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DISCOVERER III
PRELIMINARY SYSTEM TEST REPORT
(5 DAY)

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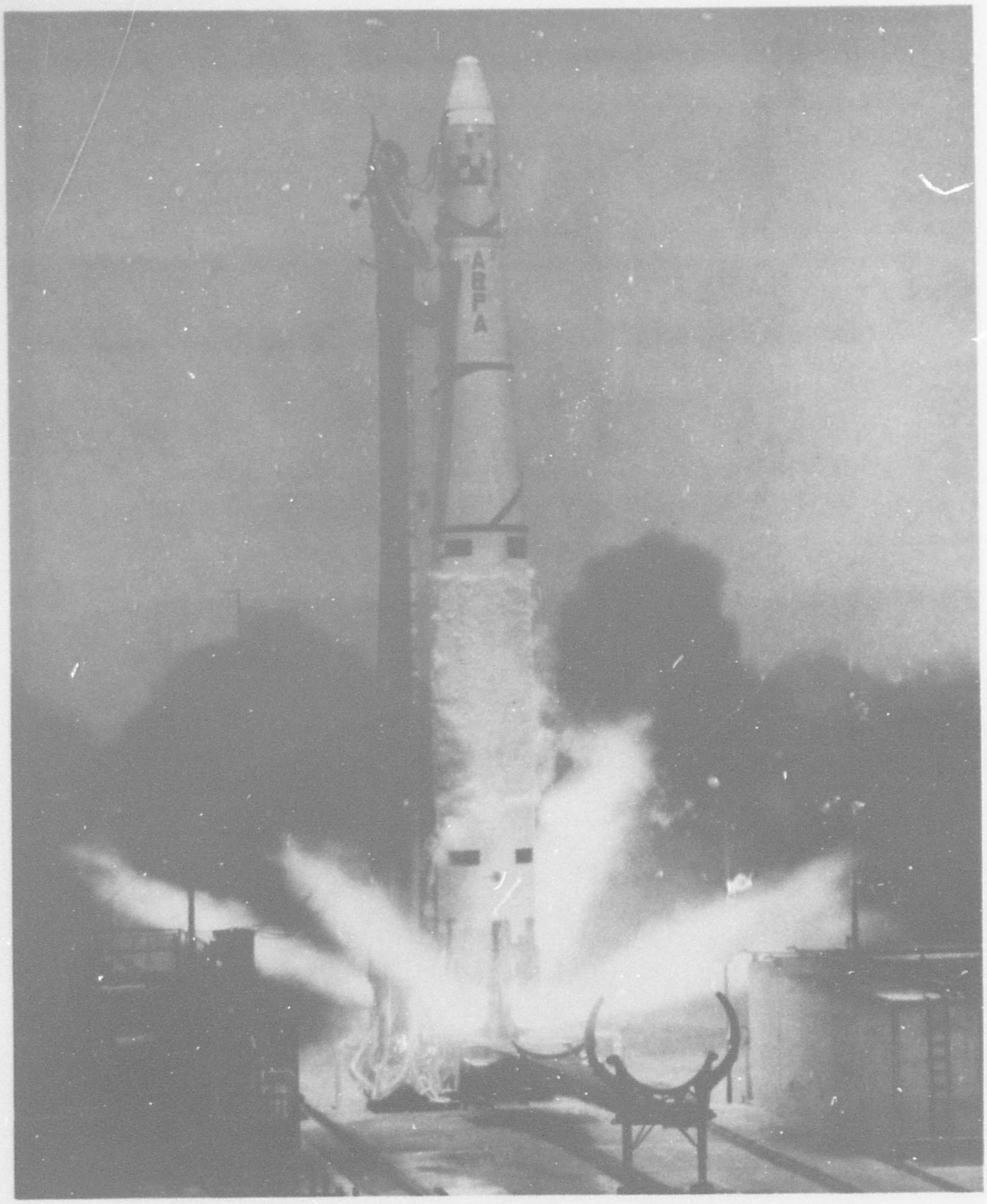

Discoverer III/Thor at Lift-Off, Pad 4 Vandenberg Air Force Base

FOREWORD

This document has been prepared to meet a requirement of Contract AF 04(647)-97, paragraph IVJ, Exhibit WDT 57-19, and is presented as a preliminary test report documenting the launch of the Discoverer III flight from Vandenberg Air Force Base on 3 June 1959.

CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

The Discoverer Program has been established by the Advanced Research Projects Agency (ARPA) through the agency of the Air Force Ballistic Missiles Division (AFBMD). The principal objective of this program, which utilizes the Discoverer/Thor combination, is the development of a space vehicle capable of functioning as a carrier-satellite for the material of various scientific projects.

This report represents a preliminary evaluation of the results of the launching of the fourth vehicle in the Discoverer series from Pad 4 at Vandenberg Air Force Base, California.

SUMMARY

The fourth countdown for Discoverer III was successfully conducted at Vandenberg Air Force Base (VAFB) on 3 June 1959. Three previous attempts, (21, 23, and 26 May 1959) to complete a countdown for the launch of this vehicle were unsuccessful as a result of technical difficulties, coupled with poor weather conditions and range scheduling limitations. Final countdown was initiated at 0200 Pacific Daylight Time (PDT) and culminated in a successful launching at 1309:20 PDT. No significant delays were encountered except for a 2 hour and 52 minute "hold" which was called because of unfavorable weather.

Lift-off was normal and resulted in only slight pad fire damage. First stage boost phase events and vehicle staging were close to nominal. However, second stage boost was not sufficient to place the Discoverer vehicle into orbit, primarily as a result of early termination of thrust (Refer to page 19). Based on preliminary trajectory studies, it is estimated that the vehicle impacted in the vicinity of 30 degrees South Latitude after having reached an apogee altitude of approximately 157 statute miles.

The coast trajectory as initially determined from Pt. Mugu radar tracking data was substantially higher than that experienced with Discoverer II and significantly higher than the predicted flight path. As a result of marginal radar tracking coverage, data were not sufficient to accurately determine the second stage trajectory. Postflight analysis of these trajectory data showed the Pt. Mugu radar information to be erroneous.

As planned, the Pt. Mugu radar tracking data were utilized for orbital engine "time-to-fire" and "velocity-to-be-gained" computations. The apparent excessive "lofting" of the trajectory required an engine ignition time delay of 28 seconds beyond the nominal and a larger velocity increment to be gained than had been predicted. Having no reason to suspect tracking data accuracy at the time, the Pt. Mugu tracking station properly executed commands to the vehicle to adjust the orbital boost phase accordingly.

Revised trajectory data based on metric optics and FPS-16 radar data from the Pacific Missile Range show that the ascent trajectory actually was close to that of Discoverer II (page 39). Thor performance, therefore, was within tolerance, producing only the lofting effect present during the two previous Thor/Discoverer launchings.

Second stage engine ignition was normal and occurred in accordance with the commanded time-to-fire. However, engine shutdown occurred (telemetered data indicated propellant exhaustion) after 115.5 seconds of thrust, short of attaining the velocity-to-be-gained increment set into the guidance computer velocity integrator. Although engine operation appeared to be normal, computations based on telemetered propulsion data revealed that the thrust level was approximately 2 percent less than predicted which is within the engine specifications. Based on actual propellant weights for the Discoverer vehicle recorded at the launch complex prior to lift-off, approximately 6 seconds of additional engine operation should have been available. A satisfactory explanation for this apparent discrepancy has not yet been found.

Discoverer subsystems performances were in accordance with specifications with the exception of the questionable operation time of the orbital engine and the poor performance of the Pt. Mugu radar. These two problems are under investigation.

Many primary objectives and nearly all secondary test objectives were either partially or fully achieved even though the basic objective — to obtain orbital status — was not attained. In addition, much valuable information was recovered as a result of excellent telemetering coverage. Data from the capsule specimens throughout ascent and until loss of telemetering contact indicated that the mice were behaving as expected. While these data were being recorded the specimens experienced weightlessness for a total period of approximately 8-1/2 minutes.

SECTION I
TEST OBJECTIVES AND RESULTS

SECTION I
TEST OBJECTIVES AND RESULTS

A. PRIMARY - GENERAL

Placement in orbit of Discoverer satellite containing biomedical capsule capable of returning test data from orbit and of re-entry and recovery.

Result - Objective not achieved because orbital status not reached. However, biomedical telemetry data were received under near orbital conditions.

B. PRIMARY - SPECIFIC

1. Ground Support Equipment

Provision of adequate ground support and checkout equipment through lift-off, including that required for the Biomedical Research Capsule (BRC).

Result - Objective achieved. Ground support and checkout equipment performed satisfactorily.

2. Thor Booster

Demonstration of launch, control, and separation from the Discoverer within specified performance, including arrival at separation point within the accuracy limits of $\pm 4^{\circ}$ in flight path angle.

Result - Objective achieved. Thor functions occurred within tolerance. However, the trajectory path angle was slightly higher than nominal. Separation occurred satisfactorily.

3. Airframe and Adapter

Demonstration of structural ability to withstand flight perturbations and environment.

Result - Objective achieved. Design load envelope was not exceeded, and structural performance was satisfactory.

4. Propulsion System

Demonstration of ullage rocket operation, engine ignition in a vacuum, sufficient total impulse to achieve orbit, and proper propellant utilization.

Result - Objective partially achieved. Functions in general appeared normal, although sub-nominal total impulse prevented orbital injection.

5. Auxiliary Power Unit

Demonstration of satisfactory performance of all auxiliary power components, especially of batteries and inverters.

Result - Objective achieved. Power supply operation through all functions appeared normal.

6. Guidance and Control System

Demonstration of the ability to time and control all Subsystem D functions, including maintenance of proper orientation during coast, boost, and orbiting phases until ejection of the BRC.

Result - Objective largely achieved. Records show functions occurred at proper times and that proper attitude was maintained through ascent. No opportunity to demonstrate the system in orbit was present.

7. Telemetry, Tracking and Command

Demonstration of the ability to satisfactorily monitor all primary vehicle functions, to command Subsystem D timer delay and velocity integrator operation, and to track and command orbital functions, including adjustment of the BRC ejection sequence time.

Result - Objective partially achieved. Telemetry data from the launch tracking stations were satisfactory. D-timer "time-to-fire" and velocity integrator command signals were satisfactorily received. No opportunity to track or command orbital functions existed.

8. Recovery System

Demonstration of the compatibility of the BRC with the satellite, and its ability to transmit test data, also the suitability of the related recovery force technique.

Result - Objective partially achieved. Operation of the satellite with the BRC attached was satisfactory, and usable data were received from it during ascent and near orbital flight conditions. The recovery force, although fully operational, was not utilized.

C. SECONDARY AND TERTIARY TEST OBJECTIVES

1. System and Structure

Evaluation of the satellite systems and structure and their effective functional interrelationship.

Result - All satellite systems functioned normally for the duration of flight covered by telemeter data, and structural integrity was demonstrated.

2. Temperature Environment

Evaluation of temperature environment and distribution on the vehicle.

Result - Data are not yet available for a definitive evaluation of the thermal environment.

3. Tracking and Communications

Evaluation of interstation communication network, orbital prediction using only azimuth and elevation data, and acquisition by means other than radar.

Result - Interstation communications were satisfactory. The initial orbital prediction was made from all ascent trajectory data available. Orbital tracking attempts were satisfactorily conducted, although no opportunity for vehicle acquisition was present.

4. Optical Tracking

Evaluation of aerodynamic integrity of Discoverer/Thor by means of optical tracking.

Result - Satisfactory metric optics data were obtained and indicate no structural or stability problems other than minor Thor-induced yaw oscillations in the early portion of boosted flight.

5. Human Factors

Evaluation of crew proficiency and ground equipment design from human engineering standpoint.

Result - Satisfactory equipment and crew proficiency were demonstrated by the efficient manner in which the countdown and launch preparations were conducted. Evaluation of this objective in relation to the erroneous Pt. Mugu radar data is being continued.

