~~TOP SECRET~~ G

1

BIF-008-W-C-019843-RI-80

This document contains 185 classified sheets including the front and back cover.

PHOTOGRAPHIC SYSTEM REFERENCE HANDBOOK
FOR
GAMBIT RECONNAISSANCE SYSTEM
WITH
EXTENDED ALTITUDE CAPABILITY
(EAC)

VOLUME 6

Prepared by
BIF-008

Under Contract

25X1

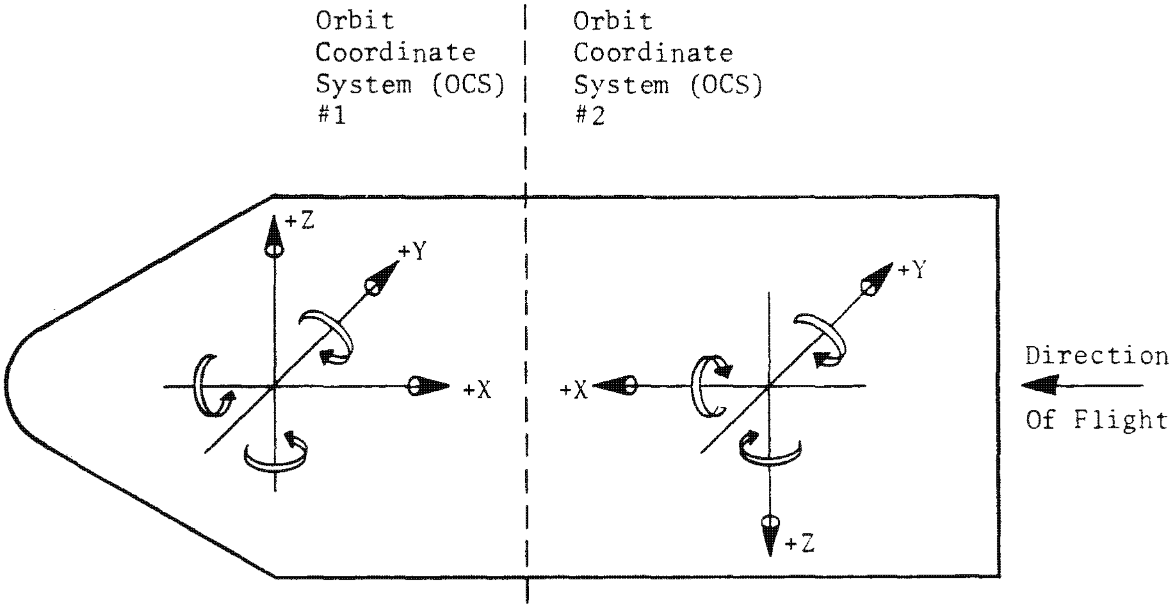
Approved by:

1 July 1980

"WARNING - THIS DOCUMENT SHALL NOT BE USED AS A SOURCE FOR DERIVATIVE CLASSIFICATION"

Handle via BYEMAN
Control System Only

~~TOP SECRET~~ G



BIF-008 Uses OCS #1

OCS #1 Is Used In This Document

Orbit Coordinate Systems Sign Convention

FRONTISPIECE

TABLE OF CONTENTS

VOLUME 6

25X1

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

VOLUME 6 Page

25X1

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

VOLUME 6

25X1

LIST OF TABLES

VOLUME 6

5.0 STORAGE AND SHIPMENT

Storage and shipment encompasses those activities undertaken between final factory testing (excluding revalidation tests) and arrival of the PPS/DP EAC at the launch complex.

5.1 Storage

Completion of assembly and testing of a PPS/DP EAC often occurs before the date when shipment is scheduled. A requirement therefore exists for the factory storage of a PPS/DP EAC for varying time periods. Provisions have also been made for brief periods of storage at Vandenberg AFB when unforseen circumstances preclude transport directly from the shipping aircraft to the launch complex, and immediate erection and mating.

5.1.1 Factory Storage

The PPS/DP EAC is stored horizontally in a sealed, portable, tent-like structure. The unit is mounted on a wheeled platform known as a cradle which is mounted on a factory truck during this period. The mounting is such that the vehicle can be rotated 180-degrees about the X-axis (Z-axis vertical) every seven days to prevent any permanent "set" in the optical components and to prevent lubricants from settling.

5.1.1.1 Panels and Pyros. All PPS/DP EAC access panels are in place during storage and pyrotechnic units are installed with the associated safety devices attached. In some locations, test panels are substituted for prime panels to allow the connection of test cables and pyro safety devices.

5.1.1.2 Operation and Testing. During periods of extended storage, the PPS/DP EAC is operated every 90 days to prevent degradation of motors, encoders, potentiometers, etc. The sequences employed are similar to test sequences except that pyros are not actuated and instrumentation is not recorded.

Thirteen days prior to shipment the PPS/DP EAC is removed from storage and the revalidation tests are performed (see Part 4, Section 4). Before these tests are performed, test film is removed and the flight film load installed.

5.1.2 Storage at Vandenberg AFB

Storage at Vandenberg Air Force Base, when necessary, is accomplished with the PPS/DP EAC in the controlled environment of the shipping container. Power may be made available at several sites to operate the container air conditioner and vehicle shipping blanket heaters as required. (see Part 4, Section 6).

5.2 Shipment

Shipment involves the physical movement of the PPS/DP EAC from the factory location to the launch site. Shipment is complicated by the need to maintain required environmental conditions throughout the over-the-road [redacted] 25X1 portions of the movement.

5.2.1 Shipping Preparation

After completion of the revalidation testing and installation of flight film, the PPS/DP EAC is fitted with external thermal control blankets and loaded into the PPS/DP EAC shipping container. Figure 4.5-1 shows the PPS/DP EAC with blankets installed, in the shipping container with the cover being lowered.

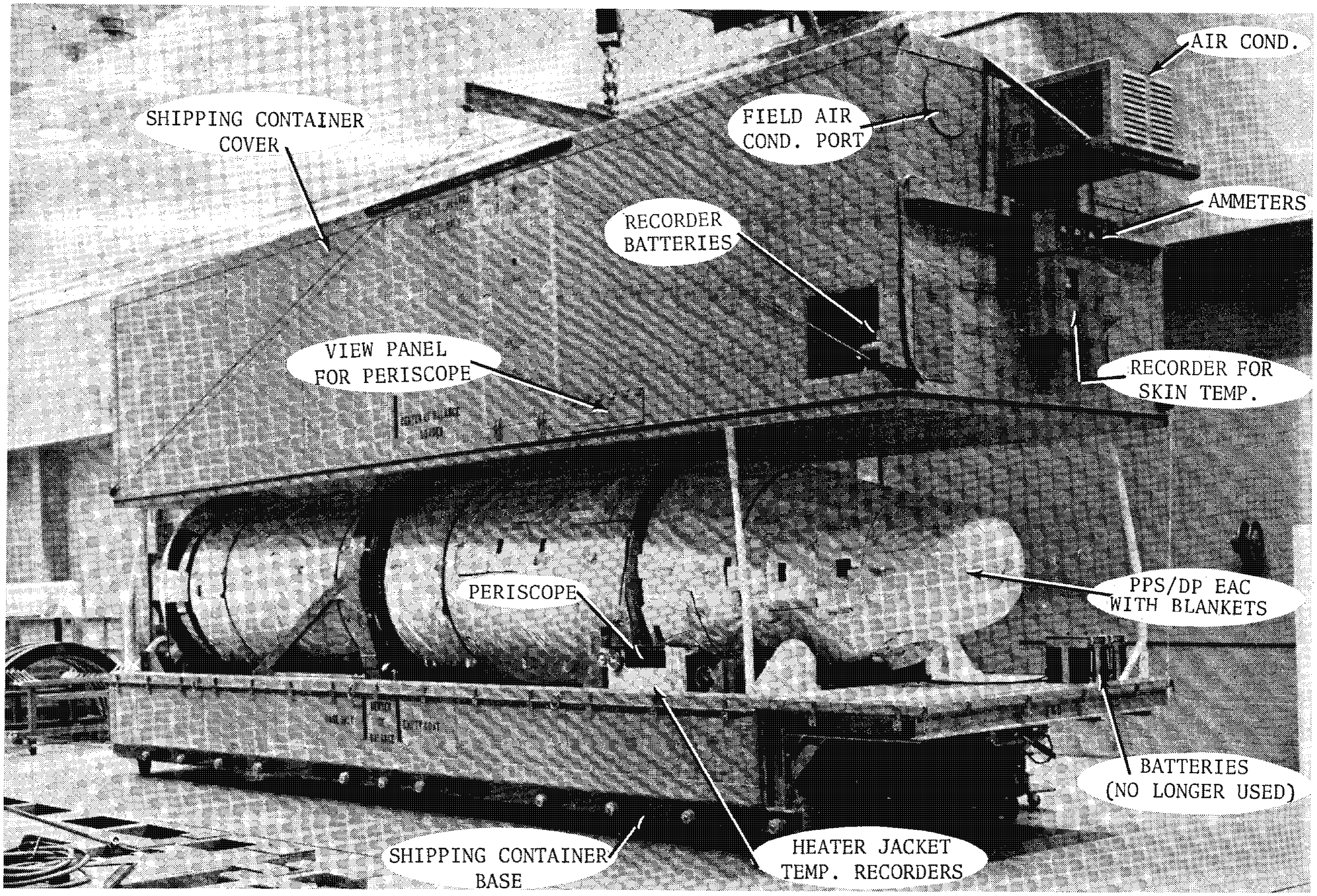


Figure 4.5-1 PPS/DP EAC in Shipping Container

Approved for Release: 2017/02/14 C05097223

5.2.2 Shipping Container

The shipping container is a sealed thermally insulated enclosure which provides protection from dust and moisture and provides a high degree of isolation from the external thermal environment. A suspension system within the container also isolates the PPS/DP EAC from the mechanical shocks of over-the-road transportation. The container is equipped with a breather valve with desiccant to allow air pressure equalization during air shipment. Capability for cooling and/or dehumidifying the container interior is provided by the shipping container air-conditioning unit, the heating function being performed by the electrically heated PPS/DP EAC heater jackets. During transportation the heater jackets maintain the PPS/DP EAC at 72F. The air-conditioner maintains the container air between 65 and 85F and relative humidity less than 50% during over-the-road movement.

5.2.3 Ground Transportation

The shipping container is loaded onto a special trailer equipped with a motor generator to provide power for environmental control during the ground transportation phases of shipment. A conventional heavy duty tractor is used to tow the shipping container and trailer.

A Manufacturing Engineer escort maintains surveillance of the environmental control during over-the-road travel by means of an electronic monitoring device located in the truck cab. BIF-008 Security personnel traveling in a separate vehicle, provide assistance in the event of traffic delays, accident, or other interference. Figure 4.5-2 shows the [redacted] 25X1

25X1

TOP SECRET G

BIF-008- W-C-019843-RI-80

TOP SECRET G

Handle via BYEMAN
Control System Only

Approved for Release: 2017/02/14 C05097223

25X1

25X1

BIF-008- W-C-019843-RI-80

TOP SECRET G

TOP SECRET G

Handle via BYEMAN
Control System Only

This page intentionally blank

6.0 LAUNCH SUPPORT

BIF-008 activities in support of the Gambit program at the launch site are accomplished by a resident group referred to as field activity south (FAS). Space launch complex 4-west (SLC 4-W) pad at Vandenberg Air Force Base (VAFB) is the facility employed for all Gambit launches.

6.1 Support Activity Overview

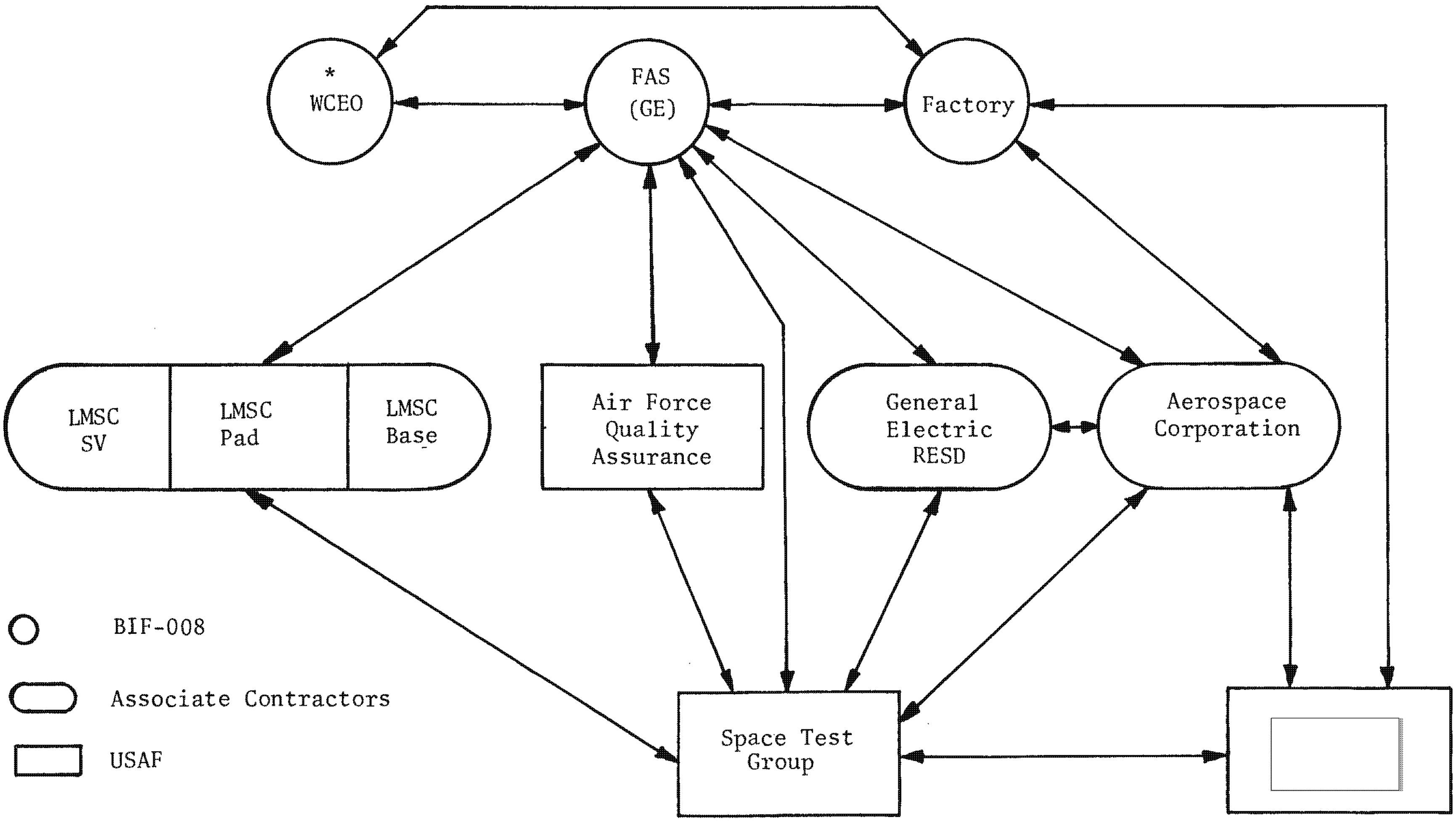
The FAS organization consists of a group of people living in the VAFB area, reporting to the Program Manager through the Field Coordinator. Insofar as non-Gambit briefed persons are concerned, the FAS organization, when on the base, is to be known as a division of the General Electric Company (GE/RESD)* doing consulting work for the existing General Electric Company. Outside the confines of the VAFB area, the FAS personnel can be recognized as contractor personnel. For this reason, all visiting Gambit-cleared persons are required to obtain a security briefing BEFORE their arrival so that comprising situations may be avoided.

Within the Gambit Community, however, relationships among BIF-008, Associate Contractors, and the Air Force are shown in Figure 4.6-1.

6.1.1 FAS Functional Overview

FAS is a field assembly and test group having responsibility for performing necessary planning, procedure generation, software generation, test equipment (maintenance, repair, design and fabrication), testing and data evaluation functions. Additionally, the interests of BIF-008 are represented at various meetings and activities associated with the launch support.

*Reentry and Environmental Systems Division.



*See Part 4, Section 7

Figure 4.6-1. Gambit Organization at VAFB

It is in the field location that all Associate contractor interfaces are mated for the first time and by test, proven to be compatible. The factory-to-pad philosophy is implemented by subjecting the PPS/DP EAC to a minimum amount of testing to assure operational readiness of each electromechanical subystem as seen through telemetry instrumentation and selected hardline instrumentation, in accordance with a preplanned, time sequence of commands, identical, as far as possible, to sequences run at the factory prior to shipment. Final external skin thermal pattern configuration, surface repair and cleaning, installation of flight pyro-circuit arming plugs, and installation of flight skin panels are accomplished in the last few days prior to launch.

6.1.2 FAS Organization

The FAS group is organized into four major areas:

Test Methods - responsible for configuration control, pad interfaces and procedure generation.

Test Software - responsible for the development, maintenance and integration of FAS computer programs utilized in testing the test support equpment and PPS/DP EAC.

Test Equipment - responsible for the readiness (maintenance, repair, design, fabrication, calibration and validation) of test support equipment, and

Test Support - responsible for quality control, document control, property control, purchasing, safety, security, etc.

6.1.2.1 Test Methods. The test methods group is responsible for generating, publishing, distributing, and updating procedures for all operations performed during the testing cycle. These operations begin with receipt of the vehicle and include such activities as the following:

(1) Aircraft unloading.

(2) PPS/DP EAC over-the-road transport.

(3) PPS/DP EAC storage under environmental control.

(4) Removal of the PPS/DP EAC from the container.

(5) Mechanical mating.

(6) Electrical mating.

(7) Vehicle inspections.

(8) Igniter installation.

(9) Gas loading.

(10) Support equipment setups.

(11) Thermal pattern configuration.

(12) Arming.

(13) Support of GE's vehicle preparation.

(14) Final vehicle configuration.

(15) Vehicle testing.

Interface documents defining all testing and facility requirements are generated, distributed, and maintained by the test methods group. A data file, including several hundred documents, must be updated for each vehicle and transported to the testing area for each launch cycle.

6.1.2.2. Test Software. The test software group assembles the factory-to-pad testing requirements with those peculiar to the launch facility. These requirements are subsequently supplied to LMSC in the proper format and structure for integration into the simulated flight and countdown test sequences. LMSC, as the test software integration contractor, writes and maintains a multitude of computer programs which are utilized as manipulative, control and check aids during the process of constructing the real-time command, control and response test tapes.

The test software group uses and actively participates in modifying many of these programs.

A block diagram of software associated with launch-site testing of the aerospace vehicle is shown in Figure 4.6-2. This software is briefly described in Appendix C.

6.1.2.3 Test Equipment. The test equipment group assures proper test equipment configuration and operation during a test cycle, and is responsible for all field support equipment and related procedures. Field support equipment includes electronic test consoles, mechanical devices, special tool sets, standard mechanical and electrical measuring instruments, and electromechanical shop facilities. Test equipment group responsibilities include modification, repair, maintenance, calibration and validation as well as design and fabrication, when necessary, of this support equipment. Procedural responsibilities include generation, updating, and publication of support equipment calibration procedures, a support equipment validation procedure, equipment interconnection/patching manual, and validation procedures that are integrated with LMSC and GE. Test equipment which carries a project requirement list (PRL) number is described in Appendix D.

6.1.2.4 Test Support. The test support group is responsible for quality monitoring of all work performed at the field test site. This effort includes:

(1) Monitoring for compliance to acceptable work standards for prime and support equipment.

(2) Monitoring preparation of prime hardware for test and certification that approved procedures were followed.

(3) Maintenance of control and accountability for test equipment and prime hardware.

(4) Coordination with Air Force quality assurance personnel.

Administrative tasks include safety monitoring and inspections, fire inspections, and control of accountable equipment. Additionally, special security requirements, arising from the covert nature of many FAS activities must be met which involves perimenter and document control personnel passes, etc.

This page intentionally left blank.

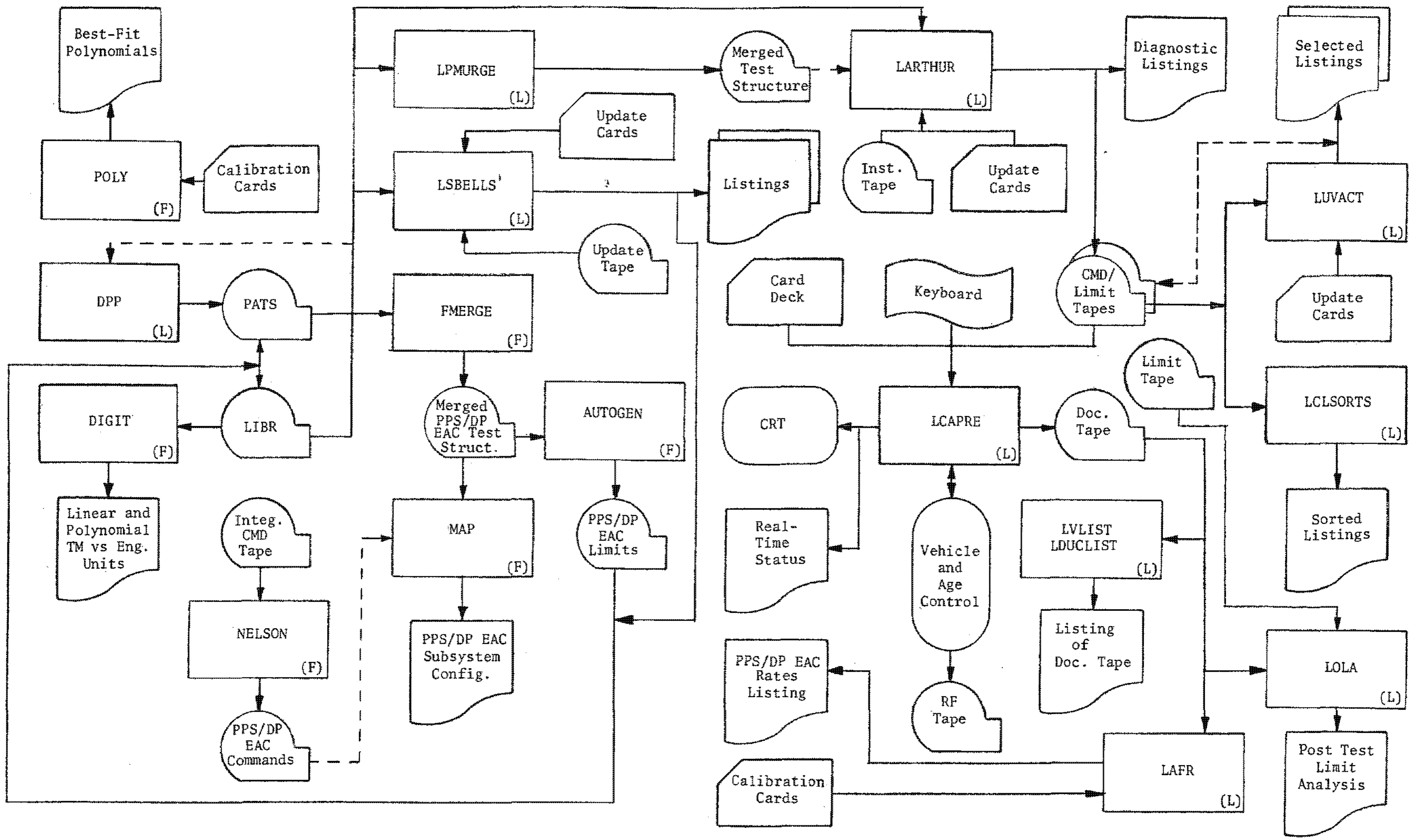


Figure 4.6-2. Launch Site Software Block Diagram

Approved for Release: 2017/02/14 C05097223

6.2 FAS Facility Overview

VAFB is located on the Pacific coast near the city of Lompoc, California. The Gambit program utilizes (along with other programs) SLC 4-W for launch acitivities. Figure 4.6-3 shows principal areas of the complex and identifies those areas within which BIF-008 activities are performed. In addition to those areas shown in the figure, FAS personnel support off-loading of the PPS/DP EAC from the aircraft at the base airstrip. Meetings are held in the administrative areas not shown, and the FAS engineering office is in another part of the base.

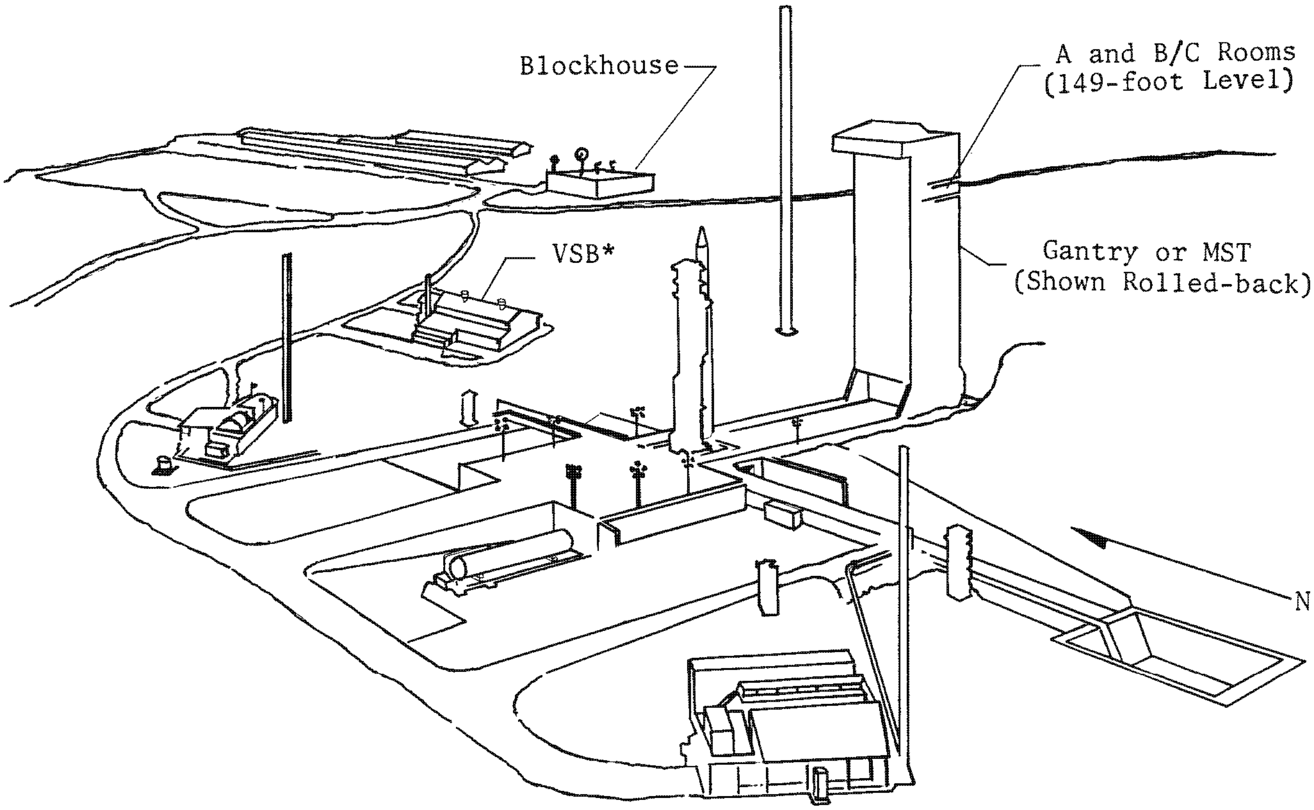
6.2.1 Vehicle Service Building (VSB)

The VSB contains electromechanical shop facilities required for repair, calibration and modification of test equipment. It is also used for temporary storage of various cycle-related shipping containers, and for between-cycle storage of portable test equipment. The VSB is the major work center for FAS personnel during periods between launch cycles.

6.2.2 A and B/C Rooms

The A room is an enclosed area within the gantry, or mobile service tower (MST) at the 149-ft level. The A room contains test consoles, gas loading equipment (used by GE RESD during spin and despin bottle charging), and tools and equipment necessary for vehicle mechanical mating, electrical mating, and arming of pyrotechnic circuits.

The B/C room is an extension to the A room incorporating large clam-shell doors which are closed around the PPS/DP EAC to provide an enclosed working space for final mating, arming, and testing tasks.



*VSB: Vehicle
Service
Building

Figure 4.6-3. Gambit Vehicle Launch Site (SLC 4-W)

The areas together are known as the gantry clean rooms and are shown in Figure 4.6-4. Clean, conditioned air is supplied to the B/C room through the air inlet and to the vehicle, when in place, through the air umbilical. Air flow and pressure valves are adjusted such that the net flow of air is from the vehicle to the clean room, thereby reducing the probability of contamination of sensitive vehicle areas. Required air flow and pressurization are discussed in Part 2, Section 13 of this handbook.

Though these areas are no longer routinely maintained as clean rooms (particle counts, special cleaning operations and procedures), the capability exists to restore a clean room environment if required. This requirement might arise, for example, if it became necessary to open the film path.

6.2.3 Blockhouse L Room

During integrated testing, instrumentation is routed to the blockhouse for evaluation by the appropriate contractor. The L Room is the BIF-008 assigned area and contains a set of five eight-channel recorders and an instrumentation console for the L Room data engineer (LDE). This console provides a means of quickly examining incoming data, and has communications facilities to the various communications networks in operation during testing.

The L Room is located in the blockhouse which is a reinforced concrete structure designed to protect its occupants in the event of a pad catastrophe during a launch.

6.2.4 Missile Assembly Building (MAB)

The MAB is the custodial responsibility of LMSC. FAS utilizes part of the MAB as a administrative work area and two separate storage areas. The administrative work area is a Gambit-cleared facility and contains office furniture, storage cabinets,

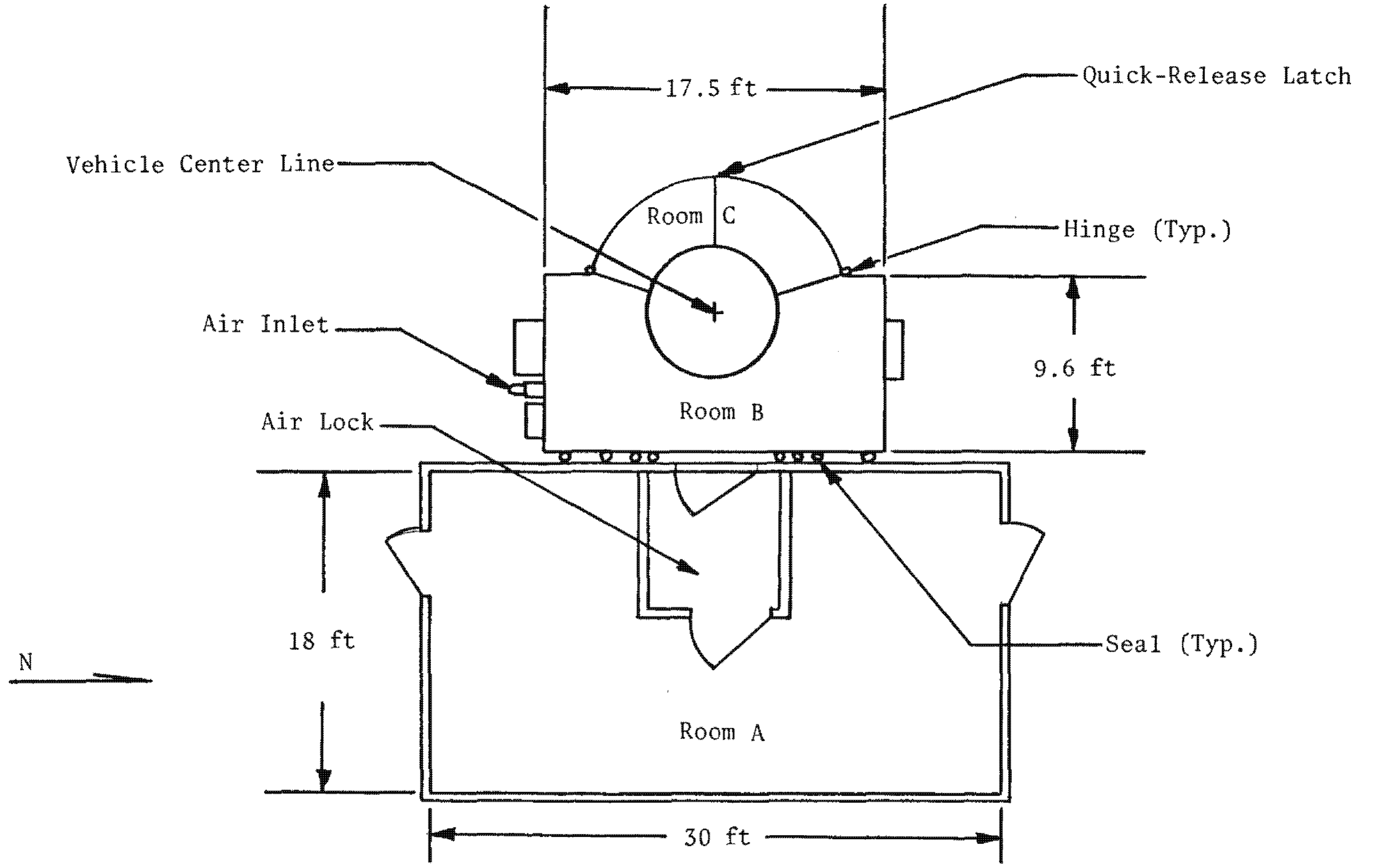


Figure 4.6-4. Gantry Clean Rooms (A and B/C Rooms)

file cabinets, safes, reproduction equipment and a keypunch machine. One area is used for storage of test support equipment and materials used for fabrication of shipping crates. Another storage area is used to store a PPS/DP EAC in its shipping container, when necessary. Also stored in the area are the adjustable, powered workstands used during PPS/DP EAC mechanical mating (erection of the PPS/DP EAC and installation of the lifting yoke), and the empty shipping container and peripheral equipment.

6.2.5 FAS Administrative Office

The FAS administrative office is a Gambit-cleared facility located in the MAB on north Vandenberg and is 11 miles from SLC 4-W. The administrative office contains engineering offices, conference room, document control, reproduction and keypunch rooms, and a shipping and receiving area. These areas are used for the preparation and/or storage of procedures, test software documentation, and historical documentation of PPS/DP EAC and support equipment operations.

6.3 Launch Support Activities

The following sections describe activities of FAS personnel when a PPS/DP EAC is being prepared for operation. Figure 4.6-5 presents a block diagram of these activites. The "L" days may vary depending upon the schedule plan adopted.

6.3.1 Off-Loading (L-12 Days)

25X1

This page intentionally left blank.

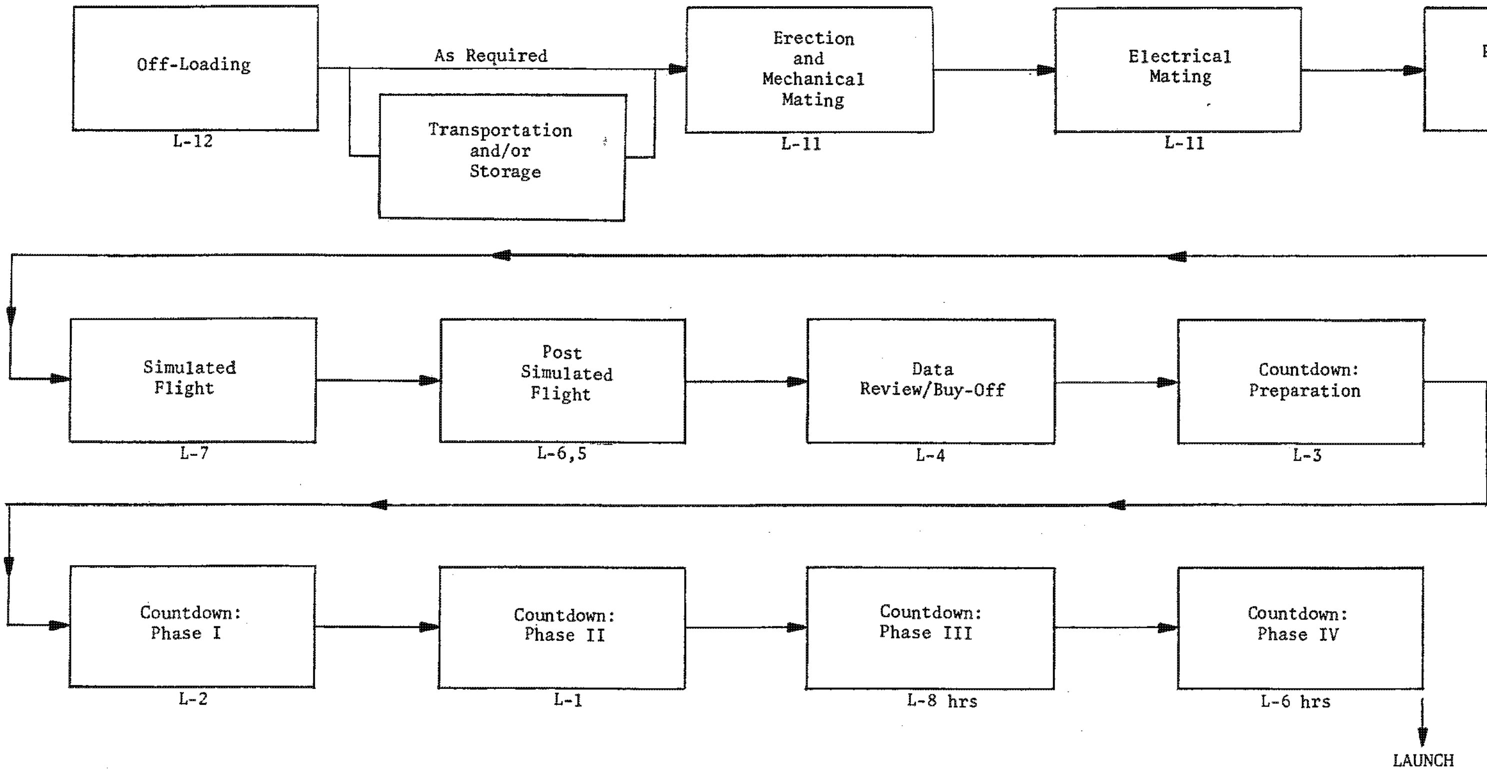


Figure 4.6-5. FAS Activity Block Diagram

Approved for Release: 2017/02/14 C05097223

6.3.2 Transportation and/or Storage

Normal operations require the vehicle/trailer to be driven directly to the launch complex (pad) once airport operations have been completed. Provisions and procedures have been developed to transport the vehicle/trailer to the MAB for temporary storage, if required, due to launch schedule changes. Should this be necessary, the power source for environmental control is transferred from the motor/generator to building power. The PPS/DP EAC is then monitored by FAS personnel at 4-hour intervals to verify proper environmental control. Overnight storage may be accomplished at the pad. The base of the gantry has a connection to provide 208 volts, 60 hertz, 3-phase (ABC) power for environmental control of the container. In the event of a container air-conditioner problem, it is possible to connect the pad air conditioner to the PPS/DP EAC container by means of emergency ducts.

A convoy is formed for transportation of the vehicle/trailer and support equipment from the airstrip to the pad. LMSC has the responsibility for this transportation, but FAS personnel monitor all phases of transportation, and are responsible for halting the convoy if temperature or vibration limits are exceeded. These limits are defined and discussed in Part 4, Section 5 of this handbook.

6.3.3 Erection and Mating

Erection and mating include those operations necessary to transfer the PPS/DP EAC from its shipping container to a position atop the booster/satellite control section combination. Erection involves the removal of the shipping container cover and rotation of the shipping container base and attached PPS/DP EAC to a vertical position by means of hydraulic cylinders on the trailer. These activities are not undertaken under the following environmental conditions:

(1) During electrical storms.

(2) Winds in excess of 15 knots (including gusts) with a direction between 176° and 17° from ground level to the 204-ft level.

(3) Winds in excess of 20 knots (including gusts) with a direction between 17° and 176° from ground level to the 204-ft level.

(4) Rain.

(5) Ambient temperatures greater than 90F, or less than 30F.

While the PPS/DP EAC is within the closed container, the full capabilities of the container humidity and temperature controls are in effect. Just prior to cover removal, ground cabling is switched to allow blanket heater operation until the vehicle is in a vertical position and ready to be removed from the container cradle. When the cabling change for cover removal is made, the only environmental control available is the capability to power heater blankets. In order to allow the vehicle to be removed from the cradle, the cable between the temperature controller and the aft heater blanket must be disconnected. This terminates all environmental control to the vehicle until it is mechanically mated to the satellite control section (SCS). Limits have been established defining time intervals that blanket power may be off. These limits are a function of ambient temperature and are shown in Table 4.6-1.

TABLE 4.6-1

ALLOWABLE BLANKET OFF TIMES

Ambient Temperature (F)	Maximum OFF Time (Minutes)
30	40
40	56
45	70
50	90
55	160

The vehicle is erected immediately after cover removal, and the integration lifting yoke is attached. When the vehicle is free of the vertical erector, responsibility for continuation of hoisting and mating operations passes to LMSC and FAS becomes a supporting member of the mating operation.

6.3.3.1 Mechanical Mating. Mechanical mating occurs at the 129-foot level of the MST when the PPS/DP EAC is lowered by crane and hydraset* to the top of the SCS and interface screws are installed and tightened to the proper torque by LMSC. FAS/QC representatives monitor the actual mechanical mate at the station 288 interface.

When mechanical mating is completed, FAS personnel assist in removal of the integration lifting yoke and seal the B/C room at the 149-foot level. Environmental control is transferred to ground facilities and vehicle air at 70F and 40 lb/min. flow is supplied by LMSC. Environmental monitoring begins at this point.

A vehicle inspection is performed after the B/C room and PPS/DP EAC are under environmental control. This inspection should uncover grossly anomalous situations and prepare the vehicle for subsequent testing functions.

6.3.3.2 Electrical Mating. In most cases, mating of electrical cables at the station 288 interface occurs immediately after the PPS/DP EAC is in place on the SCS and mechanical mating is complete. FAS/QC representatives inspect all cable connectors and monitor final cable connection. Ground heater checks are made as soon as possible after the station 288 cables are mated.

6.3.4 Simulated Flight Testing Activities

The simulated flight test achieves a functional checkout and compatibility verification of the entire, integrated aerospace vehicle. The objective of the

*The hydraset is a device inserted between the crane hook and the integration lifting yoke which allows for precise, shockless vertical positioning of the PPS/DP PPS/DP EAC.

simulated flight test is to obtain as thorough a functional checkout as practical within limitations imposed by reliability, safety, the state of hardware buildup, and consumption of expendables.

6.3.4.1 Pre-Simulated Flight Test Activities. Spin and despin bottles are charged and retro-rocket igniters are installed by GE. Cables from ground support test equipment are connected to appropriate socket-saver panels (see Part 2, Section 1.2.1). The mini-console, instrumentation console, analog recording console (ARC), and field system test equipment (FSTE) are configured in accordance with approved check lists so that simulated flight testing can be performed.

6.3.4.2 Simulated Flight Test. The simulated flight test consists of a sequence of commands and expected responses which exercise, insofar as possible, all aerospace vehicle subsystems. The simulated flight test is the first time the complete system is tested. The mission profile portion of the test is a one-for-one test compared to one of the final factory tests to verify that the PPS/DP EAC is in the same condition as when it left the factory. The entire test is conducted by LMSC as integrating contractor from the control room in the blockhouse. The covert nature of BIF-008 involvement precludes participation in these activities from the control room. However, FAS personnel are part of the test team from the L room and from the computer complex in the blockhouse through physical presence and through the communications network. PPS/DP EAC related checkpoints are referred to as GE/LDE (General Electric L room data engineer). The LDE station is manned by FAS personnel from the time the PPS/DP EAC is mechanically mated until liftoff.

The pad automatic data evaluation (PADE) system monitors, via telemetry, performance of the majority of PPS/DP EAC subsystems, including data on all simulated functions which are coded and supplied to the pulse code modulation telemetry stream during PPS/DP EAC tests. Analog recorders and real-time test equipment outputs are employed to monitor status of selected PPS/DP EAC subsystems.

6.3.4.3 Post Simulated Flight. Thermal tape repairs and reconfiguration, if required, for the expected orbit are performed subsequent to the simulated flight test. Miscellaneous preparations are completed prior to countdown: Phase I.

6.3.5 Data Review and Buy-Off

All data generated during simulated flight testing is reduced and/or reviewed for verification of acceptability. Results of simulated flight testing are reviewed with Air Force representatives. Data discrepancies are discussed and action to be taken, if any, is defined. A data buy-off is held with the Air Force and the aerospace vehicle is certified as flight-ready.

6.3.6 Countdown Activities

Countdown activities mark the final preparation of the aerospace vehicle for flight. In preparation for countdown activities, PPS/DP EAC flight panels and equipment required for PPS/DP EAC arming are moved to the A room on the MST. The configuration of the miniconsole, instrumentation console, analog recorder console and field system test equipment is again verified using the check lists.

6.3.6.1 Pre-countdown Task. Pre-countdown task includes a final functional test of the PPS/DP EAC. The final command load is sent [redacted] through the Vandenberg tracking station and correct receipt is verified. 25X1

6.3.6.2 Coundown: Phase I. Countdown: Phase I establishes the satellite vehicle and ground test equipment configuration and readiness for continuation of the countdown activities.

6.3.6.3 Countdown: Phase II. Countdown: Phase II is the arming phase of the launch activities. Pyrotechnic devices in the PPS/DP EAC, SCS and booster are armed. Socket-saver panels are replaced with flight panels at all PPS/DP EAC locations. If not previously accomplished, shipping panels are replaced with flight panels and all access openings are closed with flight panels. The B/C room doors are opened and all preparations for MST rollback are made by FAS personnel.

6.3.6.4 Countdown: Phase III. Countdown: Phase III prepares the vehicle for termination countdown. The PPS/DP EAC is checked periodically for proper instrumentation voltages and environmental limits. The MST doors are opened and the MST is rolled back in preparation for launch.

6.3.6.5 Countdown: Phase IV. Countdown: Phase IV is the terminal countdown phase of the aerospace vehicle. The PPS/DP EAC instrumentation and environmental status are monitored continuously from terminal countdown through launch. If any critical instrumentation points go out of specified limits during this time, an immediate halt is called and the cause determined. If all systems are go, the aerospace vehicle is launched and FAS processing of the PPS/DP EAC is complete.

6.4 Between Cycle Activities

Immediately after launch, selected personnel leave to support orbital activities at the [redacted] and preparations are begun for the next launch activity. These 25X1
activities are summarized in the following sections.

6.4.1 Hardware

Support equipment is calibrated, checked and updated to a revised configuration, if required. Necessary repairs are accomplished. Complete validation, involving procedures (CS-15003, AGE Validation and CS-15127, Integrated Test Equipment Validation), is performed on a 6-month cycle.

An abridged validation is performed every 30 days following the complete validation in accordance with CS-15100, Callup, Readiness and Activation Procedure.

The PPS/DP EAC shipping container and other support equipment, which is to be returned to the factory, are packed and shipped. When required, the BC-room is detached from the A-room and stored.

6.4.2 Software

Desired and/or necessary changes to the various software packages are accomplished in cooperation with GE (RESD) and LMSC. Any changes agreed to in interface documentation are reviewed and implemented. Procedures are reviewed and updated as required.

6.4.3 Factory/Field Liaison

Configuration status of the next vehicle is reviewed and any revisions to procedures or changes to support equipment are accomplished. FAS personnel are in contact with factory test personnel so that test status currency is maintained.

6.4.4 Training for FAS Cycle

The majority of personnel used during a FAS cycle will be trained Factory visitors. A complete and comprehensive training program is routinely conducted to assure that the people remain informed of the latest changes in operating mathods.

This page intentionally left blank.

7.0 FIELD ACTIVITY, NORTH (FAN)

After launch of the Gambit reconnaissance vehicle, operational control passes to the satellite control facility (SCF). Included are tracking, command and telemetry functions. These activities and the role of the BIF-008 West Coast Engineering Office (WCEO) are discussed in this Section.

7.1 [redacted]

25X1

[redacted]

7.1.1 Remote Tracking Stations (RTS's)

Six RTS's support the Gambit program:

- BOSS - New Boston, New Hampshire
- COOK - Vandenburg Air Force Base, California
- GUAM - Guam
- HULA - Hawaii
- INDI - Seychelles Islands, Indian Ocean
- POGO - Thule Air Force Base, Greenland

Each station includes a large diameter (40' - 60') moveable dish antenna capable of operating in the S-band through a space ground link subsystem (SGLS). UHF antennas and equipment are also included. The stations are operated from a console connected to a Univac 1230 military tactical computer. Three stations, BOSS, COOK and HULA each contain dual independent antennas and a Univac 1230 computer for redundancy and simultaneous support.

7.1.2 Communications

Communications are handled by the 1230 computer which is linked by land-line or satellite circuits to the [redacted] Control Data or Varian (bird buffer) computers serve as the data interface. Other computers [redacted] perform the functions of command generation, data prediction, tracking reduction, and target file and data base maintenance. 25X1

7.2 Program 110 Operations Director

The facilities, personnel, and other resources necessary for the mission conduct are the responsibility of the Program 110 operations director (OD). All the requirements of the mission are levied on the mission control force (MCF). These are, overtly, to provide precise orbital control of the satellite vehicle and to provide for recovery of reentry vehicles. Covertly, the MCF responds to the Gambit program requirements as defined by the director, Secretary of the Air Force, special projects and the deputy director, [redacted] These covert requirements include, firstly, to acquire high-resolution intelligence photography, and secondly, to conduct experiments which will result in improved system capabilities. The actual coverage and target selection requirements are defined by a separate special projects (SP) organization, [redacted] while the use and capabilities of the satellite hardware necessary for acquiring the photography ultimately remain the responsibility of [redacted]

The OD, in order to meet the program requirements, operates a staff of specialized organizations whose tasks include command generation, test control (communications), orbit planning, and technical analysis.

