AD NUMBER: AD0801833
CLASSIFICATION CHANGES
TO: Unclassified
FROM: Confidential
LIMITATION CHANGES
TO: Approved for public release; distribution is unlimited.
FROM: Distribution authorized to US Government Agencies only; Export Control; 28 Aug 1959. Other requests shall be referred to Space and Missile Systems Organization, Los Angeles, CA 90009.
AUTHORITY
U per DoDD 5200.1 dtd 31 Dec 1971; ST-A per SAMSO, USAF ltr dtd 28 Feb 1972

AD NUMBER: AD0801833
CLASSIFICATION CHANGES
TO: Confidential
FROM: Secret
AUTHORITY
Per SSD-FD dtd 9 Aug 1963

UNCLASSIFIED

DISCOVERER

DETAILED TEST OBJECTIVES

FOR AGENA VEHICLE NO. 1052
AND THOR BOOSTER NO. 218

CONTRACT AF 04 (647)-97

LMSD-6155-11 28 AUGUST 1959

LMSD-6155-11

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69 pgs

DISCOVERER
DETAILED TEST OBJECTIVES

FOR

Agena Vehicle No. 1052

Thor Booster No. 218

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FOREWORD

This document, a requirement of Contract AF 04(647)-347, has been prepared by the Flight Test Planning Department (61-41) as a working document in support of the flight test of Discoverer 1052 and SM-75 booster 218.

CONCURRENCE

Information contained in this DTO which pertains to the SM-75 booster has been furnished, and consequently agreed to, by Douglas Aircraft Co.

Douglas Aircraft Company

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ILLUSTRATIONS

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INTRODUCTION

The information presented in this document defines the overall plans for flight testing Discoverer satellite vehicle Serial No. 1052. This Detailed Test Objectives (DTO) document is intended to be an authoritative planning source, for use by the Flight Test Working Group (FTWG), System Test Working Group (STWG), and all launch base, tracking stations, and recovery force personnel in planning Discoverer flight test operation procedures.

A description of the contents of this document follows:

Section 1 - Test Plan: Section 1 is a general description of the overall test plan for the flight.

Section 2 - Test Objectives: Section 2 presents the test objectives to be achieved from flight.

Section 3 - Configuration: Section 3 presents detailed descriptive information pertaining to the Thor booster and Discoverer satellite subsystems plus ground station configuration.

Sections 4, 5, 6 - Flight Plan (Launch Phase, Orbit Life, Recovery): These sections present information describing system preparations, launch criteria and operations during launch, orbit, and recovery phases. They also describe the instrumentation coverage to be provided for these phases.

Sections 7 and 8 - Test Data and Test Reports: Sections 7 and 8 specify the test data to be gathered during flight and the reports which are to be generated for the flight.

Appendix A: Appendix A presents three profiles showing the Discoverer satellite and the Thor booster with this equipment listed in chart form.

Appendix B: Appendix B-1 presents a detailed weight breakdown of the Discoverer satellite; Appendix B-2, presents the estimated inertia and c.g. data for Discoverer; Appendix B-3 presents a weight breakdown of the Thor booster.

Appendix C: Appendices C-1 and C-2 present the satellite telemetry data and the booster telemetry data, respectively.

Appendix D: Appendix D is a tabulation of landline instrumentation that will be monitored during the prelaunch phase.

Appendix E: Trajectory data and curves normally included in this section were not available for inclusion. Booster performance curves based on actual weight, pitch program, and booster engine acceptance values will be found in Discoverer Range Safety Report No. 11, LMSD-6104-11. Orbital data reflecting the most recent computations may be obtained from Discoverer Systems Test Directive No. 11, LMSD-414760-11. A nominal orbit track presentation is included.

Appendix F: Appendix F is a tabulation of the preliminary Subsystem D (SS/D) timer sequence of events.

Appendix G. Appendix G presents the procedure to be followed in the analysis of prelaunch wind shear data affecting the launch decision.

SECTION 1
TEST PLAN

1.1 GENERAL

The Discoverer satellite, Serial No. 2205-1052 will employ a modified Thor SM-75 booster, Serial No. 218. The satellite will be launched from Vandenberg Air Force Base (VAFB) launch complex SM-75-3, pad 4 at 1800 GMT (1000 PST). The scheduled date for launch is 19 September 1959. The Discoverer configuration will include an instrumented recoverable capsule for the purpose of securing advanced engineering test data while in orbit. Support equipment will be deployed to recover the capsule by air snatch or surface recovery methods.

Support for this flight will include facilities at VAFB, NAMTC, Point Mugu, Alaska, Hawaii, Palo Alto and a downrange Telemetry Ship.

1.2 SYSTEM CONTROL

The Development Control Center (DCC) in Palo Alto will exercise overall control of the Discoverer System by coordinating and directing the launch and orbital phase activities of the launch base and tracking stations.

1.2.1 Prelaunch Operations

Vehicle prelaunch preparation and countdown will be coordinated by LMSD Vandenberg Control (located in the LMSD administrative area), which will alert all supporting facilities to an impending launch, provide countdown status information, and announce liftoff. The AFBMD Launch Controller will have direct control over all countdown operations performed at the launch area.

1.2.2 Exit Tracking and Command

Following Discoverer/Thor liftoff, the Vandenberg telemetry and tracking station and the Vandenberg Auxiliary Station at NAMTC, Pt. Mugu, will record exit telemetry and tracking data. In addition, the Pt. Mugu station will transmit commands to regulate the times for orbit engine ignition and cutoff at the appropriate time during the vehicle coast period.

1.2.3 Telemetry Ship

The downrange instrumentation ship will record telemetry data during the coast, orbit injection, and reorientation phases of flight. This ship will be located within the range limitations of the onboard trihelix antennas to permit telemetry reception during vehicle pitchover. Recorded data will be transferred from the ship to a C-119 aircraft by means of air pickup, and delivered to the LMSD Sunnyvale, (Calif.) facility.

1.2.4 Orbit Operations

During the satellite's useful life, telemetering and tracking data will be gathered by the Alaskan, Hawaiian, and Vandenberg AFB stations. The tracking data will be transmitted to the Development Control Center in Palo Alto for orbit profile computation.

1.2.5 Recovery Operations

Operational support will include recovery of the nose capsule in the Hawaiian area on the seventeenth orbit pass. Detailed flight sequencing is contained in Sections 4, 5 and 6, and detailed information regarding data processing at each station is presented in Section 7.

Table 1-1

COMPREHENSIVE FLIGHT DATA

Items	Data
DISCOVERER	
S/N	2205-1052
Payload	GFE (AET)
Fuel	UDMH
Launch Weight	8498 Lbs
THOR	
S/N	218
Launch Weight (With Payload)	117,509 Lbs
Fuel	RJ-1
Oxidizer	Liquid Oxygen
LAUNCH	
Site	VAFB, SM-75-3, Pad 4
Date	19 September 1959
Time	1800 GMT (1000 PST)
Pad Azimuth	181.48°
Launch Azimuth	170°
ORBIT	
Period	95.28 Min (5717 Sec)
Apogee	550 sm
Perigee	120 sm
Eccentricity	.05
Average Regression Rate	24°
Inclination Angle	77.4°
RECOVERY	
Aircraft (Type, Quantity)	C-119's(9), RC-121's (4)
Surface Ships	Dalton Victory and Haiti Victory
Surface Ship Initial Location	17° N, 160° 45' and 17° N, 169° 15'
Surface Ship Helicopters	HRS-3 (2 on each ship)
Recovery Pass	17
Predicted Impact Area Center	17° N, 165° W
ETPD	T + 27 Hours

SECTION 2
TEST OBJECTIVES

2.1 PRIMARY TEST OBJECTIVES

The primary test objectives must not be compromised by any discernible inadequacy of airborne or ground equipment. Status changes that jeopardize the accomplishment of a primary objective are sufficient justification to hold, recycle or terminate the launch countdown.

2.1.1 Flight

The primary flight objective of this test is to place a satellite in orbit with a recoverable capsule, secure from it primary telemetered data on the test material and equipment for a minimum of one day, and to recover the capsule for direct examination of the test material and equipment for data and analysis.

2.1.2 Ground Support Equipment

The ground support equipment must demonstrate compatibility with the satellite and its payload, including ground support, control center, data processing, and communications during all phases.

2.1.3 Thor Booster

The primary test objective includes test and evaluation of the capability of the Thor to carry the Discoverer satellite to the planned separation altitude and achieve the planned attitude for separation.

2.1.4 Discoverer Satellite Airframe and Adapter

The Discoverer airframe must demonstrate its compatibility with gimbal-mounted, swiveling, burning rocket motor and with flight environment.

2.1.5 Discoverer Satellite Propulsion System

The Discoverer propulsion system must demonstrate the following:

a. Ignition of the YLR-81-BA-5 rocket engine in a vacuum

b. Ability of the rocket engine to provide the total impulse required to attain orbital velocity

c. Proper propellant utilization.

2.1.6 Discoverer Satellite APU System

The Discoverer auxiliary power unit must demonstrate acceptable performance of its components, especially batteries and inverters.

2.1.7 Discoverer Guidance and Control System

The Discoverer guidance and control system must demonstrate the ability of its components to:

a. Derive the time to initiate orbital boost and the velocity-to-be-gained during orbital boost, using the Reeves computation equipment

b. Initiate and terminate orbital boost at the proper time

c. Maintain proper vehicle orientation during the coast, orbital boost and orbiting phases until the ejection of the recoverable capsule (including proper function of the Subsystem D computer, inertial reference package, horizon scanner, pneumatic control system, and hydraulic control system).

2.1.8 Discoverer Satellite Telemetry, Tracking and Command Equipment

Airborne and ground telemetry tracking, and command systems must demonstrate the ability of their command components to:

a. Satisfactorily monitor all primary vehicle functions (Thor and Discoverer), and produce adequate ground telemetry records of these functions

b. Properly receive, act upon, and verify all ground-space commands, and insure that no false commands are acted upon

c. Send the command to adjust the Subsystem D timer to initiate and terminate orbital boost at the proper time

d. Determine an ephemeris of orbit sufficiently accurate to assure acquisition on each successive intercept and to allow the vehicle timer to be adjusted with sufficient accuracy to program the required vehicle functions.

2.1.9 Recovery Payload System

The Discoverer recovery payload system must demonstrate:

a. The ability of the recoverable capsule components to obtain and transmit data

b. Compatibility of the recoverable capsule with the satellite in its ascent, orbit, and ejection for recovery

c. Compatibility and suitability of the related surface and airborne recovery system components and techniques.

2.2 PRIMARY DATA

The telemetry instrumentation schedule is presented in Appendix C. The primary telemetry data are indicated with a "P". Launch phase radar tracking data obtained from the Vandenberg AFB Tracking Station and the Vandenberg Auxiliary Station at Pt. Mugu, and orbit tracking data for the establishment of an orbit profile, are primary data. The launch phase tracking data in conjunction with the launch phase telemetry data will

form the basis of the vehicle performance analysis through orbit injection. All records of the recovery operation will be considered primary data, and as such will be returned to Palo Alto for evaluation. See Section 7 for a discussion of test data handling.

2.3 SECONDARY TEST OBJECTIVES

If the accomplishment of any secondary objective appears to be in jeopardy at any time prior to initiation of the booster automatic launch sequence, the countdown may be held or recycled to resolve the difficulty.

The secondary flight test objectives are to test and evaluate the following:

a. Satellite systems and structure and their effective functional interrelationships

b. Temperatures at a sufficient number of locations on the vehicle so that the heat-flow patterns established in theoretical design can be verified and the temperature environment for later flights established

c. Interstation communications network

d. Acquisition of the satellite at any one station by means other than radar, and orbit prediction with only azimuth and elevation information for any given intercept

e. Aerodynamic integrity of the Discoverer/Thor combination.

2.4 SECONDARY DATA

The secondary telemetry data is that data not indicated as primary by the designation "P" in Appendix C.

Vehicle orbit life tracking data is in excess of that required to establish the orbit profile and will be considered as secondary data.

2.5 TERTIARY TEST OBJECTIVES

Tertiary flight test objectives are the testing and evaluation of the crew proficiency and ground equipment design from the human engineering point of view.

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SECTION 3
CONFIGURATION

3.1 THOR BOOSTER

The booster will consist of a modified SM-75 missile, Serial No. DM-18-218. An inboard profile and the basic systems are presented in Appendix A. Refer to Appendices A-2, A-3, B-3, C-2 and D-2 for detailed booster data.

3.2 DISCOVERER SATELLITE

3.2.1 Airframe

An inboard profile of the Discoverer and an equipment location call-out chart is presented in Appendix A.

The nose cone section consists of a recoverable capsule and fairing which contains Advanced Engineering Test (AET) equipment.

3.2.2 Propulsion System

The propulsion system consists of an AF Model YLR-81-BA-5 rocket engine, hypergolic propellants, ullage control rockets, a gas pressurization system and two helium supply spheres.

3.2.3 Auxiliary Power System

The primary power source consists of two (one Type IIA and one Type IA) silver peroxide-zinc batteries with a total power of 8500 watt-hours and a useful life of 27 hours with a 15 percent reserve. Conversion of the basic power to vehicle system equipments operation is as follows:

a. By a Type I voltage regulator, to 28.3 v dc ± 2 percent

b. By a Type I (rectifier) power supply, to 28.3 v dc ± 2 percent

c. By a transistor-oscillator Type IA inverter with a load limit assembly, to 115 v ac ± 1 percent, 3-phase, 400-cps ± 0.02 percent

d. By a transistor-oscillator Type IVB inverter with a load limit assembly, to 115 v ac ± 5.0 percent, 1-phase, 2000-cps ± 1.0 percent.

3.2.4 Guidance and Control System

The guidance and control system, consisting of the guidance subsystem and the flight control subsystem, includes equipment used for attitude and directional control from separation to establishment on orbit of the vehicle in the planned attitude and altitude. In addition, the flight control subsystem provides the means to reorient the satellite in orbit prior to ejection of the recoverable capsule.

3.2.4.1 Guidance Subsystem. The guidance subsystem includes an inertial reference package (IRP), a horizon scanner and a program computer.

3.2.4.2 Flight Control Subsystem. This subsystem includes an electronics and rate gyro package, a pneumatic control system and a hydraulic control system.

3.2.5 Communications System

Airborne communications equipment for this Discoverer satellite consists primarily of an S-band beacon transponder, a telemeter instrumentation system, a VHF acquisition transmitter, and a Fairchild timer.

3.2.5.1 S-Band Beacon Transponder. The S-band beacon transponder operates on frequencies of 2850 mc (receiving) and 2920 (transmitting). It is capable of receiving six coded commands from the VERLORT tracking radars.

3.2.5.2 Telemeter Instrumentation System. The Discoverer telemetry transmitter (237.8 mc) is described in Appendix C-1.

3.2.5.3 VHF Acquisition Transmitter. The Discoverer acquisition transmitter (232.4 mc, CW) transmits continuously until battery exhaustion for use in tracking acquisition by all agencies.

3.2.5.4 Secondary Programmer. Readout cycles of the beacon and telemetry are programmed by a perforated mylar tape in the secondary programmer manufactured by the Fairchild Camera and Instrument Corporation. The programmer operation is cyclic with a period from 84 to 100.5 minutes which is adjustable from the ground by commands transmitted via the S-band radar beacon.

3.2.6 Recoverable Capsule System

This recoverable capsule subsystem consists of the re-entry capsule, which includes a re-entry shield and structure. The thrust cone assembly mounted to the aft end of the re-entry capsule structure is deployed as an orbit ejection system consisting of thrust rocket, stabilization spin rockets, despin rockets instrumentation, and structural components. The entire subsystem weighs 429 pounds, and is pictured in outline in Appendix A-1. An alternate recoverable payload which is a complete and interchangeable nose cone and capsule containing equipment for Geophysical Research Directorate (GRD) studies may be substituted.

3.2.6.1 Recovery System. The recovery system is designed to establish the location of the recoverable capsule and to aid in air-snatch recovery. The design also provides for flotation and location if water recovery becomes necessary. Components of the recovery system include:

a. Parachute, metalized to provide a radar target of 202 square feet, and checkered barded with orange panels to aid in visual location

b. Chaff, released from a one-pound package and producing a radar target of 2400 square feet

c. VHF beacon, transmitting on 232.4 mc with peak power of 15 watts, with a repetition rate of 1000 pps, pulse width of 29 microseconds, and average power of 640 milliwatts

d. Rescuelite, a high-intensity light flashing at 1.5-second intervals

e. Dye marker, a powdered aluminum slurry dissolved after water impact.

3.3 GROUND STATION CONFIGURATION

3.3.1 Launch Facilities, Vandenberg Air Force Base

LMSD facilities comprising preflight support at VAFB include administration, missile assembly, engineering, storage, ground handling and payload buildings. The launch complex consists of a blockhouse and two launch pads located approximately ten miles from the LMSD preflight facilities.

In addition to AFBMD who exercises technical test control, the following organizations also operationally support launch activities. They are the First Missile Division (SAC), Pacific Missile Range (PMR) and the Douglas Aircraft Company.

3.3.2 Tracking Stations

Five tracking stations are utilized for telemetry receiving, tracking and vehicle command. They are as follows:

a. Vandenberg Tracking Station, VAFB, California

b. NAMTC. Point Mugu Tracking Station, Port Hueneme, California

c. Kaena Point Tracking Station, Kaena Point, Oahu Island, Hawaii

d. Chiniak Tracking Station, Kodiak Island, Alaska

e. Annette Tracking Station, Annette Island, Alaska

These stations have the capability to acquire, track and command the vehicle and to receive telemetry data transmitted from the vehicle. Each station is equipped with:

a. VERLORT (Very Long Range Tracking) Radars
b. Modified A/N TLM-18 High Gain Automatic Tracking Antenna (at VAFB and Hawaii)
c. Tri-Helix Antenna (manually tracked)
d. Doppler Measuring Equipment
e. Teletype and Voice Communication System

3.3.3 Telemetry Ship

A telemetry ship equipped with two tri-helix antennas and telemetry receiving and recording equipment will be stationed approximately 1200 nautical miles down-range of the launch pad in the vertical plane which contains the nominal trajectory.

3.3.4 Palo Alto Development Control Center

The DCC in Lockheed Building 204, Palo Alto, will be equipped with the necessary communications equipment, plot boards, and status boards for the overall direction of flight test operations. The Center will be supported by an LMSD computer (UNIVAC 1103AF) with backup from a second 1103, which, with the necessary data transmission equipment, will process tracking data and generate command and acquisition data.

The DCC will be operated by a staff of LMSD personnel and by an AFBMD representative assigned as System Test Controller. The Center will perform the following functions:

a. Overall direction and control of Discoverer flight test operations
b. Administrative and technical tracking station coordination and direction

c. Maintenance of weather charts at the various stations and in the recovery area.

3.3.5 Hawaiian Control Center

The Hawaiian Control Center (HCC) at Hickam Air Force Base, Oahu, T.H., will control the deployment of all elements of the Recovery Force. The HCC will effect independent control over the following functions:

a. Definition of search mode
b. Cancellation of recovery effort based on local exigencies that affect Recovery Force safety
c. Designation of Recovery Force Controller
d. Assumption of recovery operation functions of DCC in the event of communications loss with the DCC.

For other command functions, the option is exercised by the DCC, with the HCC insuring execution of the commands.

3.3.6 Instrumentation

Landline instrumentation is recorded in Appendix D-1 for Discoverer satellite instrumentation and Appendix D-2 for Thor instrumentation. Complete telemetry schedules are included as Appendix C, and Thor and Discoverer satellite telemetry data are discussed in Paragraphs 7.1.1 and 7.2.1.

Optical engineering sequential instrumentation and documentary coverage is supplied by the Air Force Lookout Mountain Laboratory and is included in Paragraphs 7.1.3 and 7.1.4.1.

Metric optical instrumentation is furnished by four Mobile Optical Tracking Units supplied by the Pacific Missile Range, NAMTC, and located as shown in Table 7-5.

