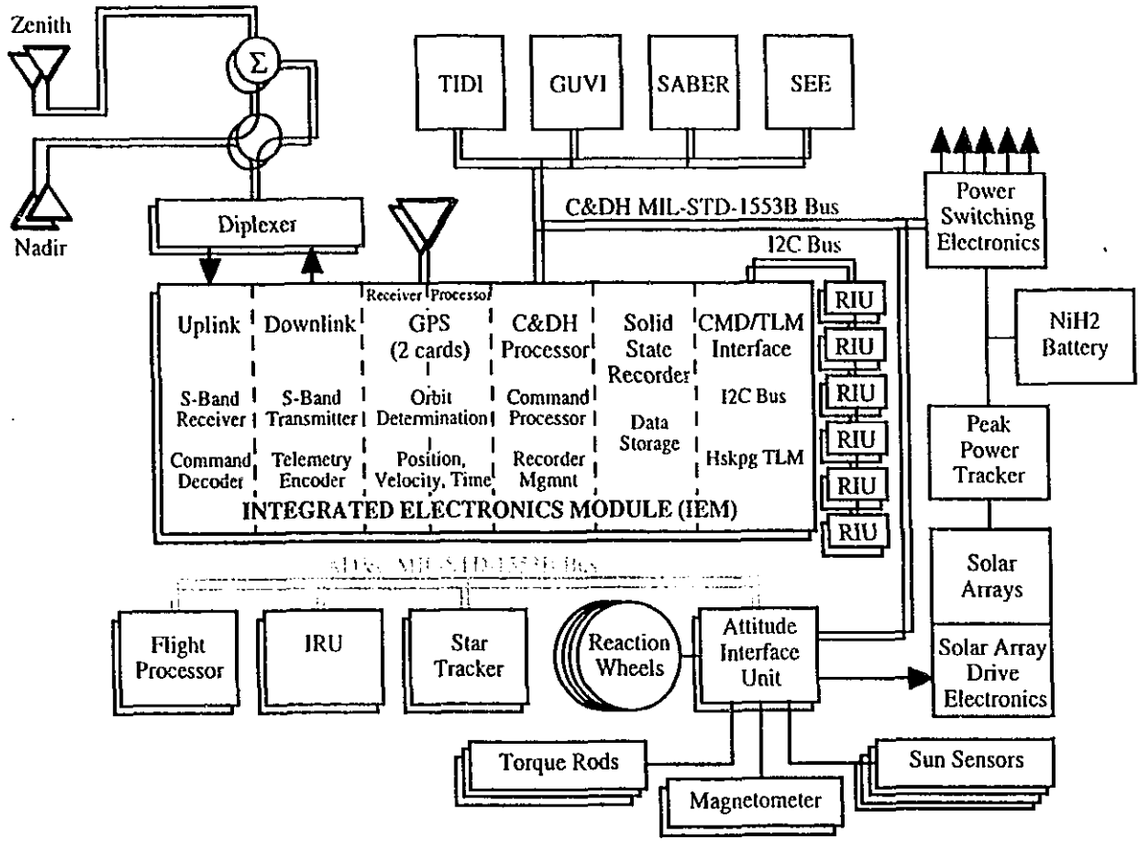
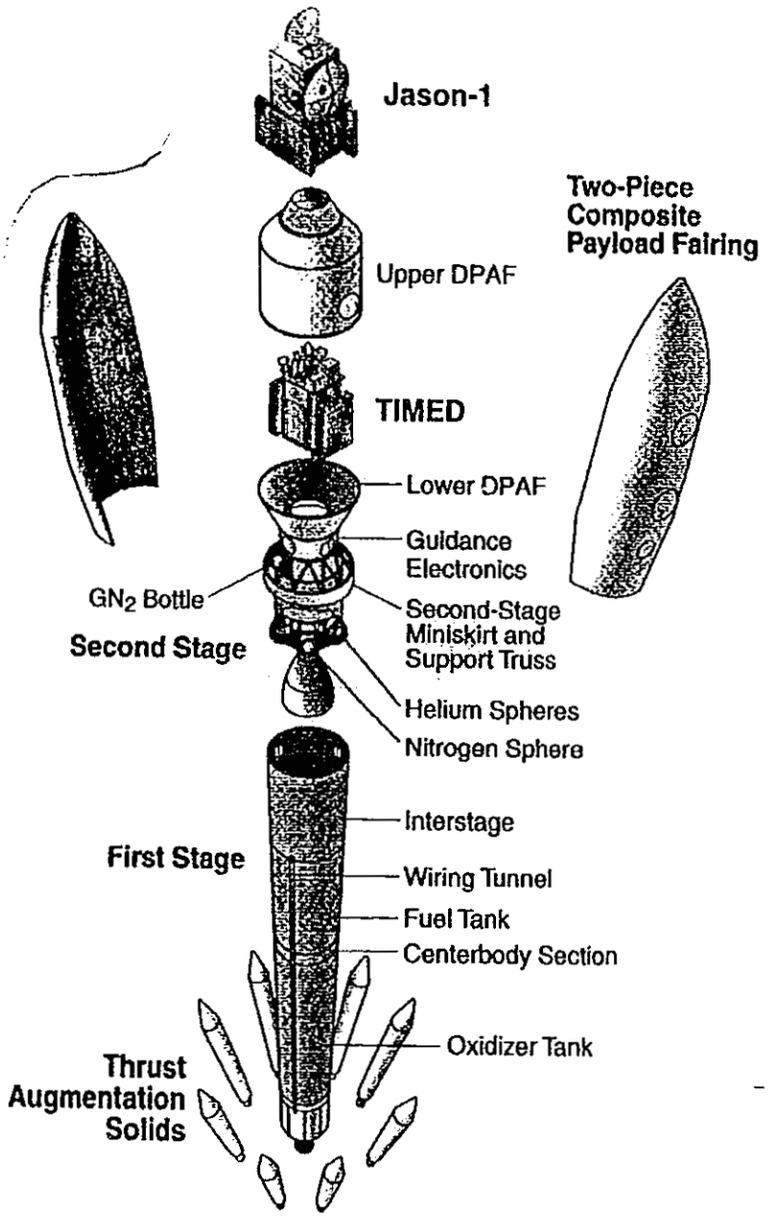


Figure 1.2-3: Spacecraft/ Launch Vehicle Configuration



1.3 AREAS OF CONCERN

The APL TIMED Program is dedicated to ensuring a safe working environment for their employees. In addition, the Program adheres to strict quality assurance practices including Electro-Static Discharge (ESD) control to ensure the safety and reliability of its flight hardware. To accomplish these goals, the Program has been assured, and expects to receive the best facilities, security, and support personnel available.

1.3.1 Safety

In addition to NASA and Boeing Safety requirements for operations at the Western Test Range, the US Air Force EWR 127-1 Range Safety Requirements apply for military airlift and all operations at VAFB. Detailed safety information is documented in the TIMED Missile System Pre-launch Safety Plan (MSPSP) 7363-9076.

APL Program Safety and QA personnel will have oversight for all operations to ensure that proper safety and contamination control procedures are strictly followed. Spacecraft subcontractors and instrument manufacturers involved in the development and testing of the spacecraft, instruments and associated hazardous subsystems are required to comply with the APL TIMED Program Safety Plan 7363-9065.

Tasks involving hazardous operations will be restricted to the minimum number of personnel required to perform the task. All assembly and test operations at the range, including hazardous operations, will be coordinated with NASA/KSC/SSI at Bldg. 375 (IPF) and Boeing at SLC-2W. Normally this will be accomplished through daily morning meetings. Hazardous operations at VAFB must be conducted using written procedures that have been approved by NASA and the USAF.

Notification of hazardous operations can be provided to IPF Facility Management during the daily morning meetings. Prior to the start of hazardous operations, Control Center personnel will be notified with at least one or more hour advance notice. The SSI/IPF Operations Manager will conduct a final review prior to the start of hazardous operations.

1.3.2 Hazardous Subsystems

Safety hazards associated with the spacecraft and its Ground Support Equipment (GSE) are as follows: pyrotechnic devices, battery, RF/EMI, lasers, high voltage, electrical GSE, ionizing radiation sources, lifting/material handling, purge, pressure system, hazardous materials and ESD. Detailed information regarding associated hazards is included in the TIMED Missile System Pre-launch Safety Package (MSPSP), and briefly summarized in Appendix E.

1.3.3 Contamination

Strict adherence to contamination control and cleanliness are required at all times. This includes, but is not limited to, facility cleanliness, precision cleaning operations, bagging, and constant

purging of sensitive instruments with research grade nitrogen. During transport and under some special handling situations, a nitrogen dewar will accompany the spacecraft. Detailed contamination control requirements are documented in TIMED Contamination Control Plan 7363-9031.

1.3.4 Security

The spacecraft will be processed in SSI IPF where access will be controlled by a key card access system. When located at SLC-2W, the normal gate controlled security access will be sufficient. Proper badging will be displayed at all times.

1.3.5 Quality Assurance

APL inspection and quality assurance will be performed during all phases of spacecraft processing and operations in accordance with the applicable documents (TIMED Product Assurance Implementation Plan, 7363-9028).

1.4 APPLICABLE DOCUMENTATION

The documents listed in this section form a baseline set of organizational interface, safety, mechanical operations, handling, and contamination control references for the TIMED program.

Org	Doc No.	Title
JHUAPL	7363-9001	TIMED Requirements Document
JHUAPL	7363-9XXX	Mission Operations Readiness Demonstration
JHUAPL	7363-9028	TIMED Product Assurance Implementation Plan
JHUAPL	7363-9030	TIMED Launch Vehicle Interface Document
JHUAPL	7363-9031	TIMED Spacecraft Contamination Control Procedure
JHUAPL	7363-9034	TIMED Spacecraft Optical Alignment Procedure
JHUAPL	7363-9039	Mechanical Integration and Removal of the Solar Arrays
JHUAPL	7363-9040	Shipping Container Handling Procedure
JHUAPL	7363-9052	TIMED Spacecraft Mechanical Handling Procedure
JHUAPL	7363-9053	GSS Setup and Validation Procedures
JHUAPL	7363-9055	Launch Countdown Procedure
JHUAPL	7363-9065	TIMED Program Safety Plan
JHUAPL	7363-9066	Prelim TIMED Missile System Prelaunch Safety Plan (MSPSP)
JHUAPL	7363-9076	Final TIMED Missile System Prelaunch Safety Plan (MSPSP)
JHUAPL	7363-9087	TIMED Spacecraft System Functional Test Procedure
JHUAPL	7363-9088	TIMED Spacecraft System Performance Test Procedure
JHUAPL	7363-9089	TIMED Battery Handling Plan and Procedure
JHUAPL	7363-9091	Instrument Cover Pyrotechnic Checkout Procedure
JHUAPL	7363-9092	Ordnance Installation Procedure
JHUAPL	7363-9319	TIMED Purge System Operation Procedure
JHUAPL	7363-9320	TIMED Transportation Plan
JHUAPL	7363-9321	Mission Operations Readiness Demonstration (MORD)
JHUAPL	7363-9329	TIMED Tailored EWR-127-1
JHUAPL	7363-9390	TIMED Mechanical Handling Procedures at VAFB
KSC	N/A	TIMED Launch Site Support Plan (LSSP)
KSC	PRD EOD75	Program Requirements Document
SSI	K-STSM-141.7	SSI Payload Services Handbook (PSH) for IPF
30 SPW	N/A	Western Test Range Users Handbook (January 1987) VAFB
Boeing	MDC 98H0011	TIMED Mission Specification (February 1999)

1.5 POINTS OF CONTACT

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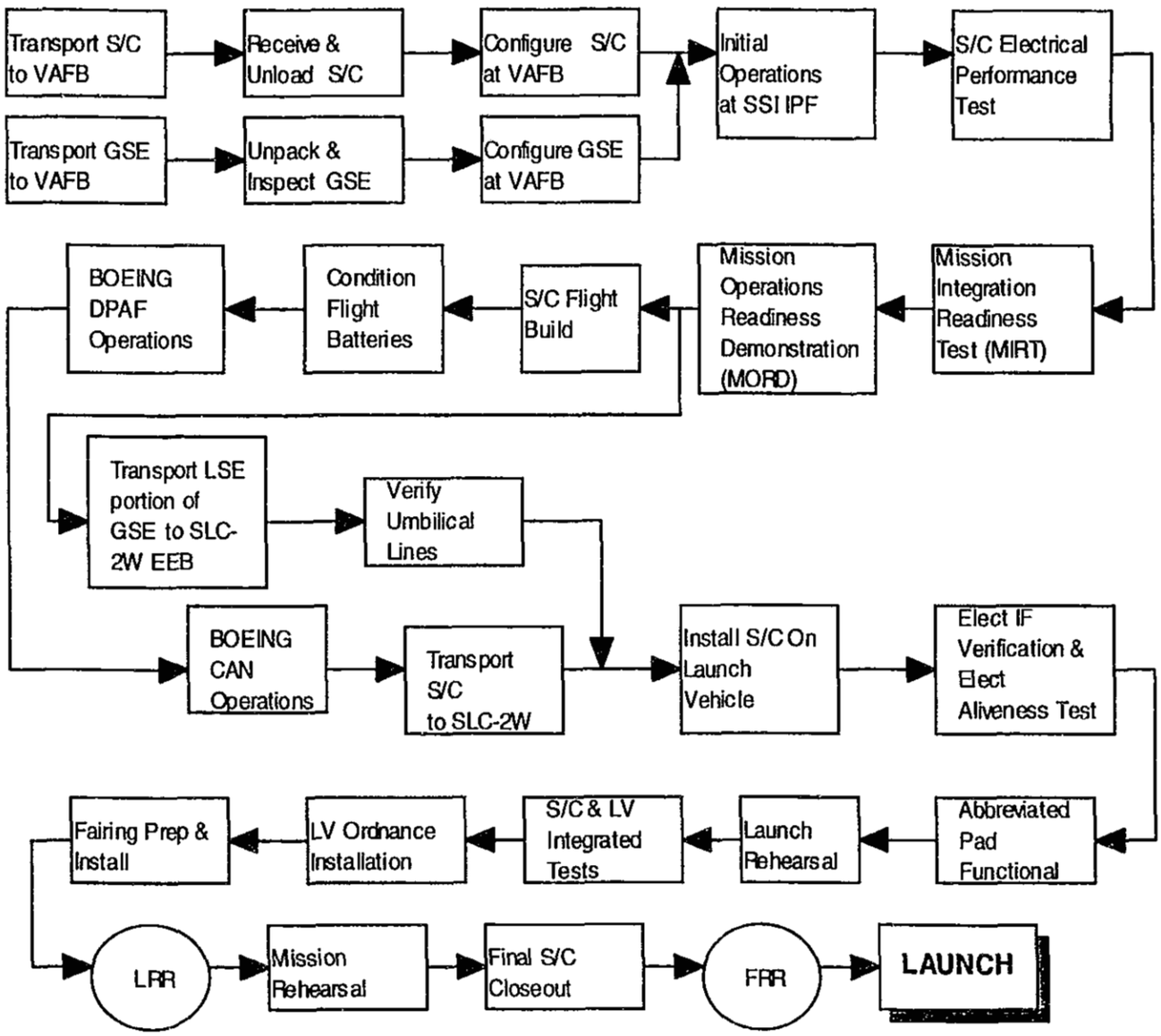
2.0 *TEST AND OPERATIONS*

2.1 LAUNCH PROCESSING FLOW/SCHEDULE

The TIMED schedule is the basis for the APL prepared work schedules. This schedule is shown in Appendix A in a test processing flow format. The major tasks to be accomplished at the launch site from arrival at Bldg. 375 (SSI IPF) through post-launch GSE return shipment and facility closeout are identified below in the top-level flow plan (Figure 2.1-1).

