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CONFIDENTIAL

MONTHLY SUMMARY OF

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SPACE

Systems Div

ACTIVITIES

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PAGES EXEMPT

SSLPR-39

a foreword to...

SPACE

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HEADQUARTERS
BALLISTIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
Air Force Unit Post Office, Los Angeles 45, California

SSLPR

18 September 1961

Monthly Summary of

SPACE SYSTEMS DIVISION

ACTIVITIES

AUGUST 1961

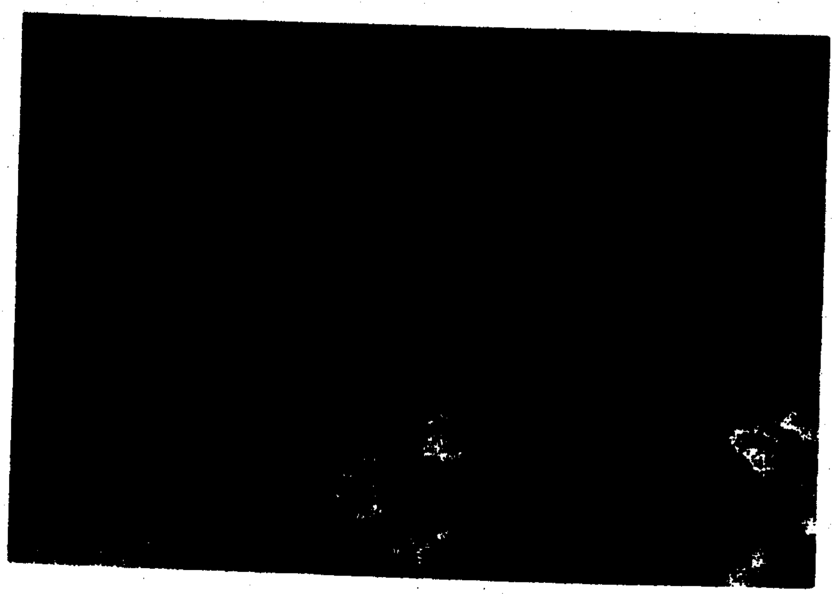
FOREWORD

This month's report includes information about the successful recovery of the DISCOVERER XXIX Capsule. The capsule was retrieved from the Pacific by an Air Force para-rescue team. Instruments for the VELA HOTEL Program were carried aboard the AGENA satellite vehicle. BLUE SCOUT vehicle 0-1 was launched on 17 August and although all four stages appeared to perform successfully, a loss of telemetry following fourth stage ignition prevented the receipt of fourth stage burning information and payload experiment data. MERCURY MA-4 was successfully launched at 1404Z on 13 September. Booster and capsule performance were nominal throughout the flight. Although capsule impact occurred approximately 70 n.m. west of the planned area, recovery was effected. Valuable information gathered during the flight is now being analyzed. The RANGER Program has been expanded to include twenty-four launches extending through 1963. RA-1 was launched on 23 August. ATLAS performance and AGENA first burn occurred as programmed but ignition of the AGENA for the second burn period was not obtained. Commands were transmitted to the spacecraft and telemetry from the spacecraft confirmed that all experiments were functioning. During the month the Space Systems Division noted a deficiency in the USASRDL/Sylvania design approach for the ADVENT satellite-to-ground link. Several solutions to the problem were provided.

[signature] Col USAF
for O. J. RITLAND
Major General, USAF
Commander

SATELLITE

SYSTEMS

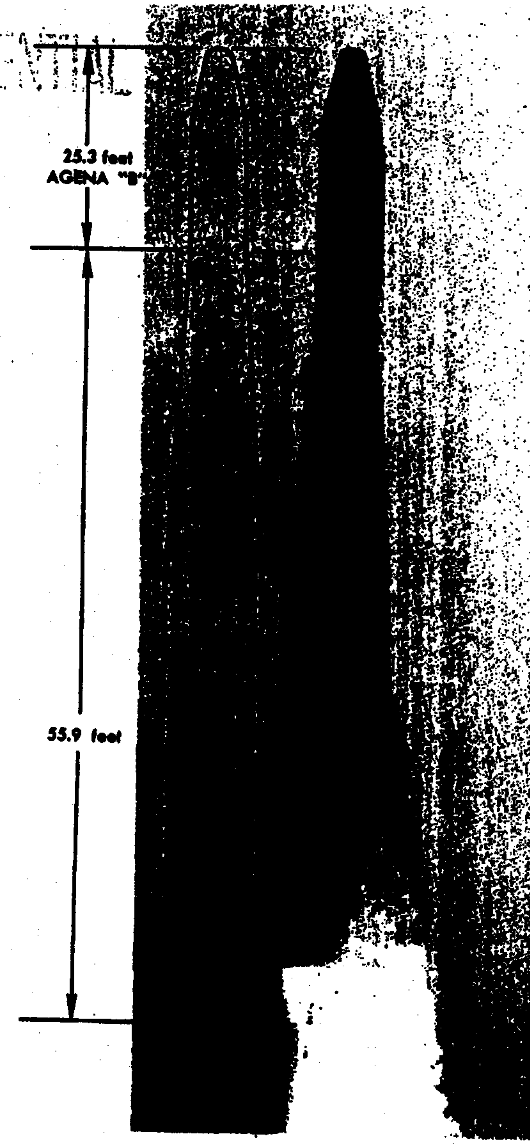


DISCOVERER
MIDAS
BIOASTRONAUTICS
BLUE SCOUT
SAINT
VELA HOTEL

SATELLITE SYSTEMS

The DISCOVERER Program consists of the design, development and flight testing of two-stage vehicles, using the Douglas DM-21 Space Booster as the first stage booster and the AGENA as the second stage, satellite vehicle. The program was established early in 1958 under direction of the Advanced Research Projects Agency, with technical management assigned to AFBMD. On 14 November 1959, program responsibility was transferred from ARPA to the Air Force by the Secretary of Defense. Prime contractor for the program is Lockheed Missile and Space Division. The DISCOVERER Program will perform space research in support of advanced satellite programs.

Discoverer



PROGRAM OBJECTIVES

(a) Flight test of the satellite vehicle airframe, propulsion, guidance and control systems, auxiliary power supply, and telemetry, tracking and command equipment.

(b) Attaining satellite stabilization in orbit.

(c) Obtaining satellite internal thermal environment data.

(d) Testing of techniques for recovery of a capsule ejected from the orbiting satellite.

(e) Testing of ground support equipment and development of personnel proficiency.

(f) Conducting bio-medical experiments, including injection into orbit, re-entry and recovery.

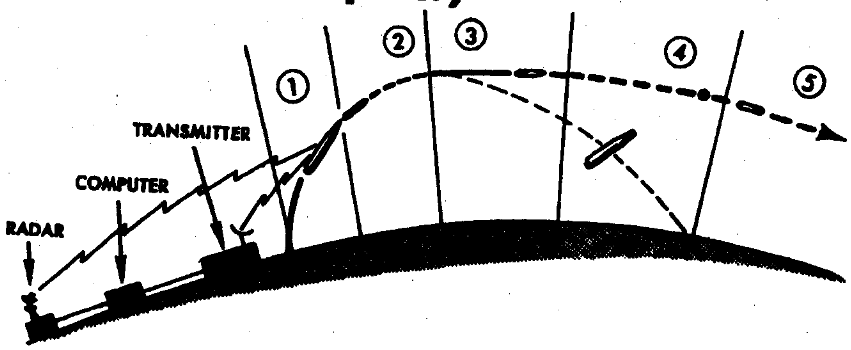
PROGRAM SUMMARY

Early launches confirmed vehicle flight and satellite orbit capabilities, developed system reliability, and established ground support, tracking and data acquisition requirements. Later in the program, biomedical and advanced engineering payloads will be flight tested to obtain support data for more advanced space systems programs. DISCOVERER vehicles are launched from Vandenberg Air Force Base, with orbital operational control exercised by the Satellite Test Center, Sunnyvale, California.

Tracking and command functions are performed by the stations listed in the Table on Page A-4. A history of DISCOVERER flights to date is given on pages A-5 and A-6.

SECOND STAGE	AGENA "B"
Weight—	
Orbital	2,261
Impulse propellants	12,950
Other	511
TOTAL WEIGHT	15,722
Engine Model	XLR81-Ba-9
Thrust-lbs., vac.	16,000
Spec. Imp.-sec., vac.	290
Burn time-sec.	240
BOOSTER	DM-21
Weight—Dry	6,500
Fuel	33,700
Oxidizer (LOX)	68,200
GROSS WEIGHT (lbs.)	108,400
Engine	MB-3 Block 2
Thrust, lbs. (S.L.)	169,000
Spec. Imp., sec. (S.L.)	248.3
Burn Time, sec.	148

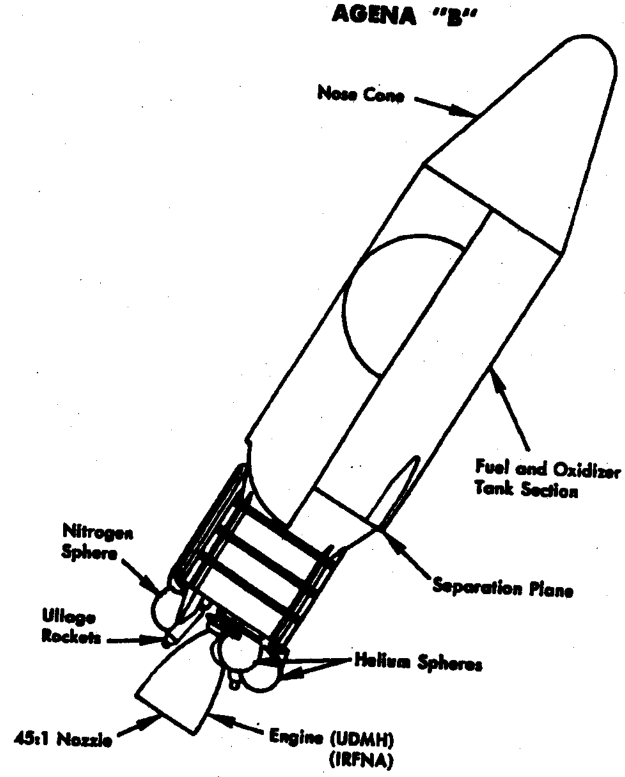
Powered Flight Trajectory



1. **First Stage Powered Flight** – 2.5 minutes duration, 78 n.m. downrange, guided by BTL guidance.
2. **Coast Period** – 2.4 minutes duration, to 380 n.m. downrange, attitude controlled by inertial reference package, horizon scanner, gas reaction jets. Receives AGENA time to fire and velocity to be gained commands thru the BTL system.
3. **Second Stage Powered Flight** – Approximately four minutes or until injection velocity is attained. Pitch and yaw stabilization achieved by gimballing the engine and roll by gas reaction jets. Engine shutdown achieved by integrator accelerometer cutoff command.
4. **Vehicle Reorients to Nose Aft** – 2 minutes duration. Guided and attitude controlled by inertial reference package, horizon scanner and gas reaction jets.
5. **In Orbit** – Controlled (same as 4).

Telemetry ships are positioned as required by the specific mission of each flight. Illustrations on the opposite page show a typical launch trajectory from Vandenberg Air Force Base and a typical orbit. An additional objective of this program is the development of a controlled re-entry and recovery capability for the payload capsule. The recovery operation is also shown on the opposite page. An impact area has been established near the Hawaiian Islands and a recovery force activated. Techniques have been developed for aerial recovery by C-119 and JC-130 aircraft and for sea recovery by Air Force pararescue men and Navy surface vessels. The recovery phase of the program has provided advances in re-entry technology. This information will be used in support of more advanced projects.

AGENA "B"

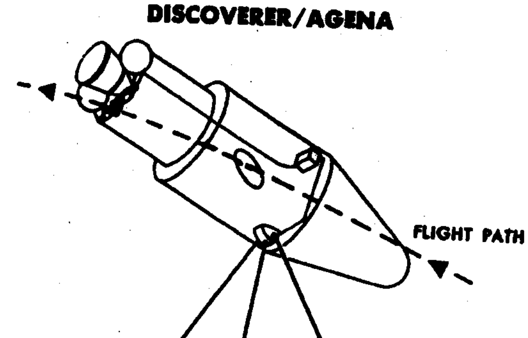


AGENA VEHICLE DEVELOPMENT

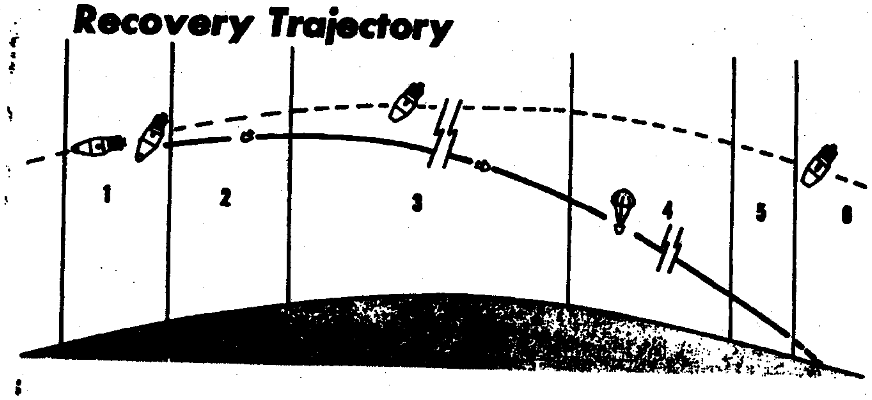
The AGENA vehicle was originally designed as a basic satellite vehicle for Military Space Programs.

The first AGENA "B" used the Bell XLR-81Ba-7 engine and was first flown on DISCOVERER XVI. The latest AGENA "B" vehicles use the 16,000 pound thrust XLR-81Ba-9 engine.

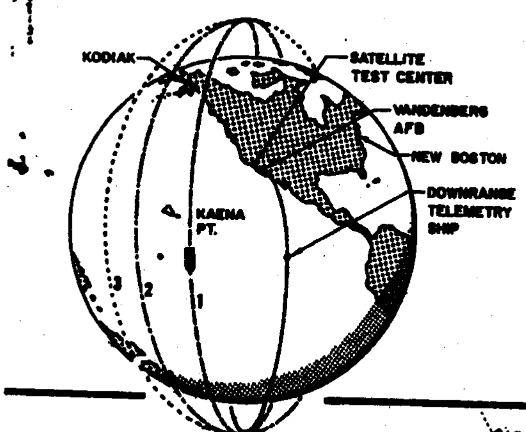
DISCOVERER/AGENA



Recovery Trajectory



1. **Vehicle Reorients to Separation Attitude**—83.5 seconds duration, 2,000 nautical miles north of impact point. Pitch reorientation starts and vehicle assumes separation attitude.
2. **Capsule Separation**—18 seconds duration, capsule separates, spin gas jets fire, retro rocket fires and de-spin gas jets fire. Retro rocket and thrust cone separate from re-entry capsule.
3. **Re-entry**—8 minutes duration, recovery capsule re-enters the earth's atmosphere. Parachute cover is ejected and ablation shell separated from capsule.
4. **Descent to Recovery Altitude**—18 minutes duration. Reefed parachute is deployed and chaff (to aid in radar tracking) is ejected. Capsule descends from 55,000 feet to 14,000 feet.
5. **Air Recovery**—6 minutes duration, capsule descends from 14,000 feet to 1,500 feet during which time air recovery is attempted.
6. **Sea Recovery**—Capsule impacts in the sea, surface forces attempt recovery.

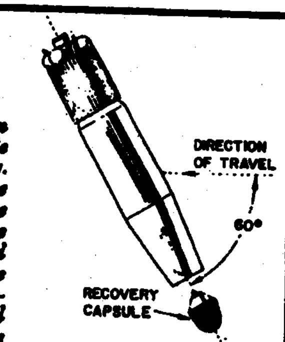


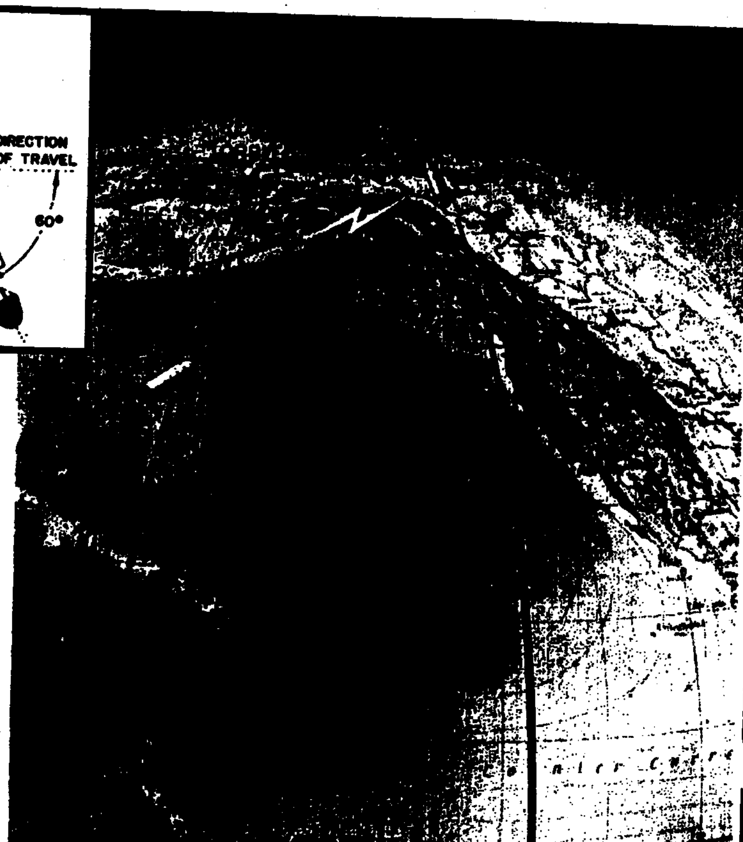
Orbital Trajectory

Schematic presentation of orbital trajectory following launch from Vandenberg Air Force Base. Functions performed by each station and a listing of equipment used by each station, is given on page A-4.

RECOVERY CAPABILITY

This objective was added to the program after the first launch achieved vehicle flight and orbit objectives successfully. It includes the orientation of the satellite vehicle to permit a recoverable capsule to be ejected from the nose section of the AGENA vehicle. Ejection is programmed to occur on a selected orbit, for capsule impact within the predetermined recovery area near Hawaii. Aircraft and surface vessels are deployed within the area as a recovery force.





CAPSULE RECOVERY SEQUENCE

- *The desired orbit for capsule ejection is selected after the vehicle is on orbit based on satellite performance, longitudinal location of the orbits, recovery force status, and weather in the potential recovery area. A command is sent to the vehicle prior to the selected recovery pass which initiates the recovery sequence. This command may be sent from any of the primary tracking stations listed on page A-4.*
- *The ejection sequence includes a pitch down maneuver, capsule separation, spin-up, retro-rocket firing, de-spin and reentry. Following parachute deployment the aerial recovery force converges on the descending capsule and snags the parachute. The capsule contains a radio beacon and reflective chaff which is dispersed to aid in tracking.*
- *The recovery force consists of C-119, RC-121, C-130, WVII and JC-54 aircraft supplemented by 2 or 3 surface vessels that receive and record telemetry data. If it is necessary to retrieve the capsule from the sea, these ships are available. Also available is a pararescue team who can be deployed to retrieve the capsule from the ocean.*

GROUND SUPPORT FACILITIES

Facility	Equipment*	Flight Function
Satellite Test Center	ABCD	Orbital control, orbit computations and predictions, acquisition data for tracking stations, prediction of recovery area.
†Vandenberg AFB Tracking Station	BDEFGHI	Ascent and orbital tracking, telemetry reception, trajectory measurements, command transmission.
Downrange Telemetry Ship	BFHI	Telemetry reception and tracking during ascent and orbit injection.
†New Hampshire Tracking Station	BDEFGHI	Orbit tracking, telemetry reception, commands to satellite.
†Kodiak Tracking Station	BDEFGHI	Orbit tracking, telemetry reception, initial acquisition on pass 1, monitor events in recovery sequence.
†Hawaiian Tracking Station	BDEFGHI	Orbit tracking, telemetry reception and transmission of commands to satellite.
Hickam AFB Oahu, Hawaii	D	Over-all direction of capsule recovery operations.
Tern Island	BFGI	Recovery capsule tracking.

†Primary Tracking Stations (have command capability)

***Equipment**

A. General Purpose Computer(s) and Support Equipment
B. Data Conversion Equipment
C. Master Timing Equipment
D. Control and Display Equipment
E. VERLORT
F. VHF FM/FM Telemetry Station
G. VHF Direction Finding Equipment
H. Doppler Equipment
I. VHF Telemetry Antenna

NOTE: In addition to equipment listed, all stations have inter- and intra-station communications equipment and checkout equipment.