An integrated paint pattern for optical roll determination is shown in Appendix A-3. Radar tracking data are discussed in Section 7.2.1.

LMSD personnel will install and operate equipment which will provide a history of atmospheric radiation in the Missile Assembly Building during the day before, the period of, and the day after Integrated System Test, and near the launch pad on X-1, X and X+1 days.

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SECTION 4
FLIGHT PLAN (PART I - LAUNCH PLAN)

4.1 SYSTEM PREPARATIONS

4.1.1 Thor

The booster will undergo DAC modifications and complete subsystem and system checkout in the DAC receiving, inspection and maintenance (RIM) building. The booster will then receive adapter fit tests and be weighed prior to being moved to the pad. The ground support equipment portion of the DAC operations can be found in DAC Drawing No. 7692043 Sections 5.0 through 5.4. LMSD will tie into the DAC electrical J-box for sequence operation of the Discoverer umbilical ejection and destruct system.

4.1.2 Discoverer

The Discoverer will have undergone thorough ground testing on the component, subsystem and system level prior to delivery to the LMSD Santa Cruz Test Base (SCTB). At the SCTB a static-firing systems run will be successfully completed prior to delivery of the Discoverer to VAFB. The recoverable capsule will be handled separately, however, until its mating to the satellite. Subsystem L checks will be accomplished in the Subsystem L building and integrated into ground checkout and countdown procedures. Refer to Figure 4-1 for the general Thor/Discoverer system preparation schedule.

4.1.3 Tracking Stations and TM Ship Checkout

The tracking stations and the TM ship will be individually checked out and calibrated. A final checkout of equipment and personnel at the tracking

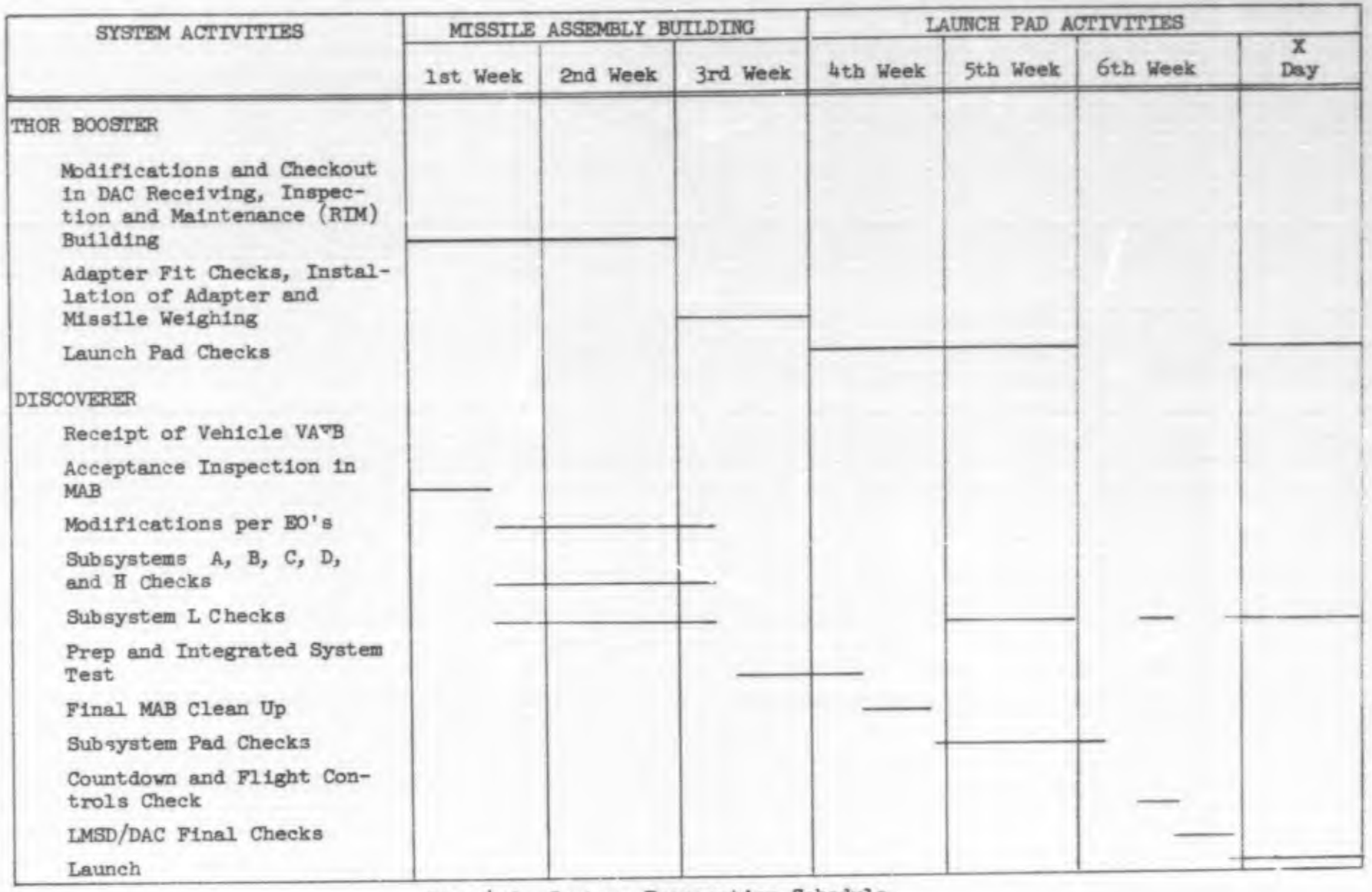

Fig. 4-1 Systems Preparation Schedule

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stations and telemetry ship will be done using an aircraft equipped with an S-band beacon, telemetry transmitter and acquisition transmitter duplicating the Discoverer equipment. Checkout and operation procedures will be in general agreement with LMSD-411459, System Checkout Plan.

4.1.4 Launch Facility Test and Checkout

The checkout of launch facilities will be accomplished by LMSD and DAC personnel. During mock countdown tests by LMSD and DAC, the blockhouse consoles will quantitatively evaluate the information received from the systems. After the launching, LMSD and DAC personnel will refurbish the launch complex.

4.1.5 Communications System Checkout

Commencing at least four days prior to launch the DCC will conduct checkout exercises with emphasis on communications proving satisfactory status of teletype conversion, transmission and reception equipments.

4.2 LAUNCH CRITERIA

Launch criteria are established on the basis of their effect upon primary and secondary objectives, range safety, and overall system operability.

4.2.1 Pad Conditions

All missile conditions effecting primary objectives will be reported satisfactory prior to launch by blockhouse personnel to Launch Controller. Blockhouse personnel will also report as satisfactory those conditions affecting secondary objectives prior to the time of initiation of the DAC automatic sequencer (T-12 minutes).

4.2.2 Photographic Equipment

A sufficient number of tracking and high-speed sequential cameras will be "ready" prior to launch to give the Launch Controller confidence that adequate photographic data will be gathered.

4.2.3 Weather conditions

The following weather and atmospheric data represent the conditions under which the Discoverer may be launched:

a. Weather Minimums:
   (1) Cloud coverage: clear to 2/10
   (2) Visibility: vertical, unlimited; horizontal, 8 miles
   (3) Precipitation: none
   (4) Surface winds: 0-20 knots (any direction)
   (5) Winds aloft: refer to Appendix G

b. Recovery Area: Weather forecasts for the recovery area must be favorable for the projected time of recovery as determined from data supplied to the DCC.

c. Telemetry Ship Area: Forecasts for the TM ship area must be favorable to assure acquisition of the vehicle during ascent. Forecasts affecting launch will be supplied to the Test Director at the VCC in accordance with Table 4-1. These forecasts, and a subsequent report of conditions at the time of launch, will later become vital launch data (refer to Section 7).

4.2.4 Range Clearance

The Range Safety Officer will issue range clearance on the basis of operability of range safety electronic tracking and plotting equipment, visual sky-screen communications, and the readiness of the range. This clearance will be issued to the Test Controller at Vandenberg Control Center and will be revocable at any time for sufficient cause.

Table 4-1

STATUS AND WEATHER FORECAST REQUIREMENTS VANDENBERG CONTROL CENTER
HAWAII CONTROL CENTER, AND TELEMETRY SHIP

Parameters	Time Required (hr)										
	T-48	T-24	T-12	T-6	T-3	T-2	T-1	T+6	T+12	T+18	T+24
Vandenberg Control Center											
1. Precipitation	x	x	x	x	x		x				
2. Surface Wind	x	x	x	x	x		x				
3. Visibility	x	x	x	x	x		x				
4. Cloud Coverage	x	x	x	x	x		x				
5. Winds Aloft			x	x							
TM Ship											
Items 1 through 4 plus sea state conditions and the ship position, heading, and speed		x	x				x (T and Hourly Until Data Pickup)				
Hawaiian Control Center											
Items 1 through 4 to include recovery area weather plus Recovery Force status enroute and on station		x	x	x		x		x	x	x	x

Note:

Additional forecasts may be requested due to delays or rescheduling.

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4.2.5 System Operability

Prior to launch, the operability of all LMSD tracking stations will be determined by the Development Control Center. Should any inadequacy exist sufficient to hold the launch, the DCC will so advise the VCC.

4.3 SYSTEM OPERATION

4.3.1 System Operations Control

The system countdown to Discoverer launch operations will commence six days prior to launch and will encompass final preflight checkout, countdown, launch, and vehicle flight to the limit of telemetry ship reception. System control during the launch phase is divided into three groups of responsibility, as follows: (See Figure 4-2.)

a. Development Control Center. The System Test Director at the DCC, Palo Alto, will exercise overall direction of the LMSD Vandenberg Control Center (VCC) activities and the aircraft pickup of telemetry data. He will also direct and coordinate the prelaunch preparations of the Palo Alto Computer and of the Vandenberg, Pt. Mugu, Hawaii, Annette, and Chiniak tracking stations.

b. Vandenberg Control Center. The Vandenberg Test Director at the LMSD VCC will exercise overall direction of the launch area activities and will direct and coordinate:

   (1) Prelaunch preparations of the instrumentation ship

   (2) Pt. Mugu tracking

   (3) Vandenberg Tracking Station (launch tracking only)

c. Blockhouse. The Launch Controller will direct and coordinate the Discoverer/Thor checkout and countdown conducted on the launch pad.

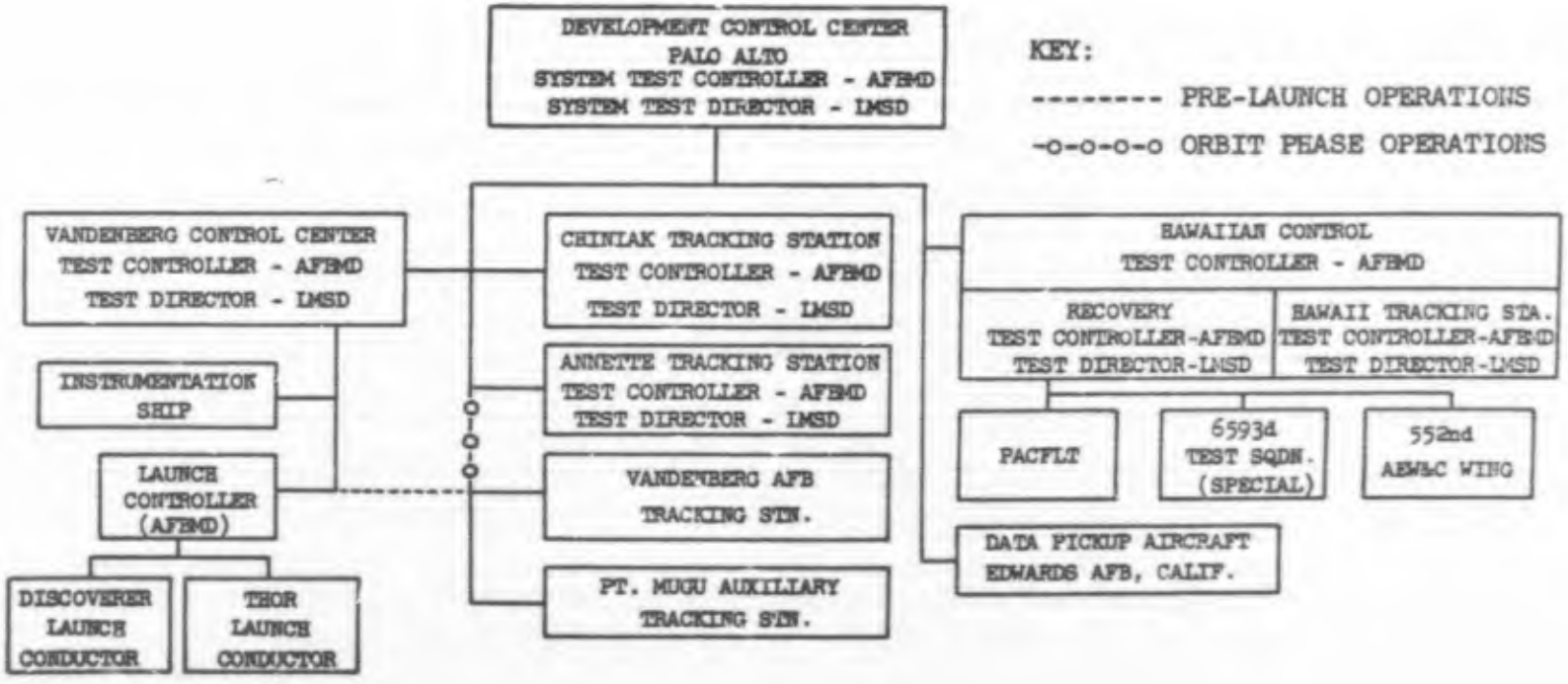


Fig. 4-2 Discoverer Test Operations Control

4.3.2 Countdown

The launch countdown will be initiated prior to dawn to provide the maximum possible daylight for operations, including full photographic coverage.

The countdown will be conducted according to the integrated countdown manual prepared by the VAFB FTWG. The time sequence portion of the countdown will be of approximately 405 minutes duration. The test capsule will be mated to the Discoverer prior to erection, during the initial phases of the countdown.

4.3.3 Liftoff Tone Transmission

Missile liftoff will be signalled by a 1-kc tone generated in the blockhouse via a Douglas-supplied lift-off limit switch which is activated during the initial three inches of flight. This tone will be heard in the blockhouse, at the Vandenberg VHF receiving building (where it will be recorded in real time), and at the Vandenberg Control Center. From the VCC the signal will go out via the interstation communications network to all stations, including the telemetry ship. The time of liftoff will be read from the recording at Vandenberg Tracking Station and will be sent to the computer at Palo Alto to initiate orbit computations.

4.3.4 Real-Time Monitoring and Command Transmission

The time of occurrence of three additional events will be used as initial computer information. They are: (1) Thor main engine chamber pressure decay, (2) Discoverer satellite engine ignition, and (3) Discoverer satellite engine burnout. These events will be recorded in real time on oscillographs at the Vandenberg Tracking Station, Pt. Mugu, and on the telemetry ship. Main engine cutoff time will be sent from VCC via 60-wpm teletype to the Palo Alto DCC. Ignition time will be sent from Pt. Mugu through VCC to the Palo Alto DCC via 60-wpm

teletype. Burnout time will be sent from the telemetry ship via the single-sideband radio link, and from there to DCC via 60-wpm teletype.

4.3.5 Boost Phase of Flight

Vertical flight will continue for 10 seconds, during which time the booster will be programmed to roll to the departure azimuth, 170°. Launching from Pad No. 4 will require that the booster be programmed in roll 11°, 28' 53.86" from the launch azimuth of 181° 28' 53.86" to obtain a flight departure azimuth of 170°. A zero-lift trajectory will subsequently be programmed in pitch until the separation attitude is attained. At this time, a constant attitude trajectory will be programmed and will be maintained through Thor main engine cutoff and vernier engine burning.

The Thor boost phase extends for 163 seconds (nominal), with first-stage main engine cutoff occurring on depletion of propellant. The vernier engines will be started prior to liftoff and will continue for nine seconds nominal after main engine cutoff.

4.3.6 Separation

At 167 seconds after launch, the first sequence signal will come from the Subsystem D computer; this will be the signal for uncaging the inertial reference gyros. Approximately eleven seconds later, the Subsystem D computer will initiate the signals for firing the explosive separation bolts, activating the pneumatic control system and igniting the retrorockets on the adapter. The vehicles will then separate.

4.3.7 Coast Period Reorientation

During the coast period, the Discoverer satellite attitude is controlled, through the pneumatic system, by the inertial reference package (IRP).

Following separation, the vehicle is programmed in pitch which, based on a nominal separation angle, will provide a zero flight path angle at orbit injection. At the conclusion of the pitchover program, the horizon scanner is activated to stabilize pitch and roll attitude. During orbital boost, vehicle attitude is controlled through the hydraulic system (engine gimballing) by the inertial reference package.

4.3.8 Engine Start and Velocity-To-Be-Gained Command

The Point Mugu Tracking Station is responsible for transmitting the time-to-fire (engine start) and velocity-to-be-gained correction commands necessary to assure orbital injection. If no ground commands are sent, the SS/D computer will initiate engine start following a nominal 20 second delay.

Normally, computation and transmission of the correction commands will be accomplished automatically by the Reeves Guidance Computer. The Reeves Guidance Computer will determine the correction commands by automatically sampling tracking data, during ascent, at two preset times.

A manual ground backup will also be provided which will permit transmission of predetermined "nominal" commands only. Tracking data sampling times and nominal duration for these commands (5 and 6) will be furnished in the System Test Directive.

4.3.9 Orbital Reorientation

Upon termination of orbital thrust, the hydraulic system is turned off and vehicle attitude is again controlled through the pneumatic system. The propellant tanks and the helium tank are vented and the vehicle is yawed 180°. The complete Subsystem D computer's functional sequence is presented in Appendix F.

SECTION 5
FLIGHT PLAN (PART II - ORBIT LIFE)

5.1 NOMINAL ORBIT PROFILE

The projected orbit injection location has been computed as 24.6°N 118.65°W based on an injection altitude of 120 statute miles at perigee. The elapsed time from launch to injection should be 387 seconds. The orbit has a nominal 0.05 eccentricity, and the nodal period has been calculated as 95.28 minutes with a corresponding average regression rate of 24.0 degrees per orbit pass. The apogee altitude is 550 statute miles for the nominal case, and the mean orbital altitude is 335 statute miles. A map of nominal orbit tracks is provided in Appendix E.

5.1.1 Variations in Profile

Deviations in launch azimuth will have little effect upon low latitude station acquisition locations but may change those of high latitude considerably, since a change in azimuth will give approximately a one-to-one change in the highest latitude reached.

Variations in period resulting from orbital energy altitude variations will affect acquisition data only slightly on early passes, but the error will be cumulative on succeeding passes.

5.1.2 Acquisition and Tracking Sequence

Approximate acquisition times and contact durations for each of the stations are shown in Table 5-1. They are based upon a 1000-statute mile VERLORT reception range and upon the nominal orbit path.