SECTION II
TEST DESCRIPTION

SECTION II
TEST DESCRIPTION

PRELAUNCH OPERATIONS

The test plan for launching the Discoverer III satellite vehicle called for using XA Model 2205, Serial 1020 vehicle mated to the IOC Thor booster, DM-18, Serial 174. The launching was to be conducted from the launch complex at Vandenberg AFB Pad 4.

The terminal countdown was initiated at 0200 PDT, 3 June 1959 and was the fourth attempt to launch the Discoverer III satellite. The first launch attempt, conducted on 21 May, was aborted because of weather and inability to check out the S-band beacon. The second launch attempt was conducted on 23 May. This attempt was aborted at 1303 PDT because of an orbital stage main helium pressure regulator malfunction. The third launch attempt, conducted on 26 May, was aborted at 1715 PDT due to first stage technical difficulties. The fourth attempt, on 3 June, culminated with a successful launching. (Further details pertaining to each launch attempt are found in Appendix II of this report.) The terminal countdown was scheduled to be accomplished in 480 minutes; however, due to inclement weather and range schedules, the actual time required to complete it was 669 minutes. Lift-off was achieved at 13:09:20:27 PDT.

The countdown operation was conducted exceptionally well. Throughout most of the countdown all tasks were completed ahead of schedule. With the completion of Task II (electronic warm-up) at 0740 PDT, the countdown status was 70 minutes ahead of schedule. Normally, Tasks 13, 14, and 15 (guidance checkout, RF checkout, and propellant pressurization, respectively) would be accomplished simultaneously. However, because of the extra time available during this count, they were completed sequentially and ahead of the predicted schedule.

During Task 15 (propellant pressurization) improper venting of the main pressure helium regulator was encountered. However, this venting was not sufficient to require a hold or delay the countdown operation. The leakage rate was measured over a 15 minute period and was within tolerance, allowing adequate pressurization.

By 0948 PDT, the countdown entered the final phases (Task 17). Twenty-six minutes and 35 seconds were planned as the required time to complete the final task. This included a planned 15 minute technical hold at T-2 minutes and 35 seconds to allow sufficient time to insure filling the vernier engine start tanks. (Previous launchings allowed only 5 minutes for this purpose.)

Because of weather and trains passing through the area, Phase I of Task 17, terminating with lift-off and a successful launching, was not begun until 1240 PDT.

FLIGHT

The launch trajectory and sequence of events followed the planned program within specified limits. The test vehicle was launched vertically, and the booster rolled the vehicle from the pad attitude azimuth of 181^{o} 28' 53.86" to the correct flight path (departure) azimuth of 182^{o} 48'. Vertical flight continued for approximately 10 seconds, after which the Thor booster initiated the required pitch program.

The Thor main engine boost phase lasted for 160.28 seconds. Engine cut-off occurred upon depletion of propellants

As the main-stage propellants exhausted, the rapid decrease in chamber pressure released a pressure switch which set the time for vernier cut-off. The vernier engines were started prior to lift-off and continued to burn for approximately 9.0 seconds after main engine cut-off.

At 161.6 seconds after launch, the first sequence signal was given by the Subsystem D timer for uncaging the inertial reference gyros. At 171.5 seconds after launch, the timer initiated the signals for firing the explosive separation bolts, activating the pneumatic control system, and igniting the retro-rockets on the adapter. The Discoverer completed separation from the Thor at 174.4 seconds.

After separation, the second-stage vehicle pitched to the horizontal as programmed. The pitch and roll horizon scanner was then coupled to the gyros. During the coast phase, "time-to-fire" computations were completed by the Pt. Mugu radar tracking station, and a command initiated orbital engine ignition sequence at 287.97 seconds after lift-off. The Subsystem D timer initiated the signal to activate the hydraulic control system and fire the ullage rockets at 293.1 seconds. Approximately 17.6 seconds later, the orbital boost engine was ignited and the pitch and yaw pneumatic controls turned off. During orbital boost, vehicle orientation was determined by the horizon scanner and the pre-programmed Inertial Reference Package (IRP). Engine thrust duration was 115. 52 seconds.

Because of limited and questionable launch radar tracking coverage, it was not possible to immediately determine whether or not the Discoverer had gone into orbit. After several unsuccessful attempts to acquire the vehicle during scheduled orbital passes and upon preliminary review of launch telemetry data, it was concluded that the vehicle had not attained the critical velocity necessary to achieve orbit. Therefore, system test operations were terminated approximately 12 hours after launch.

SECTION III
TEST EVALUATION

SECTION III
TEST EVALUATION

SYSTEM PERFORMANCE

Test Conduct

Conduct of the test from the interim Development Control Center at Palo Alto was satisfactory. Interstation communications were fully operational, and system test procedures were handled efficiently.

Following launch, search operations by all stations were initiated in preparation for the first pass as planned. However, no contact was established. Search activities were continued through pass 9 without success. By this time it was concluded from launch information that either the vehicle was not orbiting or that a complete power supply failure had occurred following launch. Subsequently, it was determined from telemetry and radar tracking information obtained during the ascent phase that orbital status had not been achieved. The Development Control Center therefore terminated its activities in support of Discoverer III.

The computing center and associated data evaluation areas were manned as required, providing evaluation and prediction of trajectory information as planned. Radar trajectory information received from the stations during the second stage boost phase proved unreliable, preventing early and accurate determination of orbit injection conditions. As a consequence, standby procedures were employed for computing acquisition messages; these were transmitted promptly to the stations in preparation for the first pass. The procedures involved utilization of Pt. Mugu radar track to the initiation of second stage boost and of nominal values for propulsion system performance.

Trajectory

The original launch trajectory, as determined from the Pt. Mugu VERLORT radar data, appeared to be significantly higher and considerably to the west of the predicted flight path.

As more launch trajectory data became available from other sources, it was obvious that the Pt. Mugu radar data were incorrect.

A revised trajectory, based on VAFB VERLORT radar data is shown in Figure 1. This trajectory is quite similar to that of Discoverer II and is considered to be within the allowable limits for the first stage boost phase.

A comparison of the Vandenberg AFB and FPS-16 radar data and the metric optics data shows very close agreement between the three data sources. Since the data coverage from these three sources extends only slightly beyond stage separation, the trajectory to Discoverer III burnout was calculated. The computation was based on the best estimate of flight conditions at main engine burnout and the fuel flow and thrust values for the Discoverer III engine as derived from actual flight data. The velocity time histories for both stages are shown in Figures 2 and 3. The critical trajectory parameters are shown in Table 1.

It is significant that for the actual altitude attained at second stage burnout, the minimum velocity needed to achieve orbital status with a perigee altitude of 70 statute miles was approximately 25,400 ft/sec. The estimated actual velocity at second stage burnout was therefore approximately 500 ft/sec short of that which would have been required for a minimum type orbit.

Table 1 Critical Trajectory Parameters

LMSD/432196

	TIME (SEC.)		ALTITUDE (S.MI.)		RANGE (N.MI.)		VELOCITY (FT/SEC)	
	PREDICTED	ACTUAL	PREDICTED	ACTUAL *	PREDICTED	ACTUAL *	PREDICTED	ACTUAL **
THOR BURNOUT	158.7	160.3	53	55	81	79	13,500	14,000
DISCOVERER IGNITION	284.6	310.7	127	147	332	369	12,650	12,700
DISCOVERER BURNOUT	400	426.2	141	157	655	683	26,000	24,900

* BASED ON VAFB AND FPS-16 RADAR DATA
** BASED ON FPS-16 RADAR DATA ONLY

THOR PERFORMANCE

The performance of the Thor booster SM-75 S/N 174 was satisfactory. All test objectives were achieved, including the primary objectives of launch, control, and separation from the orbital vehicle. Evaluation of crew efficiency and ground support equipment was accomplished.

There were no unscheduled delays in the terminal countdown, and lift-off occurred without incident. Approximate lift-off weight of the Discoverer/ Thor was 114,800 pounds, and booster thrust was 149,000 pounds.

All guidance functions and programmed commands were properly executed. Main engine cut-off occurred 160.28 seconds after lift-off with vernier engine cut-off 9 seconds later. The position of the vehicle and its velocity, as determined from the Vandenberg AFB VERLORT radar, FPS-16 radar and metric optics, were within specified tolerances, but close to the maximum allowable.

Oscillations of the vehicle were again evident in the yaw and roll planes, as experienced during the launch of Discoverer II. However, the amplitude of the oscillations were one-half the amplitude experienced on the previous flight.

Three possible causes for these oscillations are the following: (1) cross coupling of yaw and roll rate gyros which could lead to sustained oscillation in both planes, (2) localized bending in the support structure of rate gyros (which is being investigated) may be a cause, since this could also contribute to sustained oscillations, (3) a malfunction in the yaw shaping network, possibly a random component failure, could also have contributed to the oscillations.

Between 60 and 80 seconds after lift-off, rigid body oscillations were evident, as was experienced on the previous launch and are believed to have been caused by wind shear.

The propulsion system operated within specification with better than a 99. 5 percent propellant utilization before liquid oxygen depletion.

Retro-rocket operation was satisfactory,with good separation of the Discoverer from the booster.

The hydraulic system operated satisfactorily, although an additional return flow was imposed on the pump because of the yaw and roll oscillation.

DISCOVERER VEHICLE SUBSYSTEMS PERFORMANCE

Subsystem A, Airframe

The loads experienced throughout the telemetered flight time were within the design envelope. Separation was normal. No propellant slosh was detected, and wind-shear conditions sufficient to cause high loads were not encountered. First bending mode structural oscillations resulting from Thor-induced yaw oscillations were again encountered as in the case of Discoverer II, but for a shorter duration (launch to 70 seconds). These 4.5 cps oscillations had a half amplitude of 0.25 g, approximately half that recorded for Discoverer II. These magnitudes alone are not considered serious. Resolution of this problem is essential in precluding future occurrences of a more serious nature.

Temperature and vibration data have not been fully analyzed. As yet, no discrepancies have been revealed.

Subsystem B, Propulsion

With the exception of a helium regulator, all engine functions appeared normal, and occurred in the proper sequence. The engine cutoff, however, earlier than commanded.

Prelaunch blockhouse monitoring of the tank pressures indicated the main helium regulator was venting and reseating at approximately one cycle every 4 seconds. This cycling continued during boost and coast but was most severe during the first 60 seconds after lift-off. The loss in helium supply pressure was 230 psi at second stage ignition. The pressures at lift-off and second stage burnout were 2800 and 700 psi, respectively. Although an exact determination of pump inlet pressures during engine burning could not be made, the pressures appear to be near the predicted values (Figure 4).

A comparison of average predicted engine performance and average flight data results is given in Table 2 and Figure 5.

Table 2

ENGINE PERFORMANCE VALUES

	Predicted	Actual
Thrust, lbs	15437	15160
Thrust chamber pressure, psia	476.6	487.6
Turbine speed, rpm	24230	23740
Thrust duration, sec	118.4	115.52
Total flow rate, lb/sec	54.53	53.43
Specific impulse, sec	283.1	283.7
Velocity increment, ft/sec	14000	12540*

*As determined from the guidance computer velocity integrator

As shown by the table, most of the flight performance results are slightly lower than predicted. With 6614 pounds of propellants loaded, the available thrust duration would have been 121.6 seconds based on the flight turbine speed data. This indicates that approximately 328 pounds of propellant were not utilized. Although the engine combustion chamber pressure data indicate that shutdown was initiated by propellant exhaustion, a preliminary investigation of the second stage longitudinal accelerations indicates that fuel remained in the vehicle at this time. Investigations of this problem are continuing.

Subsystem C, Auxiliary Power System

The auxiliary power system performed within specifications. A review of electrical power parameters from telemetry revealed no discrepancies other than a slightly above normal voltage for the 28-volt battery bus and the 400-cycle power system. However, this minor deviation was well within the instrumentation accuracy limits and is not considered to be a problem.