Flight History

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
DISCOVERER FLIGHTS 0 THRU XX ARE ON PAGE A-6				
XXI	261	1102	18 February	*Attained orbit successfully. Non-recoverable, radio-metric data gathering MIDAS support flight.*
XXII	300	1105	30 March	*Launch, ascent, separation, coast and orbital stage ignition normal. Orbital velocity was not attained because of an AGENA hydraulic malfunction.*
XXIII	307.	1106	8 April	*Attained orbit successfully. Loss of control gas prevented proper positioning of the satellite for capsule re-entry. Capsule was ejected into new orbit on re-entry pass.*
XXIV	302	1108	8 June	*Failed to attain orbit because of a second stage malfunction.*
XXV	303	1107	16 June	*Attained orbit successfully. Capsule recovered from the ocean after two days on orbit. All objectives achieved.*
XXVI	308	1109	7 July	*Attained orbit successfully. Capsule was ejected on the 32nd orbit and aerial recovery was accomplished. All objectives achieved.*
XXVII	322	1110	21 July	*Failed to attain orbit because of severe booster pitch oscillation.*
XXVIII	309	1111	3 August	*Failed to attain orbit because of a hydraulic failure in the satellite engine control system.*
XXIX	323	1112	30 August	*Attained orbit successfully. Capsule recovered from the ocean after two days on orbit. All objectives achieved.*

Flight History (continued)

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
0	160	1019	21 January 1959	*AGENA destroyed by malfunction on pad. THOR refurbished for use on flight XII.*
I	163	1022	28 February	*Attained orbit successfully. Telemetry received for 514 seconds after lift-off.*
II	170	1018	13 April	*Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.*
III	174	1020	3 June	*Launch, ascent, separation, coast and orbital boost successful. Failed to achieve orbit because of low performance of satellite engine.*
IV	179	1023	25 June	*Same as DISCOVERER III.*
V	192	1029	13 August	*All objectives successfully achieved except capsule recovery after ejection on 17th orbit.*
VI	200	1028	19 August	*Same as DISCOVERER V.*
VII	206	1051	7 November	*Attained orbit successfully. Lack of 400-cycle power prevented stabilization on orbit and recovery.*
VIII	212	1050	20 November	*Attained orbit successfully. Malfunction prevented AGENA engine shutdown at desired orbital velocity. Recovery capsule ejected but not recovered.*
IX	218	1052	4 February 1960	*THOR shut down prematurely. Umbilical cord mast did not retract. Quick disconnect failed, causing loss of helium pressure.*
X	223	1054	19 February	*THOR destroyed at T plus 56 sec. by Range Safety Officer. Severe pitch oscillations caused by booster autopilot malfunction.*
XI	234	1055	15 April	*Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.*
XII	160	1053	29 June	*Launch, ascent, separation, coast and orbital stage ignition were successful. Failed to achieve orbit because of AGENA attitude during orbital stage boost.*
XIII	231	1057	10 August	*Attained orbit successfully. Recovery capsule ejected on 17th orbit. Capsule was recovered after a water impact with negligible damage. All objectives except the airborne recovery were successfully achieved.*
XIV	237	1056	18 August	*Attained orbit successfully. Recovery capsule ejected on 17th orbit and was successfully recovered by the airborne force. All objectives successfully achieved.*
XV	246	1058	13 September	*Attained orbit successfully. Ejection and recovery sequence completed. Capsule impact occurred south of the recovery forces; located but lost prior to being retrieved.*
XVI	253	1061	26 October	*Launch and ascent normal. AGENA failed to separate from booster and failed to attain orbit.*
XVII	297	1062	12 November	*Attained orbit successfully. Recovery capsule ejected on 31st orbit and aerial recovery was accomplished. All objectives were successfully achieved.*
XVIII	296	1103	7 December	*Attained orbit successfully. Recovery capsule ejected on 48th orbit and aerial recovery was accomplished. All objectives were successfully achieved.*
XIX	258	1101	20 December	*Attained orbit successfully. Non-recoverable, radiometric data gathering MIDAS support flight.*
XX	298	1104	17 February	*Attained orbit successfully. Capsule did not re-enter due to on-orbit malfunction.*

Monthly Progress — DISCOVERER

Flight Test Progress

DISCOVERER XXVIII Flight

• DISCOVERER XXVIII was launched from Vandenberg Air Force Base at 1701 PDT on 3 August. The launch was scheduled for 2 August but a malfunction of the horizon scanner caused a one-day postponement. Booster performance, separation, coast and AGENA ignition occurred as planned. Approximately 188 seconds after AGENA ignition the hydraulic pressure for operating the actuators which position the rocket engine dropped to zero. A decrease in hydraulic fluid temperature and a slight decrease in engine turbine speed were coincident with the hydraulic pressure drop. (C)

• Bearing friction held the satellite engine in position for a few seconds, but the actuators could not respond to correction signals from the inertial reference package. The vehicle started to tumble. The high acceleration forces caused the vehicle to break up. Impact was in the South Pacific. Analysis of the flight data revealed that only two types of failure could account for all of the observed effects: failure of tubing or fittings on the high pressure side of the system or failure of a high pressure transducer. Subsequent bench tests on a hydraulic system package supported the analytical findings. As a result of these tests some AGENA plumbing will be re-routed to reduce the possibility of vibration effects, some fittings will be changed, and a "fail-safe" type transducer will be substituted. (C)

DISCOVERER XXIX Flight

• DISCOVERER XXIX was launched into orbit from Vandenberg Air Force Base at 1300 PDT on 30 August. The satellite was launched at the earliest possible moment allowed by the established 1300-1600 launch window. All events during launch, boost, separation, coast, AGENA burn and orbital injection occurred as planned. One and one-half hours after liftoff orbital status was verified by tracking and telemetry contact over Kodiak, Alaska. The orbit, based on calculations made after pass ten, was satisfactory although slightly different than originally programmed. Table I shows the predicted and attained parameters. The variation is attributed to a slightly positive (AGENA vehicle in a pitch up position) flight path angle at orbital injection. Vehicle operation on orbit was satisfactory. (C)

Even	Programmed	Actual
Apogee, statute miles	257.1	353.4
Perigee, statute miles	147.4	103.62
Period, minutes	91.0	91.5
Eccentricity	0.0133	0.0298
Inclination Angle, degrees	81.8	82.07

TABLE I. COMPARISON OF PROGRAMMED AND ACTUAL ORBITAL PARAMETERS FOR DISCOVERER XXIX.

DISCOVERER XXIX Capsule Recovery

• As planned, capsule recovery was initiated on the 33rd pass at 1514 PDT on 1 September. Due to impact short of the recovery area, the aerial recovery force was unable to "catch" the capsule. For the second time in the DISCOVERER series a team of three Air Force pararescue men jumped into the Pacific to recover the capsule. At 1700 PDT the pararescue team had the capsule aboard their rafts and began their wait for the Navy destroyer that was to pick them up and return them to Hawaii. Together with other space experiments this capsule contained a biopack with a three day-old embryonic chicken heart, bone, and influenza virus sealed inside. The biopack has been flown to the School of Aerospace Medicine for evaluation. (U)

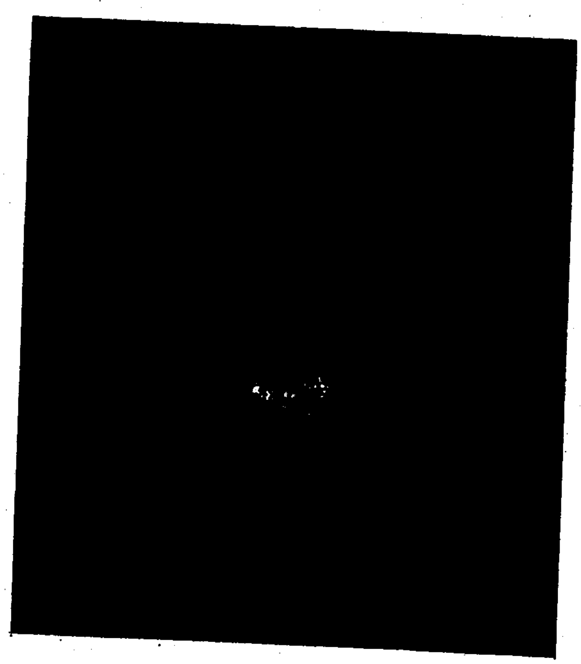


Figure 1. Air Force pararescue team during recovery of the DISCOVERER XXIX capsule on 1 September. This was the third capsule in a row to be recovered.

DISCOVERER XXIX Experiments

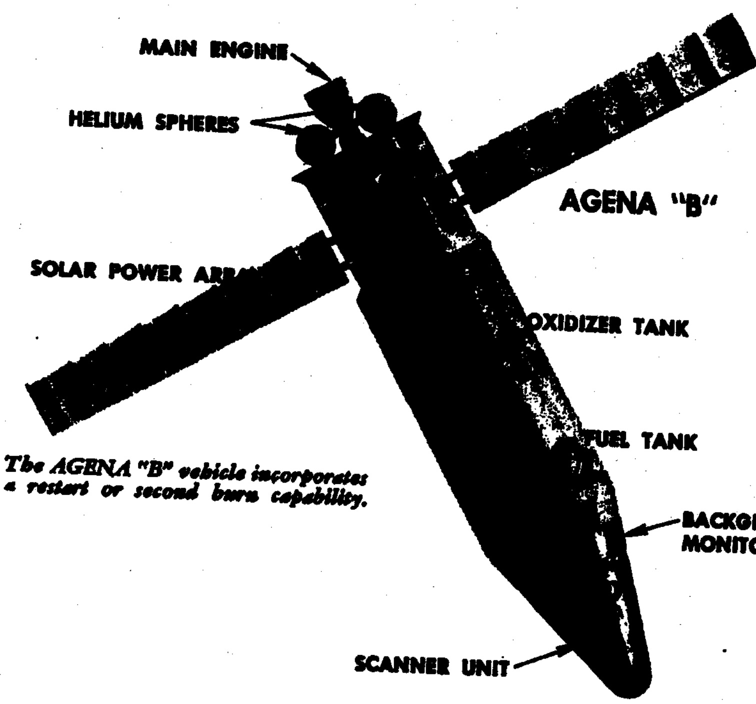
• The first VELA HOTEL instruments to be flown on DISCOVERER satellites were installed on DISCOVERER XXIX. These experiments are part of the VELA HOTEL Program whose goal is the development of satellite-borne payloads capable of detecting nuclear explosions in space. The instruments, mounted on the engine access door module, consist of two X-ray detectors and a solid state electron spectrometer. These instruments provided data on background radiation in space. The units are wired as a system to provide maximum discrimination between random radiation and radiation bursts. Data was recorded continuously on a tape recorder for playback at a 36:1 rate when the vehicle was over a tracking station. During playback, data from the instruments was transmitted to the station in real time over separate channels, thereby providing 100 percent data recovery. Lawrence Radiation Laboratories provided the instruments and is analyzing the data (C)

• In addition to the VELA HOTEL instruments, DISCOVERER XXIX carried a cosmic ray monitor and a galactic detector, both provided by the Air Force Geophysical Research Directorate. This is another experiment in the continuing series for measuring the environment of space. The cosmic ray monitor is similar to those carried on DISCOVERER flights XXV and XXVI but on this flight data was continuously recorded. The galactic detector is essentially a radio frequency receiver for detecting background RF noise emanating from celestial galaxies. Data obtained from these instruments by the DISCOVERER tracking stations is being furnished to the Geophysical Research Directorate for analysis. (U)

Figure 2. Two of the DISCOVERER launch pads at Vandenberg Air Force Base. Pad 1 of Complex 75-1, right, with the shelter closed and the liquid oxygen tank in the left foreground. This pad has a flame deflector, visible below the left edge of the shelter. Pad 4 of Complex 75-3, below, is a modified THOR stand and does not have the flame deflector.

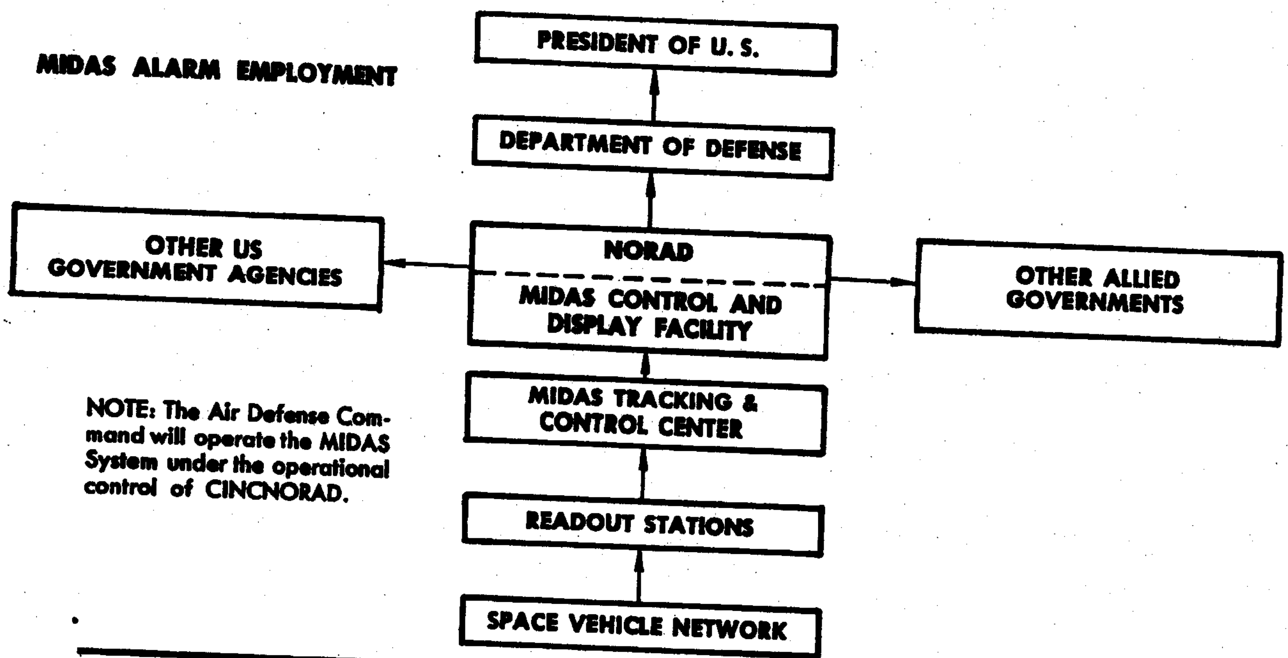
SECOND STAGE	AGENA "B"
Weight—	
Inert	1,763
Payload equipment	1,641
Orbital	3,404
Impulse Propellants	12,950
Fuel (UDMH)	
Oxidizer (IRFNA)	
Other	758
GROSS WEIGHT (lbs.)	17,112
Engine	XLR81-Ba-9
Thrust, lbs. (vac.)	16,000
Spec. Imp., sec. (vac.)	290
Burn Time, sec.	240
Restart Provisions	Yes

MIDAS



The AGENA "B" vehicle incorporates a restart or second burn capability.

BOOSTER—ATLAS ICBM		
Weight—Dry		15,100
Fuel, RP-1		74,900
Oxidizer (LOX)		172,300
GROSS WEIGHT (lbs.)		262,300
Engine—MA-2		
Thrust (lbs. vac.)	Boost	356,000
	Sustainer	82,100
Spec. Imp. (sec. vac.)	Boost	286
	Sustainer	310



CONCEPT

The MIDAS system is designed to provide continuous infrared coverage of the Soviet Union. Surveillance will be conducted by eight satellite vehicles in accurately positioned orbits. The area under surveillance must be in line-of-sight view of the scanning satellite. The system is designed to accomplish instantaneous readout of acquired data by at least one of three strategically located readout stations. The readout stations transmit the data directly to the MIDAS Tracking and Control Center where it is processed. It is then displayed and evaluated in the MIDAS Control and Display Facility. If an attack is determined to be underway, the intelligence is communicated to a central Department of Defense Command Post for relay to the President and national retaliatory and defense agencies.


Satellite Vehicle
Eight MIDAS Satellites — four each in two orthogonal polar orbital planes — at 2,000 n.m. altitude
READOUT STATION
Electronic Equipment
Sunnyvale
Satellite Test Center
Italic — Indicates R&D Facilities Only

PROGRAM HISTORY

The MIDAS Program was included in Weapon System 117L when WS 117L was transferred to the Advanced Research Projects Agency. ARPA subsequently separated WS 117L into the DISCOVERER, SAMOS and MIDAS Programs, with the MIDAS objectives based on an infrared early warning system. The MIDAS (Missile Defense Alarm System) Program was directed by ARPA Order No. 38, dated 5 November 1958 until transferred to the Air Force on 17 November 1959. The Air Force directed that the program be continued under the technical guidance of the ARPA Order and approved the MIDAS R&D Development plan dated 15 January 1960. This plan was a "minimum essential" program directed toward the satellite vehicle and proof of the feasibility of infrared detection capabilities. It provided for ten test launches, two from the Atlantic Missile Range and eight from the Pacific Missile Range. Subsequent authorization was obtained to utilize two DISCOVERER flights (designated RM-1 and RM-2) to carry background radiometers in support of MIDAS.

A program of complete system development, including the ground environment of MIDAS, has been submitted to the Department of the Air Force and has been approved in principle and objective. Authorization has been received to initiate action implementing the plan with reconsideration for approval to be accomplished subsequent to a successful test launch in 1961.

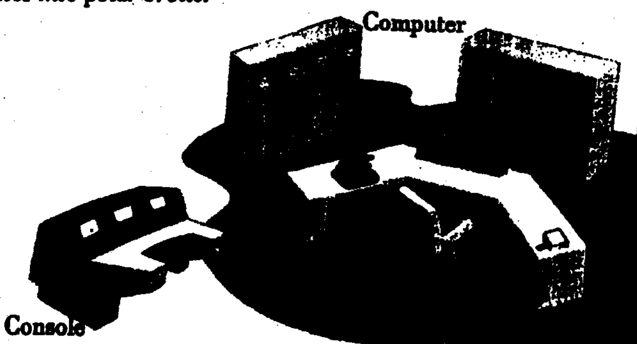
TECHNICAL HISTORY

The MIDAS infrared early warning payload is engineered to use a standard launch vehicle configuration. This consists of an ATLAS missile as the first stage and the AGENA vehicle, powered by a Bell Aircraft rocket engine as the second, orbiting stage. The final configuration payload weight will be approximately 1,000 pounds.

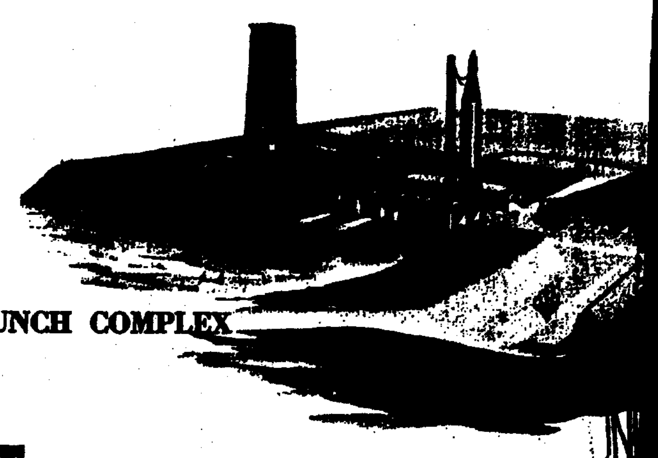
The first two R&D flights used the AGENA "A" and ATLAS "D" vehicle programmed to place the payload in a circular 261 nautical mile orbit. Subsequent R&D flights utilize the ATLAS "D"/AGENA "B" configuration programmed to place the payload in a circular 2,000 nautical mile polar orbit.

CONTROL AND DISPLAY FACILITY

Orbiting satellites detect infrared radiation emitted by ICBM's in powered flight. Data is telemetered instantaneously to Midas Tracking and Control Center via far north Readout Stations. Decoded data reveal approximately the number of missiles launched and launch location, direction of travel and burning characteristics. This data is displayed in near real time on the control consoles and operational displays at the Control and Display Facility. The Tracking and Control Center monitors and controls the status of the orbital network and the ground environment. The Point Arguello Stands are used to launch the MIDAS R&D satellites into polar orbits.



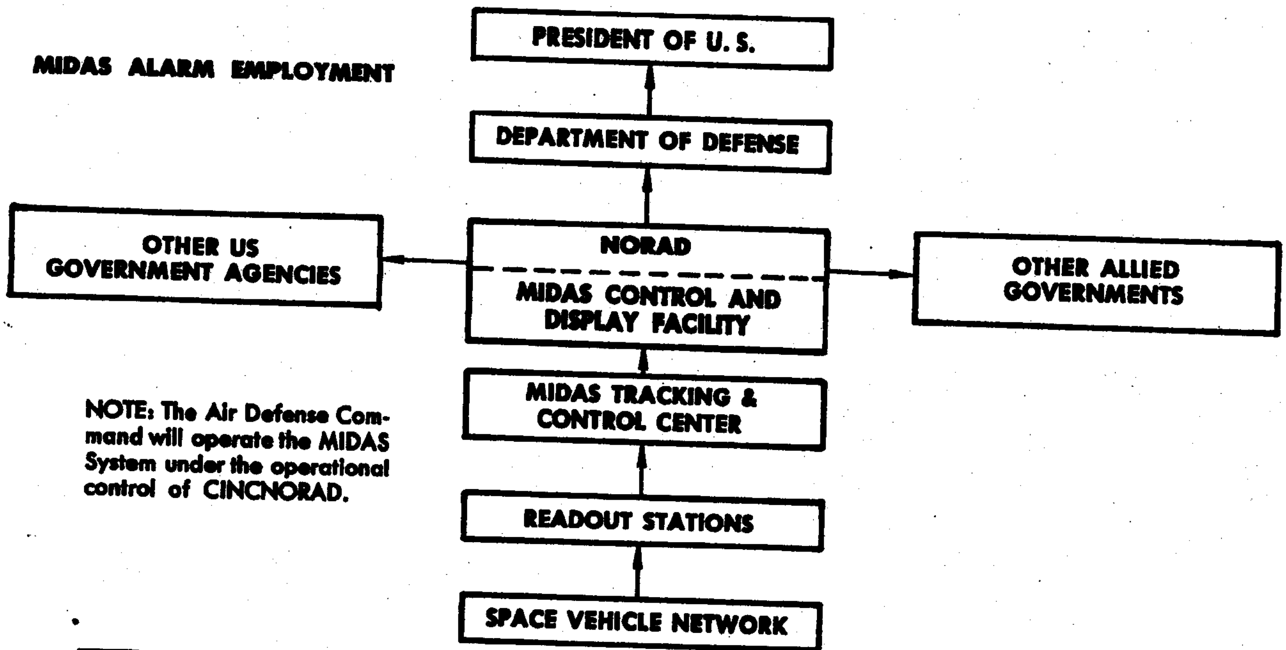
TRACKING AND CONTROL C



LAUNCH COMPLEX

SECRET

MIDAS ALARM EMPLOYMENT



NOTE: The Air Defense Command will operate the MIDAS System under the operational control of CINCNORAD.