Table 5-1

PROBABLE ACQUISITION TIMES VERSUS ORBIT PASSES

Pass No.	Station	Acquisition Time (minutes)	Fadeout Time (minutes)	Duration Time (minutes)
1 N-S	Chiniak	90.0	97.0	7.0
	Annette	92.5	96.5	4.0
2 N-S	Chiniak	188.0	191.5	3.5
	Hawaii	195.0	201.0	6.0
9 S-N	Vandenberg	831.0	838.0	7.0
	Annette	836.0	843.5	7.5
10 S-N	Hawaii	921.0	929.5	8.5
	Chiniak	931.0	938.5	7.5
	Annette	932.0	938.5	6.5
11 S-N	Chiniak	1029.0	1035.5	6.5
14 N-S	Annette (Acquisition beacon only)	1328.0	1331.5	3.5
15 N-S	Chiniak	1423.0	1429.0	6.0
	Annette	1424.0	1431.0	7.0
	Vandenberg	1429.0	1436.0	7.0
16 N-S	Chiniak	1519.0	1526.0	7.0
	Annette	1522.0	1526.0	4.0
17 N-S	Chiniak	1618.0	1620.5	2.5
	Hawaii	1623.0	1629.0	6.0

Note:
Liftoff to injection: 6.45 minutes (387 seconds)
Liftoff to crossing equator: 12.45 minutes (747 seconds)
Nominal orbit period: 95.28 minutes (5717 seconds)

Orbital passes 1 and 2, and 15 through 17 will be within reception range of one or more stations in the southbound direction. Orbits 9 through 11 will be within range during the northbound passes. One orbit pass is defined as the circuit from crossing the equator in a southerly direction to crossing the equator again in a southerly direction. The ascent pass begins with launch and ends when the vehicle, for the first time, crosses the equator in a southerly direction. The first pass is the next complete revolution, and so on.

Accurate acquisition time, heading, elevation, and range predictions will be generated by the Lockheed UNIVAC 1103AF computer at Palo Alto and will be transmitted to each station. These predictions will be based upon the nominal launch data and will be corrected by tracking data inputs from the tracking stations when acquisition is made. Tracking data inputs to the computer will be weighted double to phase old data out of the orbit calculations as rapidly as possible.

Until acquisition, tracking and telemeter ground antennas will be searched about a position directed by the MILGO programmer in the tracking station system. The VERLORT, to which the telemetry antennas are slaved, will then lock on the satellite.

A Reeves orbital computer at each tracking station will be updated continuously during each tracking pass and provide emergency carryover orbit prediction to direct antennas in the projected orbit path if temporary loss of the tracking signal occurs.

5.2 SYSTEMS OPERATIONS

5.2.1 Communications

Communication networks are a vital part of the overall system. Rapid and accurate data transmission is essential for completing timely acquisition predictions and initiating correction commands for control of the vehicle.

Teletype circuits, capable of 100 words per minute, will connect each tracking station to the computer for transmission of VERLORT X, Y, H, and t data as soon as it is received. The same circuit will be utilized to transmit telemetry and Doppler tracking data from each station and to return acquisition and vehicle command data from the central computer to each station.

Telemetry and Doppler tracking data will be handled on a secondary priority basis and normally will not be transmitted until a lull in activity, when orbit passes are beyond the range of the station. VERLORT tracking data will be checked for suitability upon receipt at the computer area. If necessary, retransmission of data will be requested.

5.2.2 Control

Overall control of system operations is vested in the Development Control Center (DCC) at Palo Alto. The DCC will receive milestone reports from each station and will initiate individual station operations, in the proper sequence, for integration with the activities of other stations and with satellite function. (See Figure 5-1.)

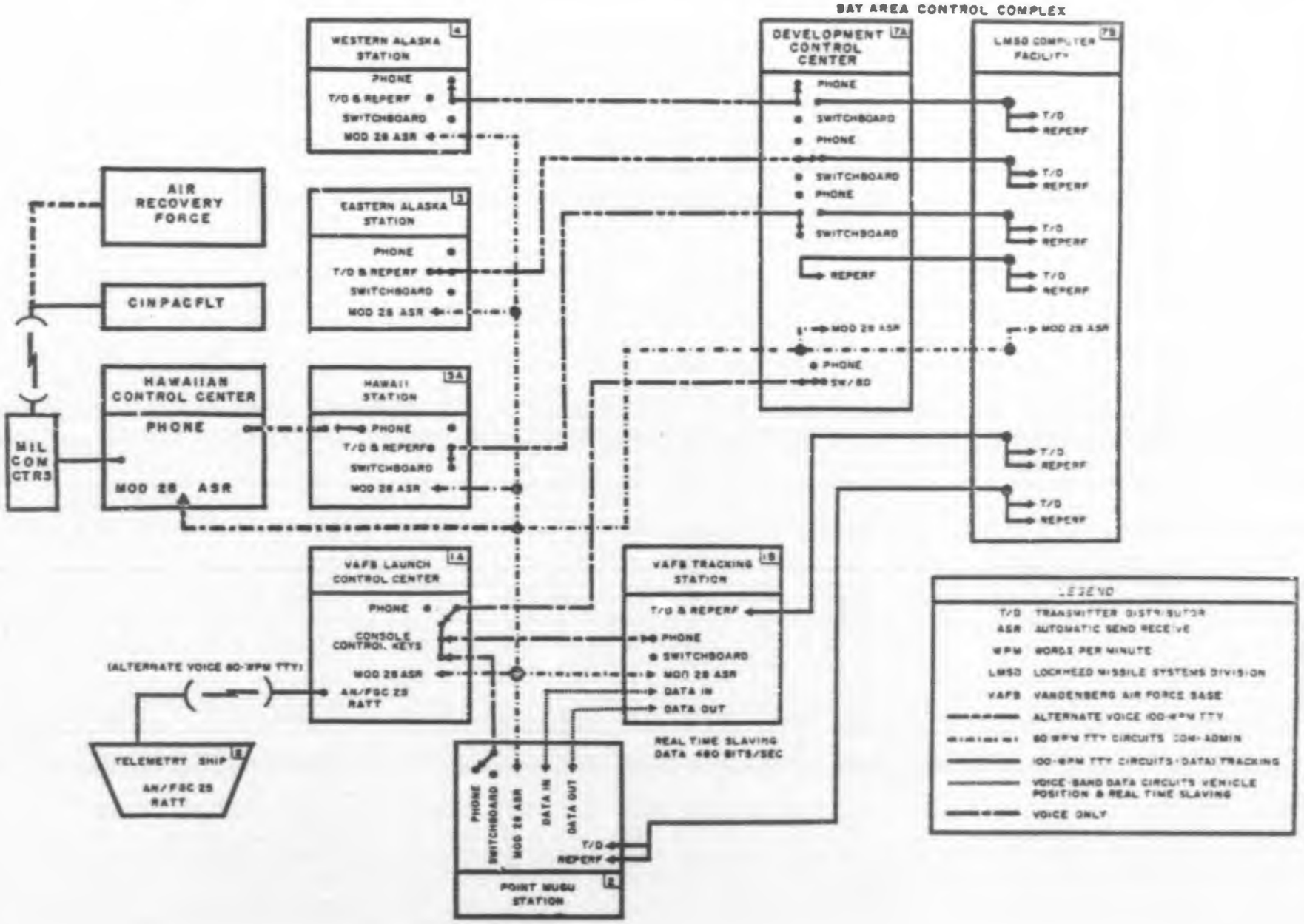


Fig. 5-1 Discoverer System Communications

5.3 INSTRUMENTATION

5.3.1 Tracking Data

Primary orbital tracking data will be obtained from the VERLORT radars at the four stations (MTS considered as backup for VTS) and will be transmitted to the computer in Palo Alto, where up-to-date orbital calculations will be made. Orbit path and acquisition data will then be provided for each of the stations. One plotting board at each tracking station will present VERLORT tracking data in Cartesian coordinates. Secondary tracking data will be obtained from the positioning of the TLM-18 antenna (Vandenberg and Hawaii) and from Doppler range measurements at all stations. These data will be punched in teletype tape and transmitted following the transmission of radar data. TLM-18 tracking position data will be plotted in polar coordinates on a second plotting board provided at the Vandenberg and Hawaii stations.

5.3.2 Telemetry Data

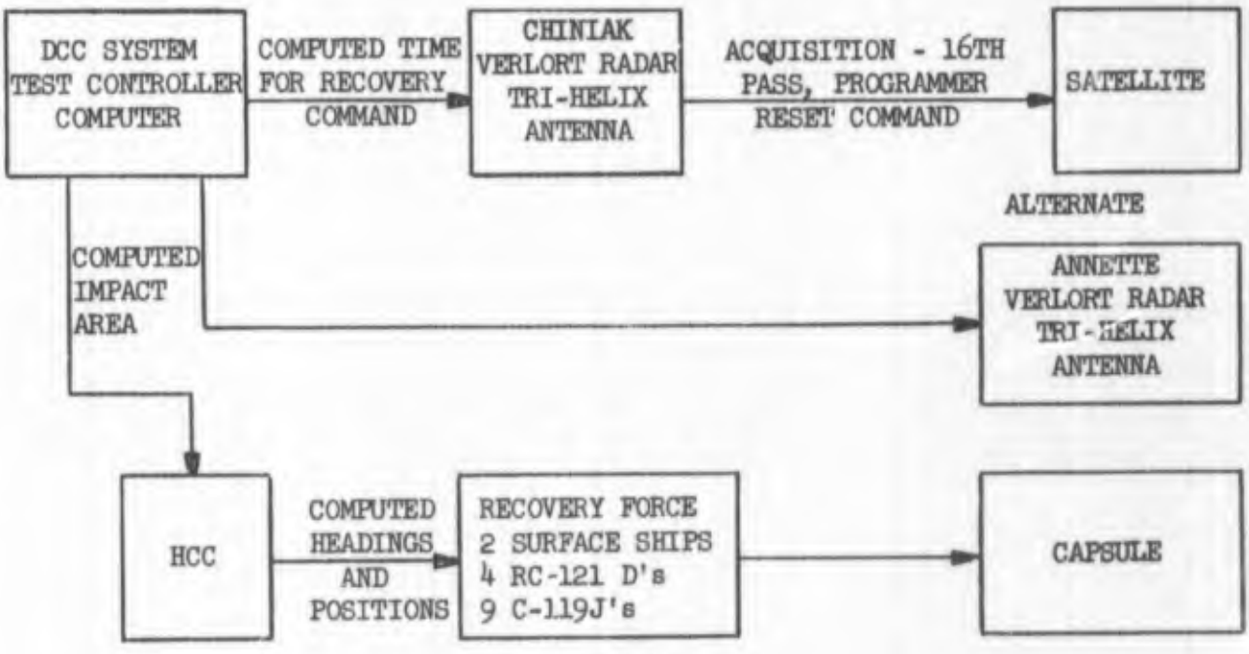
The satellite instrumentation configuration for the orbit life phase is listed in Appendix C-1. All of the channels will be "on" during orbit. Some of the channels, however, record dual functions with a switching arrangement for recording on ascent or orbit only. Telemetry operation, together with the S-band beacon, is controlled by the Fairchild timer as described in Section 3. Flight data from the satellite will be obtained only from the portions of the orbits which are within reception range of the tracking stations. Telemetry antennas at the ground stations will be slaved to radar antennas for proper orientation during the tracking period. Telemetry data will be recorded on magnetic tape and flown to Palo Alto by commercial or military air transportation. Details of telemetry data handling are presented in Section 7.

SECTION 6
FLIGHT PLAN (PART III - RECOVERY)

6.1 INTRODUCTION

It is a primary objective of this flight to recover the payload ejected from orbit on the 17th pass. The recovery capsule is placed on a re-entry trajectory utilizing a programmed retro-rocket system. At approximately 50,000 ft a parachute is deployed. Recovery will be of the capsule-parachute combination and will be made by air snatch. Should this fail, the capsule will be recovered from the sea by a surface ship.

The following material describes the capsule ejection sequence, system operation, Recovery Force and overall recovery plans. All recovery forces will be located and moved in conjunction with alphanumeric plotboard at the Hawaiian Control Center.



SYSTEM CONTROL CHART

6.2 SYSTEM OPERATION

The Hawaiian Control Center (HCC), located at Hickam AFB, Oahu, Territory of Hawaii, is under the control of the DCC. The System Test Controller will evaluate the Discoverer system status and, based on vehicle checkout and weather predictions, order the Recovery Force plan into operation. It is anticipated that this plan will be put into operation approximately seven days prior to launch to permit DCC to alert the 552nd AFW (RC-121D), and to permit HCC to alert the recovery forces in the Hawaiian area of the impending recovery operations.

6.2.1 Briefing

The RC-121D's will depart from the Continental United States for the Island of Oahu at least 48 hours before the scheduled launch time. This will allow time for electronic equipment checks at Hickam AFB after arrival. The crews of the naval recovery ships will be briefed regarding the recovery operation in sufficient time to permit a timely departure for the impact area. The crews of the C-119J and RC-121D aircraft will be briefed approximately 24 hours prior to scheduled launch time regarding the plan and details of the recovery operation. During the briefing, the HCC will designate impact area, station locations, and on-station times.

6.2.2 Force Status

Eighteen hours before scheduled launch, the HCC will check the status of the Recovery Force to determine its readiness. The crews of the C-119J's will check out the air-snatch equipment and the direction finder (DF), and the crews of the RC-121D's will check out the radar. The HCC will radio and obtain a status report from the naval ships. The status of the Recovery Force will be relayed to the DCC and, based on system evaluation, the System Test Controller will proceed with the scheduled launching or make changes as

required. Should the launching be delayed, the HCC will be notified and in turn it will notify the Recovery Force personnel of the change in schedule.

6.2.3 Communications and Weather Checks

Communication checks to HCC will be part of the system countdown. At T-2 hours, a weather and status report from the naval ships at the impact area and the local weather will be relayed to DCC. The Recovery Force status will also be included in this report. Weather forecasts will be provided to the DCC by the HCC as follows:

a. Weather Data.
   (1) Terminal forecast for Hickam, Johnston Island, and Kaena Point
   (2) Area forecast for recovery area to include sea surface forecast.

b. Commencement. Outlook reports will be submitted at T-24 hours. Definite forecasts will commence at T-12 hours and continue per Table 4-1.

c. Termination. Forecasts will continue until aircraft recovery operations cease; however, Kaena Point forecasts are required only until re-entry has been accomplished.

d. Forecast Valid Time. The forecasts are to cover the period from launch until recovery operations are scheduled to cease.

6.2.4 Impact Area Prediction

After the launching, approximately two hours will be required to acquire the vehicle at Alaska and to calculate the orbit ephemeris and the impact area. This impact area will be relayed to the HCC, which will command the ships to their proper positions. Based on information from each tracking station, the orbit ephemeris and impact area will be up-dated.

6.2.5 Recovery Plan

The on-station schedule times for the Recovery Force are as follows: The C-119J aircraft will be on station at ETPD-1, the ships at ETPD-2, and the RC-121D aircraft at ETPD-3 hours. (ETPD = Estimated Time of Parachute Deployment.)

The operation will be directed by a Controller aboard the lead RC-121D. Communication and time checks will be conducted between the aircraft and naval ships as they rendezvous prior to taking up their assigned positions. The C-119J's will fly at 14,000 feet and maintain constant communication with the RC-121D's flying around 10,000 feet (adjusting altitude for optimum radar acquisition). The flight pattern has been planned to place the aircraft at midpoints of straight flight legs at ETPD-30 minutes, ETPD-15 minutes, and ETPD-0 minutes. At these points, the RC-121D aircraft are positioned so that an area of optimum radar return overlaps the impact area. The C-119J aircraft will orbit on station, flying 4-minute legs with port turns, thus assuring a random altitude and a thorough DF coverage of the area. The search mode will begin at ETPD-30 minutes, and will be at optimum operations at ETPD-7 minutes to ETPD+7 minutes which is the straight line of the flight pattern.

6.2.6 Air Recovery Operations

At approximately 50,000 feet the parachute will deploy, releasing the chaff. The beacon and flashing light will also begin operating. The RC-121's will search and should acquire the chaff as the first radar return. Upon receiving the first radar return, the RC-121 Controller will notify the nearest C-119J and the control RC-121, and proceed to vector the C-119J pilot into an interception flight. The C-119J pilot will follow the RC-121 vectoring, and use the DF for homing. All returns from the Recovery Force radars and direction finders will be verified as soon as possible.

Table 6-1

CAPSULE RECOVERY SEQUENCE

Operation Phase	Event*	Function
Recovery Command (16th pass)	1. Chiniak VERLORT acquisition 2. Chiniak ground command as directed by the DCC	1. Satellite contact on 16th pass 2. Fairchild timer reset
Separation Sequence (17th pass)	1. SS/H timer turns on SS/D computer 2. H/S is off 3. Command -45 deg/min pitch rate 4. Command +4 deg/min pitch rate 5. SS/D computer initiates SS/L transfer circuits 6. Command ejects	1. Initiation of dump sequence 2. Allows vehicle to pitch 3. Vehicle reorients 60 deg from horizontal 4. Maintains vehicle attitude 5. Capsule disconnects from vehicle power supply 6. Squibs fire pin pullers; separation is by compressed springs
Re-Entry	1. Capsule programmer starts on separation 2. Programmer fires electrical disconnect squibs and explosive bolts	1. Fires spin-up rockets, main retro-rocket, and de-spin rockets 2. Burnout-out propulsion system released
Parachute Deployment	1. Timer runs out at approximately 50,000 ft (Capsule timer starts when acceleration reduces to 5 g's).	1. At timer run-out, VHF beacon and flashing light are activated, chute is deployed, and radar chaff is dispensed
Recovery	1. RC-121D aircraft, APS-20/45 radar search before ETPD 2. RC-121D aircraft vectors C-119J aircraft toward capsule 3. C-119J visual contact 4. C-119J drops visual-aid markers 5. RC-121D Controller vectors surface ship to capsule position 6. Capsule delivery to AFBMD as directed	1. Detect chaff and/or silvered capsule chute 2. C-119J utilizes DF equipment to home on capsule VHF beacon 3. C-119J intercepts capsule at 14,000 ft and makes air snatch 4. Aids recovery if air snatch is unsuccessful and capsule impacts on water 5. Effects a sea-surface recovery

*This revised table corrects errors noted in the "Event" column of the original table.

DF acquisitions by the C-119J aircraft will be plotted to verify that only one intersect point exists. DF returns will also be checked against radar returns of the RC-121 aircraft. The maximum capability of the aircraft and ships will be used to verify the returns. If, after verification, bogus signals still appear to exist, the airborne Controller will direct a systematic visual search for the source of each signal. This procedure will probably require a period in excess of air search time available and thus the search will enter the water search mode.

6.2.7 Capsule Disposition

Should the vectoring be successful and the C-119J sight the capsule, the air recovery will be made. Upon successful recovery, the C-119J recovering the capsule will proceed as directed at maximum continuous speed. One C-119J will intercept the C-119J with the capsule and accompany it to the destination directed. The naval ships will return to Hawaii as directed by the HCC.

6.2.8 Surface Recovery

Should the air recovery be unsuccessful after sighting the capsule, the C-119J's will circle the area of water impact and drop smoke bombs while the RC-121D Controller vectors a surface ship or HRS-3 helicopter into position to effect recovery. Once aboard the ship, the capsule will be kept unopened and under guard and will be delivered by the most expeditious means to the HCC.

6.3 INSTRUMENTATION

6.3.1 Telemetry

When the vehicle is over Chiniak on orbital pass 17, the capsule telemetered data will be read in real time to ascertain the condition of the test material before orbit ejection. As the satellite vehicle, minus the capsule, comes

into range of the Hawaiian Tracking Station, telemetry will be recorded, indicating the previous capsule disconnection. See Appendix C-1 for a complete telemetry schedule.

6.3.2 Recovery Aircraft Instrumentation

6.3.2.1 RC-121 Aircraft. The RC-121 aircraft are equipped with the APS-20/45 radar acquisition and tracking system. The primary radar (APS-20) is instrumented to provide photographic coverage of the radar-scope presentation. Performance parameters of both radars will be periodically logged.

6.3.2.2 C-119 Aircraft. The C-119 aircraft have electronic direction-finding equipment for homing on the capsule beacon signal.

6.3.3 Surface Ship Instrumentation

Instrumentation of surface ships is similar to that of the C-119's described in the preceding paragraph.

6.3.4 Hawaiian Control Center

The HCC contains a large-scale plotting board used to present the relative location of all the Recovery Force ships and aircraft. The board has a coded alphanumeric grid coordinate system to satisfy security requirements concerning Recovery Force deployment. Backlighted boards reflect the status of recovery and direction-finding equipments. The HCC is linked to all associated functions by means of a communication network consisting of telephone, "voice hot lines," MHF, HF, UHF, VHF, voice, CW, and RATT circuits.