Figure 2.1-1: TIMED Test Flow and Activities



2.2 WORK SCHEDULE

APL is responsible for formatting, preparing and maintaining weekly schedules to define APL activities at the VAFB. The schedules shall define both stand-alone and integrated activities for the current day and the planned activities for the following two weeks. The schedule shall have a time span resolution of one 8-hour shift. APL shall provide schedule inputs (updated daily) to the IPF manager for TIMED activities performed at the IPF. APL will coordinate operations with the IPF manager.

APL shall provide schedule inputs (updated daily) to KSC/Boeing for transportation of GSE to the SLC-2W Electrical Equipment Building (EEB), for encapsulation of the S/C (Boeing Dual Payload Attach Fitting operations), and for transportation of the S/C to the SLC-2W Mobile Service Tower (MST) for mating with the Launch Vehicle (LV). Boeing is responsible for preparing integrated transportation and SLC-2W schedules utilizing TIMED inputs.

2.2.1 Schedule Data

Appendix B is an example of the TIMED weekly schedule. The format and level of content is typical.

2.2.2 Schedule Distribution

The TIMED day-to-day schedule shall be distributed to each organization present in the daily schedule/status meeting. Boeing shall distribute the integrated T-day Pad schedules to APL at the daily meetings.

2.2.3 Work Days

TIMED schedules shall be prepared based on working one 8-hour shift/day, 5 days per week. Work schedules will be expanded to 6 or 7 days/week, 12-hour shifts, 2 shifts per day and/or 8-hour shifts, 3 shifts per day to provide continuity for certain activities. These activities include but are not limited to the Pre and Post-Shipment Performance Tests, Battery Conditioning/Charging and SLC-2W operations. Activities requiring extended shifts or multi-shift operations will be coordinated with the IPF manager and/or Boeing. If the extended workday includes hazardous activities, safety concurrence shall be required.

2.2.4 Work Hour Restrictions

The TIMED program will adhere to the EWR 127-1 Requirements policy for authorized work time (see Appendix C). All critical tasks are identified so the program can support the launch team such that no critical person should have to work more than 12 hours. The planned shift is 8 hours, Monday through Friday.

2.3 MEETINGS

2.3.1 Daily Schedule/Status Meeting

Daily Schedule/Status meeting will be held to discuss near-term stand-alone and integrated APL, Boeing, and SSI IPF activities. Updated S/C work schedules will be presented at these meetings. Boeing will provide the integrated schedule for S/C encapsulation and transportation of TIMED & GSE to SLC-2W and for SLC-2W activities. Post-launch meetings will provide coordination between agencies for shipment of GSE and other support equipment from VAFB, and for facility closeout.

The purpose of the meetings is to:

- Review the previous day's activities.
- Review the schedule to assure IPF, Boeing and VAFB resource readiness.
- Discuss schedule changes.
- Integrate TIMED/JASON/IPF/Boeing activities.
- Discuss any issues or concerns, which may impact any agency.

The meeting will be held at the beginning of the workday. Additional meetings may be held as required.

2.3.2 TIMED/JASON/BOEING Integrated Meeting

A daily TIMED/JASON/Boeing Integrated Meeting will be held to discuss activities in which both the spacecraft and Boeing have involvement. Representatives from KSC, TIMED, JASON, and Boeing will attend this meeting to coordinate activities, schedules, and resources. A representative from the IPF will attend as required.

2.4 TEST CONDUCT

The TIMED support requirements at VAFB have been addressed in the LSSP, the EOD75, and the Boeing Mission Specification. Test activities will be performed in accordance with the referenced procedures.

The Mission Operations Center (MOC) at APL will be the spacecraft control center during the IPF and pad testing. Voice and Data Communication links (shown later in figures 3.2-1, 2, and 3) will be established and checked out at least 2 weeks prior to S/C and GSE arrival at VAFB.

No tests will be performed which require open RF radiation. RF hat couplers will be used during processing in the IPF. All communication between the MOC and the S/C will be via baseband and RF hat coupler.

Maintenance of the S/C from arrival at VAFB through launch will require the following activities (except for brief periods as dictated by specific operations) around-the-clock:

- Gaseous Nitrogen purge of the S/C
- Battery cooling
- Battery trickle Charge

2.4.1 Spacecraft and GSE Arrival

The TIMED spacecraft, Mechanical GSE (MGSE), Electrical GSE (EGSE), and all other support equipment (including support personnel workstations, etc) will be transported to VAFB in accordance with the APL TIMED Transportation Plan (7363-9320). Other applicable documents which cover requirements and agency responsibilities include the LSSP and the PRD (EOD75).

The GSE is expected to arrive at VAFB 3 days prior to receipt of the spacecraft. The GSE will be taken directly to Bldg 375 (SSI IPF) for unpacking, setup and checkout. The handling and checkout of the purge system upon arrival at the IPF needs to include re-charging of the purge dewars. Appendix D is a preliminary list of GSE that will be used during testing of TIMED at VAFB.

The spacecraft (S/C) will arrive at VAFB via a government provided military aircraft. The JHU/APL VAFB Coordinator will ensure that SSI and APL personnel are standing-by to assist the Air Force personnel in the off-loading of the aircraft. This person will also ensure that the badging requirements have been fulfilled so that arriving personnel will have unrestricted access to the appropriate areas of the base.

The APL lead mechanical engineer will direct and ensure that off-loading activities are in accordance with the S/C handling procedures, 7363-9390 and S/C Shipping Container handling, 7363-9040.

Photographic coverage for all loading and transportation activities will be coordinated by the TIMED Lead Mechanical Engineer with the SSI Launch Support Manager (LSM).

The spacecraft will be processed at the IPF, and when the spacecraft is relocated to SLC2W, part of the GSE will go to the SLC-2W EEB. The list of equipment to be transported to the EEB will be provided to SSI NLT 60 days prior to arrival at VAFB. The major processing flow while in the IPF, and at SLC2W was shown previously in Figure 2.1-1.

2.4.2 Integrated Processing Facility Operations

Appendix A is a detailed summary the major tasks to be performed at the SSI IPF. The first of the major tasks at the IPF is the initial receipt of the GSE and S/C. The spacecraft and GSE will be delivered to the Bldg 375 (SSI IPF) shown later in Figures 3.0-1 and 3.1-1 for processing and checkout. Handling of the S/C is detailed in the APL TIMED Mechanical Handling Procedures at VAFB (7363-9390). The S/C and MGSE will be staged through the IPF airlock, in compliance with the APL TIMED Contamination Control Plan (7363-9031). The TIMED spacecraft and mechanical ground support equipment will be located and set-up in Cell 3 of the IPF.

Before the spacecraft is placed in IPF Cell 3, the spacecraft workstand has to be secured to the Cell 3 floor. The APL lead mechanical engineer will coordinate this activity with SSI.

The EGSE will be unpacked by APL Shipping personnel, and the S/C field operations team will set up and check out the GSE in preparation for initial operations testing and to verify survival of shipment. Additional equipment and computers will be placed in the other supporting areas (such as the office area, the thermal blanket room, etc) as identified in the APL Integrated Processing Facility Requirements Document (7363-9322).

The Contamination Control Engineer will insure that the IPF is at the proper cleanliness level before removing the spacecraft from it's shipping container. A constant nitrogen purge will be maintained on the TIMED spacecraft. The APL safety and QA personnel will also insure that all proper safety and contamination control procedures are strictly followed.

After the spacecraft is installed on the workstand, a number of tasks will be initially performed in parallel, both mechanical and electrical. This includes the verifying the alignments, battery charging, GSE set-up and checkout, verifying the communication network, and performing some of the mechanical tasks.

During the S/C flight build, a solar array flood lamp test will be performed prior to the installation of the solar arrays. The area in the high bay outside the Cell #3 doors will be used for this test. After completion of the S/C flight build and before the DPAF installation activity, the flight battery will be reconditioned per the 7363-9089 TIMED Battery Handling Plan and Procedure

Following the completion of IPF operations, S/C contamination inspection and closeouts will be performed in preparation for DPAF mating activities. The TIMED spacecraft will be turned over to Boeing for weighing and DPAF operations.

After both the PAF and DPAF installations, a visual examination of the S/C antennas and an RF test will be performed as per TBS procedure.

The TIMED shipping container and all other containers and boxes will be stored in a warehouse or other designated area.

The APL Lead GSS Engineer will ensure that all communications have been established, arrange for frequency clearances when required, and interface with SSI and Boeing personnel. All interface cabling and other communications connections will be handled in accordance with the LSSP and PRD EOD75.

Photographic coverage for all loading and transportation activities will be coordinated by the TIMED Mechanical Engineer with the SSI Launch Support Manager.

2.4.3 Spacecraft and Equipment Transport to SLC-2W

Boeing personnel will transport the spacecraft to SLC-2W. This will occur on T-14 days. Appropriate security personnel, escorts, and safety personnel during this transition will be

provided. Upon spacecraft arrival at the pad, Boeing will lift the spacecraft to the MST station level 5/6. The GN2 purge will be maintained during all lifting/mating operations via APL supplied purge lines and dewar.

Prior to the transport of the spacecraft to the Pad, the Blockhouse equipment and other required GSE will be transported to the pad complex (i.e., specifically the EEB and the air conditioner building at the base of the FUT), set-up, checked out in the SLC-2W EEB, and validated for satellite operations:

During the DPAF operations, including transport to SLC-2W, the instrument purge will be provided per 7363-9031 (TIMED Contamination Control Plan) and 7363-9319 (TIMED Purge System Operation Procedure).

2.4.4 Space Launch Complex-2W Activities

Upon arrival at SLC-2W, the encapsulated satellite will be hoisted in the Boeing provided handling can and mated with the Delta II. The handling can will be disassembled and removed following satellite mate to the second stage. The satellite will be inspected for damage and contamination and cleaning will be performed as required, An electrical interface test will be performed to verify proper mating of the satellite to launch vehicle In-Flight Disconnect connections. All spacecraft functional tests on the pad will be abbreviated versions of the TIMED full functional test. The detailed flow in Appendix A covers the Pad activities through launch.

The spacecraft instruments will be under continuous nitrogen purge and serviced by a dewar containing liquid nitrogen located at the base of the FUT. An APL supplied tube assembly will connect the dewar to the spacecraft. Nitrogen purging will continue until lift-off. Cooling and trickle charging of the Flight battery will also be maintained until lift-off.

A spacecraft launch rehearsal will be performed on T-10 day. No hazardous operations will be performed during any of these tests.

Additional testing will be performed on the satellite at SLC-2W including a JASON/TIMED compatibility test (with both spacecraft powered), several abbreviated satellite health tests, and RF antenna tests of both the S-Band and GPS antennas. Health testing will be performed following battery charging to verify proper operation of the mission critical components.

During a series of vehicle critical tasks (stray voltage/no-voltage), which includes vehicle and spacecraft ordnance installation and connection prior to fairing operations, there will be no spacecraft electrical operations and limited personnel pad access during the ordnance operations.

S/C closeout operations will be performed on T-1 day including installation of the arming plugs, final spacecraft inspection, and red tag removal and accountability (in accordance with the 7363-9055).

On T-0 day, the same procedure used during the Dress Rehearsal Countdown (Launch Countdown Procedure 7363-9055) will be utilized. Limited personnel pad access will be enforced. Battery charging and nitrogen purging will continue.

The principal TIMED launch team will be on station at the MOC (at APL), SSI IPF, and the Mission Directors Center (MDC) at VAFB.

2.5 POST LAUNCH OPERATIONS

Following the successful launch, orbit insertion, and control of the TIMED Spacecraft, the TIMED GSE at VAFB will not be required to support the in-orbit checkout and testing. The GSE and all other equipment will be packed and shipped in accordance with the TIMED Transportation Plan (JHUAPL doc # 7363-9320).

2.6 CONTINGENCIES

A decision to recycle or abort can occur at any point in the launch countdown. The plan for pre-launch recycle or abort requires the capability to reverse the normal flow of activities and to proceed to a facility or configuration that will be determined in real-time.