7.2.1 Test Control

The communications necessary for mission support are provided by civilian personnel contracted [redacted] Both voice and data contact with the RTS's and other remote groups are handled by test control. Following a prepass meeting of the OD and staff, each station is briefed prior to contact with the satellite vehicle. Any command messages to be loaded are transmitted and the "command plan" is discussed with the station console operator. The data requirements both during and after the contact are also defined. During the time the satellite is acquired by a station (average of one station/rev), the test controller [redacted] communicates any action to be taken as determined in the prepass meeting or in real time by the OD and staff. In addition to the commands to be loaded which will result in photography, the station is directed to send commands to cause the on-board tape recorder to read out data which was recorded while out of station contact.

25X1

Test control and the station also respond to real-time bias software which, on the basis of range and range-rate, determines what in-track timing error may have been induced by errors in the atmospheric drag modeling. Appropriate commands are then determined at the station and loaded to give the vehicle clock an offset which will result in proper photographic timing. Typical time biases range up to one second.

After the contact (approximately five minutes duration), test control coordinates the transmission of data which was telemetered from the vehicle tape recorder back [redacted] where it is processed, displayed, and distributed.

7.2.2 Orbit Plans

25X1

Another group contracted [redacted] is orbit plans (OP). Their function is to maintain precise knowledge and control of the vehicle orbit to meet mission requirements for earth coverage. Normally, this includes close control of the orbit period allowing the earth's rotation and the precession of the orbit to yield evenly spaced coverage over the duration of the flight. Modifications to this plan may result from a change in specific target requirements on short notice after the flight is in progress. Usually a daily "period maintenance" orbit adjust is performed to restore the approximate ten seconds lost due to the orbital energy removed by drag effects. Occasionally the height and/or the argument of perigee is modified by performing a positive/negative orbit adjust pair where the vehicle is yawed 180 degrees for the negative "burn". Approximately 10 seconds of integrated secondary propulsion system (ISPS) burn time (at $\approx$ 90 lbs thrust) is required to effect a one second change in period. The perigee parameters are generally derived from the tradeoffs among acceptable drags, desired mission length, available orbit maintenance fuel, minimization of photographic slant range, and various tolerances of the hardware to the thermal pulses of low altitude orbits.

7.2.3 Weather

A weather engineering (WE) organization services the needs of the program in several areas. Firstly, the weather in the locations of planned photography is determined on a close timeline basis to allow efficient use of film by trading off the importance (priority) of targets with the probability of a "clear" shot. Secondly, the weather in the recovery area near the Hawaiian Islands is monitored on a daily basis in anticipation of each mission's termination. Another phenomenon monitored by this organization is solar storm activity and the effect of the resulting proton streams on the upper atmosphere density. This density and the resultant drag predictions are used by OP in determining the amount of energy required in the daily orbit maintenance engine burn.

7.2.4 Technical Advisors

The MCF is completed by the technical advisor (TA) staff. (See Figure 4.7-1.) This group, which is managed by Aerospace Corporation, forms the interface of the hardware contractors to the MCF. Included, in addition to BIF-008, are Lockheed Missiles and Space Co., (LMSC), General Electric Reentry and Environmental Systems Division (GE RESD) and General Electric Aeropsace Electronics Systems Division (GE AESD). Lockheed is responsible for technical support of the Agena vehicle which forms the satellite control section (SCS). GE RESD supports the satellite reentry vehicles (SRV's) while GE AESD maintains support of the on-board command systems (ECS amd MCS) which are located in the SCS.

The BIF-008 WCEO provides the support necessary for the Gambit program on the TA staff and [redacted] 25X1

7.3 WCEO Activities

There are basically three segments to the WCEO support activities. These are: Pre-flight, on-orbit, and post flight support. Each of the three are in the following paragraphs.

7.3.1 Pre-Flight

The pre-flight tasks consist of preparing inputs to the software through command and telemetry data base management and through mode preparation. These activities are coordinated with OD, AF software, Associate contractors, and the TA. Planning of R and D experiments such as defocus record (DFR) and/or continuous defocus record (CDFR), is accomplished with [redacted] In addition, preparation and submittal of a prediction of power consumption is required for integration into the overall satellite power requirements. All

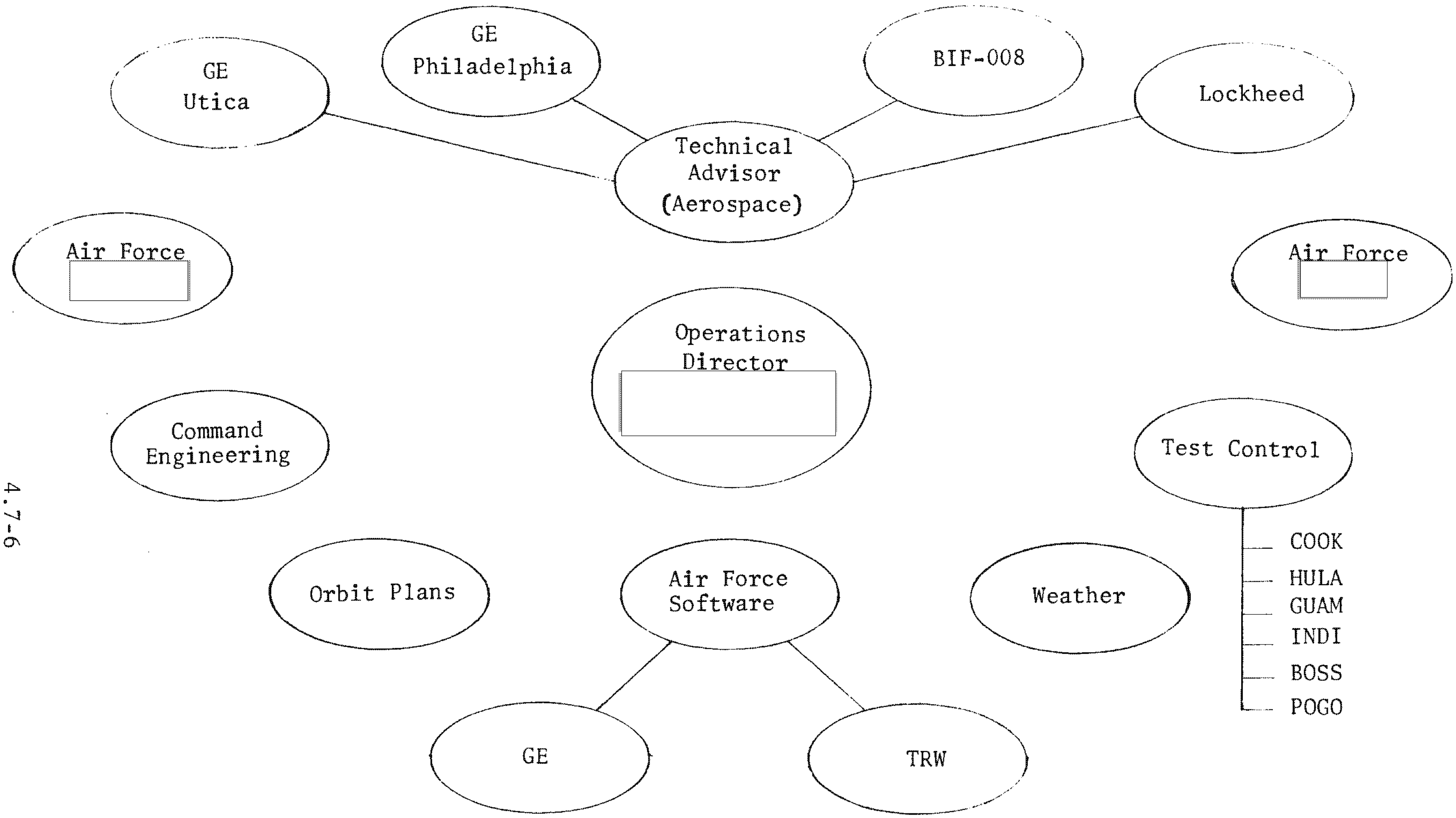


Figure 4.7-1. [redacted] Organization

Approved for Release: 2017/02/14 C05097223

Associate contractors and the TA are involved. WCEO, along with all other contractors, is required to support rehearsals during the pre-flight preparation. The purpose is to check out and validate software as well as general readiness of the SCF to support an operation.

7.3.2 On-Orbit

During the on-orbit segment, WCEO acts in an analytical/technical advisory capacity to [redacted] and Associate contractors. This effort is conducted 25X1
on a round-the-clock basis for the duration of the photographic mission plus a solo period which is used for nonmission oriented experiments.

7.3.2.1 Message Checking. Command messages are checked and analyzed prior to being loaded into the satellite. This is done on a rev-by-rev basis, to assure that no commands have been inserted or omitted that would be detrimental to the hardware or to photography. Approximately 10 messages per day are loaded. Further details on the payload message checking function may be found in Section 7.6.

7.3.2.2 Planning/Briefing. Each morning, the shift supervisor participates in a briefing of all the mission operations groups which covers the past day's problems and anomalies and discusses the next day's objectives and/or revisions to plans of operation.

Any changes to the data bases are made as required after discussion with others in the mission operations community that might be affected, and approval of the TA.

R and D experiments are planned, normally for the revs not containing prime photography.

7.3.2.3 Film Accounting/Evaluation. Film management/accounting is done to keep [redacted] and BIF-008 factory personnel informed of such things as total film used/remaining, film type in use, and when to expect the next film type change. 25X1

During the flight and immediately after SRV 1 and SRV 2 recoveries, BIF-008 supports quick-look meetings with [redacted] to analyze the mission and determine the accuracy of the focus recommendations and any necessary adjustments for the second half of the flight.

7.3.2.4 Focus Analysis (Dynamic Filter). Data from the on-board focus detection subsystem (FDS) is analyzed in depth to provide the basis for BIF-008 recommendations for platen position. Additionally, the focus data is analyzed in conjunction with other vehicle data to examine the variance in focus data through stepwise regression analysis. Figure 4.7-2 presents a block diagram of the five software modules involved which are collectively known as the dynamic filter.

7.3.2.4.1 Dynamic Filter Input Data. Inputs to the dynamic filter software are:

(1) Bird buffer recording tape (raw data).

(2) Data base (editing and calibration parameters).

(3) Vehicle clock parameters.

(4) Ephemeris parameters.

(5) Operation requests (user instructions).

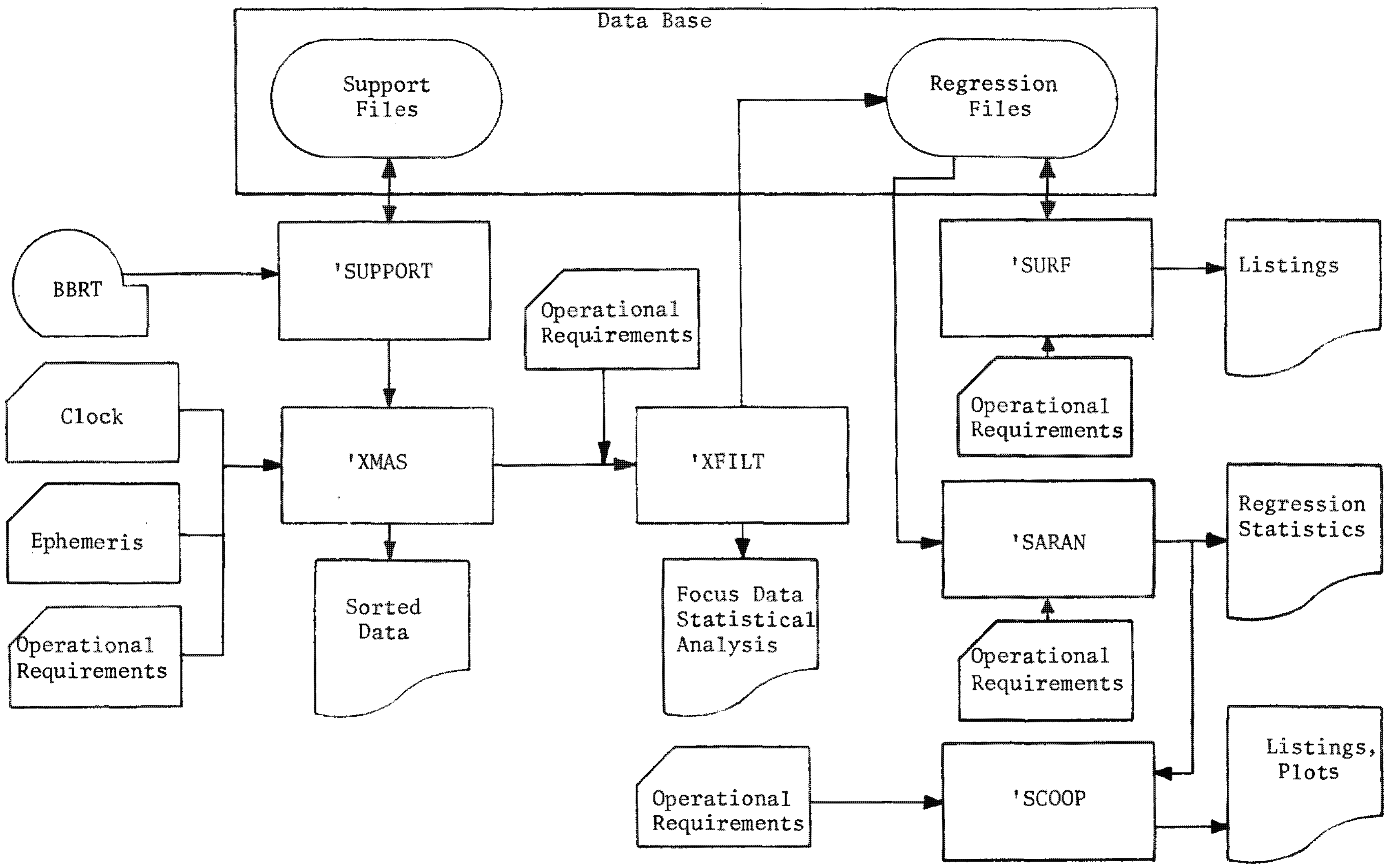


Figure 4.7-2. Dynamic Filter Block Diagram

Approved for Release: 2017/02/14 C05097223

7.3.2.4.2 Dynamic Filter Data Base. The dynamic data base is generated and maintained by the user who is solely responsible for its configuration. The following data base blocks are basic to the dynamic filter:

(1)	Kalman filter constants	'ACOMON
(2)	Editing constants	'AEDIT
(3)	Needed telemetry identification	'AIDS
(4)	Calibration coefficients	'CALBLK
(5)	Clock coefficients	'CALCLK
(6)	Platen position calibration	'CALPL

7.3.2.4.3 Dynamic Filter Modules. The calibration module, 'XMAS, processes selected vehicle instrumentation points and calculates ephemeris parameters. This data, comprised of the raw telemetry points, vehicle clock data and ephemeris parameters, is stored in support files in the data base where it is chronologically sorted. Poor data is deleted via data base editing. Input data from 'XMAS is edited and quality checks are included where applicable. Special regression parameters are then calculated and input with the acceptable data to 'XFILT, the focus calibration module. 'XFILT contains models of specific focus hardware and a discrete-time Kalman filter-smoother to improve the quality of estimated focus parameters. Statistical quality evaluation criteria are output for analysis. The focus data and regression parameters are output and stored in regression files in the data base (see Figure 4.7-2).

The stepwise regression module, 'SARAN, performs a single stepwise regression analysis on focus samples stored in the regression files. Up to 64 independent variables may be entered into the modules.

The update module, 'SURF, is used to modify data in the regression files. 'SURF can delete all or part of the data for any specified rev.

The plotting module, 'SCOOP, can plot and/or list any variables used in 'SARAN. Size and scales are User-specified.

7.3.2.5 Data Analyses. Various data, such as thermal and power, is collected, plotted, and analyzed on a rev-by-rev basis, to ensure the health of the hardware and protect against degradation of operations and hardware. In addition, recommendations for various subsystems are developed.

7.3.3 Post Flight

This is the time span immediately after solo and shutdown of the round-the-clock mission operations activities. At this time WCEO prepares an input to the Preliminary Flight Evaluation Report (PFER) which is compiled, edited and published by Aerospace, Inc. for [redacted] Meetings are held to appraise R and D activities, to critique the operation, and the performance evaluation team (PET) evaluation. 25X1

7.4 Vehicle Commanding

The process of commanding the Gambit vehicle is centered around an extensive and involved software system which has undergone constant refinement throughout the duration of the Gambit program. The end purpose of this system is to provide a set of vehicle commands which will execute a sequence of photographic operations yielding the maximum intelligence return, within the bounds of system constraints and capabilities. In so doing, the software accomplishes a variety of functions which run the gamut from constructing and maintaining the target/requirements file, to modeling vehicle hardware subsystems, to optimizing target selection and photography, to generating a bit-by-bit command pattern for transmission to the vehicle, and predicting the vehicle's response to those commands.

The major tasks performed by the software system include:

(1) Generating and maintaining the target/requirements file, which may consist of 15,000 targets and 30,000 requirements for the surveillance mission and 32,767 targets and 65,535 requirements for the search mission. Additionally, for the search mission, a file of 50,000 report only targets is generated and maintained.

(2) Generating and maintaining the problem set file, which may consist of 2047 problem sets.

(3) Adjusting the status of targets, and individual, as well as category requirements, to reflect actual photography and planned photography.

(4) Selecting an optimum sequence of photographic events so that intelligence return is maximized.

(5) Considering forecast weather in selecting targets to be photographed.

(6) Determining all vehicle events necessary to define vehicle activities.

(7) Generating command messages based on defined and selected vehicle events.

(8) Analyzing vehicle photographic activity to determine which targets have been photographed.

(9) Requesting assessed weather for photographed targets.

(10) Reflecting the weather and actually-photographed target data in determining which requirements need further satisfaction.

(11) Predicting the telemetry response of the vehicle to specified command loads.

(12) Generating and maintaining a command and activity history for the entire mission.

(13) Accepting manual inputs and data base changes at all stages of processing.

The software which accomplishes all of these tasks is comprised of two main elements: "system IIB" and "Gambit-specific". The system IIB software is a multi-faceted package providing functional satellite support mechanisms shared by all satellites operated through the SCF. The Gambit-specific software defines and contains those software components which are peculiar to the Gambit program.

7.4.1 System IIB Software

The multi-program system IIB software is maintained on the system support tape (SST). Its components are described briefly in the following sections.

7.4.1.1 SYMON. SYMON is the system executive, which controls the operation of all programs running on the (CDC 3800) operational computers.

7.4.1.2 AOES. AOES is the advanced orbital ephemeris system, which processes vehicle tracking data from the RTS network, models atmospheric-drag effects, and predicts the vehicle ephemeris. AOES is also employed to calculate the maneuvers necessary to maintain the vehicle in its planned orbit.

7.4.1.3 'SACRED. System routine 'SACRED formats the defined commands for delivery to the vehicle. The generated commands are accepted, by 'SACRED, from the program-specific command generation software, are formatted, and are forwarded to the emulator buffer transmission tape (EBTT) for delivery to the RTS.

7.4.1.4 'SUPPORT. Telemetered vehicle data is processed through the 'SUPPORT system routine. The data is received from the RTS and stored on the emulator buffer recording tape (EBRT). It is then played through the 'SUPPORT routine which formats it for delivery to the program-specific software.

7.4.1.5 'UTILITIES. The system 'UTILITIES includes those routines which provide for the generation and maintenance of such items as the system macros, compool and data base.

7.4.2 Gambit-Specific Software

The Gambit-specific software is maintained on the auxiliary master tape (AMT) and, operationally, is comprised of the following six (6) main functional subsystems.

7.4.2.1 Acquisition Processor Subsystem (ACQ). The ACQ uses payload parameters to select those targets that are potentially photographable on each rev.

7.4.2.2 Mission Requirements Subsystem (MRS). The MRS builds and maintains the file of targets and requirements and counts down the degree of target/requirement satisfaction. MRS passes the target/requirements (TR's) file to the events generator subsystem (EGS).

7.4.2.3 Events Generator Subsystem (ECS). This subsystem selects the targets to be photographed, computes commandable parameters for those targets, and optimizes the events required to accomplish photography. Payload maneuvers, station contacts, and R&D events are assembled through this event generator. Thus, the EGS generates all the events necessary to define the vehicle's activities. This subsystem includes and executive which calls and sequences all the functions in the EGS, command assembly subsystem (CAS), and the telemetry predict subsystem (TPS) (see following descriptions). The EGS reads and processes all pertinent data cards and the forecast weather tape, and builds the payload event generator data file ('PEG) which is used by the CAS.

7.4.2.4 Command Assembly Subsystem. This subsystem translates the event requests from the 'PEG file into a vehicle-compatible set of commands. The commands are output to the command message file which is used by system routine 'SACRED to format the command message for transmission to the tracking stations. CAS builds an executed command file for use by the mission analysis subsystem (MAS) and a chronological command memory image (CCMI) file for use by the TPS.

7.4.2.5 Telemetry Predict Subsystem. This subsystem uses the CCMI from CAS to produce static and dynamic telemetry predictions, i.e., time dependent predictions of expected telemetry values resulting from the execution of the commands loaded into the vehicle. The TPS outputs a telemetry limits tape which is input to the emulator buffer computer (EBC - the STS communications computer) for direct comparison with the actual telemetry received from vehicle. For further detail see Section 7.5.5.

7.4.2.6 Mission Analysis Subsystem. This subsystem essentially performs a bookkeeping function. It orders and correlates data, determining the best estimate of which targets were photographed. It outputs this mission correlation data (MCD) and an assessed weather request tape. The MCD and the assessed weather are then fed back to the MRS, closing the loop to permit a constant reevaluation of target priorities.

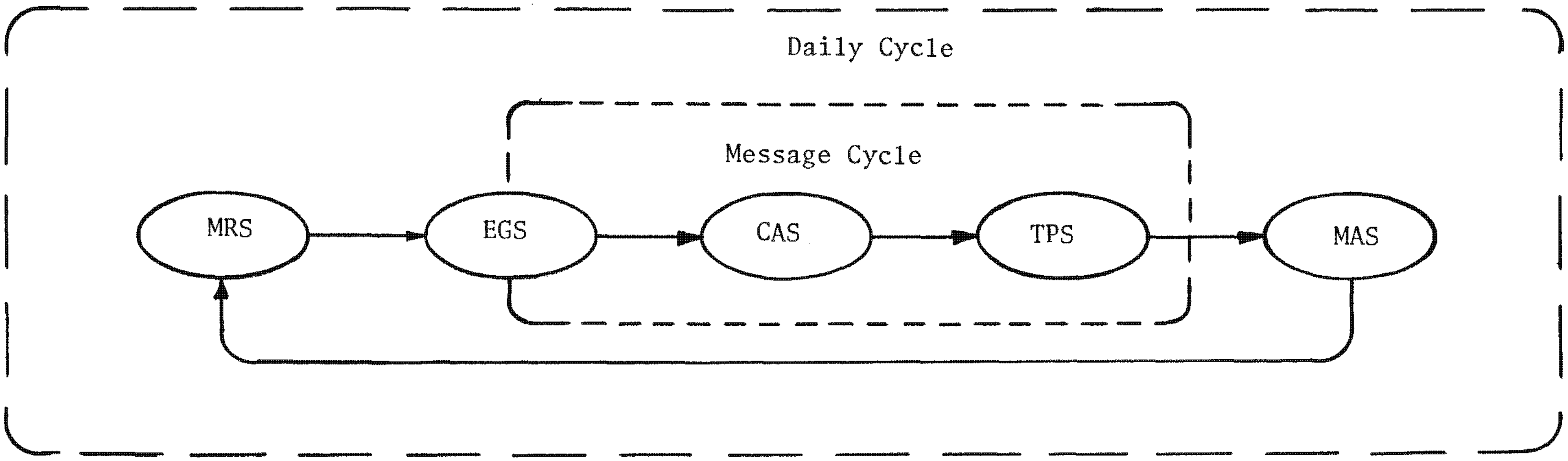
The interrelationship of these subsystems is depicted in Figure 4.7-3. Essentially, the five operational elements comprise a continuous feedback loop which is executed daily, beginning and ending with the MRS (daily cycle). Within this loop, a portion of the EGS subsystem, as well as the entire CAS and TPS subsystems, are executed for each command message generated (message cycle).

7.4.2.7 Auxiliary Gambit Subsystems

The operational software is supported, also, by two auxiliary Gambit subsystems. These are:

(1) Data Base Management Subsystem: This subsystem constructs the data base, maintains and displays the data base, compares data blocks and provides the capability for computer printout of data base related documents.

(2) Mission Performance Subsystem: This subsystem provides the capability to construct summary listings and histograms reporting a number of pre-requested categories of target/requirements/characteristics sets. The output of this subsystem is used primarily by the User Community in analyzing "mission effectiveness".



MRS: Mission Requirement Subsystem
EGS: Event Generator Subsystem
CAS: Command Assembly Subsystem
TPS: Telemetry Predict Subsystem
MAS: Mission Analysis Subsystem

Figure 4.7-3. Gambit Operational Software

(The 'GREPORT program is an element of this subsystem. It provides, among other things, summaries of the various PPS servo positions for all camera frames.)

7.5 Message Generation

This section is devoted to descriptions of the basic elements and processes involved in the generation of a PPS/DP EAC command message for loading into the vehicle at any RTS.

7.5.1 Mission Requirements Subsystem (Pre-Mission)

The first element in the process of Gambit vehicle commanding takes place preflight with the establishment of the mission-length target/requirements (TR) deck. The TR deck is a deck of computer cards defining each target to be considered for photography during the mission. There may be up to 15,000 (surveillance mode) or 32,767 (search mode) individual targets, each with one or more requirement sets. The total number of requirements is 30,000 for the surveillance mode and 65,535 for the search mode.

A single target card nominally contains the following physical characteristics:

(1) Target identifier which is a unique label for the target. The target ID, by code, specifies its problem set and target number for point targets and World Aeronautical Chart (WAC) cell designator, chart and Air Target Chart (ATC) for cell targets.

(2) Latitude, longitude, and altitude of the target.

(3) Target diameter for point targets or target width for cell targets.

(4) Target location uncertainty.

(5) Target geometric mean reflectance.

(6) Country code designating the country in which the target is located.

A single target card nominally contains the following requirement characteristics:

(1) Priority and shade. There are 10 priorities, 0 through 9, with 0 being the highest. Shade (a number ranging from -99 to +99) ranks targets within a given priority. Priority and shade together determine the basic weight to be assigned to a target/requirement combination.

(2) Photographic mode (aft strip, vertical strip, forward strip, stereo pair, lateral pair, lateral triplet, stereo triplet).

(3) Required resolution.

(4) Sun azimuth and elevation limits.

(5) Target azimuth and elevation limits.

(6) Date of last coverage.

(7) Probability objective for the requirement (when the cumulative probability of satisfying the requirement exceeds this value, the requirement is considered satisfied).

(8) Special processing (mandatory selection, special processing, report only, suppress countdown).

In addition, target/requirements may belong to the following problem sets:

(1) Problem set identifier.

(2) Coverage period (3, 6, or 12 months).

(3) Percent unique cloud-free photographic modes required.

(4) Period start date.

(5) Period type (fixed, cyclic or sliding [search mode only]).

The TR deck, then, provides one primary input to the MRS. The other basic input is the climatological weather tape. Climatological weather is a statistically averaged compilation of world wide historical weather which has been collected by global weather central (GWC) and dates back to 1959.

With these two elements, MRS now builds the target/requirements ('TAR) file, which is essentially a rearrangement of the TR deck ordered by world aeronautical chart (WAC) cells. In addition, the climatological weather has been factored in to calculate the probability of attaining each target at some future time in the mission. The 'TAR file now becomes a primary input to the acquisition processor function of the EGS.

7.5.2 Event Generator Subsystem (Daily Cycle)

As mentioned earlier, the EGS operates in daily- and message-cycles. The relationship between the two cycles is shown in Figure 4.7-4. In the daily-cycle mode, the EGS calls the following programs, in chronological order.

7.5.2.1 'TSPAGN. 'TSPAGN is the station contact event generator. It assembles the vehicle events necessary to accomplish communication of tracking data, real time and recorded telemetry data, and vehicle commands. The day's desired station contact plan is input to EGS which then accesses the AOES to determine the correct contact times. The assembled events are passed to the 'PEG file. These are subsequently routed through CAS, where they are converted to vehicle commands, and loaded into the vehicle memory as the daily station-contacts message.

7.5.2.2 'TROGEN. 'TROGEN is called next to assemble the vehicle maneuver events. The maneuver events are those which control the firing of the ISPS for vehicle orbit adjusts (OA's). OA's are commands programmed daily to maintain the vehicle orbit. They are also assembled periodically to adjust the height of perigee (HOP) or other orbit parameters in accordance with the current orbit plan. Additionally, OA's are called as required for special events [redacted] and SRV recoveries.

25X1

The maneuver events assembled by 'TROGEN are time conflicted by EGS to avoid any conflict with the station contact events. They are then output to the 'PEG file

[redacted]

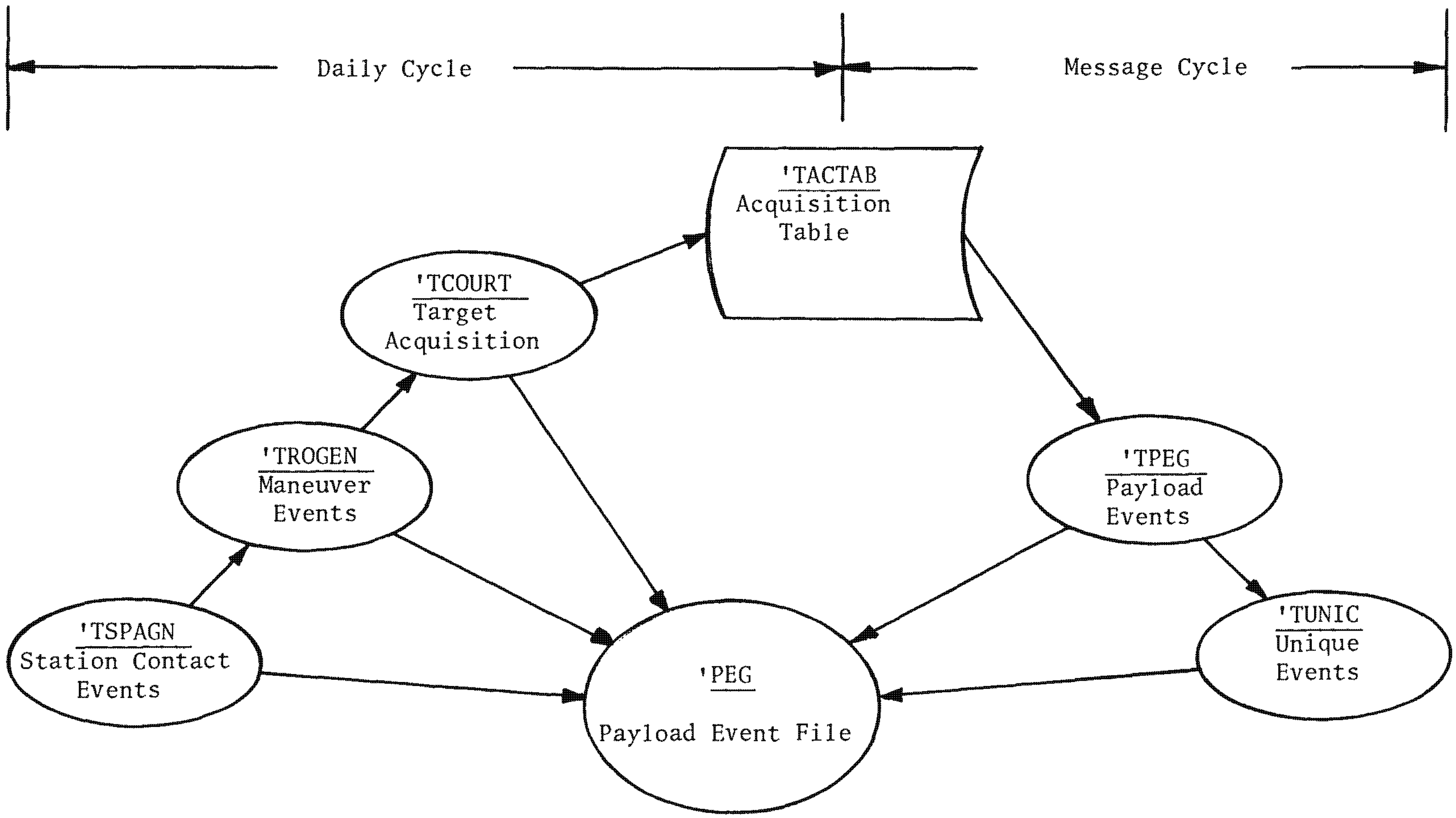


Figure 4.7-4. Event Generator System

Approved for Release: 2017/02/14 C05097223

where they reside until called by CAS. They are eventually converted by CAS to vehicle commands which are loaded into the vehicle memory as part of the last command message preceding the occurrence.

7.5.2.3 'TCOURT. 'TCOURT, the acquisition processor, is the third and last program called in the EGS daily cycle. Its job is to organize and compress the master 'TAR file into a time-ordered set of visible targets for the day's rev span.

Using the 'TAR file from MRS and the vehicle ephemeris from AOES, 'TCOURT determines the targets which will be accessible to the PPS/DP EAC during that day.

For each rev, it begins by determining the ground track of the vehicle. With this information, it can select those WAC cells which will be accessed by the ground swath of the PPS/DP EAC.

At this point, 'TCOURT searches the 'TAR file and identifies all targets residing in the accessed WAC cells. Now, knowing the relative position of each target with respect to the vehicle ephemeris, 'TCOURT compares these physical realities against the physical limitations defined on each target card (i.e., minimum sun angle, maximum slant range, obliquity, etc.). As a part of this process, also, a 'TCOURT subprogram calculates a predicted ground resolution which is compared against threshold requirement specified on the target card. The total process of elimination accomplished by the acquisition processor normally results in retention of about 20 percent of the total target set for a one-day run.

Targets which meet the full set of requirements are entered directly into the acquisition table ('TACTAB). Targets which meet only some portion of the requirements set are deweighted (i.e., their relative priority is reduced) before being entered into the 'TACTAB. The 'TACTAB is a compilation of candidate targets ordered by vertical acquisition time and defining for each of the pertinent physical parameters and estimated resolution as well as the nominal required PPS/DP EAC servo positions (referenced to the WAC cell center). The 'TACTAB becomes, now, the basic input to the payload event generator ('TPEG) program which is run in the message-cycle mode of the EGS.

Upon completion of its selection process, the acquisition processor outputs a 'TCOURT listing which is a listing of the contents of the 'TACTAB. This output is of significance to BIF-008 operations personnel since it provides the basic "road map" for selection of subject targets for photographic experiments (DFR's, CDFR's, etc.). 'TCOURT also outputs a "forecast weather tape" which is transmitted to GWC requesting a weather forecast for each of the day's candidate targets.

7.5.3 Event Generator Subsystem (Message Cycle)

This second mode of the event generator is executed for each command message which is to be loaded into the PPS/DP EAC. It is normally accomplished within a one-rev (90-min.) time line during periods of peak photographic activity (and somewhat less frequently during periods of relative inactivity). The message cycle mode is comprised of two chronologically-called programs, 'TPEG and 'TUNIC.

7.5.3.1 Payload Event Generator ('TPEG). The Payload Event Generation function software is capable of operating in two altitude modes: search (high) and surveillance (low). To accomplish this, certain software modules are provided with both search mode and surveillance mode versions as necessary to perform the tasks unique to the altitude modes. Although only surveillance mode routines are referred to in this section, the discussion applies also to the search mode routines. In general, the search mode routines are functionally equivalent to their surveillance mode counterparts. The System Executive Subsystem (SES) invokes either the search or the surveillance mode PEG driver, 'TPEG or 'TPEGH. 'TPEGH, the search mode driver, controls the execution of these high-mode routines.

The first program called in the message cycle is the payload event generator 'TPEG program. The function of 'TPEG is to sort out the candidate targets on each rev and build an optimum sequence of photographic events for that rev. The "optimum sequence" is defined as that order of photographic frames adding up to the greatest total weight or "score".

'TPEG begins with the 'TACTAB from 'TCOURT. It steps through this time-ordered list, identifying each target as it is acquired. Its first order of business is "mode generation".* In generating modes, 'TPEG expands the acquisition table to include FWD, NADIR and AFT stereo positions, or modes, for each target. It then calculates the appropriate payload parameters for each mode (i.e., crab, roll, FDS, slit, and burst time). The target mode list is further expanded here to include acceptable decentered roll stops for each target. Thus for a particular target with three acceptable stereo angles and acceptable decentering of ±2 roll stops, the target mode table is expanded to 15 candidates (3 stereos x 5 rolls). For each roll stop away from center, the target weight is decreased.

The event generator now calls up the most current weather forecast for the pertinent rev span (furnished by GWC as a result of the request from the acquisition processor). Weather forecasts are stated as a percentaage of cloud-free sky over each target and the basic weight of each target mode is altered in direct proportion to this percentage. Using the most current ephemeris from AOES, 'TPEG now enters the process of payload optimization. Basically, optimization involves a time-ordered search through the target-mode (T/M) table, to determine a viable sequence of targets within the capabilities of the PPS/DP EAC. (The data base is examined here for vehicle servo positions and rates.) As each T/M is accessed, the software works back to find the

*In this context, "mode" refers to stereo mirror position. The term "mode" has other meanings in other contexts.

last previous T/M from which the current candidate could best be reached (defined as its "optimal predecessor"). It then adds the basic weight of the current T/M to the cumulative total weight of the T/M sequence containing the optimal predecessor. This new cumulative score is now compared to the maximum cumulative score, to date, for the rev. The higher total is retained as the new standard of comparison and the software passes on to the next T/M. The lower score is not discarded, but is kept to provide a possible optimal predecessor sequence for a future T/M candidate.

This process can, perhaps, be seen more readily by referring to Figure 4.7-5.

The basic selection equation as shown in the figure is:

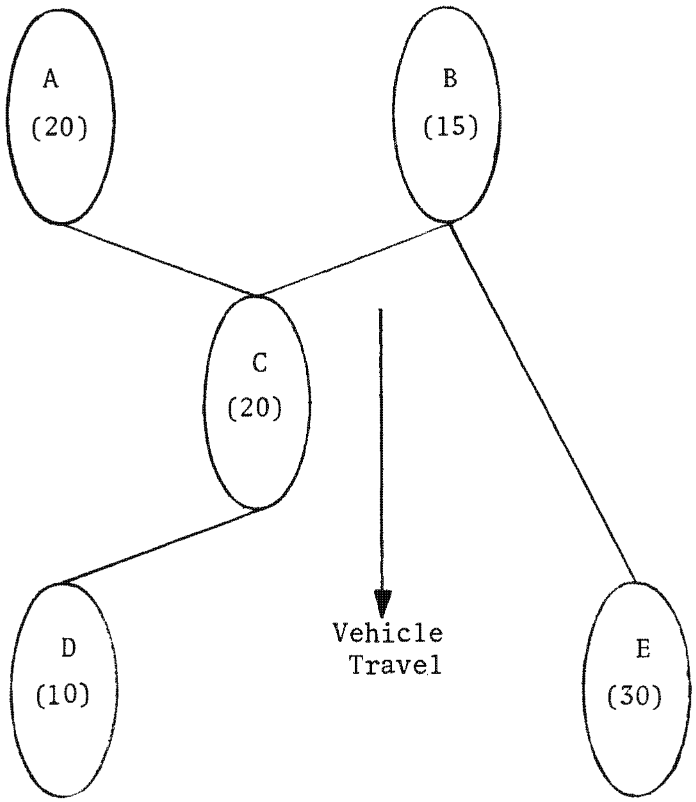
$$S_X = W_X + \max \Sigma S_{<X}$$

Where: S_X = score obtained from sequence of T/M's ending with T/M (X).

W = weight of T/M (X), and

ΣS = accumulated score of attainable T/M sequence prior to T/M (X) (optimal predecessor sequence).

In the figure, each ellipse (A through E) represents a T/M, with its individual weight in parentheses. The lines connecting T/M's depict those combinations which are not in conflict (i.e., can be consecutively achieved). Reference vehicle motion is from top to bottom, as indicated by the arrow.



$$S_X = W_X + \max \Sigma S_{<X}$$

TARGET	PREDECESSOR	SUMMED SCORE
A	-	20
B	-	15
C	A	40
D	C	50
E	B	45

Figure 4.7-5. Optimization Algorithm

In this example, T/M's A and B are assumed to be accessed simultaneously as the first two T/M's in the rev. The next T/M, in time, is C. The software looks back to the possible predecessors, A and B, and sums a cumulative weight for each sequence; i.e., A+C = 40, B+C - 35. The A-C sequence will be retained as the highest score to date. The next two T/M's, D and E, also occur simultaneously in time. The 'TPEG program looks for the optimal predecessor for each of these new candidates. For T/M D, the sequence is A-C-D with a summed score of 50. In the case of T/M E, the software must look all the way back to B as its only possible predecessor. The score for this sequence (B-E) is 45. Thus, the A-C-D sequence will be retained as the current maximum for the rev and the software continues to the next T/M('s). Note again that the B-E sequence continues as a potential sequence for future candidates. In this fashion, the 'TPEG software continues through the T/M table until all candidates for the rev have been examined.

When the optimum target sequence has been selected, another 'TPEG subprogram constructs the corresponding camera frame sequence. Here, the basic procedure is to group targets of close physical proximity together into a single camera frame. The camera ON time and OFF time are keyed, respectively, to the earliest and latest targets in the frame. Image motion compensation, which is accomplished entirely by crab (cross-track) and FDS (in-track) may be calculated for the highest-weight roll-centered target in the frame or for the geographical center of the frame (depending upon a data base setting).

The next 'TPEG subprogram accepts the frame sequence generated above, and assembles the necessary correlating payload events. This process entails the calling of a camera setup procedure at the beginning of every payload rev and/or payload sequence and a single camera shutdown procedure at the end of every payload sequence. (Historic policy has been to shut down the PPS whenever photography is not scheduled for a period of 5 minutes or longer.) The assembled payload events are now time-conflicted with the station contact and vehicle maneuver events and are then loaded into the 'PEG file.

7.5.3.2 Payload Events ('PEG File). An event may be described as a predefined, time-ordered sequence of vehicle function states, identified by a unique event call number within the auxiliary (i.e., Gambit) data base.

In the Gambit program, the procedures necessary for camera setup and shutdown are combined into a single event (No. 406). The setup portion is illustrated, in simplified form, in Table 4.7-1. The time reference for setup is the first camera ON time in the sequence. All times (in the "Time" column) for setup events are keyed to this reference. At a time 239.0 seconds prior to the first camera ON, focus electronics power is turned ON. At camera ON minus 59.0 seconds, the tape recorder main telemetry unit, payload telemetry unit, and forward and aft slave telemetry units are commanded ON. The processor then continues on to set the SRC, turn ON the roll joint power and camera operational power, set up the stereo and crab servos, command the viewport doors OPEN, and set up the slit servos and roll joint position for the first frame.

Note that in the "State" column, a number of items are filled with the descriptor "Any". Each of these entries is accompanied by an "EG" entry in the "EFLAG" column. This indicates that, at the specified event time, the appropriate state for the subject function must be furnished by the event generator. Those function states which are directly specified and which contain an "EVT" notation in the "EFLAG" column are "hardwired" in the event and can only be changed by redefining the event in the data base. It is important to realize that the event structures shown in Table 4.7-1 are furnished for purposes of illustration only. In actuality, the events are subject to constant review and revision. At any one time, the only authoritative reference is the most current data base.

The shutdown portion of event No. 406 is illustrated in Table 4.7-2 and is keyed to the last camera OFF in the payload sequence. At a time 0.2 second

TABLE 4.7-1

EVENT 406 SETUP/SHUTDOWN, SETUP PORTION

Time (Seconds	Function	State	EGFLAG
-239.0	Focus Electronics Power	+	EVT
- 59.0	Tape Recorder	+	EVT
- 59.0	Main Telemetry Unit	+	EVT
- 59.0	Payload Telemetry Unit	+	EVT
- 59.0	Forward Slave Telemetry Unit	+	EVT
- 59.0	AFT Slave Telemetry Unit	+	EVT
- 42.0	9 Camera*	+	EVT
- 42.0	9 SRC	Any	EG
- 40.6	9 Camera	-	EVT
- 40.6	5 Camera*	+	EVT
- 40.6	5 SRC	Any	EG
- 39.2	5 Camera	-	EVT
- 39.2	Stereo Mirror	Any	EG
- 39.0	Roll Joint Power	+	EVT
- 38.6	9 Operational Power	Any	EG
- 38.4	5 Operational Power	Any	EG
- 38.0	Crab	Any	EG
- 20.2	9 Slit	Any	EG
- 20.0	5 Slit	Any	EG
- 18.0	Viewport Door	Open	EVT
- 11.0	Roll	Any	EG

NOTE: Times are relative to first camera ON time of the sequence.

*The camera is turned ON here to allow the SRC subsystem to move the platen to the correct position for the first frame. Without operational power; no film is moved.

TABLE 4.7-2

EVENT 406 SETUP/SHUTDOWN, SHUTDOWN PORTION

Time (Seconds)	Function	State	EGFLAG
0.2	9/5 Take-up	Inhibit	EVT
1.0	9/5 Take-up	Enable	EVT
5.2	9 Slit	Any	EG
5.4	5 Slit	Any	EG
10.0	Viewport Door	Close	EVT
32.0	Roll Joint Power	-	EVT
38.0	9 Operational Power	-	EVT
38.4	5 Operational Power	-	EVT
38.8	Focus Electronics Power	-	EVT
53.8	Tape Recorder	-	EVT
53.8	Main Telemetry Unit	-	EVT
53.8	Payload Telemetry Unit	-	EVT
53.8	Forward Slave Telemetry Unit	-	EVT
53.8	Aft Slave Telemetry Unit	-	EVT

NOTE: Times are relative to the last camera OFF time of the sequence.

after camera OFF, the take-ups are inhibited to reset the film handling logic. At a time 1.0 second after camera OFF, the take-ups are enabled. At camera OFF plus 5.2 and 5.4 seconds, the 9 and 5 slits, respectively, are commanded to their shutdown positions. Subsequently, the viewport door is closed, roll joint power, camera operational power and focus electronics power are turned OFF and, finally, the tape recorder and the various telemetry units are turned OFF.

Table 4.7-3 delineates the "Basic Camera Event" (No. 400). Any number of these may be assembled between the setup and shutdown sequences of Event 406. A second type, the "Compound Camera Event" (not illustrated) may also be called, in any quantity, to accommodate the nesting and/or overlapping of 9-inch and 5-inch frames. Times are referenced to the camera ON time or camera OFF time for a camera event. The camera ON time for the first camera event of a sequence is the reference for shutdown.

The primary output of the 'TPEG program, then is the required sequence of camera setups, frames, and shutdowns placed in the 'PEG file. (An event is said to be "evoked" when the EGS software places the event number, call time, duration, and necessary servo steps in the 'PEG file.) Additional pertinent 'TPEG output includes the 'XFRAMED listing and the camera event list. The 'XFRAMED listing is used by the BIF-008 command analyst in manual command checking (see Section 7.6). The camera event list comprises one of the primary inputs to the MAS.

7.5.3.3 Unique Events Generator ('TUNIC). The last program called in the event generator message cycle is the unique events generator ('TUNIC). This program is used for the assembly of manually-input events and non photographic experiments. (Experiments associated with a target, although requested manually, are assembled by a subprogram of the 'TPEG software.)

TABLE 4.7-3

EVENT 400, BASIC CAMERA EVENT

Time* (Seconds)	Function	State	EGFLAG
0.0	9 Camera	Any	EG
0.0	5 Camera	Any	EG
0.0	Film-Drive Speed	Any	EG
0.0	Stereo Mirror	Any	EG

Time** (Seconds)	Function	State	EGFLAG
0.0	9 Camera	-	EVT
0.0	5 Camera	-	EVT
0.0	Crab	Any	EG
0.0	Roll	Any	EG

*Times are relative to camera ON time for camera event.

**Times are relative to camera OFF time for camera event.

'TUNIC can evoke either single events or secondary flight objectives (SFO's). An SFO is a predefined, time-ordered arrangement of two or more events identified by a unique "sequence" number within the auxiliary data base. The primary utility of these predefined sequences is convenience in planning and scheduling repetitious experiments.

Requested manual events and SFO's are time-conflicted with their predecessors in the 'PEG file. If any conflicts are found, the 'TUNIC entries are deleted. Non conflicting items are evoked, comprising the last event generator input to the 'PEG file.

7.5.4 Command Assembly Subsystem (Message Cycle)

The second message-cycle step, and the final step in the physical output of the command message proper, occurs within the auspices of the CAS. The CAS converts the events passed from the EGS into a non conflicting, chronological sequence of vehicle commands which can be transmitted to the tracking station for loading into the vehicle memory.

The basic input to CAS is the 'PEG file from EGS, which consists of a chronologically-ordered set of vehicle events. Each event is passed as an event number, duration and call time and is accompanied by the EGS calculated servo step numbers. The CAS begins by stepping through each of these events and assembling the corresponding vehicle function/states for each. It then time conflicts the resulting function/states and, if necessary, resolves any conflicts by adjusting one of the function/state times forward or backward by one or more clock steps. (The permissible range and direction of this adjustment is a part of the event definition in the data base.) As a part of this process, CAS compares each assembled function/state with its chronological status and deletes any redundant entries (unless directed otherwise by the event definition).

CAS now calls an automatic checking routine which compares the assembled function/states to a set of data base defined vehicle and operational constraints. If any violations are detected at this point, this routine will insert the proper corrective function/state.