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SECTION 7
TEST DATA

Raw test data and films generated as a result of this flight are required as listed below. Each item listed will be correlated with LMSD timing and will be clearly identified as to source, content, test number and date. Other items not listed, but which are pertinent to test results, will be included in written reports in accordance with Section 8 of this DTO.

Because of the many individual pieces of information which must be assembled within a short period of time, every effort will be made to deliver each item of data within the time specified. Deviations resulting from conditions arising during or subsequent to conduct of the flight will be coordinated through the Palo Alto Development Control Center.

Douglas and Lockheed will designate data couriers as necessary to facilitate transmission of post data to either DAC, LMSD, the Flight Test Working Group (FTWG) or AFBMD (Inglewood) in accordance with the requirements specified herein. Data items not hand-carried by designated couriers will be transmitted via registered air mail. Mailing addresses of the five recipients are as follows:

a. Douglas Aircraft Company
Santa Monica Division
Missiles Engineering, DM-18 Project Office
Attention: O. E. Nemitz, A-260
3000 Ocean Park Boulevard
Santa Monica, California

b. Douglas Aircraft Company
A31 Location
Attention: L. J. Messersmith
P. O. Box 1596 (VAFB)
Lompoc, California

c. Lockheed Aircraft Corporation
Missiles and Space Division
Test Management and Operations, Bldg. 204
Attention: L. F. Morgan, Dept. 61-44
3251 Hanover Street
Palo Alto, California

d. Chief
Air Force Ballistic Missile Division
VAFB Field Office, WS-117L Project
Attention: FTWG, Lt. Col. W. Heisler
Vandenberg Air Force Base, California

e. Commander
Air Force Ballistic Missile Division
Air Research and Development Command
Attention: WDZW, Col. F. C. E. Oder
Air Force Unit Post Office
Los Angeles 45, California

7.1 LAUNCH DATA REQUIREMENTS

7.1.1 Launch Telemetry

Launch telemetry data requirements are listed in Table 7-1. The requirements for magnetic tapes, given in Item 1.1 of Table 7-1, assume satisfactory reception and recording of Thor telemetry at both the Air Force telemetry van and the LMSD tracking stations. In the event that recording at one station is unsatisfactory, the other station will provide the necessary duplicate copy. The data described in Table 7-1, Items 1.3 and 1.5, need not be better than plus or minus 5 percent of bandwidth. These records will be appropriately annotated by ground station personnel to facilitate interpretation.

The telemetry magnetic tape recorder track allocations and the detailed real-time CEC oscillograph setups to be used will be specified to all stations by LMSD Dept. 61-44 via TWX not later than five days prior to flight. This real-time oscillograph setup will include the following operationally required parameters:

a. Ascent (VAFB and Pt. Mugu)
   (1) Thor combustion chamber pressure
   (2) Beacon verifications 1, 2, 3, 4,
   (3) Discoverer combustion chamber pressure
   (4) Timer increase-decrease
   (5) Timer 10-sec increment
   (6) Timer 100-sec increment

b. Orbit (All stations)
   (1) Beacon verifications 1, 2, 3, 4
   (2) Timer reset monitor
   (3) Timer increase-decrease
   (4) Timer 10-sec increment
   (5) Timer 100-sec increment
   (6) Subsystem D timer operation monitor
   (7) Channel 13 commutated wave train (positions 18 through 24 only)

c. Re-entry (Kodiak and Hawaii)
   (1) Pod separation monitor
   (2) Pitch gyro
   (3) AET functions to be called out in STD 1052/218.

7.1.2 Launch Tracking Data

Tracking data acquired by VAFB and Pt. Mugu during launch and ascent to loss-of-signal as required are shown in Table 7-2.

7.1.3 Photographic Requirements

Documentary and engineering sequential photographic coverage of launch and early boost will be provided in accordance with Tables 7-3 and 7-4. Selected quick-look motion picture and still prints, as determined by the FTWG at VAFB, will be made available to DAC (VAFB), LMSD (Palo Alto),

and FTWG (VAFB) within 24 hours after firing. One work print each of all engineering sequential films will be delivered to the FTWG, AFBMD, (Inglewood), DAC (SM), and LMSD (PA) within 74 hours after firing. One master or otherwise reproducible print of all documentary films will also be delivered to each of the above within 98 hours after firing. Transmittal will be by courier or registered air mail. All engineering sequential motion picture prints will be 16-mm.

7.1.4 Pacific Missile Range Support Data

7.1.4.1 Metric Optics. Films resulting from metric optics instrumentation are required as shown in Table 7-5. Prints of selected footage, as determined by the FTWG at VAFB, will be forwarded to DAC (VAFB) and LMSD (PA) within 48 hours after launch. Within 72 hours following the test, positive prints of all exposed metric film will be distributed to DAC (VAFB), FTWG (VAFB), and LMSD (PA), (one print each).

Metric optics data requirements are listed in Table 7-6A. A tabulation of X, Y, Z, space position data, consisting of approximately 50 points (from liftoff to the last available point) and velocity data (at the last point for which a high confidence level can be established) will be forwarded to DAC (VAFB), FTWG (VAFB), and LMSD (PA) within 24 hours after launch. In the event that orbital status is verified on Passes 1 and 2, this time requirement may be relaxed to T+32 hours by means of notification to the AFBMD Field Office (VAFB) by LMSD (PA) within 8 hours after launch. Twelve copies of final smoothed data, as listed, will be distributed by courier or registered mail as follows:

a. Three copies each to LMSD (PA), AFBMD (Inglewood), and DAC (VAFB).
b. Two copies to FTWG (VAFB)
c. One copy to LMSD (VAFB).

7.1.4.2 FPS-16 Radar Data. A tabulation of the FPS-16 radar data obtained from PMR stations is required as shown in Table 7-6B. The Cartesian coordinate data from launch to loss of track will be forwarded with the quick-look metric optics data, from 24 to 32 hours following launch, to DAC (VAFB), FTWG (VAFB), and LMSD (PA). Twelve copies of final data consisting of annotated plot-board charts, Cartesian coordinate tabulated data interpolated to even quarter-seconds of WS-117L System time*, and polar coordinate system tabulated data (with interpolated system time) will be forwarded with the smoothed metric optics data at 72 hours following launch. The distribution will be:

a. Three copies each to LMSD (PA), AFBMD (Inglewood), and DAC (VAFB).
b. Two copies to FTWG (VAFB)
c. One copy to LMSD (VAFB).

In the event that corrections to the 72 hour package are necessary a "clean-up" data package shall be issued. LMSD Dept. 61-44 shall immediately be notified of the issuance of such a package, and distribution shall be the same as the T+72-hour date.

7.1.5 Launch Weather Data

Launch weather data requirements are listed in Table 7-7. Copies of these data are required within 48 hours after firing with distribution of two copies to DAC, VAFB, and one each to the FTWG (VAFB) and LMSD (PA).

7.1.6 Range Safety

One copy of each Range Safety chart, or recording, is required within eight hours after firing.

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* WS-117L System time is synchronized to even seconds with WWV time.

7.1.7 Electromagnetic Interference Monitoring

A written statement from Range Interference Control concerning the results of electromagnetic interference monitoring during countdown and launch will be transmitted to DAC (VAFB), LMSD (PA), and the FTWG (VAFB) within four hours after firing.

7.1.8 Blockhouse Landline Data

Six copies of all blockhouse quick-look landline recordings (analog) of Discoverer functions monitored during countdown and launch operations will be supplied within eight hours after firing. Necessary calibration information in the form of overlays or annotation will accompany the records. Three copies each will be transmitted to LMSD, (PA) and to the FTWG (VAFB).

7.1.9 Electronics Warm-up Telemetry Data

A tape record of the electronics warm-up period is necessary from the telemetering station. This record shall include all telemetry parameters, and consist of one minute of records approximately three minutes after the telemetering is turned on, and about two minutes of records at the end of the warm-up period. These tapes shall be furnished to LMSD (PA) within eight hours after launch.

7.1.10 Voice Communications Tapes

The original magnetic tape recordings of voice communications recorded at Vandenberg Control Center and the blockhouse during countdown and launch operations will be furnished to LMSD (PA) upon request from LMSD Dept. 61-44, with one copy to the FTWG (VAFB) and two copies to DAC (VAFB) within four hours after firing. If the tapes are not requested by Palo Alto the originals will be furnished to the FTWG rather than the copies.

7.1.11 Atmospheric Radiation History

The results of the atmospheric radiation monitoring in the Missile Assembly Building before, during, and following the integrated systems test, and on the pad prior to and after launch will be supplied by LMSD (VAFB) within 48 hours after launch. Three copies each of the results will be transmitted to LMSD (PA) and the FTWG (VAFB), and shall include necessary annotations and calibrations.

7.1.12 Servicing Notes

Final liftoff weight and balance data, alignment data and instrumentation schedules for the Discoverer/Thor combination will be supplied to DAC (Santa Monica), LMSD (PA), and the FTWG (VAFB) within four hours after launch.

7.2 ORBITAL DATA REQUIREMENTS

7.2.1 Radar and Telemetry Data

Radar and telemetry data recorded by each tracking station will be transmitted to LMSD (PA) in accordance with Table 7-8.

7.2.2 Voice Communications

Inter-station communications will be recorded on magnetic tape by the Development Control Center during the launch and orbital phases of the test. One copy of these recordings will be made available to STWG at Palo Alto within 36 hours after firing.

7.3 RECOVERY DATA REQUIREMENTS

Recovery data will be required from aboard the participating aircraft and surface vessels, the Hawaiian Control Center, and the Naval Weather Station, Pearl Harbor.

The following required data will be transmitted to LMSD Dept. 61-44 (PA), within 48 hours after termination of recovery operations. Data log sheets for use on the flight will be furnished by LMSD Dept. 61-44.

7.3.1 Test Conditions

Test conditions at time of recovery initiation will be recorded as follows:

a. Surface and upper air weather conditions in recovery area

b. Recovery Force deployment

c. Status of communications.

7.3.2 Acquisition Data

Data pertaining to the performance of the acquisition aids will be recorded as indicated below:

a. RC-121 and surface ship radar logs: chaff and silvered chute acquisition and tracking data

b. C-119 and surface ship DF logs: beacon acquisition and homing data

c. Aircraft and surface ship visual logs: acquisition data on the parachute, rescuelite, dye marker, and capsule

d. Rate of descent and impact location data.

7.3.3 Recovery Data

The following data will be noted for each recovery or attempted recovery:

a. Aircraft or ship number executing recovery
b. Time of day
c. Capsule altitude (at visual sighting and on contact)
d. Observed condition of parachute before recovery
e. Capsule and parachute motion before contact (oscillation, rotation, etc.)
f. Cable payout (air snatch)
g. Contacts (air pickup poles, cabling, fuselage, ship's hull, grappling hooks, sharks, etc.)
h. Observe if beacon light and transmitter are still operational.

7.3.4 Condition of Capsule

When the capsule is recovered, the following conditions will be noted based on a preliminary examination of the capsule:

a. Extent of capsule damage
b. Condition of parachute
c. Condition of water seals
d. Condition of sea marker (if recovered by air-snatch).

7.3.5 Operations Data

Recovery operations will be documented by motion picture and still photographic coverage as required. Still pictures of all significant items of equipment, including capsule and parachute after their recovery and their return to MCC, shall be made by Air Force photographers. A 16-mm motion picture coverage (32 frames/sec) shall be made of the aerial pickup operation by Air Force-operated, hand-held cameras. All film must be properly identified with title boards. Tape recordings of radio communications will

be made at the HCC, aboard one of the Naval Recovery Force contingent, and aboard the lead RC-121 aircraft. A detailed time-correlated log of Recovery Force deployment will be maintained at the HCC covering the period from the time of the recovery initiation to the termination of operations. The operations data required will also include copies of the regular (routine) logs maintained by the aircraft and ships. All logs and two copies of all photographic coverage shall be transmitted to LMSD Dept. 61-44 (PA), within 48 hours following recovery.

Table 7-1

LAUNCH TELEMETRY DATA REQUIREMENTS

Item No.	Description of Item	Data Source	Expected Coverage	No. Copies	Copies to:	Time Required
			THOR DATA			
1.1	Magnetic tape recordings of Thor telemeter receiver output	AF T/M Van, VAFB TLM-18, VAFB T.S.	T-2.5 minutes through separation	1 Copy 1 Orig. 1 to each	FTWG/VAFB DAC/VAFB LMSD, Palo Alto LMSD/VAFB DAC/VAFB FTWG/VAFB	T+4 hrs
1.2	Thor telemetry signal strength records	AF T/M Van, VAFB TLM-18, VAFB T.S.	Same	1	DAC/VAFB	T+4 hrs
1.3	Complete set of playback analog records of Thor telemetered functions with accompanying calibration scales	DAC, Santa Monica	T-3 minutes to sustained loss of signal	1 of each 1 of each	DAC/VAFB LMSD, Palo Alto	T+24 hrs T+48 hrs
			DISCOVERER SATELLITE DATA			
1.4	Magnetic tape recordings of Discoverer satellite telemeter receiver output	TLM-18, VAFB T.S.	T-2.5 minutes through satellite engine burnout	1 to each	LMSD, Palo Alto FTWG/VAFB DAC/VAFB	T+8 hrs
		VAFB Aux., Pt. Mugu	Launch through satellite pitchover	1 to each	LMSD, Palo Alto LMSD/VAFB	T+8 hrs
		Telemetry Ship	T+4 minutes through satellite reorientation	1	LMSD, Palo Alto	T+24 hrs
1.5	Analog recordings of Discoverer satellite telemetered functions recorded in real time	TLM-18, VAFB T.S. VAFB Aux., Pt. Mugu Telemetry Ship	As indicated above	1 of each	LMSD, Palo Alto	T+8 hrs T+8 hrs T+24 hrs
1.6	Quick-look, Analog kits of satellite test data	LMSD, Palo Alto Data Servicer	Launch only	1 1 1 2	FTWG/VAFB DAC/VAFB DAC/Santa Monica LMSD/VAFB	T+48 hrs

Table 7-2

LAUNCH TRACKING DATA REQUIREMENTS (RADAR AND TELEMETRY)

Item No.	Description of Item	Data Source	Expected Coverage	No. and Distribution of Copies	Time Required
2.1	Punched paper tapes of radar and telemeter tracking data (includes Doppler tapes)	VERLORT/VAFB VERLORT/Pt. Mugu TLM 18, VAFB	Lift-off through satellite engine burnout (one data point per 4 seconds)	1 each to: LMSD, Palo Alto FTWG/ VAFB	T+4 hrs
2.2	Plotting board charts of radar and telemetry tracking data * **	VERLORT/VAFB VERLORT/VAFB TLM-18, VAFB		3 each to: FTWG/VAFB DAC/VAFB LMSD, Palo Alto	
2.3	Radar signal strength records	VERLORT/VAFB VERLORT/Pt. Mugu		1 each to: LMSD, Palo Alto	T+8 hrs
2.4	Smooth trajectory plots	DCC, Palo Alto		1 DAC/VAFB 1 LMSD, Palo Alto 2 FTWG/VAFB 3 DAC, Santa Monica	T+48 hrs
2,5	Tabulation of computed space position data in Cartesian (X, Y, H) and polar (θ, ϕ, R) coordinates vs universal and local time **	DCC, Palo Alto (Computer Services)		1 DAC/VAFB 2 each to: FTWG/VAFB DAC, Santa Monica LMSD, Palo Alto	T+48 hrs
2.6	Quick-Look, Analog Kits of satellite Test Data	LMSD, Palo Alto Data Services	Launch only	1 each to: FTWG/VAFB DAC/VAFB DAC, Santa Monica LMSD/VAFB	T+48 hrs

* Includes plots of Mugu tracking made at VAFB, and vice-versa

** Source of tracking data and mode of station operation will be noted.

TABLE 7-3

Documentary Film Requirements

Item No.	Coverage	Desired Presentation	Frame Rate (FPS)	Image/Frame Ratio	Approximate Camera Location
3.1	Prefiring preparations on launch stand as directed (newsreel)	16-or 35-mm color motion pictures	24	--	10-200 ft from pad
3.2	Launch sequence (5 fixed cameras, remotely operated)		24 and 48	Approx. 30% missile image	50-200 ft from pad
3.3	Launch sequence (4 tracking cameras, manually operated)		24 and 48		2500 ft from pad
3.4	Still camera coverage of prefiring operations	B/W and color stills	Approx. 200 plates	--	10-200 ft from pad
3.5	On-call coverage of missile preparation and transport	16-or 35-mm color motion pictures, or B/W and color stills	As required	--	--
3.6	Sequential still coverage of flight (2 Hulcher-type cameras)	70-mm color stills	10	Approx. 50% missile image	One fixed on pad, one tracking

TABLE 7-4

Engineering Sequential Film Requirements

Item No.	Coverage	Desired Presentation	Time Interval	Frame Rate (FPS)	Image/Frame Ratio	Resolution	Camera Location *
4.1	Motion study of operations activity (3 cameras)	16-mm color motion pictures	Pre-countdown	12 to 60	--	--	C, D & E
4.2	Discoverer umbilical disconnect and launch sequence (2 cameras)	16-mm color motion pictures	T-5 to T+5 seconds	350	Discoverer to occupy 75% of frame	1/4-inch detail	B & E
4.3	Thor start sequence (2 cameras)	16-mm color motion pictures	T-5 to T+5 seconds	200	Thor eng. comp. to occupy 95% of frame	1/4-inch detail	F & H
4.4	Lift-off sequence (2 cameras)	16-mm color motion pictures	T-5 to T+5 seconds	500	Discoverer/ Thor to occupy 75% of frame	2-inch detail desirable	B & C
4.5	Thor engine performance (1 camera)	16-mm color motion pictures	T-5 to T+10 seconds	200	Nozzle of engine to occupy 75% of frame	1/4-inch detail	G
4.6	Countdown activities (5 cameras)	16-mm color motion pictures	T-15 to T+1 minutes	24	--	--	A, B, C, D & E

* Letters refer to camera location in Figure 7-1
All films will carry LMSD timing

TABLE 7-5
Metric Optics Film Requirements*

Item No.	Coverage**	Type Film	Time Interval	Frame Rate (FPS)	Image/Frame Ratio	Resolution	Camera Location**
5.1	4 Mobile Optical Tracking Units with 2 cameras each (MOTU's)	35-mm color	Lift-off to T+2 minutes	32	Best obtainable at 60,000 feet altitude		OT1, OT2, OT3, and OT4
5.2	One Recording Optical Tracking Instrument (ROTI or TAR)	35-mm color	Lift-off to T+4 minutes	64	Discoverer/ Thor to occupy 75% of frame at lift-off	6-inch detail at lift-off	OT5

* All films must carry IMSD timing.

** These cameras are located at five optical tracking sites with approximate pad coordinates as follows:

Distance from Pad (feet)

	OT1	OT2	OT3	OT4	OT5
North	4000	11,700	(-)19,500	(-)41,200	Tranquillon
East	5300	38,200	14,100	22,100	Peak

Pad 4 Location***		Pad 5 Location***	
Latitude:	34° 45' 26.18" N	Latitude:	34° 45' 22.15"
Longitude:	120° 37' 45.55" W	Longitude:	120° 37' 30.80"

*** North American data of 1927

Table 7-6A

METRIC OPTICS DATA REQUIREMENTS

Item	Description of Item	Data Source	Required Coverage	Desired Accuracy	Sample Rate	Required Presentation*	Time Required
6.1	Space position data	Best combination of Askania and MOTU photo-theodolite stations	Selected points from liftoff to limit of tracking ability	±1.0 Mil	50 pts. total	Tabulation of X, Y, Z (feet) versus time (sec)	T +24 to 32 hrs
6.2	Velocity data	VAFB (PMR)	Last available point for which a high confidence level can be established		Single Velocity Point	Tabulation of V_x, V_y, V_z, V_r (ft/sec) versus time (sec)	
6.3	Space position data		Liftoff to limit of tracking ability		4/sec	Tabulation of X, Y, Z (feet) versus time (sec); smoothed & time interpolated to even quarter sec of WS-117L time	T +72 hrs
6.4	Velocity data					Tabulation of V_x, V_y, V_z, V_r (ft/sec) versus time (sec); smoothed & time interpolated to even quarter sec of WS-117L time.	
6.5	Attitude data (pitch, roll, and yaw)	ROTI or TPR: Tranquillion Peak/PMR		±2 degree or best obtainable		Tabulation of θ, ϕ, Ω (deg) versus time from liftoff (sec)	

*Coordinates: X, Y, Z, V_x, V_y, V_z, V_r: cartesian coordinates, earth axes (non-rotating), with origin at launch pad, position Z upwards along local gravitational vertical, positive X in direction of predicted launch azimuth, Y to complete right-hand system.