The APL Test and Evaluation Engineer will make the decision as to what actions will be implemented with the concurrence of the APL Program Manager. Any of these contingencies may require ordnance safing, battery charging, contamination protection, green/red tag item removal/installation and/or gaseous nitrogen purge.

2.6.1 Power Outage

The IPF provides an Uninterruptible Power Supply (UPS) to all TIMED GSE in both the Test Cell #3 and the Satellite control area (room 8910). The LSE in the EEB at SLC-2W includes an UPS that powers all the launch support equipment at that location. Therefore no contingency plans have been made to preclude a loss of electrical power at either the IPF or at SLC-2W.

2.6.2 Scrub Turnaround

TIMED is turned on during launch. Air conditioning, battery trickle charging and nitrogen purging is maintained until T-0. Currently, no action appears warranted in the event of a launch scrub and turnaround.

2.6.3 Launch Termination

Launch termination may require demating from the DELTA, and returning the TIMED spacecraft to the SSI IPF (Bldg 375). Assessment by the program will determine other steps that are deemed necessary to return the payload to a flight timeline.

3.0 TEST & OPERATION SUPPORT

The TIMED operations will be conducted at 2 VAFB sites, the SSI facility on south VAFB and the NASA Spacelaunch Complex 2W (SLC-2W) located on north VAFB and operated by Boeing. These locations are denoted in Figure 3.0-1.

3.1 FACILITIES

3.1.1 SSI Integrated Processing Facility (IPF) Utilization

The SSI IPF (bldg 375) is described in the referenced Payload Services Handbook. It will provide the facilities necessary to process TIMED prior to delivery to SLC-2W.
The layout of the IPF is shown in Figure 3.1-1 and the TIMED space utilization is summarized below in Table 3.1-1.

SPACECRAFT RELATED ITEM NAME	IPF AREA
AIRLOCK	AIRLOCK
SPACECRAFT ON IT'S WORKSTAND INCLUDING EXPECTED SCAFFOLDING	IPF CELL #3
PRECISION CLEANING LABORATORY	IPF ROOM 8930
SPACECRAFT SHIPPING CONTAINER	STORAGE AREA
BATTERY AIR CONDITIONERS (2)	CELL #3
SPACECRAFT EGSE	ROOM 8910
INSTRUMENT EGSE	ROOM 8910
SPACECRAFT PURGE DEWARS AND SCALE	PASSAGEWAY
ALIGNMENT EQUIPMENT	CELL #3
SOLAR ARRAY DEPLOYMENT TEST AREA	HIGHBAY
THERMAL BLANKET PREPARATION AREA	ROOM 6902
ORDNANCE STORAGE FACILITIES	STAGING ROOM
GOWNING AND DEGOWNING AREA	DRESSING ROOM
OFFICE AREA	ROOMS 8913/8914/8915
BREAK ROOM/DINING AREA	EXISTING DINING ROOMS
CONFERENCE ROOM	CONF ROOM
WAREHOUSE STORAGE	1200 SQ FT

Table 3.1-1: TIMED IPF Space Utilization

Figure 3.0-1 VAFB Map

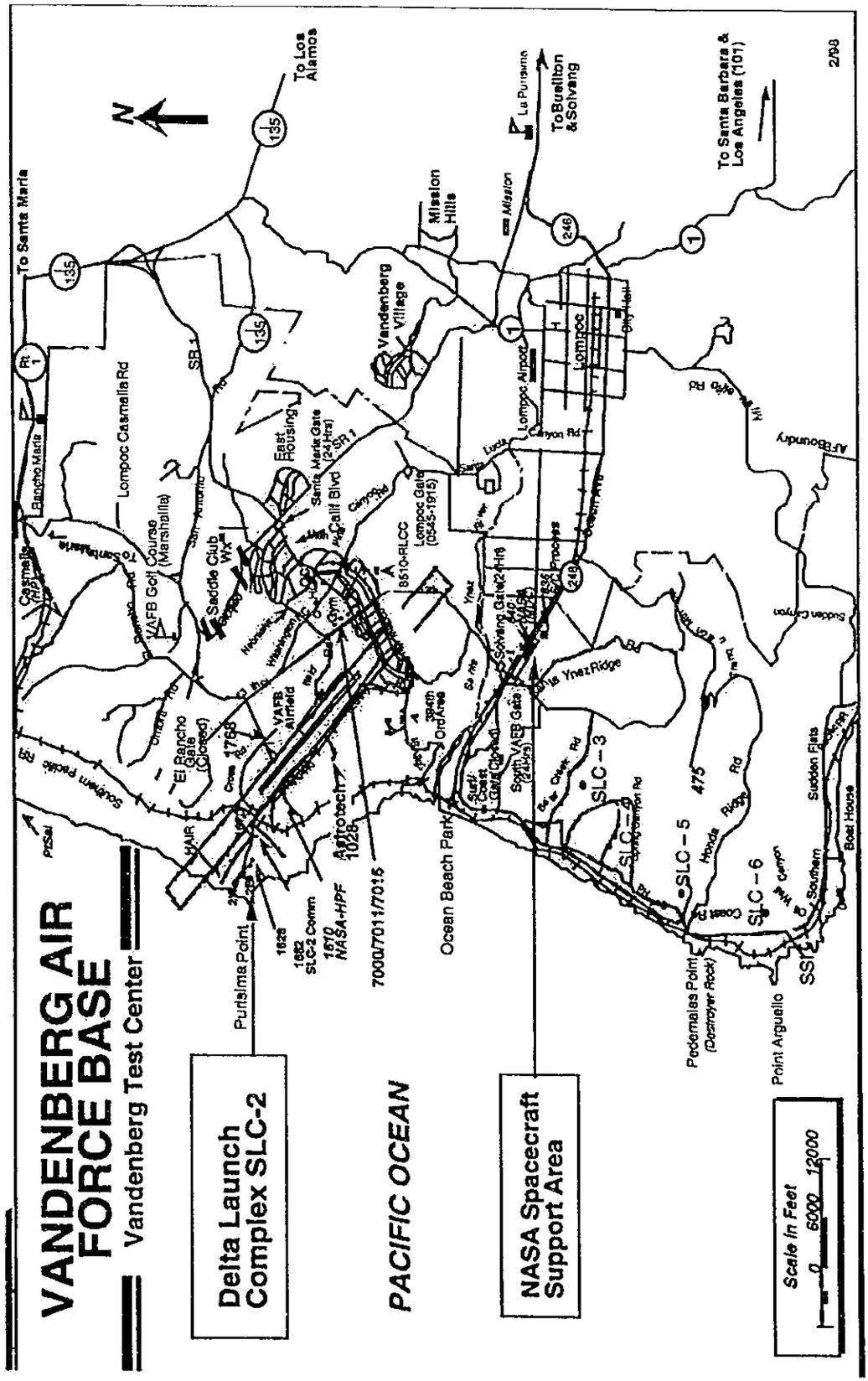
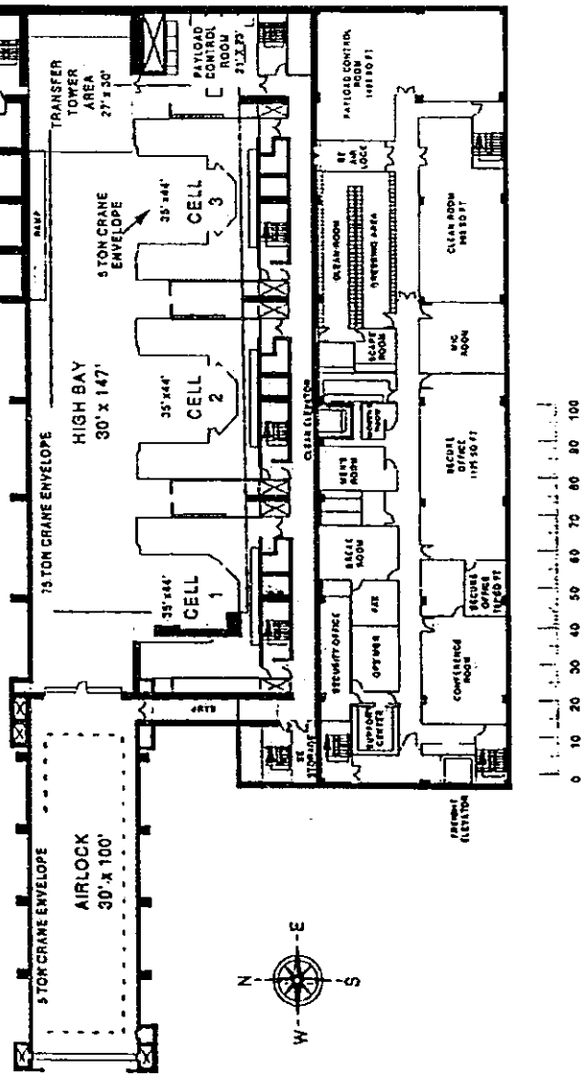


Figure 3.1-1 SSI IPF Layout



3.1.2 Space Launch Complex (SLC-2W)

The TIMED spacecraft will be launched atop a Delta II from SLC-2W. SLC-2W has the facilities necessary to integrate TIMED with the LV. VAFB SLC-2 consists of one launch pad (SLC-2W), a blockhouse, Electrical Equipment Building (EEB), ready room and other facilities necessary to launch the Delta II. The launch pad has a Mobile Service Tower (MST) and a Fixed Umbilical Tower (FUT). The MST provides the environmental enclosure for TIMED on-pad test activities. MST work levels will enable access to TIMED once mated to the Delta II.

The SLC-2W MST, FUT and other PAD facilities are shown in Figures 3.1-2 and 3.1-3.

Figure 3.1-2 SLC-2W MST and FUT

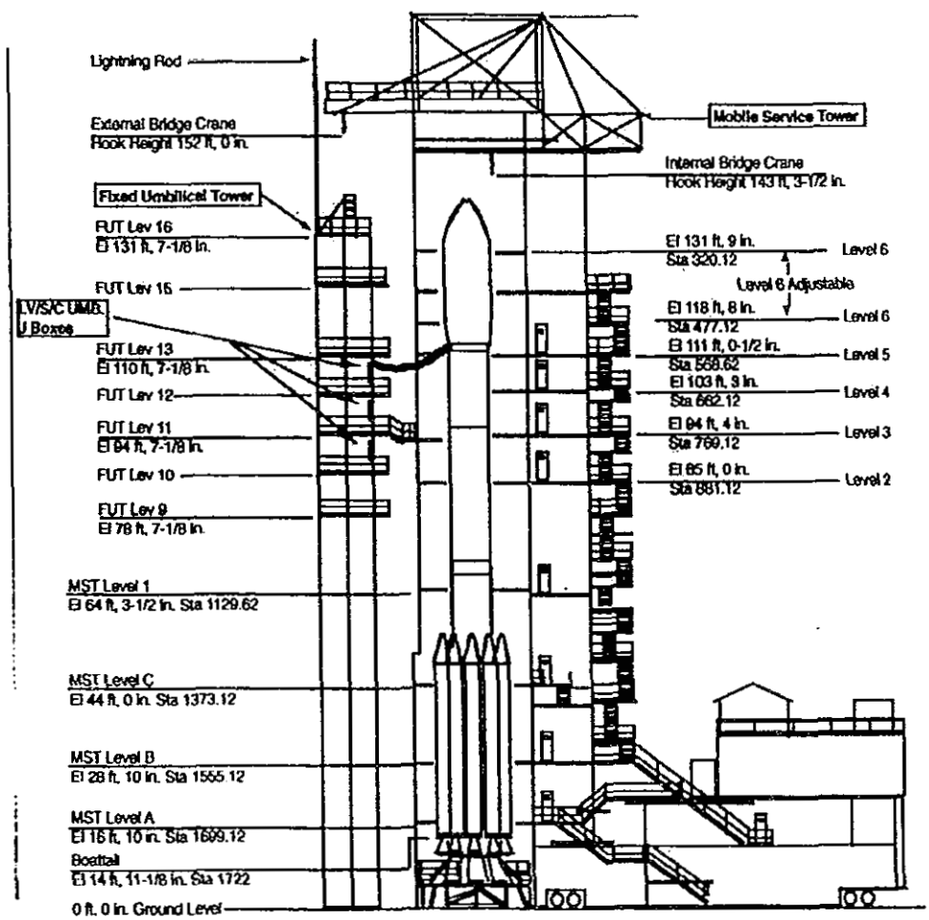
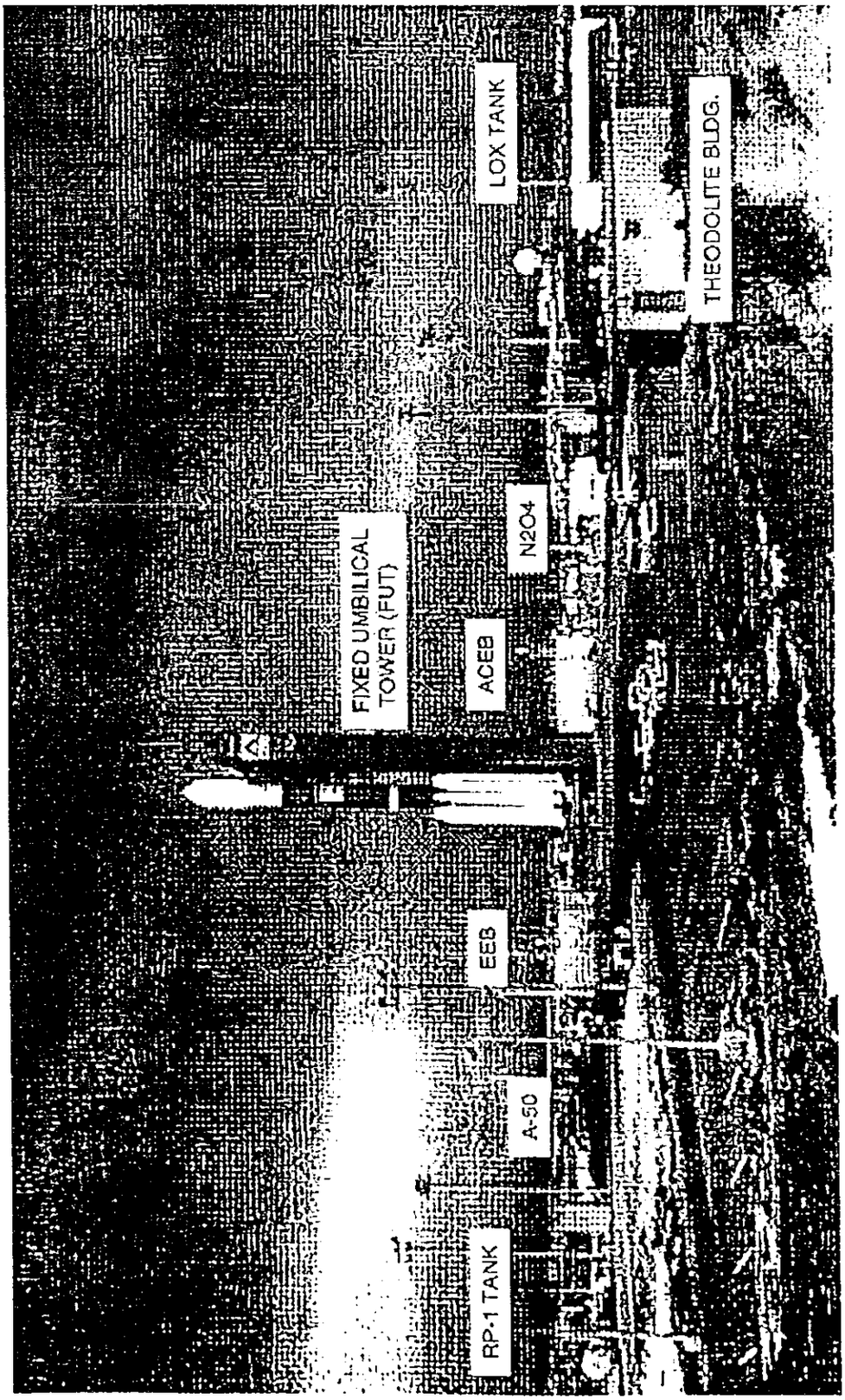