CONCEPT

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Flight History

MIDAS No.	Launch Date	ATLAS No.	AGENA No.	Remarks
I	26 February	29D	1008	*Did not attain orbit because of a failure during ATLAS/AGENA separation.*
II	24 May	45D	1007	*Highly successful. Performance with respect to programmed orbital parameters was outstanding. Useful infrared data were observed and recorded.*
RM-1	20 December	DISCOVERER Vehicle		*Despite satellite oscillations, sufficient data were obtained for evaluation of payload operation. Information obtained in the 2.7- micron region agrees with data obtained from balloon-borne radiometric equipment. Data in the 4.3- micron region is somewhat higher than had been anticipated from theoretical studies.*
RM-2	18 February	DISCOVERER Vehicle		*All channels functioned properly and valid data were obtained on six stable orbits. Data confirmed previous radiometric measurements.*
III	12 July	97D	1201	*Extremely successful. Second firing of the second stage occurred as programmed. AGENA B vehicle was stabilized in an 1850 nautical mile circular orbit with an eccentricity of 0.0039. Operation of the payload and data link was excellent. Because of an electrical power loss, apparently caused by the failure of one solar array panel to extend, data acquired subsequent to pass five was limited to Van Allen belt radiation information. Inability to properly control power consumption by appropriate and timely vehicle command programming resulted in nearly complete power deterioration within the succeeding several orbits. Van Allen radiation measurements will be obtained during the anticipated 60-90 day battery life of the High Energy Proton Damage Experiment (HEPDEX) package.*

MIDAS GROUND SUPPORT FACILITIES

Facility	Equipment*	Flight Function
Satellite Test Center	ABCDEP	Operations control, orbit computations and predictions, initiation of commands to satellite (via tracking stations), process payload data.
Vandenberg AFB Tracking Station	ABCEFGHIJKLMP	Ascent and orbital tracking; telemetry reception; trajectory computations; command transmission; reception recording and processing of payload data.
Downrange Telemetry Ships	GHIJNO	Tracking and data reception during ascent. (Three ships are available for this function. Equipment is typical.)
Hawaiian Tracking Station	BEFGHJ	Orbital tracking, telemetry reception, payload data reception.
AMR	HJ	Orbital data reception.
New Hampshire Station	ABCEFGHIJKLM	Orbital tracking; telemetry reception; command transmission; reception, recording and transmission of payload data.
African Tracking Station	BEGJ	Telemetry reception and recording during second burn.
North Pacific Station	BCEHKMP	Satellite and payload data reception, command transmission.
Kodiak Tracking Station	FJ	Orbital tracking.
Mugu Tracking Station	BEFGJ	Tracking and telemetry reception.

NOTES: (1) In addition to equipment listed, all stations have inter- and intra-station communications equipment and checkout equipment.

(2) Equipment listed is either presently available or planned and approved for procurement.

*Equipment

- A. General Purpose Computer(s) and Support Equipment
- B. Data Conversion Equipment
- C. PICE
- D. Master Timing Equipment
- E. Control and Display Equipment
- F. VERLORT
- G. VHF FM/FM Telemetry Station
- H. PAM FM Ground Station
- I. Doppler Equipment
- J. VHF Telemetry Antenna
- K. UHF Tracking and Data Acquisition Equipment (60 foot F&D Antenna)
- L. UHF Angle Tracker
- M. UHF Command Transmitter
- N. APL Doppler Equipment
- O. SPQ-2 Radar
- P. Midas Payload Evaluation and Command Equipment

CONFIDENTIAL

Monthly Progress — MIDAS

Program Administration

• Three members of the United Kingdom team concerned with establishment and operation of the Kirkbride Tracking and Readout Station visited Lockheed facilities on 14 through 18 August and were briefed on MIDAS operation and readout requirements. (U)

Flight Test Progress

• The 6594th Test Wing reported on a series of tracks of MIDAS II, vehicle 1007, launched in May 1960. The tracks were recorded during the period 18 through 21 July 1961 on several passes, pass No. 6414 and No. 6450 on the dates noted. The Solar Auxiliary Power Unit Telemeter (SAPUT) continues to transmit and operation appears satisfactory. (C)

• MIDAS III launched on 12 July 1961 continued to transmit data throughout this reporting period. Data analyses from the payload established that Venus and vehicle reflections of the sun were among radiating sources detected by the satellite. The data transmitted subsequent to pass five were all from the High Energy Proton Detection Experiment (HEPDEX). This experiment is providing Van Allen radiation measurement data. (C)

Technical Progress

Second Stage Vehicles

• The MIDAS IV vehicle underwent numerous modifications during this report period. Early in August the changes involving the Westford Project (needle dispenser) were completed. These changes included removing the vacuum bearing tester, all Geophysical Research Directorate equipment, the APL doppler equipment and its power supply, the Speidel tape recorder and the R&D radiometer. Changes to the SAPUT, solar array, and vehicle command system resulting from the MIDAS III flight experience were also completed. The command system modification permits real time ground commands to override stored program commands for the operation of the

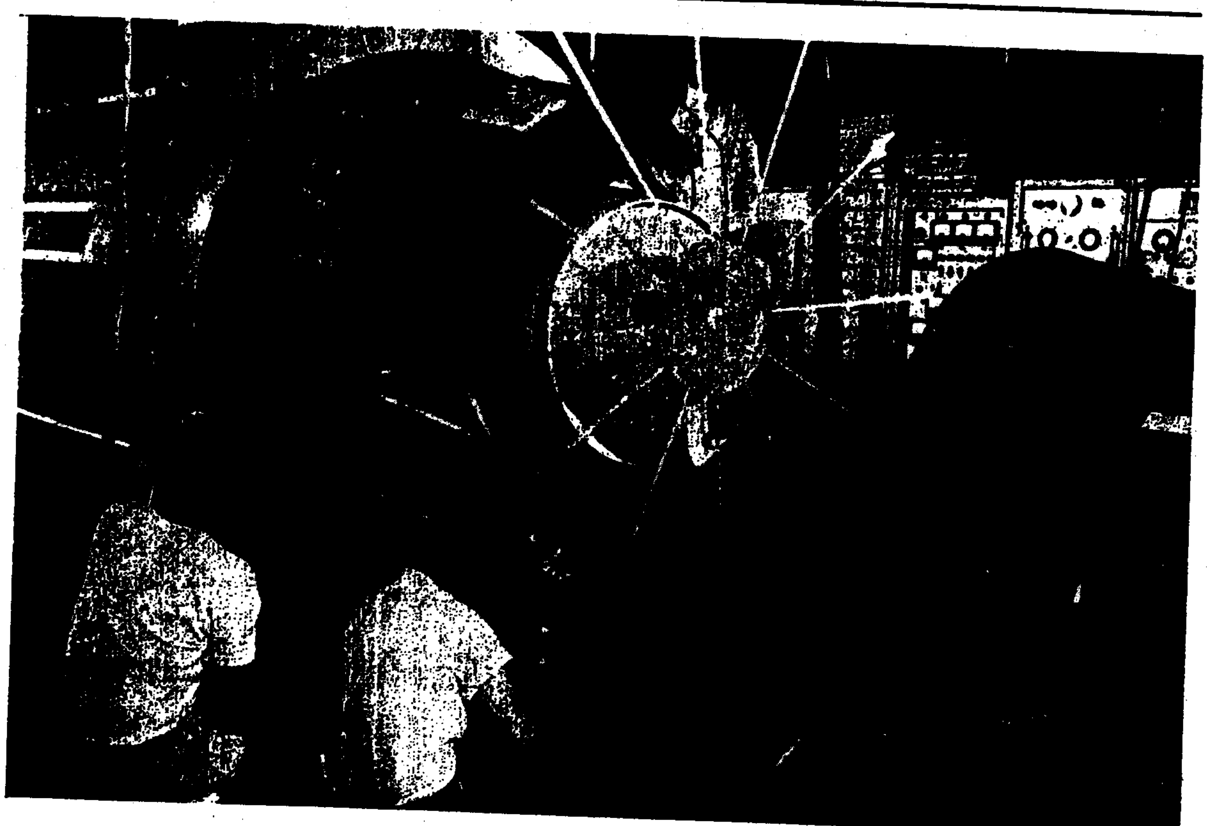


Figure 1. MIDAS IV payload during checkout in the systems test area. The "S"-band beacon is visible in the right foreground. The unit in the center with the spokes radiating outward is the VHF/UHF command antenna.

vehicle telemetry (FM/FM) and the "S" band beacon. This modification will provide greater utility and control in vehicle tracking and in obtaining vehicle status data. (S)

• At the end of the reporting period the MIDAS IV AGENA vehicle was undergoing prelaunch testing in the Vandenberg Air Force Base Missile Assembly Building, with expected transfer to the launch pad on 8 September. (S)

• The MIDAS V satellite vehicle is undergoing systems test at LMSC, Sunnyvale, and is scheduled for release to the Vandenberg Air Force Base Missile Assembly Building on 29 September. This systems test is being conducted in accordance with a new test philosophy which will eliminate system testing in the Vandenberg Air Force Base Missile Assembly Building; however, it appears that necessary modifications of vehicle 1203 will require a re-run of systems test in the Missile Assembly Building prior to launch. (C)

Facilities

• The Final Design Review Conference on the Ottumwa, Iowa Tracking and Control Center technical facilities was held at Space Systems Division on 31 August. A conference was held the following day to evaluate proposed design criteria changes. Subsequent review is scheduled for 21 September. (U)

• A preliminary design review conference on the Ottumwa support facilities was held on 29 August by the Air Force Regional Civil Engineers — Missouri River (AFRCE-MR). Development of plans and specifications by the architect-engineer was found to be behind schedule. The pertinent deficiencies were identified. A final review is tentatively scheduled for 24 October. The release date of construction funds for this project is indefinite. (U)

• Design of the modifications to Point Arguello Launch Complex No. 1, Launch Stand No. 1, has been completed. Because of changes in the launch schedule the stand is not available for the construction to start. (U)

Figure 2. Donnelly Flats, Alaska radome support ring, showing the steel "spider-web" which will support the radome to protect the UHF telemetry receivers.

• All construction of Point Arguello Launch Complex No. 2 is progressing satisfactorily. Earthwork is approximately 60 percent complete. Foundations are being poured for Launch Stand No. 3 and for the Technical Support Building. Foundations for the Launch Operations Building are scheduled to be started early in September. (U)

• A reduced scope construction contract for modifications to the MIDAS technical facilities at Donnelly Flats, Alaska was awarded on 4 August. Scheduled completion date for this project is 25 November. (U)

• Construction bids for the MIDAS Technical Support Building at the New Hampshire Tracking and Telemetry Station were opened on 3 August. The Air Force Regional Civil Engineers — North Atlantic (AFRCE-NA) approved the contract award. (U)

• The Lockheed High Vacuum Orbital Simulator (HIVOS) presently under construction at the Sunnyvale facility was 85 percent complete at the end of the report period. Data handling and instrumentation installations together with system calibration have not yet been completed. Testing of a satellite within the simulator is scheduled to start on 15 January 1962. (U)

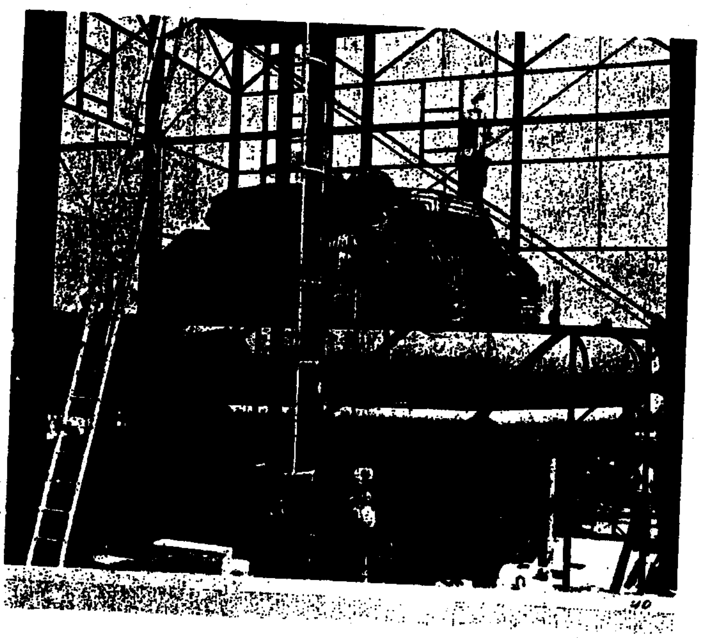
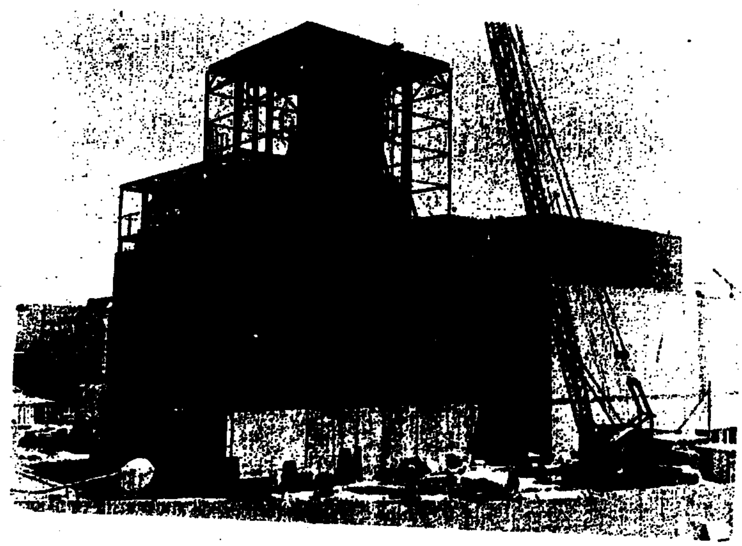
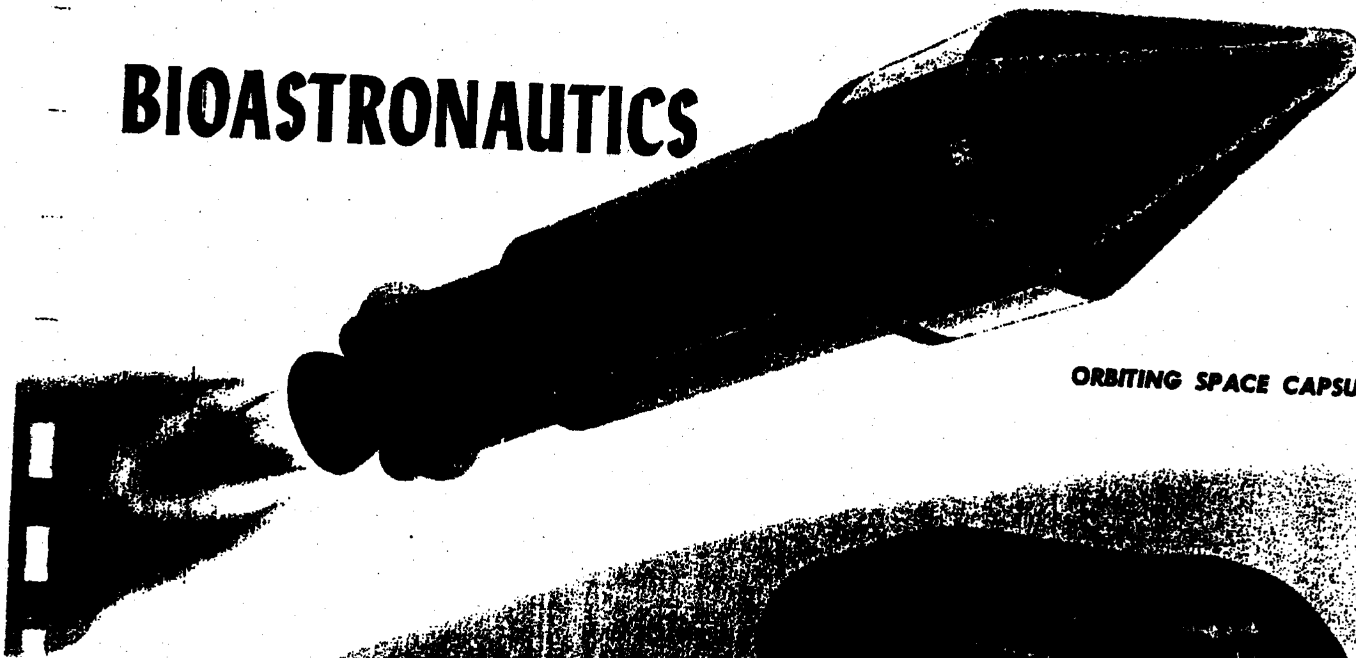


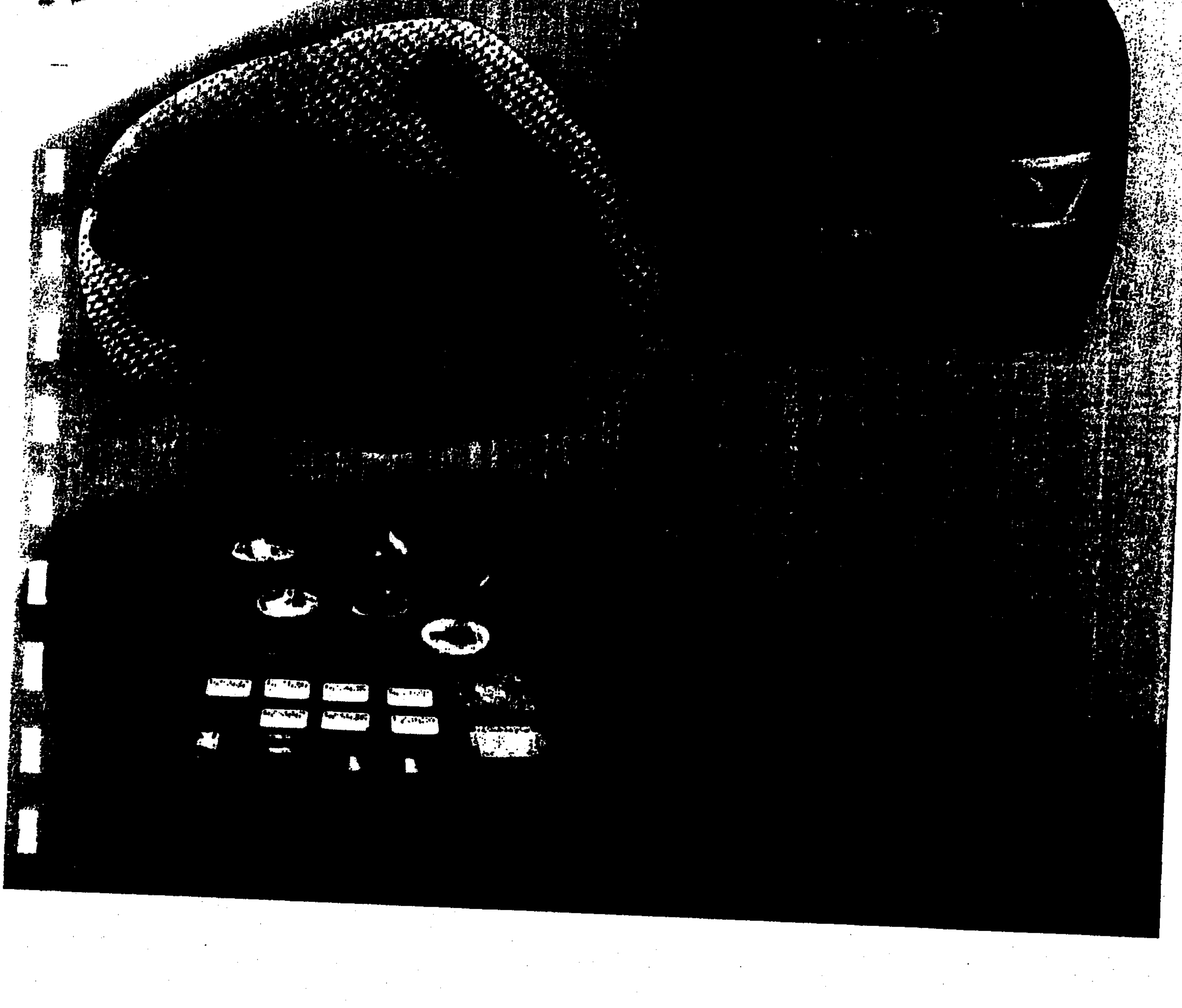
Figure 3. The High Vacuum Orbital Simulator (HIVOS) test chamber which is presently 85% complete. The chamber has an inside diameter of 18 feet and is designed to simulate the space environment. The operation of the MIDAS payload in the chamber will be controlled, observed, and recorded by an Automatic Programming and Data System (APADS).



BIOASTRONAUTICS



ORBITING SPACE CAPSULE



Program History

The BIOASTRONAUTICS Office was established in May 1958 and charged with the biotechnical supervision of the early military "Man-in-Space" Program and the Bioastronautics aspects of the DISCOVERER Program. NASA was subsequently assigned the "Man-in-Space" responsibility in the fall of 1958. The development and fabrication of suitable Biomedical Recovery Capsules for the DISCOVERER Program has continued without interruption.

On 13 May 1959, a MARK I biomedical capsule was successfully flown without specimens. The flight telemetry demonstrated successful operation of the Bioastronautic subsystem as an engineering concept. Although re-entry was successful, recovery was not accomplished. A second MARK I capsule was launched on DISCOVERER IV on 25 June 1959 with four mice aboard. Although orbit and recovery were not achieved, 600 seconds to telemetry showed the animals to be in good condition throughout the flight.

Subsequent DISCOVERER efforts culminated in preparation of a MARK II capsule suitable for a small primate. Launch and recovery of a small primate from orbit awaits approval of an "Abbreviated Space Systems Development Plan, Biomedical Program" submitted to Hq AFSC in November 1960.

Applied Research contracts for the design and development of advanced biocapsule hardware include photosynthetic oxygen production, super-critical gas storage, radiation shielding and bio-instrumentation. All components are scheduled to be flown in subsequent advanced space biocapsule programs.

An Advanced Biomedical Capsule has successfully completed the mockup phase of development. The capsule is designed to carry a fifty pound chimpanzee to altitudes of about 25,000 n.m. to thoroughly explore and assess the radiation hazards of the inner and outer Van Allen Belts. In addition, long-term weightlessness effects will be investigated. On 7 November 1960, Space Systems Division approved continued development of the advanced capsule in support of eventual manned military space systems.