θ, ϕ, Ω: θ-angle between longitudinal axes and local horizontal, positive for pitch-up; ϕ-degree of rotation about longitudinal axes referenced to launch position, positive for clockwise roll; Ω-angle between the projection of the vehicle longitudinal axis on the horizontal plane and the projection of the velocity vector on the horizontal plane, positive for right yaw.

Table 7-6B

FPS-16 RADAR DATA REQUIREMENTS

Item	Description of Item	Data Source	Required Coverage	Desired Accuracy	Sample Rate	Required Presentation*	Time Required
6.6	Space position data	Best combination of PMR FPS-16 Stations (preferably Tranquillon Peak)	From liftoff to limit of tracking	$\pm\frac{1}{2}$ mil Note: Velocity and position data to be specified to nearest foot or foot per sec	4 per sec	Tabulation of X, Y, Z, (feet) versus time (sec)	T +24 to 32 hrs
6.7	Velocity data					Tabulation of V_x, V_y, V_z, V_r (ft/sec) versus time (sec)	
6.8	Space position data					(a) Smoothed cartesian coordinate position and velocity quick-data interpolated to even quarter-sec increments of WS-117L time	T +72 hrs
6.9	Velocity data					(b) Smoothed Polar coordinate position data referenced to primary FPS-16 radar site and also LMSD Mod II sites at Pt. Mugu and VAFB. Time interpolated to even quarter sec increments of WS-117L time.	

*Coordinate System:

Cartesian - $X, Y, Z, V_x, V_y, V_z, V_r$: earth axes (non-rotating), with origin at launch pad, position Z upwards along local gravitational vertical, positive X in direction of predicted launch azimuth, Y to complete right-hand system.

Polar - Azimuth, Elevation angles (deg) and range (feet), with origin at radar site (PMR FPS-16, also LMSD Mod II at VAFB and Pt. Mugu) with true north being 0° azimuth (clockwise positive).

TABLE 7-7

Launch Weather Data Requirements

Item No.	Description of Item		Required Coverage	Desired Accuracy	Time of Observation	Required Presentation	Time Required
7.1	Surface Conditions	Pressure	Actual conditions at launch pad for each observation	± 3 mb	T-12, T-4 and T+1 hours	Tabular	T + 48 hours
		Temperature		± 1°C			
		Humidity		± 10%			
		Wind Speed		± 3.6 knots			
		Wind Direction		± 10°			
		Visibility		± 1000 ft			
7.2	Upper Air Conditions	Pressure *	Surface to 110,000 ft or maximum capability of the weather station	± 1.5 mb above 50,000 feet	Conditions prevailing at time of launch	Graphical presentation with all parameters correlated with tape-line altitude	
		Temperature**		± 1°C			
		Humidity **		Best obtainable			
		Wind Speed *		± 3.6 knots			
		Wind Direction *		± 10°			
		Density *		± 0.6%			
		Cloud Cover		± 10%		Noted	

* Data points required each 1000 feet of altitude

** Data points required each 1000 feet to 10,000 feet; each 2000 feet to 20,000 feet; each 5000 feet above 20,000 feet.

Table 7-8

ORBITAL RADAR AND TELEMETRY DATA REQUIREMENTS*

Tracking Station	Expected Coverage (Passes)	Time Required (hr)	Method of Delivery
VAFB	9N, 15S	T + 15	Courier
Hawaii	2S	T + 12	Courier
	10N, 17S	T + 48	Commercial Airline
Annette	1S	T + 18	Courier
	9N, 10N, 15S, 16S	T + 48	Commercial Airline
Chiniak	1S, 2S	T + 18	Courier
	10N, 11N, 15S, 16S 17S,	T + 48	Commercial Airline

* The following items of data from each tracking station will be transmitted to LMSD, Palo Alto, within the times specified:

a. Magnetic tape recordings of Discoverer satellite telemeter receiver output

b. Discoverer telemetry signal strength records

c. Real-time analog records of Discoverer satellite telemetered functions

d. Punched paper tapes of radar and telemetry tracking data

e. Plotting board charts of radar and telemetry tracking data

f. Radar signal strength records

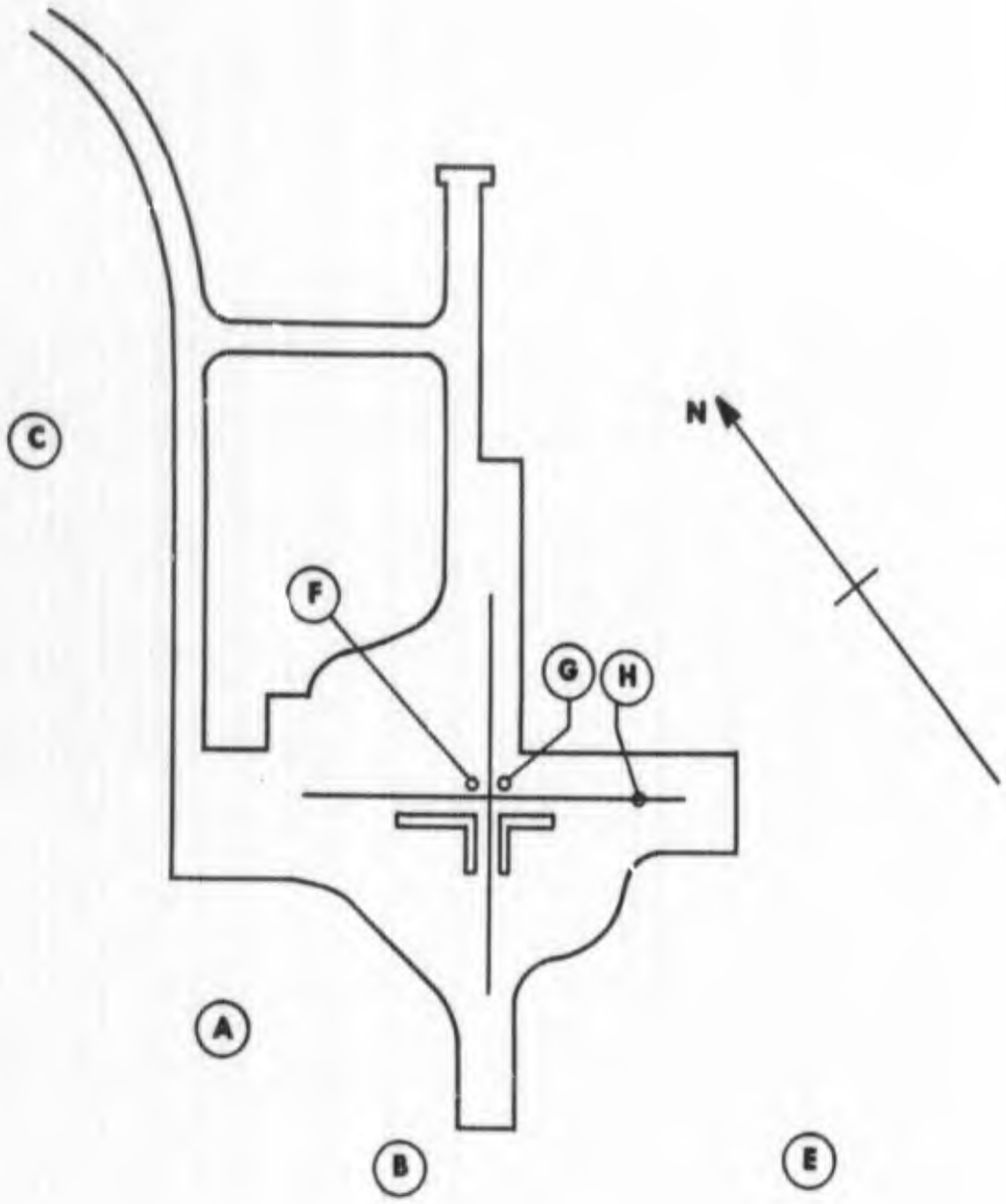


Fig. 7-1 Launch Complex SM-75-3 Pad 5,
with Camera Locations

SECTION 8
TEST REPORTS

Test Reports which are required for official distribution are listed in Table 8-1. In addition, field reports describing actual test support activities and equipment operation will be required from all stations. The content and format of these reports are given below.

8.1 LAUNCH REPORTS

The Flight Test Working Group at VAFB will prepare and transmit the following reports to AFBMD/WDZW with distribution as shown in Table 8-1.

8.1.1 Flash Report

A flash report briefly describing launch operations and results will be transmitted via TWX.

8.1.2 Follow-On Launch Report

A follow-on report giving a more complete description of launch operations and flight results will be transmitted via TWX after a preliminary review of raw launch data.

8.1.3 Final Launch Report

This report will provide a formal documentation and FTWG evaluation of launch operations and results, including the pertinent launch data.

Table 8-1

TEST REPORTS

Report	Type	Time Req'd	Responsibility	Required Inputs by	Copies to:
Commentary	Voice link	T-0 to T+15 min	Test Director (VAFB)	LC/DAC LC/LMSD	DCC/PA
Flash	TWX	0-8 hrs	BMD/VAFB	FTWG/VAFB DAC/VAFB LMSD/VAFB	BMD/WDZW LMSD/(61-44) LMSD/(61-70) BMD/Palo Alto DAC/Santa Monica
FOLR	TWX	24-48 hrs			
FLR	Pub.	7-14 days			
PRTR	TWX	48 hrs	HCC	All Recovery Force Elements	
DQLR	TWX	48 hrs	DAC/Santa Monica	DAC/Santa Monica	BMD/WDZW LMSD/(61-44) LMSD/(61-70) BMD/Palo Alto
FDFTR	Pub.	30 days			
PFIT	TWX	2-8 hrs	LMSD/Palo Alto	DCC/PA LMSD/VAFB DAC/Santa Monica Tracking Stations	BMD/WDZW BMD/PA DAC/Santa Monica BMD/VAFB
PSTR	Pub.	7-10 days			
FFTR	Pub.	30 days			
STER	Pub.	45 days	BMD/PA	STWG as required	BMD/WDZW BMD/VAFB DAC/Santa Monica LMSD/Palo Alto

Code:

FOLR	Follow-on Launch Report	PSTR	Preliminary System Test Report
PRTR	Preliminary Recovery Test Report	FFTR	Final Flight Test Report
FLR	Final Launch Report	STER	System Test Evaluation Report
DQLR	Douglas Quick-Look Report	Pub.	Published Formal Report
FDFTR	Final Douglas Flight Test Report	LC	Launch Conductor
PFIT	Preliminary Flight Information TWX		

8.2 DOUGLAS THOR REPORTS

8.2.1 Douglas Quick-Look Report

A quick-look report containing the results of a preliminary review of Thor launch data at Santa Monica, with particular emphasis upon indicated problem areas, will be transmitted via TWX.

8.2.2 Final Douglas Flight Test Report

This report will provide an analysis of Thor equipment operation and performance during countdown, launch, and flight, and will encompass all factors involving possible modification of equipment, plans, or procedures on future tests.

8.3 DISCOVERER SATELLITE REPORTS

8.3.1 Preliminary Flight Information TWX

This report will contain a brief description of flight operations and results based on the flash report of Paragraph 8.1.1 and the latest inputs from the remote tracking stations.

8.3.2 Preliminary System Test Report

This report will be based upon system quick-look evaluation at Palo Alto, the follow-on launch report (Paragraph 8.1.2), the Douglas quick-look report (Paragraph 8.2.1), and internal LMSD reports from the tracking stations and the Development Control Center. The report will include a brief summary of test results, a complete account of test conduct, and a preliminary operational evaluation of the flight in terms of the achievement of test objectives, problems encountered, and overall system performance.

8.3.3 Final Flight Test Report

This report will be based upon a complete analysis of boost and orbital trajectory and Discoverer satellite subsystems performance. The report will contain an analysis of all factors involving possible hardware refinement or test procedures and will provide a complete documentation of the flight, including test data.

8.3.4 System Test Evaluation Report

This report will be based upon all test information previously published. The report will contain a final operational evaluation of overall system performance and will make specific recommendations regarding possible program redirection.

8.4 TRACKING STATION REPORTS

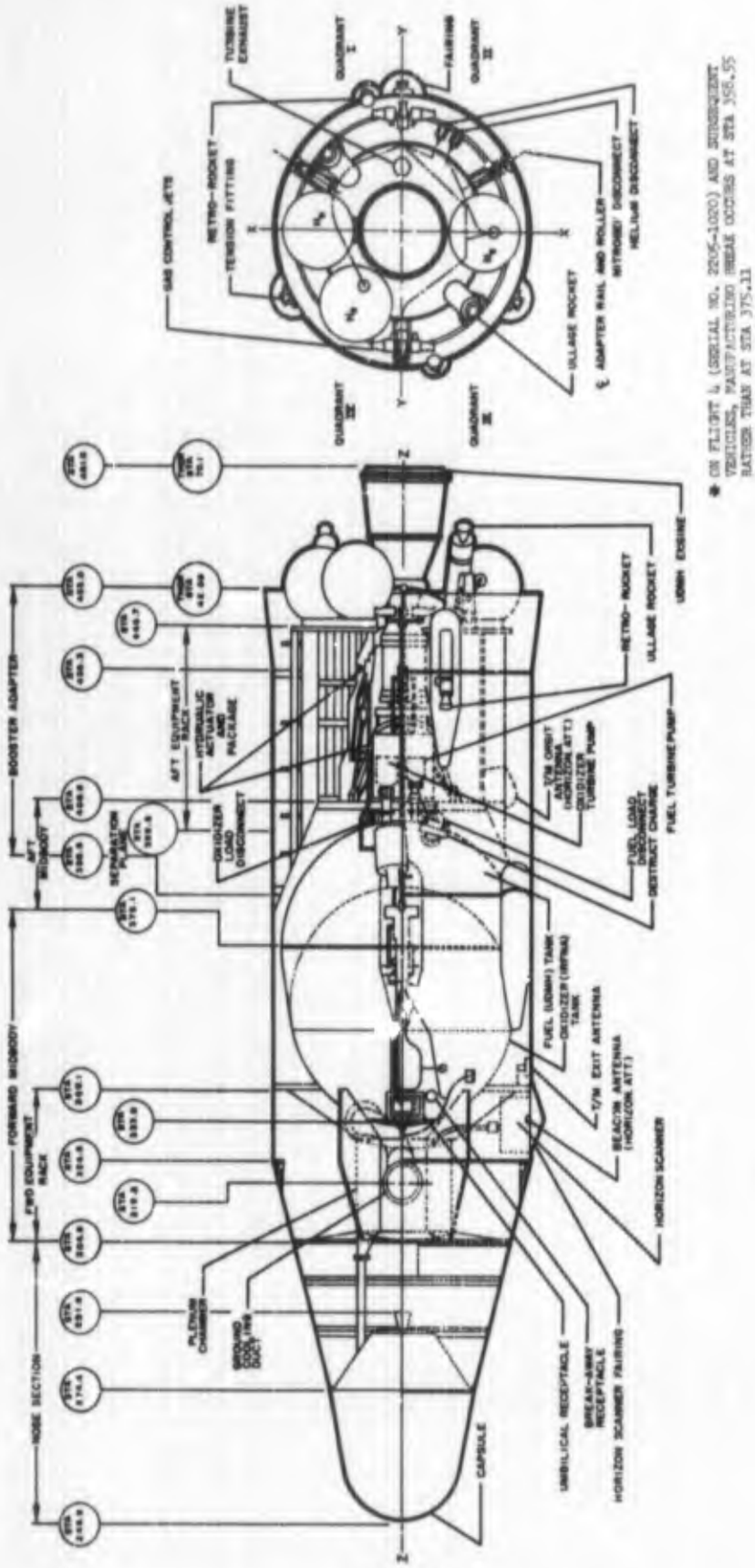
All tracking stations will report on the operation of their equipment via TWX to the Development Control Center (attn: L. F. Morgan, Dept. 61-44) within 24 hours after termination of station activities. This report will constitute a summary of station performance in support of launch and all active passes. Any problem areas encountered shall be delineated.

8.5 HAWAIIAN CONTROL CENTER REPORTS

The HCC will transmit a commentary on test results to the DCC via the voice link immediately after termination of recovery operations This will be followed by a more complete report to be transmitted via TWX within 8 hours. In addition, each major contingent of the Recovery Force will prepare a written report describing the operation of equipment, actual procedures used, and pertinent observations. These reports will be furnished to the HCC, which will complete a preliminary recovery test report for formal transmission to the DCC within 48 hours after termination of recovery operations.