The next CAS program examines each function/state in the list and selects the required (and preferred) command octal for each by searching through a "preferred command" table in the data base. The resulting command octals are now routed through a command blocking program which groups them into PMU-specific command blocks according to event-defined load orders. The resulting command block file is now delivered to the system IIB routine 'SACRED where it is formatted and relayed to the EBTT for delivery to the RTS.

As its last step, the CAS enters the command listing program. This program again calls the automatic checking routine which now functions in a "passive" mode. That is, at this point the checking routine will not insert corrective commands, but will instead print out a message alerting the command analyst to the situation. The command listing program also calls a message summarizing routine which summarizes payload and servo activity for each rev and assembles a summary of the automatic check messages to provide a quick reference for the command analyst.

From the viewpoint of the BIF-008 command analyst, the primary output from CAS is the chronological command list accompanied by the message checking summaries described above, and the 'XFRAMED listing brought forward from the EGS. (The message checking procedure is discussed in Section 7.6.) The major on-line outputs from CAS are the CCMI used by the TPS to provide a basis for telemetry comparison and the command history file which is forwarded to the MAS where it comprises a basic input to the process of performance evaluation.

7.5.5 Telemetry Predict Subsystem (Message Cycle)

Using the CCMI from CAS, the third and last message-cycle program sets about the task of building the telemetry predicts used by the data analysts. TPS builds both static and dynamic predicts defining the expected vehicle telemetry values, in time, as a result of the commands loaded into the vehicle memory and subsequently executed.

Static predicts are output to specify the expected quiescent vehicle condition, at the station acquisition time, for each tracking station within the rev span of the command message. This prediction is compared by the TPS software to the actual telemetry received from the PPS/DP EAC at the station contact. If any miscompares are found, they appear as flags on the display screen monitored by the real-time data analyst during each station contact. TPS also outputs a pre-contact printer listing for each active RTS within the message span. As a redundant check on some of the more significant telemetered values, the real-time analyst also compares the values on the display screen to the predicted values on this listing.

The TPS dynamic predict software builds a chronologically-ordered model of the PPS/DP EAC servo activity expected to occur as a result of each command message. Actual servo activity is recorded on the vehicle tape recorder. After each station contact, the contents of the tape recorder are compared to the dynamic predict model. A dynamic compare summary (DCS) is output to the playback data analyst. This listing summarizes vehicle activity for the subject time period and flags any miscompares. Each of these flags must then be analyzed and reconciled by operations personnel.

7.5.6 Mission Analysis Subsystem (Daily Cycle)

The Gambit software reenters the daily cycle when the MAS is executed at the end of each day's activity. The MAS functions primarily as the Gambit bookkeeper, compiling, as accurately as possible, a historical appraisal of mission performance. In assembling this appraisal, MAS employs the best fit ephemeris (BFE) from AOES. The BFE is a post-fact report of the vehicle's location in time (as opposed to the predicted ephemeris used on all planning calculations). The other primary inputs to MAS are the command history file from CAS and the camera event list from EGS.

7.5.6.1 Mission Correlation Data. Using all three of these information sources, MAS constructs the MCD which, for photo interpreters (PI's), is its primary output. In summary, the MCD comprises the physical and optical information needed to interpret and score each photographic frame taken during a Gambit mission. This data is based upon a precise reconstruction of the physical position and velocity of the satellite vehicle relative to the earth and of the stereo mirror position for each frame. The basic MCD data provided for the PI's consists of the following:

(1) 9 x 5 camera event data, such as frame start/end times frame length and duration, etc.

(2) Ephemeris or orbital position data such as vehicle latitude, longitude, altitude, etc.

(3) The identification and film coordinates of each target statistically determined to be within the frame.

(4) The probability of target coverage in each photographic mode; i.e., stereo, lateral pair or strip.

7.5.6.2 Mission History Data. For the hardware contractors, the mission history data (MHD) comprises one of the most useful outputs of the MAS. The MHD is constructed through a merger of the executed command list (ECL) from CAS and the BFE from AOES. It is a complete chronology of all vehicle commands executed during the mission. It can be assembled on a daily, weekly, or mission-length basis. In addition to the stored program commands (SPC's), it includes the real-time commands sent to the vehicle, and accurately reflects time biases and vehicle location.

7.5.6.3 Accessed Targets and Weather Data. From the Gambit software viewpoint, the essential MAS outputs are the accessed target list, and the assessed and quick-look weather requests. The accessed target list, constructed from the EGS camera event list and the BFE, is a frame-by-frame report of those targets that were actually photographed. This list provides the target countdown information used to adjust target worth which, in turn, influences future target selection. This is the last link in the target selection, verification, and countdown feedback loop.

The assessed and quick-look weather requests are formulated from the accessed target list. The assessed weather request is forwarded to GWC to obtain post target weather information after each day's activity. The quick-look weather request is directed to the satellite operations center (SOC) at the conclusion of each mission (i.e., after recovery of SRV 1 and SRV 2). It seeks mission length post-facto weather information, based on analysis of the recovered film.

7.5.7 Mission Requirements Subsystem (Intra and Post Mission)

The Gambit software feedback loop is closed daily when the MAS inputs its report to the MRS. In this intramission mode, the MRS references the previous day's accessed target list and the daily assessed weather report from GWC.

The GWC weather report furnishes, on a target-by-target basis, the reported, post-facto percent cloud coverage for each entry on the target list. Using this information, the MRS software calculates the probability of having acquired each target and, on the basis of this calculation, updates the TR file (i.e., deweights accessed targets) for the next day's payload operation.

In the post mission mode, the process is repeated for the entire mission-length target/requirements file. In this case, after recovery of SRV 1, the MRS calls upon the quick-look weather report from the SOC. The quick-look report furnishes the percentage cloud cover on a frame-by-frame basis, based on actual inspection of the recovered film. It is considered a more realistic reflection of true fact than is the GWC weather report.

The entire process is repeated again at the end of mission 2, when the confirmed coverage weather report is input to the mission requirements software. Confirmed coverage is reported on a target-by-target basis after detailed analysis of the recovered film by the SOC. The information accumulated here is used to update the entire TR file for the next Gambit flight.

7.6 Payload Message Checking

Gambit operational policy requires that, before any command message can be loaded into the vehicle, it must pass a final manual analysis by representatives of each of the prime hardware contractors. This final check is designed to assure the efficiency of vehicle operation, the quality of the mission payload and, above all, to insure the health of the vehicle throughout the planned mission duration.

7.6.1 Normal Mode

As mentioned previously, the primary input to the BIF-008 command analyst is the chronological command list, from CAS, accompanied by the message checking summaries, and the 'XFRAMED listing passed from EGS. The command generation system [redacted] is organized to build a new command message every 90 minutes during periods of heavy payload activity and is chartered to deliver each message no later than 30 minutes prior to its planned load time. 25X1

When this occurs, the command analyst begins his routine check with an investigation of the automatic check flags in the message checking summary. Any gross errors should be flagged here by the software allowing immediate rejection of the message and thus possibly permitting the message to be altered in time for loading at the planned station. The analyst next turns his attention to the chronological command list. This is normally checked in chronological order, evaluating each vehicle sequence as it occurs in time. Among the items verified are:

(1) Proper PPS/DP EAC setup and shutdown at the beginning and end of each payload sequence.

(2) Proper station contact sequence at each RTS.

(3) Proper placement and structure of secondary flight objectives and vehicle maneuvers.

The complete check of the chronological command list commonly occupies the bulk of the analyst's allotted 30-minute checking time. (A payload message is normally generated for a 3 to 4 rev span, including contingency payload.) Upon completing the check of the "chrono", the BIF-008 analyst begins a spot-check comparison of PPS/DP EAC servo positions commanded by CAS against those requested by EGS. This procedure involves a parallel check of the "chrono" and the 'XFRAMED listing. Usually, a number of frames are checked on each rev. During this comparison, the EGS calculated camera slits are also compared against slit charts which have been constructed pre-flight by the BIF-008 analysts. This generally completes the pre-load duties of the analyst. His approval of each message is documented by his signature of a message sign-off sheet.

7.6.2 Priority Mode

Not infrequently, the command message delivery occurs somewhat beyond the "chartered" delivery time. If the message is significantly late, the BIF-008 analyst reverts to a "priority mode" of command checking. In this mode, the analyst will grant a level 1, 2 or 3 approval depending upon the progress of his message analysis at the required load time. This method is again begun with an inspection of the flag summaries. However, rather than a chronological review, the "chrono" is now searched in specific areas for compliance with a pre-defined set of constraints.

7.6.2.1 Level 1. A level 1 approval can be granted when the analyst has verified that the message contains no commands that will result in permanent harm to the vehicle and/or irreversible mission degradation. Among the items verified here are:

(1) No unplanned pyro functions commanded.

(2) Each ON/OPEN followed by corresponding OFF/CLOSE.

(3) Camera not commanded ON during erasure of vehicle memory at a command load station. (The erasure of the accompanying camera OFF could leave film running until the next tracking station.)

(4) Sun not imaged at the slit.

A message which does not receive a level 1 signoff prior to load time cannot be entered into the vehicle memory.

7.6.2.2 Level 2. After completion of a level 1 check, the analyst returns to the message and begins the level 2 analysis. This level is designed to insure the quality of photography. The specifics checked here include:

(1) Proper setup and shutdown for each photographic sequence.

(2) Proper duration and direction of any platen excursions.

7.6.2.3 Level 3. The level 3 check comprises a full review of the message and implies the same degree of satisfaction as the "normal" check. The items remaining at the level 3 stage are:

(1) Structure and timing of SFO's.

(2) Proper station contacts.

(3) Closure of viewport door as planned.

(4) Tape recorder and/or telemetry ON for all PPS/DP EAC activity.

(5) Software verification ('XFRAMED versus 'CHRONO).

When a level 3 review has been completed, the command analyst annotates the message signoff sheet to document his final approval of the message.

7.7 Telemetry Data Processing System

The telemetry data processing system provides the capability to format and display telemetered vehicle data for analysis according to a set of User specifications called telemetry modes and to report vehicle discrepancies via telemetry limits compare (TLC).

7.7.1 Telemetry Mode Definition

A telemetry mode provides a set of instructions for formatting the telemetered vehicle data into a telemetry message reported at a RTS to a communications buffer called the bird buffer [redacted] and the processing and formatting 25X1 for display of the reported data by the bird buffer.

Two basic message types are utilized for reporting mode data: The type 53 which time-tags by mainframe (0.02 second) and the type 13 which time-tags to the nearest masterframe (1.000 second).

Mode definition is specified by the User to produce a set of modes satisfying the analyst requirements. The specification for each mode includes the following:

(1) A set of telemetry identifications (ID's) and their labels.

(2) An RTS report sample rate for each ID.

(3) An RTS data compression algorithm for each ID.

(4) Instrumentation schedule information.

(5) Conversion and formatting instructions for the bird buffer.

(6) Vehicle calibration data.

7.7.1.1 RTS Data Compression Algorithms. A library of algorithms is available for assignment to a telemetry ID in order to reduce the amount of data reported to the bird buffer and to provide the User with the data he requires to be displayed or processed. Each algorithm consists of executable software which samples the vehicle data at the mode rate and which tests the data according to the specific algorithm employed and a set of algorithm parameters. A few basic algorithms are outlined:

(1) Threshold algorithm: Report the current data sample if it differs from the last data value by a threshold.

(2) Transition algorithm: Report the current data sample if it has been steady state within an aperture for a specified number of samples, and if it differs by more than a threshold from the last reported value.

(3) Level detector algorithm: Set (or reset) a specified bit in the output data word if the input value is within a specified bound.

(4) Throughput algorithm: Output the current data sample.

As an example, the threshold algorithm would be utilized to plot analytical data; whereas, the transition algorithm would be useful in comparing the data report with a set of limits bounding both the data value and the transition time.

7.7.1.2 Vehicle Calibration Data. Data is reported from the RTS and processed by the bird buffer in units of PCM counts. The conversions specified in the mode for displaying data in engineering units require vehicle calibration data to be supplied to the bird buffer. The following types of calibration data are available:

(1) Linear segments:
   (a) Endpoints in PCM counts and engineering units supplied for each segment.
   (b) Up to thirteen (13) segments per ID.

(2) Bilevel:
   (a) For 1-bit discrete ID's.
   (b) English descriptors are supplied for each state.

(3) Polynominal:
   (a) Up to seventh (7) order for each ID.
   (b) Each coefficient can be modified without regeneration of a mode (the other calibration types require mode regeneration).

(4) Multilevel:
   (a) For 2-(or more) bit discrete ID's.
   (b) English descriptors are supplied for each state.

7.7.1.3 Mode Generation. Mode generation is done pre-flight by a computer program 'MSTAC which translates the user mode requirements into a set of mode instructions on tape for transmitting to the prepass disk at the RTS and for use by the bird buffer. The mode requirements are input from an 'LPROFIT tape (see Section 7.7.5) and a mode definition deck built by a support agency [redacted] Figure 4.7-6 illustrates mode generation. 25X1

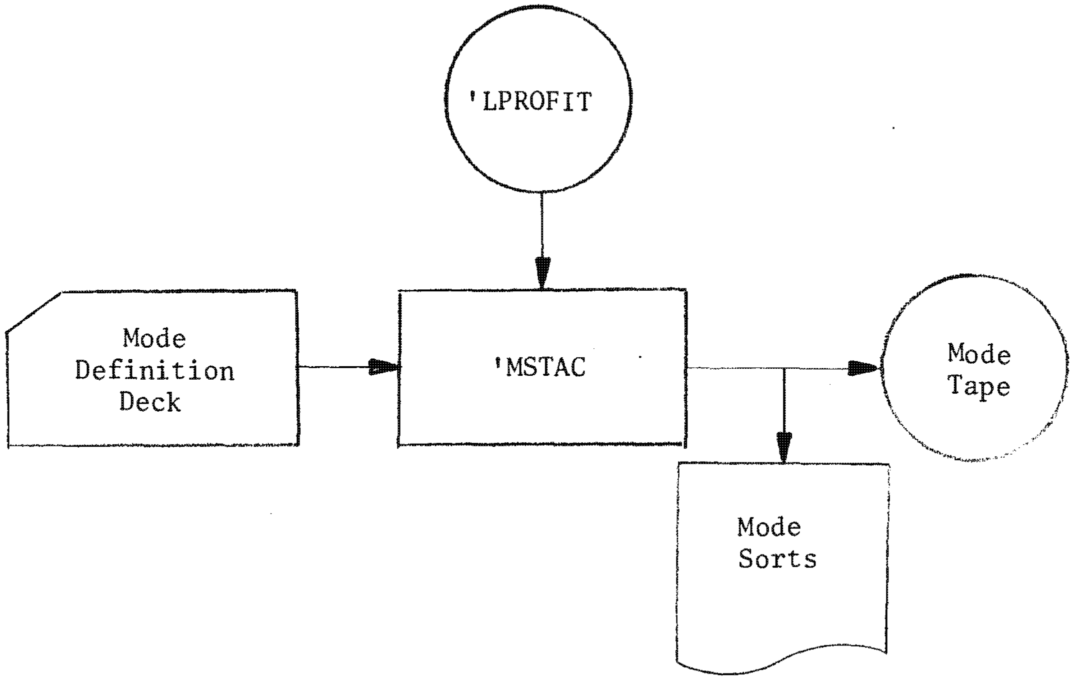


Figure 4.7-6. Mode Generation

7.7.2 Telemetry Limits Compare (TLC)

TLC consists of the TPS which generates a set of data limits for use by the bird buffer compare function to report vehicle discrepancies from TLC designated mode data. A telemetry simulate function (TMSIM) generates a data source from TPS generated limits data and manual inputs to validate the telemetry modes and TLC operational software.

7.7.2.1 Telemetry Predict Subsystem (TPS)

TPS generates a limits tape on every message load cycle using the CCMI supplied by the command generation subsystem for the message load span. The limits are output for a User specified set of telemetry ID's from data base static vehicle status blocks maintained up to the current load station, vehicle ephemeris information, and predictor algorithm chains modeling the vehicle's telemetry response to function/state changes determined from the CCMI. A simplified block diagram of the TPS is shown in Figure 4.7-7.

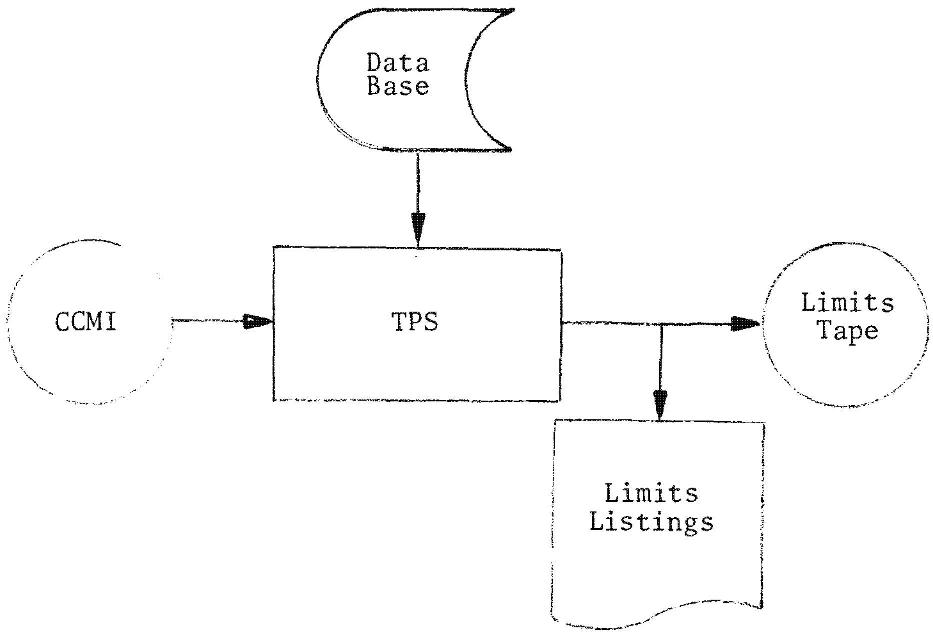


Figure 4.7-7. Telemetry Predict Subsystem

7.7.2.1.1 Limits Definition - The limits generated consist of upper limit and lower limit values (PCM counts) within which the telemetry value is expected to remain. During the time span when a transition is expected to occur, the limits are expanded and then close around the expected new telemetry values when the transition must be completed. Figure 4.7-8 illustrates typical limits.

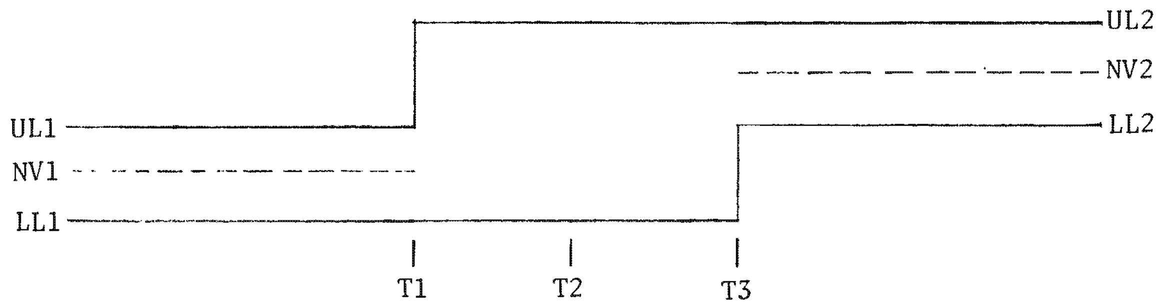


Figure 4.7-8. Typical Telemetry Limits

where: UL = Upper limit
LL = Lower limit
NV = Nominal value

T1 = Command execution time
T2 = Earliest time that transition could be completed
T3 = Time at which transition must be completed

7.7.2.1.2 Predictor Algorithms. A library of predictor algorithms is available to the User for modeling specific vehicle subsystems. Each algorithm consists of executable software which outputs a set of limits for a telemetry ID whenever a specific vehicle function changes state and uses a set of data base algorithm parameters. A set of parameters typically includes the telemetry ID for which the limits apply, transition times, time and value tolerances, and calibration data. Algorithms are available to predict the following PPS subsystems:

(1) Camera functions
(2) Film handling functions
(3) Crab and stereo servos
(4) Termination events
(5) Power and static temperatures

7.7.2.1.3 Limits Tape. The limits tape consists of static limits records predicting vehicle status at each station contact over the predict span, and dynamic limits records predicting all vehicle activity over the predict span and which is recorded on the vehicle tape recorder or occurring within a station contact. The limits tape may be listed in engineering units from data base calibration. In particular, listings of the static limits records are useful for film accounting activities and for indicating the status of operations counters and other items of interest.

7.7.2.1.4 TPS Data Base. The TPS data base is a subset of the flight data base and is maintained by the User using the data base management subsystem. The following TPS data base blocks are basic to TPS:

(1) Telemetry ID index table ('CMI)

(2) Calibration data ('CAL/'CML)

(3) Vehicle function/state-algorithm chain index table ('CMB)

(4) Predictor algorithm chains and associated parameters ('CMDX)

(5) Vehicle telemetry status tables ('CMS)

(6) Static/dynamic limits output control ('CMT)

7.7.2.2 Bird Buffer Compare Function. The bird buffer compare function compares data reports from the RTS to a set of limits from the applicable limits tape and displays any discrepancies which occur. An all points report (APR) request generated by TPS at selected times provides a display of all telemetry ID's in a telemetry mode, their data value, and their limits if predicted.

7.7.2.2.1 Static Compare. Static compare is run during a station pass to compare real-time vehicle data reports from the RTS against a set of magnitude limits for the telemetry ID's predicted for the selected modes. If a telemetry ID is predicted to be dynamic at a given time during the pass, static compare is terminated at that time on that ID only. Discrepancies are displayed directly to the printer (CRT) as they occur. An APR request is generated for station acquisition and fade which is printed off-line.

7.7.2.2.2 Dynamic Compare. Dynamic compare is run postpass from dynamic vehicle data reports from the RTS and a set of time dependent limits for those mode telemetry ID's predicted. A set of current limits is maintained from the limits tape in the bird buffer according to vehicle time reported from the RTS. Each data report is compared to the current magnitude limits, and, correspondingly, each limit change is compared against the last reported data value. In particular, if the limit change for a transition is the latest time for the transition to occur (T3), the time of the last reported value must be greater than the earliest time for the transition to occur (T2) if T2 is set. This last mode of checking insures that the transition time for a vehicle function state change is within limits.

All discrepancies are retained for sorting and displaying on the DCS which lists on the printer each discrepancy that occurred. Following is a count summary which tabulates, for each camera and the viewport door, the number of operations commanded, the number compared and miscompared, and the number not compared because of data dropouts. The APR's are also displayed, real-time information, the data span, and data dropouts are summarized.

7.7.2.3 Telemetry Simulate Function (TMSIM). TMSIM generates an analog tape called the 'RAVI tape simulating PCM real time, orbit record, and diagnostic I formats using nominal values from the limits tape and manual inputs. The

'RAVI tape can then be played back from the RTS through the telemetry modes and TLC to validate the telemetry operational software and modes.

7.7.3 'LPROFIT

'LPROFIT is an LMSC program that generates a tape providing instrumentation schedule information, vehicle calibration data, and telemetry ID labels, state descriptors and units descriptors for input to 'MSTAC for mode generation (file 1) and the TPS data base (file 2). 'LPROFIT is contracted for delivery at L-45 days and is the only source for filling these mode/TPS data requirements.

7.7.4 RTS/[redacted] Processing 25X1

Prior to vehicle contact at a particular RTS, a prepass meeting is held at [redacted] to, among other related events, establish priorities and inform the RTS/[redacted] complex of the User data requirements in the form of specific mode requests for that station pass. If a command message is to be loaded at the station, the current limits are merged with the old mode/limits tape for the bird buffer compare function. The RTS[redacted] complex then proceeds to the pass (real time) and postpass phases, where vehicle data is processed and reported on 2400 baud landlines to the bird buffer [redacted] in accordance with the User requested mode instructions on the prepass disk at the RTS.

7.7.4.1 Pass Phase (Real Time). The flow of data in the pass phase is illustrated in Figure 4.7-9. In the pass phase, real-time vehicle data (PCM format real time) and data played out of the vehicle tape recorder is simultaneously received and recorded on an analog tape by the RTS. Also simultaneously, the real-time vehicle data is processed and reported to the bird buffer which retains the data on the BBRT tape and formats the data for CRT display according to the requested mode instructions and calibration data on the mode/limits tape. If the requested mode is a static TLC mode, the static compare function is executed to display any discrepancies in the vehicle's static

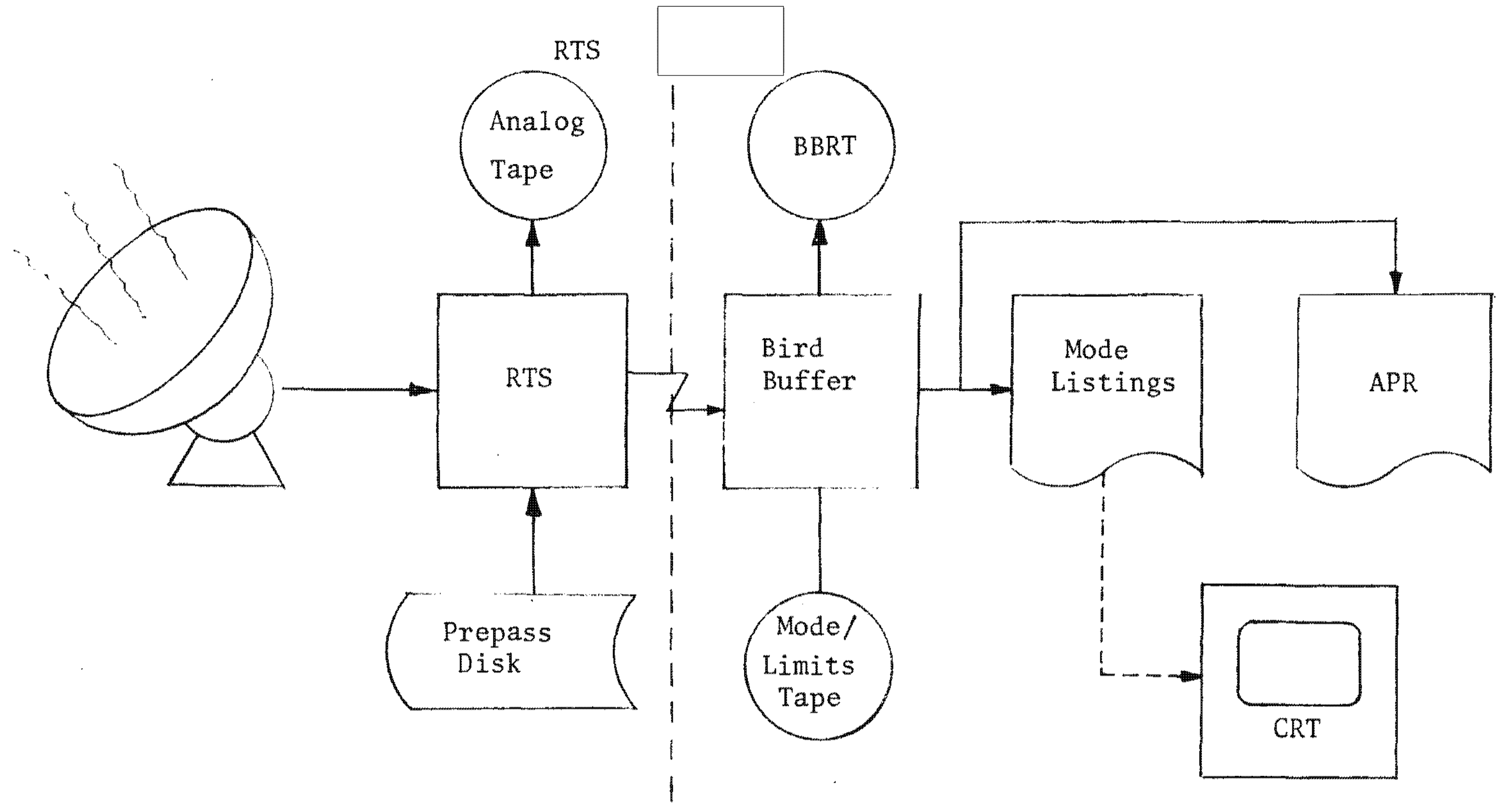


Figure 4.7-9. Pass (Real Time) Data Flow

Approved for Release: 2017/02/14 C05097223

status to the CRT and output the APR's.

7.7.4.2 Postpass Phase. The flow of data in the postpass phase is illustrated in Figure 4.7-10. Postpass data is played back from the analog tape recorded at the RTS during the pass, and processed and reported to the bird buffer. The bird buffer retains the reported data on the BBRT tape and formats the data for plotting of digital listings according to the requested mode instructions and calibration data on the mode/limits tape. If the requested mode is a dynamic TLC mode, the dynamic compare function is executed giving the DCS and the APR's.

7.7.5 Modes Matrix

The modes matrix (Table 4.7-4) illustrates the basic set of telemetry modes satisfying the analyst requirements for monitoring the PPS. The mode function "R/T dynamic" monitors all vehicle activity during a station contact and the mode function "playback" monitors all activity recorded on the vehicle tape recorders. The above modes utilize TLC as a primary method of analysis and mode definition is specified to this end. The mode function "diagnostic" is designed to display analytical data at vehicle sample rates for selected hardware subsystem analysis, failure analysis, and to provide data for updating prediction algorithm parameters to allow TLC to more accurately model the vehicle.

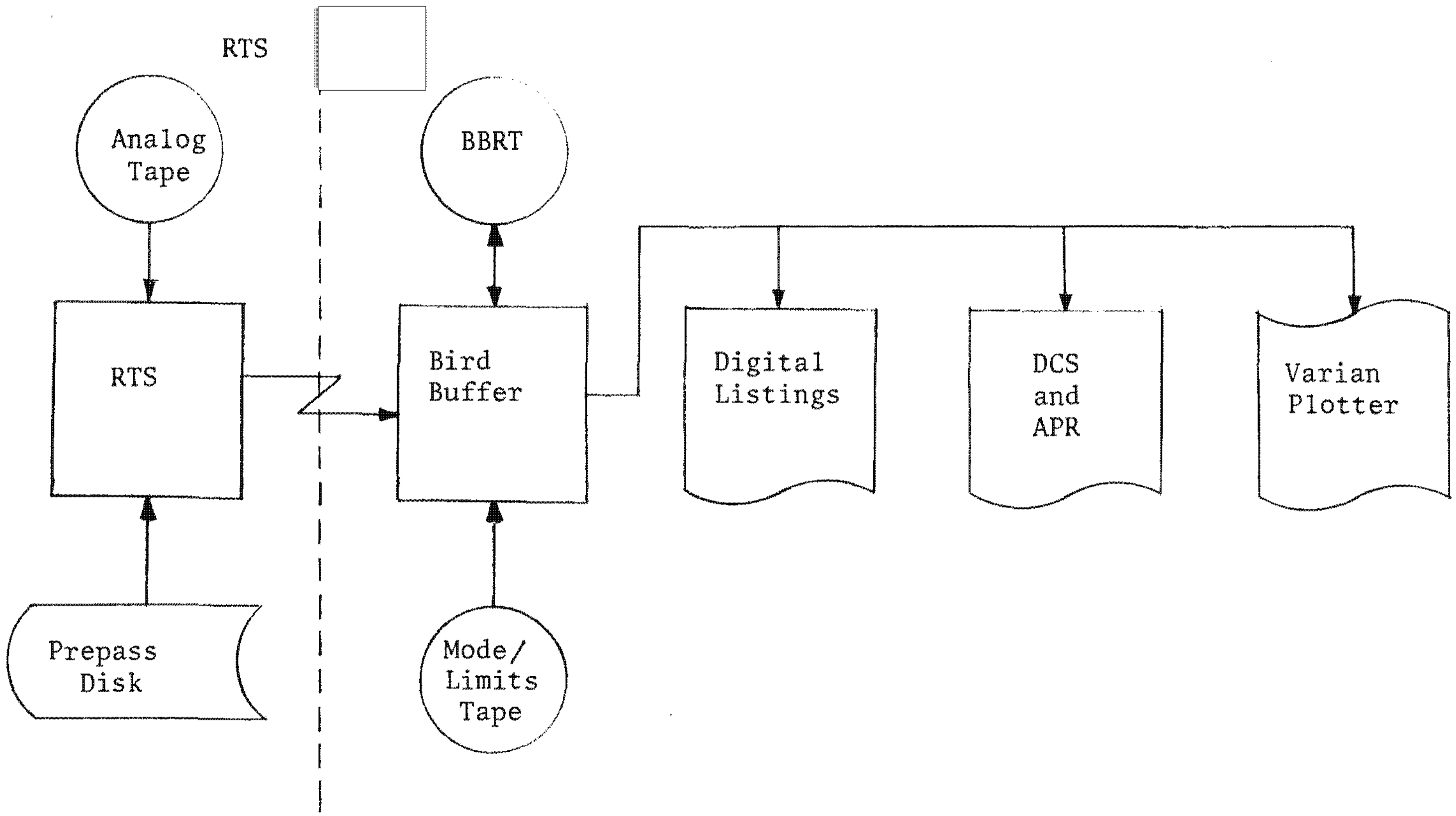


Figure 4.7-10. Postpass Data Flow

Approved for Release: 2017/02/14 C05097223

TABLE 4.7-4

MODES MATRIX

Mode Function	Mode	Message Type	PCM Format	TLC
R/T Static Status	A	Type 13	Real time	Static
R/T Dynamic	B	Type 53	Real time	Dynamic
Playback	C	Type 53	Orbit record	Dynamic
Diagnostics:		Type 53		No
(1) Cameras, film handling, servos	D.1		Real time	
	E.1		Orbit record	
	F.1		Diagnostic 1	
	G.1		Diagnostic 2	
(2) Power and thermal	D.2		Real time	
	E.2		Orbit record	
	F.2		Diagnostic 1	
	G.2		Diagnostic 2	
(3) Termination	D.3		Real time	
	E.3		Orbit record	
	F.3		Diagnostic 1	
	G.3		Diagnostic 2	

Approved for Release: 2017/02/14 C05097223

8.0 FIELD ENGINEERING OPERATIONS SUPPORT ACTIVITIES

Field Engineering Operations (FEO) support activities consist basically of five areas, all of which are related to the support of a specific flight vehicle or flight operations in general. These areas are: preflight, launch support, on-orbit liaison, postflight support and between flight activities. The primary functions in each of these areas are to provide the liaison between the factory and field organization (see Figure 4.8-1) and prepare the documentation to support flight operations.

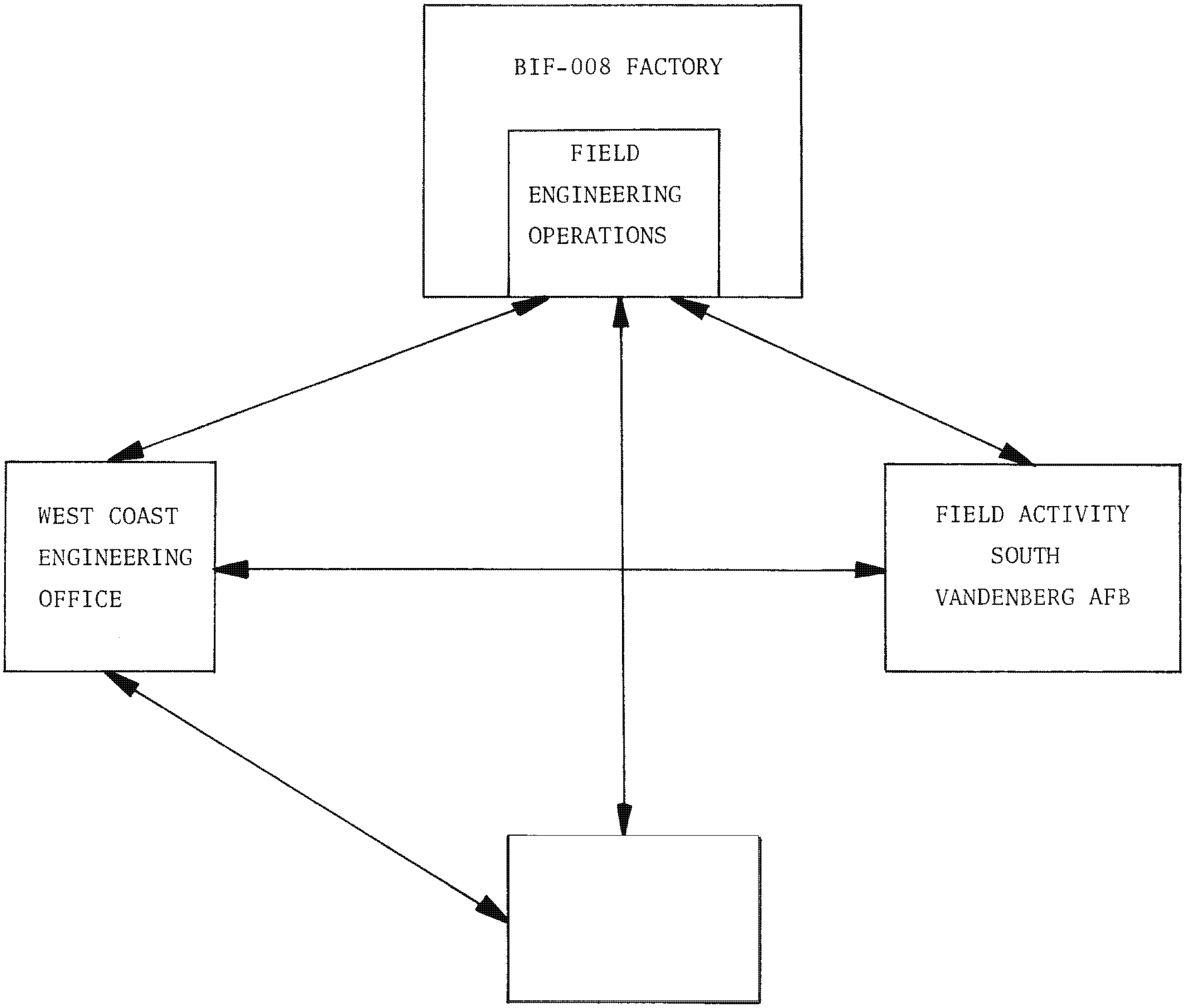
8.1 Preflight

The preflight activities include preparation of the documentation necessary to support the vehicle during pad testing and on-orbit operations. This documentation consists of vehicle specific calibration data, telemetry changes, film load configuration and recommended film management for each recovery vehicle (RV). The command data base used by the operational software is assembled by FEO for each unit. This information is used at Vandenberg Air Force Base (VAFB) during launch preparations and at the [redacted] during orbital operations. 25X1

8.2 Launch Support

FEO provides the liaison between the launch facility and the factory while the vehicle is on the pad. Daily status reports are received from field personnel and routine questions relayed to appropriate factory groups.

During troubleshooting activities, FEO provides the single point contact for communications between the factory "tiger team" and field personnel.



25X1

Figure 4.8-1. Factory-Field Liaison Organization for Flight Operations

FEO personnel participate in failure analysis and prepare the final factory recommendation that is sent to the field.

8.3 On-Orbit Liaison

During the on-orbit phase of activities, FEO again acts as liaison, this time between the factory personnel and West Coast Engineering Office (WCEO) personnel. Factory personnel are kept abreast of vehicle status by a daily morning report and status charts in the FEO conference room. Daily focus data is analyzed by both FEO and WCEO personnel and agreement reached on recommendations for platen position. These recommendations are presented to the Air Force by WCEO personnel during the daily status meeting [redacted] 25X1

FEO is on call around the clock to answer questions or initiate necessary action to get a problem resolved. FEO receives data concerning anomalous conditions, assists factory personnel in interpretation of data, coordinates analysis activities and transmits factory recommendations to WCEO.

Immediately following the recovery of RV-1 and RV-2, FEO supports "Quick Look" activities with other community personnel to analyze vehicle performance. FEO participates in the analysis of focus and exposure data and recommendations for adjustments in the second half of the flight. Measurements taken from RV-1 film are used to update film management plans for RV-2. Overall system performance is evaluated to identify areas for possible improvement during RV-2 activity.

R&D activities conducted during the mission are analyzed and the necessary reports written by the group.

8.4 Postflight Support

Postflight activities commence with the recovery of RV-2. During this time, FEO is concerned with analysis and evaluation of mission second half results and preparation of postflight status reports which include:

(a) Twenty Day Malfunction - This message is sent to the Air Force and Associate Contractors identifying the malfunctions or failures that occurred during the mission, the failure analysis if available and the effect they may have on the next mission.

(b) Final Flight Evaluation Report (FFER) - This report summarizes all PPS functions and describes the final disposition of all failure analyses. It identifies new investigations arising from the flight and investigations closed since the last flight.

(c) Incentive Fee - Based on PPS/DP EAC performance and the incentive fee formula, a recommendation for expected fee is prepared for the Program Contracts office.

Other FEO postflight activities include:

(a) Analysis of R&D experiments and preparation of reports.
(b) Complete flight history summary.
(c) Participation in the preparation of the Performance Evaluation Team (PET) report.
(d) Preparation of the addendum to the FFER at the completion of the PET meeting.

8.5 Between Flight Activity

The time between flights is devoted to general flight related tasks. In support of these tasks, the personnel:

(a) Generate and maintain flight documentation including:

1. Photographic System Reference Handbook (PSRH)
2. PPS/DP EAC Operational Programming Guide (OCTOPUS)
3. Waveform Book
4. Operational Hardware Software Specification (OHSS)
5. PPS/DP EAC Calibration Requirements Specification

(b) Participate in

1. Integrated Test Schedule of Events (ITSOE) meeting (factory representative)
2. Pad test sequence review
3. Flight software review
4. Image evaluation studies
5. Launch base documentation review
6. Design reviews for new or modified hardware

(c) Coordinate launch base action items

(d) Act as consultants to factory personnel on questions concerning operational situations

(e) Provide operational data for factory studies

(f) Provide liaison between WCEO and factory for documentation and future planning.

8.6 Factory/[redacted] Data Link Computer System

To facilitate timely analysis of orbital data by factory personnel, a computerized data link was implemented with one end at the factory in Rochester, New York and the other at the [redacted] where the orbital operations are controlled. The basic system is comprised of two mini-computers and a communications network; explicit details are described later in this section.

The purpose of the Data Link Computer System (DLCS) is to transfer large quantities of data between the two locations with a short time lapse. Previously used (non-dedicated) systems were fortunate to achieve data transfer within 48 hours; the DLCS can achieve that same transfer within 30 minutes. Data on Bird Buffer Recording Tapes (BBRTs) received [redacted] from the Remote Tracking Stations 25X1
(RTSs) is stripped and written onto a file on the DLCS terminal [redacted] That data is then transmitted to the factory computer via the DECNET communications link, and written onto a factory file. From this point, various forms of processing can be performed on the data, depending on the type of output desired. Graphical representations of the response of analog instrumentation sensors can be displayed on graphics terminals, and hard copy obtained. Software packages have been generated that permit a variety of statistical and trend analysis techniques on the orbital data.

The DLCS is also used to transfer calibration data from factory testing to the field. [redacted] this calibration data is used to assemble command and telemetry data bases required for control of the orbiting vehicle, and analysis of its activities.

8.6.1 Factory System

The factory system hardware consists of a Digital Equipment VAX-11/780 computer operating under the VAX/VMS operating system. Connected to the computer are two

67 megabyte disk drives, a line printer, a magnetic tape drive, an XY plotter, some DECwriter teletype terminals, several VT-100 CRT terminals, a pair of Tektronix Graphic Display terminals with one Hard Copy Unit output, and a high-speed synchronous communications interface.

Purchased software consists of a Scientific Subroutine package, compilers (i.e., VAX BASIC PLUS and FORTRAN 4-PLUS), DECNET communications software, sort utilities, and plotting software for both the XY plotter and the Graphic terminals.

8.6.2 FAN System

The FAN system hardware consists of a Digital Equipment PDP-11/34 computer performing under the RSX-11M operating system. Connected to the computer are two 5 megabyte disk drives, a line printer, a 7-track 556 BPI tape drive, an XY plotter, some VT-100 CRT terminals, a floating point processor and a high-speed synchronous communications interface.

Purchased software consists of compilers (i.e., BASIC PLUS-2, FORTRAN 4-PLUS, PASCAL), DECNET communications software, and plotting software for the XY plotter.

8.6.3 Stand Alone Operation

Each computer system was designed so that it could stand by itself and perform on-site computer operations. The system is set up as an interactive time-sharing system.

8.6.4 Joint Operation

Using the DECNET communications software, each system will be able to send data to the other system or run computer programs on the other system.

Periodically the Bird Buffer Recording Tape (BBRT) data and CHRONO information will be sent to the factory from FAN. This data will then be displayed on the Graphics Display Terminal for analyzation. Any questionable waveforms can be duplicated by the Hard Copy Unit.

APPENDIX A REFERENCE DOCUMENTS

This appendix consists of a listing of many of the key documents generated by BIF-008 and other contractors, which contain information relevant to the Gambit Reconnaissance System. In a system having the scope of the Gambit System, no listing of this type can be said to be complete. An attempt was made to reference all basic BIF-008 documentation and as much other material as could be identified.

A.1 CONTRACT DOCUMENTS

General System Specification	
Statement of Work	
Contract Document Requirement List (CDRL)	DD-1423

A.2 BIF-008 DOCUMENTS

A.2.1 System Level Specifications

System Requirements Spec.	1402-585
Qualification Test Plan, FO-7	1402-558
Environmental Design Criteria Spec. including Addendum A	1402-320
Electromagnetic Control Plan	1402-524
Handling Specification for Recovered Film	1402-571
Specification Tree	1402-579
Configuration Management Plan	1499-152
PPS/DP EAC Calibration Requirements	1402-580

Instrumentation Index, Waveforms and Transfer Functions	1499-148
PPS/DP EAC Operational Programming Guide (Block 48)	1402-570
Film Requirements Specification	1402-593
Photographic System Reference Handbook	(6 Volumes)

* PPS/DP EAC Telemetry List

* PPS/DP EAC Calibration Book

* Preliminary Flight Evaluation Report (PFER)

* Final Flight Evaluation Report (FFER)

* PPS/DP EAC Data Package Input

* Mass Properties Report

* Post-Flight 20-Day Malfunction TWX

A.2.2 Major Module Specifications/Drawings

If more than one PRL** number applies to an item, only the lowest PRL number will be referenced.