Figure 3.1-2 Space Launch Complex-2 West (PAD)



3.1.3 Other Support

Additional support facilities outside the IPF and SLC-2W consist primarily of general warehouse storage for the shipping container, crates, and miscellaneous supplies.

3.2 SERVICES

Administrative and other support services are addressed in the requirements documentation. However due to the importance of the voice and data communications, some special mention of these networks is warranted.

3.2.1 Communication Networks

Figures 3.2-1, 3.2-2 and 3.2-3 are block diagrams showing the TIMED voice, data, and pad ops/launch day communications network while the spacecraft is resident at the SSI IPF and at the launch pad (SLC-2W). At least two (2) weeks prior to spacecraft arrival, the APL MOC to IPF voice and data links must be set-up and checked out by NASA and APL personnel. Specific details of the TIMED communication requirements are documented in the KSC TIMED Launch Site Support Plan (LSSP).

Figure 3.2-1: TIMED S/C Processing Voice Configuration

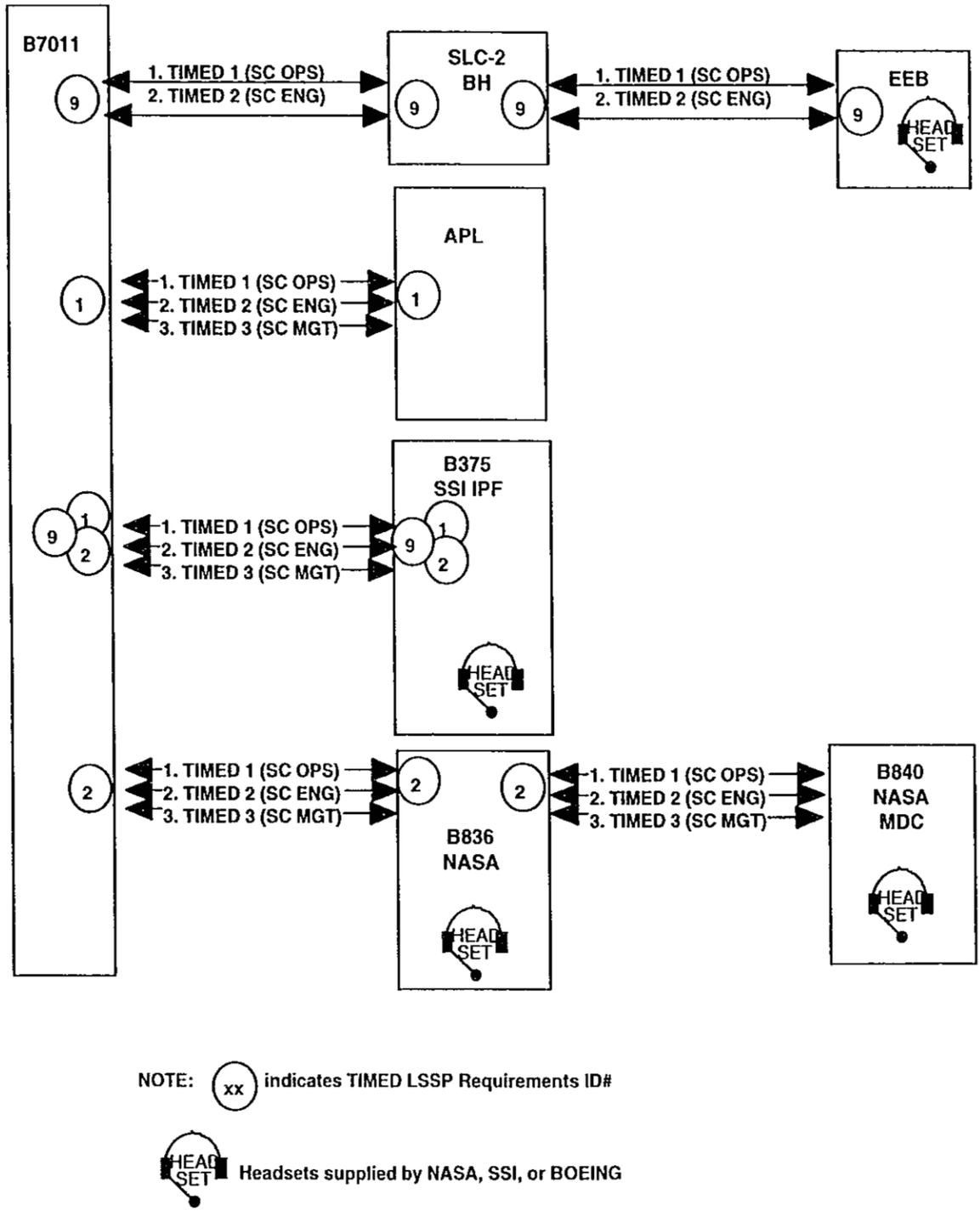
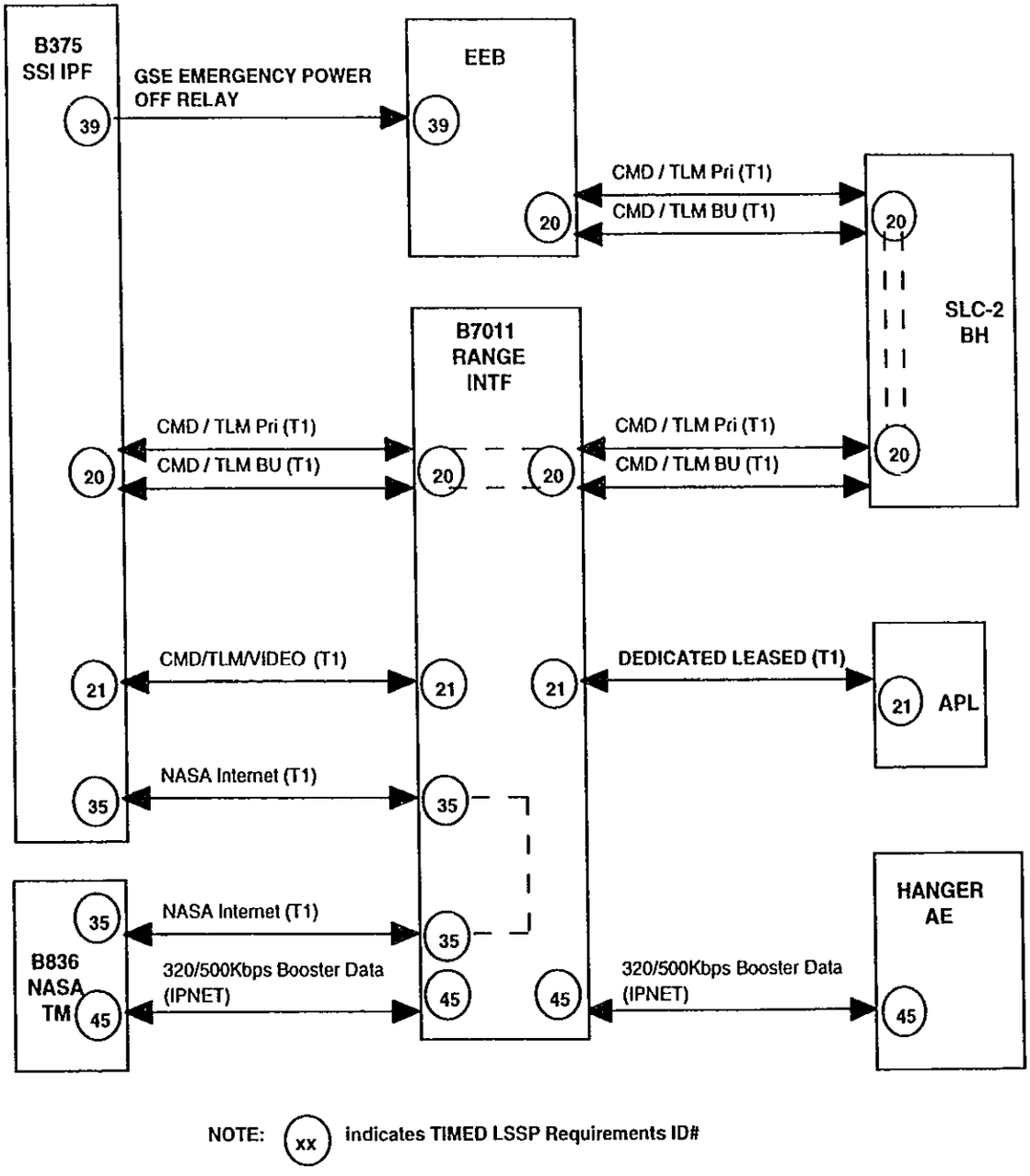
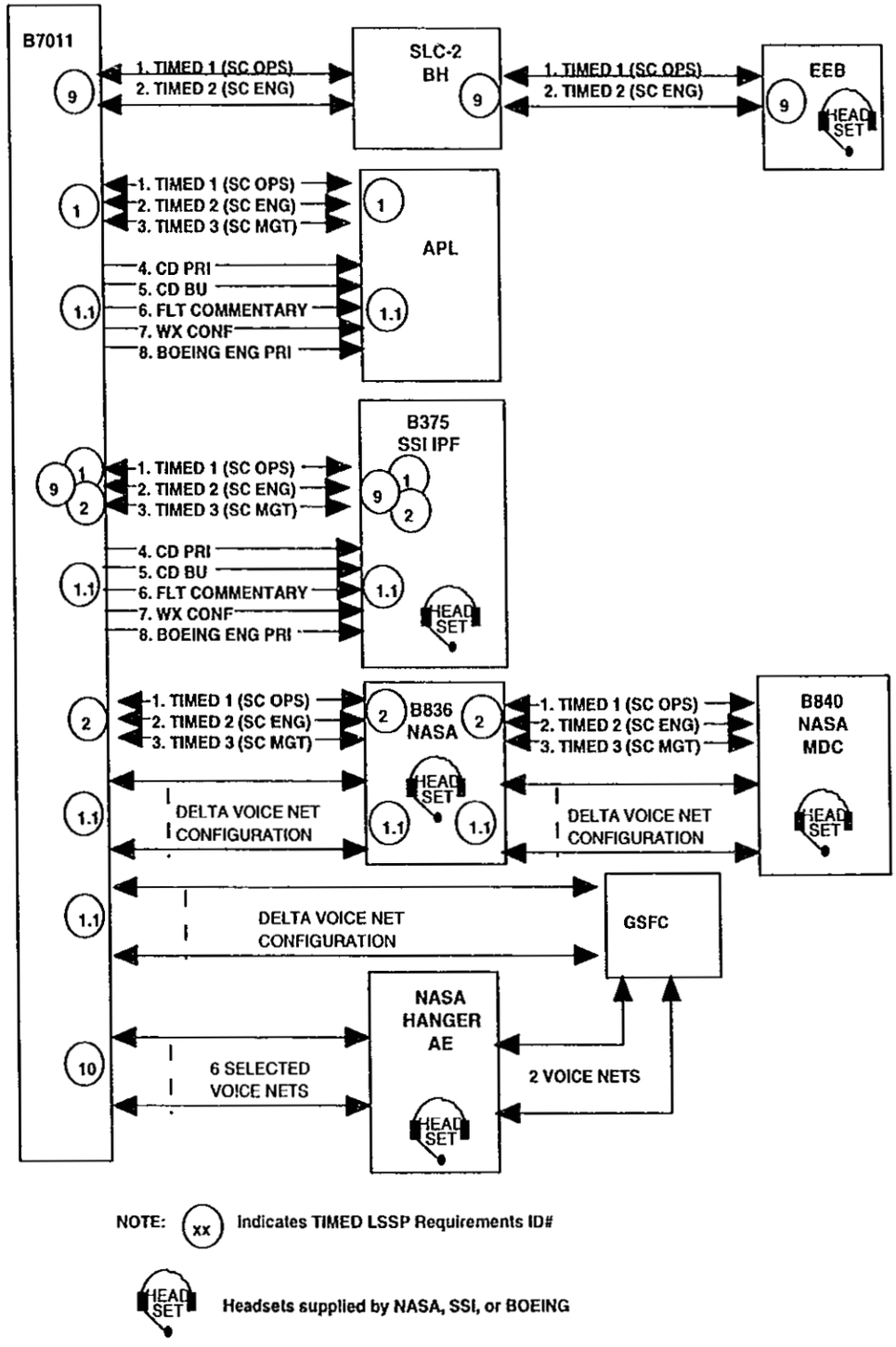