APPENDIX A

APPENDIX A-1



* ON FLIGHT 4 (SERIAL NO. 2206-1020) AND SUBSEQUENT VEHICLES, PANEL ATTACHING BREAK OCCURS AT STA 368.55 RATHER THAN AT STA 375.11

Discoverer Satellite Vehicle, Inboard Profile

DISCOVERER VEHICLE SERIAL NO. 1028 EQUIPMENT LOCATION

Equipment	Location	SS
Propulsion System		
Engine	Aft Equip Rack	F
Ullage Control Rocket	Aft Equip Rack	
Press. Sys. & H_e Supply	Midbody & Aft Equip Rack	
Aux. Power System		
(1) Battery, Type IA	Fwd Equip Rack, Quad I	C
(1) Battery, Type IA	II	
Power Supply, Type I, DC	IV	
(2) Regulator, Type I, DC	IV	
Regulator, Type II, AC	II	
Inverter, 400 ~ 3	IV	
Limiter 400 ~ 3	IV	
Inverter, 2000 ~ 1	IV	
Limiter 2000 ~ 1	IV	
(2) Relay, Power Hyd	IV	
Guidance System		
Inertial Reference Pkg	Fwd Equip Rack, Quad III	D
Horizon Scanner	II	
Sequence Programmer	III	

Equipment	Location	SS
Flight Control System		
Electronic & Rate Gyro Pkg	Fwd Equip Rack, Quad II	D
Hydraulic Power Pkg	Aft Equip Rack	
(2) Hydraulic Actuators		
Pneumatic Control Pkg		
(6) Gas Valves & Nozzles		
(2) N_2 Spheres		
Communications System		
S-band Beacon, Power Supply & Decoder	Fwd Equip Rack, Quad III	H
S-band Beacon Antenna	Fwd Midbody	
Secondary Programmer	Fwd Equip Rack, Quad III	
Telemeter Pkg	Quad I	
T/M VCO Tray		
T/M Dual Loop OSG		
VHF Acquisition Beacon Diplexer		
(2) VHF Antenna	Fwd Midbody (Exit)	
(1) Exit (1) Orbit	Aft Equip Rack (Orbit)	
Antenna Switch	Fwd Equip Rack, Quad I	
Battery, Acq Beacon	Quad II	

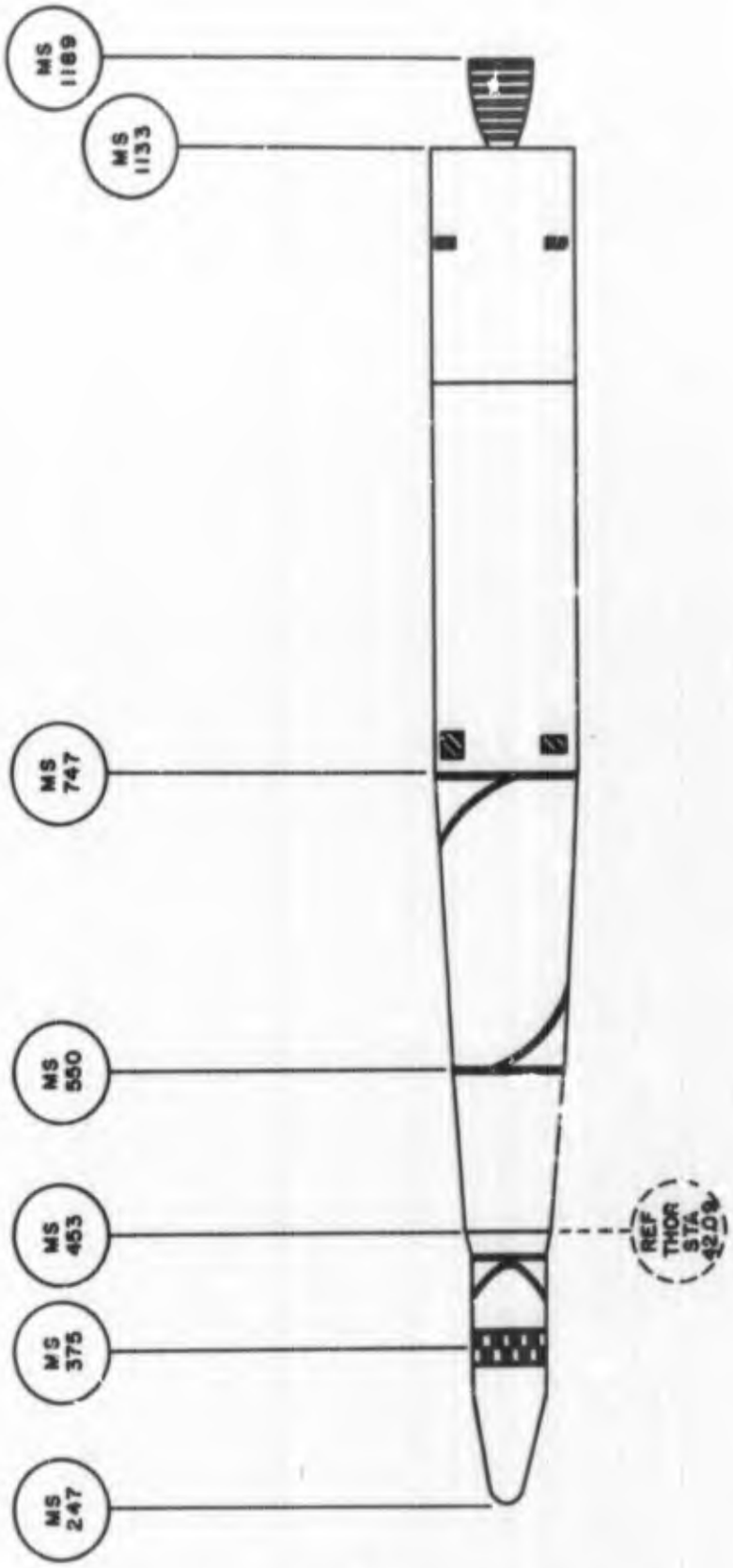
SECRET

SECRET

THOR (DISCOVERER BOOSTER) DAC SM-75 - INBOARD PROFILE,
SYSTEMS LOCATION AND FUNCTIONAL DATA

System	Location	Functional Data	System	Location	Functional Data
Autopilot Control Electronics Assembly Gyros AIC Amplifiers DIC Amplifiers Programmer	Guidance section	Controls missile trajectory by swiveling main and vernier rocket engines	Hydraulics-Con't Hydraulic Power Package N_2 Storage Sphere Press Reservoir Accumulator Filters, Valves, Plumbing actuators	Forward engine & access section	
Electrical 28 V Batteries(2)	Guidance section	Supplies DC power to guidance system, engine relay box & accessories, control elect. assembly and 28 V to inverter.	Propulsion N_2 Spheres	Forward engine & access. section	Engine pneumatic control, vernier and main engine fuel tank pressurization
Inverter 115/208 VAC 400 ~ 3KVA		Supplies AC power to guidance system control electronics assembly,	Main Engine (Rocketdyne) XLR 79-NA-5		150,000# thrust 163 sec (nominal) duration
Hydraulics Engine Driven Pump 7 hp 3600 rpm flow rate 7 gpm output 3000 psig	Mounted on engine turbine take off pad	Supplies Hydraulic power required to position main and vernier engines	Vernier Engine (two)		1,000# thrust each 72 sec (nominal) duration

APPENDIX A-3



Discoverer/Thor Configuration: Paint Pattern

APPENDIX B

APPENDIX B-1

DETAILED WEIGHT BREAKDOWN, DISCOVERER SERIAL 2205-1052

		Weight (lb)
Weight Empty		1945
Propellant Load (Acid 4706 UDMH 1847)		
Impulse Propellant, (Acid 4636, UDMH 1804)	6440	
Oxidizer Pre-Flow Expended	21	
Trapped in Lines, Tanks and Engine	78	
Residuals for Mixture Ratio	14	
TOTAL		6553
Thor Payload		8498
Less: Adapter and Attachments	-146	
Retro-Rockets	-16	
Destruct System	-5	-167
Separation Weight		8331
Less: Horizon Scanner Fairing	-2	
Control Gas Expended During Coast	-5	
Ullage Control Rockets	-38	
		-45
Orbital Boost Weight		8286
Less: Expendable Propellants	6461	
Control Gas Expended During Boost	-4	
Engine Starting Charge	-1	
Engine Nozzle Closure	-3	
		-6469
Burnout Weight		1817
Less: Residual Propellants	-92	
Helium Vented	-5	
		-97
Operational Empty Weight on Orbit	1720	
Less: Remaining Control Gas	-20	
Weight Empty on Orbit	1700	

APPENDIX B-2

ESTIMATED INERTIA AND CENTER OF GRAVITY (C.G.) DATA (WEIGHT AND BALANCE) FOR DISCOVERER VEHICLE 1052/THOR 218

Condition	Weight (lbs)	C.G. Location (in.) $\bar{Z}$	C.G. Location (in.) $\bar{X}$	C.G. Location (in.) $\bar{Y}$	Moments of Inertia (slug-ft^2) I_{xx}	Moments of Inertia (slug-ft^2) I_{yy}	Moments of Inertia (slug-ft^2) I_{zz}
Launch	117,509	798.2	+0.03	+0.07	801,245	801,238	3,728
Booster Burnout	17,636	655.0	+0.25	+0.32	390,866	390,860	2,174
Thor Payload	8,498	361.9	+0.02	+0.08	2,104	2,116	151
Separation	8,331	360.7	+0.01	+0.09	1,945	1,959	125
Engine Ignition	8,286	360.2	+0.03	+0.09	1,856	1,870	121
Burnout	1,817	351.5	+0.16	+0.42	1,440	1,454	121
Burnout Less Residuals and Gas	1,700	347.7	+0.36	+0.45	1,336	1,348	119

APPENDIX B-3

WEIGHT BREAKDOWN, THOR BOOSTER SERIAL 218

	Booster S/N 218	
	Weight (lb)	C. G. (Sta)
Dry Thor Booster	7011	
Trapped Propellant	636	
Pressurization Gas	362	
Unusable Lube Oil	44	
Residual Propellant	1011	
Booster at Vernier Burnout (1% Residuals)	9064	515.57
Vernier Propellant Burned	74	
Booster at Main Stage Burnout (1% Residuals)	9138	516.62
Propellant Burned	99,649	
Liquid Oxygen Overboard	128	
Vernier Propellant Overboard	12	
Lube Oil Used	84	
Liftoff	109,011	421.25

APPENDIX C

APPENDIX C-1

TELEMETER INSTRUMENTATION SCHEDULE

DISCOVERER VEHICLE NO. 2205-1052

Vehicle Transmitter No.	Bus 1
Frequency (MC)	237.8
Transmitter Type	Telechrome
Transmitter No.	1024905-501
R.F. Amplifier Type	Telechrome
R.F. Amplifier No.	1024915-501

Final Schedule

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INSTRUMENTATION SCHEDULE (CONTINUOUS CHANNELS)

Telemeter #9002
FLIGHT NO. FTV-11 VEHICLE Nº 2205-1052 TYPE _____ TRANSMITTER NO. _____

RDB CHAN. NO.	FREQUENCY - CPS -	FREQUENCY - CPS C.F.	FREQUENCY - CPS +	MEASUREMENT NAME	MEAS. NO.	FREQ. RESP. (CPS)	MEAS. RANGE	TYPE AND SERIAL PICKUP	TYPE AND SERIAL OSC	LOC. OSC. P.U.	REMARKS	
1 & 2	200		500	Turbine Speed	B35	4CPS	12,000 to 20,000 RPM	Bell Aircraft		416	Turbine Speed Coupler	P
	518	560	602	Timer Freq.	E110	360 - 450CPS						
3	675	730	785	Not Used								
4	888	960	1,032	Not Used								
5	1,202	1,300	1,398	Not Used								
6	1,572	1,700	1,828	Not Used								
7	2,127	35	2,473	Comm. #2 Ring B (Pos. 22,52)	AET20 AET21		0-5VDC		VCO UED TSO 200B			
8	2,775	45	3,225	No Name Assigned	AET50		0-5VDC		VCO UED TSO 200B			P
9	3,607	60	4,193	"Y" Acceleration Comm. #2 Ring B (Pos. 18, 48)	A-4	100CPS	±3G	S-A501TCa	VCO UED	409	1) With CA7 Carrier 2) AMP	
10	4,995	do	5,805	"X" Acceleration Comm. #2 Ring B (Pos. 20, 50)	A-3 AET14 AET15	100CPS	±3G	S-A501TCa	VCO UED TSO 200B	409	1) With CA7 Carrier 2) AMP	
11	6,799	110	7,901	Beacon Commands	Tones 1-4		Telltales				Beacon Comm 1 2 3 4 Tone cps 183 244 293 400	
12	9,712	160	11,288	Comm. Volt (see pp. C-1-4 & C-1-5)					VCO UED TSO 200B			P *
13	13,412	220	15,588	Comm. Volt (see pp. C-1-6 & C-1-7)				PG2857L-700-350	VCO UED TSO 200B			P *
14	20,350	330	23,650	Comb. Chamber Press. Comm #2 Ring B (Pos. 24, 54)	B-6 AET23 AET24	200CPS	0-700 PSIA		VCO UED TSO 200B	438	1) With CA7 Carrier 2) AMP	P
15	27,750	450	32,250	Comm. Temps (see p. C-1-8)					VCO UED TSO 200B			
16	37,000	600	43,000	Comm. Volt (see p. C-1-9)					VCO UED TSO 200B			P
17	48,560	790	56,440	Comm. Volt (see p. C-1-10)					VCO UED TSO 200B			P*
18	64,750	1,050	75,250	No Name Assigned	AET49				VCO UED TSO 200B			P

1) On Ascent only 2) On Orbit only * Subcarrier must be present

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2203-1052 COMMUTATED CHANNEL NO. 12

TYPE COMM. ABCDP TA30035, 60 Pt., 2 Poles Channel 12 COMM. UNIT _____ COMM. RATE 1 RPS Comm. #2 Ring "A"

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	ACCU-RACY REQ'D	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS
1	CAL 1/2							
2		AET26		0-5VDC	0-5VDC			
3		AET28		0-5VDC	0-5VDC			
4		AET30		0-5VDC	0-5VDC			
5		AET32		0-5VDC	0-5VDC			
6		AET34		0-5VDC	0-5VDC			
7		AET36		0-5VDC	0-5VDC			
8		AET38		0-5VDC	0-5VDC			
9		AET40		0-5VDC	0-5VDC			
10		AET42		0-5VDC	0-5VDC			
11		AET44		0-5VDC	0-5VDC			
12		AET46		0-5VDC	0-5VDC			
13		AET48		0-5VDC	0-5VDC			
14		AET25		0-5VDC	0-5VDC			
15		AET27		0-5VDC	0-5VDC			
16		AET29		0-5VDC	0-5VDC			
17		AET31		0-5VDC	0-5VDC			
18		AET33		0-5VDC	0-5VDC			
19		AET35		0-5VDC	0-5VDC			
20		AET37		0-5VDC	0-5VDC			
21		AET39		0-5VDC	0-5VDC			
22		AET41		0-5VDC	0-5VDC			
23		AET43		0-5VDC	0-5VDC			
24		AET45		0-5VDC	0-5VDC			
25		AET47		0-5VDC	0-5VDC			
26	Repeat Pos. #7							
27	Repeat Pos. #9							
28	Repeat Pos. #11							
29	CAL +							
30	Yaw Gyro Torque	D84	2%	±30°/min	0-5VDC	Rectif.	319	

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. SSD5-1052 COMMUTATED CHANNEL NO. 10

TYPE COMM. ABCOF TA00015 60 Pt., 2 Poles, Channel 12 COMM. UNIT _____ COMM. RATE 1 KPS Comm. #2, Ring "A"

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	ACCU-RACY REQ'D	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS
31	CAL 1/2							
32	Sep Mon Staircase	A93			0-5VDC			
33	T/M 200VDC	H77	5%	0-200VDC	0-5VDC	Div.	314	
34	Nitrogen Shut-Off Valve	D97		On-Off	0 or 5VDC	Relay	446	
35	20 V. Reg. (+)	H78	5%	0-20VDC	0-5VDC	Div.	314	
36	CAL 1/2							
37	T/M 6.3VDC	H79	5%	0-6.3VDC	0-5VDC	Div.	314	
38	Repeat Pos. #5	AET38						
39	400 Cycle Pwr. Supply A&B	C3	2%	110V to 120VAC	0-5VDC	Rectif.	326	
40	CAL 1/2							
41	T/M Regulator (-)	H80	5%	0 to -20 VDC	0-5VDC	Div.	314	
42	Repeat Pos. #6	AET34						
43	Repeat Pos. #7	AET36						
44	400 Cycle Pwr. Supply	C4	2%	110 to 120VAC	0-5VDC	Rectif.	329	
45	Repeat Pos. #8	AET38						
46	Repeat Pos. #9	AET40						
47	Repeat Pos. #10	AET42						
48	CAL 1/2							
49	Thrust Chamb. Press Sw.	B21	20%	On-Off	0-5VDC	Switch	328	
50	Fuel Case Press Sw.	B17	2%	On-Off	0 or 5VDC	Switch	328	
51	CAL 1/2							
52	Gas Gen. Pilot Valve	B18	20%	On-Off	0-5VDC	Switch	328	
53	Hydraulic Mtr. Batt. Volt.	C21	2%	23-31VDC	0-5VDC	Div.	414	
54	SS/D Timer Monitor	D85	10%	0-5VDC	0-5VDC	TT	319	
55	Repeat Pos. #30	D84						
56	Repeat Pos. #39	C3						
57	CAL 2							
58	SYNC							
59	SYNC							
60	SYNC							

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2205-1059 COMMUTATED CHANNEL NO. 13

TYPE COMM. ASCOP DA00015 60 Pt., 2 Pole, Channel 13 COMM. UNIT #2 Ring B COMM. RATE 1 RPS

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	CODE	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS
1	CAL Z							
2		AET1		0-5VDC	0-5VDC			
3	CAL Z							
4		AET3		0-5VDC	0-5VDC			
5	CAL Z							
6		AET5		0-5VDC	0-5VDC			
7	CAL Z							
8		AET7		0-5VDC	0-5VDC			
9	CAL Z							
10		AET9		0-5VDC	0-5VDC			
11	CAL Z							
12		AET10		0-5VDC	0-5VDC			
13	CAL Z							
14		AET12		0-5VDC	0-5VDC			
15	CAL Z							
16	CAL +							
17	CAL Z							
18		AET14 AET15		0-5VDC	0-5VDC			
19	CAL Z							
20		AET17 AET18						
21	CAL Z							
22		AET20 AET21		0-5VDC	0-5VDC			
23	CAL Z							
24		AET23 AET24		0-5VDC	0-5VDC			
25	CAL Z							
26	CAL 1/2							
27	CAL Z							
28	SYNC							
29	SYNC							
30	SYNC							

NOTE: No AET measurements have assigned names.

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2805-1059 COMMUTATED CHANNEL NO. 13

TYPE COMM. ASCOP 2A10015 60 Pt. 2 Pole Channel 13 COMM. UNIT #2 Ring 8 COMM. RATE 1 RPS

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	CODE	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA	REMARKS
31	CAL Z							
32		AET1		0-5VDC	0-5VDC			
33	CAL Z							
34		AET3		0-5VDC	0-5VDC			
35	CAL Z							
36		AET5		0-5VDC	0-5VDC			
37	CAL Z							
38		AET7		0-5VDC	0-5VDC			
39	CAL Z							
40		AET9		0-5VDC	0-5VDC			
41	CAL Z							
42		AET10		0-5VDC	0-5VDC			
43	CAL Z							
44		AET12		0-5VDC	0-5VDC			
45	CAL Z							
46	CAL +							
47	CAL Z							
48		AET14 AET15		0-5VDC	0-5VDC			
49	CAL Z							
50		AET17 AET18		0-5VDC	0-5VDC			
51	CAL Z							
52		AET20 AET21		0-5VDC	0-5VDC			
53	CAL 1							
54		AET23 AET24		0-5VDC	0-5VDC			
55	CAL Z							
56	CAL 1/2							
57	CAL Z							
58	SYNC							
59	SYNC							
60	SYNC							

NOTE: No AET measurements have assigned name.