* Issued with each Flight Model
**Project Requirements List

PRL Number	Description	Specification Title (if different)	Specification	Lead Drawing	Manual
30250	PPS/DP EAC	Flight Model PPS/DP EAC	1402-559 1402-580	1405-217 1405-218	1497-203
30652	Supply and Electronics Structure Assembly	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1382935	
30653	Forward Barrel	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1235506 1413-399	
30654	Aft Barrel	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1377230	
30951	Take-up Mechanism	Take-up Mechanism (9x5)	1402-549	1412-459	
31050	Supply Unit (9)	9 Supply Unit	1402-328	1411-497	
31051	9 Supply/RAM* Assembly			1405-150	
31055	Supply Unit (5)	5 Supply Unit	1402-550	1411-1124	
31056	5 Supply/RAM* Assembly			1405-211	
31102	Crab Servo	Azimuth Servo	1402-134 1402-298	1414-350	1497-191
31103	Stereo Servo	Hypocycloid Servo	1402-249 1402-290	1414-1002	1497-190
31250	Camera	Dual Platen (9x5) Camera System	1402-544	1408-2102	
31462	Digital Telemetry Unit		1402-543	35332006	
31604	Ampere Hour Meter			1417-709 1462171	
31652	Command Processor		1402-534		1417-783

*Record Attach Mechanism (Splicer Mechanism)

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Title (if different)	Specification	Lead Drawing	Manual
31655	Power Monitor and Control Unit		1402-560	1417-819	
31754	Instrumentation Processor		1402-587	1417-809	
31800	Heater Controller Assembly		1402-174	1416-100 1416-222	
31851	Stand-By (Ground) Heater Controller Assembly		1402-509	1416-196 1416-199	
31940	Sensor Head Assembly	Focus Sensor	1402-547	1410-1045	
32050	Frequency Phase Lock Loop Electronics	(Reference Dual Platen (9x5) Camera Specification 1402-544)		1409-532	
32150	Internal Structure (COA) Cables		1402-563	1418-236 thru 1418-248	
32301	Stereo Mirror and Mount		1402-576	1407-1302	
32802	Ross Corrector and Field Lens Assembly			1407-1463	
32804	Primary Mirror			1407-1310	
32805	Platen Reference Gauge			1407-1467 1407-1483	1499-153
32806	S-1 Gauge				1499-153
32807	Signal Power and Conditioning Electronics	(Sensor Encoder and Processing Unit)		1407-1510	1499-153
33150	Drum Platform Module	Camera Optics Module	1402-590	1405-213	

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Title (if different)	Specification	Lead Drawing	Manual
33250	Supply and Electronics Module (9x5)		1402-573	1405-212	
33350	Film Control Electronics		1402-416	1411-683	
33355	Film Handling Electronics	5 Film Handling Electronics	1402-533	1411-1099	
33450	Camera Electronics Assembly	Drum Recorder Electronics Assembly	1402-544 (Ref)	1408-2057	
33500	Cutter/Sealer Assembly No. 1 and 2	Cutter/Sealer (9x5)	1402-556	1382958	
33551	Aft Backup Cutter (9x5)		1402-555	1382959	
33850	Initiator Electronics Unit		1402-526	910000	1497-288
33901	Internal Structure (COA) (9x5)		1402-187	1407-441	
34450	Splicer Mechanism		1402-551	1411-1273	
34700	Camera Optics Assembly		1402-576	1405-206	
34800	Viewport Door Electronics		1402-553	1408-2278	
35050	Dual Recovery Module		1402-539	1405-215	
35051	Ejectable Adapter	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1405-207	

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Title (if different)	Specification	Lead Drawing	Manual
35052	Fixed Adapter Assembly	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1405-208	
35056	Tunnel Seal and Record Trap (9x5)		1402-557	1382961	
35057	Cutter/Sealer Assemblies No. 3 and 4	Cutter/Sealer (9x5)	1402-556	1382960	
35058	Miscellaneous DRM Hardware	External Structure, Mechanical External Structure, Electrical	1402-535 1402-536	1233276	
35150	SEM/COM Assembly			1405-214	

A.2.3 Major Aerospace Support Equipment Specification/Drawings

PRL Number	Description	Specification Number	Lead Drawing	Manual
40150	PPS/DP EAC Power Group	1402-554	1430-1661	
40160	Mini Console and Validation Cart		1430-1098	
40170	Portable Test Console		1430-1216	
40251	Command Recorder Console	1402-561	1430-1256	
40253	Test Console Recorders (64 channel)	1402-552	1430-1257	
40254	Test Console Recorders (40 channel)	1402-552	1430-1258	
40500	Secondary Standard Instrument Kit	1402-261	1431-1000	1497-178

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
40650	Secondary Standard Load Box	1402-591	1431-2048	
40753	End-to-End Electronics	1402-575		1497-292
40800	Film Advance Controller	1402-234	1433-300	1497-149 1497-221
40851	Take-up Protection Test Set		1433-1049	
41100	Instrumentation Console	1402-275	1434-100	1497-163
41400	Environmental Hatches		1435-114	
41451	DRM Environmental Hatches		1435-220	1497-242
41452	SEM Environmental Hatches	1402-402	1435-213	1497-207
42050	Leak Rate Test Set	1402-386	1436-188	1497-211
44000	Reference Mirror and Bracket Assembly	1402-206	1439-100	1497-203
45050	Integration Yoke	1402-349	1440-1000	1497-266
45051	IP-B^2 (PPS/DP EAC) Demating Equipment	1402-445	1402-445	1497-266
45150	Hydra Set-B^2		45-346	
46053	SEM/COM Assembly Jacket	1402-387	1557228	1497-265
46057	DRM Jacket	1402-501		
46060	Shipping Trailer	1402-500	1632H100	
46061	Shipping Container	1402-481	1441-1171	

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
48450	Gantry Clean Room	1402-379	1445-500	1497-248
48451	Activation Aids for Gantry Clean Room		1445-171	
48452	Portable Adjustable Work Stand	1402-448	1445-185	
50102	Stereo Servo Test Set	1402-287	1446-500	1497-194
50200	Crab Servo Test Set	1402-114	1446-250 1446-360	1497-175 1497-184
50301	Thermal Control Test Set Controller Checker	1402-136	1447-100	
50302	Thermal Control Test Set Assembly Checker	1402-171	1447-141	
50451	Command Processor and Instrumentation Processor Test Set	1402-443	1447-1250 1447-262 1447-339 1447-348	1497-262
50453	Power Monitor and Control Test Set & Adapter	1402-363	1447-1100	1497-174
50455	E.C.D. Robotester		1447-348	
50459	IEU Test Set	1402-566	920000	
50552	Automatic Circuit Analyzer with LMSC Adapter Cables	1402-350	1557150	1497-218 1497-230 1497-231 1497-232 1497-233
50554	Wire Interconnect Vibration Test Set	1402-397	1557599 1557747	1497-235

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
50556	Splicer Mechanism Test Set and Cables	1402-361	1561992	1497-216
50751	Digital Velocity Measuring System	1402-583	1449-682	1497-285
50852	Cable Test Point Board Components	1402-584	1449-1020	
50950	Focus Sensor Test Set		1450-1703	
51200	Portable Servo Drive Test Set	1402-107	1451-100	1497-135
51300	Viewport Door Operate Component Test Set	1402-112	1525844	1497-103
51853	Pyro Simulators for Shipping	1402-365	1560433	
51855	Initiator Test Set with Cables	1402-569	1453-803	
51950	Film Control Electronics Test Set	1402-370	1453-327	1497-264
52052	Test Set Cables	1402-568	1453-837	
52350	DRM Electrical and Mechanical Simulator	1402-412	1453-571	1497-240
52357	RECAL Box Event Recorder	1402-371	1453-299	1497-212
53200	COA Environmental Test Fixtures	1402-205	1455-110 1449-635	
53300	Environmental Test Fixtures for Major Elements and Components	1402-188	1455-100	

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
54050	DRM Mass Properties Measurement Equipment	1402-380	1557937	1497-236
54150	Cutter/Sealer Test Set	1402-204 1402-357	1459-2000	1497-228
54650	Supply Assembly Test Set	1402-588	1459-388	1497-227
54652	Take-up Component Test Set	1402-572	1459-3500	1497-217
54750	Dual Platen Camera Test Set	1402-548	1459-417	
55601	Autocollimating Microscope with Tungsten Light Source	1402-133	1462-149	
55602	Autocollimating Microscope with Monochromatic Light Source	1402-162	1462-171	
56004	R-5 Ross Matching Laser Interferometer	1402-471	1464-381	
56005	Interferometer	1402-477	1464-390	
56054	Through Platen Test Set		1464-683	
57500	Reference Mirror Alignment Kit	1402-250	1467-135	
58001	Test Load Mounting Fixtures	1402-203	1468-202	
58008	Mount Supports for Convex Surface Testing	1402-480	1468-369	
58009	Mount Supports for Concave Surface Testing	1402-478	1468-488	
58100	Optics Positioner	1402-173	1468-500	1497-132 1497-185
58301	Film Removal Equipment	1402-265	1468-160	1497-160

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
58352	Film Loading Equipment	1402-351	1405-146	
58800	Portable Reflectometer	1402-196	1470-1000	
58900	Interferometric Dilatometer	1402-219	1470-236	
59455	Master Digital Telemetry Unit Loader	1402-446	1543300	1497-238
59457	PCM Decommutator	1402-562	3512000 3512100	1497-294
59458	DTU Switching Unit	1402-589	1471-600	
59470	Programmable Logic Test Equipment (PLTE)	1402-521		
59480	Common Use Electrical Test Set (CUETS)	1402-545	01-013001	
60751	Light Leak Checking Equipment	1402-400	1557165	
61200	Handling Equipment Test Loads	1402-176	212-1996	
61801	Adjustable Ross Corrector Lens Mount	1402-108	1476-100	
62150	Explosive Handling and Assembly Equipment	1402-396	1560771	
62350	Film Splicer	1402-227	1560818	1497-239
62501	Borescope			1497-203
63950	Take-up Test Set	1402-577	1473-200 1473-1100	1497-234
63951	Take-up Alignment Equipment	1402-344	1473-1050	1497-226
63952	Take-up Inspection Fixture	1402-342	1473-135	1497-205

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
64150	Coplanarity Test Set		1479-389	
64155	S-1 Sensor Test Set		1479-397	
64450	DRM/SEM Alignment Checking Kit	1402-432	1557938	1497-215
64451	DRM Alignment Fixture for Station 34.5	1402-433	1561601	1497-215
64750	DRM Lifting Yoke	1402-394	1557683	1497-259
64751	Adapter Lifting Yoke	1402-393	1557692	
65001	COA Cradle	1402-155	1480-408	
65100	Barrel Lifting Slings	1402-145	1480-163	1497-121
65250	PPS/DP EAC Lifting Yoke			
65300	Stereo Mirror and Mount Cradle and Lifting Yoke	1402-151	1481-163	1497-153 1497-188
65500	COA Integration Lifting Yoke	1402-150	1481-100	1497-123
65700	Shell Structure Lifting Yoke	1402-141	1550585	1497-117
65850	Supply and Electronics Module Structure Lifting Yoke	1402-391	1557578	1497-208
66450	Instrument Package Transfer Yoke	1402-389	1484-109	1497-151
66750	DRM Work Stand	1402-395	1557364	1497-220
66751	Fixed Adapter Dolly	1402-392	1557881	
66850	DRM Cradle and Dolly		1557635	1497-259

Approved for Release: 2017/02/14 C05097223

PRL Number	Description	Specification Number	Lead Drawing	Manual
66950	Supply and Electronics Module Cradle and Dolly	1402-398	1557200	
67157	Factory Truck W/Erector, Traveler & Assist Mechanism		1485-1089	
67252	SEM/COM Assembly Cradle	1402-428	1486-2000	1497-155
69150	Adjustable Test and Work Stand	1402-441	1490-3550	
69152	Film Chute Closure Plates and FSE Covers	1402-409	1560032	1497-229
69155	Tunnel Protective Cover	1402-440	1490-2500	1497-257
70200	Elevating Personnel Positioner	1402-592	1490-3913	

A.2.4 Other BIF-008 Documents

Document	Number
Interconnect Diagram (9x5)	1418-235
Code Function Correlation (9x5)	1418-250
Cable Interconnect Diagrams	1418-249
PPS/DP EAC Acceptance Test Procedure	TE-C-8500
Procurement and Control Implementation Plan	401-162
Project Requirements List	1400-200

Approved for Release: 2017/02/14 C05097223

A.3 INTERFACE (I/F) DOCUMENTS

A.3.1 PPS/SCS I/F Specifications

PPS/SCS Interface Specification (9x5)	1402-333
Interface Command Function List Pin Assignments (9x5)	1401-302
PPS/SCS Power Requirements (9x5)	1401-304
PPS/SCS Telemetry Requirements (9x5)	1401-305
PPS/SCS Thermal Interface (9x5)	1401-306
PPS/SCS Mechanical Interface (9x5)	1401-307
Command Pulse and Timing Signal Interface Specification (9x5)	1402-420
PPS/SCS (9x5) Mass Properties Interface Specification	BIF-003/2-081614-73

A.3.2 PPS/VAFB I/F Specifications

PPS/VAFB Interface Specification (9x5)	1402-337
PPS/LOB to Gantry Cabling Requirements (9x5)	1401-308
PPS/LOB Facility Requirements (9x5)	1401-309
PPS Launch Facility Conditioned Air Requirements (9x5)	1401-311
PPS Gantry Clean Room Requirements (9x5)	1401-312

A.3.3 PPS/SRV I/F Specifications

G-9x5/BIF-008/GE RESD Interface Specification	1402-277
SRV Mass Properties Requirements	1401-200
Mechanical Interface External, Forward Unit and Adapter	1401-202
Internal Mechanical Interface and Space Allocation, Forward Unit	1401-203

A.3.3 PPS/SRV I/F Specifications (Cont'd)

Thermal Interface Forward Unit	1401-204
Electrical Interface SRV/PPS	1401-205
SRV/ASE Interface	1401-208
9x5 SRV (with Receiver) Test Criteria	1401-209
Forward Unit Payload Components Installation Requirements	1401-211
RECAL Interface	1401-212
FSTE Interface	1401-213

A.3.4 Miscellaneous I/F Specifications

PPS Data Reduction Requirements Interface Specification (9x5)	1402-457
EMI Board Charter (9x5)	1402-352

A.4 ASSOCIATE CONTRACTOR AND AIR FORCE DOCUMENTS

A.4.1 General Electric Reentry and Environmental Systems Division

RECAL Unit	S-4935-04-0035
SRV	80S1002

A.4.2 Lockheed Missiles and Space Company

Interconnect Diagram, LMSC Hardware	1233316
LMSC Telemetry Instrumentation Schedule PCM Telemeter Systems No. 1 and No. 2	

A.4.3 TRW

Operational Hardware/Software Specification (OHSS)

A.4.4 Aerospace

System Test Objectives

Launch Test Directive

A.4.5 Air Force

Test Operations Order (TOO)	
Requirements for Relability Program	MIL-STD-785A
Calibration Systems Requirement	MIL-C-45662A
Safety Manual	SAMTEC-127-1
Electromagnetic Interference Characteristics Requirement for Equipment	MIL-STD-461A
Human Engineering Design Criteria for Military Systems Equipment and Facilities	MIL-STD-1472A
Quality Program Requirements	MIL-Q-9858A

APPENDIX B ELECTRICAL DIAGRAM

Figure B-1 is a modification of BIF-008 drawing 1418-249, Cable Interconnection Diagram (9x5), and is applicable for Flight Models 48 and 49.*

Illustrated in this figure are:

(a) Cable interconnections within the PPS/DP EAC

(b) Cable interfaces with the satellite control section

(c) PPS/DP EAC arm plug locations

Figure B-1 Notes:

(1) Unit reference designations and descriptions are shown in Table B-1.

(2) The schematic shows, in general, units which are connected by cables.

For some units not connected by cables, and for items which are not part of a unit, see the following BIF-008 schematics:

2.1 COM 1411-1165 COM/COA heater tape and miscellaneous schematic/wiring diagram (includes S1-PRG subsystem).

2.2 SEM

2.2.1 1411-1194 SEM heater and temperature sensor schematic diagram.

*Flight Model 50 and on configuration will be provided when available

2.2.2	1382962		SES instrumentation assembly.
2.3	DRM	1424-686	DRM heaters, temperature sensors, and separation switches schematic diagram.

(3) The zones of the ground heater system are defined in Part 3, Section 8.

(4) Coordinates shown are BIF-008 vehicle coordinates.

(5) Abbreviations:

ABUC	- Aft Backup Cutter
E	- Wire Termination
FL	- Filter
J	- Jack (female connector)
P	- Plug (male connector)
P/O	- Part Of
RECAL	- Remote Electrical Checkout via Air Link
S/C	- Splicer/Cutter Mechanism
STA	- Station
SQ	- Squib (pyro)
TB	- Terminal Board
VPD	- Viewport Door

(6) For additional information, refer to BIF-008 interconnection drawings 1418-235, 1418-249, and 1418-250.

TABLE B-1

UNIT REFERENCE DESIGNATIONS AND DESCRIPTIONS

Unit No.	Description	Assembly No.*	Schematic No.*
2.	Command processor	1417-783	1417-749
3.	Power monitor and control unit	1417-819	1417-826
6.	Film control electronics	1411-683	1411-679
8.	Junction box	1233457	-
10.	9 supply unit	1411-497	1411-686
14.	Instrumentation processor	1417-809	1417-808
15.	Focus sensor	Part of unit 47	
18.	Viewport door electronics	1382397	1382404
19.	Stereo servo	1414-1002	1414-1001
20.	Crab servo	1414-350	1414-386
23.	SRV No. 2	80S1002	40SR199072
25.	Digital telemetry unit	3532006-1	-
29.	Load box instrumentation	-	-
33.	SRV No. 1	80S1002	40SR199072

*BIF-008 Assembly and Schematic numbers are reference only.

TABLE B-1 (CONT'D)

Unit No.	Description	Assembly No.*	Schematic No.*
34.	Splicer mechanism - 9	1377622	1233447
35.	Cutter/sealer No. 3	1382960	1370635
36.	Tunnel seal and record trap - 9	1382961	1370635
37.	Aft backup cutter	1382959	1370635
40.	Frequency phase lock loop electronics - 5	1409-532	1409-531
41.	Frequency phase lock loop electronics - 9	1409-532	1409-531
42.	Camera electronics assembly - 5	1408-2057	1408-2058
43.	Camera electronics assembly - 9	1408-2057	1408-2058
44.	5 supply unit	1411-916	1411-1049
45.	Film handling electronics	1411-1099	1411-1100
46.	Initiator electronics unit	910000	-
47.	Dual Platen (9x5) Camera	1408-2102	1408-2084
48.	Cutter/sealer No. 4	1382960	1370635
49.	Splicer mechanism - 5	1377622	1233447
50.	Tunnel seal and record trap - 5	1382961	1370635
51.	S1-PRG electronics	See Notes 2 and 2.1	

*BIF-008 Assembly and Schematic numbers are reference only.

BIF-008- W-C-019843-RI-80

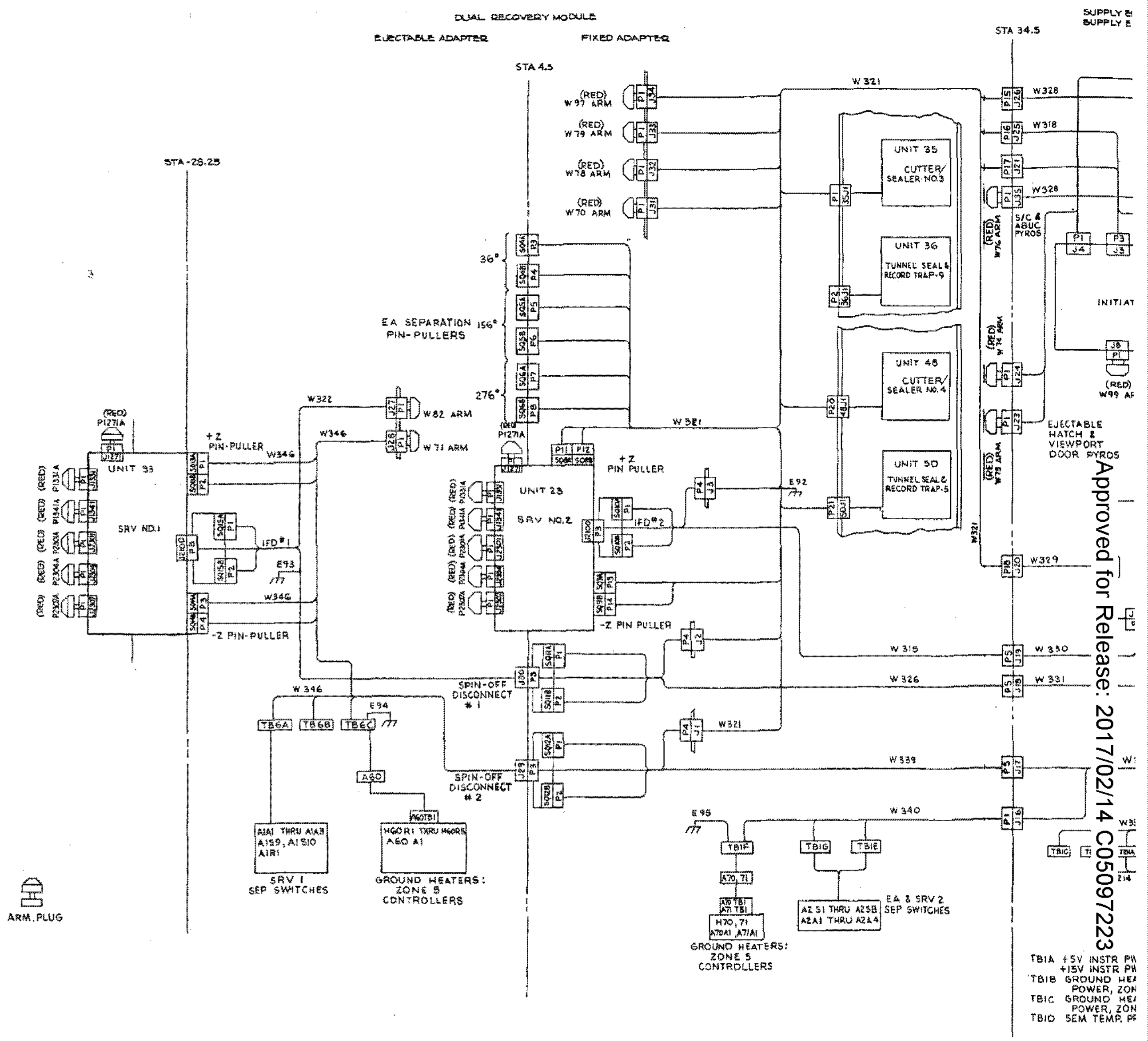
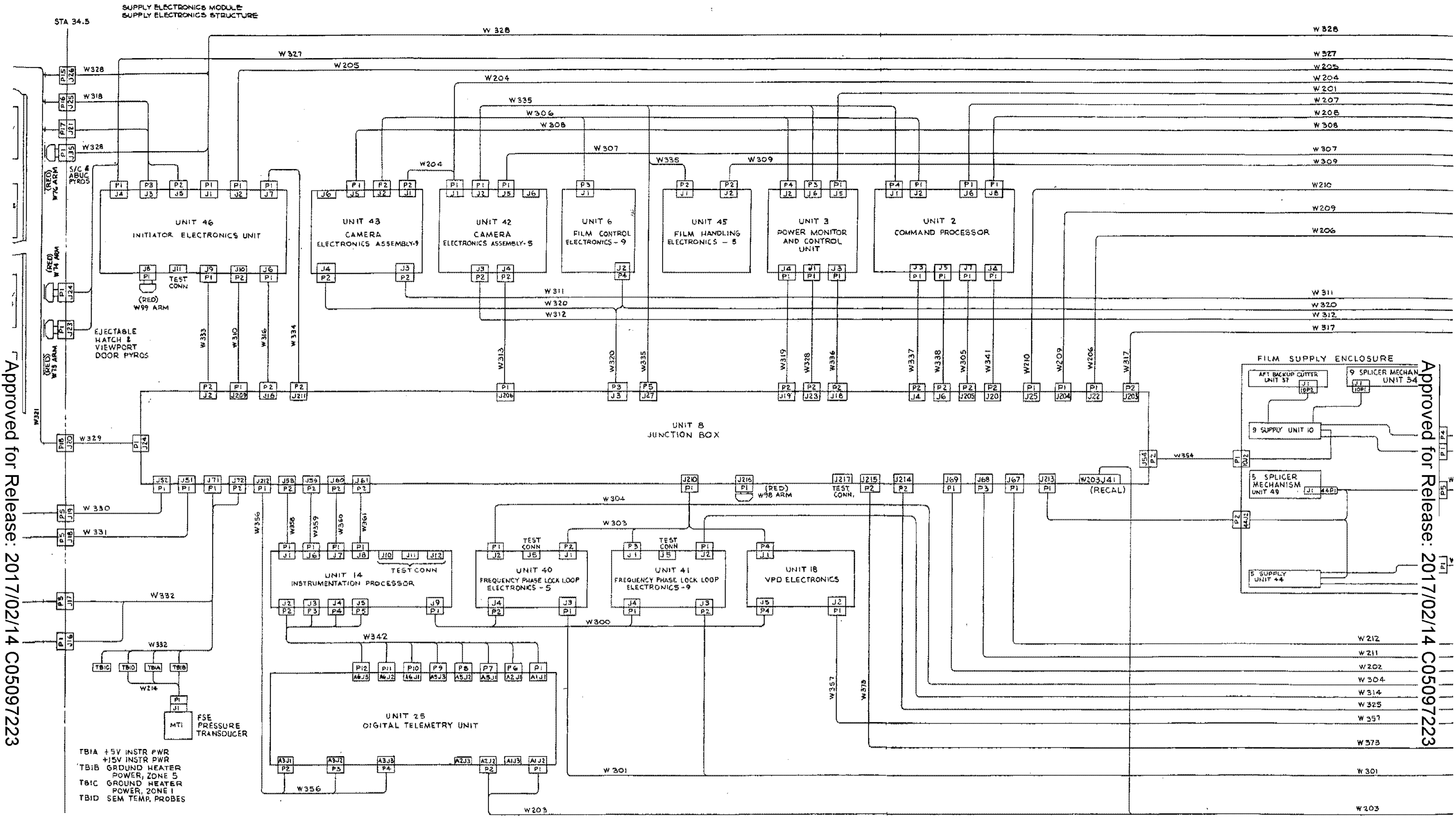
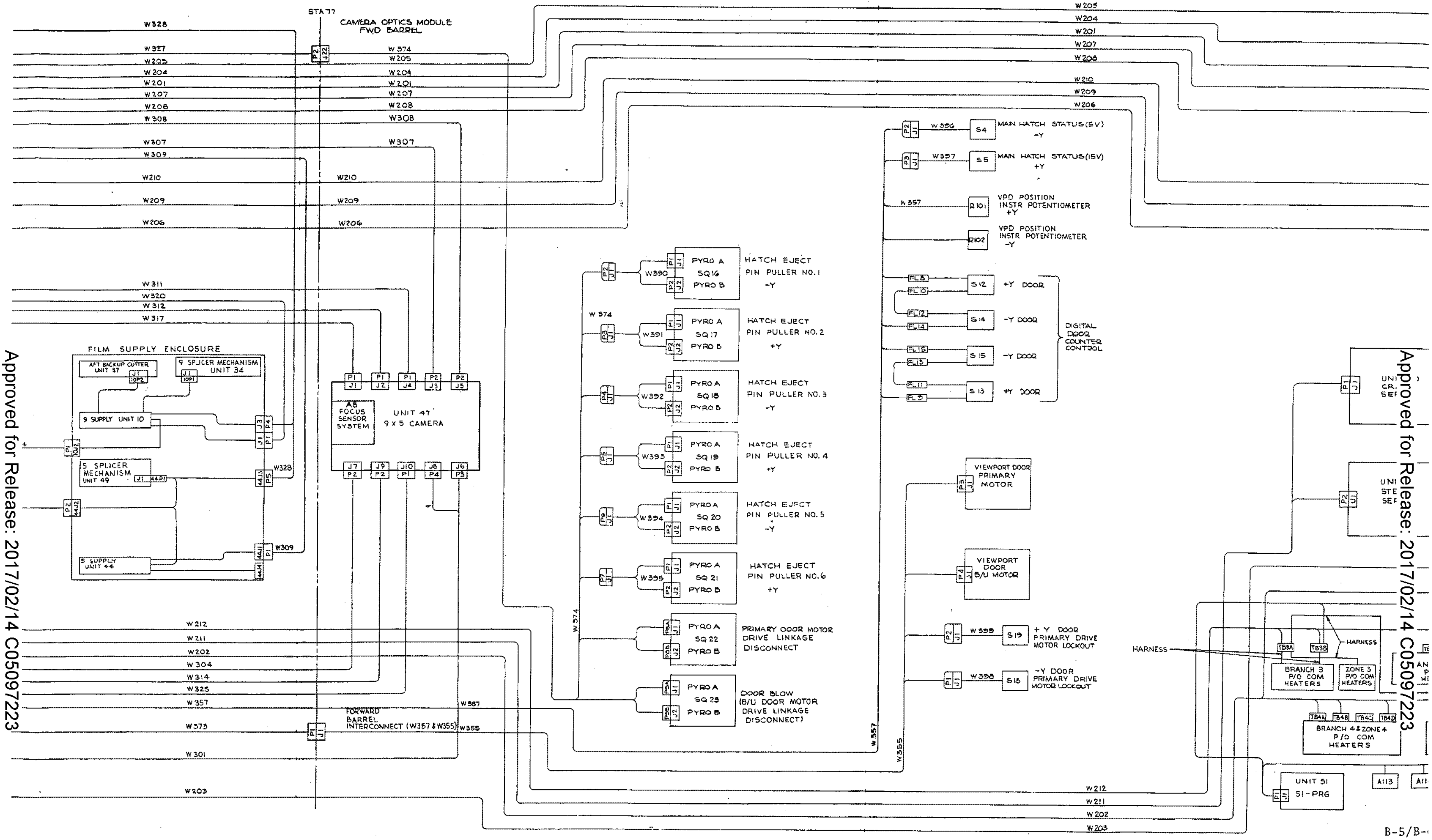


Figure B-1. Cable Interconnection Diagram (9x5)

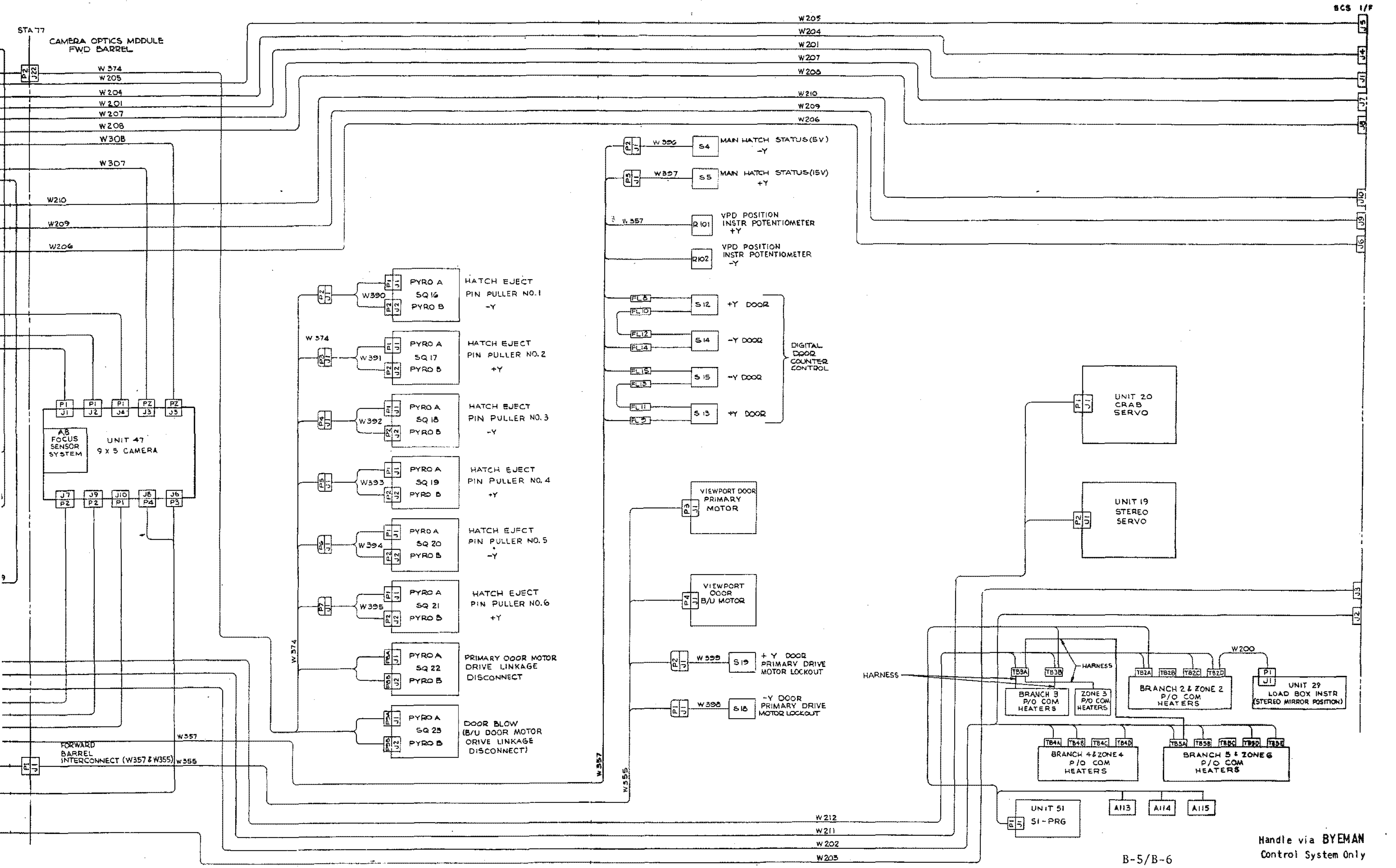
Handle via BYEMAN
Control System Only

Approved for Release: 2017/02/14 C05097223


SUPPLY ELECTRONICS MODULE
SUPPLY ELECTRONICS STRUCTURE
STA 34.5
UNIT 46
INITIATOR ELECTRONICS UNIT
UNIT 43
CAMERA
ELECTRONICS ASSEMBLY-9
UNIT 42
CAMERA
ELECTRONICS ASSEMBLY-5
UNIT 6
FILM CONTROL
ELECTRONICS - 9
UNIT 45
FILM HANDLING
ELECTRONICS - 5
UNIT 3
POWER MONITOR
AND CONTROL
UNIT
UNIT 2
COMMAND PROCESSOR
UNIT 8
JUNCTION BOX
S/C & ABUC PYROS
EJECTABLE HATCH & VIEWPORT DOOR PYROS
(RED) W99 ARM
(RED) W98 ARM
TEST CONN
(RECAL)
FILM SUPPLY ENCLOSURE
AFT BACKUP CUTTER UNIT 57
9 SPLICER MECHAN. UNIT 54
9 SUPPLY UNIT 10
5 SPLICER MECHANISM UNIT 49
5 SUPPLY UNIT 44
UNIT 14
INSTRUMENTATION PROCESSOR
UNIT 40
FREQUENCY PHASE LOCK LOOP
ELECTRONICS - 5
UNIT 41
FREQUENCY PHASE LOCK LOOP
ELECTRONICS - 9
UNIT 18
VPD ELECTRONICS
UNIT 25
DIGITAL TELEMETRY UNIT
MT1
FSE
PRESSURE
TRANSDUCER
TB1A +5V INSTR PWR
+15V INSTR PWR
TB1B GROUND HEATER
POWER, ZONE 5
TB1C GROUND HEATER
POWER, ZONE 1
TB1D SEM TEMP. PROBES



Approved for Release: 2017/02/14 C05097223



Handle via BYEMAN
Control System Only

Approved for Release: 2017/02/14 C05097223

APPENDIX C SOFTWARE

This appendix consists of a brief description of all the software used in conjunction with design, analysis and testing of the PPS/DP EAC. Software used during orbital operations is described in Part 4, Section 7.

Administrative software, cost management software, and software that checks other software have not been included.

C.1 Design and Analysis

The following computer programs are (or have been) used in the design and analysis of the PPS/DP EAC and its components. Input data may be either real or simulated.

Name	Description
CONFACII	Computes radiant interchange configuration and form factors.
SATAN	Solves transient and steady-state conductive, convective, and radiative heat transfer problems.
SF	Generates and punches the script F-area matrix, for use in radiant heat transfer problems.
OHBCP	Generates incident fluxes and computes the heat balance for hardware in an orbital environment.
MANU	A modification of OHBCP which includes the capability to simulate maneuvers about a three-axis system.
EJECT	Calculates the SRV's and EA trajectory populations using a Monte Carlo sampling technique on the acting springs.

Name	Description
KGOG	A comprehensive program that computes the mass properties of major assemblies. It prints out a report listing mass properties of all assemblies, subassemblies and piece parts.
MASS	Lists components by name and number and determines weight totals. Used mainly for miscellaneous parts such as clamps, nuts, screws, washers, etc.
MODCUP MATMAN END I END II	These programs are used to generate a dynamic structture model. MODCUP is used in conjunction with an internal and external mass matrix. The output is a mode matrix which is used with MATMAN. MATMAN is a matrix manipulation program which generates a coupling matrix. The coupling matrix is used with MATMAN to generate another coupling matrix, Ψ12. Coupling matrix Ψ12 is used with MODCUP to generate an external mode matrix, coupling transformation matrix, coupler mode matrix, and coupled frequencies. The coupled transformation and mode matrices are inputs to END I and END II which yield coupled transformation matrices, coupler mode matrices, and combined structure mass matrices for PITCH/LONGITUDINAL and YAW/TORSIONAL load cases.
RMP	Calculates mass properties for any type of film.
ROTAN	Rotates and translates moments and products of inertia of the mirrors and there mounts to determine the mass properties in the general axis system.
W/B	Used to find the center of gravity moments and products of inertia of complex bodies.
NEVADA	A thermal view factor program which utilizes a statistical ray tracing method. Its features include calculation with intervening surfaces, gray surfaces, diffuse and spectral surfaces, orbital mechanics, calculations of orbital heat rates and graphical surface plots.
SINDA	A thermal analyzer program that employs a finite differencing method of analysis. It provides for a solution of large networks including "zero mass" nodes. SINDA also allows time varying parameters and provides network generation.

Name	Description
SPAR	A structural and thermal finite element program.
GIFTS	A graphical header program for model generation and checking when using finite element analysis.
TRACK 5 and TRACK 9	Computer programs that predict the lateral film displacement (mistracking) in the 5- and 9-inch system at the camera and rollers due to misalignments of specific rollers.
VENT	Calculates differential pressures in various compartments.
BATMAX	Performs photographic smear analysis of a specific frame.
OPTIMA	Caluclates photographic performance of a specific frame with smear included.
MACSEE	Smear analysis for general case smear using a Monte Carlo sampling technique.
DLIM	Calculates performance for a range of system operational/ design parameters.
RODOS	Calculates thru-focus performance for a diffraction-limited lens for a range of design parameters.
MSA SOFTWARE	This software may be used to estimate the equipment usage and photographic performance of the PPS/DP EAC It may also be used to estimate the expected return of cloudfree photography. See Part 2, Section 8 of this handbook for results of the operation of MSA software. The software consists basically of six programs: SMART, ODC, GENIE, TSUN, TBONE, and SOS. Figure C-1 is a flow chart showing the interrelationship of these programs. Other programs may be necessary from time to time to supplement this basic software package.
TDSPA	Calculates wavefront spectral analysis. Determines predominant wavefront characteristics.
AFLT3 AFLT4	Performs mirror evaluations of surface figure.

Name	Description
TLUCVL5	Evaluates modulation versus spatial frequency for optical systems.
RAINBOW	Evaluates chromatic image defects.
DIVIDE	Evaluates mirror blanks.
NASTRAN STRAP	Provides for optical mount studies and structural evaluation of mirrors and other structures.
ABEM	Calculates absorptivity or emissivity from measured data.
INDEX	Evaluates effects of glass index error.
SOMEX V	An optical system tolerance analysis program.
TRACER	Used to trace rays (BFLT5 and TLUCVL5 compatible).
SAP-3	Provides linear open loop servo analysis.
ECAP-2	A general purpose circuit analysis program.
BFLT-5	Used in the study of alignment sensitivity, thermal effects, support and optical analysis of MTF and OQF from interferometry.
CLOSED	Calculates linear motion degradation.
LIN-SIN	Calculates dynamic image motion degradation.
RANAMO	Calculates degradation due to vibratory image motion.
PSAP	Image velocity error spectral analysis.
DYNAMO	Optical dynamic performance predictions.

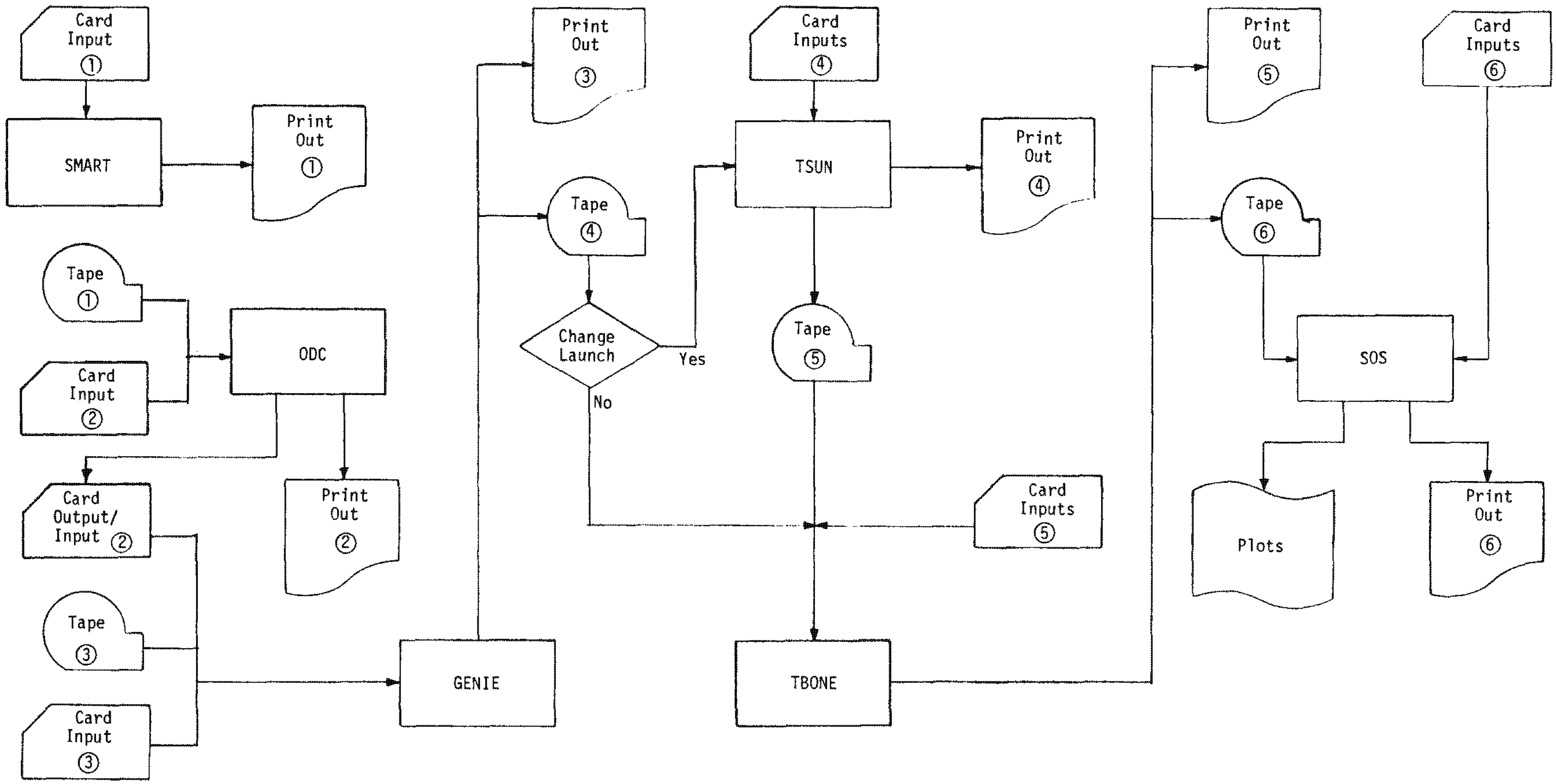


Figure C-1. MSA Block Diagram

TABLE C-1 KEY TO INPUT/OUTPUT PARAMETERS FOR MSA BLOCK DIAGRAM

CARD INPUTS:

1 · Geophysical constants
· Program options
· Initial orbital parameters
· Launch date time
· Orbit adjusts

2 · Program Constants
· Program options
· Orbit adjust schedule

3 · Hardware constraints
· Program options
· Geophysical constants

4 · New launch time date
· Solar constants
· Acquisition time adj.
· Sun angle limit

5 · Program options
· Hardware limits
· Simulation mission length
· Weather conditions
· Weather thresholds
· Burst time factors

6 · Program options
· Hardware limits
· Smear contributors
· Film descriptors
· Optics descriptors
· Sun angle tables
· Contrast tables

TAPE OR CARD OUTPUT/INPUT:

1 · Vehicle's inertial Cartesian coordinates

2 · Twenty orbital fit parameters for each 10 revs (TORBELS) (on cards)

3 · Master list of targets

4 & 5 · Chronological list of available targets

6 · Chronological list of nonconflicting targets with quantized servo values

PRINTED OUTPUT:

1 · Vehicle ephemeris

2 · List of TORBELS

3 & 4 · Chronological list of available targets

5 · Chronological list of nonconflicting targets with quantized servo values
· Weather threshold weather statistics
· Rev-by-rev acquisition statistics

6 · Rev-by-rev equipment usage statistics
· Summary equipment usage statistics
· Summary photographic performance estimates

C.2 Configuration and Requirements Management

The following computer programs are used in conjunction with requirements and data found in drawings and specifications. These programs provide a means to change (update) and/or interrogate selected drawings and specifications.

NAME	Description
RCSORT2	Stores, sorts and outputs requirements as extracted from specifications and drawings and maintained in a tape file. This program provides a means to: (a) Audit the functional/performance requirements of prime hardware for intersubsystem compatibility. (b) Identify the specification and/or drawing path leading from the top level requirements to where they are levied at the component or module level. (c) Identify the origin of component/module function requirements.
WIREUP7	Updates the interconnection diagram.
TRACE	Sorts and prints out interconnections by code number.
WIRDIG	Provides a graphic trace of circuits listed in the interconnection diagram by code number.
VADRAB	Provides an indented parts list for a given vehicle.
VADRAC	Provides a description of configuration differences between two vehicles.
VADRAD	A matrix showing all drawings and DCO's in the configuration data band.
VADRAE	Provides a listing of each assembly and the parts used in it.
VADRAF	Provides a listing of each part and the assembly on which it is used.
TMLIST	Generates a listing of all telemetry that is incorporated in a vehicle.

C.3 Testing

The following computer programs are used in conjunction with the testing of the PPS/DP EAC and its components. Some of these programs may also be used for design and analysis.

Name	Description
RANAMO2	Calculates camera modulation transfer.
DMDVMS	A direct method for calculating the camera modulation transfer from DVMS* data. This is a general image velocity error measurement.
RATE	Calculates the platen travel rate for PPS/DP EAC testing.
KELLY	Calculates the resistance of the differential temperature probes.
ABEM	Calculates the solar absorptance of the mirrors.
TRSI	Calculates spectral transmittance.
FIT	Curve fit for tri-bar resolution data.
SERVO	Calculates crab and stereo servo angles.
DYOQF	Calculates dynamic OQF.
PSAPE	DVMS spectral analysis.
ENCODE	Encoder error calculation.
DVMOD3	DVMS modulation calculation.
ADZICON	A program designed to evaluate axicon images projected through tilted refractive optics. Also evaluates system alignment.
TR-5	A program used to compute spectral and integrated transmittance values for the COA.

*Digital velocity measuring system

C.4 Reliability

The following computer programs are used in conjunction with the reliability activities.

Name	Description
TIGER	A multi-purpose computer program written to assist in the Failure Reporting Analysis Summarization (FRADS) system. The primary objective of this computer program is to load and store, on a more or less permanent basis, failure/discrepency data resulting from hardware testing.
DUCK	Lists failures by classification.
GOOSE	Summarizes status of analysis completion.
FILEK MAT FIN MAFAC	A series of computer programs that store major assembly failure data and sort for comparison to past units by vehicle number.
RATS	Used to produce quarterly reports listing failures with cause and corrective action.

C.5 Post-Test

The following computer programs are used in conjunction with the data gathered during testing of the PPS/DP EAC and its components. This information is used by either or both FAS at the launch facility and WCEO [redacted] 25X1

Name	Description
NFINK NFINK2	Calculates and lists the film quantity vs. percent bandwidth for each of the film quantity instrumentation points. NFINK is for the first half of the mission and NFINK2 is for the second half. A listing in terms of PCM* counts is also provided.

*_Pulse Code Modulation

NB76 — Prints and plots ETA vs. BETA on Calcomp plotter.

IMPCALS — Updates the calibration data base using instrumentation output and engineering unit data from the highest level calibration available. It edits the data and includes probe to IMP transfer functions.

REGRES — Updates the calibration regression data base-runs polynominal regressions on raw calibration data from the calibration data base. Checks for inflections.

OPCALS — Updates operational calibration data base. Edits the data and converts the theodolite readings from the COA tests to stereo, crab and line-of sight angles. It also performs other data auditing and conversions.

COMPAR — Updates the telemetry regression data base. Checks the regression data for new and old (previous unit) data and updates regression coefficients if a pre-established threshold is exceeded. It also compares IMP level between files or units on the same file. Flags comparisons which exceed a comparison threshold.

CALBOOK — Formats the vehicle calibration book using the calibration regression and operational calibration data files.

DOCREAD — Reads the binary 7-track DOCTAPE created by PLTE,* decodes and lists the DOCTAPE binary words and creates a 9-track DOCTAPE for use in the computer program CBMCALS.

CBMCALS — This computer program produces command bit monitor and function monitor calibration data.

C.6 Launch

The following computer programs are used in conjunction with the launch operation. They are divided into two sections: (a) computer programs used prior to the receipt of the flight vehicle and (b) computer programs used during launch operation. Even though all of the following computer programs are used by FAS, some were developed and are maintained by LMSC. All LMSC-originated computer programs are so indicated (LMSC). Application of these programs is discussed in Part 4, Section 6 of this handbook.

*Programmable Logic Test Equipment

C.6.1 Pre-vehicle Arrival

Name	Description
FLOW	Used to produce flowbooks for the "Hardline" analog records. These flowbooks are test-sequence-oriented and contain the system time and change descriptions for the monitors on each channel of the recorders.
POLY	Calculates best fit polynominal expression listing from the vehicle calibration data.
DIGIT	Produces a digital listing of all linear and polynominal calibration curves in telemetry volts vs. engineering units.
FMERGE	Merges the FAS created program acceptance test structure (PATS) and library tapes into a vehicle test structure tape.
NELSON	Copies only the commands affecting the PPS/DP EAC from the integrated command tape and places them on a separate tape.
MAP	Uses the output from either FMERGE or NELSON to generate a listing of the PPS/DP EAC subsystem configuration per command and system time. This can be used as a tape validation.
AUTOGEN	Generates most PPS/DP EAC limits. Tape output is formatted for direct input into the PATS and library tapes.
LSBELLS (LMSC)	Updates a PATS or library tape and provides a listing. Provides a format and calibration error listing. Lists the differences between two tapes.
DPP (LMSC)	Modifies specified fields on a tape. Used mostly on the PATS and library tapes.
LPMURG (LMSC)	Merges the FAS AND LMSC PATS and library tapes into a merged test structure tape.
LARTHUR (LMSC)	Merges the PATS and library or the calibration instrumentation tapes, LPMURG output tape, and update cards into the command and limit tapes to be used for PSV testing. Provides diagnostic listings.

Name	Description
LUVACT (LMSC)	Uses the PSV command and/or limit tape plus update cards as an input to modify the PSV command and/or limit tape. Provides selective listings plus tape-to-tape difference listings.
LCL SORTS (LMSC)	Using the PSV command and/or limit tapes as an input, it sorts and lists the tapes per option chosen.

C.6.2 Launch Operations

Name	Description
LCAPRE (LMSC)	Using the PSV command and limit tapes, card deck, and console typewriter, the computer program is used to command, control and check the PSV and special peripheral AGE. It also provides a real time status printer listing, selective CRT displays, and generates a documentation tape.
LVLIST (LMSC) LDOCLIST (LMSC)	These computer programs provide a listing of the documentation tape(s) with various selected options..
LAFR (LMSC)	Using a calibration card deck and documentation tape(s) this computer program calculates rates and provides an analysis listing from specified instrumentation points.
LOLA (LMSC)	Using the PSV limit tape and documentation tape(s) this computer program provides selective post-test limit analysis event detect processing and listing.

C.7 Orbit

The following computer programs are used in conjunction with the support operations between the time of lift-off and deboost of the PPS/DP EAC.

C.7.1 Factory Support

The following programs are employed at the factory.

Name	Description
STATUS	Plots FAN morning report data on CALCOMP plotter.
SLIDE	Develops slit plots for FAN.