Program Concept

The complete exploration of space, including limits to manned operational space systems, requires a determination of the biological effects of the space environment. The Space Systems Division is continuing its aggressive research and development program in this technical area to insure that sufficient bioastronautics knowledge will be available during the 1963-1965 time period. Present deficiencies in reaching these goals are: capsule development, life support system design, biological instrumentation and determination of space flight stresses (long term weightlessness, operational experience in the radiation belts, and isolation). Neither Project MERCURY with its short duration, low altitude orbit, nor DYNA SOAR with its low altitude suborbital flight will provide data concerning the key problems of long term weightlessness and Van Allen Belt radiation, Knowledge which is crucial to manned operational space systems.

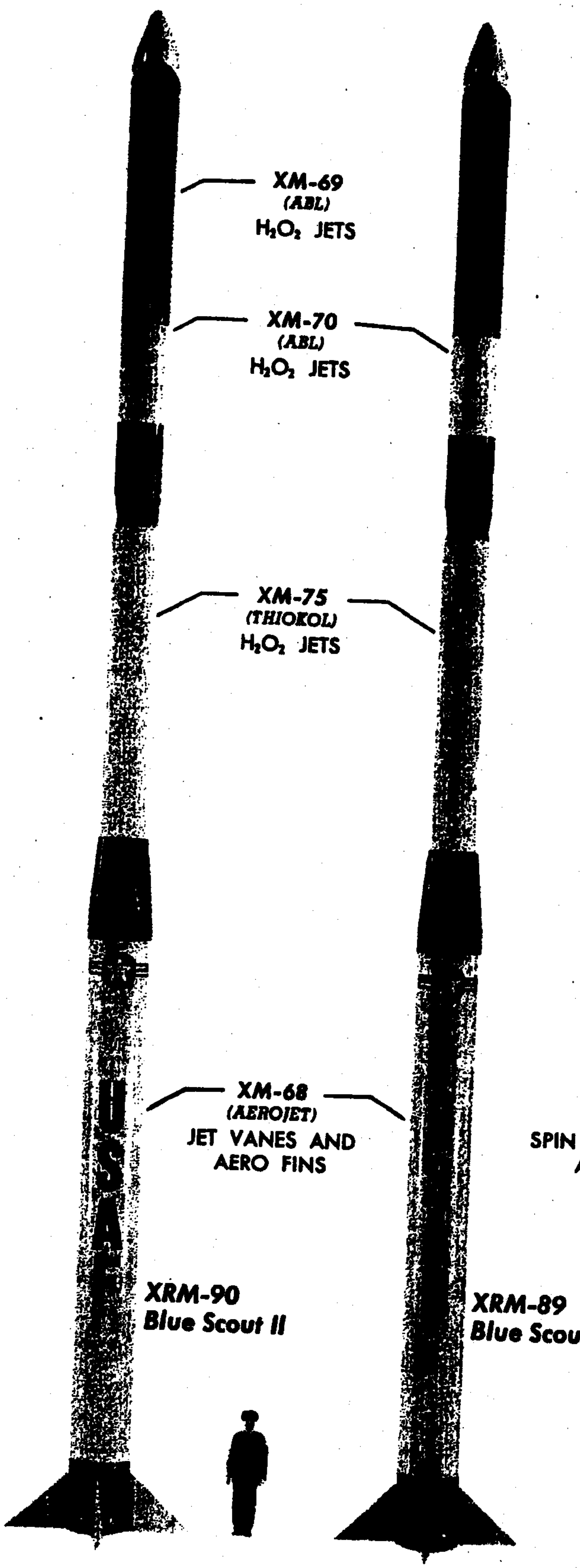
The current BIOASTRONAUTICS Program is furnishing a limited amount of data from actual ballistic and orbital flights. Experiments include those made on a space-available basis aboard scheduled ICBM and DISCOVERER Program flights. The Bioastronautics Orbital Space System (BOSS), when approved as an Air Force system, will not be limited by piggyback or space-available restrictions. Data obtained from these tests will be available for correlation with those obtained from laboratory experiments. The results will be of supplemental significance to the DYNA SOAR Program and Project MERCURY and will be necessary to the success of future manned military missions such as SMART.

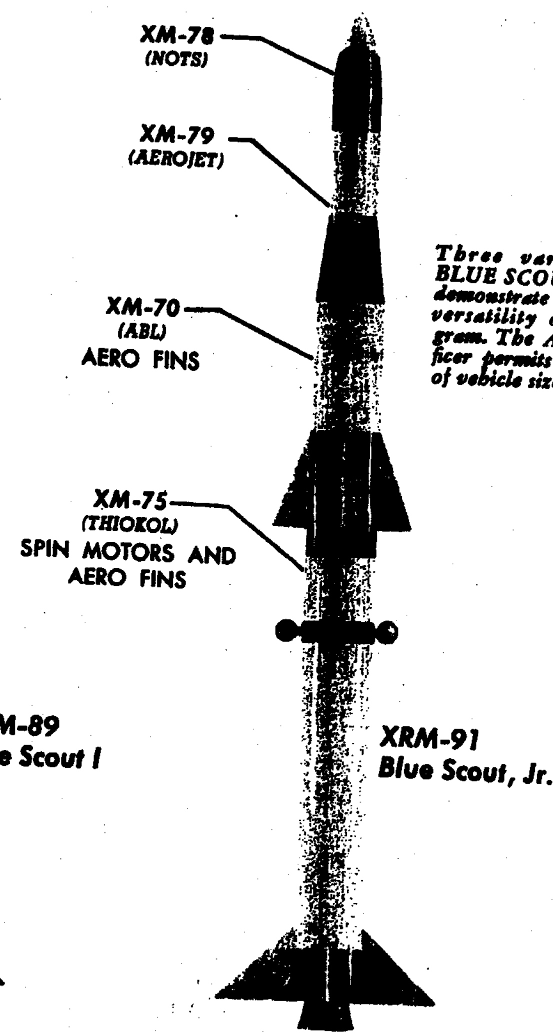
BLUE SCOUT

(Hyper-Environmental Test System)

Program Description

The BLUE SCOUT Program provides the Air Force and other governmental agencies with a family of economical and versatile standard space booster vehicles for supporting SPACE SYSTEMS, test of SPACE SUBSYSTEMS, and RESEARCH programs. The BLUE SCOUT vehicles have the inherent simplicity and reliability of solid propellant vehicles, and are far more economical for many applications than the liquid boosters that were derived from the ballistic missile programs. The program is divided into Development and Application Phases. The Development Phase is being used to develop and flight test the





Three variations of BLUE SCOUT vehicles demonstrate the mission versatility of the program. The Air Force officer permits comparison of vehicle sizes.

solid propellant vehicles, to train AIR FORCE PERSONNEL in processing launch of the vehicles, and to accomplish BLUE SCOUT Program objectives. The Application Phase will support programs such as SAMOS, SAINT, BAMBI, ASSET, TRANSIT, and PROBES. The vehicle receipt, assembly, payload mating, checkout and launch will be accomplished by Air Force military personnel during the Application Phase.

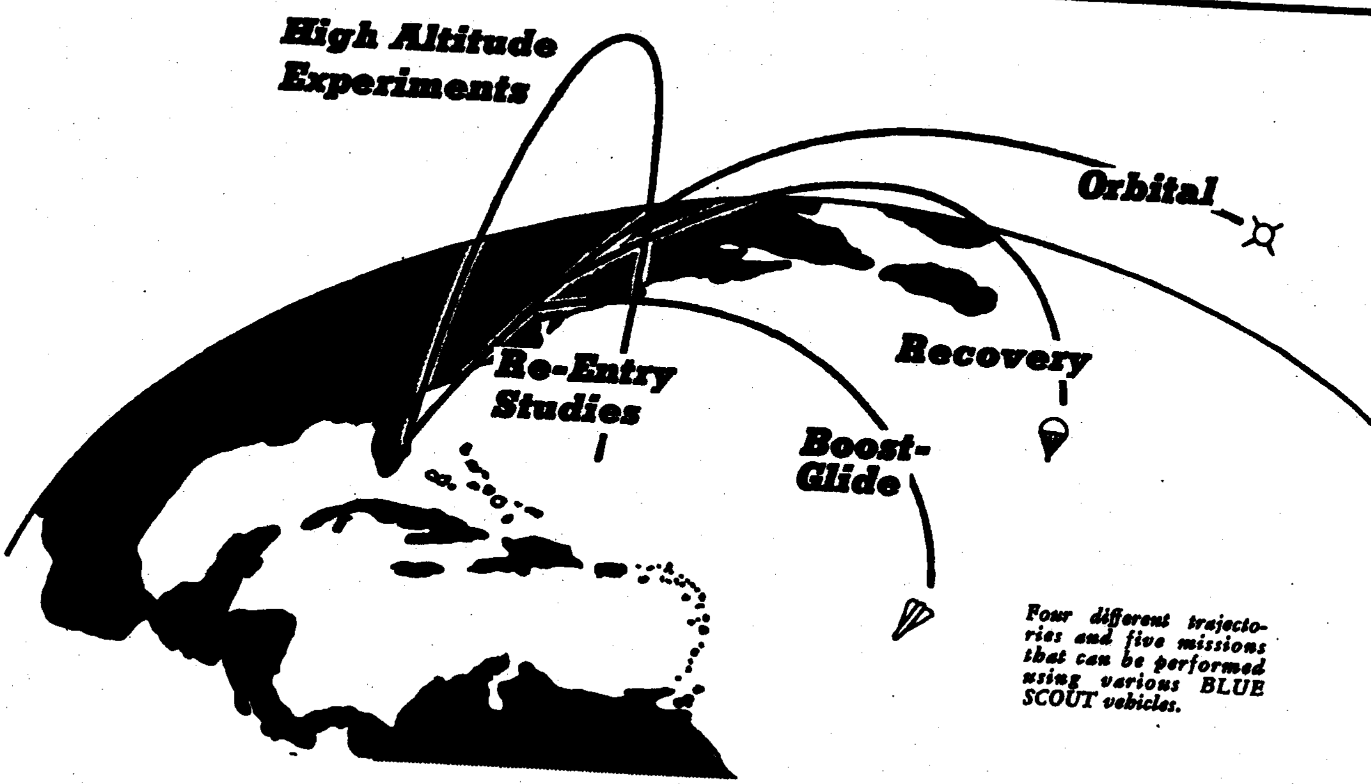
Performance

The BLUE SCOUT vehicles have a performance capability which permits them to: (1) place a 200-pound payload into a 400 nautical mile circular orbit, (2) boost a 200-pound payload to 4,000 nautical miles on a probe trajectory, (3) boost a 25-pound payload to 75,000 nautical miles on a probe trajectory, (4) place a 400-pound payload into a boost-glide trajectory at a velocity of 20,500 feet per second at 250,000 feet altitude. Besides ORBITAL FLIGHTS, PROBES, and BOOST-GLIDE trajectories, the vehicle can boost payloads into trajectories and downward booster HIGH-SPEED RE-ENTRY profiles, data RECOVERY capability and ATTITUDE STABILIZED final stage (and payload) are also provided.

Program Management

Development Phase: An abbreviated Development Plan, covering the Development Phase only, was approved on 9 January 1959. This plan gave Space Systems Division management responsibility. In June 1959, Aeronutronic Division of the Ford Motor Company was chosen through normal competitive bidding as the Payload, Test and Systems Integration Contractor. The procurement of vehicle components and associated support equipment, modified to meet BLUE SCOUT requirements, is being made through NASA, rather than direct procurement from the SCOUT contractors. Atlantic Missile Range launch complex 18 and an existing assembly building are being used for the Development Phase of the program. The 6555th Test Wing (Dev) manages the Development Test program at the Atlantic Missile Range and provides the Air Force personnel who are being trained to assume the vehicle processing, launch and evaluation tasks. An all-military operational capability will be developed from this group.

Application Phase: Space Systems Division will have the responsibility for providing BLUE SCOUT booster support to the Air Force and other government agencies for SPACE SYSTEMS, test of SPACE



Four different trajectories and five missions that can be performed using various BLUE SCOUT vehicles.

SUBSYSTEMS, and SPACE RESEARCH flight operations. This responsibility will include the coordination and establishment of agreements of responsibilities with payload agencies, both government and contractor, for the integration of the payloads and boosters; the monitoring of flight operation plans, objectives, schedules, accomplishment, and results; the funding action for the booster support; the planning for launch facilities and launch personnel; the procurement of booster vehicles and other equipment; and the over-all coordination required for execution of the BLUE SCOUT booster support program.

Missions

The Application Phase missions for the BLUE SCOUT Program, some of which are firm while others are in the planning stage, are as follows:

SAINT: Two BLUE SCOUT vehicles required, first launch from Atlantic Missile Range January, 1963.

ASSET: A requirement from Aeronautical Systems Division for seven BLUE SCOUT vehicles to be used in investigations of the aerodynamic and thermodynamic properties of boost-guide vehicles. The first launch is scheduled from Atlantic Missile Range in mid-1962 with a three-month launch interval.

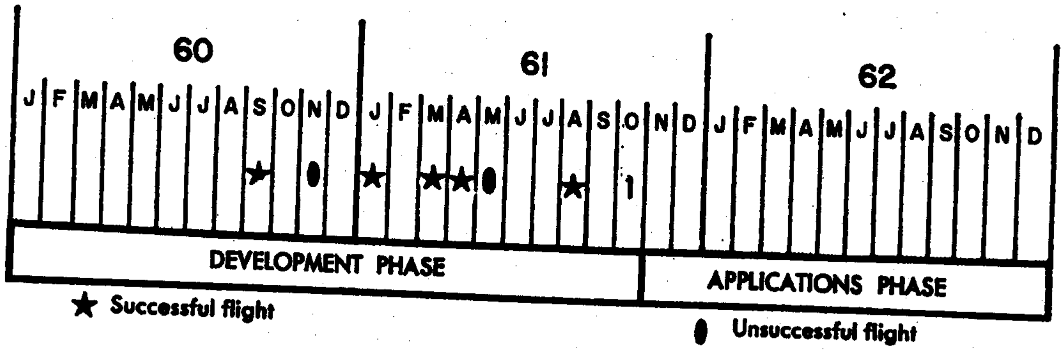
BAMBI: Four BLUE SCOUT vehicles required, first launch from Pacific Missile Range in mid-1962, interval between launches of three months.

TRANSIT: Six BLUE SCOUT vehicles required, first launch from Pacific Missile Range in mid-1962, interval between launches of three months.

PROBES PROGRAM: A requirement from the Office of Aerospace Research for thirty BLUE SCOUT vehicles indicated FY62 funding will support approximately fifteen BLUE SCOUT vehicles. A requirement of approximately fifteen BLUE SCOUT vehicles per year for the period 1962-1970 is expected.

BEANSTALK: (Emergency Positive Communication Control System): The program manager, the Electronic Systems Division, selected Bendix Corporation as the prime system contractor. Twelve BLUE SCOUT vehicles (2-3-4-5 configuration) will be launched during CY62 from the Pacific Missile Range.

Launch Schedule



Flight History

Blue Scout	Launch Date	Type of Flight*	Type Designation	Remarks
D1	21 September	A	XRM-91	*Telemetry was lost prior to fourth stage burnout. All of the primary (vehicle) objectives were accomplished; none of the secondary (payload) objectives were achieved.*
D2	8 November	A	XRM-91	*A second stage motor failure occurred at T plus 60 seconds. The vehicle impacted approximately 240 n.m. downrange.*
D3	7 January	A&C	XRM-89	*The 392-pound payload was launched successfully. The recovery capsule survived re-entry but was not recovered. All other primary objectives were achieved as were the majority of secondary objectives.*
D4	3 March	A	XRM-90	*The 172-pound payload was launched successfully. The test was completely successful. All primary and secondary objectives were achieved. Valuable payload experiment data were obtained.*
D5	12 April	A&C	XRM-90	*The 365-pound payload was launched on a probe trajectory. Seven of the eleven primary test objectives were accomplished and one was partially achieved.*
D6	9 May	A&C	XRM-89	*Indications are that a control motor power lead became disconnected during second stage burning and caused the vehicle to veer left from the programmed trajectory. At T plus 81 seconds range safety action was taken.*
O1	17 August	A	XRM-91	*Telemetry failed after approximately 16 seconds of fourth stage burning. The missile functioned normally during the operation life of telemetry.*

***Type of Flight**
A — High Altitude Experiments
B — Re-Entry Study
C — Recovery
D — Orbital
E — Boost-Glide

Monthly Progress BLUE SCOUT

Program Administration

• Preliminary Program Plans for Calendar Year 1962 were established. The planning included range support for the program, payloads that require space booster support from the BLUE SCOUT Program, vehicle configurations and submittal of cost estimates for the program. (U)

• Meetings between Electronics Systems Division, Space Systems Division, and 6555th Test Wing determined the responsibilities to be assumed by SSD for support of BEANSTALK. Essentially, SSD will procure the motors through NASA and have technical direction of the booster vehicle effort conducted by Chance Vought. SSD will also have booster test responsibility. In addition, it was determined that the 6555th Test Wing will have the launch responsibility. The launch personnel required for "blue suit" launches for BEANSTALK are now being assigned to the 6555th Test Wing. (U)

• The Navy is procuring eight SCOUT vehicles to be used for launching light-weight TRANSIT payloads from the west coast into polar orbits. The launches are scheduled to begin in April 1962. Procurement was made by the Navy through NASA to protect critical lead times and to facilitate availability of SCOUT vehicles to meet the planned launch schedule. In accordance with a memorandum from the Secretary of Defense, the Air Force has assumed responsibility for complete booster support, including launch operations and system integration for the implementation of TRANSIT operations. At a planning conference with Navy, Air Force, and NASA representatives on 15 August, the Navy presented their TRANSIT requirements as:

1. Two successful prototype operational satellite launches during the period of March thru August 1962.

2. Four operational satellites commencing in September 1962 and the maintenance of four satellites in operating condition.

3. One R&D satellite per year, beginning FY 63. (S)

• The SCOUT/TRANSIT launch support plan submitted by Space Systems Division to Hq AFSC on 22 August was approved by General Schriever. This plan provides for:

1. Early achievement of "blue suit" capability at the Pacific Missile Range.

2. Establishment of a permanent capability at PMR to support SCOUT/TRANSIT and other Department of Defense SCOUT requirements.

3. Identification of resources required.

4. Delineation of personnel action required.

5. Establishment of a SCOUT/TRANSIT program office at Space Systems Division. (S)

Flight Test Progress

• Payload equipment changes required by NASA have delayed the launching of the eighth BLUE SCOUT vehicle (D-8) until mid-October. This launch was originally scheduled for August. This guided, four-stage XRM-92 vehicle will be launched from the Atlantic Missile Range and will place a 150-pound payload into a 300 nautical mile circular orbit with a 32.5 degree inclination angle. The payload will checkout airborne and ground-based units of the world-wide MERCURY tracking network. It will contain S-band and C-band radar beacons, a Minitrack system beacon, command equipment for controlling the payload equipment during flight, and telemetry equipment for obtaining data on payload operation and for assisting in the control and tracking of the satellite. In addition to payload objectives, vehicle objectives are as follows:

1. Evaluate the guidance and control system.

2. Investigate the temperature and vibration environment within the vehicle.

3. Verify motor performance.

4. Demonstrate stage separation of the Air Force Scout.

5. Verify the adequacy of Pad 18B for use in launching guided BLUE SCOUT vehicles.

6. Demonstrate the compatibility of the vehicle and the aerospace ground equipment.

7. Develop a military capability for assembly, checkout, and launch of the Air Force Scout vehicle. (U)

• BLUE SCOUT Junior vehicle O-1 was launched at 1428Z on 17 August from the Atlantic Missile Range to demonstrate the ability of the missile to boost a twenty-seven pound Air Force Special Weapons Center payload to a planned altitude of 125,000 nautical miles. After allowing for ballistic winds, launching resulted in a true azimuth of 105 degrees and an elevation angle of 70 degrees. Propulsion, ignition, burning time, separation of the first three stages, and ignition of the fourth-stage were all within design specifications. Although fourth-stage burning time and burnout were presumed to be normal, they are unknown at present due to the complete loss of telemetry signal after approximately 16 seconds of fourth-stage burning (T plus 131 seconds). The payload contained instruments which would have provided electron and proton measurements, and electrostatic spectrometry of protons. Experiment data were not received due to loss of telemetry. (U)

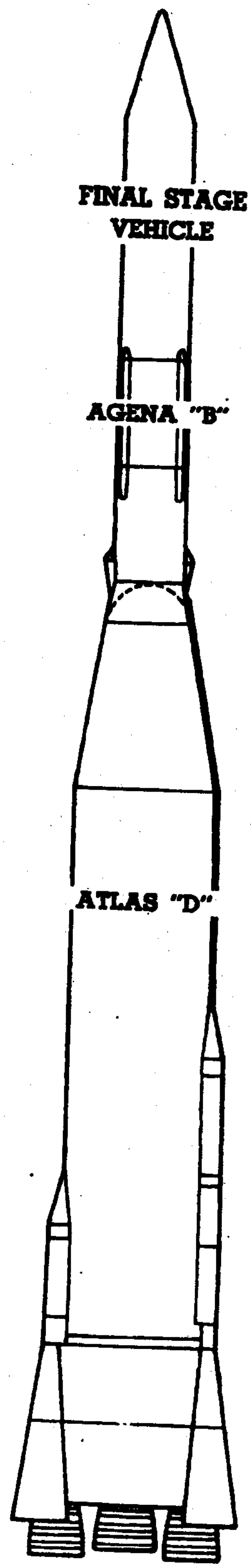
• The vehicle performance appeared to be good during the time the telemetry equipment functioned. Investigation is being conducted by Air Force Special Weapons Center to determine the cause of the telemetry loss. (U)

• The BLUE SCOUT Junior vehicles 0-2 and 0-3, with Air Force Special Weapons Center payloads, are scheduled to be launched during October from the NERV pad at Point Arguello. Launching and documentation will be accomplished completely by Air Force personnel of the 6555th Test Wing (Dev) from Atlantic Missile Range, assisted by the 6565th Test Wing (Dev), and Air Force Special Weapons Center. (U)

Facilities

• Approval for initiation of BLUE SCOUT facilities design at the Atlantic Missile Range Missile Test Annex has been requested from Hq USAF through Hq AFSC. Amended construction project justification data (Form 161) reflecting minimum facility requirements were forwarded to Hq USAF in April. Allocation of P-313 design funds has also been requested to permit immediate architect-engineer contract negotiations upon receipt of approval. (U)

SAINT



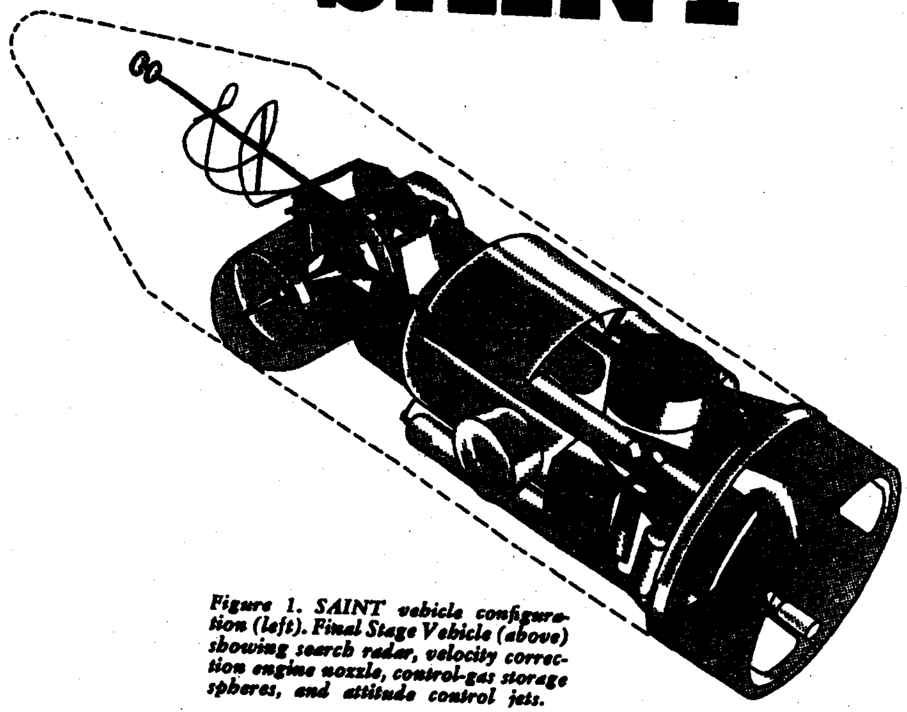


Figure 1. SAINT vehicle configuration (left). Final Stage Vehicle (above) showing search radar, velocity correction engine nozzle, control-gas storage spheres, and attitude control jets.