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2005-1052 COMMUTATED CHANNEL NO. 15

TYPE COMM. ASCOP A000 ADV 30 Pt. 2 Pole COM.4. UNIT Comm. #3, Rings "A" & "B" COMM. RATE 5 RPS

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	CODE	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS
1	CAL 1/2							
2	Horizon Scanner Temp.	D82	5%	0-200°F +200°F	0-50MV	R-88-4	334	
3	5 K to Ground							
4	Guidance Electronics Temp	D61	5%	-100° to +200°F	0-50MV	R-88-4	319	
5	Rev.2000 CPS Inv. Temp #05	SD80	2%	-100° to +200°F	0-50MV	R-88-4	338	
6	5 K to Ground							
7	CAL 1/2							
8	Inv. RF Amp Temp. #06	SD81	2%	-100° to +200°F	0-50MV	R-88-4	311	
9	CAL 1/2							
10	5 K to Ground							
11	Battery Case Temp.	C9	5%	0-200°F +200°F	0-50MV	R-88-4	315	
12	5 K to Ground							
13	T/M Transmitter Temp.	H71	5%	0-200°F +200°F	0-50MV	R-88-4 series	311	
14	CAL +							
15	CAL 1/2							
16	5 K to Ground							
17	CAL 1/2							
18	Struct. Temp. #2	SD86	2%	-100° to +200°F	0-50MV	R-88-4	320	
19	Repeat Pos. #2	D82						
20	Repeat Pos. #4	D61						
21	Repeat Pos. #5	SD80						
22	CAL 1/2							
23	Repeat Pos. #8	SD81						
24	CAL 1/2							
25	Repeat Pos. #11	C9						
26	CAL 1/2							
27	CAL Z							
28	SYNC							
29	SYNC							
30	SYNC							

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2205-1052 COMMUTATED CHANNEL NO. 16

TYPE COMM. ASCOP A00042 30 Pt., 2 Poles, Channel 16 COMM. UNIT Comm # 1, Ring "B" Real time COMM. RATE 5 RPS

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	COD*	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS	
1	CAL 1/2								
2	Beacon Verification #1	B64	20%	On-Off	0-5VDC	Relay	324		
3	Transducer Supply Voltage	T12	10%	0-5VDC	0-5VDC	Divider			
4	Beacon Verification #2	B65	20%	On-Off	0-5VDC	Relay	324		
5	CAL 1/2								
6	Beacon Verification #3	B66	20%	On-Off	0-5VDC	Relay	324		
7	Fuel Pump Inlet Press.	R1	2%	0-120 PSIG	0-5VDC	W-P2-1251 Corrosion Proof	407		
8	Beacon Verification #4	B67	20%	On-Off	0-5VDC	Relay	324		P
9	CAL 1/2	E108	5%	0-5VDC	0-5VDC		320	0-5 Volts in .5V steps	
10	Timer Monitor	E70	2%	On-Off	0-5VDC	Relay	324		P
11	Reg. Supply Voltage (-)	C11	2%	-26 to -30VDC	0-5VDC	Div.	315		
12	Repeat Pos. #2								
13	Beacon Transponder Temp.	E74	5%	0-185°F	0-5VDC	Supplied by Philco	324		
14	CAL +								
15	Battery Bus Voltage	C1	2%	23-31VDC	0-5VDC	Div.	315		
16	Beacon Signal Level	E75	5%	0-5VDC	0-5VDC	Rectif.	324		
17	Step Position Ref. Voltage	E111			0-5VDC				
18	Beacon Power Level	E76	5%	0-5VDC	0-5VDC	Rectif.	324		
19	5 K to Ground								
20	Hydraulic Press	R1	10%	0-4000 PSIG	0-5VDC	Bdcliff 2-8-2	453		
21	No Name Assigned	ART51		0-5VDC	0-5VDC				
22	Time Increase/Decrease	E107	10%	0 or 5VDC	0-5VDC		320		P
23	Oxidizer Pump Inlet Press.	R2	2%	0-120 PSIG	0-5VDC	W-P2-1251 Corrosion Proof	410		
24	10 Sec. Step Position	E108	5%	0-5VDC	0-5VDC		320	0-5 volts in .5V steps	P
25	2000 Cycle Pwr. Supply	C7	2%	110 to 120VAC	0-5VDC	Rectif.	318		
26	100 Sec. Step Position	E109	5%	0-5VDC	0-5VDC		320	0-5V in .5V steps	P
27	CAL 2								
28	SYNC								
29	SYNC								
30	SYNC								

INSTRUMENTATION SCHEDULE

FLIGHT NO. FTV-11 VEHICLE NO. 2205-1052 COMMUTATED CHANNEL NO. 17

TYPE COMM. ASCOP A00026 30 Pt., 2 Poles, Channel 17 COMM. UNIT _____ COMM. RATE 5 RPS Comm. #1 Ring "A"

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	CODE	MEAS. RANGE	VOLT RANGE	P.U. TYPE & SERIAL NO.	STA.	REMARKS
1	CAL 1/2							
2	Yaw Rate-OTV Auto Pilot	D11	2S	±10°/sec	0-5VDC		320	
3	Gas Jet Command Sig. #1	D25	2S	0-5VDC	0-5VDC		319	
4	Pitch Actuator Position	D43	5S	±.72 in.	0-5VDC		319	
5	Roll Rate-OTV Auto Pilot OTV	D12	2S	±10°/sec	0-5VDC		320	
6	Gas Jet Command Sig. #2	D26	2S	0-5VDC	0-5VDC		319	
7	Reg. Supply Voltage (+)	C2	2S	26-30VDC	0-5VDC	Div.	315	
8	Pitch Rate-OTV Auto Pilot	D10	2S	±10°/sec	0-5VDC		320	
9	Gas Jet Command Signal #3	D27	2S	0-5VDC	0-5VDC		319	
10	Velocity	D57	2S	0-14,000' per sec.	0-5VDC	Rectif.	319	
11	Pitch Gyro - E1	D16	2S	±9°	0-5VDC		319	
12	Gas Jet Command Signal #4	D28	2S	0-5VDC	0-5VDC		319	
13	CAL 1/2							
14	CAL +							
15	Roll Gyro	D17	2S	±9° & ±2°	0-5VDC		319	
16	Roll Accelerometer	D58	2S	0-15G	0-5VDC	Rectif.	319	
17	Gas Jet Command Signal #6	D30	2S	0-5VDC	0-5VDC		319	
18	Yaw Actuator Position-OTV	D44	5S	±.72 in.	0-5VDC		319	
19	Yaw Gyro	D18	2S	±9° & ±2°	0-5VDC		319	
20	Pitch Programmer	D41	2S	1°/sec	0-5VDC	Rectif.	319	
21	Repeat Pos. #5	D42						
22	Horizon Scanner-Pitch #1	D37	2S	±3°	0-5VDC		334	
23	Squib Monitors	M79	2S	0-5VDC	0-5VDC	See pg. 10	371	
24	Pitch Attitude-Lo Range	D129		±-2°			319	
25	Gas Jet Comm. Sig. #5	D29	2S	0-5VDC	0-5VDC		319	
26	Horizon Scanner-Roll #1	D39	2S	±3°	0-5VDC		334	
27	CAL 2							
28	SYNC							
29	SYNC							
30	SYNC							

TELL TALE

B-79 Squib Monitors

Condition	Voltage
1	0.3
2	0.7
3	1.3
4	2.6
1&2	1.0
1&3	1.7
1&4	2.9
2&3	2.0
2&4	3.2
3&4	3.7
1,2,&3	2.3
·,2,&4	3.4
1,3,&4	4.0
2,3,&4	4.3
1,2,3,&4	4.5

Identification:

1. Fuel tank vent valve
2. Oxide tank vent valve
3. Helium by-pass squib
4. Helium vent squib valve

INSTRUMENTATION SCHEDULE
(GROUND CHECK-OUT INSTRUMENTATION)

FLIGHT NO. FTV-11 VEHICLE NO. 2805-1052 COMMUTATED CHANNEL NO. _____

TYPE COMM. _____ COMM. UNIT _____ COMM. RATE _____

COMM. POS.	MEASUREMENT NAME	MEAS. NO.	ACCU-RACY REQ'D	MEAS. RANGE	FREQ. RESP.	P.U. TYPE & SERIAL NO.	STA.	REMARKS
1	Fuel Tank #1 Temp.	GC-1	3%	20-120°F	1 Sec.	PR-2	368	
2	Fuel Tank #2 Temp.	GC-2	3%	20-120°F	1 Sec.	PR-2	400	
3	Nitrogen Supply Temp.	GC-3	3%	20-150°F	1 Sec.	R-BR-4	452	
4	He Supply #1 Temp.	GC-4	3%	20-150°F	1 Sec.	R-BR-4	452	
5	He Supply #2 Temp.	GC-5	3%	20-150°F	1 Sec.	R-BR-4	452	
6	Oxidizer Tank #1 Temp.	GC-6	3%	20-120°F	1 Sec.	PR-2	342	
7	Oxidizer Tank #2 Temp.	GC-7	3%	20-120°F	1 Sec.	PR-2	360	
8	He Reg. Outlet #1 Press	GC-9	3%	0-100 PSIA	100 CPS	PA203EC 100-350	363	0-80 PSIA Requested
9	He Reg. Outlet #2 Press	GC-10	3%	0-100 PSIA	100 CPS	PA203EC 100-350	336	0-80 PSIA Requested
10	Cavity Lip Seal Press	GC-12	3%	0-25 PSIA	100 CPS	PA203EC 25-350	415	

APPENDIX C-2

Discoverer/Thor (ECHO)
Telemetry System: PAM/FM/FM
Carrier Frequency 246.3 MC

RDB Channel & Commutated Channel	Parameter	Range**
15-1	Liquid Oxygen Pump Inlet Pressure	0-200 psia
15-2	Fuel Pump Inlet Pressure	0-200 psia
15-3	Main Engine Pitch Position	±8°
15-4	Main Engine Yaw Position	±8°
15-5	Yaw Attitude Error	±4°
15-6	Unassigned - Grounded in TM Set	- - -
15-7	Vernier Engine #1 Pitch/Roll Position	±45°
15-8	Vernier Engine #1 Yaw Position	-36° to +6°
15-9	Vernier Engine #2 Pitch/Roll Position	±45°
15-10	Vernier Engine #2 Yaw Position	-6° to +36°
15-11	Actuator Potentiometer Positive	0-30 V
15-12	Pitch Attitude Error	±4°
15-13	Pitch Command	±1°/sec
15-14	Transducer Regulated 5 V Supply	5 V ± 0.055 V
15-15	Instrumentation Ground	0 V
15-16	Yaw Rate	±2°/sec
15-17	Roll Rate	±2°/sec
15-18	Unassigned - Grounded in TM Set	- - -
15-19	115 V Phase A Inverter	115-208 V
15-20	Yaw Attitude Error	±4°
15-21	Roll Attitude Error	±4°
15-22	Pitch Rate	±5°/sec

APPENDIX C-2 (Continued)

RDB Channel & Commutated Channel	Parameter	Range**
15-23	Actuator Potentiometer Negative	-30 to 0 V
15-24	*Vernier Engine #1 Chamber Pressure	0-500 psia
15-25	*Gas Generator Liquid Oxygen Injector Pressure	0-800 psia
15-26	*Gas Generator Chamber Pressure	0-800 psia
15-27	*Main Engine Chamber Pressure	0-800 psia
15-28	Internal Calibrate of TM Set	0-5 V
15-29,15-30	5 V Framing Signal	5 V
13	Sequential Event Channel - up to 4 events: MECO, VECO plus 2 low-level switches LOX and RP-1. If total exceeds 4, use 15-3, 15-6, 15-18, or 15-19.	0-5 V: Any one of 15 discrete steps
12	*Main Engine Chamber Pressure	0-800 psia
11	*Gas Generator Chamber Pressure	0-800 psia
9	*Vernier Engine #1 Chamber Pressure	0-500 psia
10	*Gas Generator Liquid Oxygen Injector Pressure	0-800 psia

FM/FM RDB Channels are as follows:

9		3.9 KC ± 7.5%
10		5.4 KC ± 7.5%
11		7.35 KC ± 7.5%
12		10.5 KC ± 7.5%
13		14.5 KC ± 7.5%
14	Not used	22 KC ± 7.5%
15		30 KC ± 7.5%

**It is the responsibility of DACO Equipment Section to ascertain that correct networks and transducers are employed and that channel assignments and wiring are correct for the listed parameters and ranges.

*Wired on duplicate channels to increase the statistical probability of data return. Only one transducer is used.

APPENDIX D

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APPENDIX D-1
DISCOVERER LANDLINE INSTRUMENTATION

	Function	Acceptance Limits
1.	Control Rack	
	Vehicle Bus Voltage	23 to 29.25 V dc
	Regulated +28 V dc	27.8 to 28.8 V dc
	Regulated -28 V dc	-27.8 to -28.8 V dc
	Vehicle Battery Voltage	23 to 29.25 V dc
	2000-cps Inverter Voltage ØA, ØB, ØC	112 to 117 V ac
	External +28 V dc	27.8 to 28.8 V dc
	2000-cps Inverter Frequency	1980 to 2020 cps
	400-cps Inverter Frequency	399.2 to 400.8 cps
	Fuel Flow Indicator	Percent of maximum
	Fuel Flow Totalizer	Amount transferred
	Acid Flow Indicator	Percent of maximum
	Acid Flow Totalizer	Amount transferred
	Propellant Tank Differential Pressure	Acid or Fuel Over-Pressure
2.	Propellant and Loading Rack	
	Fuel Dump Status	Complete or In Progress
	Acid Dump Status	Complete or In Progress
	Fuel Dump Switch	On-Off
	Acid Dump Switch	On-Off
	Emergency Dump Switch	On-Off
	He and N_2 Dump Switch	On-Off
	He Tank Number 1 Temperature Recorded	20°F to 120°F
	He Tank Number 2 Temperature Recorded	20°F to 120°F

APPENDIX D-1 (Continued)

Function	Acceptance Limits
2. Propellant and Loading Rack (Continued)	
N_2 Tank Temperature Recorded	20°F to 120°F
Fuel Tank Temperature Number 1 Recorded	20°F to 120°F
Fuel Tank Temperature Number 2 Recorded	20°F to 120°F
Acid Tank Temperature Number 1 Recorded	20°F to 120°F
Acid Tank Temperature Number 2 Recorded	20°F to 120°F
Fuel Fill Line Temperature Recorded	20°F to 120°F
Acid Fill Line Temperature Recorded	20°F to 120°F
He Tank Pressure Recorded	3000 to 3100 psi
N_2 Tank Pressure Recorded	0 to 3000 psi
Fuel Vent Pressure	0 to 75 psi
Acid Vent Pressure	0 to 75 psi
He Supply Pressure (2)	3200 to 6000 psi
N_2 Supply Pressure (2)	3200 to 6000 psi
300 psi Control Pressure, N_2	280 to 320 psi
100 psi Control Pressure, N_2	80 to 120 psi
Fuel Truck Tank Temperature	40°F ± 5°
Acid Truck Tank Temperature	40°F ± 5°
Cooling Air Inlet Temperature	50°F ± 3°
He Regulator Output Pressure (2)	63 ± 3 psia Total
Umbilical Number 1 Drop Test Indicator	On-Off
Umbilical Number 2 Drop Test Indicator	On-Off
Emergency Dump Auto Tank Pressure Indicator (65 psi)	On-Off
3. Power Control Desk	
Console Power (115 V ac, 60 cps) Indicator	On-Off
Pad Electrical Trailer Power No. 1, Vehicle Indicator	On-Off

APPENDIX D-1 (Continued)

	Function	Acceptance Limits
3.	Power Control Desk (Continued)	
	Vehicle 28 V Load Bus Energized: Indicator	On-Off
	Pad Electrical Trailer Power No. 2, GSE Indicator	On-Off
4.	Propellant and Loading Status Desk	
	Air Conditioning	Connected - Disconnected
	Umbilical Connection	
	Fuel Fill	Connected - Disconnected
	Fuel Vent	Connected - Disconnected
	Hi-Pressure, He	Connected - Disconnected
	Hi-Pressure, N_2	Connected - Disconnected
	Acid Fill	Connected - Disconnected
	Acid Vent	Connected - Disconnected
	Electrical	Connected - Disconnected
	Acid Supply Tank Connected	Yes - No
	Pneumatic Supply Tank Connected	Yes - No
	Fuel Supply Tank Connected	Yes - No
	He Supply to Load	On-Off
	N_2 Supply to Load	On-Off
	Fuel Pump Motor	On-Off
	Acid Pump Motor	On-Off
	Fuel Load Switch	On-Off
	Acid Load Switch	On-Off
	Safety Key (Pressurization)	In - Out
	Fuel Tank Pressure Indicator	0 to 65 psig
	Fuel Loading Status	In Progress or Complete
	Acid Loading Status	In Progress or Complete

APPENDIX D-1 (Continued)

Function	Acceptance Limits
5. Guidance and Control	
N_2 Valve Close Indicator	On-Off
Thermostat Monitor	On-Off
Pitch Gyro Position, Preamp. Output	0 to 10 V ac
Yaw Gyro Position, Preamp. Output	0 to 10 V ac
Timer Operation Indicator	On-Off
Pitch Spin Motor Monitor	0 to 1 V ac
Roll Spin Motor Monitor	0 to 1 V ac
Yaw Spin Motor Monitor	0 to 1 V ac
Roll Accelerometer, 0.7 V ac/g	0 to 0.7 V ac
Horizon Scanner Pitch Signal	0 to 1 V ac
Horizon Scanner Roll Signal	0 to 1 V ac
Roll Gyro Position, Preamp. Output	0 to 10 V ac
Yaw Accelerometer, 1.0 V ac/g	0 to 1 V ac
Heater Amplifier Cycling Indicator	On-Off
Pitch Actuator Position	0 to 5 V dc
Yaw Actuator Position	0 to 5 V dc
No. 1 Gas Valve Torque Motor	0 to 1 V dc
No. 2 Gas Valve Torque Motor	0 to 1 V dc
No. 3 Gas Valve Torque Motor	0 to 1 V dc
No. 4 Gas Valve Torque Motor	0 to 1 V dc
No. 5 Gas Valve Torque Motor	0 to 1 V dc
No. 6 Gas Valve Torque Motor	0 to 1 V dc
Integrator Resolver Output	0 to 10 V ac
Integrator Velocity Output	0 to 10 V ac
Guidance Block Temperature	0 to 10 V ac
Guidance Electronics Temperature	0 to 10 V ac
Hydraulic Reservoir Full Indicator	On-Off

APPENDIX D-1 (Continued)

Function	Acceptance Limits
5. Guidance and Control (Continued)	
Hydraulic Motor Relay Switch	On-Off
Hydraulic Motor Temperature Monitor	Recorded
Horizon Scanner Test Indicator	On-Off
Idle Start Power Switch	On-Off
Pitch Gyro Test Signal	Recorded
Roll Gyro Test Signal	Recorded
Yaw Gyro Test Signal	Recorded
Timer Motor Test Switch	On-Off
Disengage Timer and Horizon Scanner Switch	On-Off
Disengage Timer Brake Switch	On-Off
Activate Flight Control Relay No. 1	On-Off
Activate Flight Control Relay No. 2 and No. 4	On-Off
Activate Flight Control Relay No. 5	On-Off
Activate Gyro Uncaged Relay	On-Off
Integrator Input	Recorded
6. Ground-Space Communications (SS/H)	
Timer-On Indicator	On-Off
Beacon Heater Monitor	On-Off
Beacon Plate Monitor	On-Off
Tone A Relay 2 Monitor	On-Off
Tone B Relay 4 Monitor	On-Off
Tone C Relay 6 Monitor	On-Off
Tone D Relay 8 Monitor	On-Off
Timer Subcycle Monitor	On-Off
1/4 Minute Advance Monitor	On-Off
Timer Restart Indicator	On-Off
Timer Monitor Relay 4	On-Off

APPENDIX D-1 (Continued)

Function	Acceptance Limits
6. Ground-Space Communications (SS/H) - (Continued)	
Beacon Regulated Power	0 to 28 V dc
Beacon Channel 5	On-Off
Beacon Channel 6	On-Off
SS/H Frequency Monitor	Recorded
SS/H 20X Forward Test	On-Off
SS/H Rewind Stop Indicator	On-Off
SS/H Advance/Retard Command	On-Off
SS/H Rewind Command	On-Off
SS/H Rewind Monitor	On-Off
Elementary Timer Switch	On-Off
VHF Acquisition Transmitter Switch	On-Off
Antenna Switch	On-Off
SS/H Beacon Power Monitor	Recorded
7. Telemetry (TM)	
Ledex Position Monitor	Position
TM Calibration (+) Indicator	On-Off
TM Calibration (-) Indicator	On-Off
TM Calibration (0) Indicator	On-Off
TM Safety Indicator	On-Off
Ledex Control Switch	Position 1-7
8. Destruct System	
Safe-Arm Switch	Safe-Arm Indicators

APPENDIX D-2

GROUND MONITORED PARAMETERS
DISCOVERER/THOR (ECHO)

System: Direct "hard-wire" readout via safety monitor console; presented on meters.

No.		
1.	Main Liquid Oxygen Tank Pressure	0 to 100 psia
2.	Main Fuel Tank Pressure	0 to 100 psia
3.	High-Pressure Helium Sphere Pressure	0 to 5,000 psia
4.	Vernier Fuel (Start) Tank Pressure	0 to 1,000 psia
5.	Vernier Liquid Oxygen (Start) Tank Pressure	0 to 1,000 psia
6.	Gas Generator Liquid Oxygen Regulator Reference Pressure	0 to 1,000 psia

Additionally, the GSE will monitor centered position of all engines.