C.7.2 Field Support

The programs that are used [redacted] in support of target selection, commanding, and processing of telemetry data are described in Part 4, Section 7 of this handbook. 25X1

C.8 Post-Recovery

The following computer programs are used in conjunction with the post-recovery results analysis.

Name	Description
DYNAMO	Calculates tri-bar resolution performance in cpmm* on-axis.
WFITG3	Weighted or unweighted regression analysis package of general 3-variable multilinear equations. Used for the focus calibration letter.
SRAP	Stepwise regression analysis package.
SMEAR REDUCTION	Calculates smear and smear rate anywhere on the format from the smear read in the smear slit area at format edge.

*Cycles per millimeter

This page intentionally blank

APPENDIX D FUNCTIONAL DESCRIPTION OF AEROSPACE SUPPORT EQUIPMENT

This appendix is a list of the aerospace support equipment (ASE) required to support the Gambit program. The following criteria were followed in determining the categorization of a given piece of equipment:

Optical (O) - Any piece of equipment used in the manufacture or test of optical elements, including the focus detection subsystem.

Electrical (E) - Any piece of equipment used in the fabrication or electrical testing of electrical or electronic components, subsystems, or systems.

Mechanical (M) - Any piece of equipment used in the testing of mechanical components or systems; also, any device used for alignment, maneuvering, shipment, assembly, or for determination of physical parameters.

Because many items of support equipment are referred to only by an unclassified title, this section makes use of both the classified and unclassified terminology. Many items carry both terms and the associated PRL* number to minimize misinterpretations. For example, the instrument package (IP) would be noted as PPS/DP EAC (IP) or IP (30250). A cross-reference by title is included at the end of the section.

---

*PRL - Project Requirement List, a numerical index of equipment in use on the Gambit program.

PRL Number	Name and Description	Primary Use	Related Equipment
40150	Power Group The power group consists of two separate, single-bay enclosures which are used to provide primary, emergency, heater, and initiator power to the IP (30250) and SEM (33250) during testing. Voltage and current limits are programmable via programmable logic test equipment (PLTE, 59470), and provisions are made for shutdown of power upon detection of any anomalous condition. Voltage and current monitoring capability is provided.	E	
40160	Miniconsole A 2-bay field-use console with an end-to-end electronics unit (EEE, 40753) for initiator and motor testing, a master digital telemetry unit (MDTU, 59453) drawer used with forward unit test equipment (FUTE, 52351), 60 buffers between the IP (30250) and instrumentation console (41100) for test points and console functions. Gain test signals and continuity loops are checked. An oscilloscope and digital multimeter (DMM) are in the console. A remote miniconsole control and monitor, a single-bay validation unit, and computer interface (I/F) chassis are also included as part of this item.	E	
40170	Portable Test Console A single-bay enclosure capable of providing the IP (30250) with the following: Up to 98 selectable commands, the preset command, timing signals, A and B gain test signals, primary power, emergency power, initiator power, operational heater power, and standby heater power. In addition, the IP continuity loops can be checked. The console includes a DMM and provision to collect test point data by cabling to 3 external recorders.	E	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
40251	Command Recorder A two-bay electronic enclosure containing pulse-width type event recorders to document the command signals transmitted from the test console to the IP (30250).	E	33250 35150
40253	Test Console, 64-Channel Recorder A 5-bay enclosure housing eight 8-channel recorders, an EEE (40753) control and monitor chassis for initiator and motor testing, a 256-channel remote mux for PLTE (59470), and an IP (30250) test signal chassis. The IP test signal chassis has 256 buffers, timing signal monitors, A and B gain test signals, and ability to check continuity loops.	E	
40254	Test Console, 40-Channel Recorder A field-use, 5-bay enclosure housing five 8-channel recorders for test point data recording. Test time, which is obtained externally, is decoded in the console and printed on the chart paper.	E	
40500	Secondard Standard Instrumentation Kit A multiple-bay electronic enclosure containing an oscilloscope, vacuum-tube voltmeter, low-frequency function generator, differential voltmeter, precision oscillator, 50-ampere variable transformer, ac voltmeter, and ammeter. It provides a transfer standard for calibration of the test console, portable test set, and other ASE electronic units under various input voltages and load currents.	E	30250 33250 35150
40650	Secondary Standard Load Box A single-bay, electronic enclosure containing precision resistors, load-control switches, indicator lights, connectors, and jacks. It provides various resistive loads for calibration of the test console. The box electrically resembles the IP (30250).		

PRL Number	Name and Description	Primary Use	Related Equipment
40753	End to End Electronics (EEE) Performs a complete check of initiators and initiation circuits, motors and motor-drive circuits without degradation to the unit under test.	E	31050 33250 34951 34952 35150
40800	Film Advance Controller A portable box containing a power supply, voltmeters, control switches, and indicator lights. It provides a means for advancing film, for monitoring operation of the film handling system, and for measuring quality of film advance via instrumentation signals. The box also provides a means for unlatching and reversing the take-ups to allow film removal.	E/M	
40851	Receiver Protection Test Set A unit that controls the action of the ratchet solenoid. The test set is used to actuate the ratchet solenoid at the receiver, DRM (35050), SEM (33250), and IP (30250) test levels.	E/M	30250 30951 34951 34952 35050
41100	Launch-Ready Signal Distribution Console A multiple-bay electronic cabinet containing branch heater current monitors, lights, controls to switch from internal to ground heater power, digital meters, equipment for monitoring umbilical points, and communication panels. This console supplies ground power to the IP (30250) during validation tests and countdown and serves as termination for all umbilical connections.	E	30250

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
41400	Environmental Hatches Consist of 10 sav-con connectors and 2 panels. The sav-con connectors mate the prime 288 I/F connectors and replace the socket saver cables. The two panels are located under the aft handling ring and are secured to the IP (30250) by means of the handling ring PIP pins. The panels provide support, by means of cable clamping devices, for the test cables which mate to the sav-cons.	E/M	30250
41451	DRM (DFUM) Environmental Hatches Non-flight panels which replace certain access panels of the DRM (35050) during in-house and field tests and provide termination for socket-saver cables. The combination of cables, connectors, and panels remain in place until the arming cycle at the pad.	E/M	30250 34951 34952 35050
41452	SEM Environmental Hatches Non-flight panels which replace certain access panels of the SEM (33250) during in-house and field testing. Provides termination for socket-saver cables until the arming cycle.	E/M	30250 30652 33250 34800 35150
42050	Leak-Rate Test Set Charging and leak test equipment to pressurize and to determine leak rates of various compartments in the DRM (35050), COM (33150), and SEM (33250). Adapters are provided to mate the equipment with prime interfaces.	M	30652 34700 35050

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
42060	Leak Rate Plates Gasketed closure plates which attach to the Ross corrector and field lens assembly (RCFLA, 32802) and the drum recorder (DR, 31250) to monitor the rate of pressure leakage. Inlet valves and pressure gauges are mounted on each interfacing plate.	M	31250 32802
42070	DR/SEM Bellows Test Fixture This test fixture has the capability of testing the DR bellows assembly (P/N 1408-2142) for pressure leak rate, light leaks, force vs deflection, and life testing.	M	31250 33250
42551	Forward Unit Pneumatic Charging Kit A system of filters, regulators, and gas conditioning equipment installed in clean room facility to charge the spin and despin bottles in the DRM (35050) assembly. Used with 42552.	M	34951 34952 35050
42552	Forward Unit Pneumatic Testing Equipment Pneumatic fittings and a mass spectrometer used to detect leaks after spin and despin bottles in the DRM (35050) have been charged.	M	34951 34952 35050
44000	Reference Mirrors A mirror in an adjustable mount which is attached to the primary mirror cell. After being aligned to the optical line-of-sight of the IP (30250), this assembly is the primary reference for the alignment to the satellite control section.	O	30250 33150 34700 35150
45050	Vertical SEM/COM (SEM/DPM) Lifting Yoke A lifting yoke with attaching clevises. Two steel, adjustable cables, 180 degrees apart, terminate in a rotatable socket having a lifting eye to provide redundancy. Compound cross slides with projecting supports to cable sockets provide for cg compensation. Lifts the SEM/COM (35140) assembly vertically at the factory.	M	33150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
45051	PPS/DP EAC (IP) Demating Equipment A lifting yoke to mate and demate the IP (30250), as an assembly, to the vehicle at the pad. This yoke, similar to but longer than the SEM/DPM lifting yoke (45050), has a choke ring and a reinforced eye assembly. The devices for attaching to the Sta 150 Agenda ring(s) are similar to those on the SEM/DPM lifting yoke (45050). The redundant cables attach at the Sta 288 agena ring. It is possible to demate the IP (30250) with the gantry semipermanent clean room in place.	M	30250
45101	Remote Loading Cell A remotely controlled weighing cell with indicating dial to visually display load on a hoist hook. Used with hoist on crane to lift and lower large assemblies.	M	33150 33250 35050 35150
45150	PPS/DP EAC (IP) Hydra Set Hydraulic load-adjusting device with lifting eyes and precision control. Used with hoist or crane to lift and lower large assemblies through a precise distance during mating operations.	M	34050
46053	SEM/COM (SEM/DPM) Assembly Jacket A thermal jacket with the thermostatically controlled resistive heating elements and insulation. This jacket is contoured to fit the SEM/COM (35150) assembly with flaps for access. Sectionalization of the jacket permits assembly to the SEM/COM.	M	35150

PRL Number	Name and Description	Primary Use	Related Equipment
46057	DRM (DFUM) Jacket A thermal jacket with thermostatically controlled resistive heating elements and insulation. This jacket is contoured to fit the DRM (35050) assembly with flaps for access. Sectionalization of the jacket permits assembly to the DRM.	M	35050
46058	Shipping Container, Engine Starter Used to transport engine starter from General Electric to BIF-008 to field.	M	34951 34952 35050
46059	PPS/DP EAC (IP) Storage Cover A container used for storage of the entire IP (30250) in the assembly area. Usually used during a stretch-out period.	M	30250 35150
46060	PPS/DP EAC (IP) Shipping Trailer Used to support and transport the IP (30250) in the 46061 container to FAS. Provides means for rotating the IP and support assembly from a horizontal to a vertical position. It has winches capable of skidding the load from a dock which is coplanar with the load mounting surface. It also provides a source of electrical power.	M	30250
46061	PPS/DP EAC (IP) Shipping Container Provides a mounting which protects the IP (30250) against shocks and vibrations. It serves to control temperature and humidity while excluding dust, dirt and moisture encountered during shipping, handling and storage. It is used with the 46060 trailer.	M	30250

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
47750	Environmental Power Supply A mobile, single-bay enclosure containing a power transformer, converter, power switches, current meters, and test jacks. It provides controlled power to the ground heaters of the IP (30250) in conjunction with instrumentation console (41100).	E	30250 33150 33250 35150
48151	Miscellaneous Aids at Field Special small items such as insertion boxes, patch cables, hand tools, and aids needed for troubleshooting procedures at the pad. On-the-spot make or improvised items as needed for field-support activity.	E/M	
48450	Gantry Clean Room (Press Box) A semipermanent enclosure which houses the forward position of the IP (30250) at the pad. The enclosure provides a temperature and humidity controlled area in which men can work and equipment can be located. Operations such as gas pressurizing and arming take place in the enclosure. The room is located at gantry level 149 and interfaces with the gantry permanent clean room at the same level. The semipermanent enclosure has the capability to be opened in a short period of time to allow for gantry roll-back.	M	30250
48451	Activation Aids for Gantry Clean Room Consists of cables and miscellaneous hardware for on-site activation of the gantry clean room (48450) into the gantry complex.	M	30250
48452	Work Stand for Gantry Room A portable stand used in the gantry clean room (48450) to work on the IP (30250) during field operations.	M	30250

PRL Number	Name and Description	Primary Use	Related Equipment
48600	Field Systems Test Equipment (FSTE) The FSTE is a micro-processor based test set for testing forward units. The FSTE can exercise all functions in the forward unit and/or monitor functions at the J2100 interface. The FSTE provides forward unit instrumentation to PLTE via the -9 DTU module.	E	59454
50102	Stereo (Hypocycloid) Servo Test Set A mobile, separable-piece, single-bay electronic enclosure, electromechanical load simulator, and associated cable set. The electronic console contains power supplies, the command generation section, and instrumentation and test jacks. The electromechanical test stand provides mounting and dynamic load simulation for the stereo servo (31103) being tested. A thermoelectric cooler in the test stand provides controlled thermal excursions to the servo during test. The test set allows controlled commanding of the servo being tested, and provides instrumentation readouts of the outputs under test conditions of the servo for flight readiness.	E/M	31103
50200	Crab (Azimuth) Servo Test Set A single-bay, electronic enclosure containing power supplies, command generators, instrumentation measuring equipment, and an electromechanical test stand with provision for mounting and loading servos. The test set provides crab servo (31102) checkout and acceptance-test capability. It excercises and monitors responses of a crab servo under various mechanical loads and measures instrumentation outputs.	E/M	31102
50301	Thermal Control Test Set Controller Checker A single-bay electronic enclosure containing power supplies, a digital voltmeter and control, load simulation and measurement circuits. Used to test heater controllers (31800) at the component level.	E	31800

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50302	Thermal Control Test Set - Assembly Checker A single-bay, electronic enclosure containing power supplies, a digital voltmeter and control, load simulation and measurement circuits. Used to test an assembly consisting of a controller, heater, and thermistor.	E	33150
50353	Ground (Stand-By) Heater Test Set A one-bay enclosure housing power supplies, loads, DVM, and controls which normally interface with the ground heater controller (31851) assembly for its complete testing.	E	31851
50404	MEMO Scope and Cart A portable oscilloscope used for the measurement of various processed signals.	E	31652 31754
50451	Command Processor (CP) and Instrumentation Processor Test Set A set which consists of a multiple-bay, electronic enclosure containing power supplies and digital voltmeters. It is used to check manually the switching functions of the command processor (31652). The instrumentation processor portion of this test set is not used on this contract.	E	31652 50457
50452	Powered Vib CP - Checkout Equipment (Chatter Checker) A 30-inch high, single-bay, mobile console which provides the capability of powering the CP (31652) and the power monitor and control (31655) assemblies, and monitors relays for chatter or transfer during vibration testing.	E	31652

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50453	Power Monitor and Control (PM and C) Unit, and Separation Controller Test Set A set which consists of a single-bay of electronic equipment containing power supplies and a digital voltmeter with selector switch. It also includes power loads for the PM&C (31655) and controlled commands. The separation controller portion of this test set is not used on this contract.	E	31655
50455	Robotester Console A one-bay enclosure usedto automatically check continuity and isolation resistance at the component level. A coded tape is used as input.	E	31652 31655 31754
50456	Optical Recorder Console A one-bay housing used to monitor test point data and record on chart paper.	E	30250
50457	The Command Processor Test Adaptor (CPTA) A 38-inch high, single-bay, mobile console and associated cables which provide the capability of using the command processor/instrumentation processor test set (50451) to acceptance test the CP (31652). It provides the capability to test CP individual component board assemblies, and to test the CP input and output harness assemblies on the Robotester (50455).	E	31652
50458	Instrumentation Processor - Common Use Electrical Test Set (CUETS) Adapter Cables Four cables which provide adaptation between the instrumentation processor (31754) connectors and those of the CUETS (59480) cables.	E	31754 59480

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50459	Initiator Electronics Unit (IEU) Test Set A manually controlled test set housing commands and power normally interfaced with the IEU (33850). It monitors and compares the IEU outputs with predetermined requirements and displays any anomalous conditions.	E	33850
50552	Automatic Circuit Analyzer with LMSC (Lockheed) Adapter Cables An automatic circuit analyzer (DITMICO) with necessary adapter cables to perform insulation, resistance, and continuity tests of cable harnesses, cable assemblies, and the junction box.	E	30652
50554	Wire Interconnect Vibration Test Set A multiple-bay, electronic console containing power supplies, test monitor and control sections, oscilloscope, self-test simulator, adapter cables, shorting plugs and adapter cable storage. It provides a continuous continuity monitor of conduction in a cable assembly during vibration test.	E	30652
50556	Splicer Mechanism (RAM) Test Fixture and Cable A mechanical fixture used to mount the RAM (34450). This fixture can be used in an altitude chamber or mounted in the RAM test set (52450) from which it is controlled. The fixture includes one supply and two receivers, all with controlled and selectable tensions. Film can be moved with a simple transport system. An alternate means for actuating the RAM is provided on this fixture by use of a solenoid.	M	34450
50650	FPLLE - CUETS Adapter Cables Two cables which provide adaptation between the FPLLE (32050) connectors and those of the CUETS (59480) cables.	E	32050 59480

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50753	PPS/DP EAC (IP) Drive Smoothness Test Set A set of cables and three drawers of electronics which are mounted in the command recorder console (40251). This set is used to do DVM's testing on the camera (31250) at the IP (30250) level. This set is also capable of measuring velocity variations of the primary camera film platens to an accuracy of ±0.01 percent of the steady-state film velocity over the range of dc to 1000 Hz.	E	
50755	DREA - CUETS Adaptor Cables Three cables providing adaptation between the DREA (33450) connectors and those of the CUETS (59480) cables.	E	33450 59480
50760	Simulated Drum Recorder A metal-plated, box-like structure housing the 5 and 9 film drums. It is used to simulate the DR (31250) functions electronically and mechanically. It provides the film handling function in various test sets in place of the prime DR. The mounting interface duplicates the prime hardware. The structure also has provisions for mounting the interframe markers and/or data blocks to provide dynamic checkouts of these subassemblies.	E/M	
50765	Tilt Frame Coupler 5" Input and output devices located between 5" supply unit (31056) and the DR (31250) that maintain proper film tracking at the DR by correcting various misalignments due to assembly or environmental conditions. This input coupler also contains a damping mechanism to assist the DR to meet the startup required.	M	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50770	Tilt Frame Coupler 9" Input and output devices located between the 9" supply unit (31051) and the DR (31250) that maintain proper film tracking at the DR by correcting various misalignments due to assembly or environmental conditions. The input coupler also contains a damping mechanism to assist the DR to meet the startup requirements.	M	
50851	SEM/DRM (SEM/DFUM) Breakout Boxes Breakout boxes and cables to permit connection to DRM (35050) interface for continuity and resistance measurements. They also permit breaking out functions between the SEM (33250) and DRM (35050) while mated electrically.	E	33250 34951 34952 35050
50852	Cable Test Point Equipment The test set provides the capability of connecting trouble shooting equipment into any IP (30250) circuit connector. It consists of cables, breakout boxes, storage racks, test leads, storage cabinets, and breakout box masks. Charts on the storage cabinets list the proper cable, breakout box, and mask to be used with any given IP connector.	E	
50950	Focus (Gain) Sensor Test Set A three-bay console providing all the electronics to operate the gain sensor (31940) along with the DR (31250) and the gain calibration and test (GCT) bench. It contains a DVM (rms), signal generator, chart recorder, counter, oscilloscope, motor and lamp drive circuits, platen control circuits, and specialized circuits for inputing electrical signals to determine the BPF/BEF biases.	E	31940 51150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
50960	Focus (Gain) System Simulator Simulates the mass of present gain system. Also contains reference reflective surfaces so that pre- and post-vib alignment can be checked when attached to the pivot frame at the DR (31250) top assembly level.	M	31250
51150	Target For Gain Sensor Test Set A strip of images and ground scenes that simulates mission targets. It is used in connection with the gain sensor test set (50950) to fully test the focus and acquiring capability of the gain system. It includes sets of tribars for calibration purposes.	E	31940 50950
51200	Portable Servo Drive Consists of a portable electronic box containing a power supply, switches, meters, test jacks, and cables. It drives crab (31102) and stereo (31103) servos to commanded position.	E	34700
51300	Door-Operate Component Test Set A single bay of electronic equipment containing a power supply, control switches, indicator lights, meter, and timer. The test set exercises the door opening assembly and monitors operating time and instrumentation outputs during door operation.	E	30652 33150
51803	Insulation Resistance Tester Allows measurement of pyro insulation resistance between bridgewire and case.	E	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
51853	Pyro Simulators for Shipping M-11 pyro cases which have bridgewires replaced by an electrical short, and all explosive material removed. The simulators are substituted for live pyros for DRM (35050) associated with engineering model and reliability model configurations, and are also used for pyro harness electrical checkout in the SEM/COM (35150).	E	30652 33150 33250 34700 35050 35151
51855	Initiator Test Set with Cables A low-current, selectable-test-point DVM, with cables to connect the DVM to prime cables containing initiator circuits. The test set is used to test initiator circuit for continuity and isolation.	E	
51950	Record Control Electronics Test Set A two-bay enclosure housing all the test loads, controls, commands, and signals normally interfacing with the RCE (33350). Looper conditions, status of the take-ups, a dynamic tension looper signal, simulated supply and receiver motors, and brake coils are provided by this test set. A storage oscilloscope, DVM, and function generator provide the necessary tools for complete testing of the RCE.	E	33350
51951	Record Control Electronics Subassembly Test Set A single bay of electronics partitioned into five sections. Each section is designed to test an associated subassembly of the RCE (33350). Inputs, outputs, and simulated loads are provided for each subassembly which is required for calibration and trouble shooting. Any combination of the five subassemblies can be tested simultaneously.	E	33350

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
51955	RHE - CUETS Adapter Cables One cable providing adaptation between the RHE (33355) connectors and the CUETS (59480) cables.	E	33355 59480
52051	Tunnel Bulkheads Bulkhead penetrations for environmental vacuum chambers.	E/M	30250 33150 33250 34700 35150
52052	Cables - Test Set, Tunnel, Adapter, and Socket Saver Molded neoprene rubber cables used during the IP (30250) tests at the system level as well as at the subsystem levels.	E	
52054	Interface Adapter Kit Provides adaptation required for electrically testing the IP (30250) while subsystems are mechanically demated.	E	34700
52056	EMI Susceptibility Test Equipment This equipment consists of test voltmeters to detect and record transient voltages during EMI testing.	E	
52058	SEM Breakout Boxes and Cables Consists of 21 cables which are mounted to one socket saver. The assembly is used at the SEM (33250) level of testing and is mounted to the SEM dolly at Sta 77. Twelve of the cables take the place of those cables which come from the DPM (33150); the other cables act as socket saver cables for the prime cables in the SEM (33250) which normally connect to the DR (31250).	E	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
52104	Camera (DR) Adapter Mount A fixture which mounts the DR (31250) in proper position and alignment (simulates COA testing) during SEM (33250) testing.	M	33250
52151	COM (DPM) Electrical Simulator A single-bay enclosure consisting of five chassis and 15 cables. The test set electrically simulates the DPM (33150) servos, vent and other loads & instrumentation associated with the DPM assembly.	E	
52350	DRM (DFUM) Electrical and Mechanical Simulator Provides the electrical/mechanical characteristics necessary to validate the film handling characteristics existing at the SEM/DRM (33250/35050) interface. The unit functionally duplicates the DRM (35050) and contains two receivers (53550). Signals passing either way through the SEM/DRM interface are either provided or terminated and a complete electrical breakout of this interface is available on the structure.	E/M	30652 33250 35050 35150
52351	Remote Electrical Checkout via Air Link (RECAL) Boxes Two boxes of portable electronics used in conjunction with a computer complex or event recorders for checkout of the SRVs in the DRM (35050) or IP (30250) configuration. The boxes contain connections for feeding up to 96 external event signals into the slave unit for computer processing. When the boxes are used with the DRM test console or the flight validation test equipment (FVTE), a complete computer checkout of the SRVs and IP pyro system is possible.	E	30250 34951 34952 35050 35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
52353	Slave Digital Telemetry Unit (DTU) A slave unit for support use. Unit receives addresses from master DTU (59453) and returns the telemetry signals in a pulse code modulated (PCM) serial train to the master DTU.	E	30250
52354	DTU Slave Module Assembly A portable box containing the slave DTU (52353). Socket-saver type cables couple the inputs and outputs of the DTU slave unit to the exterior of the box. The DTU slave module is used for IP (30250) testing to condition the RECAL (52351) outputs into a PCM serial train.	E	30250
52355	RECAL (FUTE) Box Cables Cables used to integrate the forward unit test equipment (FUTE, 52351) box into the test configurations at the various test sites.	E	30250
52357	RECAL (FUTE) Box Event Recorder Console A multiple bay container, write-type event recorder used to provide a permanent record of the FUTE (52351) output during IP (30250) and the DRM (35050) tests at BIF-008.	E	30250 34951 34952 35050
52360	SRV Simulators Portable electronic enclosures containing the necessary circuits to simulate the SRVs (34951 and 34952) for the purpose of validating the FUTE (52351).	E	30250 34951 34952

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
52361	PCM Code Converter A portable, 19-inch, rack mounted chassis which contains the electrical components required to convert the PCM output of the master DTU (31462) module to a manchester II code and amplify the signal for transmission to the field computer.	E	59452 59455
52450	Splicer (Record Attach Mechanism) Mechanism Test Set A two-bay enclosure in which one bay houses all necessary electrical and electronic equipment required to test the record attach mechanism (34450) and the second mounts the record attach mechanism (RAM) test fixture (50556). The test set provides controls for take-up, supply and leader tensions, dimple motor actuation and simple film advance and transport. There is a complete electrical breakout and self-check capability on the electrical console. A calibrated, grid-lined, frosted-glass template is used to determine the acceptability of the splice. A DVM and optical recorder are used to monitor signals before, during, and after mechanism operation.	E	33250 34450
52451	RAM Reset Kit These aids are required for resetting the RAM (34450) on the IP (30250) after each test actuation. The kit contains a loading mechanism, supports, cocking tool, safety device, and shields used in reloading of the splicer mechanism in-house and in the field.	E	30250 33250 34450 35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
53200	Camera Optics Assembly (Dual Platen Module) Environmental Test Fixtures A framework structure with mating supports for dual platen module (DPM) Intergration lifting yoke (65500). It supports the DPM integration lifting yoke section on a bed of vibration machinery during vibration tests in vertical orientation only.	M	34700
53300	Environmental Test Fixtures For Major Elements & Components Adapts the components or major elements to the vibrator and associated slip plates for vibration testing.	M	
53350	Environmental Test Fixtures Structural supporting jigs for holding subassemblies and parts in simulated flight position(s) on vibrator bed during vibration test.	M	33250
53355	Drum Recorder (DR) Mass Simulator A metal block which simulates the weight and center of gravity of the DR (31250). One side has a mounting interface which duplicates the DR mounting interface.	M	
53550	Receivers Re-Furbished Standard flight model take-up assembly which provides film take-up capability for in-house testing of the film handling systems.	M	31050
53750	9" Supply Test Assembly Provides film supply capability for in-house tests of the film handling system as part of the supply assembly test set (54650).	M	30951 31050

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
54050	DRM (DFUM) Mass Properties Measuring Equipment Provides the capability for measuring the center of gravity and determining the moment of inertia and the product of DRM (35050). The equipment consists of a mass properties measuring unit and a console, plus a power cable, an interconnecting instrumentation cable, and a nitrogen gas base. Also provides capability for determining moment of inertia of an SRV. This equipment is not planned for use on this contract.	M	30250 35050
54100	Cutter and Sealer (C/S) Test Set A mobile bench containing power supplies, logic circuits, instrumentation, manometer, a film tensioning device, and rollers. The unit provides a check of the C/S under dynamic conditions and allows testing of the actuated assembly for water leak rate.	E	33500 33551 33556 33557
54150	Cutter and Sealer Test Set (B^2) A mobile, single-bay electronics console containing a power supply, digital voltmeter, switches, instrumentation, and logic. The unit provides a check of the C/S assembled to the SRV cover under dynamic conditions.	E	33500 34951 34952
54650	Supply Assembly Test Set Consists of a base assembly and console. The base assembly provides a mounting for the 9" and 5" supplies, receivers 1 and 2, and the DR (31250) in normal and maximum positions. The equipment is mounted on the test bed and is operated as a system. The console supplies and measures the electrical inputs and	M	30951 31050 31200 33350

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
	outputs. It includes controls, meters, and instrumentation readout devices to test the units. It also provides mounting for two prime FPLLEs (32050), record control electronics (RCE)(33350), and record handling electronics (RHE) (33355).		
54652	Receiver Component Test Set A portable, electronic enclosure containing a power supply, instrumentation, command generator and test jacks. It provides power to the 9- and 5-inch wide film take-up motors, and monitors the inputs and outputs to and from the take-up mechanism during receiving inspection electrical tests.	E	30951 34951 34952 35050
54655	5" Supply Test Assembly A prime-like 5-inch supply used to provide supply dynamics testing of receivers and the 5-inch portion of 9 x 5 drum recorder used on test set 54650.	M	31055
54750	Dual Drum Recorder Test Set (DDRTS) A two-bay console and a mechanical test stand comprising inputs and loads normally seen by the DR (31250). It includes a test drum recorder electronics assembly (DREA), test FPLLE, storage oscilloscope, oscillograph recorder, function generator, DVM, and ammeter. For special tests record handling load electronics, a record handling load simulator, and an external phase meter are also provided.		

PRL Number	Name and Description	Primary Use	Related Equipment
55000	<u>35mm Test Camera Assembly (R/K)</u> Mounts to the COA/prime camera interface by means of an interface plate. The assembly injects tribar resolution targets into the COA optics and records the images thereof. By moving the test-camera platen between exposures, the assembly produces a through-focus measurement of optical system performance. This measurement is used to establish the plane of best photographic focus.	0	32801 32803 34700
55100	<u>Microdensitometer</u> An assembly of stereo microscope, densitometer, moving stage, and recorder used to measure density differences in film.	0	31050 31200
55200	<u>Film Viewer</u> A console-type viewer for 9-½-inch wide film with slow/fast film drive in both forward and reverse directions, and a stereo microscope. Used to check IP (30250) film for resolution and positional accuracy of fiducial marks and edge data.	0	31050 31200
55550	<u>R/K Interface Plate</u> A precision adapter plate attaching the R/K camera to the RCFLA (32802) Ross match equipment or any DR (31250) interface to permit tribar testing.	0	31050 31200
55601	<u>Autocollimating Microscope with Tungsten Light Source</u> A microscope used to observe and evaluate, by means of a point source, the optical quality of any focusing optical element or system.	0	32301 32801 32803 34700 35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
55800	48-Inch Diameter Flat Test Mirror A master optical flat used to autocollimate the optical system for double-pass testing at various assembly levels.	0	30250 32801 33150 34700
55900	52-Inch Diameter Spherical Test Mirror A master spherical mirror used to test the optical quality of stereo and flat test mirrors by converging light rays to a point capable of being viewed and analyzed.	0	32301
56001	Standard Laser Interferometer A modified Twyman - Green-type interferometer, with a laser source, used to measure the wavefront aberrations of optical components and optical systems.	0	32301 32302 32801 32803 33150 34700 35150
56004	R-5 Ross Matching Laser Interferometer An interferometer used to evaluate the Ross-primary platform assembly interferometrically.	0	32801 32803
56005	Interferometer In-process interferometer used to evaluate concave surfaces of lens elements.	0	32803
56052	Objective Setting Test Set A fixture to hold the 5- and 9-inch drums to permit setting the test objectives, mounted within the drums, to a precise gain position with respect to the record plane. An autocollimation mirror and spacer locators, to align a K-type interferometer, completes this test set.	O/M	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
56054	Thru Drum Test Set A five-beam interferometer assembly constructed to allow sequential access to the five infinity conjugate lenses placed in the 9 and 5 drums and the gain system. The instrumentation is equipped with a variable conjugate relay system of high angular admittance to optimize fiducial resolution. Interferograms collected are double-pass through the COA and indicate the foci of the ∞ conjugate lenses from the plane of best COA focus for each field position. The optical components of the test set are mounted on a table having six degrees of freedom of movement. Electrical control is by means of a small graphic control panel. The equipment is remotely controlled and vacuum compatible.		0
56060	Interferometric Interface Plate A high precision reference plate having a DR/RCFLA (31250/32802) interface which provides a gain reference plane for the interferometer to obtain a null setting at a calibrated distance from the interface. Properly positioned openings permit system interferometry without removal of the plate. The plate also provides a reference for the inductive proximity sensors mounted on the interferometers used for system testing.		0
56400	Universal Mount A commercial stand with extension posts, cross-slide assembly, and collar for mounting theodolites. Used to support theodolites, autocollimating microscopes, and telescopes during optical alignment procedures.	M	33150 33250 35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
56900	Spectroreflectometer A modified spectrophotometer used to test the spectral reflectance characteristics of test-sample mirrors.	O	32301 32302
57200	PPS-SCS Mechanical Alignment Jig A magnesium triangular weldment which mounts two mirrors. The fixture interfaces with the shear joint at the aft end of the external shell at three discrete points for mechanically aligning the optical axis relative to the shear-joint plane.	M	33150 35150
57403	Alignment (Axicon) Instrument - Standard An Axicon autocollimating telescope with an arc source used to check alignment of the Ross-corrector lens elements. It is used to check Ross-corrector-to-asphere alignment, and for general alignment of optical setups.	O/M	32802 34700
57500	Reference Mirror Alignment Kit A theodolite and pentaprism assembly with bracket for mounting to the IP (30250) structure (or cradle) and with a camera-slit illuminating system. This assembly establishes the orientation of the reference mirror and bracket, checks the zero-zero position of the stereo mirror with reference to the fiducial mark on the camera slit, and permits checking of the angular orientation of the stereo mirror in all positions.	M	30250 33150 34700
58001	48-Inch Diameter Test Flat Mount For on edge test of 48" flat. Equipment includes Presray rings and a McCloud mount.	O	32801

PRL Number	Name and Description	Primary Use	Related Equipment
58002	52-Inch Diameter Test Sphere Mount For on-edge testing of the 52" sphere. Equipment includes Presray rings and a McCloud mount.	0	32302
58005	Adapter for Mounted Asphere Mirror A device used to adapt the prime asphere to the positioner.	0	32801
58008	Mount Supports For Convex Surface Test Evaluation The interface for a concave test plate in testing the convex surface of an optical element. It provides proper positioning adjustments to produce interference fringes for viewing and recording.	0	32802
58009	Mount Supports For Concave Surface Test Evaluation Interfaces with an interferometer and provides for the positioning of optics for viewing by the interferometer.	0	32802
58100	Optics Positioner An assembly of mechanical rotating devices used to provide fine adjustment of the optical elements so that focal points of light, approximately 35 feet from the optical elements, fall within the entrance pupil of the autocollimating microscopes, MTF equipment, or laser interfereometers. These entrance pupils vary down to 0.040-inch diameter.	M	32301 32801 32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
58301	Film Removal Equipment A fixture which interfaces with the SEM (33250) for removing film from the DRM (35050) take-up assembly. The fixture consists of rewind equipment and can remove film from either receiver.	M	30250 33250 35050
58352	Film Loading Equipment A fixture which interfaces with the SEM (33250) and permits the film spool to be lowered vertically into the supply structure.	M	33250
58800	Portable Reflectometer An instrument used to measure the reflectance of the aluminized coating on the optical elements.	O	32301
58900	Interferometric Dilatometer An optical device used to measure the coefficient of linear expansion of materials used for prime hardware.	O	32301
59051	Miscellaneous Inspection and Test Aids Specialized optical, mechanical, electrical, and safety equipment or unique assemblies of conventional equipment required to establish conformance of assemblies or incoming parts to specification and drawing.	O/E/M	
59200	Temperature Recorder Commercial twelve-channel recorders used to monitor temperatures of test tunnels, prime hardware, and development test samples.	M	35150

PRL Number	Name and Description	Primary Use	Related Equipment
59250	Surface Sampler & Cleaning System A vacuum device used to sample the camera film handling equipment, the film, and other equipment for any foreign particles and to determine the amount of contamination. It also cleans the surface of the equipment while sampling.	M	30250 31200
59453	Master DTU Module A modular drawer containing a power supply, a flight-type Master DTU (59453), and associated cabling. It interrogates the DTU (31462) slave units inside the IP (30250), receives the telemetry signals in a PCM serial train, and translates them to the programmed checkout console for processing.	E	30250 35050 52361 81462
59454	-9 DTU Module The -9 DTU Module is an analog/discrete multiplexer compatible with the master DTU. The -9 DTU is located in the FSTE at the factory and provides forward unit instrumentation to PLTE.	E	48600 59453
59455	Master Digital Telemetry Unit (MDTU) Loader A portable enclosure containing tape reading and punching equipment and electronics. Used to load and verify correct load of the MDTU module (59453).	E	30250 52361 59453
59456	PCM Generator The PCM generator is an analog/discrete multiplexer with pulse code modulated output. The PCM generator is located in the FSTE at FAS and provides forward unit instrumentation to the LMSC computerized test system.	E	48600
59457	PCM Decommutator Used to process pulse code modulated/non-return-to-zero level signals. It conditions these signals for presentation to an external digital computer and provides system troubleshooting capabilities.	F	

PRL Number	Name and Description	Primary Use	Related Equipment
59458	PCM Switching Unit Capable of distributing incoming and outgoing signals between a MDTU (59453) and the unit under test (UUT). This unit simulates two MDTUs through the use of various switching arrangements. It can switch signals to either of two DTUs (31462) in tunnels 3 and/or 4 while switching from side A to B of the individual DTU.	E	
59459	DTU System Analyzer The analyzer provides the necessary timing and stimulus to completely check out either one or two halves of the DTU (31462). It tests accurately with cross talk applied to adjacent channels, provides a data recovery test, and an analog impedance test, and verifies all command paths.	E	
59460	Master Unit System Test Set The master unit test is a computer based automatic tester for the ASE master DTU. The master unit test set is located at Space Craft, Inc.	E	59453
59470	Programmable Logic Test Equipment (PLTE) A general purpose, computer-controlled test system which generates commands, monitors and compares outputs to predetermined requirements, and displays all anomalous conditions that occur in final level assembly testing.	E	30250 33250 35150 40100 50751 59451
59480	Common Use Electrical Test Sets (CUETS) A general purpose, computer-controlled testing device used at the component level. It generates and controls commands, power, and stimuli to a UUT while monitoring and comparing outputs to predetermined requirements. It also displays any anomalous conditions.	E	32050 31754 33355 33450 50457 50458 50650 50755 51955

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
60172	5" Handling Device The equipment used to install the 5-inch supply into the SEM (33250), consisting of a yoke assembly which attaches to the supply. This yoke has provisions for adjusting the lifting eye bolt to compensate for changes in the center of gravity of the supply.	M	
60304	Portable Pyro Test Box Used to make individual resistance measurements of pyrotechnic devices after installation in the SRV.	E	34951 34952 35050
60305	Beacon Test Set Consists of a single-bay, mobile, electronic enclosure used for the checkout of the recovery beacons in SRVs. Contains attenuator panel, oscilloscope, oscillator, discriminator, telemetry receiver, counters, and power supplies. It also allows an air-link type checkout of the beacons under simulated recovery conditions.	E	34951 34952 35050
60650	Supply and Electronic Structure (SES) Support Shipping Fixture Several contoured sheet metal panels with interfacing electrical connectors mounted to receive cable end-connectors in the exact position and relationship as flight orientation, when electronic boxes will be in place.	M	30652
60750	Lighttight Box Aperture Covers - Used to cover record-access openings in the record supply enclosure (RSE) in the SES (30652) during storage handling, shipping, and testing. The covers also hold and secure all film ends during handling and shipping.	M	30652 33250

PRL Number	Name and Description	Primary Use	Related Equipment
60304	Portable Pyro Test Box Used to make individual resistance measurements of pyrotechnic devices after installation in the SRV.	E	34951 34952 35050
60305	Beacon Test Set Consists of a single-bay, mobile, electronic enclosure used for the checkout of the recovery beacons in SRVs. Contains attenuator panel, oscilloscope, oscillator, discriminator, telemetry receiver, counters, and power supplies. It also allows an air-link type checkout of the beacons under simulated recovery conditions.	E	34951 34952 35050
60650	Supply and Electronic Structure (SES) Support Shipping Fixture Several contoured sheet metal panels with interfacing electrical connectors mounted to receive cable end-connectors in the exact position and relationship as flight orientation, when electronic boxes will be in place.	M	30652
60750	Lighttight Box Aperture Covers - Used to cover record-access openings in the record supply enclosure (RSE) in the SES (30652) during storage handling, shipping, and testing. The covers also hold and secure all film ends during handling and shipping.	M	30652 33250

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
60751	Light-Leak Checking Equipment The light-leak checking equipment allows strips of unexposed film to be placed in the RSE and the record chutes. The external surfaces of the RSE and record chutes are exposed to simulated daylight conditions for a specified period of time. The film is processed and the density level checked to determine light leakage.	M	30652
61200	Handling Equipment Test Loads A tubular steel member with various solid weights extending out at various locations and mounting feet similar to the optics section. Simulates the mass distribution of loading points of the optical section for checking the mounting and safety of ASE handling equipment.	M	
61451	Supply and Electronics Module (SEM) Vibration Fixture A flat steel plate and ring structure with simulated SCS interface, bungee cabled yoke, and attachment hardware. Mounts the SEM (33250) vertically in the vibration machine.	M	33250
61452	DRM (DFUM) Vibration Equipment Consists of bungee cords and a DRM (35050) adapter ring connected to a "star" fixture positioned on the B-C-210 vibration exciter.	M	35050

PRL Number	Name and Description	Primary Use	Related Equipment
61700	Explosive Storage Chamber (Class 3) A desk-type base supporting a 36" x 30" x 25" explosive chamber with a 2" protective glass entry hatch.	E/M	
61801	Adjustable Ross Corrector Tower and Lens Mount Used to support the optics while providing these optics with adjustments in the full diameter and slabbed conditions.	O	32801 32803
61802	RCFLA Adapter Box Provides the interface between the Ross match tower and the RCFLA (32802). It provides a strain-free mounting in the ±Y-up orientation to permit interferometer and tribar evaluation of the system without the elevation platform.	O	32801 32803 69050
62000	Adjustable Table All purpose table used for supporting the optics positioner (58100) and in-process optics.	M	32301 32803 34700
62150	Explosive Handling and Assembly Equipment Consists of the equipment necessary to move, handle, assemble, and insert explosive charges into the DRM (35050).	M	35050
62350	Film Splicer The splicer aligns, grips, positions, and recuts two pieces of overlapping film. After recutting, the film is spliced while held in the fixture. The splicer has splicing capability for film up to 9-½-inches wide.	M	30250 33250 35050 35150
62400	Special Curve Generator and Associated Tooling Consists of equipment required to grind the aspheric surfaces of the large-diameter glass subcontract blanks.	O	32302 32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
62501	Borescope A fiber-optics device which is used to visually check the rest position of the redundant door drive motor.	0	30250 35150
62502	Slider Cleaner Two extendable tube assemblies, one for the 5" slider and one for the 9" slider, which insert into special access parts in the DR (31250) for vacuum cleaning the slider slits. Fittings are provided at the free end of the tube assemblies for the vacuum system attachment.	M	30250 35150
62553	Supply/Receiver Cassette A lighttight metal box, compatible with ultra-clean-room requirements, containing removable supply and take-up spools for the 9 and 5 record used for testing the DR (31250) on the gain sensor test set (50950) and for slider cleanliness evaluation. The 9 or 5 record is manually advanced thru the DR (31250) by external handles. Tension is maintained by combination of tensioning devices and one-way clutches. The cassette mounts to the DR cover and is load compensated by a separate support stand.	M	31250 50950
63950	Receiver Test Set A mechanical-electrical simulator consisting of a single-bay console and mechanical equipment. The mechanical equipment interfaces with the SRV (34951) and contains spools for all film sizes. The test set will check mistracking (within system requirements) and receiving under tension on all spools in the receiver mechanism (30951), provide for rewind of film back to supply spools, and perform some electrical system checks to validate the completed SRV (34951).	E/M	30951 34951 34952

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
63951	Receivers Alignment Equipment A fixture with mounted alignment scope. Used in conjunction with an alignment ring which mates with a simulated thrust cone (T/C) interface or the prime T/C interface. Locates and aligns the take-up mechanism No. 1 (30950) in the bucket relative to the T/C interface by optical sighting of 30950 reference mirror. Also checks receiver alignment and tunnel location at the 34951 level.		30951 34951 34952
63952	Receiver Inspection Fixture Holds the receiver mechanism (30951) during the inspection of critical dimensions and characteristics. Gaging attachments are provided as accessories for inspection of reference mirror angles and location. Enables Quality Control to determine whether the receiver mechansim (30951) meets specified tolerances.	M	30951 34951 34952
63953	SRV Master Gage Reproduces the T/C interface and the receiver mechanism (30951) reference mirror for calibration of the receiver mechanism alignment equipment.	M	34951 34952
63954	Handling Frame Assembly A mounting and holding device for the receiver mechanism (30951) during handling, inspecting and shipping. During the inspection process, the handling frame assembly becomes an integral part of the receiver mechanism inspection fixture.	M	30951
63955	Adapter A-Frame Alignment And Drill Fixtures Used to provide a means to align the prime supply structure relative to three orthogonal axes.	M	

PRL Number	Name and Description	Primary Use	Related Equipment
64150	Coplanarity Test Set A test structure capable of supporting the DR (31250) in the ±Y and ±Z orientations. It uses white light interferometric devices for measurements of the drum and gain system position tilt with respect to the DR/RCFLA (31250/32802) interface plane. It also incorporates drum position sensors and readout displays. A Hewlett Packard laser measurement system provides direct position readout in millionths of an inch.	M	
64151	Drum Recorder Assy. Alignment Gauge A DR (31250) support and measurement device similar in operation to the 64150 test set but without rotational capability or drum position sensor readout. It incorporates an autocollimator used to align angularly the gain system frame and optics assembly with the DR/RCFLA (31250/32802) interface plane. Measurement of drum position is accomplished using dial indicators calibrated to 0.0001 inch rather than the Hewlett Packard laser measurement system employed on the 64150 test set.	M	
64153	5" Prism Test Set A DR (31250) support and test structure having a traversing instrument table in the Y and Z planes. Components include a modified Zygo interferometer to evaluate the 5-inch prism surface and a dual microscope assembly to measure slider width and drum tilt about the X-axis. Other routine functions, such as slider cleanliness tests and assembly procedures, also use this test stand to support the DR (31250).	M	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
64155	S-1 Sensor Test Set The S-1 sensor test set consists of power supplies, 2 DVMs, a chart recorder (3-channel), and a controlling switch panel. The test set can operate the S-1 (32806) and DRG (32805) gage assemblies at the subassembly level and at the COA level, either through the signal and power conditioner electronics (SEPE, 32807) or independently. The test set is also capable of providing an independent, in-place, calibration of the SEPE. Calibrate slide status is indicated in each operating mode.	E	32806 32807
64160	Test Set, Frame and Optics Gain An interferometric test device used to measure the location and tilt of the optical surfaces of the gain assembly with respect to its mounting surface and to each other. A Hewett Packard laser measurement system having a readout precision of one millionth of an inch is an integral part of this test set.	O/M	
64450	DRM/SEM (DFUM/SEM) and COM (DPM) Alignment Checking Kit Various alignment checking fixtures and accessory inspection tools for verifying structural-interface alignments. Fixture interfaces are produced and controlled with prime-structure master tooling.	M	33250 35050 35150
64451	DRM (DFUM) Alignment Checking Fixture for Sta 34.5 A fixture with mounted alignment scopes to verify the alignment of the SRVs (34951/34952) in the DRM (35050) relative to the Sta 34.5 interface. The receiver reference mirrors are sighted through the record tunnels and angles are checked by collimation to calibrated alignment scope settings. The fixture is used in conjunction with 66750 work stand.	M	35050

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
64550	SES Alignment Checking Fixture for Sta 34.5 A fixture interfacing at Sta 34.5 and providing reference mirrors on the record path intersection points of the DRM/SEM (35050/33250) interface. Used in conjunction with the 68565 fixture to verify the alignment of the supply relative to Sta 34.5 interface.	M	30250 30652
64750	DRM (DFUM) Lifting Yoke Used to lift the DRM (35050) during factory assembly operations. When used with the 66850 cradle, it has the capability to rotate the axis of the DRM (35050) from vertical to horizontal.	M	35050
64751	Adapter Lifting Yoke The adapter lifting yoke is an adjustable yoke capable of lifting the ejectable and fixed adapters without the SRV (34951/34952). When used in conjunction with the fixed and ejectable adapter dollies, it is capable of lifting the ejectable and fixed adapters with either SRV.	M	35050
65001	Support Cradle A fixture to support the DR and heater tube assembly (34700) during assembly, rotation, horizontal lifting, testing and erection. This fixture consists of a three-piece cradle to support the optics section, a cradle bed for rotation, and a support stand for use in the erected orientation.	M	32801 33901 34700
65003	DPA Preload Equipment This equipment is used to apply prestress compression and tension loading to the internal structure (33901). The load is applied between the "A" frame mounts and the Ross attachment points on the structure and the recorder support frame. The preload equipment consists of a load application beam attached to the "A" frame mounts and a jack to apply a load through a dummy Ross. Independent instrumentation is part of this item.	M	34700

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
65053	Load Compensator A vertical structure with two cantilevered, adjustable arms. The upper arm pulls up on the stereo mirror and the lower arm pushes up on the stereo mirror to approximate a zero-g condition of the mirror. The fixture mounts in the factory truck on the SEM/COM (33250/33150) cradle.	M	33150 33901 34700
65100	Primary Mirror Barrel Lifting Slings Slings made from lint-free material for lifting the lens tube assembly into a horizontal position for assembly and tests.	M	33901 34700
65250	PPS/DP EAC (IP) Lifting Yoke A structure used to pick up and move the IP (30250), COM (33150), or the internal structure.	M	30250
65300	Stereo Mirror and Mount Cradle and Lifting Yoke A mobile fixture which supports the stereo mirror and mount, and provides the elements to control the installation of the elevation platform (32301) into the lens tube assembly.	M	33901 34700
65500	Camera Optics Assembly Integration Lifting Yoke A welded steel frame with provision for leveling in two places by adjusting a movable lifting eye. Used to lift the DR and heater assembly (34700) onto the vibration test fixture.	M	34700
65551	R-5 Ross Lift and and Turn-Over Yoke Assembly Used to lift and rotate the R-5 Ross assembly.	M	32802