A 30 cps modulation caused by an unidentifiable electrical source occurred on the continuous telemetry channels. Although it was undesirable from an instrumentation standpoint, no evidence exists to indicate any effects upon vehicle subsystem functions. (Investigation into the possible causes for this interference will continue.)

Subsystem D, Guidance and Control

A preliminary analysis of available telemetry data indicates that all guidance and flight control equipment operated within specifications from launch to orbit entry.

Correct D-timer start at lift-off was verified by subsequent timing functions. A tabulation of the major D-timer functions is given in Table 3.

During coast phase of flight, the maximum gyro perturbations were as follows:

Pitch	1.25°	Pitch rate	$+0.6^\circ$ per sec
Yaw	0°	Yaw rate	$+1.5^\circ$ per sec
Roll	1°	Roll rate	$+1^\circ$ per sec

Maximum vehicle attitude transients as a result of separation were recorded as a yaw gyro displacement of $+2^\circ$. No significant gyro perturbations in the roll and pitch planes could be observed.

An analysis of telemetered horizon scanner output signals (Figure 6) indicates the presence of four large transients. The first began upon the activation of the horizon scanner and stabilizes after 35 seconds to within acceptable limits. This is normal. The second began at approximately 264 seconds and lasted until just prior to Discoverer ignition. No explanation is presently available to account for this vehicle horizon scanner displacement. The two remaining displacements were the result of normal engine ignition, and shutdown transients and were properly damped.

Table 3

MAJOR FLIGHT EVENTS

	Nominal From Lift-off (sec)	Actual From Lift-off (sec)
Thor Meco		160.28
Thor Veco		169.28
Discoverer gyros uncaged	161	161
Nitrogen valve opened	171	171.5
Fire separation explosive bolts	171	171.5
Fire retro-rockets	172	172.5
Separation completed	174	174.4
Command -40°/min pitch rate	178	176.2
Fire horizon scanner cover squib	178	
Command -2°/min pitch rate	214	212.40
Timer brake hold		240.02-287.97
Integrator (velocity) correction		287.97-292.90
Fire ullage rockets	*267	293.1
Preactivate hydraulics	*267	293.1
Fire gas generator squibs	*283	309.3
Fire helium valve squibs	*283	309.3
Engine thrust attainment	*284	310.7
Engine burnout	*400	426.2
Hydraulics shutdown	*404	430.3
Command -40°/min yaw rate	*404	430.3
Fire Helium fuel and oxidizer vent squibs	*404	430.3
Start Fairchild timer	*406	432.3

*Time includes nominal 20 second brake hold

PAGES 22 AND 23 DELETED

No appreciable thrust misalignment was measured. All engine position monitors were well below the allowable limits. Maximum engine transients due to engine ignition were $+0.5^{\circ}$ in pitch and $+0.7^{\circ}$ in yaw. During engine firing, the maximum gyro displacements were as follows:

Pitch	-0.6°	Pitch rate	0° per sec
Yaw	$+1^{\circ}$	Yaw rate	$+0.5^{\circ}$ per sec
Roll	-1°	Roll rate	$+0.4^{\circ}$ per sec

Hydraulics were activated at 293.1 seconds, as evidenced by subsequent engine centering. Telemetered hydraulic pressure data, although noisy shows pressure buildup (at 293.1 seconds) and pressure decay at 430.3 seconds.

An analysis of telemetered propulsion parameters indicates that the engine was shut down due to propellant exhaustion rather than by the integrator. The integrator resolver had not reached its shutdown position at the time of thrust termination.

As a result of smooth ignition, no significant propellant sloshing was present, as indicated by either the rate gyros or accelerometer.

Ground computations based on Pt. Mugu radar data called for a D-timer brake hold for 48 seconds (beacon command 5) and an integrator correction of 4.93 seconds (beacon command 6). Both beacon commands were verified by their respective telemetered verification signals. The integrator was preset before flight for an orbital stage velocity to be gained of 14,202 ft/sec.

The setting was reduced by 259 ft/sec to 13,943 ft/sec by the transmission of command 6. The velocity gained during the orbital boost phase of flight as measured by the integrator was 12540 ft/sec. This was approximately 1400 ft/sec less than that required to effect command shutdown of the engine.

Control gas consumption was far below the maximum allowable consumption for the period of flight involved.

Subsystem H, Ground-Space Communications

The performance of Subsystem H equipment was satisfactory. The difficulty experienced at Pt. Mugu in tracking the beacon during the later portion of the ascent phase has been attributed to a ground system problem as discussed on pages 32 and 33.

Beacon interrogation and response was satisfactory, and all commands were executed properly. The beacon power level plot of Figure 7 is employed to show that adequate power was present at the beacon output until loss of track at 419 seconds. This premature loss of track was preceded by a gradual decrease of received signal strength (AGC voltage, Figure 7) at the Pt. Mugu radar until the abrupt drop at 419 seconds. This is indicative that tracking was lost because of attenuation of the beacon signal either in the vehicle or at the Pt. Mugu radar. This is further substantiated by the fact that the beacon return from 449 to 479 seconds and from 491 to 524 seconds was not received by the Pt. Mugu radar. On previous launches, reception has been possible out to the radio horizon at approximately 520 seconds.

Although plans called for the installation of a new (modified) radar beacon on vehicle 1020 which would not be as susceptible to spurious interference, difficulties with this beacon during prelaunch checkout and the aborted countdowns necessitated use of the same type beacon used previously. Spurious interference effects were present during launch, but the problem was not serious and created no difficulties.

Acquisition transmitter operation was satisfactory. Doppler data was received and recorded at Vandenberg AFB, Pt. Mugu, and the telemetry ship. Calculations are being made on this data, taking into account the effect created by rising internal vehicle temperature during ascent.

Performance of the telemetry was generally good. Noise on commutated channels was less than 2 percent except for commutated channel 14 where spiking caused poor performance. Some 28-cycle noise of unknown origin was apparent on all continuous channels. This noise was of sufficient amplitude on channel 9, the longitudinal acceleration, to make the data questionable.

Of 131 measurements telemetered, eight were lost, constituting a 94 percent data point recovery. The measurements lost were the longitudinal accelerometer, explosive bolt monitor, BRC separation monitor, and five temperature measurements.

Subsystem L, Recovery Payload

The Discoverer III Biomedical Research Capsule (BRC) was the first capsule launched which contained a live payload. This payload consisted of four mice instrumented to transmit electrocardiographic information by means of telemetry transmitters attached to the back of each specimen.

BRC data were available through 500 seconds for most parameters and through 791 seconds for viability information. Examination of the viability data shows normal activity of the specimens throughout the 791 seconds. The rodent passengers were subjected to periods of weightlessness from VECO to orbital engine thrust attainment (2 minutes and 21 seconds) and orbital engine shutdown to re-entry of the atmosphere (telemetry lost after 6 minutes and 5 seconds of this period). Therefore, a weightless condition was experienced by the specimens for a total verified time period of 8-1/2 minutes.

The data reveal two discrepancies: the life cell temperature was 58°F, 14 degrees lower than desired, and a failure of the pod separation monitor. Both items are discussed below.

Several Subsystem L quantities were monitored in the Vandenberg AFB Subsystem L building and truck during final assembly operations and transport to the pad. These were recorded on a Sanborn Recorder which was moved with the capsule. After capsule mating with the Discoverer, these quantities were recorded on another Sanborn Recorder in the blockhouse via the umbilical connection.

During the recording from 2100 on 2 June 1959 until mating of the capsule to Discoverer at 0300 on 3 June the temperature was maintained in the region between 73°F and 82°F. The temperature pickup indicates two significant jumps in temperature with a gradual decay back to normal during this time. It is believed that this was caused by one of the mice urinating on the temperature pickup.

After capsule mating with the Discoverer, the compartment temperature began dropping and finally stabilized at about 58°F at 0900. This temperature value remained constant until launch. The temperature then showed a rapid drop of over 2 degrees immediately before lift-off. It is believed that this was due to a voltage change in the shift from external to internal power. The temperature then remained constant through 500 seconds. No data have yet been reduced for subsequent times.

The recording of compartment pressure from 2100 on 2 June 1959, indicates a decreasing pressure to 5.5 psia at about 2200 as the specimens "breathed down" the pressure. At this point, the regulator took over and maintained this value. At the time of capsule mating to the vehicle, a pressure jump to 6.5 psia was shown. It is believed that this is due to the shift from transport dolly direct readout to blockhouse readout via the umbilical connection. This pressure was maintained through launch to 500 seconds.

Relative humidity data have not been reduced except during the telemetered portions (-160 to +500 seconds). During this time, relative humidity remained below 60 percent, which is the lowest point calibrated. Since the dehydrating agent was still fresh at this time, low relative humidity is to be expected.

The oxygen bottle pressure quantity was monitored by RF telemetering, hence can only be read when telemetry is on. This point was extremely noisy, with up to 15 millivolts of noise on a 20 millivolt signal. All readings during quiet periods agreed with nominal predicted values, however. The oxygen bottle pressure read 1125 psig at launch.

All viability readings as recorded from 2100, 2 June to 1309, 3 June, show normal periods of activity and rest. After main engine ignition, the effects of acceleration, vibration, and noise are apparent on three of the viability channels (the fourth has not yet been decommutated). Activity increased at main engine ignition and decreased on all channels up to the time of main engine cutoff, showing the effects of increasing acceleration holding the specimens tighter to the floor of the cage. At MECO, activity abruptly increased again. The same thing happened, though to a lesser degree, at Discoverer ignition and burnout. From this time until the telemetry ship lost track (791 seconds), the three viability traces showed normal activity of the specimens.

The pod separation monitor showed a drop from 63 to 0 volts at 371.5 seconds, giving an erroneous indication of separation of the BRC. Since no other Subsystem L quantity was affected at this time, it is apparent that the BRC did not separate. This drop in voltage can only be attributed to a malfunction of the equipment.

The fan monitor indicated small variations in voltage. No significant variations occurred, however, and perturbations of the order of magnitude detected are normal.

RECOVERY OPERATIONS

HCC Operations

Preparations for the Discoverer III capsule recovery operation were satisfactory. A briefing was held for the Navy and Air Force participants in the operation on 19 May 1959 at the Hawaiian Control Center (HCC). On 20 May the naval units departed for their stations about the nominal impact area at 17° N, 164° 30' W. All participating aircraft were ready at Hickam AFB, and all three destroyers were at their respective sea positions during the countdowns on 21, 23, and 26 May. Following the 26 May countdown, it was necessary to refuel the destroyers prior to another launch attempt.

The destroyers were re-deployed on 1 June in anticipation of the 3 June launch. An alternate destroyer was outfitted for the operation when one of the assigned units developed a turbine problem requiring extensive repair. At the time of the launch on 3 June, a fully operative recovery force of four RC-121 aircraft, nine C-119 aircraft, and three destroyers was in readiness for the recovery operation. After no signals were received from Discoverer III through predicted pass 8, the recovery operation was cancelled. All recovery force components were recalled and dismissed from the operation at 0910 GCT.

Training Exercise

A training exercise was conducted as planned on 18 May prior to the Discoverer III recovery flight. A 70- by 112-mile recovery area was used, along with a reduced recovery force of four C-119 aircraft, three destroyers, and one RC-121D aircraft. The first capsule dropped from a B-47 aircraft was immediately detected at a 149-mile range on the RC-121 radar. (The destroyer acquired the chaff on its radar and the beacon signal on its DDF equipment.) The four C-119 aircraft were vectored to the drop area, and all verified the vectors given by the RC-121 by means of DDF (Discoverer Direction Finding) equipment aboard. Visual contact was subsequently made by the C-119 aircraft.