The SAINT (Satellite Inspector System for Space Defense) Program has been established to develop and demonstrate feasibility of a co-orbital satellite inspector system capable of rendezvousing with and inspecting suspected hostile satellites and assessing their mission.

Program Objectives

1. Design, fabricate, and demonstrate feasibility of a prototype vehicle capable of co-orbital rendezvous with another satellite at 400 nautical miles with a capability of inspecting and identifying the unknown satellite.

2. Study and define a SAINT vehicle which could be used as an ultimate defense vehicle having a capability of rendezvous up to 4,000 nautical miles with necessary orbit changes.

3. Develop and fabricate those long lead type items required for the ultimate defense system including a capability of negating hostile systems.

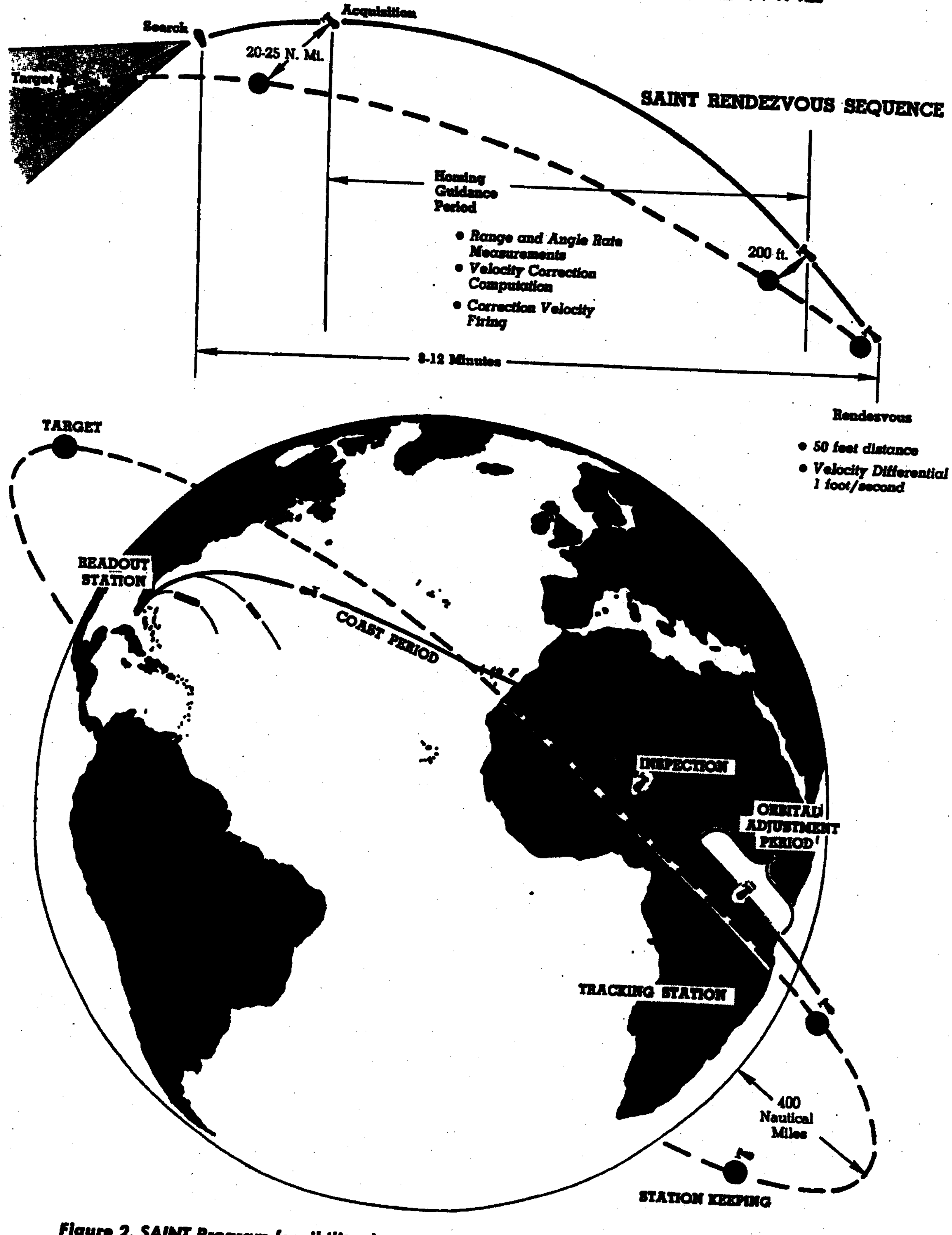


Figure 2. SAINT Program feasibility demonstration flight and rendezvous sequence.

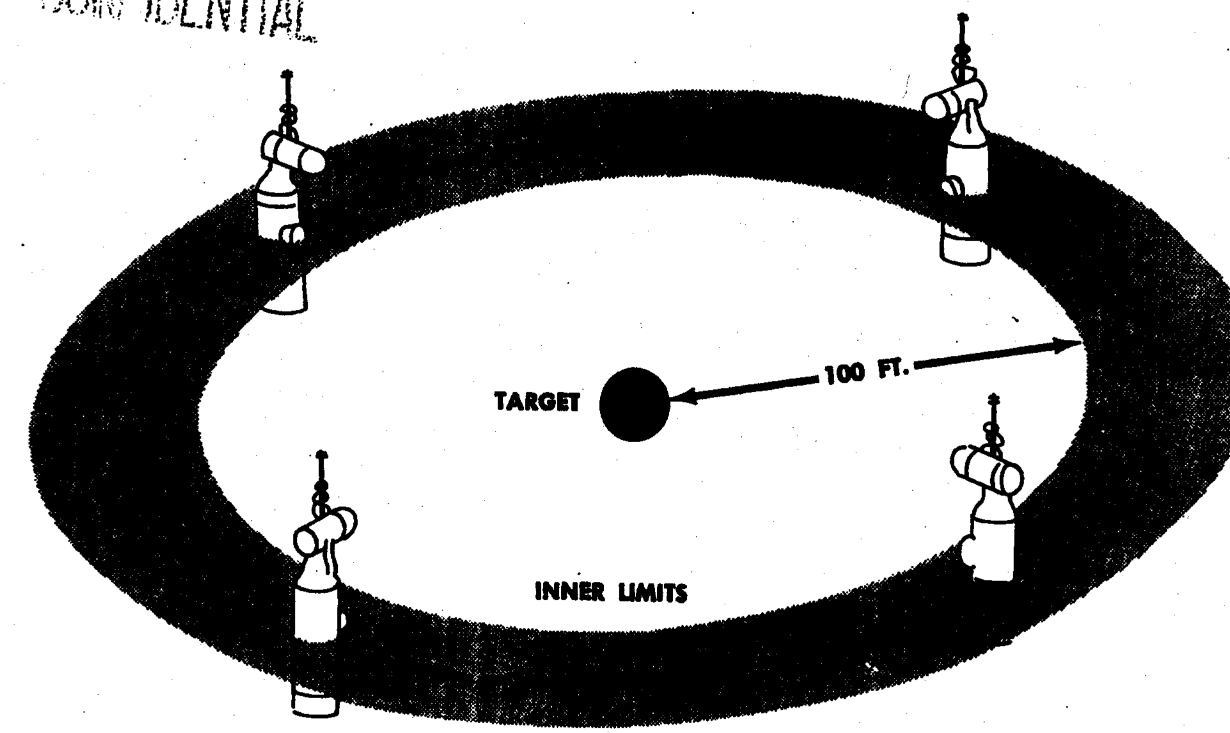


Figure 3. During station keeping, the Final Stage Vehicle will remain at a nominal distance of 125 feet from the target with the payload sensors pointed at the target. The Final Stage Vehicle will move around the target in a plane parallel to the surface of the earth at the rate of one revolution every sixteen minutes. This will permit inspection of the entire target during station keeping.

Program History

Initial studies were conducted by industry in 1958 under SR187. Studies were continued in 1959 by the Radio Corporation of America under ARPA contract and Space Technology Laboratories under Space Systems Division management. The STL study was completed 21 December 1959 and the RCA study 31 January 1960, both indicating SAINT would be a feasible system of practical value to the Department of Defense. Subsequently, the following actions have been taken:

1. AF System Development Requirement No. 18 published . . . . 21 April 1960
2. AFBMC approval of SAINT Development Plan . . . . 15 July 1960
3. Department of Defense approval of Development Plan . . . . 25 August 1960
4. Air Force Development Directive No. 412 . . . . 17 October 1960
5. Assigned Systems No. 621A. . 31 October 1960
6. RCA chosen as Final Stage Vehicle and payload contractor. . . . 25 November 1960
7. Contract agreement with RCA 27 January 1961
8. Contract with RCA. . . . . 17 March 1961

Concept

Philosophy — The philosophy for development of the prototype vehicle calls for a step-by-step development program with a conservative choice of subsystems and emphasis upon reliability. Ground tests will provide assurance of component capability and reliability before flight.

Over-all System — Unidentified orbiting objects will be acquired, catalogued, and the ephemeris accurately determined through the facilities of the Space Detection and Tracking System (SPADATS) utilizing available acquisition and tracking equipments. (It is anticipated that, for the ultimate operational system, the capabilities of SPADATS will be expanded to provide additional information such as target size, configuration and stability in orbit, possibly within 12 hours after detection.) This information will be relayed to a Defense Command Control Center which will determine if inspection is necessary. Should inspection be deemed necessary, the ephemeris information will be used to compute data which will be inserted into the guidance system of a SAINT vehicle. The vehicle will be launched into an appropriate position at a time which enables the final stage vehicle to go into orbit with the unknown satellite and inspect it at close range. This inspection data will be stored in the payload for transmission upon command to ground stations. After reception by the ground stations the data will be processed, displayed and evaluated, to determine the mission and intent of the unknown satellite.

Vehicle — The SAINT system as presently envisioned, consists of three stages including an active "Final Stage" or rendezvous vehicle. Early configurations of the SAINT vehicle will consist of a Series "D" ATLAS booster, AGENA "B" second stage, and a SAINT final stage vehicle. This configuration is shown in Figure 1. Later final stage vehicles having increased maneuvering capability and additional sensors would be boosted with the ATLAS/CENTAUR. The final stage vehicle (Figure 1) will include a radar seeker, launch and homing guidance system, attitude control, maneuvering propulsion and a payload. The payload will include television cameras and various other sensors to determine the nature of the target satellite and its functional purpose. In addition the payload will have a storage and communications capability.

Feasibility Demonstration — Four flights launched from the Atlantic Missile Range, are planned for the feasibility demonstration. The first flight is scheduled in March 1963 with the subsequent flights scheduled at three month intervals. The feasibility demonstration configuration of the SAINT vehicle will consist of a Series "D" ATLAS booster, AGENA "B" second stage and a SAINT final stage vehicle. The demonstration final stage vehicle weighs approximately 2,500 pounds. In this demonstration (Figure 2), the final stage vehicle will be programmed to rendezvous with an existing satellite if one is available in a three hundred to five hundred mile easterly orbit. If such a satellite is not available, a target satellite will be placed in a 400 nautical mile, 28.8 degree inclination circular orbit by a USAF SCOUT booster. Rendezvous will be accomplished while under surveillance of a Southeast Africa station and a TV image of the target, in addition to the telemetered data of final stage vehicle performance, will be transmitted to the ground station. The image and data will also be stored and read out on command as the vehicle passes over the Air Force Missile Test Center. For the purpose of the feasibility demonstration rendezvous is defined as a closing of the final stage vehicle with the target satellite to within 50 feet and a relative velocity of less than one-foot per second. Station keeping will be maintained for one orbital period.

Future Development — Continued study toward definition of an ultimate operational system is being pursued simultaneously with the other phases of the program. This effort will distinguish certain long lead type items on which development action must be initiated and provide further refinements to the system. Included are extension of the maneuvering capability of the vehicle into 4,000 nautical mile orbits with the necessary station keeping and inspections of multiple targets as well as more exotic sensor capability. For example, a sensor capable of detecting a nuclear warhead is most desirable. Effort is currently underway to proceed with the development of such a sensor.

Program Management

Space Systems Division management of this program is based upon the associate contractor structure composed of a First Stage contractor, Second Stage contractor, Final Stage Vehicle contractor, and Systems Engineering and Technical Supervision contractor (Aerospace Corporation). Military support is provided by the Space Detection and Tracking System through the Air Force Command and Control Development Division, and by the 6594th and 6555th Missile Test Wings.

Facilities

The demonstration program will utilize existing launch, tracking and data reduction facilities insofar as possible. However, some additional ground support equipment will be required at the Air Force Missile Test Center and at the Southeast Africa tracking site.

Monthly Progress – SAINT

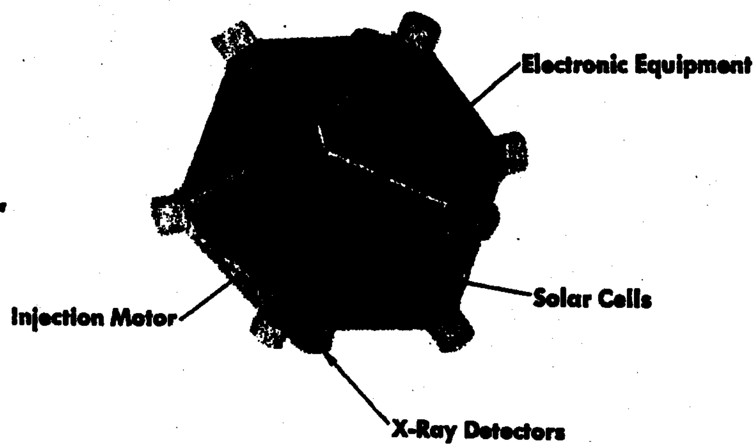
Program Administration

• Revised cost estimates for the SAINT target were received from the prospective contractors on 7 August. Selection of a contractor was postponed last month pending receipt of this additional cost data from the participating contractors. The SAINT Target Evaluation Board reconvened and evaluation was completed. Negotiations are planned for early September. (U)

• SAINT Program Office personnel attended initial design reviews on the search and track radar subsystems at Westinghouse, guidance subsystem at Minneapolis-Honeywell and the main propulsion system at Aerojet-General. Design progress was found to be satisfactory in all areas. (C)

• The standard AGENA second stage vehicle was placed on letter contract on 29 August. (U)

VELA HOTEL



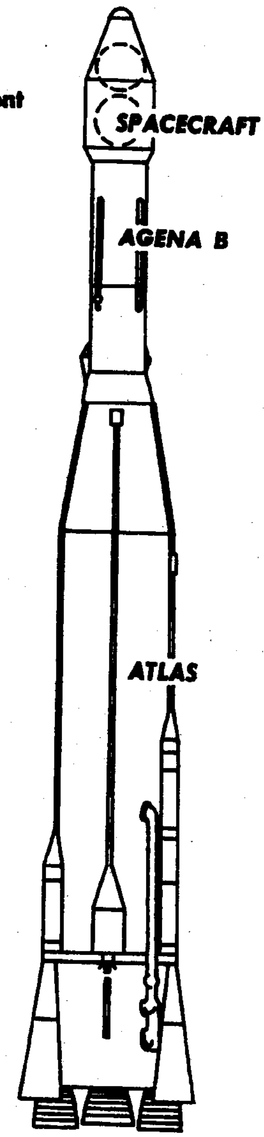


Figure 1. VELA HOTEL vehicle configuration (right). Artist's concept of payload showing solar cells, X-ray detectors and injection motor.

Program Objectives

The objective of the VELA HOTEL Project is to conduct a research and development program including experiments and prototype testing to gain information which will lead to the definition of an operational space-based system for high altitude nuclear detonation detection.

Program History

The Panofsky Panel on High Altitude Detection, reporting to the President's Scientific Advisory Committee, made several recommendations with respect to research and development work which should be accomplished in order to increase basic understanding of the physical mechanisms involved. The Department of Defense agreed to assume over-all responsibility with Atomic Energy Commission support in the high-altitude detection area. Further, it was agreed that the AEC would undertake laboratory development of the nuclear detection instrumentation and that the portion of the effort concerning measurements of natural radiations in space should be implemented jointly by the DOD and the NASA. Within the Department of Defense, the Advanced Research Projects Agency was assigned the management responsibility for Project VELA on 2 September 1959. On 18 September 1959, ARPA issued Order Number 102-60 to AFSC for a study and evaluation of the technical and operational factors associated with the detection of high-altitude nuclear detonations. The initial results were used in October 1959 to provide the State Department with supporting technical data for the United States delegation at the Geneva conference. Amendment No. 1 to the original ARPA Order directed AFSC to extend and refine the original study. It was subsequently requested that a joint working group including AFSC, AEC and NASA representatives, chaired by AFSC, be established. The mission of the Joint Working Group was to recommend a research and development program which would investigate the concept of nuclear detonation detection from satellites. To facilitate conducting the work involved, the Joint Working Group formed subcommittees for payload, space boosters, and communications and control.

Program Concept

On 21 June 1961, the Secretary of Defense approved and funded the VELA HOTEL Program. The program will consist of five launches from the Atlantic Missile Range, beginning in April 1963 and extending through April 1964.

The launch vehicle for the VELA HOTEL Program will be an ATLAS D/AGENA B. Each vehicle will place two spacecraft into a single highly elliptical orbit. The instrumentation aboard the spacecraft will be furnished by the AEC and will consist of X-ray,

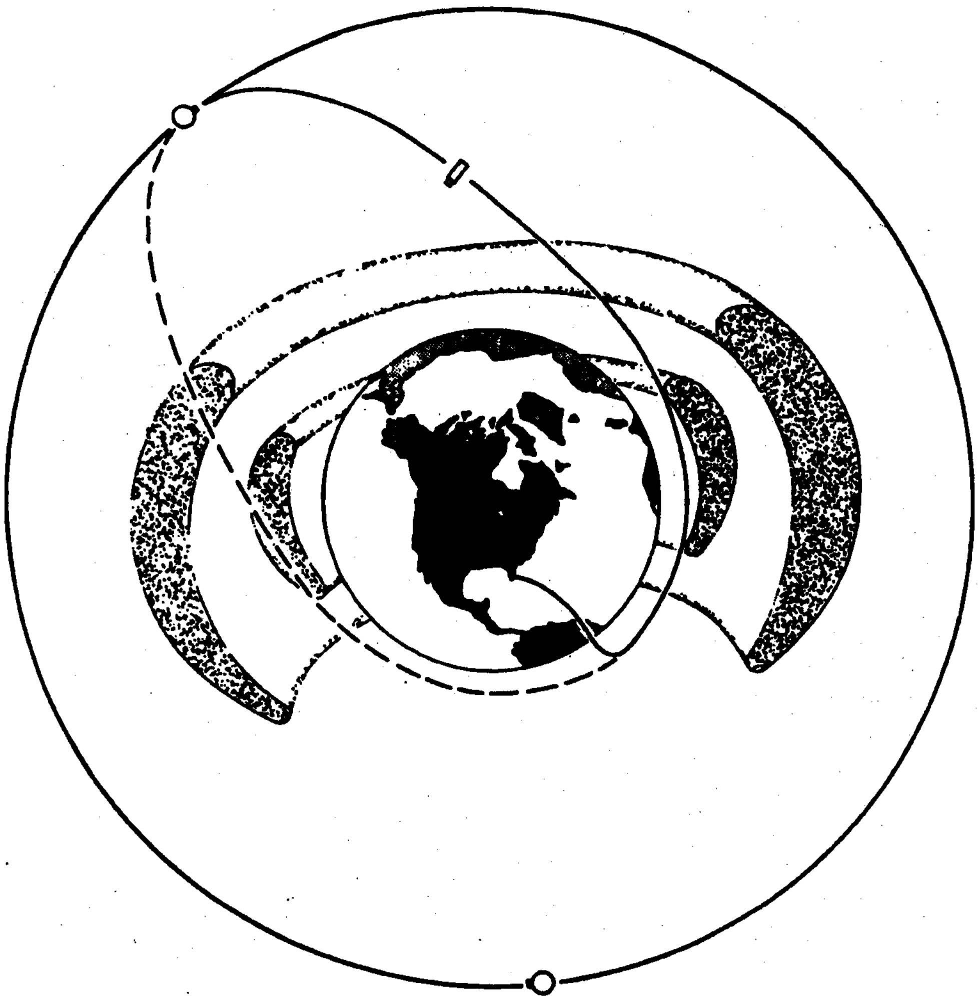


Figure 2. VELA HOTEL trajectory showing the elliptical transfer orbit which has a 200 n.m. perigee and a 50,000 n.m. apogee. On the first orbit one payload will be ejected, on the next orbit, the second payload will be fired and placed into orbit approximately 140 degrees behind the first payload.

gamma ray, and neutron detectors and Geiger-Mueller tubes. Each spacecraft will contain a propulsion unit capable of transferring the spacecraft into a minimum circular orbit of 50,000 nautical miles. The propulsion unit of one spacecraft will be fired at first apogee and the second spacecraft will be transferred at a later apogee such that the spacecraft will initially be 140° apart in orbit. The spacecraft will be designed to have an operating life of six months with redundant telemetry transmission capabilities in range of 75,000 nautical miles.