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
65600	Laminar Flow Tent An approximately 12' x 12' x 12' enclosure that filters the air of a class 3 clean area to provide a class 6 clean area in which to mate the DR (31250) with the COM (33150) section.	M	34700
65700	Shell Structure Yokes Two yokes used to lift the forward and aft sections of the structural shell. The yokes contain features to hold the shell level, to within 2 degrees, about the transverse axis. The aft-section structural shell yoke is also used to lift the lens tube horizontally.	M	30653 30654 34700
65850	SEM Structure Lifting Yoke Provides lifting capability for the SEM (33250) and/or DRM simulator (52350) when the axis is vertical. It is used in combination with the 66950 cradle.	M	30652
66000	Holding Fixtures for Optical Coating A structural framework fitting inside the vacuum chamber to support the optical elements. Holds the stereo mirror, aspheric mirror, and other large optics during the evaporative coating process.	M	32803
66150	SRV Lifting Yoke A three-cable sling with adapter clamps and a rotatable lifting eye. Lifts either SRV (34951/34952) vertically from its shipping container and places it in the dolly.	M	34951 34952 35050
66450	PPS/DP EAC (IP) Transfer Yoke The yoke transfers the IP (30250) from one horizontal fixture to another for in-plant operations.	M	30250 35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
66750	DRM Work Stand An alignment table to support DRM (35050) vertically for assembly, disassembly, alignment checks, and other operations. A personnel work platform provides a stable surface above the floor for two men and tools.		
66751	Fixed Adapter Dolly A four-wheeled structure containing a frame which supports SRV 2 (34952) during assembly to the fixed adapter. It is capable of rotating the SRV/fixed adapter 360 degrees about the Y-Y axis. The support frame detaches for lifting the SRV/fixed adapter by an overhead crane and the 64751 yoke.	M	35050
66752	Ejectable Adapter Dolly A four-wheeled structure containing a frame which supports SRV 1 (34951) during assembly to the ejectable adapter. It is capable of rotating the SRV/ejectable adapter 360 degrees about either the Y-Y or Z-Z axis. The support frame detaches for lifting the SRV/ejectable adapter by an overhead crane and the 64751 yoke.	M	35050
66850	DRM Cradle and Dolly A four-wheeled structure which provides support, mobility, and rotational capability for the DRM (35050) during assembly operations. A roller system is provided to allow 360-degree rotation around the axis. A trunnion is provided for rotation of the axis from the horizontal to the vertical by means of an overhead crane and the 64750 yoke.	M	35050

PRL Number	Name and Description	Primary Use	Related Equipment
66950	SEM Cradle and Dolly A four-wheeled structure which provides support, mobility and rotational capability for the SEM (33250) during assembly operations. A roller system is provided for 360-degree rotation of the SEM (33250) about its X-X axis and a mechanical means for rotating the X-X axis from the horizontal to the vertical is also included. The forward rotational ring, when used in conjunction with the cradle (65850), provides for removing and lifting the SEM (33250) from the dolly by means of an overhead crane.	M	35050
66951	SEM Vibration Transport Dolly To transport the SEM (33250), assembled, to the vibration fixture between test sites.	M	33250
66952	Supply Electronics Module Handling Ring Assemblies Hold the SEM (33250) to provide a support by which it can be turned and lifted.		30652 33250
67001	Air Conditioned Interplant Transportation Van An over-the-road, 30-foot van trailer with guides to accept the truck and cradle supporting the DR and heater tubes (34700), COM (33150) or the IP (30250). The van provides clean, controlled inside atmosphere and contains provisions for isolation against shock and vibration. Used for transporting modules and optics for various assembly and test functions, using the 69603 container between plants.	M	32301 32302 33150 33250 34700
67101	Factory Truck with Erector An eight-wheel truck with coplanar mounting pads to accept the cradle holding the DR & heater tubes (34700), or the COM (33150). It has leveling jacks and supports to protect the loaded cradles. Contains self-erecting capabilities for rotating the loaded cradles 90 degrees from a horizontal to a vertical orientation.	M	33150 34700

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
67102	Factory Truck Without Erector An eight-wheel truck with coplanar mounts to accept cradles loaded with the DR and heater tubes (34700), COM (33150), or the IP (30250). Supports, protects, and transports horizontally oriented, loaded cradles.	M	33150 34700
67103	Power Drive Unit Used to move the loaded or unloaded factory truck erector. The unit is powered by a 12-volt battery.	M	33150 34700
67104	Dummy Load Simulates the weight of the IP (30250) in order to check out the lifting yokes and factory trucks.	M	33150
67155	Instrument Package - Horizontal Mating Equipment A rigid yoke used to hold the DRM (35050) for mating to the SEM or SEM/COM (33250/33150) in a horizontal position.	M	30250
67157	Factory Truck with Erector and Assist Mechanism An eight-wheel truck with coplanar mounting pads to accept the cradle holding the DR & heater tubes (34700), COM (33150), or the IP (30250). It has leveling jacks and supports to protect the loaded cradles. Contains self-erecting capabilities for rotating the loaded cradles 90 degrees from a horizontal to a vertical orientation.	M	30250 33150 34700
67201	DPM, PPS Cradle A rectangular metal platform with two split structures having elements to support a SEM/COM (33250/33150) during assembly, horizontal lifting, testing erection to vertical, and shipment. It provides 360-degree rotational capability and includes rotation locking devices.	M	35150

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
67202	COM, PPS/DP EAC Handling Ring Assembly The Agena rings which interface with the aft barrel of the IP (30250) or SEM/DPM (35150) to support the after barrel in the cradle (67252). The rings permit the assembly to be rotated in the cradles. The forward ring of the pair interfaces with 45050 yoke to lift the SEM/DPM and with the 45051 equipment to demate the IP as an assembly at the pad.	M	33150 35150
67252	SEM/COM Assembly Cradle A rectangular, metal frame with a circular split structure at right angles to the base frame. The split structure contains elements to support the COM (33150) and the SEM/COM (35150) during assembly, horizontal testing, erecting to the vertical orientation, and shipping. Provides 360-degree rotational capability for the load(s) and rotating-locking devices. Provides adjustable support at the forward end of the SEM (33250) to compensate for the sag of the structure when all access panels are removed. The adjustable support projecting forward from the main base structure is retractable during shipment.	M	33150 35150
67253	Nonmagnetic Cradle A cradle constructed of nonmagnetic material, hardware and equipment that supports the IP (30250) during magnetic moments testing. This is used at BIF-008 and is rotated by hand about a special pivot that is attached to the floor.	M	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
67402	SRV Dolly With Trunnion Used to hold the forward unit in the vertical position during servicing and transport. The SRVs (34951/34952) can be rotated to the horizontal position and the cradle removed from the dolly for horizontal mating or demating of SRV 1 (34951) to the IP (30250).	M	34951 34952
67403	SRV Capsule Dolly A mobile work stand with balconied levels for assembly and disassembly of either SRV (34951 or 34952).	M	34951
67404	SRV Cover Dolly A base frame and trunnioned side members which provide rotational capabilities.	M	34951
67451	SRV Forebody Mating Dolly A work stand and mobile storage vehicle for either SRV (34951 or 34952).	M	35050
67456	Retro-Rocket Lifting Yoke A clamping mechanism and lifting eye joined together to grip the retro-rocket at an interfacing ring. Removes the retro-rocket from its shipping container and also handles the retro-rocket during assembly to the SRVs (34951 or 34952).	M	34951 34952 35050
67550	Thrust Cone Dolly A base frame and trunnioned side members which provide rotational capabilities.	M	
67651	Handling and Storage Containers Various wood or metal boxes, trays and cabinets with blocking to fit parts and assemblies. Used to store parts and subassemblies prior to assembly.	M	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
67652	Record Shipping Including Transfer Dolly Used to accomplish inter- and intra-plant shipping of prime record.	M	
68150	Receiver Shipping Container Has a built-in isolation structure to protect the receiver components from shock and vibration during shipping and handling. Four wheels provide mobility during in-plant use. The wheels are retractable for shipping purposes. The container has the capability of holding an internal pressure of a few psi above atmospheric to maintain a dirt- and dust-free environment for the take-up components during shipping and storage.	M	30951
68503	Ballast Ring Center Illumination Fixture Used to align the cradle by establishing the X-axis at the aft end.	M	32801 32803
68504	X-Axis Reference Fixture Used to orient the axis of the DR & heater tube assembly (34700) with respect to the cradle at the forward end.	M	33150
68505	Uniball Mount Locating Fixture Used to establish the location of the cradle uniball to maintain axis located by the 68504 fixture.	M	34700
68508	End Bell Centering Fixture Used to center the primary mirror in the end bell.	M	32801 32803
68513	Focal Plane Fixture Used to check optical alignment and performance of the DR & heater tube assembly (34700).	M	32801 32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
68522	Adjustable Mount (Axicon) Used in the alignment of the drum platform assembly (33150).	M	33150
68558	COM (DPM) Record Handling Axes Gauge Establishes the location of the coupler mounting block, which is attached to the DR (31250), with respect to the forward barrel of the DPM (33150). The gauge will interface with the DPM shear joint holes at Sta 77.60 and establish the basic reference axes and planes.	M	31250
68563	Misc Qual Test Equipment A heater/chiller unit which is a self-contained environmental accessory with the capability of heating, chilling, and circulating a working fluid for the purpose of changing or maintaining required temperatures during a qualification test. Various other equipment (such as cables, timers, etc.) is included in this PRL.	M	
68565	Supply Alignment Fixture Used to align the supply (31050). Joins the supply early in assembly cycle and remains with supply until final check in field.	M	31050 33250
68568	Misc DTV Test Items Nine cables built for connecting the IP (30250) recorders and portable test console (40170) function generator to the 40-channel recorder (40254) test console.	E	

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
68576	Misc Assembly Aids (Heater Tube Dollies) Consist of six heater tube dollies (406-358) and one non-magnetic heater tube dolly (406-359). They have a 4-inch aluminum base with one cross member at the center and five pairs of uprights with nylon straps. The nonmagnetic dolly is used to hold the internal structure during demagnetizing activities. The other heater tube dollies are used to hold the internal structure during assembly operations of the heater tapes, heater controllers, and cabling.	M	33250
68580	Abbreviated Drum Recorder Test Set A half-console housing a test DREA (33450) for the purpose of assisting in mechanical setup of the DR (31250) during assembly.	E/M	
68600	Heat Treat Dolly Identified with metal straps and used to hold the internal structure during heat treat operations. It has a 4-inch aluminum base with one cross member at the center and five pairs of uprights with metal straps.	M	
68608	Trunnion Lifting Yoke A yoke and turnover that interfaces with handlers which are used for picking up mirror blanks and finished mirrors and placing them on polished equipment and test mounts.	M	32301 32302
68611	Vertical Test Equipment Hardware necessary to maintain certain test instruments at the required height during optical surface tests of aspheric mirrors.	O	32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
68615	Vibration Isolation Support for Stereo Mirror A support structure to mount the 52-inch diameter spherical test mirror and test equipment when evaluating the quality of the stereo mirror.	O/M	32302
68616	Flotation Support for 58-Inch Supports the stereo mirror in a strain-free support while the mirror is in a horizontal position and being checked in conjunction with the 68615 support. Also serves as flotation support for 48-inch diameter and 70-inch diameter test plano mirrors.	O/M	32302
68617	Test Glass and Masters with Tooling Optical elements used to test the radii of Ross corrector elements in round and slabbed conditions.	O	32802
68618	Fiducial Markers for 58-Inch A set of mechanical datum markers to insert information relative to scale factor and component orientation in interferograms.	O	32802 32803
68619	Asphere Test Glasses and Tooling Masters working glasses for the R-5 lens system.	O	32803
68620	Ross Corrector Test Glasses and Tooling Used in the testing of the R-5 lens system.	O	32802
68621	Null Compensator Test Glasses and Tooling Used in the testing of the R-5 lens system.	O	32802
68622	Radius Measuring Equipment Used to provide radius measurement capability for R-5 glasses.	O	32802 68625

PRL Number	Name and Description	Primary Use	Related Equipment
68623	Contact Glasses Physical support for thin optical sections during in-process fabrication.	O	32802
68624	Misc Optical Mfg Aids for R-5 Standard tools and storage equipment to manufacture R-5 lenses.	O	32802
68625	R-5 Test Equipment Mount Serves as a base and isolates an optical bench.	O	68622
68626	Misc Optical Mfg Aids Customer designed fixtures and tools which assist in building, aligning, assembling and handling prime optical subassemblies and assemblies. These aids are controlled by 406 series drawings.	O	
68628	Fiducial Marker Fixture for 58-Inch Lightweight oval frames fitted to the periphery of the elevation platform. Fine wires stretched across them support fiducial markers at calibrated locations. These fiducials are used to identify orientation and provide accurate measurement points for analysis of the photographed interferometric data obtained at component level.	O	
69050	Misc Aids for Testing Fixtures and tools used to assist in the checkout of the prime hardware to be used in the SEM (33250).	E/M	
69150	Adjustable Test and Work Stand A stand to support test consoles and operating personnel during assembly and test of the EM and RM payload when erected. The stand is mobile and adjusts to various working heights.	M	30250

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
69152	Record Chute Closure Plates Closure plates for protecting the DRM (35050) film chutes during storage and transit. The closure plates contain a means for holding the free end of all film leaders under tension. The closure plates also provide means for removal of the cover with the film holder and tension device retained in the film chute.	M	35050
69155	Tunnel Protective Cover Installation of take-up units at GE (RSD) requires a tunnel protective cover for storage and shipment of the SRVs (34951/34952). The cover contains a means for holding the free end of all film leaders under tension.	M	35050
69158	Record Holding Clamps Retain film during connection.	M	33250
69602	Yoke, Transport, and Turnover Yokes for picking up stereo-mirror blank and finished mirrors and placing these mirrors and blanks on the polishing equipment and test mounts. They pick up the mirrors by interfacing with the uniball in the side mount.	M	32301
69603	Storage and Transporting Containers, 58-Inch Sturdy wood-constructed boxes with wheels used to store and transport the mirror while moving between plants. The wheels interface with the interplant van (67001) during moves. The boxes are lined with foam to protect the optic.	M	32301
69604	Positioning Fingers, 58-Inch Used to dampen vibrations from the 67001 van during test and to sense the plane of the stereo in order to minimize the alignment adjustment required.	M	32301

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
69605	Locating Arms for 58-Inch Yoke Arms to correctly center the van (67001) on the air flotation system to within the preferred tolerances. These arms become a part of 69602. The arms pick up guide posts from the test chamber to accomplish this positioning.	M	32301
69606	Mount Counterbalances, 58-Inch Compensate for the weight added to the stereo from the side mounts during an air flotation test. The counterbalances are a basic, adjustable lever arm, fulcrum and weight.	M	32301
69607	Transfer Tables Transport the aspheres and test mirrors between test and work stations. They have nonmetallic locking wheels and a top surface adjustable from a height of 30 to 48 inches.	M	32301
69608	Positioning Shims, 58-Inch Position the stereo mirror at the correct level for testing by raising the air flotation system. They interface to the existing chamber shims.	M	32301
69609	Flotation Support for 44½-Inch An air flotation system used to support the asphere in a strain-free condition during test.	M	32803
69610	Handling Ring, 44½-Inch Handling ring (when integrated with yoke 69611) used to pick up the production aspheres and place them on polishing equipment and on test mounts. They are pneumatic rings with keys which, when pressurized, allow the keys to contact and grip the optic.	M	32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
69611	Yoke and Turnover, 44½-Inch Used with 69610 to transport and pick up the production aspheres in order to position them on polishing equipment and on test mounts.	M	32803
69612	Storage and Transporting Containers, 44½-Inch Sturdy wooden-construction boxes with wheels used to store and transport the asphere between plants. The wheels interface with the interplant van during moves. The boxes are lined with foam to protect the optic.	M	32803
69613	Positioning Fingers, 44½-Inch Used to dampen vibrations from the asphere during test and to sense the center of curvature of the asphere before test in order to minimize the alignment adjustment required.	M	32803
69614	Locating Arms for 44½-Inch Arms to correctly center the asphere on the air flotation system to within the tolerances allowed. These arms are attached to and become a part of 69610. The arms pick up guide posts from the test chamber in order to accomplish this positioning.	M	32803
69615	Mount Counterbalances, 44½-Inch Used on 69609 to compensate for the weight added to the asphere from its ring mount.	M	32803
69616	Positioning Shims, 44½-Inch Position the asphere at the correct level for testing by raising the air flotation system the required distance. They interface with the existing chamber shims.	M	32803

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
69617	Fiducial Markers for 44½-Inch Used to establish orientation and scale in interferogram.	O	32301 32803
69618	Null Compensator Lens Assembly (Air) A two-element lens assembly used to test the optical performance of asperes in the vertical test tunnels.	O	32803
69619	Null Compensator Lens Assembly (Vacuum) A test lens very similar to 69618, but modified to perform correctly in a vacuum.	O	32803
69620	Laser Interferometer (Remote) A modified Twyman-Green interferometer with a laser source and remote control capability for vacuum operation.	O	32803
69621	Adjustment Assembly for Null Compensator An adjustment assembly to align the null compensator to the asphere prior to asphere interferometric testing.	O	32803
69622	Adjustment Assembly for Null Compensator (Remote) An adjustment assembly to align the null compensator to the asphere by remote control for vacuum interferometric testing of the asphere.	O/M	32803
69623	Protective Covers Used to protect the optics during handling between in-house stations. They are of a lightweight construction, contoured to the optic size.	M	32301 32803
69626	Vacuum Handling Device A device used to hold plano mirrors in early stages of manufacture.	M	32301 32302
69627	58-Inch Coater Adapter Ring for 120-Inch Coater Used to hold plano during vacuum coating.	M	32301 32302

Approved for Release: 2017/02/14 C05097223

PRL Number	Name and Description	Primary Use	Related Equipment
69628	44½-Inch Coater Adapter Ring for 120-Inch Coater Used to hold asphere during vacuum coating.	M	32803
69629	Sensor Support Structure Mounting of sensor supports to the structure.	M	32301
69630	Remote Interferometer Specialized for remote control capability for vacuum operation.	O	
69633	Mount Counterbalances 58-Inch ULE Compensates for mount on 58-inch mirror.	O/M	32301
69637	Fiducial Marker Fixtures for 44½-Inch Serve the same function as those of the 68628 fixture for component testing of primary platforms; their shapes are round to fit the component circumference.	O	
69700	Draper Polishing Machine Used in facedown polishing of stereo mirror.	M	32302
69950	Drum Recorder Handling Equipment A sling assembly for handling the DR (31250) during test set mounting/demounting and mounting in the next assembly level. It consists of side plates which attach to the DR and a sling assembly which attaches to the side plates and is hooked to a hoist. A force gauge is coupled to the sling assembly to monitor the lifting forces during interface assembly/disassembly.	M	31250

PRL Number	Name and Description	Primary Use	Related Equipment
70200	Platform Assembly, Personnel The work platform consists of two electrically powered, hydraulic platforms which are joined together mechanically by a center platform. The units are electronically synchronized as the platform is raised or lowered. The platform surrounds about 180° of the IP (30250) and can be raised or lowered to provide a work area for 5 persons. It is used at the DPM (33150), SEM/DPM (33250/33150) and IP (30250) levels of assembly and testing.	M	30250

CROSS REFERENCE BY TITLE *

Name	PRL Number
Abbreviated Drum Recorder Test Set	68580
Activation Aids for Gantry Clean Room	48151
Adapter A-Frame Alignment and Drill Fixtures	63955
Adapter Lifting Yoke	64751
Adapter for Mounted Asphere Mirror	58005
Adjustable Assembly for Null Compensator	69621
Adjustable Assembly for Null Compensator (Remote)	69622
Adjustable Mount (Axicon)	68522
Adjustable Ross Corrector Tower and Lens Mount	61801
Adjustable Table	62000
Adjustable Test and Work Stand	69150
Air Conditioned Interplant Transportation Van	67001
Alignment (Axion) Instrument - Standard	57403
Asphere Test Glasses and Tooling	68619
Autocollimating Microscope with Monochromatic Light Source	55602
Autocollimating Microscope with Tungsten Light Source	55601
Automatic Circuit Analyzer with LMSC Adapter Cables	50552
Ballast Ring Center Illuminator Fixture	68503
Beacon Test Set	60305
Borescope	62501
Cable Test Point Equipment	50852
Cable - Test Set, Tunnel, Adapter and Socket Saver	52052
Camera (DR) Adapter Mount	52104
Camera Optics Assembly Integration Lifting Yoke	65500
COA (DPM) Environmental Test Fixtures	53200
Coater Adapter Ring for 120-Inch Coater, 44½-Inch	69628
Coater Adapter Ring for 120-Inch Coater, 58-Inch	69627
COM (DPM) Electrical Simulator	52151
COM (DPM) Record Handling Axes Gauge	68558
COM, PPS/DP EAC Handling Ring Assembly	67202
Command Processor and Instrumentation Processor Test Set	50451
Command Processor Test Adapter (CPTA)	50457
Command Recorder	40251
Common Use Electrical Test Set (CUETS)	59480

*Title as referenced in Project Requirement List

Name	PRL Number
Contact Glasses	68623
Coplanarity Test Set	64150
Crab (Azimuth) Servo Test Set	50200
Cutter and Sealer Test Set	54100
Cutter and Sealer Test Set, B^2	54150
Door-Operate Component Test Set	51300
DPA Preload Equipment	65003
DPM, PPS Cradle	67201
Draper Polishing Machine	69700
DREA-CUETS Adapter Cables	50755
DRM (DFUM) Alignment Checking Fixture for Sta 34.5	64451
DRM (DFUM) Cradle and Dolly	66850
DRM (DFUM) Electrical and Mechanical Simulator	52350
DRM (DFUM) Environmental Hatches	41451
DRM (DFUM) Jacket	46057
DRM (DFUM) Lifting Yoke	64750
DRM (DFUM) Mass Properties Measuring Equipment	54050
DRM (DFUM) Vibration Equipment	61452
DRM (DFUM) Work Stand	66750
DRM/SEM (DFUM/SEM) and COM (DPM) Alignment Checking Kit	64450
DR/SEM Bellows Test Fixture	42070
Drum Recorder Assembly Alignment Gauge	64151
Drum Recorder Handling Equipment	69950
Drum Recorder Mass Simulator	53355
DTU Module, 9	59454
DTU Slave Module Assembly	52354
DTU System Analyzer	59459
Dual Drum Recorder Test Set (DDRTS)	54750
Dummy Load	67104
Ejectable Adapter Dolly	66752
EMI Susceptibility Test Equipment	52056
End Bell Centering Fixture	68508
End-to-End Electronics (EEE)	40753
Environmental Hatches	41400
Environmental Power Supply	47750
Environmental Test Fixtures	53350
Environmental Test Fixtures for Major Elements and Components	53300
Explosive Handling and Assembly Equipment	62150
Explosive Storage Chamber (Class 3)	61700

Name	PRL Number
Factory Truck with Erector	67101
Factory Truck with Erector and Assist Mechanism	67157
Factory Truck without Erector	67102
Fiducial Marker Fixture for 44½-inch	69637
Fiducial Marker Fixture for 58-Inch	68628
Fiducial Markers for 44½-Inch	68617
Fiducial Markers for 58-Inch	68618
Field Systems Test Equipment (FSTE)	48600
Film Advance Controller	40800
Film Loading Equipment	58352
Film Removal Equipment	58301
Film Splicer	62350
Film Viewer	55200
Fixed Adapter Dolly	66751
Flat Test Mirror, 48-Inch Dia.	55800
Flotation Support for 44½-Inch	69609
Flotation Support for 58-Inch	68616
Focal Plane Fixture	68513
Focus (Gain) Sensor Test Set	50950
Focus (Gain) System Simulator	50960
Forward Unit Pneumatic Charging Kit	42551
Forward Unit Pneumatic Testing Equipment	42552
FPLLE-CUETS Adapter Cables	50650
Gantry Clean Room (Press Box)	48450
Ground (Stand-by) Heater Test Set	50353
Handling and Storage Containers	67651
Handling Device, 5-Inch	60172
Handling Equipment Test Loads	61200
Handling Frame Assembly	63954
Handling Ring, 44½-Inch	69610
Heat Treat Dolly	68600
Holding Fixtures for Optical Coating	66000
IEU Test Set	50459
Initiator Test Set With Cables	51855
Instrument Package-Horizontal Mating Equipment	61755
Insulation Resistance Tester	51803
Interface Adapter Kit	52054
Interferometer	56005
Interferometer Dilatometer	58900
Interferometer Interface Plate	56060
IP-CUETS Adapter Cables	50458

Name	PRL Number
Laminar Flow Tent	65600
Laser Interferometer (Remote)	69620
Launch Ready - Signal Distribution Console	41100
Leak Rate Plates	42060
Leak Rate Test Set	42050
Light Leak Checking Equipment	60751
Light-Tight Box Aperture Covers	60750
Load Compensator	65053
Locating Arms for 44½-Inch Yoke	69614
Locating Arms for 58-Inch Yoke	69605
Master Digital Telemetry Unit (DTU) Loader	59455
Master DTU Module	59453
Master Unit System Test Set	59460
Memo Scope and Cart	50404
Microdensitometer	55100
Mini Console	40160
Misc Aids at Field	48151
Misc Aids for Testing	69050
Misc Assembly Aids (Heater Tube Dollies)	68576
Misc DTV Test Items	68568
Misc Inspection and Test Aids	59051
Misc Optical Mfg. Aids	68626
Misc Optical Mfg. Aids for R-5	68624
Misc Qual. Test Equipment	68563
Mount Counterbalances, 44½-Inch	69615
Mount Counterbalances, 58-Inch	69606
Mount Counterbalances, 58-Inch ULE	69633
Mount Supports for Concave Surface Test Evaluation	58009
Mount Supports for Convex Surface Test Evaluation	58008
Nonmagnetic Cradle	67253
Null Compensator Lens Assembly (Air)	69618
Null Compensator Lens Assembly (Vacuum)	69619
Null Compensator Test Glasses and Tooling	68621
Objective Setting Test Set	56052
Optical Recorder Console	50456
Optics Positioner	58100

Name	PRL Number
PCM Code Converter	52361
PCM Decommutator	59457
PCM Generator	59456
PCM Switching Unit	59458
Platform Assembly, Personnel	70200
PM & C and Separation Controller Test Set	50453
Portable Pyro Test Box	60304
Portable Reflectometer	58800
Portable Servo Drive	51200
Portable Test Console	40170
Positioning Fingers, 44½-Inch	69613
Positioning Fingers, 58-Inch	69604
Positioning Shims, 44½-Inch	69616
Positioning Shims, 58-Inch	69608
Potting Fixture and Associated Equipment	68519
Power Drive Unit	67103
Power Group	40150
Powered Vib, CP Check-Out Equip (Chatter Checker)	50452
PPS/DP EAC (IP) Demating Equipment	45051
PPS/DP EAC (IP) Drive Smoothness Test Set	50753
PPS/DP EAC (IP) Hydra Set	45150
PPS/DP EAC (IP) Lifting Yoke	65250
PPS/DP EAC (IP) Shipping Container	46061
PPS/DP EAC (IP) Shipping Trailer	46060
PPS/DP EAC (IP) Storage Cover	46059
PPS/DP EAC (IP) Transfer Yoke	66450
PPS/SCS Mechanical Alignment Jig	57200
Primary Mirror Barrel Lifting Slings	65100
Prism Test Set, 5-Inch	64153
Programmable Logic Test Equipment (PLTE)	59470
Protective Covers	69623
Pyro Simulators for Shipping	51853
R-5 Ross Lift and Turn-Over Yoke Assembly	62551
R-5 Ross Matching Laser Interferometer	56004
R-5 Test Equipment Mount	68625
Radius Measuring Equipment	68622
RAM Reset Kit	52451
RCFLA Adapter Box	61802
RECAL Boxes	52351
RECAL (FUTE) Box Cables	52355
RECAL (FUTE) Box Event Recorder Console	52357
Receiver Component Test Set	54652
Receiver Inspection Fixture	63952
Receiver Protection Test Set	40851
Receiver Shipping Container	68150
Receiver Test Set	63950

Name	PRL Number
Receivers Alignment Equipment	63951
Receivers Refurbished	53550
Record Chute Closure Plates	69152
Record Control Electronics Subassembly Test Set	51951
Record Control Electronics Test Set	51950
Record Holding Clamps	69158
Record Shipping Including Transfer Dolly	67652
Reference Mirror Alignment Kit	57500
Reference Mirrors	44000
Remote Interferometer	69630
Remote Loading Cell	45101
Retro-Rocket Lifting Yoke	67456
RHE-CUETS Adapter Cables	51955
R/K Interface Plate	55550
Robotester Console	50450
Ross Corrector Test Glasses and Tooling	68621
S-1 Sensor Test Set	64155
Secondary Standard Instrumentation Kit	40500
Secondary Standard Load Box	40650
SEM Breakout Boxes and Cables	52058
SEM Cradle and Dolly	66950
SEM Environmental Hatches	41452
SEM Structure Lifting Yoke	65850
SEM Vibration Transport Dolly	66951
SEM/COM Cradle	67252
SEM/COM (SEM/DPM) Assembly Jacket	46053
SEM/DRM (SEM/DFUM) Breakout Boxes	50851
Sensor Support Structure	69629
SES Alignment Checking Fixture for Sta 34.5	64550
Shell Structure Yoke	65700
Shipping Container, Engine Starter	46058
Simulated Drum Recorder	50760
Slave Digital Telemetry Unit	52353
Slider Cleaner	62502
Special Curve Generator and Associated Tooling	62400
Spectroreflectometer	56900
Spherical Test Mirror, 52-Inch Dia	55900
Splicer Mechanims (RAM) Test Fixture and Cable	50556
Splicer Mechanism (RAM) Test Set	52450
SRV Capsule Dolly	67403
SRV Cover Dolly	67404
SRV Dolly With Trunnion	67402

Name	PRL Number
SRV Forebody Mating Dolly	67451
SRV Lifting Yoke	66150
SRV Master Gauge	63953
SRV Simulators	52360
Standard Laser Interferometer	56001
Stereo (Hypocycloid) Servo Test Set	50102
Stereo Mirror and Mount Cradle and Lifting Yoke	65300
Storage and Transporting Containers	69612
Storage and Transporting Containers, 58-Inch	69603
Supply Alignment Fixture	68565
Supply and Electronics Module (SEM) Vibration Fixture	61451
Supply and Electronics Structure Support Shipping Fixture	60650
Supply Assembly Test Set	54650
Supply Electronics Module Handling Ring Assembly	66952
Supply Test Assembly, 5-Inch	54655
Supply Test Assembly, 9-Inch	53750
Supply/Receiver Cassette	62553
Surface Sampler and Cleaning System	59250
Support Cradle	65001
Target for Gain Sensor Test Set	51150
Temperature Recorder	59200
Test Camera Assembly (R/K), 35mm	55000
Test Console, 40-Channel Recorder	40254
Test Console, 64-Channel Recorder	40253
Test Flat Mount, 48-Inch Dia	58001
Test Glass and Masters with Tooling	68617
Test Set, Frame and Optics Gain	64160
Test Sphere Mount, 52-Inch Dia	58002
Thermal Control Test Set - Assembly Checker	50302
Thermal Control Test Set - Controller Checker	50301
Thru Drum Test Set	56054
Thrust Cone Dolly	67550
Tilt Frame Coupler, 5-Inch	50765
Tilt Frame Coupler, 9-Inch	50770
Transfer Table	69607
Trunnion Lifting Yoke	68608
Tunnel Bulkheads	52051
Tunnel Protective Cover	69155
Uninall Mount Locating Fixture	68505
Universal Mount	56400

Name	PRL Number
Vacuum Handling Device	69626
Vertical SEM/COM (SEM/DPM) Lifting Yoke	45050
Vertical Test Equipment	68611
Vibration Isolation Support for Stereo Mirror	68615
Wire Interconnect Vibration Test Set	50554
Work Stand for Gantry Room	48452
X-Axis Reference Fixture	68504
Yoke and Turnover, 44½-Inch	69611
Yoke, Transport and Turnover	69602

This page intentionally blank

APPENDIX E E(95, 95) STATISTICAL COMBINATION OF ERROR CONTRIBUTORS

E.1 E(95, 95)* Combinatorial Procedure

The E(95, 95) value describes the 95th percentile performance for a 95-percent bias mission. Each error contributor is assigned to one of two categories: mission bias or random error. Complications arise in combining within- and between-mission error statistics if predictions of error are computed for a single mission. If predictions are being made for a large population of missions, it is reasonable to root-sum-square (RSS) the within-mission error standard deviation (σ_R) with the between-mission error standard deviation (σ_B) to obtain an overall error standard deviation. Single-mission predictions cannot assume RSS combinations in that the between-mission error is fixed throughout a single mission and thus acts as a fixed bias term for the mission in question. Mean bias errors (μ_B), fixed over all missions, similarly impact error predictions for a single mission. The solution as used in error budgeting is the treatment of the mean error as a fixed shift of the final total error distribution and the between-mission error source as a fixed shift relative to some preselected statistical confidence level. This involves a total shift value of $\mu_B + K_1 \sigma_B$, where K_1 is a function of the shifted normal distribution relative to the μ_B shift. Therefore, $\mu_{0.95}$ is determined according to:

$$\mu_{0.95} = \mu_B + K_1 \sigma_B$$

*E(95, 95) value may also be written as the 95/95 value.

The final error prediction for a single mission is obtained by adding the within-mission error source (σ_R) relative to the combined shift for the pre-selected confidence value.

The 95-percent upper bound on error for 95 percent of the missions is:

$$E(0.95,\ 0.95) = \mu_B + K_1\ \sigma_B + K_2\ \sigma_R$$

$$= \mu_{0.95} + K_2\ \sigma_R$$

where K_2 is a function of the shifted normal distribution as induced by $\mu_B + K_1\ \sigma_B$. This process is shown graphically in Figure E-1 for the $\mu_B + K_1\ \sigma_B$ result (in terms of normalized standard deviations) which represents the 95-percent bias error (μ_{95}). Extension to E(95, 95) is straightforward.

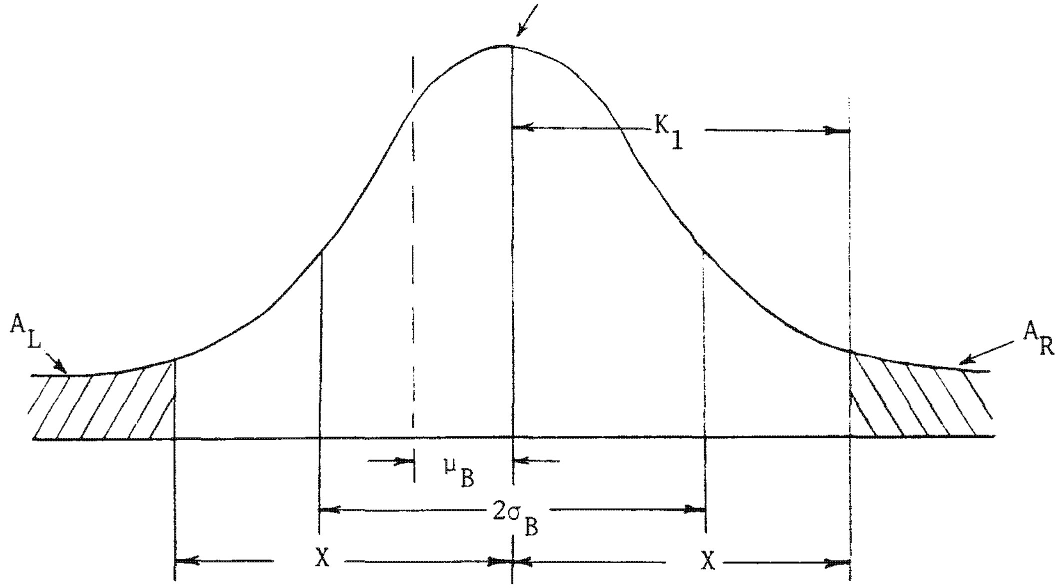


Figure E-1. Normalized Standard Deviation

For example, if $\mu_B = 4.0$ and $\sigma_B = 10.0$, the shift is $\frac{\mu_B}{\sigma_B} = 0.4$ (shift in terms of normalized standard deviation units*).

The problem is one of placing confidence limits on the resulting combined error distribution, and reduces to finding a $\mu_{0.95}$ (or X) value for the shifted distribution. The most direct method for a given statistical confidence (e.g., 95 percent) in which the error does not exceed the 95-percent error value is iteration based on the shifted normal distribution. Therefore, find an X value relative to the shifted distribution which gives the combined area beyond X of approximately 5 percent (i.e., $A_L + A_R \approx 0.05$ for the normal distribution (see Figure E-1)). Since the total area under the normal probability distribution is 1.00, the confidence on the error not exceeding X is 95 percent. Once X is determined, the known bias, $\frac{\mu_B}{\sigma_B}$, is subtracted from X to get K_1, the factor in normalized standard deviation units, which gives the 95-percent bound on the error, not exceeding X standardized normal deviation units. For example, if $\frac{\mu_B}{\sigma_B} = 0.4$ normalized standard deviation units, find the K_1 value such that the area below $X + \frac{\mu_B}{\sigma_B}$ plus the area above $X - \frac{\mu_B}{\sigma_B}$ is exactly 0.05. This is accomplished using a table of areas under the normal curve as follows. (Note that all results will be discussed in terms of normalized standard deviations.)

(1) The minimum value for X for 95-percent confidence is 1.96 and occurs only when $\mu_B = 0$, that is, zero shift. For all instances where $\frac{\mu_B}{\sigma_B}$ is greater than 0, X is greater than 1.96.

(2) From tables of area under the normal distribution, if X = 2.0, the error beyond the upper bound on the shifted curve is the area intercepted between

*A normalized-standard-deviation normal distribution (unshifted) has a zero mean and standard deviation equal to 1.0.

the normal curve and $X - \frac{\mu_B}{\sigma_B} = 2.0 - 0.4 = 1.6$. This gives an A_R area of 0.0548 which is obviously not permissible for 95-percent confidence (0.05 total is required).

(3) The above indicates that X = 2.0 is too small. Setting $X = 2.05$ gives $X - \frac{\mu B}{\sigma_B} = 2.05 - 0.4 = 1.65$. The area above 1.65 ($A_R$) is found to be 0.0495, which does not exceed 0.05. Thus, a trial $K_1 = 1.65$.

(4) A_L, the area below $X + \frac{\mu_B}{\sigma_B}$, is now required, $-(2.05 + 0.4) = -2.45$. From tables, $A_L = 0.0071$.

(5) The total area for the trial K_1 is thus $A_L + A_R = 0.0071 + 0.0495 = 0.0566$. Since this exceeds 0.05, steps 3 and 4 must be repeated with a larger X-value.

(6) The above result indicates that X = 2.05 is still too small. Setting X = 2.1 gives X - 0.4 = 1.7. The area above 1.7 is $0.0446 = A_R$.

(7) A_L is the area below $-(2.1 + 0.4) = -2.5$, which is $0.0062 = A_L$.

(8) The total area for trial K_1 is 0.0446 + 0.0062 = 0.0508.

The last result is reasonably close to 0.05 and thus the required $K_1 \cong 1.7$. Consequently, the non-normalized, 95-percent upper bound for the between-error contributors, given $\frac{\mu B}{\sigma_B} = 0.4$, is approximately $\mu_B + 1.7\ \sigma_B = 4.0 + 1.7\ \sigma_B$. A similar approach is used in obtaining 95/95 values. It is only necessary to calculate the shift on the basis of $\mu_B + K_1\ \sigma_B$. The normalized shift in this case is $\frac{(\mu_B + K_1\ \sigma_B)}{\sigma_R}$. A K_2 would be calculated to give the 95/95 result as $E(95, 95) = \mu_B + K_1\ \sigma_B + K_2\ \sigma_R$.

In order to facilitate calculation of combined statistics, a curve giving K_1 or K_2 as a function of $\frac{\mu_B}{\sigma_B}$ and $\frac{(\mu_B + K_1\,\sigma_B)}{\sigma_R}$ respectively, is presented in Figure E-2.

In summary, it is necessary to establish three statistical parameters for determining an E(95, 95) value: μ_B, σ_B, and σ_R.

E.2 Performance Estimate For A Population Of Missions

The E(95, 95) value of Section E.1 describes the 95th percentile performance for a 95-percent biased mission. If it is desired to determine a 95-percentile error for a series of missions, a different combination of mission bias and random terms is performed. The "many-mission" performance is represented by a single normal probability distribution having a mean, μ_B, and standard deviation, $\sqrt{\sigma_B^2 + \sigma_R^2}$.

The 95th percentile (E95) is found as:

$$E(95) = \mu_B + K_3\sqrt{\sigma_B^2 + \sigma_R^2} \ ,$$

where K_3 is selected from Figure E-2 using the ratio, $K_3 = \dfrac{\mu_B}{\sqrt{\sigma_B^2 + \sigma_R^2}}$.

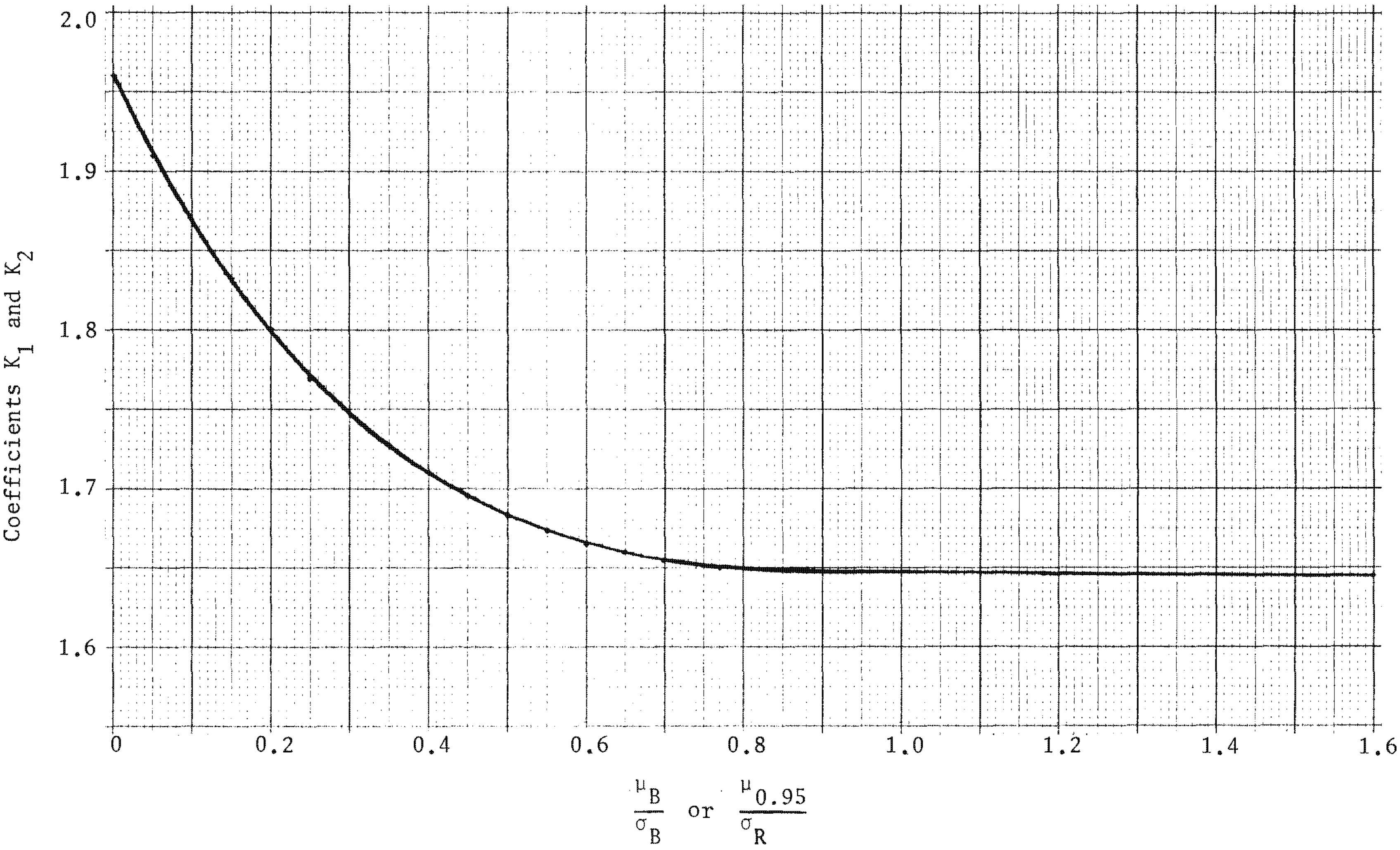


Figure E-2. Graph For Computation Of 95%/95% Probability

Approved for Release: 2017/02/14 C05097223

APPENDIX F NUMERICAL SUMMARY AND MASS PROPERTIES

This appendix records in one location the various parameters associated with the PPS/DP EAC and its R-5 optical system. Also recorded are the PPS/DP EAC mass properties as they were known in January 1980.

F.1 PPS/DP EAC Numerical Summary

F.1.1 Physical Description of Lens System

a.	Optical formula	The R-5 optical formula is presented in Part 2, Section 12.
b.	Overall length	189.87 inches
c.	Asphere-to-Ross #1 length	162.47 inches
d.	Back focal length	5.756 inches
e.	Aperture diameter	43.5 inches

F.1.2 Optical Properties

a.	Effective focal length	175 ±0.5 inches
b.	f/number	4.02 (nominal - nadir position)
c.	Percent obstruction (central & edge)	12.37 (nadir)
d.	Clear aperture transmittance at zero-degree stereo mirror position	84 percent
e.	T/number	4.8 (nominal at nadir - the effective T/number is weighted by the film)
f.	Field of view	2.89 degrees (9 system) 1.45 degrees (5 system)

g.	Stereo-angle of line-of-sight	-8.65, 0, +8.65 degrees
h.	Depth of focus	±0.00072 inch (Rayleigh criterion)
i.	Crab-angle range	-3.85 to +3.85 degrees (in 0.35 degree steps)
j.	Optical quality factor (on axis)	85% (9 system) 82% (5 system)
k.	5 system centerline offset (-z direction)	0.725 inch
l.	Refractive indices	See Table F-1
m.	Peak static resolution	[redacted] lines/mm (geometric mean)*
n.	Spectral weights (for MTF determination)	See Table F-2

25X1

F.1.3 Operational Parameters

a. Exposure — Exposure times may be obtained by use of Figure 2.6-2 in Part 2, Section 6.

b. Film-drive speed

1.	Nominal film drive for 87.5 nmi, nadir (inches/second)	8.24
2.	Nominal film drive for 450 nmi, nadir (inches/second)	1.38
3.	Film-drive speed ranges (inches/second)	
	High altitude, normal speed range	0.84 to 2.95
	High altitude, high speed range	1.68 to 5.90
	Low altitude, normal speed range	3.37 to 11.80
	Low altitude, high speed range	6.74 to 23.60
4.	Film-drive speed ratio	3.5:1

*Based on 2:1 contrast at film plane, 85 percent OQF: threshold modulation = [redacted]f, where f is spatial frequency in lines/millimeter

TABLE F-1

R-5 REFRACTIVE INDICES

	Schott Glass Type	
Wavelength (mu)	SK-14	LaKN-14
486.1	1.610029	1.705546
516.7	1.607513	1.702362
546.1	1.605482	1.699796
587.6	1.603108	1.696797
623.4	1.601412	1.694656
656.3	1.600073	1.692966
686.9	1.598978	1.691584

NOTE: Glass indices are Schott-catalog values. Glass types are Schott designations.

TABLE F-2

SPECTRAL WEIGHTING FACTORS
FOR MTF DETERMINATION

Wavelength (Nanometers)	Weighting Factor
450.0	0.0152
486.1	0.0443
516.7	0.1219
546.1	0.1496
587.6	0.1634
623.4	0.1427
656.3	0.1787
686.9	0.1842

Conditions: Type 1414 Film
1970 Scene*

*The "1970 scene" is an agreed upon estimate of the spectral content of an "average" scene.

F.1.3 Operational Parameters (continued)

5.	Number of steps in each drive speed range (10 bit command)	1024
6.	Step function granularity error (inches/second):	
	High altitude, normal speed range	±.001
	High altitude, high speed range	±.002
	Low altitude, normal speed range	±.004
	Low altitude, high speed range	±.008
7.	Repeatability - static drift (percent)	±0.10
8.	Dynamic error (maximum resolution loss in lines/mm)	5**
9.	Film drive start-up transient (seconds from start of film motion past the exposing slit until the film meets the dynamic error requirement in b.7)	0.150 max.**
10.	Film drive stopping transient (seconds)	0.150 max.**
11.	Operational cycles:	
	9-inch system	18,000
	5-inch system	5,000

12. Film drive speed equation (inches/second)

WHERE: $0 \leq n \leq 1023$ and is the command step number and MINV and MAXV are the limits of a film drive speed range as shown in F.1.3.b.3.

$$V_f = \text{MAXV} \pm \frac{n(\text{MAXV} - \text{MINV})}{1023}$$

**These are the design goals for the low altitude, high-speed range.

F.1.3 Operational Parameters (continued)

c. Interframe times:

1. Stereo pair

Extreme positions	3 seconds
Adjacent positions	2.0 seconds

2. Crab change

One position	3.0 seconds
Per additional step	2.5 seconds

3. Slit change

One step	1.0 seconds
Per additional step	1.0 second

4. Looper fill (to electrical stop)

Full looper	3.0 seconds*
9 inches in looper	1.0 second

d. Operational modes — Strip, stereo pair/triplet lateral pair/triplet, half stereo pair (intermittently).

e. Exposure slit mechanism:

1. Slit widths -

(a) Number — 16 (4-bit command)

(b) Range — 0.0040 to 0.3000 with 1.334:1 average increment

(c) Operational values

Slit No.	Width (Inch)	Slit No.	Width (Inch)
1	0.0040	9	0.0040
2	0.0054	10	0.0534
3	0.0072	11	0.0712
4	0.0094	12	0.0948
5	0.0126	13	0.1266
6	0.0168	14	0.1686
7	0.0224	15	0.2250
8	0.0300	16	0.3000

*At voltage extremes and/or with small or large amounts of film on the TU spool, this number may be as much as 3.5 seconds.