A contact with the parachute was made by a C-119 Aircraft upon the second aerial pickup pass. However, the coiled line was cut before all of the line in the trough was paid out. The remaining three C-119 aircraft continued the attempt at aerial pickup. The parachute, descending with the cable attached, was again contacted on the sixth pass and recovered at an altitude of 4500 feet. The recovery aircraft was initially vectored from 42 miles on a heading of 020° by the RC-121 Control Aircraft.

The second drop was immediately detected on the RC-121 radar at a range of 169 miles, and three C-119 aircraft were immediately vectored to the drop. DDF equipment aboard the four C-119 aircraft verified the target headings determined by the RC-121 aircraft's APS-20 radar. The three vectored C-119 aircraft visually sighted the descending parachute.

A total of four passes on the parachute by two aircraft were required to effect the recovery, which was made at an altitude of 7500 feet. The recovery aircraft was initially vectored from 30 miles on a heading of 100°.

The training received by all participants was considered valuable in assuring readiness for the planned Discoverer III recovery operation.

GROUND SYSTEMS PERFORMANCE

Computer and Data Evaluation Operation

The computer and data evaluation and analysis activity, collectively termed DEA, was manned 4 hours prior to launch until 15 hours after launch. Prior to launch, acquisition messages were transmitted to all tracking stations in order to make system test checks of the tracking equipment. The system test data from the tracking stations were evaluated, and all stations were checked out well in advance of launch time and were found to be operating satisfactorily.

During the launch the computer and evaluation teams performed according to plan. Since radar tracking data were not available through orbital stage burnout, the magnitude and direction of burnout velocity was computed using Pt. Mugu radar data up to the point of engine ignition and engine nominal fuel flow and thrust values for the telemetered burning time. The calculations (assuming that the vehicle maintained a horizontal attitude), indicate a burnout velocity of 25, 689 ft/sec. This would have resulted in an orbit having a 93. 3 minute period and an eccentricity of .023.

This information was generated within approximately 1/2 hour after lift-off. Acquisition messages were sent to the tracking stations based upon this prediction. However, the vehicle was not acquired on pass 1 by any station. Shortly after the time for pass 1, the IDCC requested that information for an orbit plane search be generated and transmitted to all stations.

The DEA was manned through the time for pass 9, during which time no acquisitions were made. At this time, sufficient study of the available information had been made to indicate that orbital status had not been achieved. The DEA was then secured.

Tracking Stations

Vandenberg Tracking Station. Station performance was satisfactory. No major equipment malfunctions occurred.

The VERLORT radar tracked smoothly from lift-off until 180 seconds, when the radar went passive as requested by Pt. Mugu. Active tracking was attempted again between 325 and 350 seconds after Pt. Mugu had sent commands 5 and 6 but was discontinued to avoid interference with Pt. Mugu.

As shown in Figure 8, intermittent tracking was maintained in the passive mode until 419 seconds.

The inability of the Vandenberg AFB radar to track in the passive mode is not considered serious, since good tracking in this mode is most difficult. The TLM-18 system tracked smoothly from lift-off to 579 seconds, with useable telemetry data and doppler signal fading at approximately 518 seconds.

Pt. Mugu Tracking Station. Station operation appeared to be normal and no equipment malfunctions occurred. However, a preliminary post-flight analysis of the data clearly indicates that the radar was tracking on a minor lobe of the antenna pattern. Tracking on the minor lobe resulted in systematic errors in azimuth and elevation angles and caused early loss of track.

The radar appeared to acquire normally at 28 seconds and tracked smoothly until approximately 310 seconds, when second stage ignition occurred. From then until signal loss at 419 seconds, the tracking was erratic.

Because of the high signal level present at the time of initial acquisition, it was not possible for the radar or the operator to initially detect the side lobe condition. The normally high signal level at the time of acquisition was partially enhanced for this flight as a consequence of recent maintenance and adjustment of equipment such that the station was operating at peak power levels.

Positive "lock-on" to the minor lobe occurred at approximately 28 seconds, a few seconds earlier than nominal. As the track proceeded, the apparent high trajectory, in addition to the early lock-on, was questioned by operating personnel. The possibility of minor lobe tracking was briefly discussed, and consideration was given to reverting to "Manual" search. However, because of the continued solid track, it was decided that the vehicle trajectory was actually above nominal. The station therefore maintained the position as the primary tracking station and initiated commands to the vehicle to adjust the second stage firing time and velocity-to-be-gained.

Following second stage ignition, the track became erratic, and at 419 seconds, the signal dropped to a level which could no longer be tracked. The early loss of track was questioned by the operator, who immediately switched to the manual search mode. Efforts to re-acquire the vehicle, however, were unsuccessful.

This was the first experience by personnel at this station with minor lobe tracking, although extensive "fly by" tests utilizing a T-33 aircraft have been conducted to check out procedures and equipment. The condition, therefore, was completely unexpected. An intensive study of this problem is continuing so that present procedures and human factors engineering can be supplemented so as to prevent recurrence of minor lobe tracking.

Telemetry coverage provided by this station was excellent, with useable signal continuing to 516 seconds.

USNS Pvt. Joe E. Mann. The Pvt. Joe E. Mann was stationed at 14° 50' N latitude and 121° 47' W longitude on a 000° T heading during the launch.

Telemetry reception by the ship was satisfactory, and useable telemetry signal was recorded from 264 seconds until 791 seconds, or for a duration of 527 seconds. Acquisition and tracking procedures were normal, with the vehicle being tracked very nearly overhead. The forward antenna held an azimuth of 0° while the aft antenna azimuth deviated to 345° during the overhead portion of the track. Both antennas were smoothly trained in elevation from 0° to 180° during the tracking period.

DATA AND SUPPORT

Data Coverage

Data coverage on this launch was excellent and was maintained from lift-off to approximately 791 seconds. Figure 9 is employed to illustrate the station coverage of useable data. Subsequent to the flight, all Quick-Look data were prepared, annotated, and transmitted expiditiously to Vandenberg AFB and Palo Alto. Many of the data handling problems that existed on previous launchings were not encountered this time.

Launch Data. Data coverage during launch was superior to that of any previous Discoverer flight. Excellent telemetry records were obtained from Vandenberg AFB, Pt. Mugu, and the telemetry ship, Joe E. Mann. Radar tracking data were obtained from Pt. Mugu and Vandenberg AFB, althouth their accuracy has yet to be verified.

Metric optics data were obtained satisfactorily and were tabulated, plotted, and transmitted to Palo Alto for review.

In contrast to the previous Discoverer flight, data handling maintained its proposed schedule, and in many cases the Quick-Look data arrived at its destination ahead of the specified time required for delivery. A summary of the major items with the times due and received at Palo Alto follows in Table 4.

Table 4

DATA DELIVERY TIMETABLE

DATA DESCRIPTION	DUE TIME (hours)	TIME RECEIVED (hours)
1 Blockhouse landline records	T +6	T +6
2 Range safety plot boards	T +6	T +6
3 VAFB Plotting Boards VERLORT radar & TTF	T +6	T +6
4 VAFB tracking station real time analogs	T +8	T +8
5 Real time analogs, Pt. Mugu	T +8	T +13
6 Pt. Mugu doppler, VERLORT punched tape	T +8	T +13
7 Pt. Mugu telemetry tape	T +8	T +13
8 Radiation Monitor report	T +8	T +30
9 LMSD service notes	T +8	T +6
10 LMSD instrumentation schedule	T +8	T +6
11 PACC/VCC voice tapes	T +24	T +6
12 "Quick-Look" metric optics tabular	T +24	T +30
13 First stage analog kit	T +36	T +28
14 Copy of metric optic films	T +52	T +30
15 "Quick-Look" documentary films	T +72	T +30
16 Sunnyvale analog (playback)	ASAP	T +7
17 Van Nuys (Pt. Mugu data) analog kit	ASAP	T +23
18 Telemetry ship tapes, analogs	ASAP	T +26
19 Pacific Missile Range telemetry tapes	ASAP	T +31
20 Smooth metric optics	T +72	T +78

Since the Pt. Mugu data was not delivered to Vandenberg AFB until after 7 hours, it was not carried on the first data flight to Palo Alto 4 1/2 hours after launch. The data were placed on the second flight 7 hours later, arriving in Palo Alto at 13 hours after launch. No other significant delays were encountered.

Support

Launch Base. Support from the first Missile Division services was satisfactory.

Pacific Missile Range. Support provided by the Pacific Missile Range (PMR) included provisioning of the down range telemetry ship and metric optics and FPS-16 trajectory coverage. The quality and presentation of the PMR data was excellent, as it had been after the launch of Discoverer II.

6593rd Test Squadron. The C-119 data pick-up aircraft provided by the 6593rd Test Squadron at Edwards AFB was utilized to air-lift the telemetry tapes from the Pvt. Joe E. Mann to Moffett Field. Aerial pick-up of the capsule from the ship was successfully accomplished on the Aircraft's second pass. The package was then air-lifted to Moffett Field via Edwards AFB within 26 hours after launch, making it possible to prepare this data in time for inclusion in this report.

LMSD Van Nuys. The Van Nuys plant of LMSD successfully tracked the vehicle during launch and provided decommutated analogs and real-time recordings to Palo Alto covering the period from 60 to 420 seconds within 12 hours after launch.

Ground Support Equipment

Blockhouse. Personnel and equipment performance during all phases of the countdown and launch was satisfactory. Primary communications and all electrical and mechanical systems functioned properly.

Medical Vans. Personnel at the medical van complex assisted in the mechanical and electrical assembly and the installation of the life cell portion of the recovery capsule. Preparation of the life cell readout instrumentation and calibration of the life-cell electronic instruments were completed as scheduled.

Pad Electrical Trailer. Satisfactorily operation of the Pad Electrical trailer was reported.

Vehicle Fueling. The fueling system operated without serious malfunction. Fueling problems encountered on the previous launching (FTV-1018) were not repeated on this launch. All functions of the fueling task were performed satisfactorily.

Air Conditioning Van. The Air Conditioning Van operated satisfactorily.

Launch Complex. Thor ground support equipment performed satisfactorily. Pad damage resulting from booster exhaust was minor and comparable to that experienced during previous Discoverer launchings.