Figure 3.2-2: TIMED CMD/TLM Data Links Summary

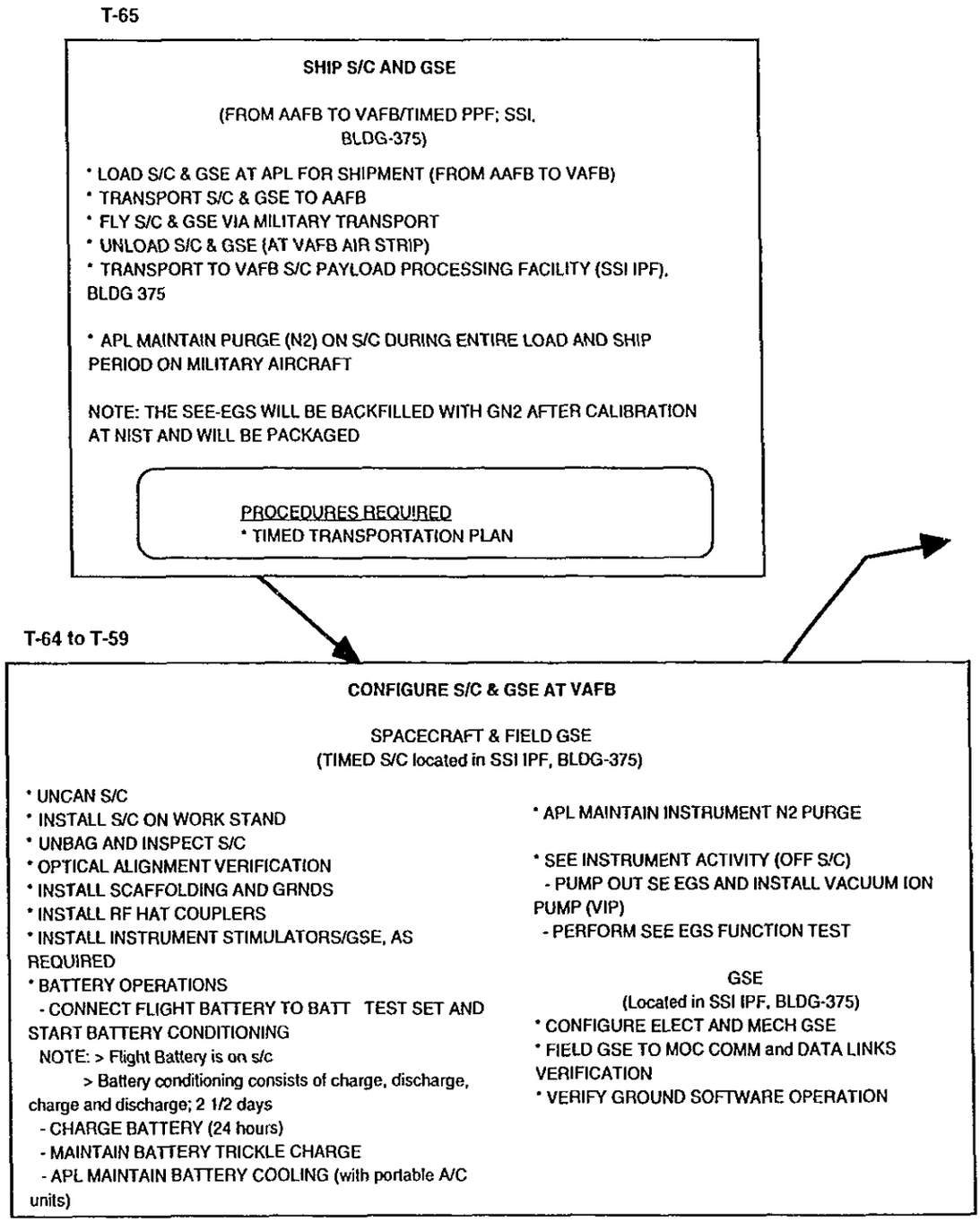


NOTE: (xx) indicates TIMED LSSP Requirements ID#

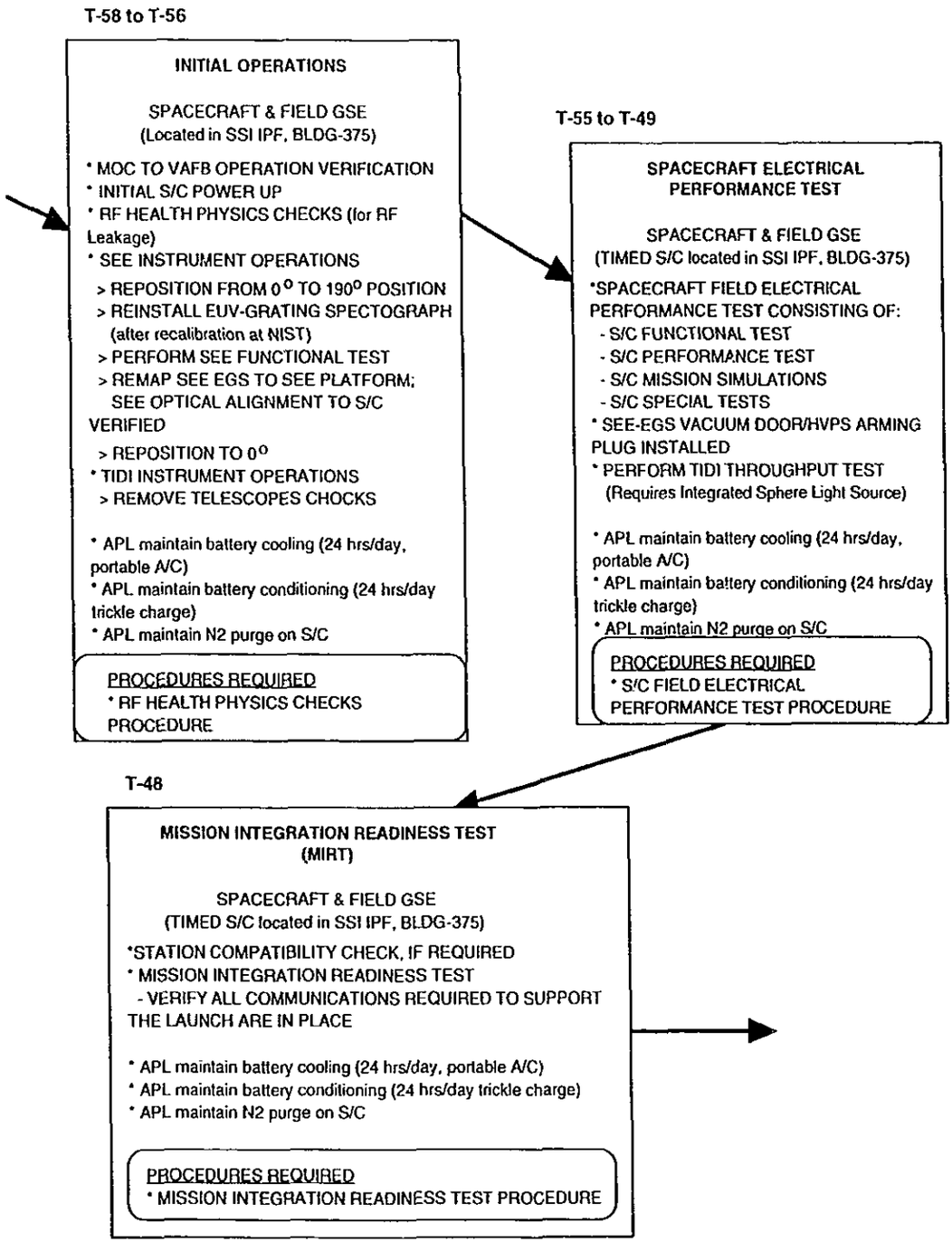
Figure 3.2-3: TIMED PAD Ops/Launch Day Voice Configuration



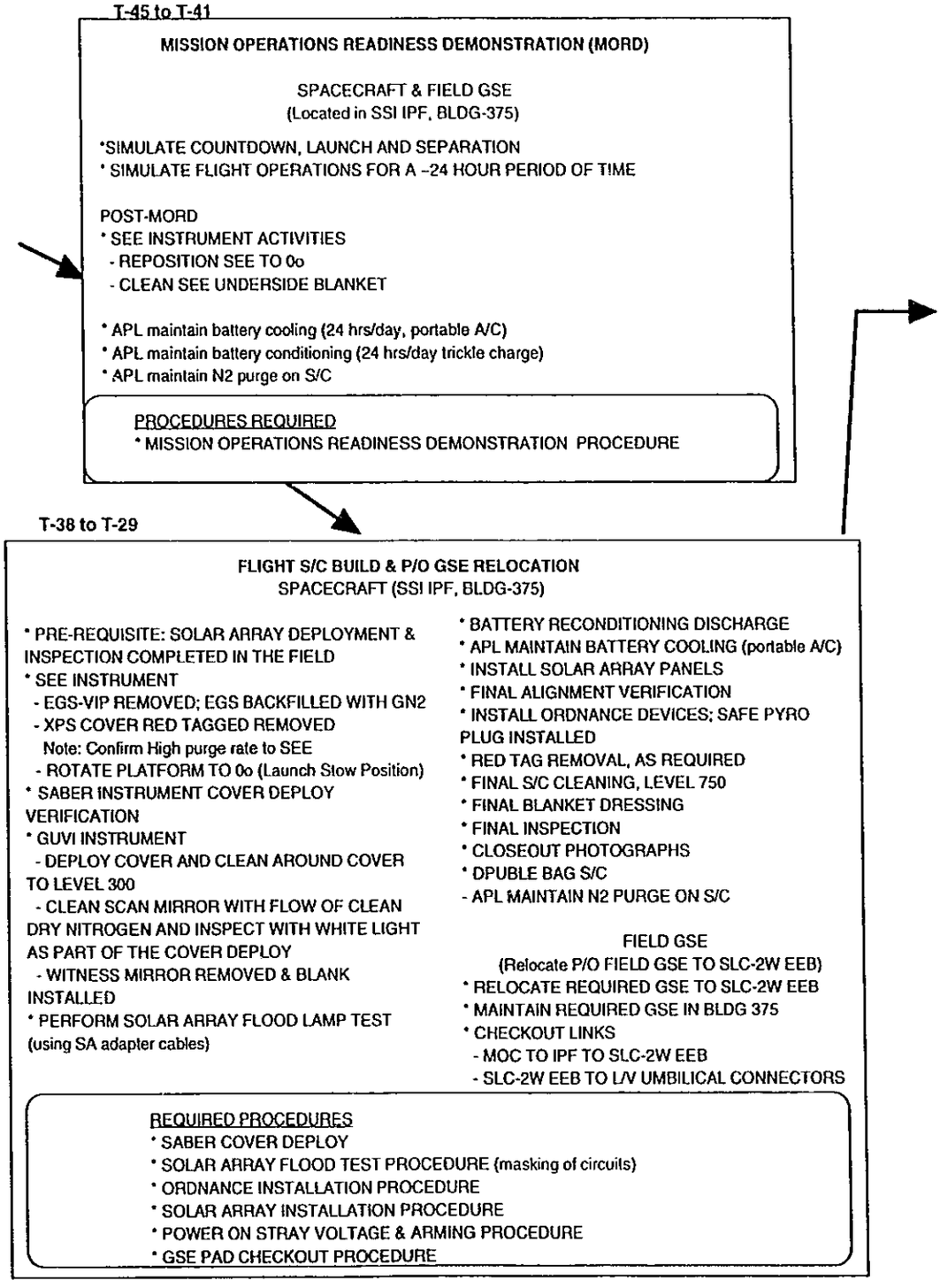
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW



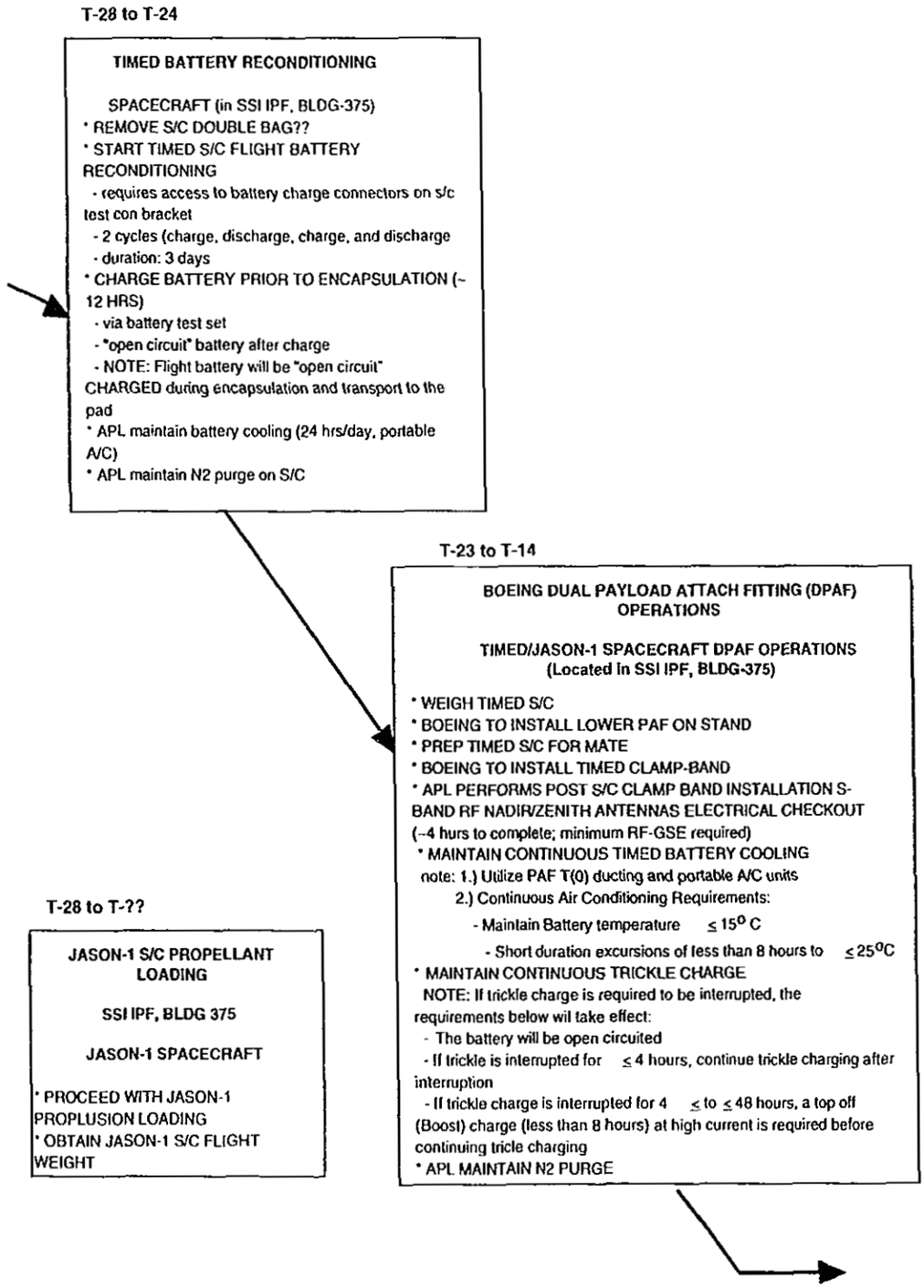
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW
(CONT'D – p 2 of 9)



APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW
(CONT'D – p 3 of 9)

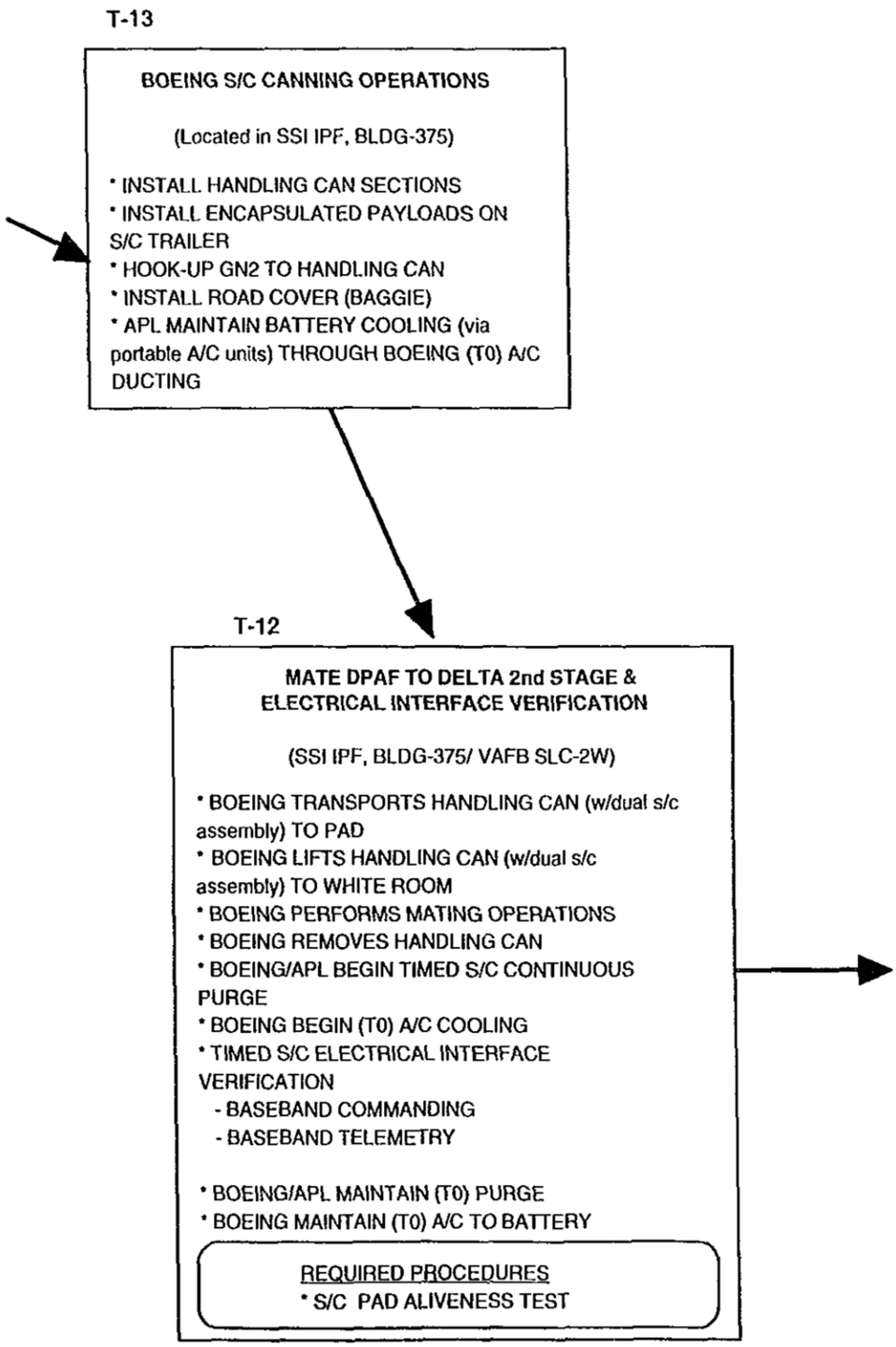


APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW
(CONT'D – p 4 of 9)



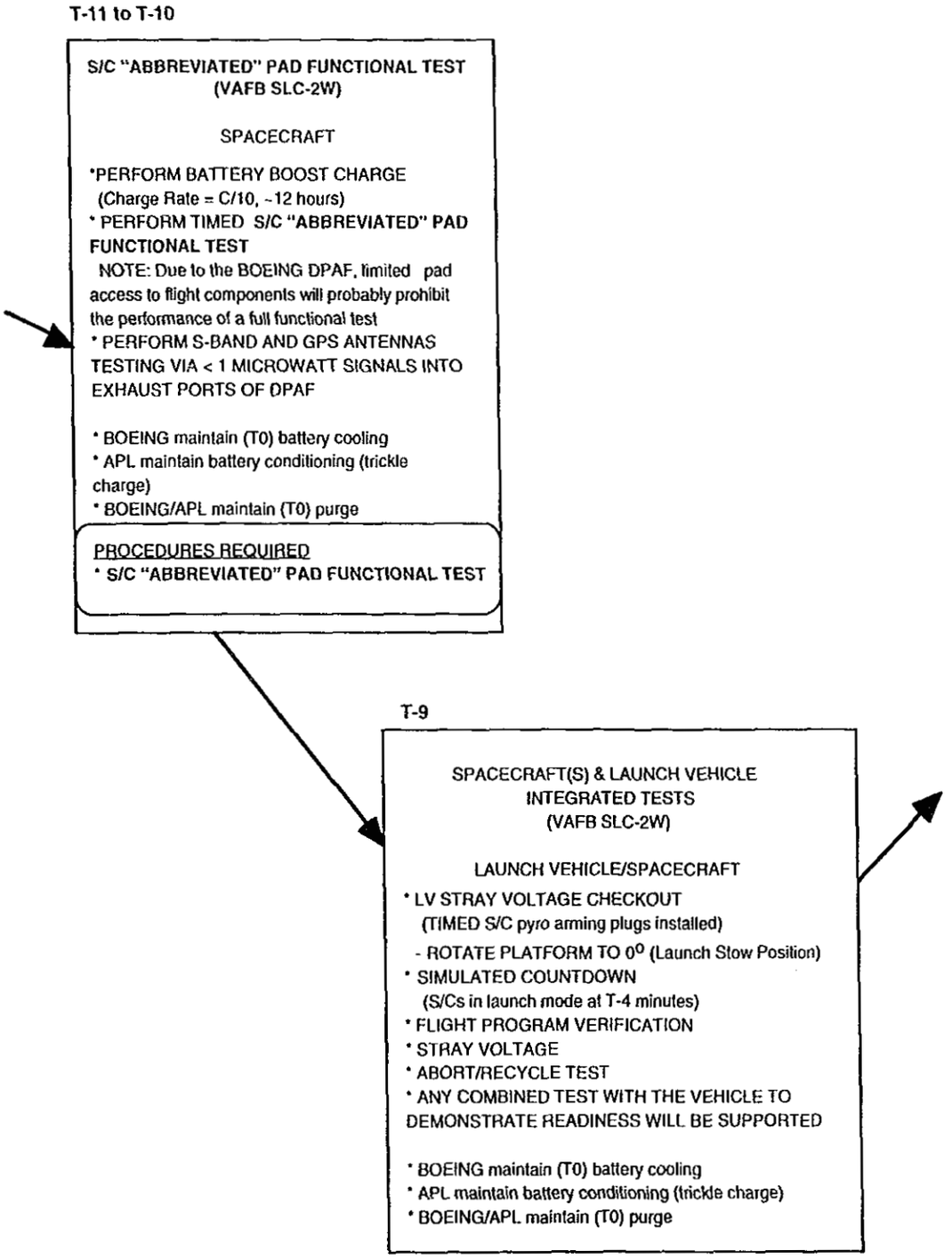
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW

(CONT'D – p 5 of 9)



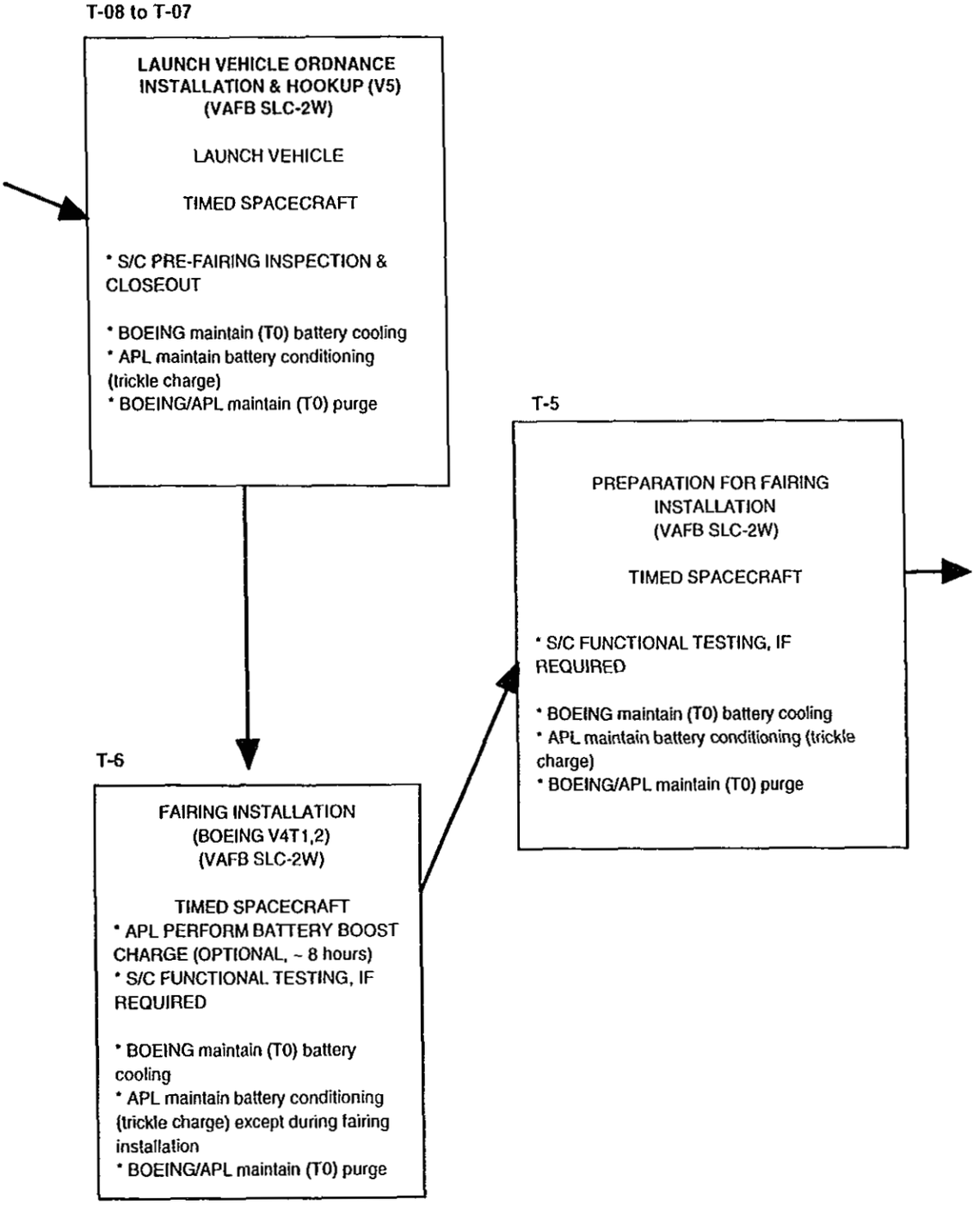
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW

(CONT'D – p 6 of 9)



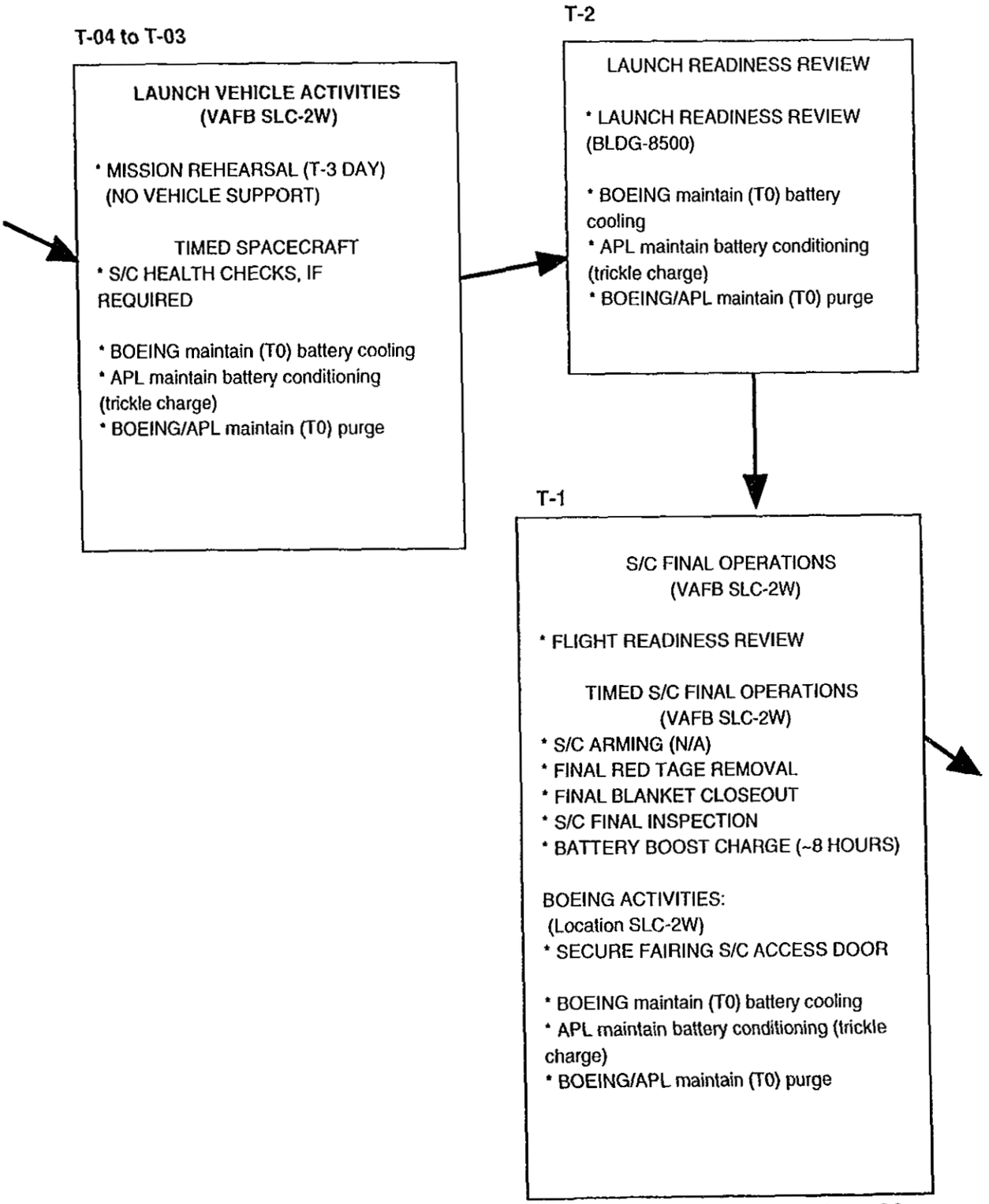
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW

(CONT'D – p 7 of 9)



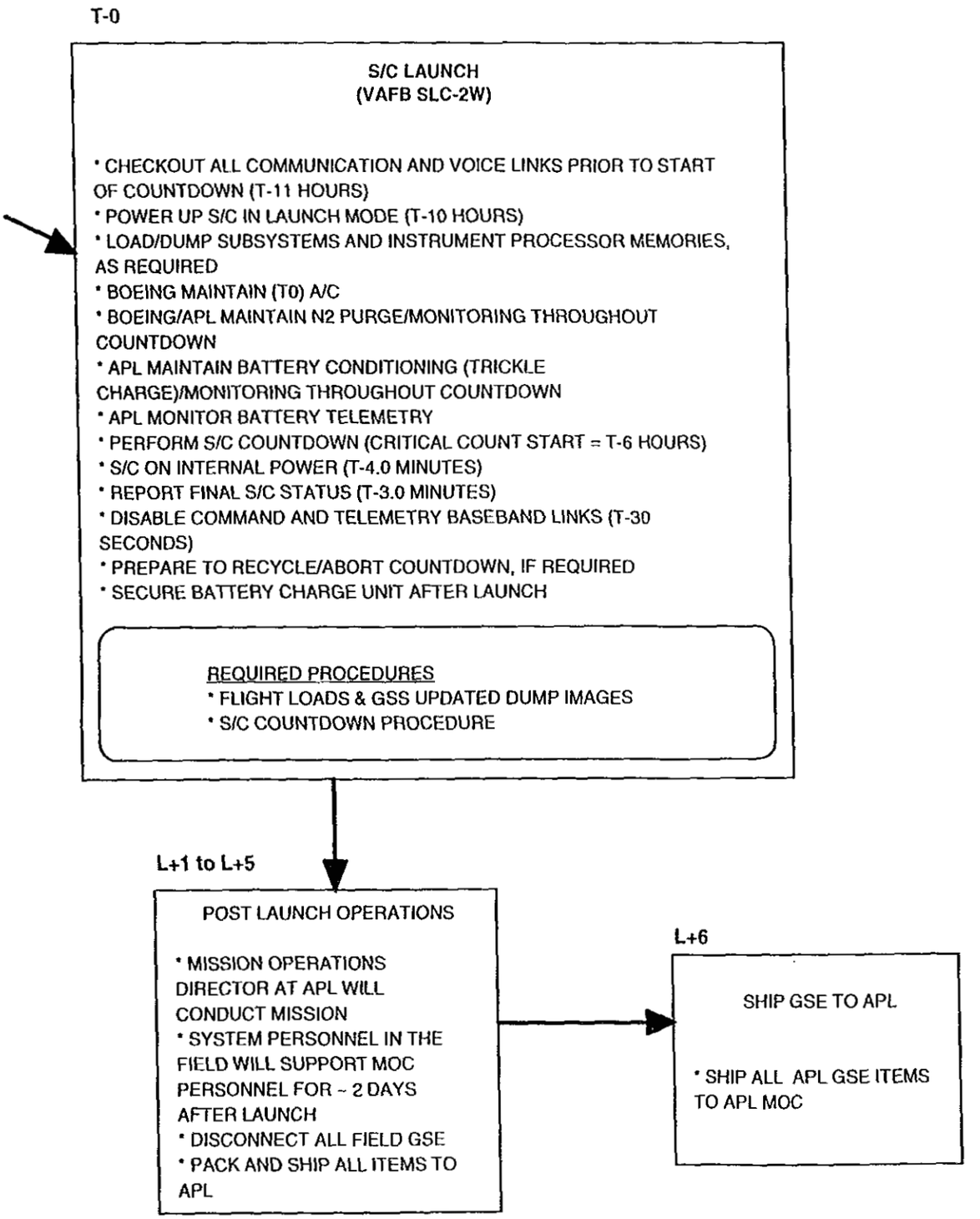
APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW

(CONT'D - p 8 of 9)

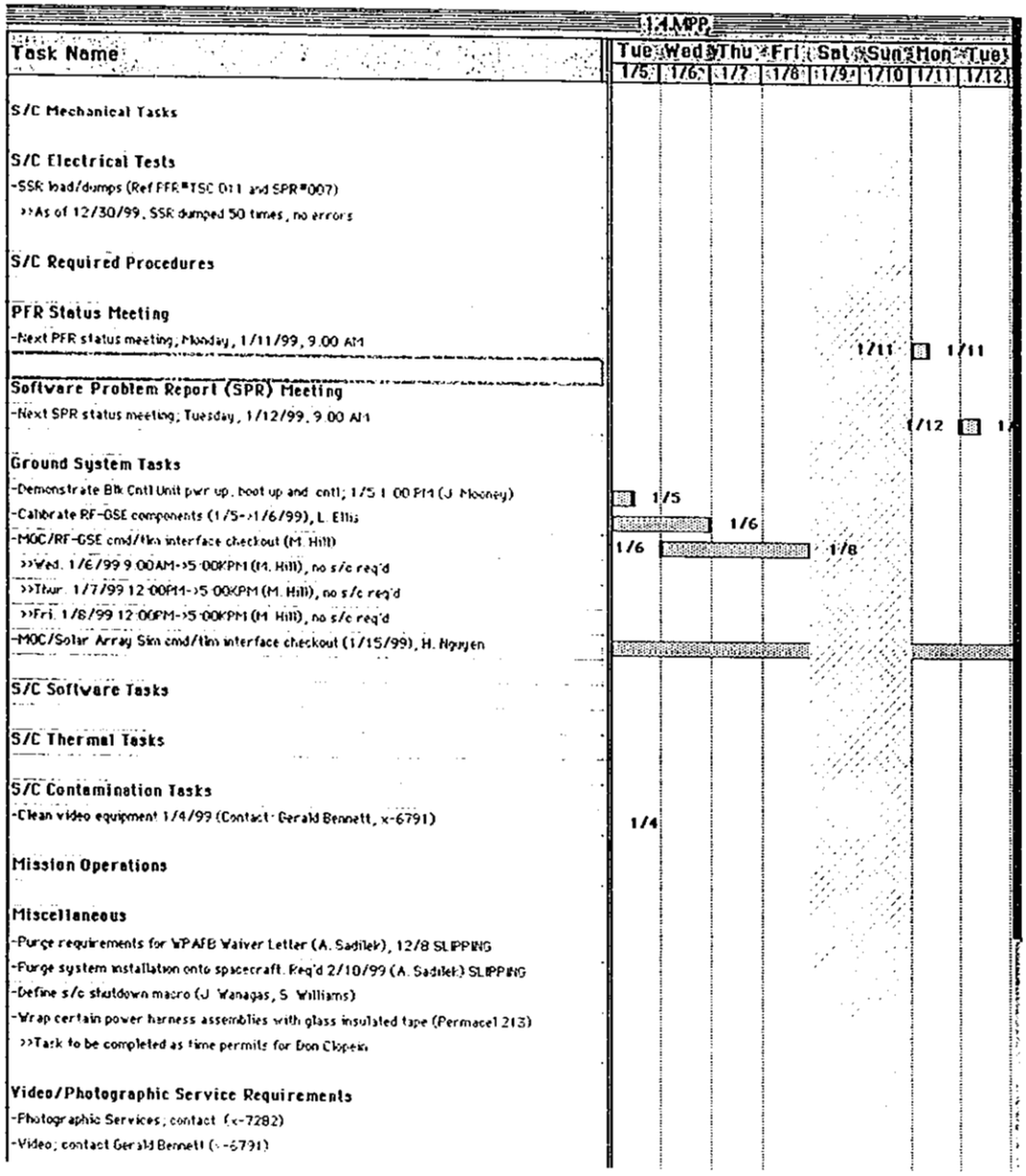


APPENDIX A - TIMED DETAILED INTEGRATION AND TEST FLOW

(CONT'D – p 9 of 9)



APPENDIX B: WEEKLY ACTIVITY SCHEDULE (EXAMPLE)



APPENDIX C: AUTHORIZED WORK TIME (EWR 127-1 EXCERPT)

Supervisors at all levels should ensure their personnel will not be assigned to, and not participate in, critical operations if it is evident that their physiological or psychological well-being is, or is likely to be, adversely affected by immunizations, fatigue, blood donations, use of drugs, illness, consumption of alcohol, or other stress conditions.

Each duty period for Mission Ready (Category A) and Mission Support (Category B) personnel, including participation in a launch or launch attempt activity, shall be preceded by an available rest period.

Planned duty for personnel in either mission ready or mission support should normally be eight hours, starting when the individual reports for duty. Those personnel identified to support operational tests shall not be scheduled for duty during the planned rest period.

Hazardous Operations and Prelaunch Attempts. The following criteria shall be used for determining hours worked versus rest time for all personnel who work with hazardous systems, materials, or components, or who accomplish prelaunch functions that require a high degree of concentration:

- Maximum 12-h shift, unless approved by Range Safety or USAF Squadron Commander, with at least 8-h rest after 12 h of work
- A maximum of 60 h per week
- A maximum of 14 consecutive days

Consecutive Launch Attempts. When 12-h shifts are required and launches are rescheduled on a 24-h basis, consideration shall be given for a 48-h launch delay after three consecutive back-to-back launch attempts. In the event mission impacts or operational requirements necessitate 12-h shifts, mission ready personnel shall not be scheduled for more than five consecutive shifts without a 48-h break and mission support personnel shall not be scheduled for more than six consecutive shifts without a 24-h break.

30 SW Additional Work Restrictions.

- In the event of a missile accident, emergency, or operational necessity, the duty time limits defined in this document may be exceeded with the expressed knowledge of the 30 SW Commander or Vice Commander, Commanders of tenant organizations, or the 30 SW Chief of Safety for personnel under their respective control.
- When mission requirements dictate, the duty period may be extended to 12 h by the first level supervisor. Rest periods and break periods shall be provided according to appropriate regulations and negotiated agreements.
- If, after a complete evaluation of the potential hazards involved, mission requirements dictate a duty period in excess of 12 h, the following criteria shall apply:
  - For Mission Ready (Category A) personnel, the duty periods may be increased to 14 h or rest periods may be waived with the expressed knowledge of the 30 SW Commander or Vice Commander, Western Range Commander, Operations Groups Commander, or the Chief of Safety.
  - For Mission Support (Category B) personnel, the duty period may be increased to 14 h with the expressed knowledge of the applicable division chief or equivalent level supervisor.