F.1.3 Operational Parameters (continued)

e. 2.	Slit to platen spacing	0.0085 ±0.001 inch (for slits 1 through 12)
3.	Operational cycles	3000 (9 system) 1000 (5 system)

f. Focus Adjust Mechanism

1. Nominal Platen Adjust (NPA)

(a)	Dynamic range	0.024 inch
(b)	Step granularity error (max)	±0.00005 inch
(c)	Adjust rate	
	- Primary mode	0.0005 inch/second
	- Backup mode	0.000125 inch/second
(d)	Servo accuracy (Actual position versus commanded)	±0.00008 inch
(e)	Operation cycles	
	- 9 system	9,000
	- 5 system	2,500

2. Slant Range Compensation (SRC)

(a)	Placement	See Table F-3
(b)	Range (to extremes of steps)	0.00485-inch
(c)	Number of steps	16
(d)	Granularity error (max)	±0.000152 inch
(e)	Reproducibility	±0.00008 inch
(f)	Adjust rate	4 steps in 0.20 second from the camera ON command
(g)	Operational cycles	
	- 9 system	9,000
	- 5 system	2,500

TABLE F-3

R-5 SLANT RANGE COMPENSATIONS PARAMETERS

SRC Step** Number	Platen Position (Inches)	Slant Range (nmi)	Image Shift Relative to 87.5 nmi Conjugate* Shift (Inches)
1	0.002728	203	0.002731
2	0.002425	177	0.002427
3	0.002122	157	0.002125
4	0.001819	141	0.001821
5	0.001516	128	0.001519
6	0.001213	117	0.001210
7	0.000909	108	0.000911
8	0.000606	100	0.000600
9	0.000303	93.4	0.000303
10	0	87.5	0
11	-0.000303	82.3	-0.000303
12	-0.000606	76.9	-0.000662
13	-0.000909	73.6	-0.000907
14	-0.001213	69.9	-0.001209
15	-0.001516	66.5	-0.001516
16	-0.001819	63.5	-0.001814

*Shorter slant range yields a (-) focus shift (away from lens)

**Whenever the high altitude mode of the PPS/DP EAC is selected, the SRC mechanism will remain in step number 1. The SRC mechanism provides proper slant range focus compensation only when earth photography in the low altitude, normal speed range of a film-drive system is selected. Incorrect compensation occurs in the low altitude, high speed range of a system.

F.1.3 Operational Parameters (continued)

g. Focus Sensor

1. Slant Range

(a) Optimized Range (Full obliquity) — 65 - 717 nmi

(b) Design Center — 119 nmi low altitude mode; 325 nmi high altitude mode

2. Timing

(a) Response — 4.5 seconds

(b) Time Constant — 1.5 seconds

3. Sensor Accuracy — 0.00025 inch

4. Total System (Sensor and Platen Adjust) accuracy, 95% probability — ±0.000537 inch

h. Film Format

	9-Inch System	5-Inch System
1. Main Image Width including fiducial lines (inches)	8.831 ±0.003	4.430 ±0.003
2. Smear Slit Tracks	One low altitude One high altitude	One low altitude -
3. Fiducials (0.004 ±0.002 inches)	Two	Two
4. Interframe Marks	Required	Required
5. Vehicle Timing Data	Timing Signals "$\overline{A}$ and B" (500 pulses per second timing labels)	

i. Film Tension (lbs, controlled by tension arm)	3.0 ±0.25	1.5 ±0.25
j. Swath Width (Nadir)		
1. 75 nmi Altitude	3.78	1.90
2. 450 nmi Altitude	22.69	11.37
k. Looper		
1. Mechanical Capacity (inches)	60	45
2. Film Capacity Between Electrical Stops (inches)	36.8	36.8

F.1.3 Operational Parameters (continued)

l. Altitude Limits for Photography

1. 68 to 470 nmi with obliquity between ±45 degrees.
2. Film drive speed capability exists for slant ranges between 65 and 710 nmi.

m. Film Quantity - Required to be Recoverable

1.	9.5 Inch Film (feet)	10,800 (0.002-inch thick film)
2.	5-Inch Film (feet)	3,000 (0.002-inch thick film)
3.	Take-Up Full Sensor Trip Point* (feet)	
	- 9 Take-Up	4,900
	- 5 Take-Up	1,200

F.2 PPS/DP EAC Mass Properties

Mass properties of the PPS/DP EAC and its major components are summarized in Table F-4. The center of gravity is with reference to the BIF-008W coordinate vehicle system. Moments and products of inertia are about the component center of mass.

*Based on 0.002-inch thick film and nominal leader.

TABLE F.4 MASS PROPERTIES
Effective FM-52 as of 1/9/80
(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1405-218	PHOTOGRAPHIC P/L SECTION (9 X 5)	4036.26	100.05	0.39	0.11	344.655	7471.352	7497.875	-0.3074	30.3197	2.5141
1405-215	DUAL FORWARD UNIT MODULE	991.00	-7.24	0.05	-1.41	38.193	172.784	169.654	0.0204	-6.2563	0.5577
1405-207	EJECTABLE ADAPTER ASSY (EA)	80.00	-9.70	-0.50	-1.70	5.750	4.820	3.700	0.1000	0.1000	0.0000
1405-208	FIXED ADAPTER ASSY (FA)	129.80	20.50	0.80	-1.50	15.980	11.130	8.800	-0.1000	-0.0000	0.0000
80S1096-1	SRV/RA NO. 1 (EMPTY)	390.60	-36.15	-0.02	0.13	8.030	14.980	15.320	0.0100	-0.0300	-0.0500
80S1096-2	SRV/RA NO. 2 (EMPTY)	390.60	12.95	-0.02	-2.87	8.030	14.980	15.320	0.0100	-0.0300	-0.0500
1405-214	SEM-DPM ASSY	3045.26	134.97	0.50	0.61	305.767	4034.141	4064.426	-0.4766	-9.9024	-8.4935
1405-212	SUPPLY ELECTRONICS MODULE (SEM)	788.18	56.17	1.25	-0.65	65.542	53.715	49.864	-1.4910	0.4569	0.7781
1382935	SUPPLY ELECTRONICS STRUCTURE	258.95	57.20	0.20	0.40	36.272	30.259	27.641	-0.0970	1.0668	-0.0970
1405-150	9" SUPPLY UNIT & RAM ASSY	234.38	57.96	-0.30	4.34	4.794	5.825	3.312	0.0633	-0.0185	-0.0196
1411-497	9" SUPPLY UNIT ASSY	94.67	58.18	-0.74	7.66	2.417	2.466	1.736	0.1136	0.0974	-0.0162
1411-869	9" COUPLERS	8.59	72.69	0.0	10.50	0.000	0.000	0.000	0.0	0.0000	0.0
1377622-P	RECORD ATTACH MECHANISM	9.12	47.88	0.0	22.06	0.100	0.010	0.100	0.0	0.0000	0.0
GFE-PRIME	9" FILM (SUPPLY POSITION)	122.00	57.50	0.0	0.0	0.860	1.330	0.860	0.0	0.0	0.0
1405-211	5" SUPPLY UNIT & RAM ASSY	71.82	56.58	-0.59	-16.76	0.598	1.696	1.943	0.0056	0.0738	0.0125
1411-1124	5" SUPPLY UNIT ASSY	41.55	58.82	-1.02	-16.28	0.389	1.071	1.299	0.0100	-0.0730	0.0330
1411-872	5" COUPLERS	3.15	72.03	0.0	-8.50	0.000	0.000	0.000	0.0	-0.0000	0.0
1377622-S	RECORD ATTACH MECHANISM	9.12	44.66	0.0	-18.38	0.100	0.010	0.100	0.0	-0.0000	0.0
GFE-5 IN	5" FILM (SUPPLY POSITION)	18.00	54.75	0.0	-18.50	0.040	0.050	0.040	0.0	0.0	0.0
TOTAL-1	SEM ELECTRONIC CONTROL UNITS	205.96	52.79	5.04	-1.90	16.275	8.704	14.376	-1.2658	-1.2689	1.6595
1417-783	UNIT-2 COMMAND PROCESSOR	23.04	60.19	19.50	-4.31	0.059	0.077	0.101	-0.0000	-0.0000	0.0000
1417-819	UNIT-3 POWER MONITOR & CONTROL	20.73	60.11	16.31	-15.00	0.078	0.107	0.078	-0.0000	-0.0000	0.0000

Approved for Release: 2017/02/14 C05097223

TABLE F.4 Cont'd

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1408-2057P	UNIT-43 PRIMARY DREA	17.40	60.14	16.13	10.56	0.046	0.076	0.059	0.0000	0.0000	0.0000
1411-683	UNIT-6 PRIMARY RCE	8.32	39.66	16.44	1.90	0.029	0.025	0.010	0.0000	0.0000	0.0000
1408-2057S	UNIT-42 SECONDARY DREA	17.40	45.80	16.19	-12.75	0.046	0.076	0.059	-0.0000	-0.0000	0.0000
1411-1099	UNIT-45 SECONDARY RHE	9.91	70.64	16.48	-14.59	0.036	0.031	0.013	-0.0000	-0.0000	0.0000
1409-532P	UNIT-41 PRIMARY FPLL	17.65	52.69	-15.63	13.13	0.046	0.077	0.060	-0.0000	0.0000	-0.0000
1409-532S	UNIT-40 SECONDARY FPLL	17.65	46.13	-15.63	-12.13	0.046	0.077	0.060	0.0000	-0.0000	-0.0000
910000	UNIT-46 IEU	33.17	48.07	16.27	4.38	0.228	0.231	0.073	0.0000	0.0000	0.0000
1417-809	UNIT-14 INSTRUMENT. PROCESSOR	14.91	52.69	-15.63	0.88	0.049	0.082	0.047	-0.0000	0.0000	-0.0000
1408-2278	UNIT-18 PORT DOOR ELECTRONICS	9.66	61.78	-14.91	-17.00	0.017	0.053	0.043	0.0000	-0.0000	0.0
3532006-2	UNIT-25 DIGITAL TELEMETRY UNIT	13.50	40.98	-16.50	10.81	0.019	0.027	0.025	-0.0000	0.0	0.0
1382959	UNIT-37 AFT BACK UP CUTTER	2.62	35.25	0.0	10.81	0.000	0.000	0.000	0.0	0.0000	0.0
MISC-212	ASSY HARDWARE & MISC. PARTS	17.07	55.00	0.30	-2.40	1.300	1.070	0.980	-0.0000	-0.0000	0.0000
1405-213	CAMERA OPTICS MODULE,9X5	2257.08	162.49	0.24	1.05	239.731	2554.820	2589.195	1.2300	-33.2539	4.1574
1413-399	FORWARD BARREL ASSY	203.17	106.68	-0.34	-2.68	35.898	26.254	29.606	-0.2898	-0.2621	0.4684
1382930	FORWARD BARREL	197.17	106.70	-0.35	-2.11	35.196	25.774	29.374	-0.2813	-0.2813	0.4688
1416-132	PANEL ASSY,TAPE SUPPORT+Y	1.71	104.35	13.00	-21.60	0.000	0.000	0.000	-0.0000	-0.0000	0.0000
1416-131	PANEL ASSY,TAPE SUPPORT-Y	1.71	104.35	-13.00	-21.60	0.000	0.000	0.000	0.0000	-0.0000	-0.0000
1420-206-2	BLANKET ASSY BAY DOOR+Y	1.29	108.00	13.50	-21.50	0.000	0.000	0.000	-0.0000	-0.0000	0.0000
1420-206-1	BLANKET ASSY BAY DOOR-Y	1.29	108.00	-13.50	-21.50	0.000	0.000	0.000	0.0000	-0.0000	-0.0000
1377230	AFT BARREL ASSY	277.22	217.90	0.28	0.24	50.930	144.003	145.201	0.0999	-0.2896	0.7590
TOTAL-2	MASS SUPPORTED BY A-FRAMES	1776.70	160.22	0.31	1.61	152.116	2061.500	2092.082	1.3129	-38.6712	1.4361
TOTAL-3	COM THERMAL BLANKETS & SUPPORTS	52.11	148.10	-0.04	0.71	5.246	31.056	31.513	0.1974	0.0437	-0.0533

TABLE F.4 Cont'd

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1416-224	TAPE ASSY SUPPORT A	6.75	83.70	0.0	3.40	0.650	0.200	0.300	0.0	0.0000	0.0
1420-117	BLANKET, BAY AREA UPPER, +Y	3.04	108.20	18.20	18.30	0.000	0.000	0.000	0.0000	0.0000	0.0000
1420-107	BLANKET, BAY AREA UPPER ,-Y	2.93	108.20	-18.40	16.90	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1420-118	BLANKET, BAY AREA LOWER, +Y	3.31	107.90	18.10	-7.90	0.000	0.000	0.000	-0.0000	-0.0000	0.0000
1420-119	BLANKET, BAY AREA LOWER, -Y	3.10	107.90	-18.00	-18.80	0.000	0.000	0.000	0.0000	-0.0000	-0.0000
1420-106	BLANKET, TRANSITION COLLAR	1.92	144.70	0.0	-0.50	0.0	0.000	0.000	0.0	-0.0000	0.0
1408-1710	BLANKET, END BELL	1.79	282.00	0.0	-1.00	0.0	0.000	0.000	0.0	-0.0000	0.0
1420-126	BLANKET, CABLES, +Y	0.71	274.00	26.20	7.50	0.000	0.000	0.000	0.0000	0.0000	0.0000
1420-127	BLANKET, CABLES, -Y	0.27	274.00	-25.10	8.20	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1420-108	BLANKET, +Y AFT	5.18	175.90	23.80	6.20	0.000	0.000	0.000	0.0000	0.0000	0.0000
1420-109	BLANKET, -Y AFT	5.97	179.40	-23.60	-6.10	0.000	0.000	0.0	0.0000	-0.0000	-0.0000
1420-110	BLANKET, +Z AFT	6.64	178.10	-6.10	22.20	0.000	0.000	0.0	-0.0000	0.0000	0.0
1420-111	BLANKET, -Z AFT	7.21	181.20	4.90	-16.20	0.000	0.000	0.000	-0.0000	-0.0000	0.0000
1420-214	BLANKET, AFT BULKHEAD	1.06	77.30	0.12	-2.06	0.000	0.0	0.0	-0.0000	-0.0000	0.0000
1420-212	BLANKET, THERMAL OR COVER	0.24	9.30	14.32	0.0	0.000	0.000	0.000	0.0	0.0	0.0000
1420-217	BLANKET,THERMAL-BAY COVER	1.73	108.50	0.0	-22.87	0.000	0.000	0.000	0.0	-0.0000	0.0
1420-225	BLANKET, THERMAL AFT BLKHD	0.26	78.69	0.0	14.50	0.000	0.000	0.000	0.0	0.0000	0.0
1407-1143	BEARING ASSY, AFT, SPHERICAL	0.83	285.70	0.0	-1.00	0.0	0.000	0.000	0.0	-0.0000	0.0
1407-1144	MOUNT, BEARING, AFT, SPHERICAL	0.43	285.06	0.0	-1.00	0.0	0.000	0.000	0.0	-0.0000	0.0
1407-1145	HOUSING, ECCENTRIC, AFT BEARING	0.90	285.32	0.0	0.0	0.0	0.000	0.000	0.0	0.0	0.0
MISC-213	ASSY HARDWARE & MISC. PARTS	8.90	165.60	0.25	1.00	1.200	4.940	4.940	0.0000	0.0	0.0
1405-206	CAMERA OPTICS ASSEMBLY, 9X5	1713.53	160.40	0.32	1.64	145.657	2016.457	2046.594	1.1115	-38.7061	1.4605

TABLE F.4 Cont'd

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

	TITLE	LBS. WEIGHT	- INCHES - X BAR	Y BAR	Z BAR	- SLUG FEET SQUARED - IXX	IYY	IZZ	IZY	IXZ	IXY
TOTAL-4	YOKE SUPPORT MECHANISM	44.48	104.66	0.29	13.07	3.123	0.603	2.564	0.0599	0.0337	0.0230
1407-903	YOKE ASSY, MOUNTING	21.33	103.37	-0.14	11.35	1.710	0.220	1.510	-0.0040	-0.0040	-0.0010
1407-899	PILLOW BLOCK ASSY LEFT TYPE-5	2.70	105.95	-23.78	1.70	0.000	0.0	0.000	-0.0000	0.0000	-0.0000
1407-900	PILLOW BLOCK ASSY RIGHT TYPE-5	2.70	105.95	23.78	1.70	0.000	0.0	0.000	0.0000	0.0000	0.0000
1407-1037	HYPOCYCLOID LINKAGE DRIVE ASSY	10.92	106.75	5.30	21.35	0.020	0.000	0.020	0.0000	0.0000	0.0000
1407-1017	AZIMUTH BALL SCREW ASSY	2.67	105.00	-12.70	17.70	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1407-1090	PLATE & MOUNT ASSY, TRUNNION	0.52	104.80	-14.50	15.90	0.0	0.0	0.000	-0.0000	0.0	0.0
400-1139	BEARING,SEALED,CAMROL (2)	1.18	102.75	0.0	13.20	0.000	0.000	0.000	0.0	0.0000	0.0
1407-1223	GEAR, BOX, ELEVATION	0.99	105.10	-1.20	17.70	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
MISC-4	MISC YOKE MECHANISM	1.47	103.65	0.42	5.61	0.190	0.000	0.170	0.0000	0.0000	0.0000
1407-1463	ROSS CORRECTOR FIELD LENS ASSY	94.86	100.71	0.0	-0.51	0.670	1.791	2.291	0.0	-0.0352	0.0160
1407-1464	SUPPORT, R/C, R-5	46.94	96.44	0.0	0.0	0.425	0.834	1.138	0.0	0.0080	0.0160
1407-1313	MOUNTING LENS HOUSING	1.95	90.13	0.0	-1.00	0.0	0.0	0.0	0.0	0.0	0.0
1407-1292	LENS NO. 1	10.48	110.27	0.0	-1.00	0.060	0.010	0.050	0.0	0.0	0.0
1407-1293	LENS NO. 2	14.44	108.47	0.0	-1.00	0.080	0.010	0.080	0.0	0.0	0.0
1407-1294	LENS NO. 3	13.33	107.22	0.0	-1.00	0.060	0.010	0.060	0.0	0.0	0.0
1407-1295	LENS NO. 4	3.47	91.22	0.0	-1.00	0.020	0.000	0.020	0.0	0.0	0.0
1407-1296	LENS NO. 5	4.25	89.92	0.0	-1.00	0.020	0.0	0.020	0.0	0.0	0.0
1407-1510	S-I/ORG SENSOR & PWR	11.70	114.56	0.06	-1.52	0.303	1.155	0.989	-0.0010	-0.2390	-0.0030
1407-1302	STEREO MIRROR ASSY,ULE	456.27	105.53	-0.00	1.82	28.518	21.331	28.473	0.5702	9.6423	-0.4009
1407-1286	BLANK MACHINED, ULE	392.00	105.56	0.0	1.72	21.769	19.926	21.779	0.5718	8.9817	0.0099
1407-1256L	MOUNT & BEARING, ELEVATION, -Y	31.36	105.20	-21.05	2.09	0.340	0.660	0.340	-0.0500	0.2800	-0.2400

Approved for Release: 2017/02/14 C05097223

TABLE F.4 Cont'd'

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1407-1256R	MOUNT & BEARING, ELEVATION, +Y	31.36	105.20	21.05	2.09	0.340	0.660	0.340	0.0500	0.2800	-0.1700
MISC-1300	SERVO MOUNT & HARDWARE	1.55	112.26	-0.34	16.10	0.000	0.000	0.000	-0.0000	0.0700	-0.0000
1407-1314	END BELL ASSY, PRIMARY, ULE	347.26	275.56	-0.02	-1.08	22.763	11.824	11.844	-0.0360	-0.0026	0.0164
1407-1311	END BELL, CAST	49.50	276.91	-0.11	-1.14	4.781	2.534	2.587	-0.0360	-0.0000	0.0160
MISC-1315	HEATER CONTROLLERS & HARDWARE	4.14	281.00	0.0	-1.00	0.090	0.040	0.040	0.0	0.0	0.0
1407-1316	MIRROR ASSY, PRIMARY,ULE	291.00	275.26	0.0	-1.00	17.538	9.165	9.165	0.0	0.0	0.0
1407-1310	MIRROR, PRIMARY ULE	259.00	275.19	0.0	-1.00	13.908	7.329	7.329	0.0	0.0	0.0
1407-1207	SEGMENTED RING ASSY	32.00	275.80	0.0	-1.00	3.629	1.833	1.833	0.0	0.0	0.0
MISC-1314	ASSY HARDWARE & MISC PARTS	2.62	275.70	0.0	-8.70	0.320	0.000	0.000	0.0	-0.0000	0.0
1408-2102	DRUM, RECORDER ASSY (9 X 5)	97.78	83.06	-0.26	-1.53	1.474	0.737	1.474	0.0632	-0.0095	-0.0442
1414-350	SERVO - AZIMUTH	5.30	105.90	-8.80	21.70	0.000	0.000	0.000	-0.0000	0.0000	0.0
1407-1456	GUIDE-CAM ROLLER, UPPER	1.63	102.40	0.0	23.70	0.000	0.000	0.000	0.0	0.0000	0.0
1407-600	TRACK , BEARING	1.15	102.90	0.0	13.20	0.000	0.000	0.000	0.0	0.0000	0.0
1407-1022	BLOCK ASSY BEARING (2)	2.06	108.75	0.0	0.75	0.220	0.000	0.000	0.0	0.0000	0.0
1407-1116	BRACKET ASSY PIVOT	0.72	106.30	-10.10	22.50	0.000	0.0	0.0	-0.0000	0.0000	-0.0000
1407-1189	SHAFT PIVOT	0.74	109.40	0.0	18.00	0.000	0.000	0.0	0.0	0.0000	0.0
1408-1326	POT & GEAR BOX ASSY	0.96	104.80	-9.20	23.20	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1407-901	MOUNT, BEARING, LEFT	4.17	103.90	-25.60	1.10	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1407-902	MOUNT,BEARING, RIGHT	4.17	103.90	25.60	1.10	0.000	0.000	0.000	0.0000	0.0000	0.0000
1417-586	ENCODER LOAD	2.00	96.48	0.0	18.40	0.0	0.0	0.0	0.0	0.0	0.0
1416-170	SUPPORT ASSY, TB4	1.12	182.80	-24.10	-5.30	0.000	0.000	0.000	0.0000	-0.0000	0.0
1418-206	SUPPORT ASSY, TB5	1.09	257.50	-24.10	-5.30	0.000	0.000	0.000	0.0000	-0.0000	-0.0000

Approved for Release: 2017/02/14 C05097223

TABLE F.4 Cont'd

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1407-441	INTERNAL STRUCTURE & TUBE ASSY	457.42	168.17	0.04	2.48	60.240	310.998	320.101	-0.0502	-21.9400	-0.5101
1407-1020	BEAM ASSY, BOX, L.H.	7.40	119.50	-24.50	0.07	0.000	0.000	0.000	-0.0000	0.0000	-0.0000
1407-1021	BEAM ASSY, BOX R.H.	7.40	119.50	24.50	0.07	0.000	0.000	0.000	0.0000	0.0000	0.0000
1407-1265	MOUNT & INSULATOR ASSY, A-FRAME	12.26	147.20	-27.00	0.0	0.100	0.000	0.100	0.0	0.0	-0.0000
1407-1267	MOUNT & INSULATOR A-FRAME ADJUST	14.64	147.20	27.00	0.0	0.100	0.000	0.100	0.0	0.0	0.0000
1407-1031	RAMP A, CABLE	0.09	141.00	23.30	13.00	0.000	0.000	0.000	0.0000	0.0000	0.0
1407-1032	RAMP B, CABLE	0.12	141.00	20.00	17.00	0.000	0.000	0.000	0.0000	0.0000	0.0000
1407-1098	RAMP C, CABLE	0.09	141.00	-23.30	13.00	0.000	0.000	0.000	-0.0000	0.0000	0.0
1407-1490	SUPPORT FRAME, RECORDER	7.13	91.27	0.0	6.67	0.390	0.058	0.389	0.0	-0.0039	0.0
1407-1514	MOUNTING PLATE, CONTROLLERS	0.83	94.68	0.0	7.90	0.020	0.001	0.020	0.0	0.0	0.0
1416-222	HEATER CONTROLLER ASSY (29)	7.25	196.77	0.83	-0.60	0.922	1.891	2.761	0.0150	0.1150	0.1450
400-1340	EMI FILTER ASSEMBLIES (24)	10.32	181.56	-1.46	2.35	1.400	6.830	6.850	-0.0610	-1.0300	0.2290
HR7-HR308	HEATER ASSEMBLYS (34)	18.80	173.38	0.0	1.60	2.540	11.540	11.540	0.0	0.0000	0.0
TOTAL-5	COA CABLES	54.97	151.50	10.42	6.91	5.175	60.297	64.229	0.0512	0.4034	3.0543
1418-237	CABLE ASSEMBLY, W-201	5.44	153.68	20.08	10.47	0.147	6.020	5.895	-0.0147	0.6041	-0.0347
1418-238	CABLE ASSEMBLY, W-202	6.75	157.23	-23.50	5.33	0.026	8.579	8.577	-0.0026	-0.7805	-0.1345
1418-239	CABLE ASSEMBLY, W-203	4.88	133.05	-23.66	6.20	0.025	5.814	5.796	-0.0025	0.1643	-0.0432
1418-240	CABLE ASSEMBLY, W-204	2.84	159.11	20.87	10.76	0.036	3.149	3.122	0.0009	0.1928	0.0280
1418-241	CABLE ASSEMBLY, W-205	5.50	145.22	19.33	12.91	0.083	6.678	6.615	-0.0139	0.5375	-0.1559
1418-242	CABLE ASSEMBLY, W-206	3.63	165.40	23.84	0.42	0.027	3.556	3.529	0.0000	-0.1580	0.7900
1418-243	CABLE ASSEMBLY, W-207	6.31	160.48	22.15	8.36	0.050	6.311	6.278	0.0041	0.0950	0.1915
1418-244	CABLE ASSEMBLY, W-208	7.25	158.67	23.04	6.59	0.029	7.284	7.265	0.0019	0.0190	0.1548

Approved for Release: 2017/02/14 C05097223

TABLE F.4 Cont'd

(MASS PROPERTIES TO C.G. OF GIVEN ELEMENT)

		LBS.	- INCHES -			- SLUG FEET SQUARED -					
	TITLE	WEIGHT	X BAR	Y BAR	Z BAR	IXX	IYY	IZZ	IZY	IXZ	IXY
1418-245	CABLE ASSEMBLY, W-209	4.28	156.53	22.86	4.59	0.024	4.452	4.440	0.0035	-0.0077	0.1251
1418-246	CABLE ASSEMBLY, W-210	5.09	162.60	23.41	1.00	0.044	4.728	4.706	0.0052	-0.0565	0.1250
1418-247	CABLE ASSEMBLY, W-211	1.53	90.83	-13.64	13.04	0.054	0.080	0.071	0.0231	0.0372	0.0283
1418-248	CABLE ASSEMBLY, W-212	1.47	88.94	-11.89	5.80	0.044	0.029	0.059	0.0174	0.0134	0.0220
MISC-206	ASSY HARDWARE & MISC. PARTS	9.83	162.20	0.40	2.00	1.000	4.300	4.300	0.0000	0.0000	0.0000
MISC-209	ASSY HARDWARE & MISC. PARTS	23.67	165.50	1.05	3.29	3.500	9.000	9.000	0.0000	0.0000	0.0000
MISC-210	ASSY HARDWARE & MISC. PARTS	3.85	168.20	0.0	2.80	0.510	2.290	2.390	0.0	0.0000	0.0

Approved for Release: 2017/02/14 C05097223

This page intentionally blank

APPENDIX G PPS/DP EAC INSTRUMENTATION SUMMARY

Most sections in Part Three of this handbook contain detailed descriptions of the flight instrumentation points (IMP's) related to that section.

Table G-1 is a listing of all IMP's within the PPS/DP EAC in numerical order, their title, and the locations of descriptions within this handbook. Where more than one reference is listed, the detailed information is the same at each location. All locations are referenced simply for greater convenience.

TABLE G-1

PPS/DP EAC INSTRUMENTATION LISTING

IMP	Title	Description Location(s)
5000	9 Slit Bits 1,2,3,4	3.2-153, 3.9-86
5001	5 Slit Bits 1,2,3,4	3.2-154, 3.9-86
5002	Cal On/Off, FEP On/Off, Cal Bit A/$\bar{A}$, Cal Bit B/$\bar{B}$	3.6-33, 3.7-73, 3.9-86
5003	Environmental Branches 1,2,4, and 5 Parking Brake On/Off	3.2-144, 3.7-73, 3.8-55, 3.9-87, 3.12-43
5004	Environmental Branches 5,6, EPSM 1, EPSM 2 On/Off	3.7-73, 3.8-55, 3.9-87, 3.12-44
5005	9 FPLL Select Side A, 9 FPLL Select Side B, 5 FPLL Select Side A, 5 FPLL Select Side B	3.2-152, 3.9-87
5006	9 Slit Enable/Inhibit, 9 Slit Select A/B, 5 Slit Enable/Inhibit, 5 Slit Select A/B	3.2-154, 3.9-87
5007	5 Focus Drive Enable/Inhibit, 5 Minus/Stop, 5 Plus/Stop, S1-PRG Calibrate On/Off	3.2-153, 3.7-74,3.9-87, 3.13-24
5009	Crab Angle (Coarse)	3.3-18, 3.4-27
5010	Crab Angle (Fine)	3.3-18, 3.4-27
5011	Crab Bits 1,2,3,4	3.4-28, 3.9-88
5013	Temp. Primary Film Supply	3.2-144, 3.8-58
5014	Looper Position (9)	3.2-138
5015	Primary Film Tension (9)	3.2-134
5016	Primary Film Quantity, Coarse (9)	3.2-137
5017	Primary Film Quantity, Medium (9)	3.2-137
5018	Primary Film Quantity, Fine (9)	3.2-137
5019	Film Path Pressure (9 & 5)	3.2-140, 3.8-57
5020	Looper Position (9)	3.2-139
5021	Primary Film Quantity, Coarse (9)	3.2-138

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5022	Primary Film Quantity, Medium (9)	3.2-138
5023	Primary Film Quantity, Fine (9)	3.2-138
5024	9 Focus Drive Enable/Inhibit, 9 Minus Stop, 9 Plus Stop, Sl-PRG Disable/Enable	3.2-153, 3.7-74 3.9-88, 3.13-24
5025	Platen Position, Fine (9)	3.2-148
5026	Platen Position, Coarse (9)	3.2-148
5027	FDS Bits 1,2,3,4	3.2-152, 3.9-88
5028	FDS Bits 5,6,7,8	3.2-152, 3.9-88
5029	9 Cam.On/Off, 5 Cam.On/Off, 9 OP On/Off, 5 OP On/Off	3.2-151, 3.4-29, 3.7-74, 3.9-88
5030	Platen Position, Fine (9)	3.2-148
5031	Platen Position, Coarse (9)	3.2-148
5032	PCM 1 On/Off, PCM 2 On/Off, FDS Bits 9,10	3.2-153, 3.7-74, 3.9-89, 3.10-114
5033	9 NPA Prime/BU, 5 NPA Prime/BU, T/U Enable/Inhibit	3.2-143, 3.2-153, 3.9-89
5035	Stereo Drive Transfer Bit 1,2, Viewport Door Open/Close, Crab Polarity +/-	3.4-28, 3.5-28, 3.9-89
5036	9 Ops Counter Bits 1,2,3 Spare	3.2-151, 3.9-90
5037	5 Ops Counter Bits 1,2,3, Spare	3.2-152, 3.9-90
5046	Stereo Bit 1 Stored, Stereo Bit 2 Stored, CP Select A/B, FPLL Speed Range High/Normal	3.2-152, 3.4-29, 3.9-90
5047	Data Tracks and SRC 9 Enable/Inhibit, 9 Enable/Disable, 5 Enable/Inhibit 5 Enable/Disable	3.2-149, 3.9-90
5049	Slit Position (9)	3.2-148
5050	Slit Position (9)	3.2-149
5051	Platen Position, Fine (5)	3.2-148
5052	Platen Position, Coarse (5)	3.2-148

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5053	Platen Position, Fine (5)	3.2-148
5054	Platen Position, Coarse (5)	3.2-148
5055	Slit Position (5)	3.2-149
5056	Slit Position (5)	3.2-149
5057	Temp., Camera Housing	3.2-154, 3.8-58
5058	Temp., Focus Sensor Head	3.6-32, 3.8-58
5059	Focus Signal Strength (A+B)	3.5-32, 3.6-30
5060	Temp., 5 Tilt Frame	3.2-154, 3.8-59
5061	Temp., 9 Tilt Frame	3.2-155, 3.8-59
5062	DREA Current (9)	3.2-150
5063	Primary NPA Enable/Inhibit, B/U NPA Enable/Inhibit, Data Signal C (9)	3.2-149
5064	Slit A Enable/Inhibit, Slit B Enable/Inhibit, Data Tracks (9)	3.2-150
5065	Slit A Enable/Inhibit, Slit B Enable/Inhibit, Data Tracks (5)	3.2-150
5066	Primary NPA Enable/Inhibit, B/U NPA Enable/Inhibit, Data Signal C (5)	3.2-150
5067	Focus Correction Signal, Fine	3.6-32
5068	Looper Position (5)	3.2-139
5069	Looper Position (5)	3.2-139
5070	Film Tension (5)	3.2-136
5071	Film Quantity, Medium (5)	3.2-138
5072	Film Quantity, Fine (5)	3.2-138
5073	Film Quantity, Medium (5)	3.2-138
5074	Film Quantity, Fine (5)	3.2-138
5075	Secondary T/U Motor Current 1 & 2 (5)	3.2-142
5076	Temp., Secondary Film Supply	3.2-145, 3.8-59

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5077	Supply Motor Current (5)	3.2-141
5078	#2 Battery Temperature, SRV 2	3.8-59, 3.12-35
5079	#2 Battery Temperature, SRV 1	3.8-59, 3.12-34
5080	Take-up Warning (9 & 5), SRV 2	3.2-140
5081	Cut/Seal 4 (5 TSRT)	3.11-21
5082	Cut/Seal 4 (5 TSRT)	3.11-21
5083	TSRT (5)	3.11-21
5084	TSRT (5)	3.11-21
5085	Splice/Cut (5)	3.11-22
5086	Splice/Cut (5)	3.11-21
5090	Crab, Stereo, and Door Current	3.4-28, 3.5-27, 3.7-75
5091	Main Power Current	3.7-75
5092	FPLL Current Monitor (9)	3.2-146
5097	FPLL Loop Diagnostic (9)	3.2-146
5098	FPLL Current Monitor (5)	3.2-146
5099	Temp., Stereo Mirror	3.3-17, 3.8-60
5100	Viewport Door Position +Y	3.5-26
5104	Viewport Door Position -Y	3.5-26
5105	Average Irradiation Level (Channel B)	3.5-31, 3.6-33
5107	Focus Correction Signal, Coarse	3.6-33
5108	Focus Difference Signal (A-B)	3.6-33
5109	CBM for IEU (#1)	3.7-80, 3.12-36
5110	Temp., Corrector, Camera Spacer	3.2-155, 3.3-17, 3.8-60

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Locations(s)
5111	Temp., V.P. Door Inside Insulation, -Y	3.5-26, 3.8-60
5112	Temp., Lens Tube Fwd, Sta. 175, 279 Deg.	3.3-17, 3.8-60
5113	Temp., Lens Tube Aft, Sta. 244, 5 Deg.	3.3-17, 3.8-60
5114	Temp., V.P. Door Inside Insulation, +Y	3.5-26, 3.8-61
5115	Temp., Lens Tube Fwd, Sta. 175, 99 Deg.	3.3-17, 3.8-61
5116	CBM for IEU (#2)	3.7-80, 3.12-36
5117	CBM for IEU (#3)	3.7-80, 3.12-36
5118	CBM for IEU (#4)	3.7-80, 3.12-37
5119	CBM for IEU (#5)	3.2-144, 3.7-81, 3.11-24, 3.12-37
5120	Temp., Insulation Inner, Sta. 108, 7 Deg.	3.8-61
5121	CBM for IEU (#6)	3.2-144, 3.7-81, 3.11-24 3.12-37
5122	CBM for IEU (#7)	3.5-28, 3.7-81, 3.12-37
5123	CBM for IEU (#8)	3.5-29, 3.7-81, 3.12-37
5124	Supply Brake Current (5)	3.2-142
5127	Stereo Angle	3.3-19, 3.4-27
5130	BUSS Power Supply	3.7-74, 3.8-55
5131	Environmental Power Supply	3.7-75, 3.8-55
5133	Environmemtal Current Branch 1, Branch 6, EPSM 1, EPSM 2	3.7-75, 3.8-57, 3.12-45
5134	Environmental Current Branch 2 and 5 Parking Brake Current	3.2-143, 3.7-76, 3.8-57
5135	Environmental Current Branch 4	3.7-76, 3.8-57
5136	Environmental Current Branch 5	3.7-76, 3.8-57
5138	PPS Main Power Consumption (Coarse)	3.7-76

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5139	PPS Main Power Consumption (Medium)	3.7-76
5140	PPS Main Power Consumption (Fine)	3.7-76
5141	Primary PPS Power Supply	3.7-75
5145	Temp., Primary Mirror 2 (-Y)	3.3-18, 3.8-61
5146	Viewport Door Operation	3.5-26
5147	Stereo Angle	3.3-19, 3.4-27
5148	Crab Angle (Coarse)	3.3-19, 3.4-27
5149	Crab Angle (Fine)	3.3-19, 3.4-27
5150	Temp., Primary Mirror 1 (+Y)	3.3-18, 3.8-61
5152	Pyro Voltage IEU	3.7-82
5155	Temp., Insulation Inner, Sta. 244, 186 Deg.	3.8-61
5156	FPLL Loop Diagnostic (5)	3.2-146
5157	DREA Current (5)	3.2-151
5159	CBM for IEU (#9)	3.7-81, 3.12-38
5196	+15 volts dc Supply	3.7-77, 3.10-115
5198	+5 volts dc Supply	3.7-77, 3.10-115
5200	-15 volts dc Supply	3.7-77, 3.10-115
5231	Average Irradiation Level (Channel A)	3.5-31, 3.6-33
5235	Temp., SRV 1, Film T/U Assembly	3.2-145, 3.8-62
5236	Temp., SRV 2, Film T/U Assembly	3.2-145, 3.8-62
5238	Temp., SRV 1 Recovery Battery, +Y Side	3.8-62, 3.12-34
5239	Temp., SRV 2 Recovery Battery, +Y Side	3.8-62, 3.12-35
5240	Temp., SRV 1 T/C Retro Attach Point	3.8-62, 3.12-34

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5241	Temp.,SRV 2 T/C Retro Attach Point	3.8-62, 3.12-35
5242	Temp.,SEM Internal, +Y	3.8-62
5243	Temp.,SEM Internal, RSE/RAM-5	3.8-63
5244	Temp.,SRV 1 F/B Liner Skirt, X Axis	3.8-63, 3.12-34
5245	Temp.,SRV 2 F/B Liner Skirt, X Axis	3.8-63, 3.12-35
5246	Temp.,SRV 1 F/B Liner Skirt, +45 Deg.	3.8-63, 3.12-34
5247	Temp.,SRV 2 F/B Liner Skirt, +45 Deg.	3.8-63, 3.12-35
5248	Temp.,SRV 1 F/B Liner Skirt, -45 Deg.	3.8-63, 3.12-34
5249	Temp.,SRV 2 F/B Liner Skirt, -45 Deg.	3.8-63, 3.12-35
5250	Temp.,Skin FA, Sta. 16, +Z	3.8-64
5251	Temp.,Skin FA, Sta. 16, +Y	3.8-64
5252	Temp.,Skin FA, Sta. 16, -Z	3.8-64
5253	Temp.,Skin FA, Sta. 16, -Y	3.8-64
5254	Temp.,Skin SEM, Sta. 57.5, +Z	3.8-64
5255	Temp.,Skin SEM, Sta. 63.5, +Y	3.8-64
5256	Temp.,Skin SEM, Sta. 57.5, -Z	3.8-64
5257	Temp.,Skin SEM, Sta. 63.5, -Y	3.8-65
5258	Temp.,Skin EA, Sta. -9.7, 335 Deg.	3.8-65
5259	Temp.,Skin EA, Sta. -9.7, 244 Deg.	3.8-65
5260	Temp.,Skin EA, Sta. -9.7, 117 Deg.	3.8-65
5261	Temp.,SEM Internal, +Y Side, CP Mounting Rail	3.8-65
5262	Temp.,SEM Internal, +Y Side, PM and C Mounting Rail	3.8-65
5263	Temp.,SEM Internal, -Y Side, 5 FPLL Aft Mounting Rail	3.8-65
5267	Primary T/U Current 1 & 2 (9)	3.2-141

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5269	Supply Motor Current (9)	3.2-141
5276	Cut/Seal 1 (9 & 5)	3.11-20
5277	Cut/Seal 1 (9 & 5)	3.11-20
5278	Cut/Seal 3 (9 TSRT)	3.11-20
5279	Tunnel Seal and Record Trap (9)	3.11-21
5280	Tunnel Seal and Record Trap (9)	3.11-21
5281	Splice/Cut (9)	3.11-22
5282	Splice/Cut (9)	3.11-22
5283	Cut/Seal 2 (9 & 5)	3.11-20
5284	Cut/Seal 2 (9 & 5)	3.11-20
5285	Aft Backup Cutter (9 & 5)	3.11-21
5286	Aft Backup Cutter (9 & 5)	3.11-21
5291	Recovery Battery 1, SRV 1	3.12-34
5292	Recovery Battery 2, SRV 1	3.12-34
5293	Recovery Battery 1, SRV 2	3.12-35
5294	Recovery Battery 2, SRV 2	3.12-35
5295	Recovery Batteries, SRV 1	3.12-35
5296	Recovery Batteries, SRV 2	3.12-35
5298	Take-up Warning (9 & 5), SRV 1	3.2-140
5301	Temp.,SEM Internal, -Y Side, IP Mounting Rail	3.8-66
5302	Temp.,SEM Internal, RSE/RAM-9	3.8-66
5303	Temp.,SEM Internal, Sta. 76	3.8-66
5305	Cut/Seal 3 (9 TSRT)	3.11-20

IMP	Title	Description Location(s)
5330	Temp., Telemetry Unit Section 1	3.8-66, 3.10-115
5331	Temp., Telemetry Unit Section 2	3.8-66, 3.10-115
5360	Blast Shield Valve	3.8-58, 3.12-39
5361	S1 Output	3.13-22
5362	PRG-1 Output	3.13-23
5363	PRG-2 Output	3.13-23
5375	Differential Temperature, Stereo Mirror Lower	3.3-18, 3.8-66
5376	Primary Film Tension 9	3.2-135
5377	Film Tension 5	3.2-137
5378	Supply Brake Current	3.2-142
5379	9 Camera Auto Off, 5 Camera Auto Off, Camera Auto Off, Altitude Select	3.2-135
5500	SRV 1, Arm 1	3.7-82, 3.12-38
5501	SRV 1, Arm 2	3.7-82, 3.12-38
5502	SRV 1, Trans., Thermal Battery 1	3.7-82, 3.12-38
5503	SRV 1, Trans., Thermal Battery 2	3.7-82, 3.12-39
5504	SRV 1, Trans., IFD No. 1,1	3.7-82, 3.12-39
5505	SRV 1, Trans., IFD No. 1,2	3.7-82, 3.12-39
5506	SRV 1, Sep. Spinoff Disc. No. 1,1	3.7-82, 3.12-41
5507	SRV 1, Sep. Spinoff Disc. No. 1,2	3.7-82, 3.12-41
5508	SRV 1 Sep. +Z 1	3.7-82, 3.12-40
5509	SRV 1 Sep. +Z 2	3.7-82, 3.12-40
5510	SRV 1 Sep. -Z 1	3.7-82, 3.12-40
5511	SRV 1 Sep. -Z 2	3.7-82, 3.12-40
5512	SRV 2 Sep. +Z 1	3.7-82, 3.12-40
5513	SRV 2 Sep. +Z 2	3.7-82, 3.12-41
5514	SRV 2 Sep. -Z 1	3.7-82, 3.12-41
5515	SRV 2 Sep. -Z 2	3.7-82, 3.12-41

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5516	Spinoff Disconnect No. 2 1	3.7-82, 3.12-42
5517	Spinoff Disconnect No. 2 2	3.7-82, 3.12-42
5518	EA Sep. 36°, 1	3.7-82, 3.12-43
5519	EA Sep. 36°, 2	3.7-82, 3.12-43
5520	EA Sep. 156°, 1	3.7-82, 3.12-43
5521	EA Sep. 156°, 2	3.7-82, 3.12-43
5522	EA Sep. 276°,1	3.7-82, 3.12-43
5523	EA Sep. 276°, 2	3.7-82, 3.12-43
5524	SRV 2, Arm 1	3.7-82, 3.12-38
5525	SRV 2, Arm 2	3.7-82, 3.12-38
5526	SRV 2, Trans., Thermal Battery 1	3.7-82, 3.12-39
5527	SRV 2, Trans., Thermal Battery 2	3.7-82, 3.12-39
5528	SRV 2 Trans., IFD No. 2,1	3.7-82, 3.12-39
5529	SRV 2 Trans., IFD No. 2,2	3.7-82, 3.12-39
5530	Aft Backup Cutter 1	3.7-82, 3.11-23
5531	Aft Backup Cutter 2	3.7-82, 3.11-23
5532	9 Splice/Cut 1	3.7-82, 3.11-23
5533	9 Splice/Cut 2	3.7-82, 3.11-24
5534	5 Splice/Cut 1	3.7-82, 3.11-23
5535	5 Splice/Cut 2	3.7-82, 3.11-23
5536	Cut/Seal No. 1,1	3.7-82, 3.11-22
5537	Cut/Seal No. 1,2	3.7-82, 3.11-22
5538	Cut/Seal No. 3,1	3.7-82, 3.11-23

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5539	Cut/Seal No. 3,2	3.7-82, 3.11-23
5540	TSRT 5,1	3.7-82, 3.11-23
5541	TSRT 5,2	3.7-82, 3.11-23
5542	TSRT 9,1	3.7-82, 3.11-23
5543	TSRT 9,2	3.7-82, 3.11-23
5544	Cut/Seal No. 4,1	3.7-82, 3.11-23
5545	Cut/Seal No. 4,2	3.7-82, 3.11-23
5546	Cut/Seal No. 2,1	3.7-82, 3.11-22
5547	Cut/Seal No. 2,2	3.7-82, 3.11-23
5548	Hatch Eject 1	3.5-29, 3.7-82
5549	Hatch Eject 2	3.5-29, 3.7-82
5550	Hatch Eject 3	3.5-29, 3.7-82
5551	Hatch Eject 4	3.5-30, 3.7-82
5552	Hatch Eject 5	3.5-30, 3.7-82
5553	Hatch Eject 6	3.5-30, 3.7-82
5554	Hatch Eject 7	3.5-30, 3.7-82
5555	Hatch Eject 8	3.5-30, 3.7-82
5556	Hatch Eject 9	3.5-30, 3.7-82
5557	Hatch Eject 10	3.5-30, 3.7-82
5558	Hatch Eject 11	3.5-30, 3.7-82
5559	Hatch Eject 12	3.5-30, 3.7-82
5560	Backup Motor Actuate 1	3.5-30, 3.7-82
5561	Backup Motor Actuate 2	3.5-30, 3.7-82

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5562	Viewport Door Blow 1	3.5-31, 3.7-82
5563	Viewport Door Blow 2	3.5-31, 3.7-82
5564	SRV 1 Sep. +Y	3.12-39
5565	SRV 1 Sep. -Y	3.12-40
5566	SRV 2 Sep. +Y	3.12-40
5567	SRV 2 Sep. -Y	3.12-40
5568	EA Sep. 276°, +5 volts dc	3.12-42
5569	EA Sep. 36°, +5 volts dc	3.12-42
5570	EA Sep. 156°, +5 volts dc	3.12-42
5571	EA Sep. 276°, +15 volts dc	3.12-42
5572	EA Sep. 36°, +15 volts dc	3.12-42
5573	EA Sep. 156°, +15 volts dc	3.12-43
5574	Spinoff Disconnect 1	3.12-41
5575	Spinoff Disconnect 2	3.12-41
5576	Arm/Continuity 1	3.7-82
5577	Environmental Branch 1 Voltage Monitor	3.7-77, 3.8-56, 3.12-44
5578	Environmental Branch 2 Voltage Monitor	3.7-77, 3.8-56
5580	Environmental Branch 4 Voltage Monitor	3.7-78, 3.8-56
5581	Environmental Branch 5 Voltage Monitor	3.7-78, 3.8-56
5582	Environmental Branch 6 Voltage Monitor	3.7-78, 3.8-56, 3.12-44
5583	EPSM 1 Voltage Monitor	3.7-78, 3.8-56, 3.12-44
5584	EPSM 2 Voltage Monitor	3.7-78, 3.8-56, 3.12-45
5585	Servo Voltage Monitor	3.4-28, 3.7-78

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5587	Hatch Eject +5 volts dc	3.5-28
5588	Hatch Eject +15 volts dc	3.5-28
5589	DTU 1 On/Off	3.7-78, 3.10-114
5590	DTU 2 On/Off	3.7-78, 3.10-114
5591	9 OP Voltage Monitor	3.2-141, 3.2-147, 3.7-78
5593	5 OP Voltage Monitor	3.2-141, 3.2-147, 3.7-79
5594	Focus Power Monitor +15 volts dc	3.6-34, 3.7-79
5595	Focus Power Monitor -15 volts dc	3.6-34, 3.7-79
5596	Focus Calibration Monitor +15 volts dc	3.6-34, 3.7-79
5597	Focus Calibration Monitor -15 volts dc	3.6-34, 3.7-79
5598	5 Film Velocity, Count 1	3.2-147
5599	5 Film Velocity, Count 2	3.2-147
5600	5 Film Velocity, Count 4	3.2-147
5601	5 Film Velocity, Count 8	3.2-147
5602	5 Film Velocity, Count 16	3.2-147
5603	5 Film Velocity, Count 32	3.2-147
5604	5 Film Velocity, Count 64	3.2-147
5605	5 Film Velocity, Count 128	3.2-147
5606	9 Film Velocity, Count 1	3.2-146
5607	9 Film Velocity, Count 2	3.2-146
5608	9 Film Velocity, Count 4	3.2-146
5609	9 Film Velocity, Count 8	3.2-146
5610	9 Film Velocity, Count 16	3.2-146

Approved for Release: 2017/02/14 C05097223

TABLE G-1 (CONT'D)

IMP	Title	Description Location(s)
5611	9 Film Velocity, Count 32	3.2-146
5612	9 Film Velocity, Count 64	3.2-147
5613	9 Film Velocity, Count 128	3.2-147
5614	Arm/Continuity, 2	3.7-82
5615	S1-PRG Power Monitor	3.7-79, 3.13-24
5616	5 Parking Brake Voltage Monitor	3.2-143, 3.7-79

Approved for Release: 2017/02/14 C05097223

This page intentionally blank

APPENDIX H   PPS/DP EAC COMMAND LIST

Table H-1 lists all commands that control PPS/DP EAC functions. The list is arranged to allow comparison of all commands of one command system type:

(1) Real Time Commands (RTCs)

(2) Normal Stored Program Commands (NSPCs)

(3) Protected Stored Program Commands (PSPCs)

(4) Variable Stored Program Commands (VSPCs)

The commands are listed according to subsystem (Extended Command Subsystem (ECS) or Minimal Command Subsystem (MCS)), by decoder (for ECS) and according to the numerical order of the octal command code. For cross-reference, the 4-digit code used in the PPS/DP EAC 9 x 5 Interconnection Book (BIF-008 drawing number 1418-235-2) is listed next to each corresponding octal command code.