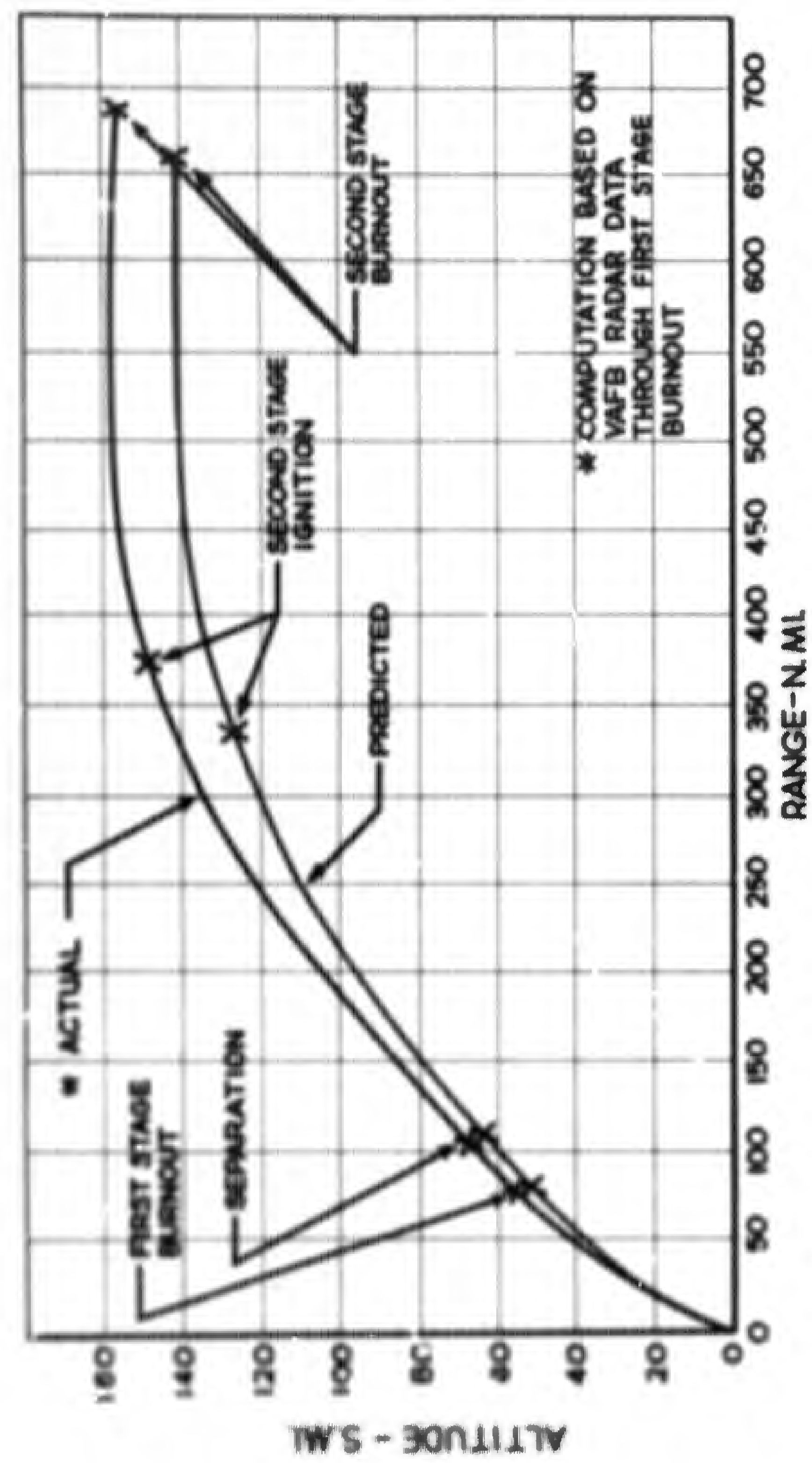

Figure 1 Altitude vs. Range, Discoverer III

LMSD / 427395

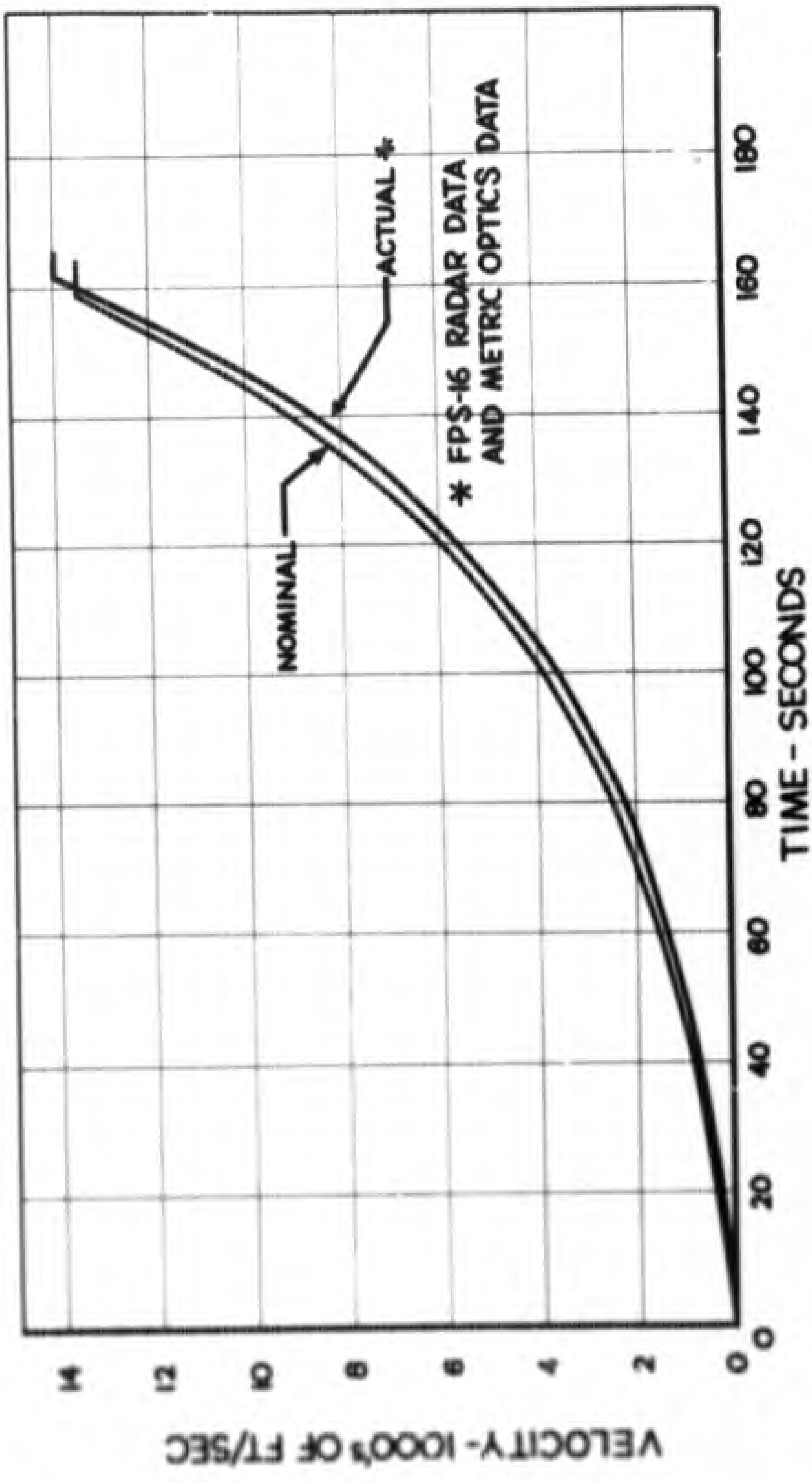

Figure 2 Velocity vs. Time During Thor Boost

LMSD/452195

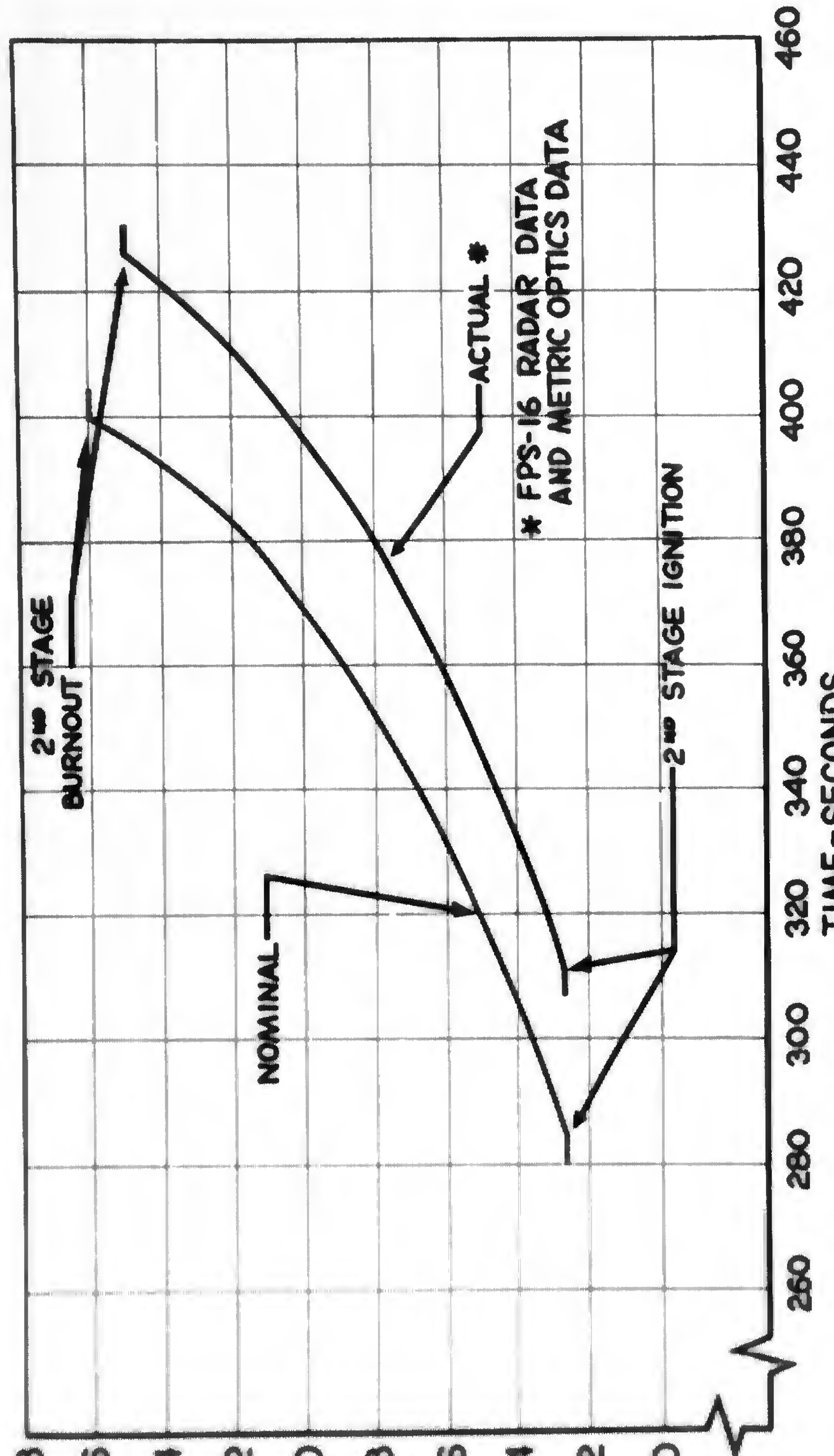

Figure 3 Velocity vs. Time During Orbital Boost

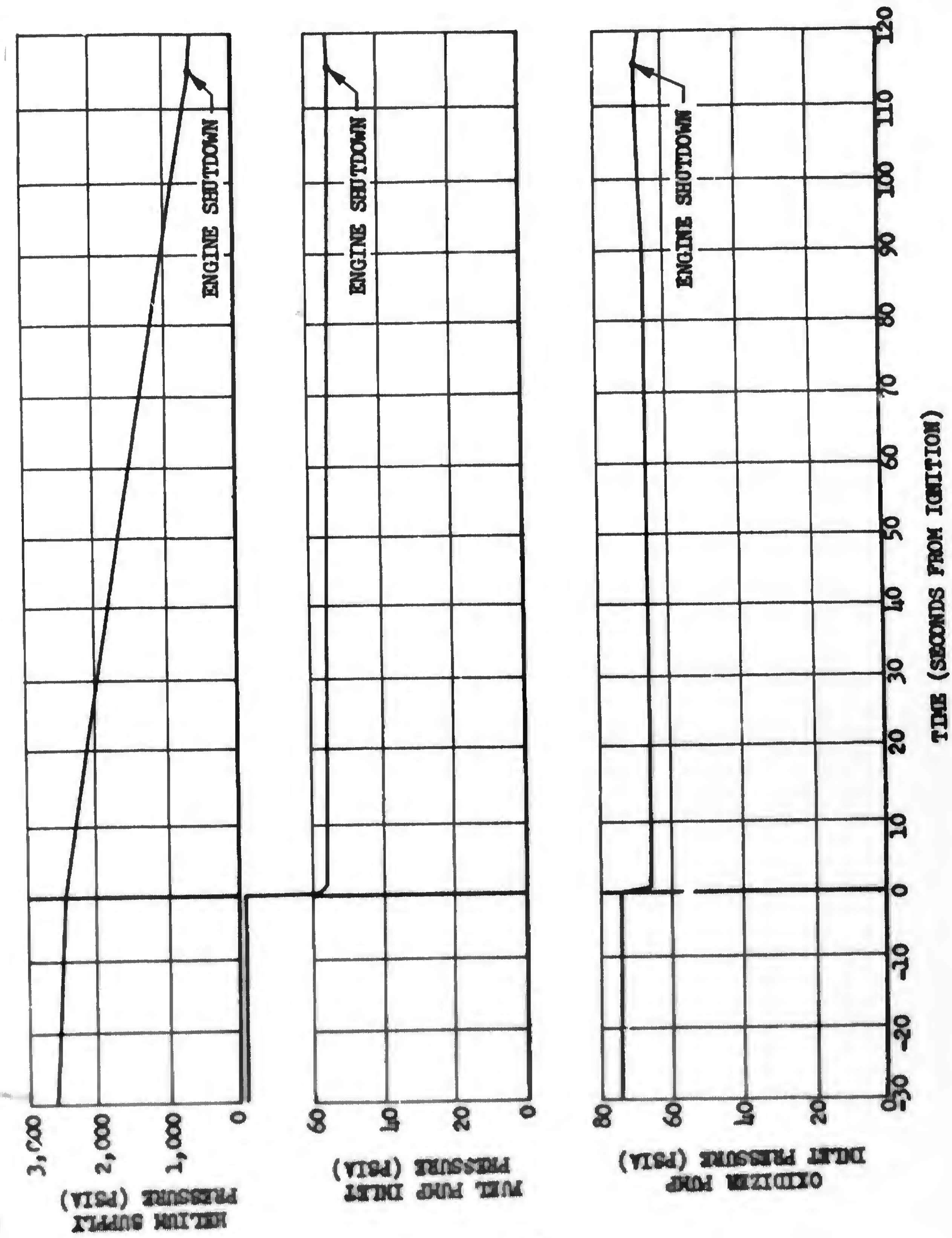

Figure 4 Pump Inlet and Helium Supply Pressures

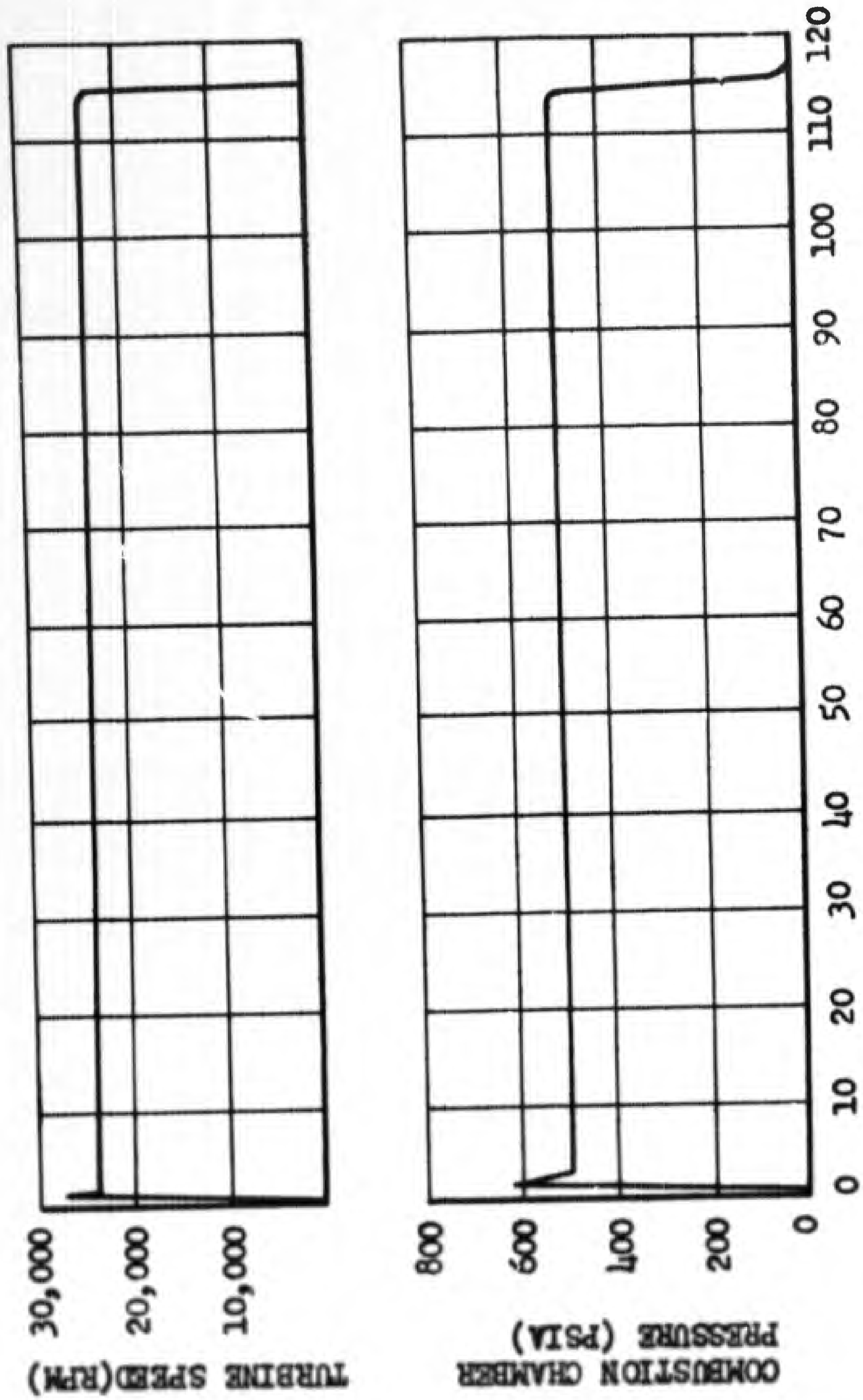

Figure 5 Engine Performance Parameters

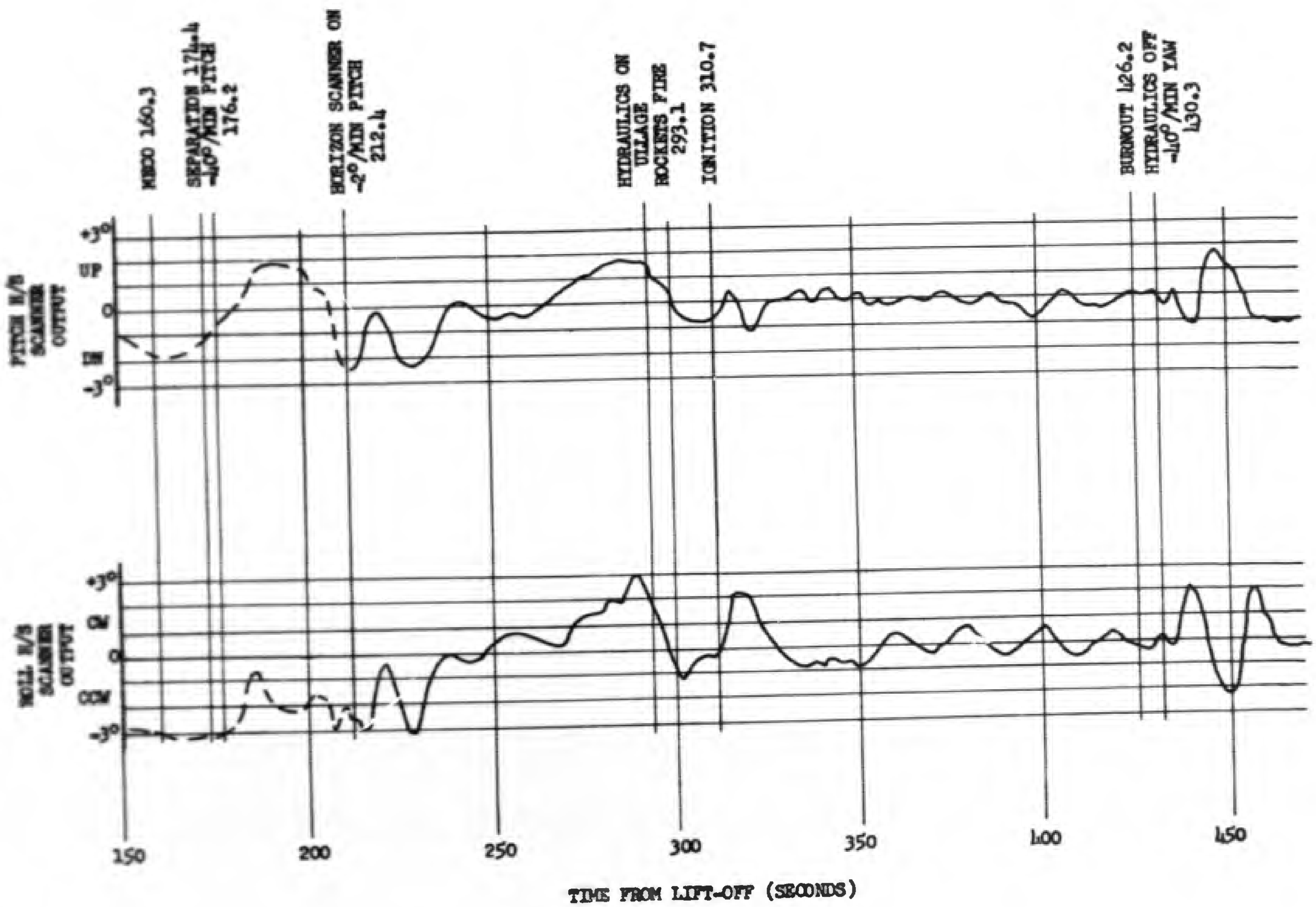

Figure 6 Horizon Scanner Error Signals

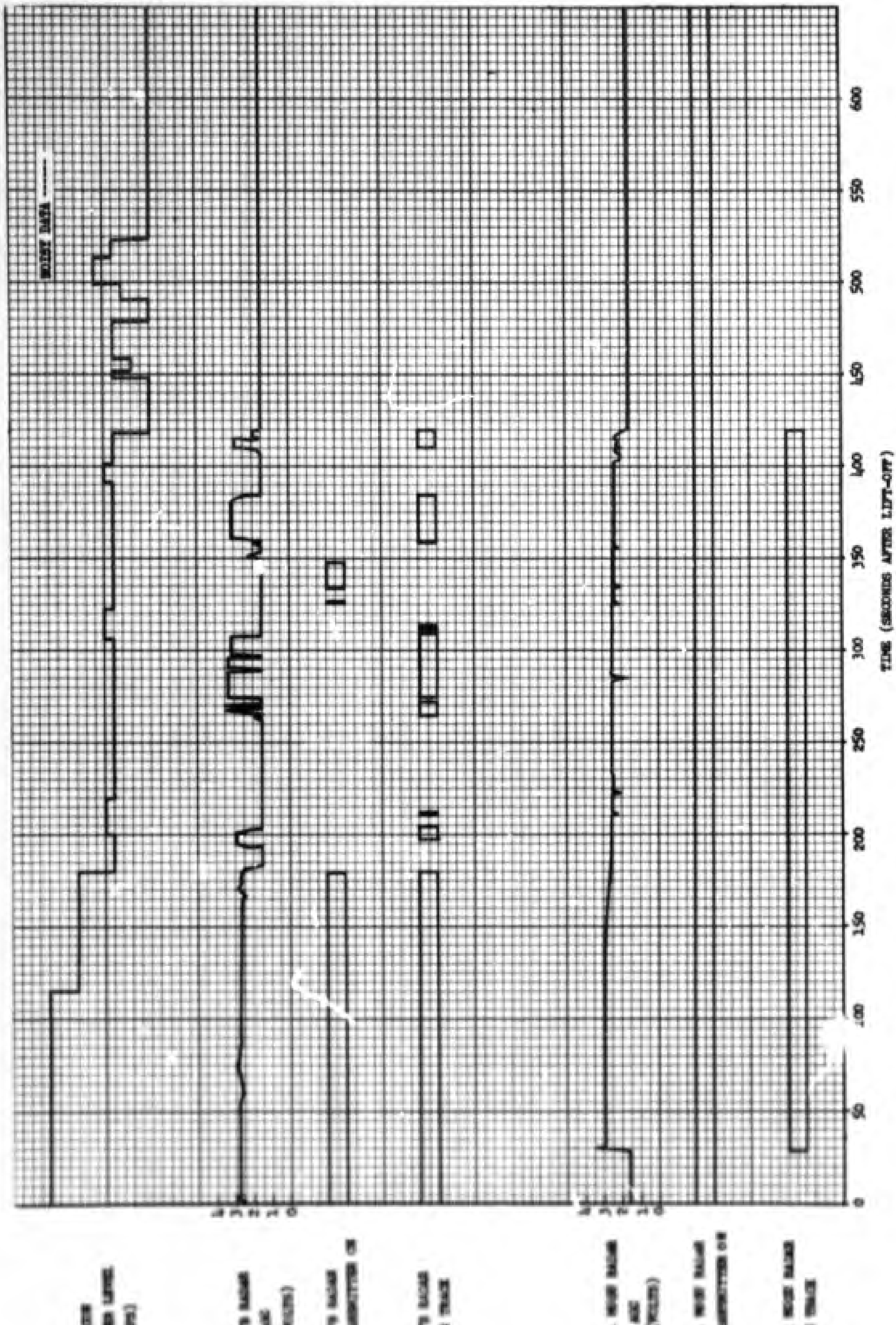

Figure 7 Radar Operation Data, Discoverer III

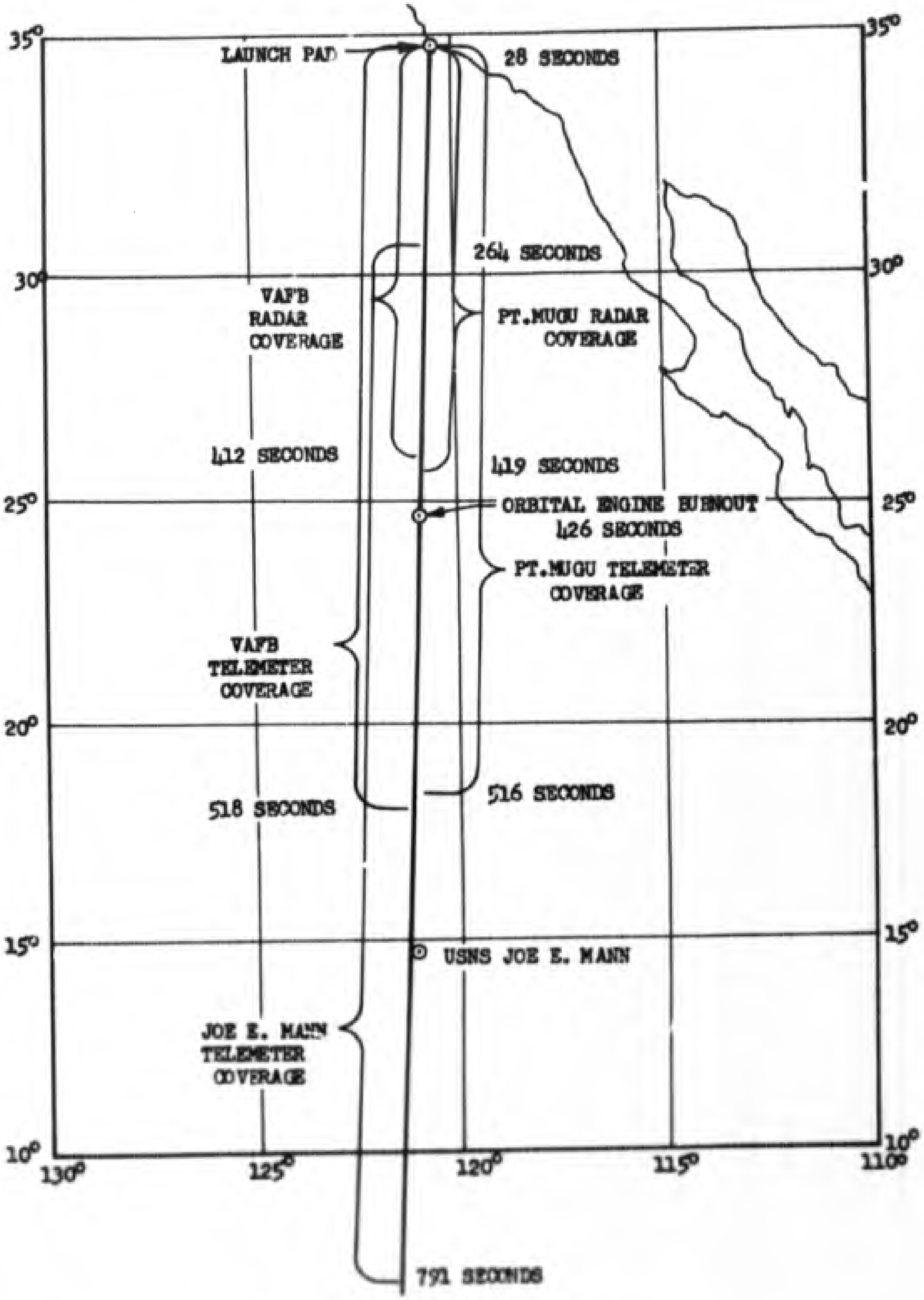

Figure 8 Ascent Trajectory Showing Radar and Telemetry Data Coverage

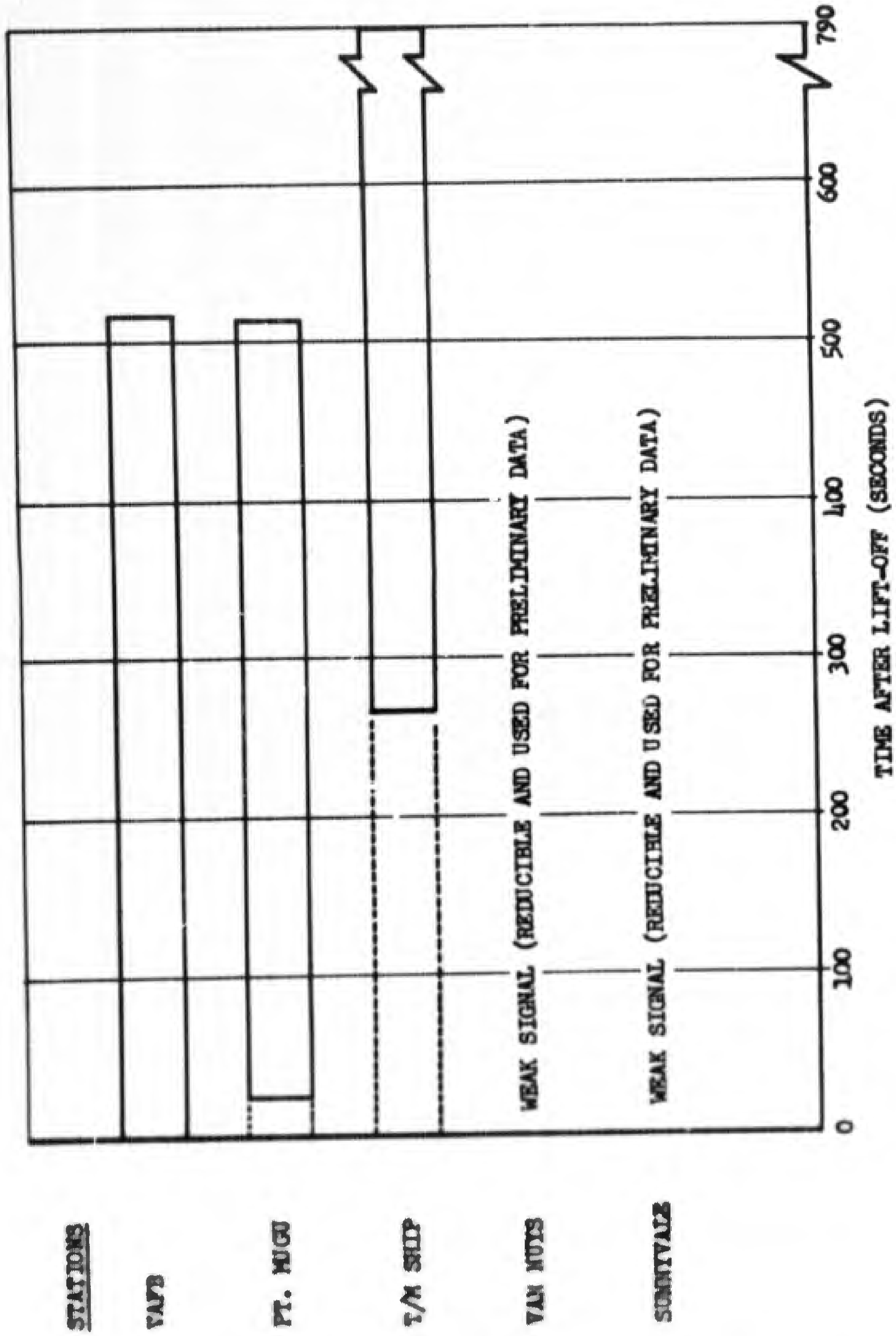

Figure 9 Station Coverage of Usable Data

SECTION IV
CONCLUSIONS

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CONCLUSIONS