The vehicle will be launched from the Atlantic Missile Range at an azimuth of approximately 110°. After AGENA B separation from the ATLAS D, the AGENA B will program through two burns with final cutoff over Australia. A spin table on the AGENA B will then spin and separate the tandem payloads. The two spacecraft will then separate such that at apogee they will be several miles apart. The previously described transfer sequence will then be initiated.

Simultaneous tracking of the two spacecraft will be carried out by the SSD world wide tracking net. Data will be collected at Sunnyvale Satellite Test Center, punched on tape and shipped to the AEC at Albuquerque, New Mexico for reduction and analysis.

In addition to the major high-altitude portion of the VELA HOTEL Program, several Discoverer piggy-back low altitude polar orbit flights are being accomplished which will obtain background radiation data below the Van Allen belts. These flights carry Lawrence Radiation Laboratory experiments consisting of X-ray, gamma ray and neutron detectors, PENG (proton-electron-neutron-gamma ray) detectors and solid state spectrometers.

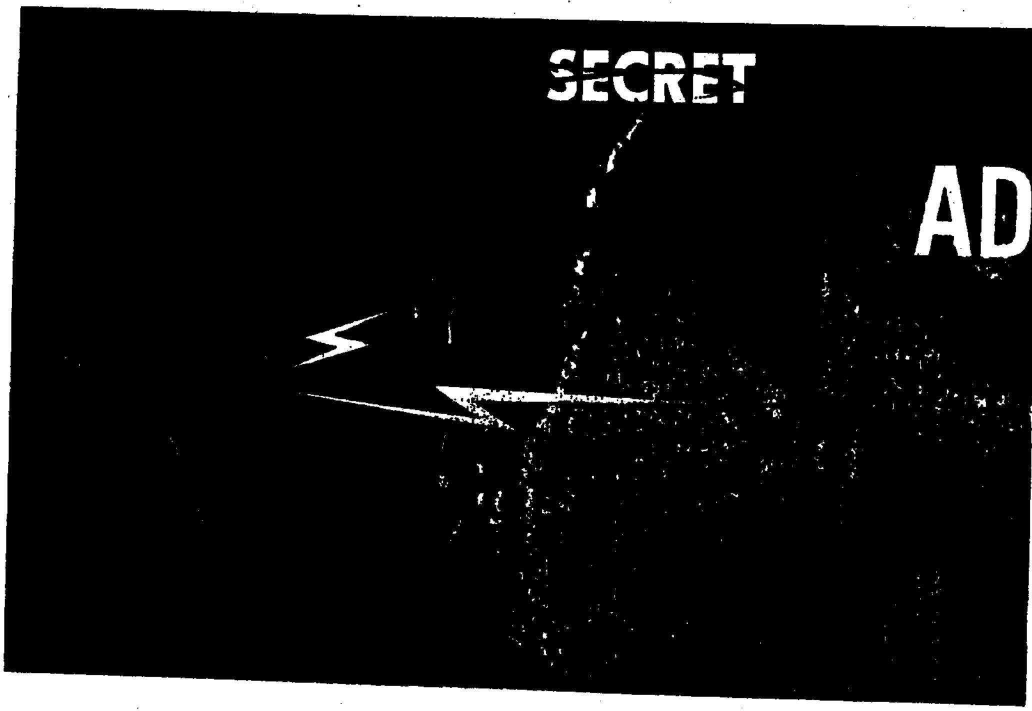
The first of these launches occurred in late August 1961. The AEC is also initiating, as a separate but related project, a piggy-back flight program aboard Rangers (Lunar probes), NASA Scouts and Mariners (Venus probes).

Monthly Progress — VELA HOTEL

Flight Test Progress

- On 30 August at 1300 PDT DISCOVERER XXIX was launched from Vandenberg Air Force Base carrying VELA HOTEL instrumentation. The instruments, mounted on the AGENA engine access door module, consisted of two X-ray detectors and a solid state spectrometer to measure energies and intensities of electrons. The units were wired as a system to provide maximum discrimination between random radiation and radiation bursts. Data was recorded continuously on tape for playback when the vehicle was over a tracking station. During the playback period, data from the instruments was transmitted to the station in real time over separate channels, thereby providing complete data recovery. Lawrence Radiation Laboratories provided the instruments and is in the process of evaluating the data. (U)

- The next module containing a VELA HOTEL instrument package is scheduled for launch aboard a DISCOVERER vehicle on 18 August. (C)



ADVENT

The ADVENT Program will investigate the feasibility of using satellites in synchronous orbit as instantaneous repeaters for microwave radio communications. A satellite vehicle station in synchronous equatorial orbit will remain in a fixed position relative to any point on the surface of the earth. Active communications equipment contained in this satellite will receive, amplify and instantaneously retransmit any message beamed in its direction.

PROGRAM HISTORY

The Research and Development program for active communication satellites was initiated by ARPA in January 1959. Following early research and development, a three-phased development program (STEER, TACKLE and DECREE) was initiated in May 1959 by Amendment No. 1 to ARPA Order No. 54. Phase I (STEER) was given priority in order to demonstrate the feasibility of providing an early UHF communications capability for positive control of the SAC strike forces. Space Systems Division (SSD) was given responsibility for the design, development, and flight testing of the complete system, including launch, satellite tracking and control, and necessary support facilities and ground equipment. Aeronautical Systems Division (ASD) and the U.S. Army Signal Research and Development Laboratory (USASRDL) were delegated responsibility for the development of the communications subsystem for Phase I and Phases II and III, respectively.

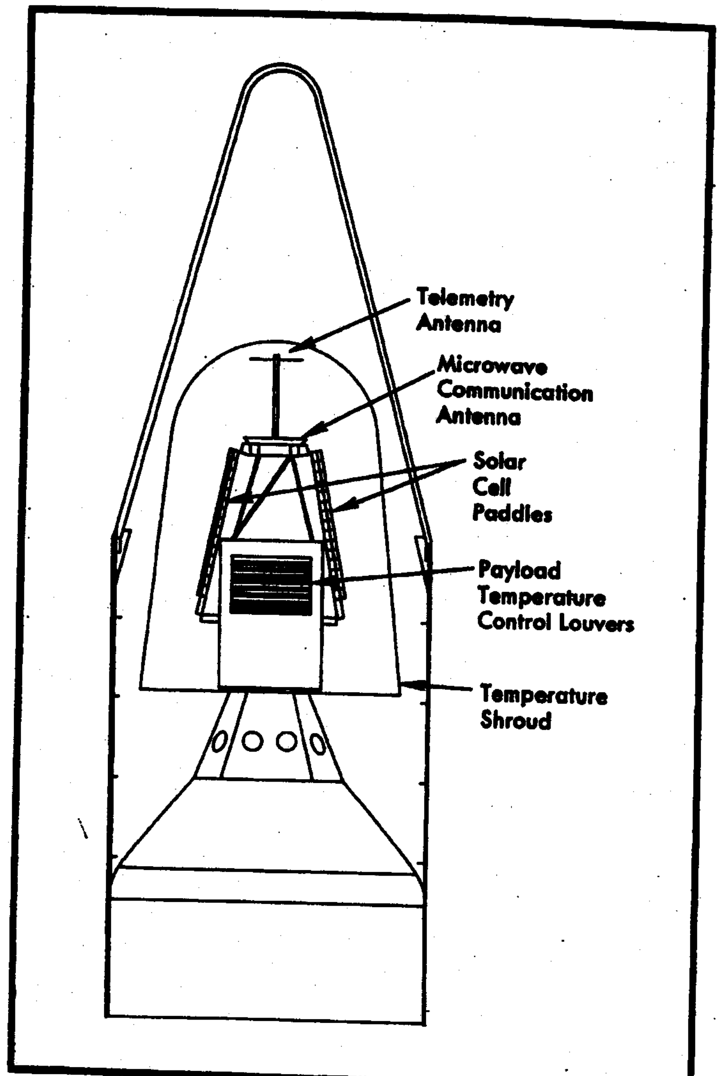


Figure 1. Proposed satellite with jettisonable fairing mounted on CENTAUR second stage.

In April 1960, Amendment No. 5 to ARPA Order No. 54 reoriented the program. The research and development effort previously directed toward providing a ground-to-satellite-to-aircraft UHF communications capability for the SAC strike forces was cancelled. A single integrated ADVENT Program for the development of a 24-hour microwave communications satellite replaced the former STEER, TACKLE and DECREE Programs.

On 15 September 1960, the Secretary of Defense transferred over-all management responsibility for the ADVENT Program from ARPA to the Department of the Army. The development responsibilities of SSD and USASRDL were retained essentially status quo. The Army was given responsibility for funding and for over-all systems engineering to provide guidance and a basis upon which detailed design data can be evolved by SSD and USASRDL.

PROGRAM OBJECTIVES

The primary ADVENT objective is to demonstrate the feasibility of achieving a military system for microwave communications (surface-to-surface) employing satellite repeaters in 24-hour equatorial orbit. The feasibility of placing a satellite in predetermined position in a 19,300 nautical mile equatorial orbit must be demonstrated. The feasibility of being able to stabilize the satellite, control its attitude and orbit, and keep it on station within the required tolerances must also be demonstrated. The satellite must be capable of providing broad band communications on a real time basis at microwave frequencies. The Program Plan is based upon the design of a single configuration of a final stage vehicle compatible with launching by either AGENA "B" or CENTAUR second stage boosters.

The ADVENT Program will consist of the following flight tests, launched from the Atlantic Missile Range:

Phase One. Three ATLAS/AGENA "B" flights, nominal 5,600 nautical mile orbits, beginning March 1962.

Phase Two. Two flight tests, using payload space on NASA ATLAS/CENTAUR research and development flights numbers 9 and 10, April and June 1963.

Phase Three. Five ATLAS/CENTAUR flights launched into 19,300 nautical mile equatorial orbits, beginning July 1963.

Launch Schedule

	62												63												64					
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J
			1			1			1							1		1	1		1		1		1		1			
Funded By	ARMY									NASA									ARMY											
Vehicle Configuration	ATLAS/AGENA "B"									ATLAS/CENTAUR																				

Monthly Progress — ADVENT

Technical Progress

Booster Vehicles

• The work statement for the ATLAS (Series I) booster is currently being revised by Aerospace Corporation to incorporate the Atlantic Missile Range Pad 12 modifications. It is anticipated that the statement will be completed by 6 September. (U)

• Model fabrication is proceeding on schedule in support of wind tunnel testing at NASA Ames Laboratory. These tests, designed to evaluate the effect of ground wind induced oscillations on the ATLAS/AGENA and ATLAS/CENTAUR vehicles, are scheduled to begin on 1 November. The final report is scheduled for 1 March 1962. (U)

• Final assembly of the first AGENA B vehicle (1501) was completed on 7 August. The vehicle was immediately transferred to the system test area. Systems tests are scheduled for completion on 13 November. (C)

• The AGENA wind tunnel test effort is proceeding on schedule with the start of trans-sonic testing in the Langley tunnel scheduled for 11 September. Testing in the Lockheed Missiles and Space Company supersonic tunnel is scheduled to begin on 9 October. The majority of the pressure data obtained at Ames Laboratory has been processed and analyzed with no indication of a problem area at this time. (U)

• The revised General Dynamics-Astronautics proposal for the ADVENT/CENTAUR configuration is nearing completion. It is anticipated that GD-A will submit this proposal by 21 September. Submission was originally scheduled for 15 August. (U)

• Design criteria for the ADVENT/CENTAUR nose fairing has been submitted by GD-A. These criteria are presently being reviewed by Aerospace Corporation and the Space Systems Division to insure compatibility with ADVENT requirements. It is anticipated that the review will be completed by 15 September. (U)

Final Stage Vehicles

• Both spare final stage vehicles have been deleted from the program for the following reasons:

1. Funding is limited.
2. A complete set of component spares will be available.
3. Overlapping delivery dates will provide spare vehicles for most FSV launches. (C)

• Space Systems Division, in conjunction with the Air Force Security Service, has taken action to establish a Cryptographic Account at General Electric-Missile and Space Vehicle Department (GE-MSVD) for ADVENT in order to properly protect the cryptographic portions of the command decoder. Action has also been taken to secure secret crypto clearances for those GE-MSVD personnel involved with the command decoder. Cryptographic accounts are also required at Philco WDL and for GE-MSVD at the Atlantic Missile Range. These accounts will be established in the near future. (C)

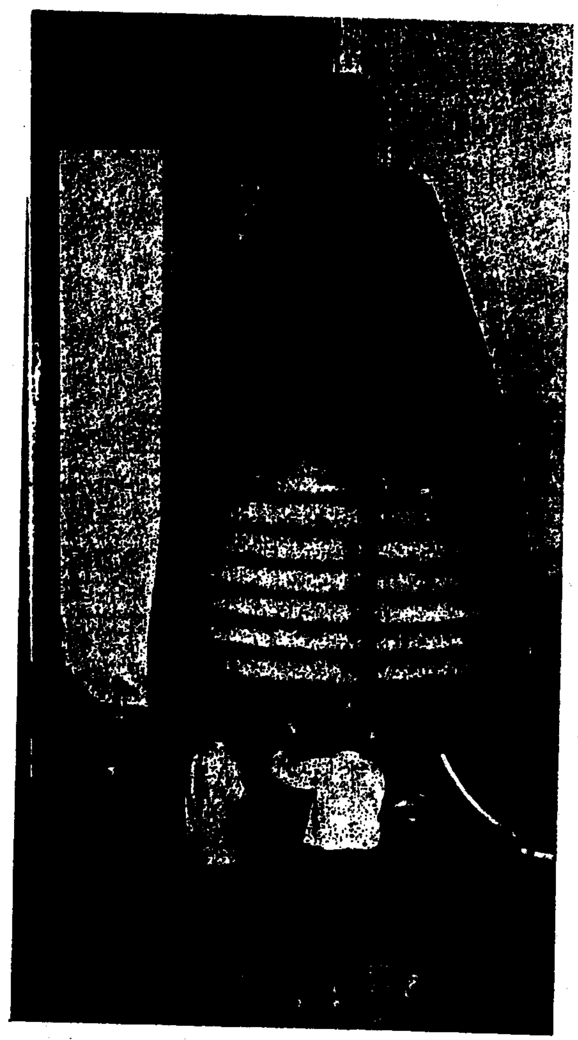


Figure 2. Final machining of the ADVENT Phase I nose fairing. This fairing will become part of AGENA vehicle 1501. The AGENA vehicle is now in the systems test area.

• The decision has been made to use, with minor modifications, the propellant loading vehicles being developed by Lockheed for another space program. This decision will avoid unnecessary duplication of design and fabrication effort in this area. (U)

Tracking, Telemetry, and Command

• A meeting attended by representatives of Sylvania, Philco-Western Development Laboratories, Aerospace Corporation, Space Systems Division, USAAMA, and USASRDL was held at USAAMA on 3 August. A revision of the link computations as applied to Camp Roberts and Fort Dix occurred. It was apparent from these revisions that marginal performance in the satellite-to-ground link existed at these two sites. The prime reason for this deficiency was the USASRDL/Sylvania approach of using the hard tube preamplifier and the broad band AM receiver. Space Systems Division, Aerospace, and Philco supplied several solutions to remedy these situations. One solution consists of using the same parametric preamplifier and narrow band receiver as used at the Kaena Point station. This recommendation was presented to USAAMA on 10 August. All agencies concerned agreed, in principle, to the desirability of this change. Aerospace and Philco proceeded with a more detailed investigation into the effects of this change. Philco indicated that these additional equipments could be supplied to Camp Roberts and Fort Dix in time to meet the schedule. (C)

• Space Systems Division made a recommendation to USAAMA to extend Philco's responsibilities as the ground TTC equipment integrating contractor at Camp Roberts and Fort Dix in order to provide a single responsible agency on a detailed mechanical and electrical interface level. This recommendation permits Philco, as the largest supplier of the ground TTC equipment, to act as a detailed integrator on the compatibility tests, fly-by acceptance tests, and ground installation detailed integration. (U)

• A more detailed investigation of the interference to the Kaena Point TTC station from the Navy Communications Moon Relay Station is being conducted by Aerospace Corporation. A profile of the intervening terrain is being plotted and the final findings will be published in the near future. (U)

Systems Test

• Extensive efforts continued on the preparation of Revision 1 to the Launch Test Plan. Inputs have been received from GD-A and General Electric. A visit was made to the Atlantic Missile Range on 10-11 August to receive inputs to the Plan from the Range Office and to discuss with them portions of the revision. The Range Office further assisted in the preparation of the Plan by providing personnel. (U)

• Revision 4 of the Launch PRD No. 1600 is being prepared. USASRDL requirements for the microwave antennas on the launch tower and Hangar AA were investigated and discussed. The requirements are now considered to be a 10-foot and a 4-foot parabolic reflector at Hangar AA and mounting facilities at the gantry for a 6-foot and a 4-foot parabolic reflector. (C)

• Discussions were held with GD-A to resolve Phase III CENTAUR telemetry requirements. A revision of the requirements to carry a C-band radar beacon was performed. Because the C-band radar is fundamental to the RADOP concept, it was determined that the C-band beacon cannot be replaced by the 400-mc beacon. (C)

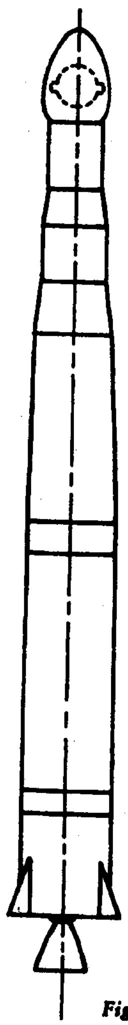
Facilities

• Final design and modification criteria were completed for launch complex No. 12 at the Atlantic Missile Range. These criteria were forwarded to the Atlantic Missile Range for review and coordination. Formal contractual coverage will be initiated pending receipt of coordination, which is anticipated on 15 September. (C)

• Aerospace is preparing a detailed report on launch support faciliity requirements and facility modification requirements for Pad 36B to support ADVENT. (C)

• Modification of Atlantic Missile Range Hangar AA is approximately thirty percent complete. (U)

Project ANNA



Second Stage — ABLESTAR (AJ-10-104)

Thrust (vacuum)	7900 pounds
Specific impulse (vacuum)	277 seconds
Burning time	296 seconds
Propellant	IRFNA UDMH

First Stage — DM-21A

Thrust (sea level)	152,000 pounds
Specific impulse (sea level)	247 seconds
Burning time	163 seconds
Propellant	Liquid Oxygen RP-1

Figure 1. Two stage ANNA vehicle.

Program Description

Project ANNA is the tri-service geodetic satellite program. The program is designed to satisfy the primary military (Army, Navy, Air Force) and scientific (NASA) requirements in geodesy. The Navy has over-all program management responsibility and is also responsible for satellite system management. The Space Systems Division (SSD) was assigned the responsibility for booster system management, which includes providing the booster vehicles, integrating payloads to the vehicles, and being responsible for flight operations from launch through attainment of orbit. On 4 April 1961, the Navy officially directed the Space Systems Division to proceed with plans for launching the first ANNA satellite on 5 December using the THOR Ablestar (Figure 1) vehicle previously purchased for TRANSIT 5A.

Payload Description

The ANNA payload (Figure 2) is a 36-inch diameter sphere with a bank of solar cells encircling the package at the equator. The satellite contains an Air Force High-Intensity Pulsed Gas Discharge Lamp for optical measurements, a Navy (TRANSIT) doppler beacon for doppler measurements, and an Army SECOR Transponder for radio ranging data. The basic payload structure is the same as the TRANSIT Navigational Satellite. The payload weight is 325 pounds. The payload contains high magnetic permeability rods which will reduce the satellite spin to zero by hysteresis damping after a few days on orbit.

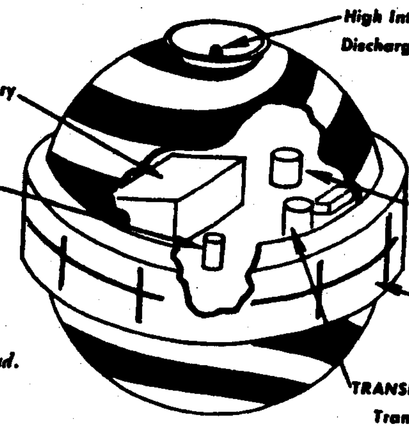


Figure 2. Cutaway drawing of ANNA payload.