APPENDIX D - DETAILED EQUIPMENT LISTS (VERY PRELIMINARY)

D.1 - GSE ROOM RACKS AND EQUIPMENT LIST

EQUIPMENT NAME	FOOTPRINT
RF Uplink Rack	24"x 48"
RF Downlink Rack	24"x 48"
RF Computer Cart w/computer	30"x 30"
GNS Rack 1	24"x 48"
GNS Rack 2	24"x 48"
GNS Rack 3	24"x 48"
BCU Computer Cart w/computer	30"x 30"
BCU Rack	24"x 32"
SAS Computer Cart w/computer	30"x 30"
SAS Rack	24"x 32"
Battery Simulator Rack	24"x 32"
Battery Test Set Rack	24"x 32"
BTS Computer Cart	30"x 30"
Power Distribution Cart	30"x 30"
UPS	24"x 24"
ATC Computer Table w/2 computers	30"x 60"
ATC Computer Table w/computer & printer	30"x 60"
G&C Computer Table w/2 computers	30"x 60"
G&C TASTIE Rack	24"x 48"
GUVI Rack	23"x 28"
SEE IPA-GSE	19"x 16"

D.2 - PURGE , ALIGNMENT AND OTHER SUPPORT EQUIPMENT LIST

Item Name	Dimension L x W x H (feet)	Max. Weight (each)	Quantity	Comments
Solar Array deployment Table	5 x 9 x 3	125	8	
Solar Array Deployment Test Stand	6 x 5 x 8	2000	1	
Spacecraft Shipping Container	9 x 9 x 12.5	0	1	Radiation, Pressure, etc.
Tool Boxes	2 x 3 x 4	300	3	
Spacecraft Lift Fixture	7 x 5 x 2	300	1	
Optical Bench Lift Fixture	2 x 4 x 4	50	1	
Transportation Dolly	8 x 9 x 3	1221	1	
Spacecraft Work Stand	4 x 4 x 4	250	1	
Dewar, 450 Liter	4 x 4 x 8	600	2	
Dewar, 200 Liter with cart	3 x 4 x 7	500	1	Pressure Vessel
Manifold, Air Bearing	1 x 3 x 1	40	1	Pressure Vessel
Air Hose, 75 foot, Sleeved for Clean Room	4 x 4 x 2	50	1	
Pyrotechnic Devices	1 x 1 x 1	10	1	Explosives, Category "B"
Case, Aluminum, Shipping Container	1 x 3 x 3	30	1	
Computer, Monitor, Keyboard, etc.	3 x 3 x 3	25	1	
Fastener Cabinet	3 x 3 x 5	1000	1	
Purge Suitcases	1 x 2 x 2	100	2	
Scaffolding (misc)	8 x 5 x 2	200	6	
Scaffolding (planks)	7 x 2 x 2	200	6	
Bridge	8 x 2 x 2	200	1	
Sewing Machine (Thermal)	3 x 4 x 4	250	1	
Tables	5 x 10 x 3	100	4	2 for therm, 2 mechanic.
Alignment Stands	4 x 4 x 6	350	2	
Purge Scale	4 x 4 x 2	500	1	
Air Conditioner	2 x 3 x 4	100	2	

APPENDIX E: SUMMARY OF TIMED OPERATIONAL HAZARDS

Operations at VAFB will comply with the safety provisions of the TIMED tailored version of EWR 127-1. Safety hazards associated with the spacecraft and its Ground Support Equipment (GSE) are as follows: pyrotechnic devices, battery, RF/EMI, lasers, high voltage, electrical GSE, ionizing radiation sources, lifting/material handling, purge, pressure system, hazardous materials and ESD. Detailed information regarding associated hazards is included in the TIMED Missile System Pre-launch Safety Package (MSPSP). The following sections are a brief summary.

E.1 Ordnance

A total of eighteen pyros will be installed on the TIMED spacecraft after arrival at VAFB. All TIMED EEDs are category B (per VAFB Range System Safety), DOT Class C. The TIMED spacecraft contains four (4) Hi-Shear Separation Nuts (w 8x/ PC-23 pyros), two (2) bellows actuator pin release and eight (8) wire cutter EEDs.

E.2 Non-Ionizing Radiation

The Spacecraft downlink transmitter operates at 2214.97 MHz at an output power level of approximately 3 watts (S-band). Antennas include 2 shaped - beam Bifilar-Helix, Nadir pointing antennas (+5 dBic max.) and 2 hemispheric coverage Quadrifilar-Helix, Zenith pointing antennas (+5 dBic max.).

During most of the spacecraft integration and testing period, the antennas are covered by absorptive "hat" couplers. These devices enclose each antenna with an RF absorbing material, resulting in very low leakage of RF radiation. The only planned exceptions are during EMC testing, where free-space radiation (hat couplers removed) may occur. At the launch site, the hat couplers will be removed prior to DPAF installation; however, this should not present a radiation hazard because no RF transmitter tests are planned after that time.

During periods of free-space radiation, the calculated safe distances from the antennas (nadir or zenith) are as follows:

- 12 feet (APL safety standard of 0.1 W/m^2)
- 4 feet (1.0 W/m^2)

The safe distance calculations, which apply to both antennas, were based on a "worst-case" estimate using the nadir antennas (having a greater power density) as a model. In addition, a field strength measurement will be taken to assure personnel safety as part of the RF testing procedure.

The SABER instrument may bring a 50 mW contingency laser that would be connected to the SABER instrument via a fiber optic cable. The laser is a class I diode laser used as a particle counter. The case for the laser cannot be opened without destroying the unit.

E.3 Ionizing Radiation

Two 1μCi sources of Europium-152 (Eu -152) are used to activate two spectral lamps (one Helium-Argon-Krypton (HAK) and one Neon lamp) in the TIDI Instrument Profiler. The radioactive sources ionize gasses in the spectral lamps allowing them to start when power is turned on. The sources, which are installed prior to arrival at VAFB, are contained and are not accessible. Sources consisting of the same isotope and strength have been flown previously on UARS/HRDI. No regulated radiation area relative to personal exposure is anticipated. Safety personnel will perform a leak test to assure the sources inside the instrument have not lost radioactive material. This will involve swiping TIMED surfaces as close to the TIDI instrument as the practical. A disintegration counter will be provided to read the swipes. A survey meter will also be used to detect and confirm that there has been no leakage.

E.4 Pressurized System

Besides the pressurized battery, the SABER instrument contains a cooler the uses 80 milliliters of He refrigerant at a nominal pressure of 400 psig. The system is completely enclosed and designed to meet MIL-STD-1522A.

E.5 Mechanical Handling

Standard lifting procedures will be performed at VAFB, Building 375. The Spacecraft (S/C) will use the TIMED S/C Lift Fixture. This Fixture will meet safety requirements and is rated to 1818 lbs. for a S/C that is projected to weigh a maximum of 660kg/1457 lbs.

At SSI IPF all crane lifting operations and spacecraft move operations are to be performed by APL personnel who will have been trained and authorized by KSC in accordance with 7363-9390 TIMED Mechanical Handling Procedure at VAFB. Tool control will be in accordance with TBS.

At SLC-2W, Boeing will be responsible for all spacecraft lifting operations with APL acting in a positive support role.

E.6 Nitrogen Purging

The spacecraft purge system supplies regulated nitrogen flow to SEE, GUVI, TIDI, and SABER for contamination control. The nitrogen emanates from a liquid nitrogen dewar as boiloff and is regulated, filtered and monitored by a GSE suitcase. LN2 Grade C is required for periodic fill of APL dewars (2)The GSE meets all range requirements. The dewar meets DOT standards. In addition, there will be an Argon backfill operation for the EGS component of SEE. K-Bottles of nitrogen are also required for battery chiller GSE which is located in the EGSE control room.

All purge systems will incorporate regulators. Oxygen depletion metering devices will be implemented if required by range safety.

E.7 Battery Charging

The TIMED spacecraft arrives at VAFB with two (2) Nickel-Hydrogen (NiH_2) 50 AH batteries installed in a discharged state. The TIMED spacecraft batteries will be charged at VAFB. Hazards associated with battery rupture are controlled through battery design. The batteries have been designed in accordance with MIL-STD 1522A, approach A. According to the manufacturer, the battery has minimum safety factor of 3:1 (Burst: Maximum Expected Operating Pressure) and has been qualification tested. Battery cells will be cooled during ground operations. In addition, each cell will be cycle and capacity tested prior to battery assembly. The battery GSE controls and monitors temperature, current and voltage and monitors pressure.

In general, packaging, handling, and transportation shall be in accordance with NASA document NHB-6000.1C. The spacecraft will be shipped with the flight spare battery installed. The battery will be discharged, letdown and shorted per 7345-9057 TIMED Battery Handling Plan and Procedures. The flight battery and back-up battery will be shipped with the spacecraft in the same configuration as the work battery. Reconditioning and charging of the battery (100MA charge rate) will be accomplished via the battery GSE. A continuous trickle charge will be applied to the battery installed on the spacecraft during non-work periods throughout the IPF flow. APL will provide the GSE for this activity, it will be located and monitored continuously after charging by APL personnel who can serve as a fire watch.

E.8 Electrical

High Voltage - The spacecraft gyro unit and 3 of the 4 instruments contain high voltage sources. The spacecraft's Bus voltage range is between 22 - 35 V. In addition, the Gyro subsystem has internal high voltage peaking at 2.0 kV. The TIDI HV supply for calibration lamps operates at 1 KV, the Solar EUV Experiment (SEE) EGS CODACON detector operates at maximum of 2 KV, and the two GUVI detector tubes operate at 4.5 KV each. All high voltage sources operate at low current and all circuitry is grounded, fused and contained.

Electrical GSE - There are several pieces of electrical GSE required to power and test the TIMED spacecraft. All electrical GSE will be inspected to insure NEC Code Compliance. All EGSE used on the pad, after the second stage is fueled, will be explosion proof to within 100 ft of the vehicle.

Electrostatic Discharge (ESD) - It is a major objective of the TIMED program to reduce potential exposure to ESD. All payload instruments and bus components will be grounded.
Wrist grounding straps are required for spacecraft work; they are to be utilized by all personnel working with or around ESD-sensitive flight items or test equipment. They will be electrically connected to ground through monitors capable of indicating faulty ground paths.

E.9 Hazardous Materials

The following items are listed for completeness of information:

- Adhesives, Lubricants: Epoxy/staking material, and typical lubricants will be used. All adhesives and lubricants will be applied and discarded properly.

- Cleaning fluids: Isopropyl alcohol will be used during spacecraft integration. Isopropyl alcohol will be applied and discarded properly.

- Hydrogen: The Battery cells of the NiH2 Battery are sealed to control H2 emission.

- Potassium Hydroxide (KOH): The Battery cells of the NiH2 Battery are sealed to contain KOH. Appropriate handling procedures will be observed.

- Mercury: GSE lamps contain extremely small amounts of mercury. The mercury is sealed within the lamps.

- Nitrogen and Argon: These gases will be used for purges; however, Nitrogen and Argon will not be used in confined areas. Nitrogen will only be used in a well-ventilated area (an oxygen depletion analysis and/or oxygen sensors will be required if used in a confined area).

APPENDIX F: LIST OF ACRONYMS

APL	Applied Physics Laboratory
BCU	Blockhouse Control Unit
BER	Bit Error Rate
C&DH	Command & Data Handling
DOT	Department of Transportation
DPAF	Dual Payload Attach Fitting
EEB	Electrical Equipment Building
EED	Electro-Explosive Devices
EGSE	Electrical Ground Support System
ESD	Electro-static Discharge
EWR 127-1	Eastern-Western Range Regulation 127-1
EUV	Extreme Ultraviolet
FTP	File Transfer Protocol
FUT	Fixed Umbilical Tower
G&C	Guidance & Control
GN2	Gaseous Nitrogen
GS	Ground Station
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
GSS	Ground Support System
GUVI	Global Ultraviolet Imager
IPF	Integrated Processing Facility
IEM	Integrated Electronics Module
JHU/APL	Johns Hopkins University Applied Physics Laboratory
Kbps	kilobits per second
KSC	Kennedy Space Center
LN2	Liquid Nitrogen
LSE	Launch Support Equipment
LSM	Launch Support Manager
LSSP	Launch Site Support Plan
LV	Launch Vehicle
Mbps	megabits per second
MGSE	Mechanical GSE
MHz	Mega-hertz
MIL-STD	Military Standard
MIRT	Mission Integration Readiness Test
MLTI	Mesosphere, Lower Thermosphere and Ionosphere
MOC	Mission Operations Center
MORD	Mission Operations Readiness Demonstration
MOS	Mission Operations System
MOT	Mission Operations Team
MRR	Mission Requirements Request
MSPSP	Missile System Prelaunch Safety Package

MST	Mobile Service Tower
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NiH2	Nickel Hydrogen
PAF	Payload Attach Fitting
PRD	Program Requirements Document
RF	Radio Frequency
S/C	Spacecraft
SABER	Sounding of the Atmosphere using Broadband Emission Radiometry
SEE	Solar Extreme-ultraviolet Experiment
SLC-2W	Space Launch Complex 2W
SSI	Spaceport Systems International
TBD	To Be Determined
TBS	To Be Supplied
TCP/IP	Transport Control Protocol/Internet Protocol
TIDI	TIMED Doppler Interferometer
TIMED	Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics
USAF	United States Air Force
UTC	Universal Time Coordinate Universal Time Coordinated
UV	Ultraviolet
VAFB	Vandenberg Air Force Base
WR	Western Range
WTR	Western Test Range