1. Orbital status of the Discoverer 1020/Thor 174 was not achieved, primarily as a result of early termination of second stage thrust. The basic reason for this early termination has still to be determined.

2. The near orbital condition obtained provided sufficient data under launch and weightless conditions to partially demonstrate the capability of the Biomedical Research Capsule.

3. Thor booster performance was within specification. However, the flight path angle at the time of main engine cutoff was slightly higher than nominal.

4. Operation of the Discoverer vehicle subsystems was generally satisfactory.

5. The recovery force, although not called upon to recover, was operationally ready.

6. Ground support and checkout equipment operation was satisfactory.

7. The system complex of tracking and control stations performed satisfactorily with the exception of the Pt. Mugu radar. It has been concluded that the Pt. Mugu radar was tracking on a minor lobe of the antenna pattern.

APPENDIX I
TEST CONFIGURATION

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The system test configuration consisted of a ground station launch complex (Pad 4, VAFB), a data command and communication system, a Douglas/Thor first-stage booster, an LMSD Discoverer second-stage orbital vehicle, and the necessary first and second stage support equipment. The ground tracking station complex consisted of launch facilities at Vandenberg AFB, five tracking and telemetry stations, one telemetry ship (Pvt. Joe E. Mann), control centers at Palo Alto, Vandenberg AFB and Hickam AFB and a control center at Palo Alto to compute orbit ephemeris. A more detailed description of system configuration appears in Section A2 of the LMSD System Operation Plan, Reference 1.

The Discoverer III satellite vehicle, XA Model 2205, Serial 1020, was mated with a structural adapter section to a modified IOC Thor booster SM-75, DM 13, Serial 174. The combination was approximately 79 feet in length. (A weight statement for Discoverer III appears in Table 5.) The Thor/Discoverer lift-off gross weight was approximately 114,800 pounds.