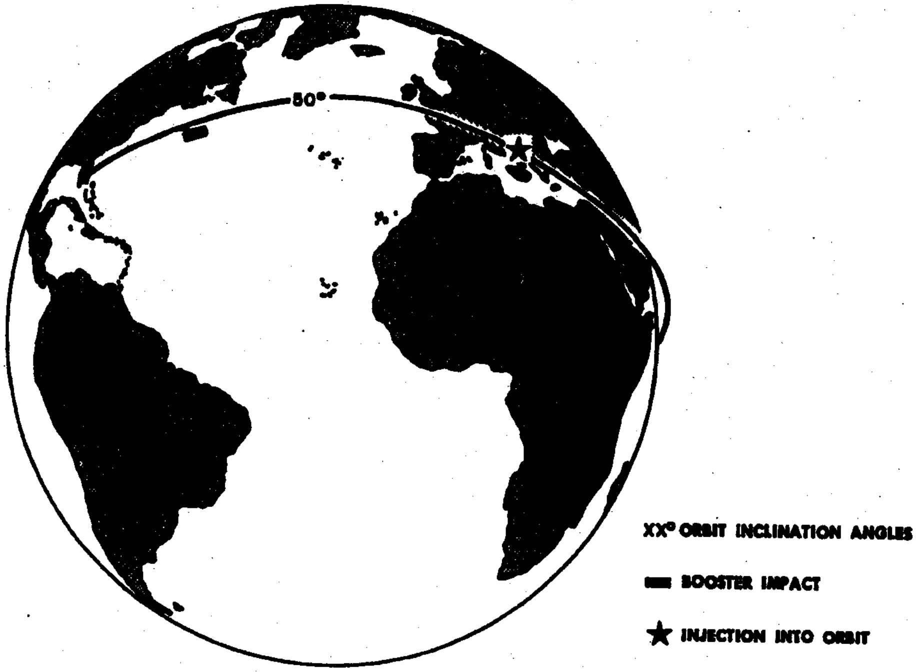


Figure 3. ANNA launch trajectory (50° orbit inclination angle) showing flight path, booster impact area, and orbital injection point.

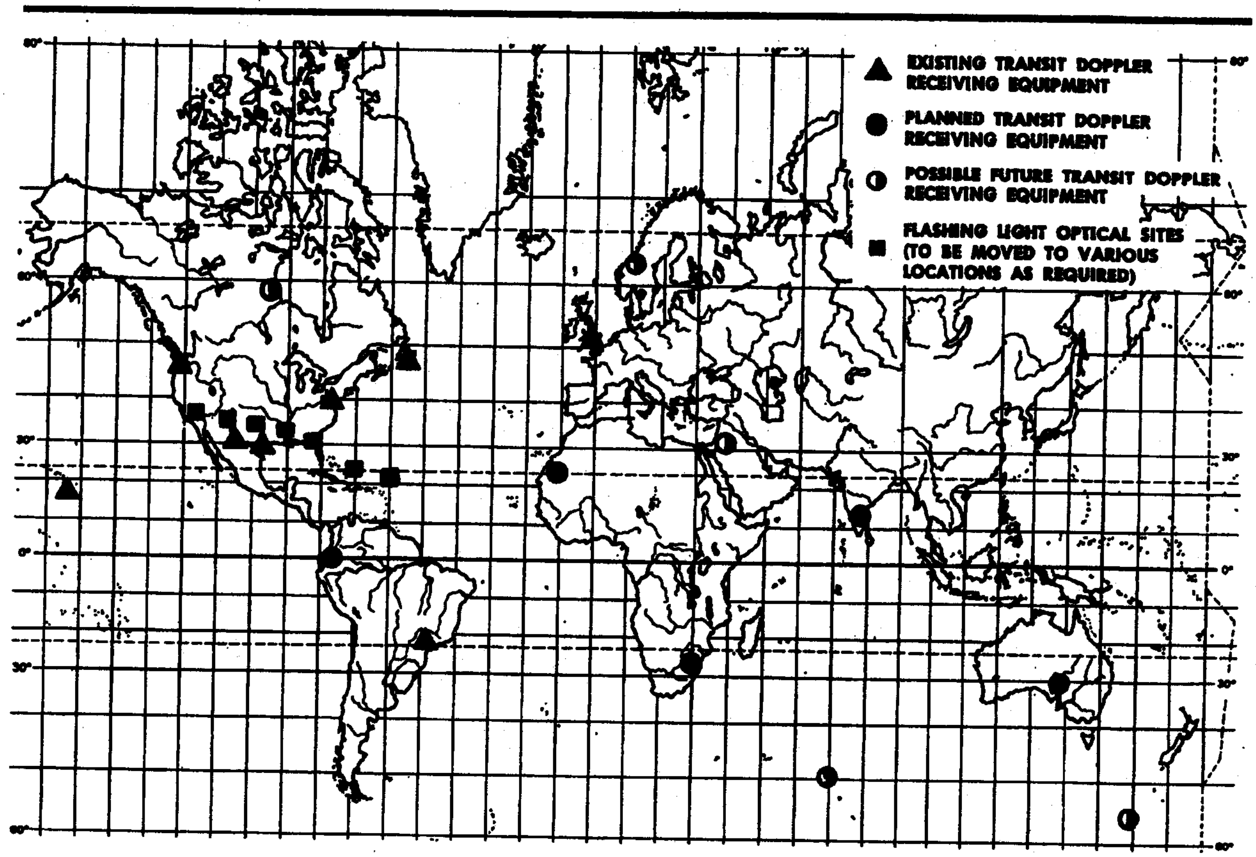


Figure 4. Location of ANNA tracking stations.

Program Objectives

The Objectives of the ANNA Program are to:

1. Relate the major datums to each other and to the earth's center of mass.
2. Determine the structure of the earth's gravitational potential.

The vehicle will be launched from the Atlantic Missile Range in a northeasterly direction and will achieve a 600 nautical mile orbit with an inclination angle of 50°. Figure 3 shows the vehicle's trajectory.

Orbital Performance

Achievement of program objectives is dependent on tracking the satellite using the three measurement techniques: optical, radio doppler and radio ranging. Since a high degree of accuracy is required, the different types of observation will provide independent measurements for cross-checking. Two basic approaches to the application of the satellite for geodetic purposes will be utilized.

1. The *orbital method* requires extremely precise determination of the satellite orbit, including minor variations from the Keplerian Ellipse, and then uses this information as a "measuring rod" for connecting the various datums over which it passes.
2. The *inter-visible method* uses the satellite as a point of simultaneous observation from known and unknown data. It does not require precise knowledge of the satellite ephemeris but it does require simultaneous sightings from several locations.

The expected accuracy in determination of the absolute geocentric variance of station positions is approximately 20 to 200 feet.

Ground Support and Tracking Stations

In regard to satellite tracking, each of the services is providing a system of tracking stations corresponding to its component in the satellite; i.e., the Air Force is providing for optical tracking, the Navy is providing for doppler ground support facilities, and the Army is providing ground facilities for the radio ranging.

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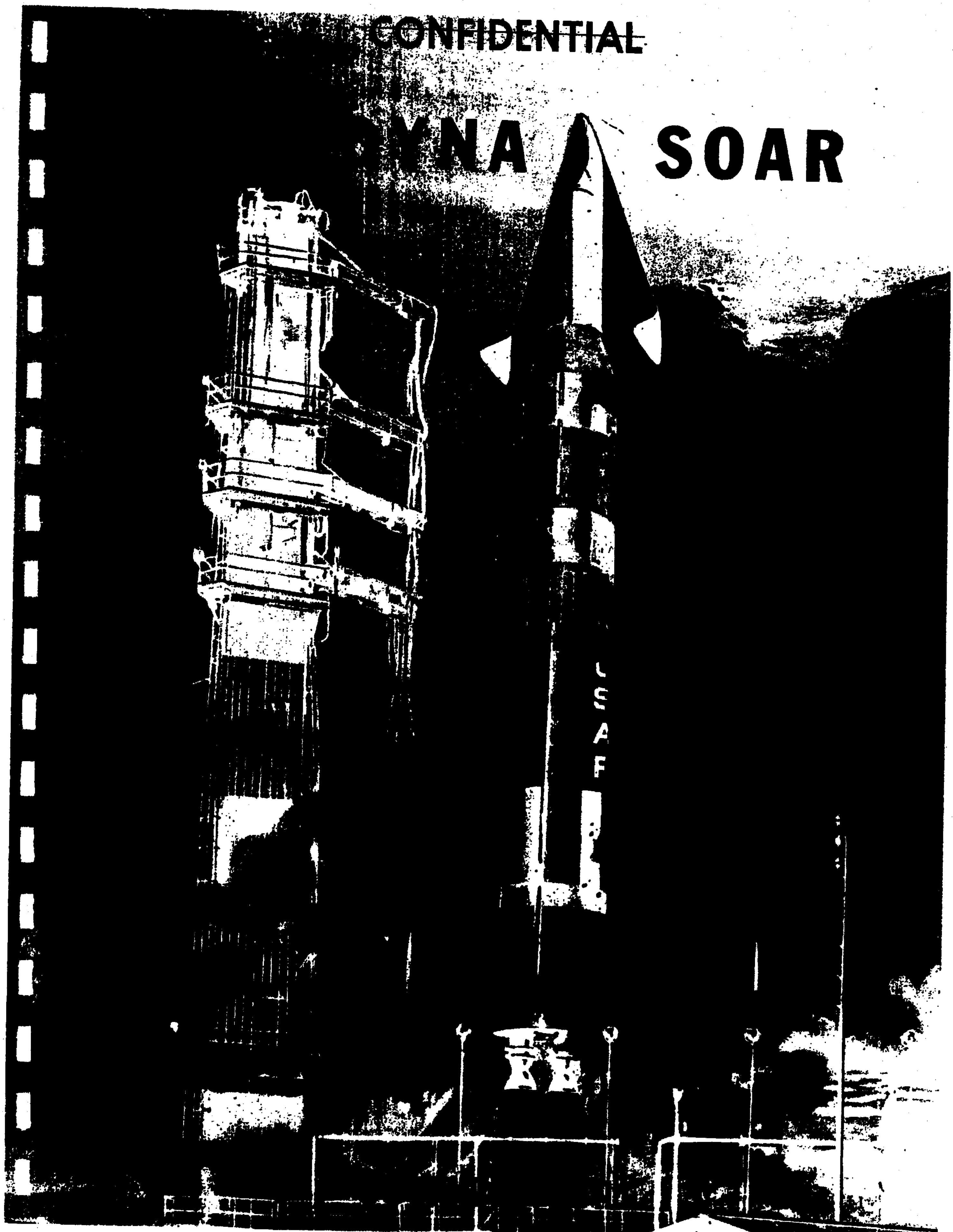
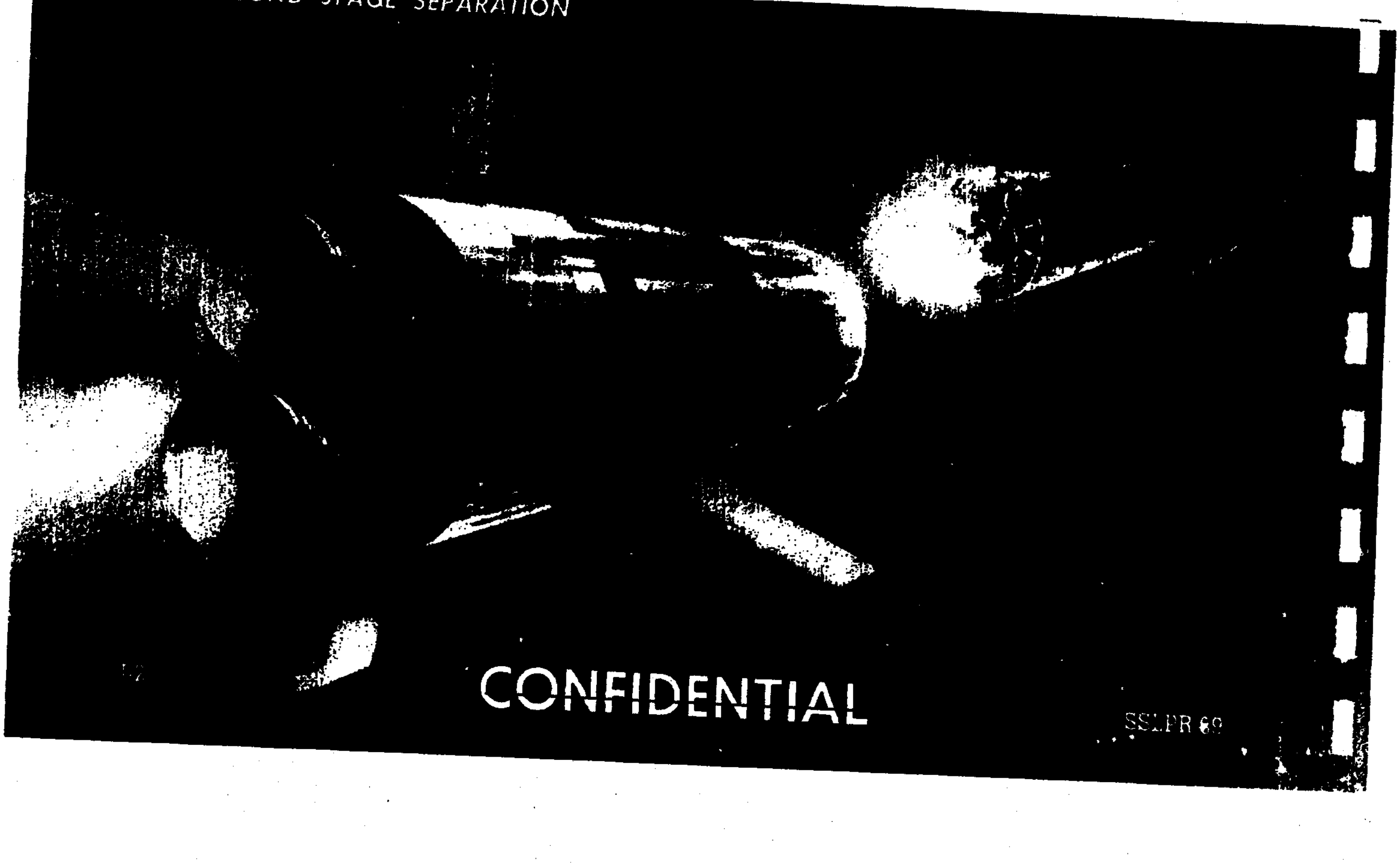


Program History—Competition for the DYNA SOAR study contract was initiated in 1958 and resulted in the Boeing Airplane Company and the Martin Company being awarded the follow-on contract to more fully define their proposed approaches. In November 1959, following review and evaluation of the Boeing/Martin detailed studies by a Source Selection Board, it was announced that Boeing had been selected as the glider and system integration prime contractor, with Martin furnishing modified TITAN ICBM's for booster support. The conceptual phase of DYNA SOAR concluded with a study program requirement known as Phase Alpha. The objective of this study was to reaffirm proposed glider design. In April 1960, Phase Alpha was completed and results were presented to the Department of Defense. On 9 May, formal approval of the DYNA SOAR Step I Program was received by AFBMD/BMC from WADD/ASC.

During the period covering program go-ahead to the end of CY 1960, efforts on the program were concentrated on design refinements to TITAN I and possible increased booster performance to accomplish program objectives. Studies on booster capabilities revealed many favorable factors on cost, time and expanded objectives by use of the XSM-68B (TITAN II) as the booster. Results of these studies were presented to Headquarters USAF and the Department of Defense. Headquarters USAF directed use of TITAN II as the SYSTEM 620 DYNA SOAR Step I Booster. Formal direction to use TITAN II was received by AFBMD/BMC from WADD/ASC on 13 January 1961. Effective April 1961, the symbols for AFBMD/BMC and WADD were redesignated SSD and ASD, respectively.

Program Objectives—The DYNA SOAR Program will explore the possibilities of manned flight in the hypersonic and orbital realms. The program will proceed in three major steps from a research and test phase to an operational military system. In Step I, a full scale, minimum sized manned glider will be developed. A modified version of the TITAN II ICBM will boost the glider into hypersonic flight at velocities up to 22,000 ft/sec and permit conventional landing at a predetermined site. In Step II the glider will be tested, using a more powerful booster to achieve orbital velocities. This phase may be expanded into an interim operational weapon system providing all-weather reconnaissance and satellite interceptor capabilities. The objectives of Step II are to test vehicle performance between 22,000 ft/sec and orbital velocities; and to gather re-entry data from various orbits; and to test military equipment and man-machine relationships. Step III will provide an operational weapon system with a vehicle that will operate primarily in a hypersonic glide, be able to maneuver within the atmosphere, and be able to make a conventional landing at a predetermined

FIRST — SECOND STAGE SEPARATION



site. The capability of DYNA SOAR type systems to perform these programmed missions appears attractive as a result of studies made to date. The missions under study are: reconnaissance (manned and unmanned); air and space defense; strategic bombardment and logistics support. Manned and unmanned versions are being considered where applicable.

Flight Program — Step I includes twenty air-launched, manned flights with the glider being dropped from a B-52. Sixteen booster-launched flights will follow; flights 1 and 2 are designated as unmanned flights. If all significant flight objectives are achieved, the third flight will be manned. Flights 3 and 4 have been programmed as backup flights in the event that flights 1 and/or 2 do not achieve program objectives. The frequency is five launches at two-month intervals and eleven launches at six-week intervals. The range from Wendover AFB, Utah, to Edwards AFB is adequately instrumented for the tracking and telemetry required during the air-launched tests of the DYNA SOAR glider. Instrumentation sites for the AMR launches will be located at Cape Canaveral, San Salvador, Mayaguana, Antigua, Santa Lucia, and Fortaleza. Instrumentation, tracking, and recovery ships will be provided to supply additional support for the AMR launches. Landing facilities will be provided at Fortaleza, Brazil; Santa Lucia, Lesser Antilles; and Mayaguana, Bahama Islands.

Program Responsibilities — Steps I and II of the DYNA SOAR Program are to be conducted by the USAF with NASA participation. USAF will provide program management and technical direction, with ASD having responsibility for over-all system management.

SSD is responsible for the booster, and its Aerospace Ground Equipment (AGE), special airborne systems, and booster requirements of the launch complex. ASD will have responsibility for glider, glider AGE, and subsystem development. NASA will provide technical support in the design and operation of the glider in obtaining basic aeronautical and space design information.

Technical Approach — Space Systems Division technical approach to meet the objectives of the program are:

1. Modifying a TITAN II ICBM by adding stabilizing fins; strengthening the holddown and skirt area, intertank and interstage sections; redesigning the guidance bay; incorporating a malfunction detection system.

2. Modifying the XLR 87-AJ-5 and XLR 91-AJ-5 rocket engines to obtain structural compatibility with the modified booster; include malfunction detection system shutdown and fail safe systems.

3. Modification of an AMR launch pad.

4. Provide an integrated launch countdown.

Monthly Progress – DYNA SOAR

Program Administration

• A joint review of the full DYNA SOAR Step I Statement of Work was completed on 25 August with the System Program Office (ASD), Space Systems Division, and the system associate contractors at Wright-Patterson Air Force Base. (U)

• Space Systems Division recommendations for an accelerated DYNA SOAR Program with orbital capability were presented to higher headquarters on 21-23 August. (U)

Technical Progress

• Detailed preparations have been made by the Space Systems Division, Aerospace Corporation, and the booster associate contractors for the DYNA SOAR System 620A Mock-Up to be held at Boeing, Seattle from 11 thru 15 September. (U)

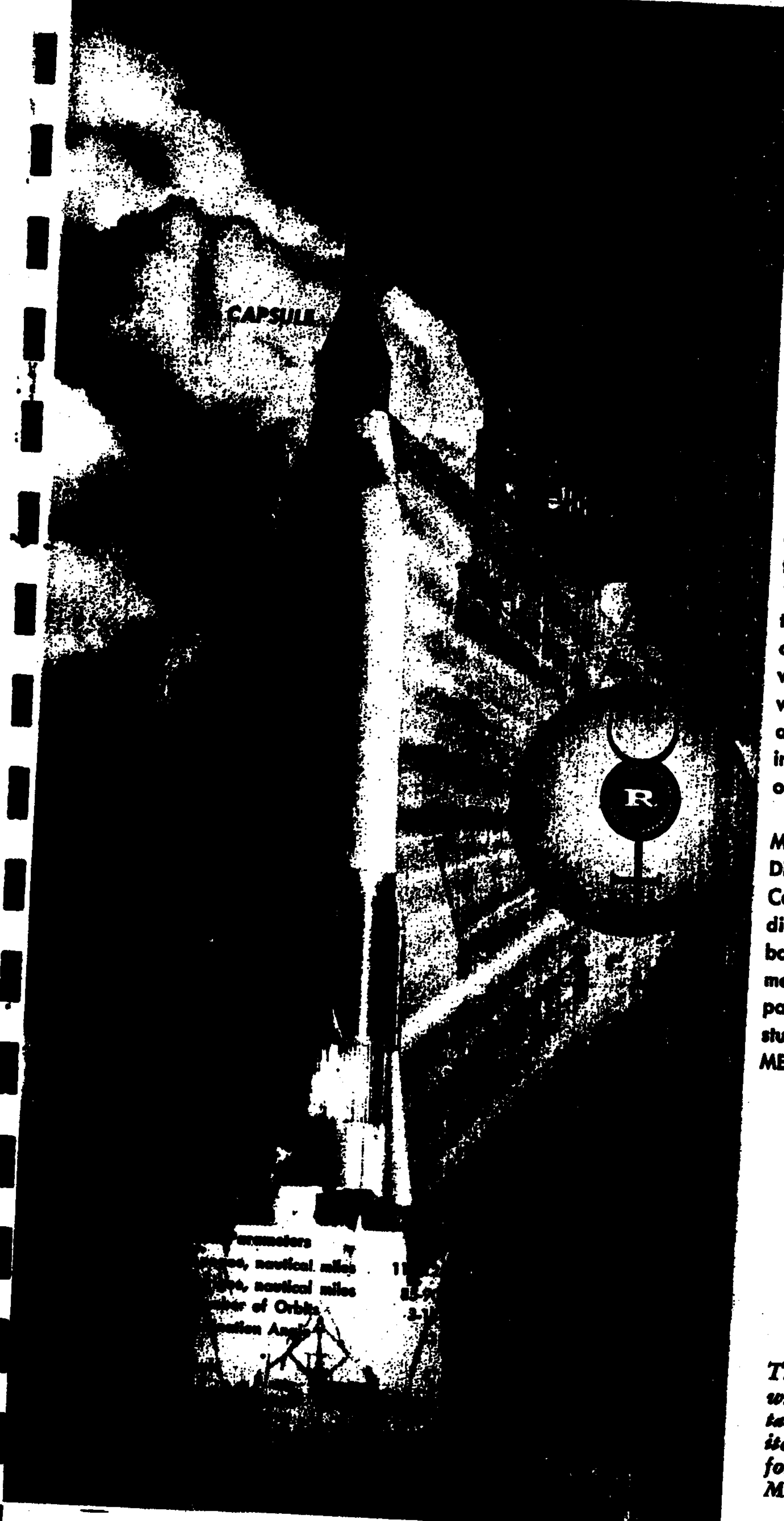
• Preliminary planning had indicated that DYNA SOAR would utilize Atlantic Missile Range Launch Complex No. 20. Recent analysis, however, has shown several advantages in changing to complex No. 19:

1. The availability of an already installed second stage flame bucket will save about $50,000 in plumbing and installation costs.