APPENDIX E

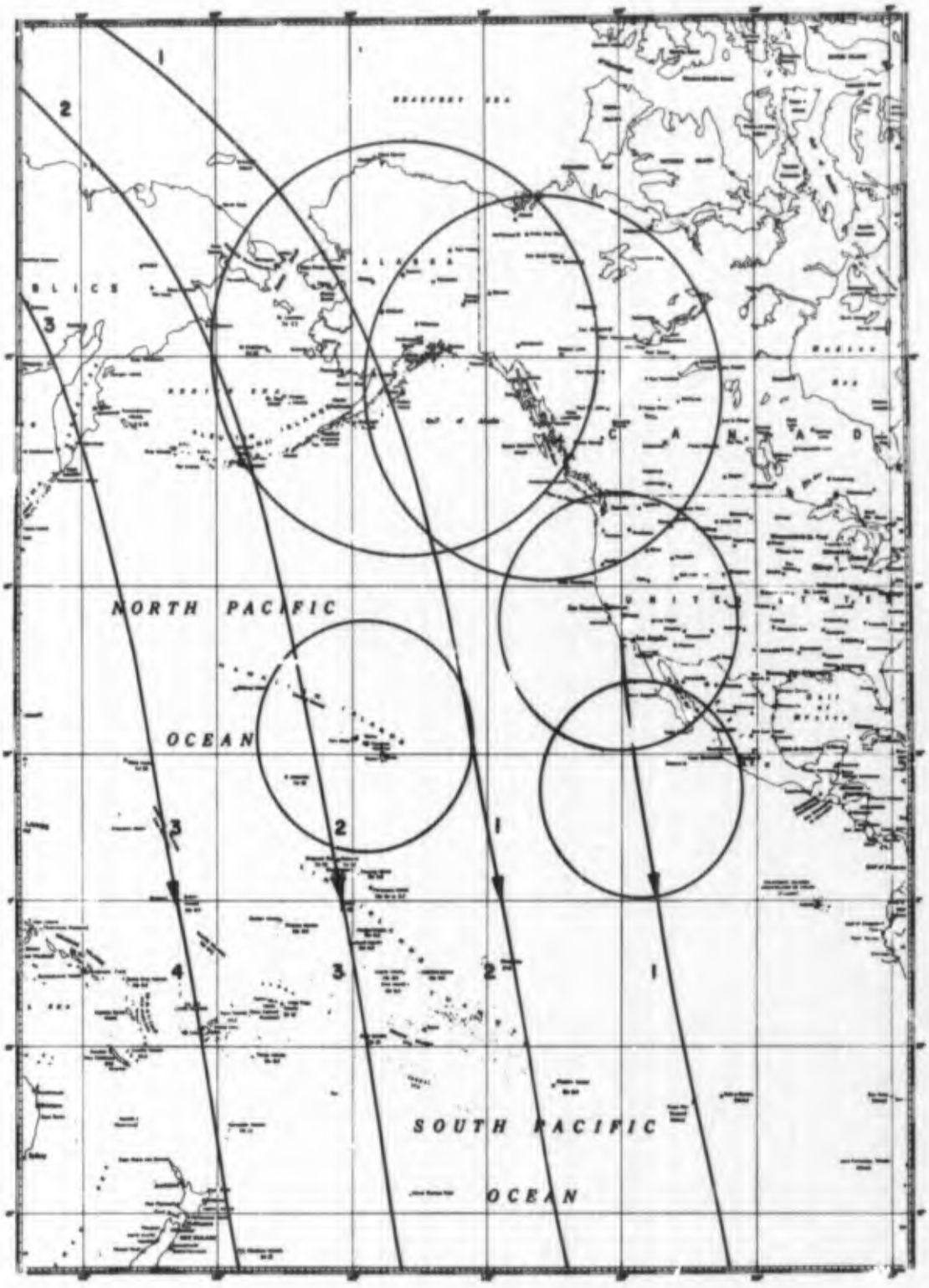

Fig. E-1 Nominal Orbit Tracks, Passes 1 through 3

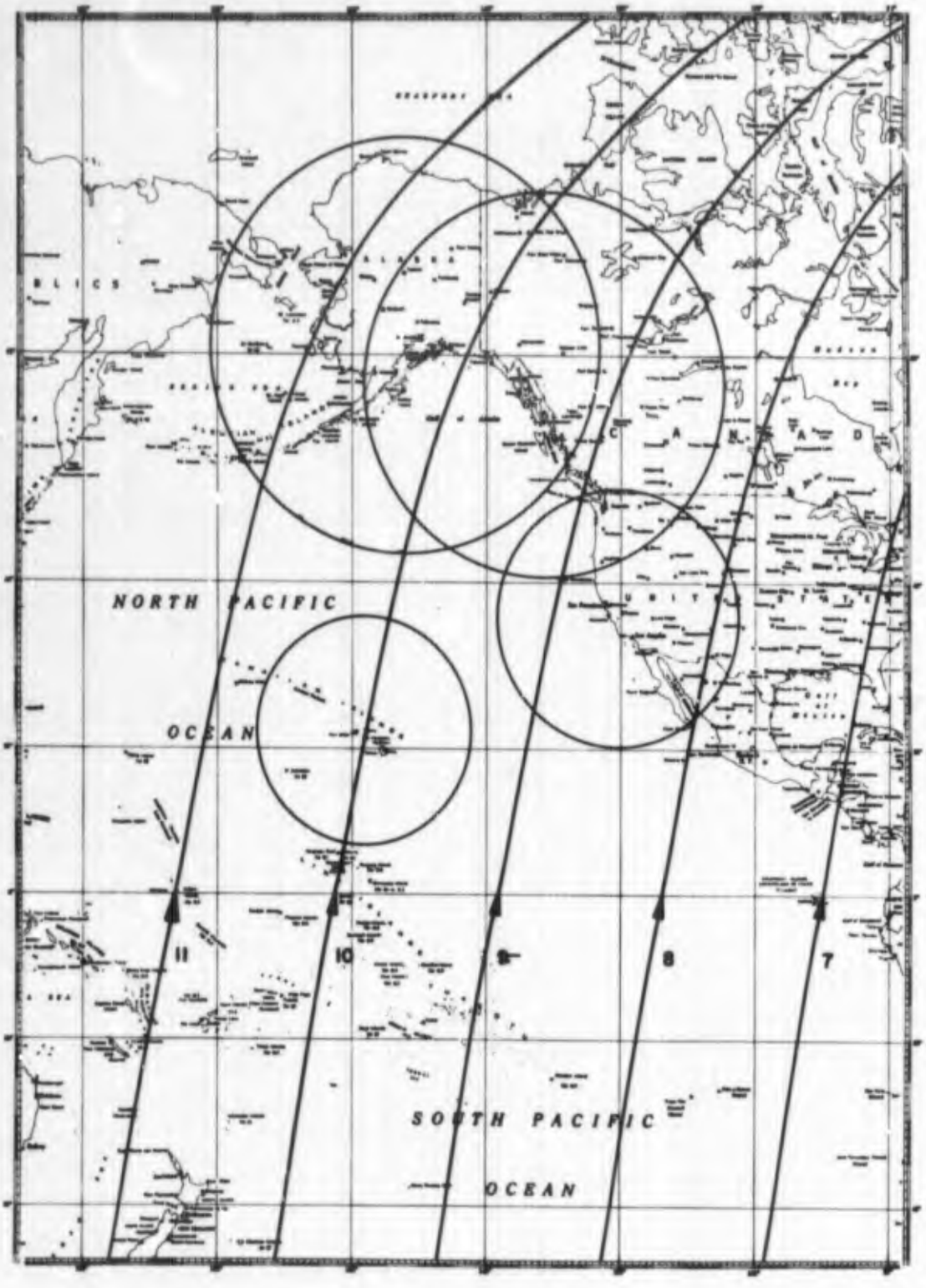

Fig. E-2 Nominal Orbit Tracks, Passes 7 through 11

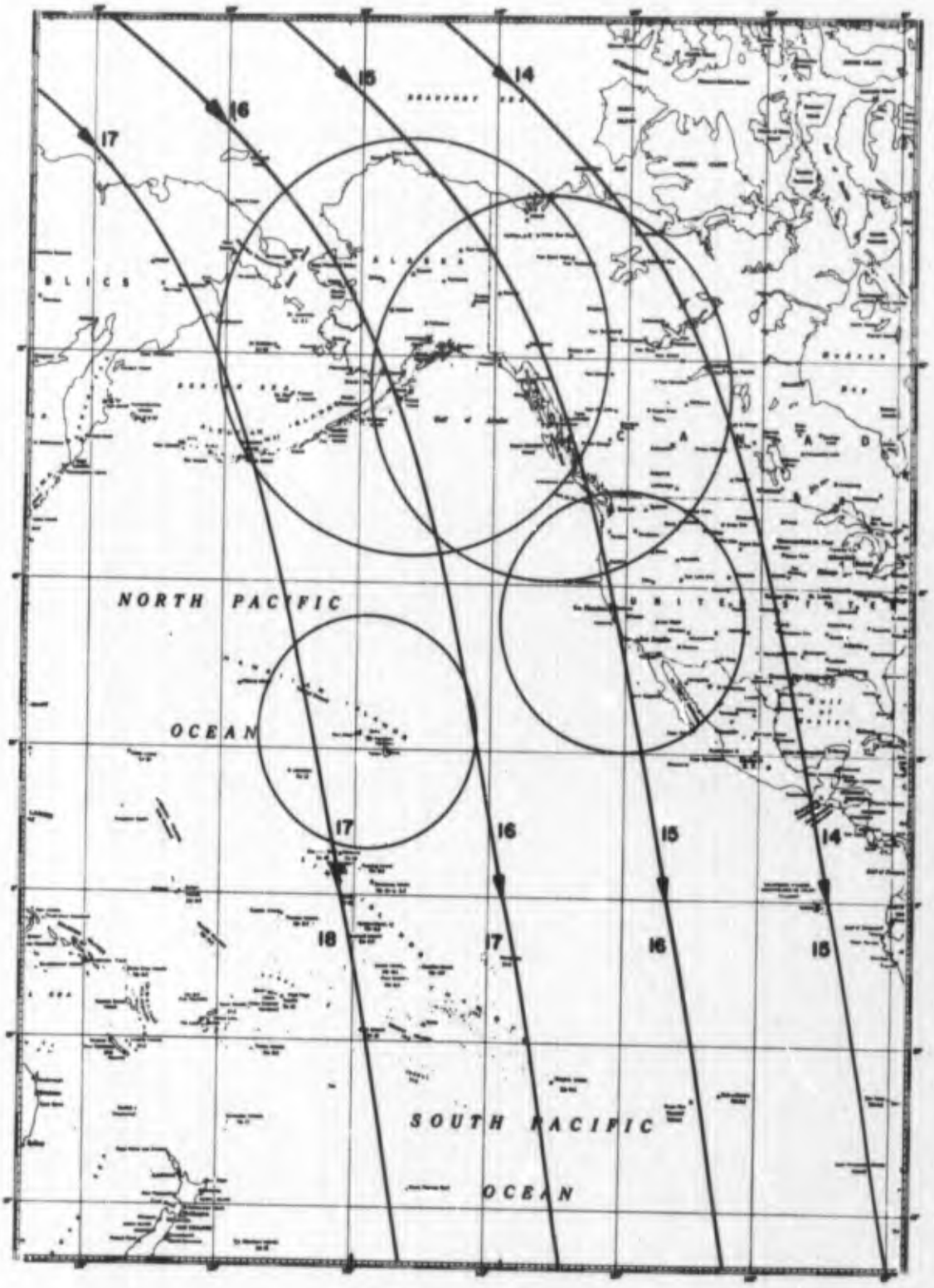

Fig. E-3 Nominal Orbit Tracks, Passes 14 through 17

APPENDIX F

APPENDIX F

PRELIMINARY SUBSYSTEM D SEQUENCE FOR DISCOVERER VEHICLE 2205-1052

Time (seconds)		
Nominal Time From Launch	Computer Running Time	Signal Control Function
	-0.1	Timer reset
0	0	Start SS/D timer
0.1	0.1	Timer reset
0.1	0.1	Timer safety circuit
167	167	De-energize K30, 31, 32 (uncage gyros)
167	167	Programmed destruct lockout
178	178	Isolate K24 from beacon No. 5
178	178	Vehicle pneumatic control
178	178	Open pneumatics valve and spare
178	178	Fire explosive bolts (paralleled)
179	179	Start Fairchild timer (paralleled)
179	179	Fire retro-rockets (paralleled)
179	179	Arm pitch and yaw control
179	179	Arm integrator correction
192	192	Command - 45°/min pitch rate (pitchover 20.8)
192	192	Arm roll H/S command
192	192	Fire H/S cover squib
192	192	Break 28v to N_2 valve, shut down separation monitor
192	192	Fire H/S cover squib
204	192	+28v to SS/D for brake control (not effective until 221 sec S5D - No)
221	221	Command -2°/min pitch rate from integrator potentiometer
221	221	Connect pitch H/S command
221	221	Arm beacon No. 5 timer brake control

APPENDIX F (Continued)

Time (seconds)		
Nominal Time From Launch	Computer Running Time	Signal Control Function
221	221	Arm integrator uncaging circuit
221	221	Arm K21 hold-in circuit, latch up K1 to start delay via Fairchild timer
221	221	Roll H/S signal shunt
221	221	Timer brake hold-in control or integrator correction respectively (isolated by S5C-No)
241	221	Stop SS/D timer delay (nominally 20 sec)
250	230	Fire ullage rockets (paralleled)
250	230	Preactivate hydraulics
250	230	Deactivate beacon No. 5 timer brake control
250	230	K21 hold-in
266	246	Arm gas generator squib; energize K28 (pitch and yaw pneumatics off)
266	246	Fire helium valve and gas generator squib (paralleled)
266	246	Connect accelerometer to integrator
267	247	Pneumatic off backup (pitch and yaw)
267	247	Open gas-generator and helium-squib circuits
267	247	Start pitch gyro offset correction (disconnected)
267	247	Open gas generator squib arm circuit
267	247	Close circuit to T/M off switch
267	247	Start thrust misalignment (M/A) correction (disconnected)
268	247	Steady state thrust
370	350	Stop thrust M/A correction (disconnected)
370	350	Stop pitch gyro offset correction (disconnected)
376	356	Arm pneumatic (pitch and yaw)

APPENDIX F (Continued)

Time (seconds)		
Nominal Time From Launch	Computer Running Time	Signal Control Function
376	356	Engine cut-off safety switch
381	356	Test isolation (no flight function)
381	356	Disconnect accelerometer from integrator
381	356	Engine shut down by integrator
381	356	Activate pneumatic controls (de-energize K28)
394	374	SS/L +28v dc unregulated
394	374	Hydraulic controls shut down, shut off ullage rockets and de-energize K34 (paralleled)
394	374	Command +40°/min yaw rate
394	374	Command 0°/min pitch rate
394	374	Fire oxidizer, helium, fuel vent valves (paralleled)
394	374	De-energize K21
492	472	Calibrate T/M
492	472	Connect K24 to beacon No. 5 (inoperative)
492	472	Heater amplifier excitation
502	482	Stop calibrate
502	482	Open engine shut down circuit and switch antenna
664	644	Command +4.0°/min pitch rate
664	644	Connect roll H/S to yaw gyro
664	644	Roll accelerometer output grounded
664	644	Shut down +28v regulated ascent only power (paralleled)
664	644	Auxiliary heater on
664	644	De-energize K33, switch out 0.1% regulation
664	644	Integrator potentiometer ground to pitch correction mode (inoperative)
664	644	F/C gain change (spare)

APPENDIX F (Continued)

Time (seconds)		
Nominal Time From Launch	Computer Running Time	Signal Control Function
664	644	Integrator shut down (latch down K4, K5, K6)
890	870	Phase balance ∅ A
890	870	Arm tape recorder
890	870	Phase balance ∅ B
890	870	Recage integrator (inoperative)
890	870	Set K21 for pitch rate correction (inoperative)
890	870	Accelerometer power amplifier return
890	870	Telemetry off
890	870	Pulse latch K7 (SS/D timer off) H/S to low gain
890	870	Open integrator recage (inoperative)
890	870	Arm SS/D timer for recovery phase
890	870	Stop integrator caging (inoperative)
890	870	Spare
*X	870	Pulse latch K7, K14, K17, K18 (SS/D timer on H/S off)
X+18	888	Command -45°/min pitch rate A
X+18	888	Arm capsule ejection (squib)
X+92	962	Command +4°/min pitch rate
X+92	962	SS/L transfer circuit No. 1
X+92	962	SS/L transfer circuit No. 2
X+92	962	Disconnect capsule from electrical power supply
X+93.5	963.5	Shut down SS/D timer
X+93.5	963.5	Command eject (paralleled)

* Time of initiation of recovery phase

APPENDIX G

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APPENDIX G
WIND SHEAR EFFECT COMPUTATION PROCEDURE

GENERAL PROCEDURE

Wind soundings are taken at T-12 and T-6 hours by the Third Weather Wing at VAFB. The wind profile information is then transferred from the Third Weather Wind Station to the VCC and transmitted via the 100-wpm teletype to the LMSD Palo Alto Computer Center (PACC).

The computer center will feed the wind profile data to the 1103A computer, under the direction of the LMSD Structures Department (53-13). The Structures Department will analyze the computer output information and determine whether or not wind conditions will permit a safe launch. The Development Control Center (DCC) in Palo Alto will review the recommendations of the Structures Department and transmit a "yes" or "no" launch command to the VAFB Launch Controller.

DETAILED PROCEDURE

1. At T-12 hours the VAFB Third Weather Wing will make a weather balloon sounding to determine wind conditions.

2. At T-9 hours or earlier, the wind data will be transmitted from the Third Weather Wing Station to LMSD personnel at the Vandenberg Control Center (VCC). This data will include altitude, wind velocity, and wind direction. (See Launch Weather Data Requirements in Section 7 of this report.) Transmission of this wind data will be initiated as soon as it is received by the Third Weather Wing, and will not be delayed pending the receipt of data for the entire balloon sounding.

3. Immediately on receipt of this wind data, the VCC will begin transmission of the available data to the PACC, via direct-line 100-wpm teletype. Transmission will not be delayed until complete data are received.

4. The Structures Department at PACC will direct a computer analysis of the wind data.

5. At T-7 hours 45 minutes, or earlier, the results of the computer analysis (as reviewed by the Structures Department) will be sent to the DCC.

6. At T-6 hours a fast-rising balloon sounding will be made, and data from 0 to 60,000 feet will be transmitted to LMSD personnel at the VCC as soon as possible. This data will include altitude wind direction, and wind velocity from 0 to 60,000 feet. It is urgent that transmission of this wind data be initiated as soon as it is received by the Third Weather Wing, and not be delayed pending completion of the balloon sounding.

7. The VCC will transmit this wind data to the PACC via direct-line 100-wpm teletype. It is urgent that transmission of this data be initiated as soon as received by the VCC (as in Item 3 above).

8. The Structures Department at PACC will direct a computer analysis of the wind data.

9. At T-3 hours 15 minutes, or earlier, the results of the computer analysis (as reviewed by the Structures Department) will be send to the DCC.

10. The DCC will review the recommendations of the Structures Department and transmit a "yes" or "no" launch command to the VAFB Launch Controller.

11. At approximately T = 0, a balloon sounding will be made in accordance with the Launch Weather Data Requirements specified in Section 7 of this report. The data from 0 to 60,000 feet will be transmitted to LMSD personnel at the VCC. This data will include altitude, wind direction and wind velocity.

12. The VCC will immediately transmit this wind data on direct-line teletype to the DCC, where it will be used for quick-look evaluation. Additional requirements for T = 0 weather data are contained in Section 7.

CRITERIA FOR ADDITIONAL WEATHER SOUNDINGS

The Structures Department will review the computer output for engine gimbal position on the T-12 hour and T-6 hour programmed flights, with wind profile data inserted. If, between these two times, the engine gimbal angle diverges from the missile centerline at such a rate that the structural design limits would be exceeded at launch time, the Structures Department shall inform the DCC. The DCC will immediately contact the VCC and request a weather forecast of the winds in the questionable area for the desired launch time. If the forecast indicates that the winds continue to increase, another fast-rising balloon sounding will be made. The procedures outlined in Items 6 through 10 above will be followed (except for the T-times) in processing the resultant data