Discoverer III was the second Discoverer vehicle to use UDMH (Unsymmetrical Dimethylhydrazine) as fuel and IRFNA (Inhibited Red Fuming Nitric Acid) as oxidizer. The vehicle configuration (Figure 10) was identical to Discoverer II with the following exceptions: The Subsystem H timer was replaced with an advanced-design Fairchild timer. The Fairchild timer uses a Mylar 35mm tape with perforations that are interpreted for vehicle systems

TABLE 5

DISCOVERER III WEIGHT STATEMENT

	Subtotal Pounds	Total Pounds
Structure	414	
Destruct System	7	
Retro-rockets	16	
Propulsion	573	
Control equipment	140	
Guidance equipment	114	
Auxiliary power supply	254	
Telemetry	81	
Communications	59	
Mark I Biomedical Research Capsule (BRC)	201	
Thor payload (Discoverer) empty		1859
Oxidizer	4752	
Fuel	1862	
Thor payload (Discoverer) total		8473
Less expendables	-159	
Adapter and attachments		
Retro-rockets		
Horizon scanner fairing		
Separation weight		8314
Less expendables	-45	
Control gas used during coast		
Ullage control rockets		
Engine ignition weight		8269
Less expendables	-6529	
Propellant		
Starting charge		
Nozzle closure, control gas		
Engine burnout weight		1740
Less expendables	-137	
Vented residual propellants		
Vented helium gas		
Empty weight		1623

control throughout each orbit. The speed and position of the Mylar tape can be controlled by S-Band beacon commands. Those commands are as follows:

Command 1	Sets alternately the increase or decrease mode of the timer control steps
Command 2	Steps timer in 10 second steps in the direction dictated by command
Command 3	Resets the Mylar tape to a predetermined set of perforations

The Subsystem D timer remains unchanged except that upon the capsule ejection command, a SS/D command is also given to shut down SS/D timer and gyros, leaving the flight control (including rate gyros) as the only orbit stability mechanism.

The accelerometer integrator dial reading was set at 1773 while in the caged condition, representing a velocity to be gained of 14, 202 ft/sec.

Discoverer III was the first vehicle to contain a Biomedical Recovery Capsule (BRC) incorporating a life cell with the necessary equipment to control cell humidity, temperature, and pressure. The life cell was provisioned to supply adequate nutrients for four mice for 52 hours.

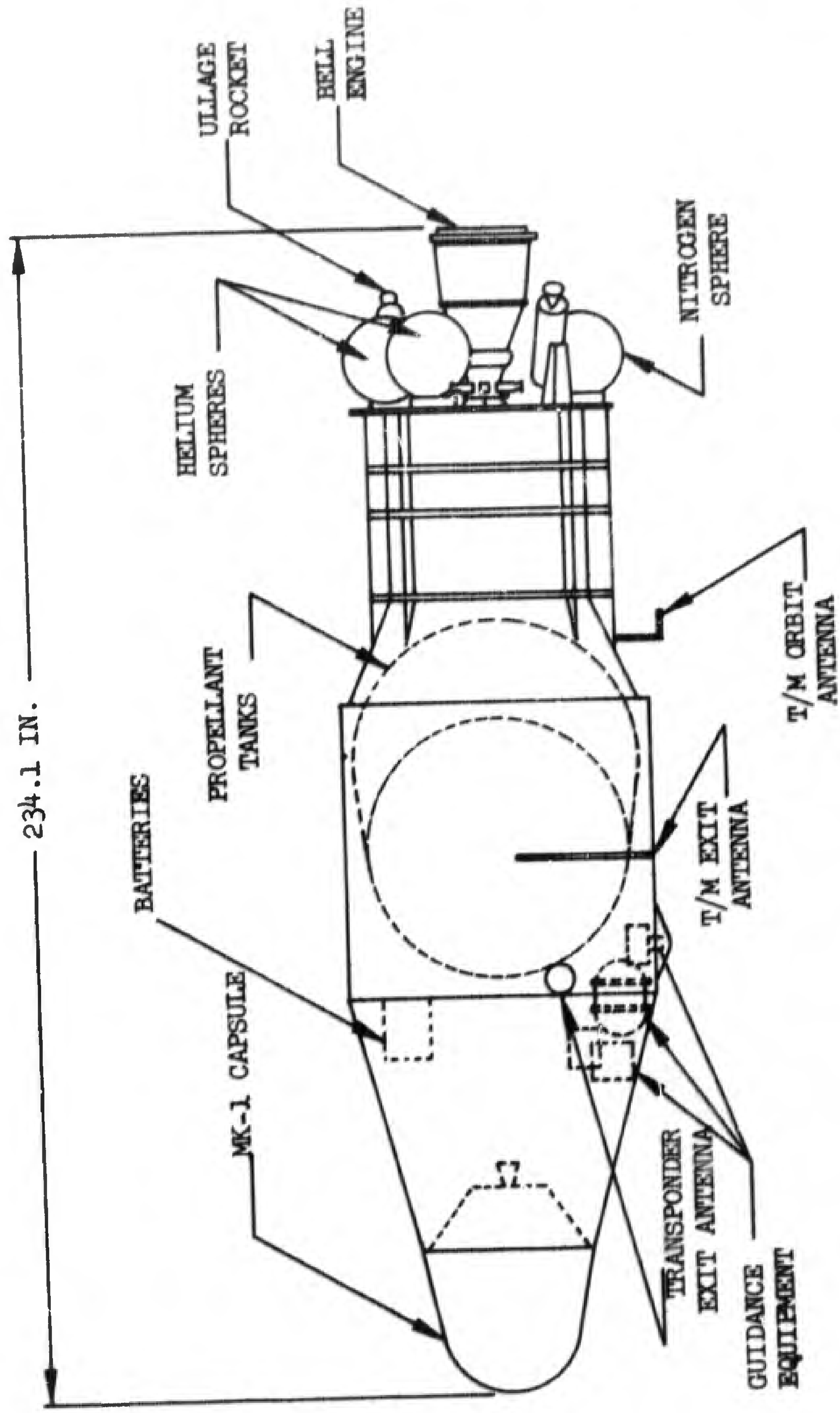

Figure 10 Discoverer III General Arrangement

APPENDIX II
COUNTDOWN CHRONOLOGY

APPENDIX II

COUNTDOWN CHRONOLOGY

Four countdowns (C-D) and launch attempts were accomplished prior to achieving a successful launching of the Discoverer III satellite. A brief description of the first three attempts follows with a more detailed description of the fourth and successful attempt. All countdowns were conducted in accordance with the prescribed procedure listed in the LMSD Discoverer Countdown Manual. (Reference 2).

First Launch Attempt, 21 May 1959

The C-D began at 0255 PDT. Shortly thereafter, at 0330 PDT, a technical hold was called because of BRC mating problems. These were resolved and the C-D was resumed at 0434 PDT. With the completion of Task 2 (BRC mating) at 0549 PDT, the C-D status was 79 minutes behind schedule. By 0925 PDT, a technical hold was called to replace a faulty "0" ring in the acid quick-disconnect line. This hold lasted for 116 minutes which, added to the previous delay, brought the C-D status to 3 hours behind schedule. However, the C-D was resumed at 1121 PDT and continued until 13:32, at which time another technical hold was called because of a malfunctioning S-band beacon. Five attempts to interrogate all beacon commands were made, with only two successfully completed. Consequently, the test was terminated.

Second Launch Attempt, 23 May 1959

When the S-band beacon problem was resolved, the second C-D was initiated at 0255 PDT. Tasks 1 through 8 were completed within the prescribed schedule. During Task 9 (C-D evaluation), a T-33 Aircraft fly-by verified beacon operation by both VAFB and Pt. Mugu. A series of "five sets of commands" was tested and verified (a total of 60 commands having been transmitted and received). This test imparted some delay to the C-D; however, the operation progressed smoothly until Task 15 (propellant pressurization). At 1116 PDT, a technical hold was called because of malfunctioning orbital stage main helium pressure regulator. Attempts were made to initiate proper operation by vibrating the regulator. When this solution failed, the C-D was "scrubbed" at 1303 PDT and rescheduled.

Third Launch Attempt, 26 May 1959

When the orbital stage main helium pressure regulator was replaced and the necessary pre-launch operations completed, the third C-D and launch attempt was initiated at 0200 PDT. Even though the terminal C-D was scheduled to be accomplished in 480 minutes, actual time expended before the C-D was terminated in 915 minutes. Causes for the additional time required were (1) weather (approximately 180 minutes), (2) range schedules (passenger trains, sky screen, etc.), and (3) first stage difficulties.

The final phase of the terminal count was started at 12:50 and continued to the end of Phase IV at 1300, when the 15-minute planned technical hold was imposed. DAC was able to fuel within 3 gallons of the prescribed 4623 gallons.

The hold was continued beyond the intended 15 minutes because of a booster liquid oxygen loading malfunction. At 1321 PDT, it was announced that the technical hold would be continued for another 30 minutes. The hold caused by the booster malfunction was finally released at 1500 PDT. However, a weather hold was imposed immediately and was not released until 1531 PDT.

Only 2 minutes and 35 seconds of the count remained plus 1 minute for "topping the liquid oxygen tank." Events leading to the final decision to abort the launch were as follows:

1531 Hold released. Phase V begun. During this attempt the liquid oxygen tank pressure inadvertently vented and the sequencer began to recycle. Simultaneously the Range Safety Officer called a weather hold at 1535. During this hold, DAC personnel corrected the malfunction.

1636 Hold released. Another attempt was aborted because the launcher failed to operate. This difficulty was caused by a malfunctioning microswitch which failed to release the launcher lock pins. Another technical hold was imposed at 1640 PDT.

1658 Technical hold released. The count was begun at -2 minutes and 30 seconds. This time the lack of nitrogen pressure in the propellant tanks was responsible for failure to complete the starting sequencer. A technical hold was imposed at 1710 PDT and released at 1713. Another attempt to continue the countdown was made but it failed because the tank pressure vented again. The launch attempt was aborted at 1715 PDT.

Fourth Attempt, 3 June 1959

After the third attempt at launch failed 8 days were necessary to prepare the orbital stage vehicle for another launch attempt. After all necessary electrical checks, engine flushing and pressurization checks were completed, the fourth and final launch attempt was begun at 0200 PDT.

Table 6

COUNTDOWN CHRONOLOGY DISCOVERER III, 3 JUNE 1959

PDT	Countdown T-Time	Activity
0200	480	Task 1 initiated (pre-countdown operations)
0210	470	Task 1 complete
0210	470	Task 2 initiated (BRC mating)
0240	440	Task 3 initiated (vehicle erection, shelter removal)
0329	[illegible]9	Task 2 completed
0340	380	Task 3 completed
0340	380	Task 4 initiated (lanyard connection and fuel truck emplacement)
0358	362	Task 5 initiated (destruct tests)
0358	362	Task 4 completed
0425	335	Task 5 completed
0425	335	Task 6 initiated (begin orbital stage arm)
0425	335	Task 7 initiated (connect Thor destruct)
0504	296	Task 7 completed
0503	297	Task 6 completed
0504	296	Task 8 initiated (line fill)
0528	272	Task 8 completed
0528	272	Task 9 initiated (countdown evaluation)
0545	255	Task 9 completed
0545	255	Task 10 initiated (tanking)
0615	225	Task 10 completed
0615	225	Task 11 initiated (electronics warm-up)
0631	209	Task 12 initiated (remove propellant trucks)
0658	182	Task 12 completed

Table 6 (Continued)

PDT	Countdown T-Time	Activity
0740	140	Task 11 completed
0740	140	Task 13 initiated
0803	117	Task 14 initiated (RC checks)
0838	82	Task 15 initiated (pressurization)
0803	117	Task 13 completed
0837	83	Task 14 completed
0928	32	Task 15 completed
0948	12	Task 16 initiated (evaluation)
		Hold for weather and train released
12:40	11:35	Terminal count initiated
1309:20	0	Lift-off

The C-D operation was completed without a single technical hold imposed. Throughout most of the C-D, all tasks were completed ahead of schedule. Only one minor difficulty was encountered and that was the inadvertent venting of the orbital stage main helium pressure regulator. However, the venting (although significant), was not sufficient to cause a delay in the count or cause a technical hold. A 15 minute check on the pressure venting problem showed that pressurization remained within the desired tolerance, and the C-D was continued. Table 6 is a record of the countdown.

REFERENCES

1. LMSD-6029, "System Operation Test Plan, Program IIA."
2. LMSD-10078-1, "Discoverer Countdown Manual 1020/179 Vandenberg Air Force Base," 27 May 1959.