An explanation of the octal command coding technique, and a detailed description of the function of each command is contained in BIF-008 specification 1402-570-2: PPS/DP EAC Operational Programming Guide (Block 52). A brief summary of the octal command coding is also presented in Part 3, Section 9 of this Handbook.

TABLE H-1

PPS/DP EAC COMMAND LIST

Extended Command Subsystem (ECS) Real Time Commands (R)

Decoder A		Decoder B		
Octal Code	PPS/DP EAC Code	Octal Code	PPS/DP EAC Code	Function
R02	9542	R01	9538	PPS/DP EAC SPARE
R12	9540	R11	9536	PPS/DP EAC SPARE
R22	9539	R21	9535	PPS/DP EAC SPARE
R52	9541	R51	9537	PPS/DP EAC SPARE

Minimal Command Subsystem (MCS) Real Time Commands (MR)

Octal Code	PPS/DP EAC Code	Function
MR 21	4272	DTU 1 ON
MR24	4271	DTU 2 ON
MR27		PPS/DP EAC SPARE

MCS Secure Word Real Time Commands (SWRTC)

Octal Code	PPS/DP EAC Code	Function
SWRTC 1	4265	MCS TERMINATION ENABLE 1
SWRTC 2	4266	MCS TERMINATION ENABLE 2

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

ECS Normal Stored Program Commands (N)

Decoder A Octal Code	Decoder A PPS/DP EAC Code	Decoder B Octal Code	Decoder B PPS/DP EAC Code	Both Decoders Octal Code	Function
NO2644	4175	NO1644	4176	NO3644	EPSM 1 OFF
NO2645	4310	NO1645	4308	NO3645	S1-PRG CALIBRATION ON
NO2646	4256	NO1646	4257	NO3646	EA SEPARATE
NO2647		NO1647		NO3647	PPS/DP EAC SPARE
NO2650		NO1650		NO3650	PPS/DP EAC SPARE
NO2651	4312	NO1651	4313	NO3651	5 PARKING BRAKE OFF
NO2652	4221	NO1652	4222	NO3652	9 ROLL-IN TERMINATE
NO2653	4293	NO1653	4291	NO3653	9/5 TAKE-UP ENABLE
NO2654	4302	NO1654	4303	NO3654	5 SRC DISABLE
NO2655	4171	NO1655	4172	NO3655	EPSM 2 ON
NO2656		NO1656		NO3656	PPS/DP EAC SPARE
NO2657	4259	NO1657	4260	NO3657	SRV 1 SEPARATE
NO2661	4153	NO1661	4154	NO3661	HEATER POWER AND 5 PARKING BRAKE ON
NO2662		NO1662		NO3662	PPS/DP EAC SPARE
NO2663	4297	NO1663	4295	NO3663	CP A SELECT
NO2665	4300	NO1665	4301	NO3665	9 SRC DISABLE
NO2666	4298	NO1666	4296	NO3666	CP B SELECT
NO2742	4166	NO1742	4167	NO3742	HEATER BRANCH 6 OFF
NO2743	4164	NO1743	4165	NO3743	HEATER BRANCH 5 OFF
NO2744	4311	NO1744	4309	NO3744	S1-PRG DISABLE
NO2745	4177	NO1745	4178	NO3745	EPSM 2 OFF
NO2746	4162	NO1746	4163	NO3746	HEATER BRANCH 4 OFF
NO2747	4169	NO1747	4170	NO3747	EPSM 1 ON
NO2750		NO1750		NO3750	PPS/DP EAC SPARE
NO2751	4158	NO1751	4159	NO3751	HEATER BRANCH 2 OFF
NO2752	4223	NO1752	4224	NO3752	5 ROLL-IN TERMINATE
NO2753	4325	NO1753	4324	NO3753	CAMERA AUTOMATIC OFF ENABLE
NO2754	4247	NO1754	4248	NO3754	SRV 1 TRANSFER
NO2755	4156	NO1755	4157	NO3755	HEATER BRANCH 1 OFF
NO2756		NO1756		NO3756	PPS/DP EAC SPARE
NO2757	4250	NO1757	4251	NO3757	SRV 2 TRANSFER

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

ECS Normal Stored Program Commands (N) (Cont'd)

Decoder A		Decoder B		Both Decoders	
Octal Code	PPS/DP EAC Code	Octal Code	PPS/DP EAC Code	Octal Code	Function
N12000	4262	N11000	4263	N13000	SRV 2 SEPARATE
N12001		N11001		N13001	PPS/DP EAC SPARE
N12002		N11002		N13002	PPS/DP EAC SPARE
N12003		N11003		N13003	PPS/DP EAC SPARE
N12015	4201	N11015	4202	N13015	5 NPA PRIME MODE SELECT
N12016	4199	N11016	4200	N13016	9 NPA B/U MODE SELECT
N12017	4197	N11017	4198	N13017	9 NPA PRIME MODE SELECT
N12020	4193	N11020	4194	N13020	5 PLATEN PLUS
N12021	4189	N11021	4190	N13021	5 PLATEN MINUS
N12022	4203	N11022	4204	N13022	5 NPA B/U MODE SELECT
N12023	4185	N11023	4186	N13023	9 PLATEN PLUS
N12024	4267	N11024	4268	N13024	5 PLATEN STOP
N12025	4181	N11025	4182	N13025	9 PLATEN MINUS
N12026	4269	N11026	4270	N13026	9 PLATEN STOP
N12027	4151	N11027	4152	N13027	5 SLIT B SELECT
N12030	4213	N11030	4214	N13030	9 FOCUS DRIVE INHIBIT
N12031	4149	N11031	4150	N13031	5 SLIT A SELECT
N12032	4217	N11032	4218	N13032	5 FOCUS DRIVE INHIBIT
N12033	4147	N11033	4148	N13033	9 SLIT B SELECT
N12034	4306	N11034	4304	N13034	9/5 FPLL HIGH SPEED RANGE
N12035	4145	N11035	4146	N13035	9 SLIT A SELECT
N12036	4307	N11036	4305	N13036	9/5 FPLL NORMAL SPEED RANGE
N12037	4014	N11037	4015	N13037	9 FPLL A SELECT
N12050	4026	N11050	4027	N13050	9 OP OFF
N12051	4016	N11051	4017	N13051	9 FPLL B SELECT
N12052	4018	N11052	4019	N13052	5 FPLL A SELECT
N12053	4020	N11053	4021	N13053	5 FPLL B SELECT
N12054	4022	N11054	4023	N13054	9 OP ON
N12055	4024	N11055	4025	N13055	5 OP ON
M12056	4028	N11056	4029	N13056	5 OP OFF

TABLE H-1 (CONT'D)

MCS Normal Stored Program Commands (MN)

Octal Code	PPS/DP EAC Code	Function
MN00111	4249	SRV 1 TRANSFER
MN00112	4261	SRV 2 SEPARATE
MN00114	4252	SRV 2 TRANSFER
MN00117	4264	SRV 2 SEPARATE
MN00121	4258	EA SEPARATE
MN00122	4009	9 OFF
MN00124	4013	5 OFF
MN00127	4108	DOOR CLOSE
MN00744		PPS/DP EAC SPARE
MN00750		PPS/DP EAC SPARE
MN00761		PPS/DP EAC SPARE
MN00762		PPS/DP EAC SPARE
MN00767		PPS/DP EAC SPARE
MN00773	4010	9/5 OFF
MN00776		PPS/DP EAC SPARE

TABLE H-1 (CONT'D)

ECS Protected Stored Program Commands (P)

Decoder A		Decoder B		Both Decoders	
Octal Code	PPS/DP EAC Code	Octal Code	PPS/DP EAC Code	Octal Code	Function
P02561	4323	P01561	4322	P03561	CAMERA AUTOMATIC OFF DISABLE
P02562		P01562		P03562	PPS/DP EAC SCS SHARED SPARE
P02564	4219	P01564	4220	P03564	5 FOCUS DRIVE ENABLE
P02570	4227	P01570	4228	P03570	HATCH EJECT
P02571	4241	P01571	4242	P03571	SRV 1 ARM
P02572	4235	P01572	4236	P03572	CUT AND SEAL 1
P02573	4233	P01573	4234	P03573	5 SPLICE AND CUT
P02574	4225	P01574	4226	P03574	VIEWPORT DOOR BLOW
P02575	4229	P01575	4230	P03575	VIEWPORT DOOR BACKUP
P02576	4319	P01576	4318	P03576	HIGH ALTITUDE SELECT
P02577	4238	P01577	4239	P03577	CUT AND SEAL 2
P02763	4253	P01763	4254	P03763	SPINOFF DISCONNECT 2
P02764	4244	P01764	4245	P03764	SRV 2 ARM
P02765	4321	P01765	4320	P03765	LOW ALTITUDE SELECT
P02766	4231	P01766	4232	P03766	9 SPLICE AND CUT
P02767	4215	P01767	4216	P03767	9 FOCUS DRIVE ENABLE

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

MCS Protected Stored Program Commands (MP)

Octal Code	PPS/DP EAC Code	Function
MP00024		PPS/DP EAC SPARE
MP00045	4237	CUT AND SEAL 1
MP00046	4002	9/5 RUNOUT ON
MP00051	4243	SRV 1 ARM
MP00052	4255	SPINOFF DISCONNECT 2
MP00061	4246	SRV 2 ARM
MP00062	4240	CUT AND SEAL 2
MP00076		PPS/DP EAC SPARE

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

ECS Variable Stored Program Commands (V)

Decoder A Octal* Code	Decoder A PPS/DP EAC Code	Decoder B Octal* Code	Decoder B PPS/DP EAC Code	Both Decoders Octal Code	Bit	Function
14V4bbWXYZ	4034	14V4bbWXYZ	4035		Implicit	9/5 SLIT OFF, 9/5 TAKE-UP INHIBIT
	4000		4001		25-1	9 FILM DRIVE, SRC, DATA TRACK AND INTERFRAME MARKERS ON
	4005		4006		25-0	9 FILM DRIVE, SRC, DATA TRACK AND INTERFRAME MARKERS OFF
	4003		4004		26-1	5 FILM DRIVE, SRC, DATA TRACK AND INTERFRAME MARKERS ON
	4011		4012		26-0	5 FILM DRIVE, SRC, DATA TRACK AND INTERFRAME MARKERS OFF
	4036		4038		27-1	STEREO ANGLE STORED (MSB)
	4037		4039		27-0	STEREO ANGLE STORED (MSB)
	4040		4042		28-1	STEREO ANGLE STORED (LSB)
	4041		4043		28-0	STEREO ANGLE STORED (LSB)
	4064		4066		29-1	FILM DRIVE SPEED (LSB)
	4065		4067		29-0	FILM DRIVE SPEED (LSB)
	4068		4070		30-1	FILM DRIVE SPEED
	4069		4071		30-0	FILM DRIVE SPEED
	4072		4074		31-1	FILM DRIVE SPEED
	4073		4075		31-0	FILM DRIVE SPEED
	4076		4078		32-1	FILM DRIVE SPEED
	4077		4079		32-0	FILM DRIVE SPEED
	4080		4082		33-1	FILM DRIVE SPEED
	4081		4083		33-0	FILM DRIVE SPEED
	4084		4086		34-1	FILM DRIVE SPEED
	4085		4087		34-0	FILM DRIVE SPEED
	4088		4090		35-1	FILM DRIVE SPEED; SRC (LSB)
	4089		4091		35-0	FILM DRIVE SPEED; SRC (LSB)
	4092		4094		36-1	FILM DRIVE SPEED; SRC
	4093		4095		36-0	FILM DRIVE SPEED; SRC
	4096		4098		37-1	FILM DRIVE SPEED; SRC
	4097		4099		37-0	FILM DRIVE SPEED; SRC
	4100		4102		38-1	FILM DRIVE SPEED (MSB); SRC (MSB)
	4101		4103		38-0	FILM DRIVE SPEED (MSB); SRC (MSB)

*Letters in the octal code represent the variable bits of the command word (reference Part 3, Section 9).

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

ECS Variable Stored Program Commands (V) (Cont'd)

Decoder A Octal Code	Decoder A PPS/DP EAC Code	Decoder B Octal Code	Decoder B PPS/DP EAC Code	Both Decoders Octal Code	Bit	Function
13V2bWXYZ	4007	13V2bWXYZ	4008		Implicit	9/5 FILM DRIVES, SRC, DATA TRACKS and INTERFRAME MARKERS OFF, CRAB ANGLE EXECUTE, STEREO ANGLE EXECUTE
					26-1	NO FUNCTION IN PPS/DP EAC
					26-0	NO FUNCTION IN PPS/DP EAC
	4044		4046		27-1	CRAB ANGLE (LSB)
	4045		4047		27-0	CRAB ANGLE (LSB)
	4048		4050		28-1	CRAB ANGLE
	4049		4051		28-0	CRAB ANGLE
	4052		4054		29-1	CRAB ANGLE
	4053		4055		29-0	CRAB ANGLE
	4056		4058		30-1	CRAB ANGLE (MSB)
	4057		4059		30-0	CRAB ANGLE (MSB)
	4060		4062		31-1	CRAB POLARITY PLUS
	4061		4063		31-0	CRAB POLARITY MINUS
					32-1	NO FUNCTION IN PPS/DP EAC
					32-0	NO FUNCTION IN PPS/DP EAC
					33-1	NO FUNCTION IN PPS/DP EAC
					33-0	NO FUNCTION IN PPS/DP EAC
					34-1	NO FUNCTION IN PPS/DP EAC
					34-0	NO FUNCTION IN PPS/DP EAC
					35-1	NO FUNCTION IN PPS/DP EAC
					35-0	NO FUNCTION IN PPS/DP EAC
					36-1	NO FUNCTION IN PPS/DP EAC
					36-0	NO FUNCTION IN PPS/DP EAC
					37-1	NO FUNCTION IN PPS/DP EAC
					37-0	NO FUNCTION IN PPS/DP EAC
					38-1	NO FUNCTION IN PPS/DP EAC
					38-0	NO FUNCTION IN PPS/DP EAC

TABLE H-1 (CONT'D)

ECS Variable Stored Program Commands (V) (Cont'd)

Decoder A		Decoder B		Both Decoders		
Octal Code	PPS/DP EAC Code	Octal Code	PPS/DP EAC Code	Octal Code	Bit	Function
10V06bXYZ		10V06bXYZ			Implicit	NO IMPLICIT AVAILABLE
	4279		4280		29-1	DTU 1 ON
	4277		4278		29-0	DTU 1 OFF
	4283		4284		30-1	DTU 2 ON
	4281		4282		30-0	DTU 2 OFF
					31-1	NO FUNCTION IN PPS/DP EAC
					31-0	NO FUNCTION IN PPS/DP EAC
					32-1	NO FUNCTION IN PPS/DP EAC
					32-0	NO FUNCTION IN PPS/DP EAC
					33-1	NO FUNCTION IN PPS/DP EAC
					33-0	NO FUNCTION IN PPS/DP EAC
					34-1	NO FUNCTION IN PPS/DP EAC
					34-0	NO FUNCTION IN PPS/DP EAC
					35-1	NO FUNCTION IN PPS/DP EAC
					35-0	NO FUNCTION IN PPS/DP EAC
					36-1	NO FUNCTION IN PPS/DP EAC
					36-0	NO FUNCTION IN PPS/DP EAC
					37-1	NO FUNCTION IN PPS/DP EAC
					37-0	NO FUNCTION IN PPS/DP EAC
					38-1	NO FUNCTION IN PPS/DP EAC
					38-0	NO FUNCTION IN PPS/DP EAC
4V0272bZ	4109	4V0172bZ	4110	4V0372bZ	Implicit	9 SLIT ON
	4111		4113		35-1	9 SLIT POSITION (LSB)
	4112		4114		35-0	9 SLIT POSITION (LSB)
	4115		4117		36-1	9 SLIT POSITION
	4116		4118		36-0	9 SLIT POSITION
	4119		4121		37-1	9 SLIT POSITION
	4120		4122		37-0	9 SLIT POSITION
	4123		4125		38-1	9 SLIT POSITION (MSB)
	4124		4126		38-0	9 SLIT POSITION (MSB)

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

ECS Variable Stored Program Commands (V) Cont'd)

Decoder A Octal Code	Decoder A PPS/DP EAC Code	Decoder B Octal Code	Decoder B PPS/DP EAC Code	Both Decoders Octal Code	Bit	Function
4V0262bZ	4127	4V0162bZ	4128	4V0362bZ	Implicit	5 SLIT ON
	4129		4131		35-1	5 SLIT POSITION (LSB)
	4130		4132		35-0	5 SLIT POSITION (LSB)
	4133		4135		36-1	5 SLIT POSITION
	4134		4136		36-0	5 SLIT POSITION
	4137		4139		37-1	5 SLIT POSITION
	4138		4140		37-0	5 SLIT POSITION
	4141		4143		38-1	5 SLIT POSITION (MSB)
	4142		4144		38-0	5 SLIT POSITION (MSB)
4V0252bZ		4V0152bZ		4V0352bZ	Implicit	SPARE
	4030		4031		35-1	FEP ON, S1-PRG ENABLE, S1-PRG POWER ON
	4032		4033		35-0	FEP OFF, S1-PRG POWER OFF
	4104		4105		36-1	VIEWPORT DOOR OPEN
	4106		4107		36-0	VIEWPORT DOOR CLOSE
	4211		4212		37-1	FOCUS CALIBRATE
	4209		4210		37-0	FOCUS CALIBRATE
	4207		4208		38-1	FOCUS CALIBRATE
	4205		4206		38-0	FOCUS CALIBRATE

Approved for Release: 2017/02/14 C05097223

TABLE H-1 (CONT'D)

MCS Variable Stored Program Commands (MV)

Octal Code	PPS/DP EAC Code	Bit	Function
M6V002YZ		Implicit	SPARE
	4274	33-1	DTU 1 ON
	4273	33-0	DTU 1 OFF
	4276	34-1	DTU 2 ON
	4275	34-0	DTU 2 OFF
	4155	35-1	HEATER BRANCHES 1,2,4,5 AND 6, AND 5 PARKING BRAKE ON
	4168	35-0	HEATER BRANCHES 1,2,4,5, AND 6, AND 5 PARKING BRAKE OFF
	4173	36-1	EPSM 1 ON
	4179	36-0	EPSM 1 OFF
	4174	37-1	EPSM 2 ON
	4180	37-0	EPSM 2 OFF
		38-1	SPARE
		38-0	SPARE

Umbilical Commands

PPS/DP EAC Code	Function
8003	LAUNCH PRESET
8005	DTU OFF

APPENDIX J GLOSSARY

Not all terms listed are used in the Photographic System Reference Handbook, but may be encountered in other Gambit-related documentation.

ABS	Absolute platen position
ABUC	Aft backup cutter
ac	Alternating current
A/D	Analog-to-digital
AEI	Aerial exposure index
AF	Air Force Analog flag
AFS	Aerial film speed
AGE	Aerospace ground equipment
A/H	Ampere-hour
AHM	Ampere-hour meter
AHU	Anti-halation undercoat
AIM	Aerial image modulation
amp	Ampere
AMP	Amplifier
AMT	Auxiliary master tape
AMU	Analog multiplexer unit
AOES	Advanced orbital ephemeris system
APR	All points report

ARE	Analog recording equipment
ASE	Aerospace support equipment
ASSY	Assembly
ATC	Air target chart
ATR	Acoustic test results
B&W	Black and white
BDC	Bottom dead center
BEF	Best electrical focus
BFE	Best fit ephemeris
BHC	Buffer hold comparator
BIL	Umbilical monitoring point
BOSS	New Boston, New Hampshire tracking station
BPF	Best photographic focus
BPI	Band of peak information
BTU	British thermal unit
B/U	Backup
BUSS	Backup stabilization system
C	Contrast Capacitance
CAO	Camera automatic off
CAS	Command assembly subsystem
CBM	Command bit monitor
CCMI	Chronological command memory image
CCN	Contract change notice
CDFR	Continuous defocus record

CDOL	Constant door open light side
CEA	Camera electronics assembly
cg, CG	Center of gravity
CHAN	Channel
CIU	Command input unit
C/L	Continuity loop
C/O	Checkout
COA	Camera optics assembly
COM	Camera optics module
COOK	Vandenberg Air Force Base, California tracking station
CORN	Controlled range network
CP	Command processor
cpmm	Cycles per millimeter
CPTA	Command processor test adapter
CRP	Combined record path (combined film path)
CRT	Cathode ray tube
C/S	Cutter/sealer
CU	Converter unit
CUETS	Common use electrical test set
c/v	Current-to-voltage
D/A	Digital-to-analog
DACS	Dual attitude control system
dc	Direct current

DCA	Data channel address
DCM	Data cycle memory
DCS	Dynamic compare summary
DDRTS	Dual drum recorder test set (Camera Test Set)
deg	Degree
deg/sec	Degree per second
Dev	Deviation
DF	Discrete flag
DFR	Defocus record
DFUM	Dual forward unit module (see DRM)
dia	Diameter
DISP	Displacement
DMM	Digital multimeter
DMU	Discrete multiplexer unit
DOD	Door open dark side
DOL	Door open light side
DPM	Drum platform module (see COM)
DR	Drum recorder (Camera)
DRAO	Drum recorder automatic off (see CAO)
DREA	Drum recorder electronics assembly (see CEA)
DRM	Dual recovery module
DTU	Digital telemetry unit
DTV	Developmental test vehicle
DVM	Digital voltmeter
DVMS	Digital velocity measuring sensor

E	Wire termination	Exposure
EA	Ejectable adapter	
EAC	Extended altitude capability	
EBC	Emulated buffer computer	
EBRT	Emulated buffer recording tape	
EBTT	Emulated buffer transmission tape	
ECCT	Extended cycle confidence test	
ECL	Executed command list	
ECS	Extended command subsystem	
EED	Electro-explosive device	
EEE	End-to-end electronics	
EFL	Effective focal length	
EGS	Events generator subsystem	
ELEC	Electrical	
EMI	Electromagnetic interference	
EPSM	Environmental power, SRV minimum	
F	Focal length	Degrees Fahrenheit
FA	Fixed adapter	
FAM	Focus adjust mechanism	
FAN	Field activity, North	
FAS	Field activity, South	
FCE	Film control electronics	
FD+	Film drive ON	

FD-	Film drive OFF
FDS	Film-drive speed Focus detection subsystem
FEO	Field engineering operations Field engineering office
FEP	Focus electronics power
FFER	Final Flight Evaluation Report
FHE	Film handling electronics
FL	Filter
FM	Flight model Frequency modulation
FPLL	Frequency phase lock loop
FPLLE	Frequency phase lock loop electronics
FRADS	Failure reporting analysis summarization
FSE	Film supply enclosure
FSTE	Field system test equipment (see RECAL) (GE RESD supplied)
ft	Foot
FT	Fourier transform
FTF	Field test force
FTFD	Field test force director
fwd	Forward
FU	Forward Unit (see SRV)
FUTE	Forward unit test equipment (see RECAL)
FVTE	Flight validation test equipment
G^3	Gambit-Cubed
GCT	Gain calibration and test (Focus Calibration and Test)
GE AESD	General Electric Aerospace Electronics Systems Division
GE RESD	General Electric Reentry and Environmental Systems Division

GEL	Gelatin
GFE	Government furnished equipment
GM	Geometric mean
GMR	Geometric mean reflectance
GMT	Greenwich Mean Time
GRD	Ground resolved distance
GSS	General System Specification
GUAM	Guam tracking station
GWC	Global Weather Central
H&D	Hurter and Driffield (Originators of film response curve)
hg	Mercury
HIM	High current instrumentation module
HOP	Height of perigee
HR	High resolution
HRM	High current resistor module
HSAM	High speed address memory
HULA	Hawaii tracking station
Hz	Hertz (cycles per second)
IBS	Improved blast shield
ID	Telemetry identification
IEU	Initiator electronics unit
I/F	Interframe Interface

IFD	In-flight disconnect
IM	Instruction memory
IMC	Image motion compensation
IMP	Instrumentation monitoring point
in.	Inch
INDI	Seychelles Islands, Indian Ocean tracking station
INST	Instrumentation
IP	Instrumentation processor
ips	Inches per second
IR	Infrared
ISPS	Integrated secondary propulsion system
ITSOE	Integrated test schedule of events
J	Jack (female connector)
L	Launch
lb	Pound
LDE	L room data engineer
LED	Light emitting diode
LIM	Low current instrumentation module
LMSC	Lockheed Missiles and Space Company
LOS	Line of sight
lpmm	Lines per millimeter
LRM	Low current resistor module
LSB	Least significant bit

m	Meter
M	Exposure modifier Modulation
MAB	Missile assembly building
MABA	Maximum access booster adapter
MAS	Mission analysis subsystem
MCD	Mission correlation data
mcs	Meter-candle-second
MCS	Minimal command subsystem
MCU	Minimal command unit
MDTU	Master digital telemetry unit
MECH	Mechanical
MHD	Mission history data
MIL-STD	Military Standard
μm	Micrometer
μrad/sec	Microradians per second
MLI	Multilayer insulation blanket
mm	Millimeter
MR	Mean reflectance
MRS	Mission requirements subsystem
MSA	Mission simulation and analysis
MSB	Most significant bit
MSM	Motor subsystem module
MST	Mobile service tower
MTF	Modulation transfer function

mtr	Motor
MUX	Multiplexer
MVC	Minimal voltage converter
NC	No connection
NIIRS	National Imagery Interpretability Rating Scale
nm	Nanometer
nmi	Nautical miles
nmi/sec	Nautical miles per second
NPA	Nominal platen adjust
NRZ	Non-return to zero
NRZL	Non-return to zero level
NSPC	Normal stored program command
OA	Orbit adjust
OCS	Orbit coordinate system
OCTOPUS	Operational Programming Guide
OHBCP	Orbital heat balance computer program
OHSS	Operational Hardware Software Specification
OP	Operational power Orbit plans
OPD	Optical path difference
OQF	Optical quality factor
oz	Ounce

P	Plug (male connector)
PADE	Pad automatic data evaluation
PAM	Pulse amplitude modulation
PAS	Payload adapter section ("roll joint")
PATS	Payload acceptance test structure
PCM	Pulse code modulation
PET	Performance evaluation team
PFER	Preliminary Flight Evaluation Report
PI	Photo interpreter
PLTE	Programmable logic test equipment Payload test equipment
PM&C	Power monitor and control unit
PMU	Programmable memory unit
P/O	Part of
POGO	Thule Air Force Base, Greenland tracking station
Pot	Potentiometer
PPS	Photographic payload section
PPS/DP EAC	Photographic payload section/dual platen, extended altitude capability
PRG	Platen reference gauge
PRL	Project requirement list
PROP	Proportional
PRS	Primary recording system (9 film-drive system)
PSA	Power spectrum analysis
PSD	Power spectral density

psid	Pounds per square inch differential
PSPC	Protected stored program command
PSRH	Photographic System Reference Handbook
PSV	Photographic satellite vehicle
Pwr	Power
Pyro	Pyrotechnic device
QC	Quality Control
QTY	Quantity
RAM	Record attach mechanism (see S/C)
R&D	Research and Development
RC	Resistance/capacitance
RCE	Record control electronics (see FCE)
RCFLA	Ross corrector and field lens assembly
RECAL	Remote electrical checkout via air link (backup for FSTE)
REF	Reference
RF	Radio Frequency
RH	Relative humidity
RHE	Record handling electronics (see FHE)
RMS	Root-mean-square
rpm	Revolutions per minute
RSS	Root-sum-square
R_T	Spectral reflectance
RTB	Real-time bias

RTC	Real-time command
RTS	Remote tracking station
RV	Recovery vehicle
S	Separation
SA	Solar altitude Sun angle
SAFSP	Secretary of the Air Force for Special Projects
[redacted]	
S/C	Splicer/cutter
SCF	Satellite control facility
SLC4-W	Space launch complex 4-West
SCS	Satellite control section
SEM	Supply and electronics module
SEPE	Sensor encoder and processing electronics
SES	Supply electronics structure
SFO	Secondary flight objective
SGLS	Space ground link system
SLOP	Sunlight on primary
SLOS	Sunlight on stereo
SMTF	Smear modulation transfer function
SOC	Satellite operations center
SP	Special projects
SPC	Stored program command
spc	Serial pulse code

25X1

SQ	Squib (see pyro)
SRC	Slant range compensation
SRS	Secondary recording system (5 film-drive system)
SRTC	Secure real-time command
SRV	Satellite reentry vehicle
SST	System support tape
Sta	Station
[redacted]	
Std	Standard
SWRTC	Secure word real-time command
T	Transmittance
TA	Technical advisor
T_A	Atmospheric transmission
T/A	Thermal altitude
TB	Terminal board
T/C	Thrust cone
TLC	Telemetry limits compare
TM	Threshold modulation
T/M	Target mode
TMSIM	Telemetry simulate function
TMV	Telemetry volts
tol	Tolerance

25X1

TOO	Test operations order
TPS	Telemetry predict subsystem
TR	Target/requirements
TRW	TRW, Incorporated
TS	Timing signal
TSP	Test point
TSRT	Tunnel seal and record trap
TT&C	Telemetry, tracking and command
T/U	Take-up
TV	Travel viewer
TYP	Typical
UHF	Ultra-high frequency
ULE	Ultra-low expansion
USAF	United States Air Force
UUT	Unit under test
V	Volts
VAFB	Vandenberg Air Force Base
VCM	Voltage controlled multivibrator
VE	Viewport door electronics
VEM	Variable exposure mechanism
VPD	Viewport door
VSB	Vehicle service building
VSPC	Variable stored program command

WAC	World Aeronautical Chart
WCEO	West Coast Engineering Office
ZULU	see GMT

APPENDIX K PYROTECHNICS

The PPS/DP EAC contains 118 pyrotechnic devices (pyros). SRV 1 and SRV 2 each contain 35 pyros, for a total of 70 pyros. There are 8 pyros in the EA and 18 pyros in the FA. The remaining pyros are in the SEM and COM which have 6 and 16, respectively. These pyrotechnic devices are used to perform single events (irreversible functions requiring high reliability). Pyro related power, commands, and instrumentation are discussed in portions of: Part 3, Sections 1, 5, 7, 11, and 12; Part 4, Sections 1, 2, and 4; and Appendices A, B, D, G, and H.

K.1 Pyro Part and Mechanical Data

Table K-1 lists all PPS/DP EAC pyrotechnic devices and contains part and mechanical data. The Pyro Device Number column runs consecutively from 1 to 116 with 2 additional pyros designated 29A and 71A. Generally, the Pyro Device Numbers increase corresponding to pyro location in the BIF-008 +X coordinate direction with Number 1 being in SRV 1. The exception is that Numbers 115 and 116 are found in the FA. The Pyro Device Number nomenclature is used in 1426-155-2, "Range Safety and Performance Report" for the PPS/DP EAC. The Pyro Description column lists pyro names as found in 1418-235, "Interconnection Diagram 9x5". Each pyro activated by an IEU command is listed in this column. All other pyros whose activation is controlled by an SRV are not listed in the Pyro Description column. Interstate Commerce Commission (ICC) class in the Hazard Potential and ICC Class column refers to class of explosives. These are described in its publication, "Dangerous Properties of Industrial Material", which is Tariff Number 10 of the ICC Bureau of Explosives, or Public Law 772. The three classes of explosives are as follows:

(1) Class A - Explosives which can be caused to deflagrate by contact with sparks or flame such as produced by a safety fuse or an electric squib.

(2) Class B - Explosives which in general function by rapid combustion rather than detonation.

(3) Class C - Articles which contain Class A or Class B explosives, or both, as components but in restricted quantities.

PPS/DP EAC pyros are Class B, Class C, or do not fit into any class. There are no Class A PPS/DP EAC pyros.

K.2 Pyro Electrical Data

Table K-2 lists all PPS/DP EAC pyros which are activated by electrically heated, low resistance bridgewires. Activation of pyros by an embedded bridgewire is a current-time dependent function. These values are based on statistical samples in which at least 99.9% of the batch performs according to the no-fire values. The no-fire value is the maximum current which does not fire a pyro in a specific time period. The all-fire value is the minumum current required to fire a pyro in a specific time period. Pyros 5, 6, and 13-16 are percussion type pyros which are mechanically activated. Pyros 30 and 72 are activated by pyros 29, 29A, 71, and 71A, respectively. Therefore, Table K-2 Bridgewire, No-Fire, and All-Fire columns are not applicable to Pyros 5, 6, 13-16, 30, and 72. Table K-3 contains a listing of applicable initiator system-related documents.

TABLE K-1

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
1, 2 (43, 44)	33A301A1SQ1/2 33A301A2SQ1/2 (23A301A1SQ1/2 23A301A2SQ1/2)	Recovery Batteries Activate	Pyro action drives piston which forces electrolyte into cells
3, 4 (45, 46)		Recovery Battery Vent	Pyro activation opens valve to vent activator gases of pyros 1-4 (43-46)
5, 6 (47, 48)		Main Chute Release	Pyro action causes blades to cut main chute release line; has 10 second delay
7, 8 (49, 50)	33A500SQ1/2 (23A500SQ1/2)	Film Cut and Seal 1 (2)	Pyro action forces small concave metal diaphragms to convex positions releasing cut and seal mechanism
9-12 (51-54)		Parachute Thermal Cover Eject	Pyro action forces pistons upwards to eject parachute thermal cover

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
1, 2 (43, 44)	Ammonium Perchlorate/Poly Butadine Acrylic Acid "PBAA"	280 mg	Non-hazardous, C
3, 4 (45, 46)	KDNBF	10 mg	Non-hazardous, C
5, 6 (47, 48)	Percussion Cap - First-Fire, Ferric Oxide, Zirconium Oxide Delay - Zirconium/Nickel, Barium Chromate, Potassium Perchlorate Cerium Oxide Output - Lead Azide Boron/Potassium Nitrate	100 mg	Non-hazardous as packed, C
7, 8 (49, 50)	LMNR Black Powder	30 mg	Inadvertent cutter actuation could cause major injury, C
9-12 (51-54)	Initiator - SOS Formula 108 Metal Oxident Main Charge - Hi-Temp. Class 4 Black Powder	117 mg 75 mg 1.5 mg	Inadvertent piston ejection could cause major injury, C

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
13 - 16 (55 - 58)		Main Chute Open	Pyro action causes blades to cut main chute open line, has 4 second delay
17, 18 (59,60)		Nose Cone In-flight Electrical Disconnect from Thrust Cone	Pyro action blows the disconnect mechanism and the female connector away from the male connector by shearing 2 shear pins
19 - 22 (61 - 64)		Nose Cone Separation from Thrust Cone	Pyro action causes blades to cut cables, releasing nose cone from thrust cone
23 - 26 (65 - 68)	33A104SQ1/2 33A105SQ1/2 (23A104SQ1/2 23A105SQ1/2)	Thermal Batteries Activate	Heat of pyro operation melts previously solid electrolyte

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
13 - 16 (55 - 58)	Percussion Cap - First-Fire, Ferric Oxide, Zirconium and Zirconium Oxide	100 mg	Non-hazardous as packed, C
	Delay - Zirconium/Nickel, Barium Chromate, Potassium Perchlorate, Cerium Oxide	800 mg	
	Output - Lead Azide, Boron/Potassium Nitrate	25 mg	
17, 18 (59, 60)	Primer Holex #1 Main Charge - Hercules Bullseye Powder	65 mg 115 mg	Inadvertent actuation could cause injury, C
19 - 22 (61 - 64)	Zirconium/Potassium Perchlorate Hercules Hi-Temp.	70 mg 30 mg	Non-hazardous as packed, C
23 - 26 (65 - 68)	Lead Mononitro Resourcinate, Potassium Chlorate Nitrocotton in Isoamylacetate	65 ±2 mg	Non-hazardous

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
27, 28 (69,70)	SQ15A/B (SQ10A/B)	SRV In-Flight Electrical Disconnect from Adapter	Pyro action blows the disconnect mechanism and the female connector away from the male connector by shearing 2 shear pins
29, 29A (71, 71A)		Retro-rocket Ignition, "Igniter"	Flames ignite retro-rocket which surrounds igniter
30 (72)		Re-entry Initiation, "Retro-rocket"	Force of rocket firing slows down SRV so that its motion changes from orbital to ballistic
31,32 (73,74)		Spin Initiation	Pyro action ruptures valve insert to open spin gas path
33,34 (75,76)		Despin Initiation	Pyro action ruptures valve insert to open despin gas path

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SRV 1 (SRV 2)

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
27, 28 (69, 70)	Primer - Holex #1 Lead Styphate Spot Delay Charge - MIL-C-13738 Main Charge - Hercules Bullseye Powder Holex #1	25 mg 375 mg 140 mg 65 mg	Inadvertent actuation could cause injury, C
29, 29A (71, 71A)	2 DuPont S-94 Squibs, Boron Pellets and Potassium Nitrate Oxidizer	25.5 g	Inadvertent ignition could cause major injury, B
30 (72)	Aluminized Composite of Polyurethane Binder and Ammonium Perchlorate Oxidizer	40 lb	Inadvertent ignition could cause fatal injury, a jet thrust unit, B
31, 32 (73, 74)	Lead Styphate Spot Zirconium/ Potassium Perchlorate Hercules Hi-Temp.	50 mg 100 mg	Inadvertent actuation could cause injury, C
33, 34 (75, 76)	Lead Styphate Spot Zirconium/ Potassium Perchlorate Hercules Hi-Temp.	50 mg 100 mg	Inadvertent actuation could cause injury, C

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

EJECTABLE ADAPTER

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
35 - 38	SQ13A/B SQ14A/B	SRV 1 Separation from Ejectable Adapter	Pyro action forces piston-pins out of clevis engagement
39,40	SQ11A/B	Ejectable Adapter Electrical Disconnect from Fixed Adapter	Pyro action rotates female part of electrical connector out of engagement with male part
41,42	SQ12A/B	Ejectable Adapter Electrical Disconnect from Fixed Adapter	Pyro action rotates female part of electrical connector out of engagement with male part

NOTE: The SRV 1 In-Flight Electrical Disconnect, Pyros 27 and 28, is part of the ejectable adapter but is included under the SRV 1 listing because it mates with SRV 1.

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

EJECTABLE ADAPTER

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
35 - 38	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
39, 40	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
41, 42	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

FIXED ADAPTER

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
77 - 82	SQ4A/B SQ5A/B SQ6A/B	Ejectable Adapter Separation from Fixed Adapter	Pyro action forces piston-pins out of clevis engagement
83 - 86	SQ8A/B SQ9A/B	SRV 2 Separation from Fixed Adapter	Pyro action forces piston-pins out of clevis engagement
87, 88	35SQ1/2	Film Cut and Seal #3	Pyro action forces small concave metal diaphragms to convex positions, releasing cut and seal mechanism
89, 90	36SQ1/2	9" Tunnel Seal and Record Trap	Pyro action forces small concave metal diaphragms to convex positions, releasing seal and trap mechanism
91, 92	50SQ1/2	5" Tunnel Seal and Record Trap	Pyro action forces small concave metal diaphragms to convex positions, releasing seal and trap mechanism
115, 116	48SQ1/2	Film Cut and Seal #4	Pyro action forces small concave metal diaphragms to convex positions, releasing cut and seal mechanism

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

FIXED ADAPTER

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
77 - 82	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
83 - 86	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
87, 88	LMNR Black Powder	30 mg	Inadvertent cutter actuation could cause major injury, C
89, 90	LMNR Black Powder	30 mg	Inadvertent sealing actuation could cause injury, C
91, 92	LMNR Black Powder	30 mg	Inadvertent sealing actuation could cause injury, C
115, 116	LMNR Black Powder	30 mg	Inadvertent sealing actuation could cause injury, C

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

FIXED ADAPTER

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation

NOTE: The 2 spinoffs, Pyros 39 - 42, and the SRV 2 in-flight disconnect, Pyros 69 and 70, are parts of the fixed adapter but are included under the ejectable adapter and SRV 2 listings respectively because they mate with the ejectable adapter and SRV 2.

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SEM

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
93, 94	37SQ1/2	ABUC Film Cut and Seal	Pyro action forces small concave metal diaphragms to convex positions, releasing cut and seal mechanism
95, 96	34SQ1/2	9" Film Splice and Cut	Pyro action forces small concave metal diaphragms to convex positions, releasing splicing mechanism
97, 98	49SQ1/2	5" Film Splice and Cut	Pyro action forces small concave metal diaphragms to convex positions, releasing splicing mechanism

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

SEM

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
93, 94	LMNR Black Powder	30 mg	Inadvertent cutter actuation could cause major injury, C
95, 96	LMNR Black Powder	30 mg	Inadvertent splicer actuation could cause major injury, C
97, 98	LMNR Black Powder	30 mg	Inadvertent splicer actuation could cause major injury, C

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

COM

Pyro Device Number	Pyro Description	Function	Effect of Pyro Activation
99, 100	SQ22A/B	Viewport Door Switchover	Pyro action forces piston-pin out of engagement, transferring door opening and closing functions to redundant motor
101, 102	SQ23A/B	Viewport Door Blow	Pyro action forces piston-pin out of engagement, allowing spring-loaded actuators to open doors
103 - 114	SQ16A/B SQ17A/B SQ18A/B SQ19A/B SQ20A/B SQ21A/B	Hatch Effect	Pyro action forces piston-pins out of ring-bolt engagement

Approved for Release: 2017/02/14 C05097223

TABLE K-1 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE PART AND MECHANICAL DATA

COM

Pyro Device Number	Type of Charge	Quantity of Charge per Device	Hazard Potential and ICC Class
99, 100	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
101, 102	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent actuation could cause injury, C
103 - 114	Hercules Bullseye Powder or Equivalent	65 ± 2 mg	Inadvertent ejection could cause injury, C

TABLE K-2

PPS/DP EAC PYROTECHNIC DEVICE ELECTRICAL DATA AND NOTES

SRV 1 (SRV 2)

Pyro Device Number	Bridgewire Resistance (Ohms)	No-Fire (Amperes, Minutes	All-Fire (Amperes, Milliseconds)	Notes
1, 2 (43, 44)	1.50 - 1.80	1.0, 5.0	3.5, 50	2 battery assemblies each have an activation pyro which has two separately connected redundant bridgewires
3,4 (45, 46)	1.6 - 2.0	0.1, 5.0	1.0, 10.0	Each battery assembly has a vent valve whose squib is connected, internal to the battery, across 6 cells of the battery
5, 6 (47, 48)	Not Applicable	Not Applicable	Not Applicable	Bagline cutter actuated by mechanical percussion cap
7, 8 (49, 50)	0.10 - 0.50	0.5, 0.5	2.0, 10	Separately connected redundant squibs
9 - 12 (51 - 54)	0.65 - 0.85	0.5, 0.5	2.0, 15	Redundant bridgewires in each squib
13 - 16 (55 - 58)	Not Applicable	Not Applicable	Not Applicable	Reefing line cutter actuated by mechanical percussion cap

Approved for Release: 2017/02/14 C05097223

TABLE K-2 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE ELECTRICAL DATA AND NOTES

SRV 1 (SRV 2)

Pyro Device Number	Bridgewire Resistance (Ohms)	No-Fire (Amperes, Minutes)	All-Fire (Amperes, Milliseconds)	Notes
17, 18 (59, 60)	0.70 - 0.80	0.5, 3.0	2.5, 50	Separately connected redundant squibs
19 - 22 (61 - 64)	0.57 - 0.73	0.5, 0.5	1.5,100	Separately connected redundant squibs in each guillotine assembly
23 - 26 (65 - 68)	0.45 - 0.65	0.25, 2.0	2.0, 50	Each battery has 2 separately connected redundant squibs
27, 28 (69, 70)	0.65 - 0.85	0.5, 3.0	2.0, 50	Separately connected redundant squibs
29, 29A (71, 71A)	0.50 - 1.15	0.5, 2.0	2.0, 40	Separately connected redundant squibs within igniter
30 (72)	Not Applicable	Not Applicable	Not Applicable	Retro-rocket actuated by igniter
31 - 34 (73 - 76)	0.85 - 1.15	1.0, 5.0	3.5, 50	Each cartridge has a single bridgewire

Approved for Release: 2017/02/14 C05097223

TABLE K-2 (Cont'd.)

PPS/DP EAC PYROTECHNIC DEVICE ELECTRICAL DATA AND NOTES

Pyro Device Number	Bridgewire Resistance (Ohms)	No-Fire (Amperes, Minutes)	All-Fire (Amperes, Milliseconds)	Notes
		EJECTABLE ADAPTER		
35 - 38	0.45 - 0.85	0.5, 5.0	2.0, 75	Separately connected redundant squibs in each pin-puller
39 - 42	0.45 - 0.85	0.5, 5.0	2.0, 75	Separately connected redundant squibs in each spinoff
		FIXED ADAPTER		
77 - 86	0.45 - 0.85	0.5, 5.0	2.0, 75	Separately connected redundant squibs in each pin-puller
87 - 92, 115, 116	0.10 -0.50	0.5, 0.5	2.0, 10	Separately connected redundant squibs
		SUPPLY AND ELECTRONICS MODULE		
93 - 98	0.10 - 0.40	0.5, 0.5	2.0, 10	Separately connected redundant squibs
		CAMERA OPTICS MODULE		
99 - 114	0.45 - 0.85	0.5, 5.0	2.0, 75	Separately connected redundant squibs in each pin-puller

TABLE K-3

INITIATOR SYSTEM RELATED DOCUMENTS

BIF-008 Documents

1401-205-18	Electrical Interface FU/IP
1401-208-18	Receiver/FU/Support Equipment I/F
1401-212-18	FUTE Interface
1401-304-8	Power Requirements (9 x 5) IP/CS
1402-575	End-to-End Electronics Specification
1426-155-2-	Safety and Performance Report for the EAC IP
1426-607	Field Schematic Diagram, Initiator System
1497-287	Operation and Service Manual for ITS PRL 51855
1497-288	Operation and Service Instructions for IEU PRL 33850
1497-292	Operating and Maintenance Instructions for EEE Test Set PRL 40753
1499-171	Safety Rules for "K" Program

VAFB Documents

CS-15003	Support Equipment Validation
CS-15010	Calibration of Miniconsole and Val Cart
CS-15049	FAS Patching Manual
CS-15127	Integrated Test Equipment Validation
CV-15070	IP Use Preparation
CV-15072	IP De-Arming
CV-15076	IP Miscellany Procedure

BIF-055 Document

74SD2013	Technical Manual for FUTE

This page intentionally left blank.

INDEX

PHOTOGRAPHIC SUBSYSTEM REFERENCE HANDBOOK

NOTE: The number before the decimal point (.) is the PART.
The number after the decimal point is the SECTION.
The number after the dash (-) is the PAGE NUMBER.

A

"WARNING - THIS DOCUMENT SHALL NOT BE USED AS A SOURCE FOR DERIVATIVE CLASSIFICATION"

A

A

B

B

C

C

C

C

C

C

D

E

E

F

F

F

F

F

F

F

F

F

G

G

H

I

I

I

J

K

L

L

M

M

M

N

O

O

O

P

P

P

P

P

Q

R

R

R

S

S

S

S

S

S

S

S

S

S

S

S

T

T

T

T

T

T

T

T

U

V

V

W

Y

YAW:
COORDINATE SYSTEM EFFECT; 2.1-3
CURVATURE; 2.14-35, 2.14-46, 2.14-56
MANEUVER: 3.12-5
VARIATIONS; 2.4-30

Z

ZENITH:
ANGLE; 2.11-11