2. The electrical cabling in complex No. 19 has recently been replaced and will be more usable by DYNA SOAR.

3. Complex No. 19 will be available one or two months ahead of complex No. 20, thereby avoiding a complex deactivation schedule with its corresponding peak manpower requirements.

4. DYNA SOAR is the only approved space program available to take over the complex immediately upon the conclusion of TITAN testing. (U)



ERCURY

Project MERCURY represents the transitional threshold between this nation's cumulative achievements in space research and the beginning of actual space travel by man. The primary program objective is to place a manned satellite into orbit about the earth, and to effect a controlled re-entry and successful recovery of the man and capsule. Unmanned ballistic trajectory and unmanned orbital flights will be used to verify the effectiveness and reliability of an extensive research program prior to manned orbital flights. The program will be conducted over a period of approximately four years. The initial R & D flight test was accomplished successfully in September 1959. The total program accomplishment is under the direction of NASA. The primary responsibility of Space Systems Division to date consists of: (a) providing 15 ATLAS boosters modified in accordance with program objectives and pilot safety factors, and (b) determination of trajectories and the launching and control of vehicles through injection into orbit.

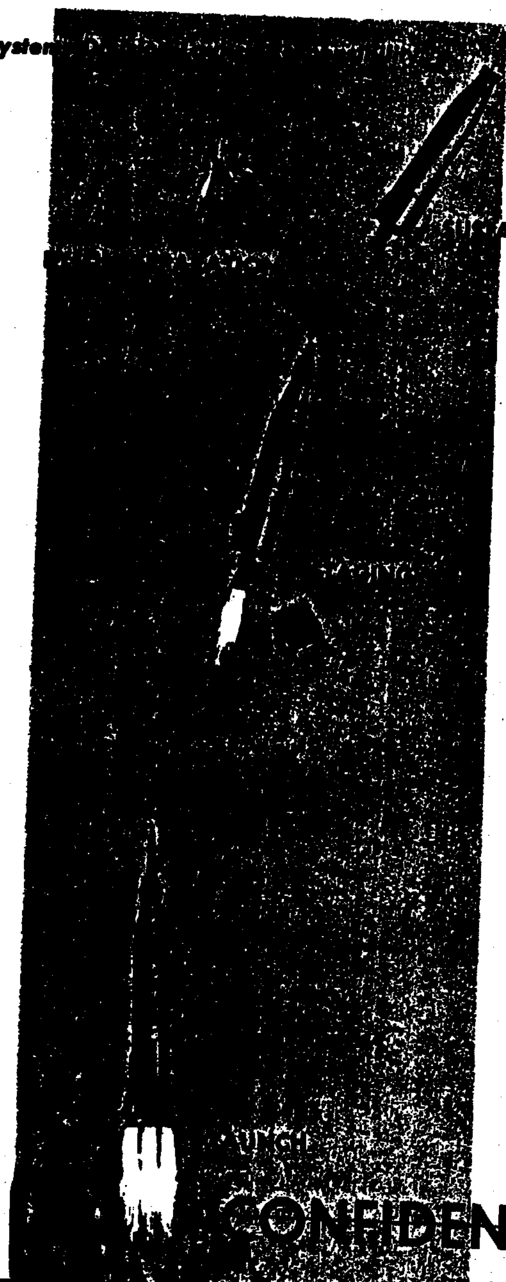
Major contractors participating in the Space Systems Division portion of this program include: Aerospace Corporation, systems engineering and technical direction; Convair-Astronautics, modified ATLAS boosters; GE/Burroughs, ATLAS guidance equipment; and Rocketdyne, engines. All of these companies also participate in launch operations, special studies and engineering efforts peculiar to Project MERCURY requirements.

The MERCURY astronomical symbol (☿) with the "R" for Reliability will be attached to those components and missile end items which have been selected and accepted for use in boosters identified for Project MERCURY.

General Sequence of Events for MA-4 Flight (Orbital)

Following the initial hold-down, the vehicle will lift-off Atlantic Missile Range Stand 14. Upon a General Electric ground guidance command the booster engine will shut down and staging will occur. Twenty seconds after booster staging, the pylon ring separation explosive bolts fire, the pylon clamp ring is separated, and the escape rocket is fired separating the pylon from the capsule. The sustainer engine accelerates the capsule to the predetermined velocity. The sustainer and vernier engines will shut down upon ground guidance command and the capsule separation explosive bolts will fire. The posigrade rockets will fire and separate capsule from the booster. After five seconds of damping the capsule initiates a 180° yaw maneuver and pitches to a 34° blunt-end-forward attitude. The capsule will maintain a 34° attitude throughout its orbit. At a specified time the Automatic Stabilization and Control System is commanded from the ground to start the orientation mode. If the capsule is in the proper attitude the retro-rockets fire. Sixty seconds after retro-fire the retro and posigrade package will be jettisoned and the capsule will assume a re-entry attitude. When the capsule has descended to 21,000 feet, the drogue parachute is deployed. At 10,000 feet, the drogue parachute and antenna fairing will be jettisoned and the main parachute deployed. At impact the parachute is jettisoned and the recovery aids are deployed.

Space Syste



CAPSULE SEPARATION

INER ENGINE CUTOFF

CONF

Space System

MERCURY Supp

- Fifteen modified ATL
- Launch complex and
- Systems developmen
- Studies and technica
- Safety program

Trajectory Outline

ROTATION

OR

Ap

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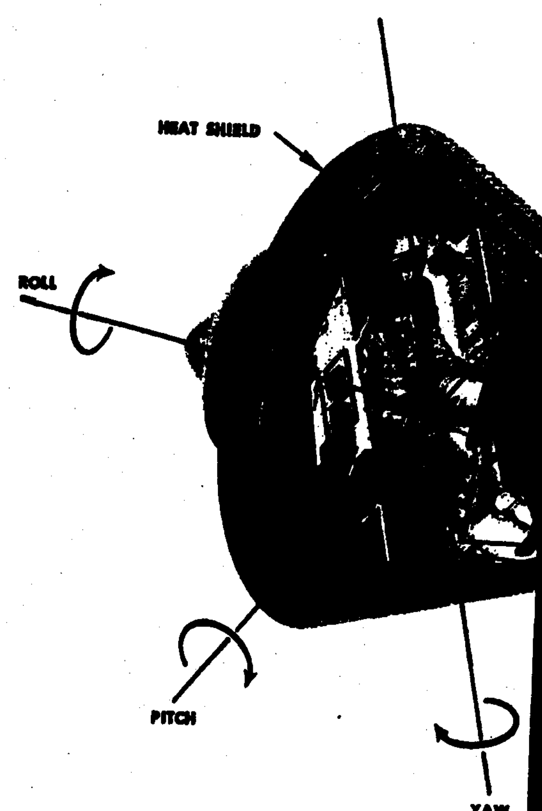

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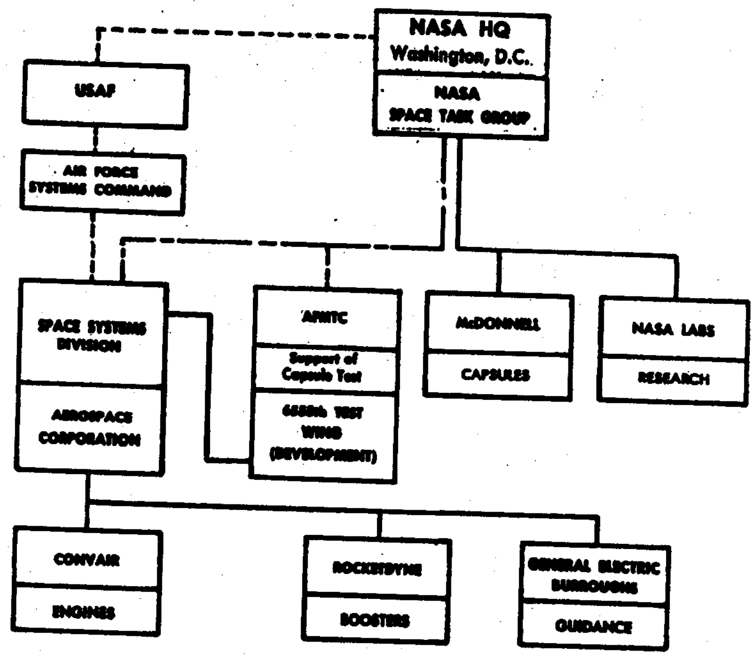
Division

rt Functions

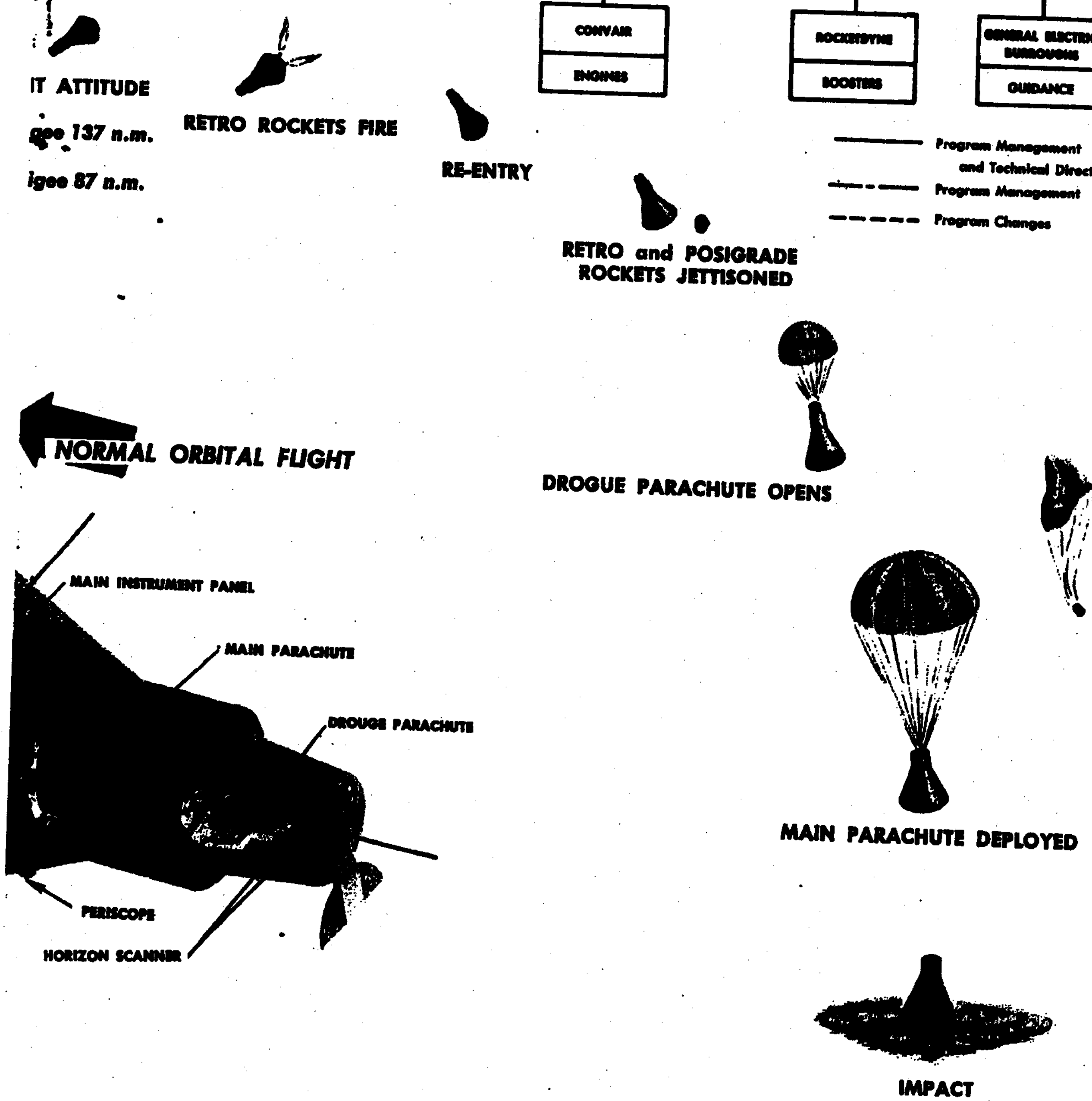
S "D" boosters

upport thru orbital insertion

assistance



for MA-4 Flight



Launch Schedule

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★ Successful flight

⬮ Unsuccessful flight

Flight History

MERCURY Flight	Launch Date	ATLAS No.	Remarks
Big Joe I	9 September	10D	*Flight test objectives were achieved to such a high degree that a second, similar flight was cancelled. The capsule was recovered intact.*
MA-1	29 July	50D	*After one minute of normal flight guidance, rate, track lock, and telemetry were lost and the vehicle was destroyed. The exact cause of the malfunction has not been determined.*
MA-2	21 February	67D	*Test analyses have been completed and all booster and capsule test objectives were achieved.*
MA-3	25 April	100D	*Vehicle destroyed after 43 seconds of flight by the Range Safety Officer. Programmed pitch and roll functions failed to occur and Range Safety criteria were violated. Investigations to determine the cause of programmer failure have resulted in changes to the autopilot system of the MA-4 and subsequent boosters.*

Monthly Progress — Project MERCURY

Flight Test Progress

• The MA-4 launch is scheduled for 13 September. The original launch date of 22 August was delayed because of problems which became apparent during final checkout of the capsule Automatic Stabilization and Control System and the booster Flight Control System. (C)

• The flight objectives for the NASA capsule are:

1. Demonstrate the integrity of the capsule structure ablation shield and afterbody shingles for a normal re-entry from orbital flight.

2. Evaluate capsule system performance for an orbital flight.

3. Determine the capsule motions during a normal re-etnry from an orbital flight.

4. Determine the capsule vibration environment during flight.

5. Demonstrate the operation of the ground command control equipment.

6. Evaluate the performance of the equipment and operational procedures used in establishing the launch trajectory, booster cutoff conditions, and the prediction of landing points.

7. Evaluate the ground communications network and communication procedures.

8. Evaluate the performance of the network acquisition aids, the radar tracking system and the associated procedures.

9. Evaluate the telemetry-received system performance and telemetry displays.

10. Evaluate the equipment and procedures used for communications for locating and recovering the capsule for a landing in the Atlantic Ocean along the MERCURY network.

11. Demonstrate the compatibility of the capsule escape system with the MERCURY/ATLAS system.

12. Develop and evaluate MERCURY network countdown and operational procedures. (C)

• The flight objectives for the ATLAS booster are:

1. Determine the ability of the ATLAS to release the capsule at the prescribed free flight insertion conditions defined by the guidance equations.

2. Determine the closed-loop performance of the Abort Sensing and Implementation System.

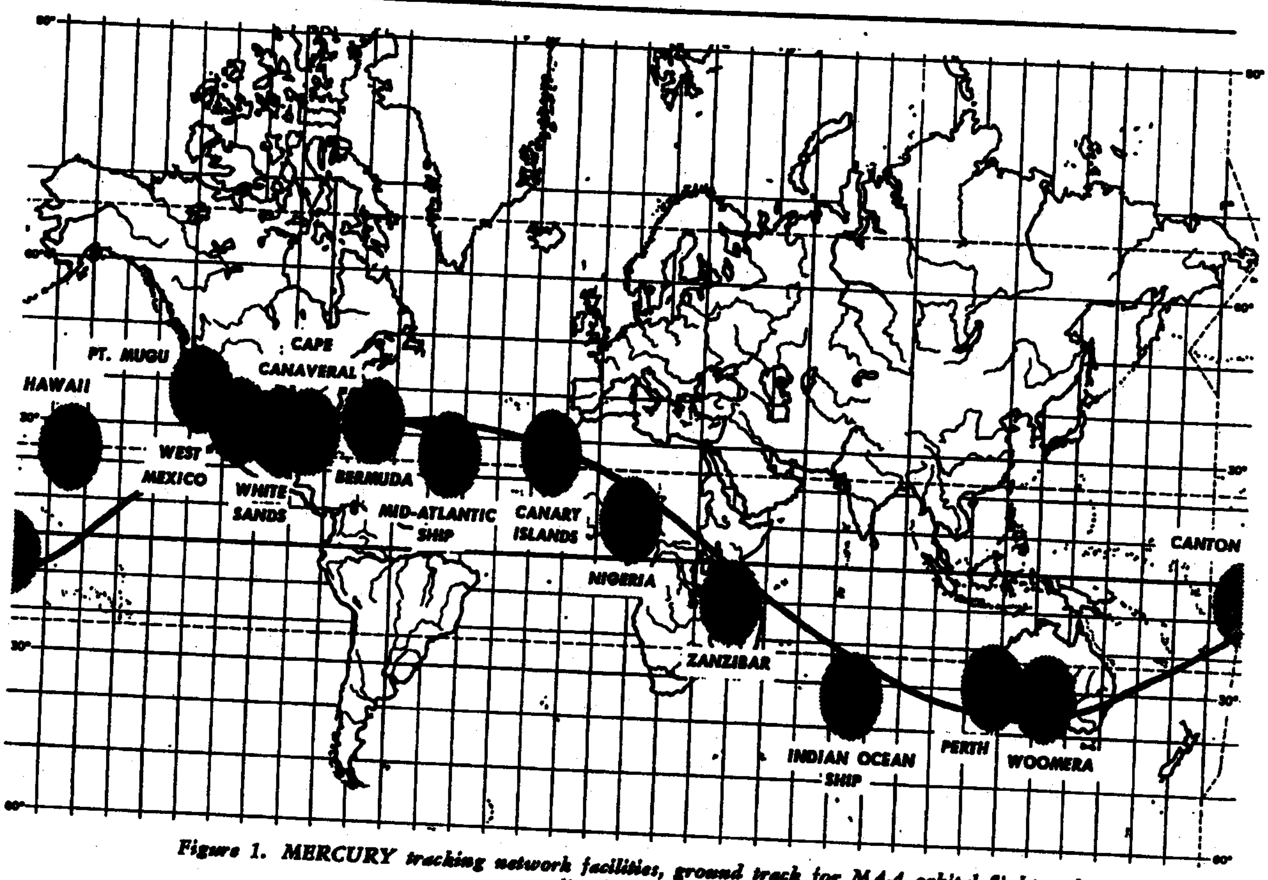


Figure 1. MERCURY tracking network facilities, ground track for MA-4 orbital flight and predicted landing area.

3. Evaluate the aerodynamic load, vibration characteristics, and structural integrity of the ATLAS liquid oxygen boil-off valve, tank dome, capable adapter and associated structures.

4. Determine the magnitude of the sustainer/vernier engine residual thrust after cutoff.

5. Obtain data on the repeatability of the performance of all ATLAS airborne and ground systems.

6. Evaluate the MERCURY/ATLAS vehicle with regard to engine start and potential causes of combustion instability.

This will be a one orbit flight with the flight simulator (a mechanical device which simulates human functions) aboard the capsule. Impact is planned to occur at 32.04° North and 60.42° West with recovery being mandatory. (C)

Technical Progress

• During a routine failure analysis teardown of a MERCURY/ATLAS autopilot at General-Dynamics/Astronautics (G-D/A) on 24 August, loose solder globules were found inside a transistor produced by Transitron Company. Disassembly of additional Transitron transistors revealed a large percentage containing similar discrepancies. A malfunction could occur in any circuit using these defective transistors and a flight failure could result if a digital device such as the "square" autopilot programmer were involved. Because of the mission failure possibility, the MA-4 launch was postponed indefinitely pending resolution of the problem. The MERCURY capsule was removed from ATLAS 88D, which remained erected on Atlantic Missile Range Pad. 14. (C)

• Representatives of Space Systems Division, Ballistic Systems Division and G-D/A met in San Diego and agreed to implement a plan for reworking all ATLAS/MERCURY components by replacing the Transitron transistors with those produced by General Electric. In addition, G-D/A is conducting a laboratory investigation of all types of transistors used in ATLAS boosters to determine if similar discrepancies exist in other types of transistors. (C)

• Because of the MERCURY priority, electronic components for ATLAS 88D are scheduled to be processed through the rework line first. Shipment of critical items is scheduled for completion by 5 September. Capsule mating is scheduled for 1 September and Joint Flight Acceptance Composite Testing is scheduled for 8 September to support the 13 September launch date. (C)

• ATLAS 93D, programmed for the MA-5 flight, will not be delivered to the Atlantic Missile Range until approximately 6 October. Delivery of the

Figure 2. Mating MERCURY Capsule No. 8, which was used on the MA-3 launch, with ATLAS 88D.

booster has been delayed to permit all modifications incorporated in ATLAS 88D to be made while ATLAS 93D is still in the factory. Delivery will be controlled through the Factory Roll-Out Inspection, a phase of the overall MERCURY Pilot Safety Program. The goal of the Factory Roll-Out Inspection is to insure that all "fly-away systems" modified to meet latest specifications are factory installed and operate properly during an entire system composite test prior to acceptance. (C)

- Because of a recent ATLAS failure attributed to rough combustion and the recommendations resulting from the baffled injector development program, the NASA Space Task Group has finally decided that future MERCURY boosters will use the modified rocket engine. The modification consists of changing the two booster engine injectors and adding the hypergolic start system. The engine production effectivity is such that the change will be incorporated in the engines scheduled for installation in MA-14. Modification kits will be procured for the rocket engines scheduled for installation in the MA-9 through MA-13 boosters. Modification of the MA-5 and MA-6 booster engines is being considered. (C)

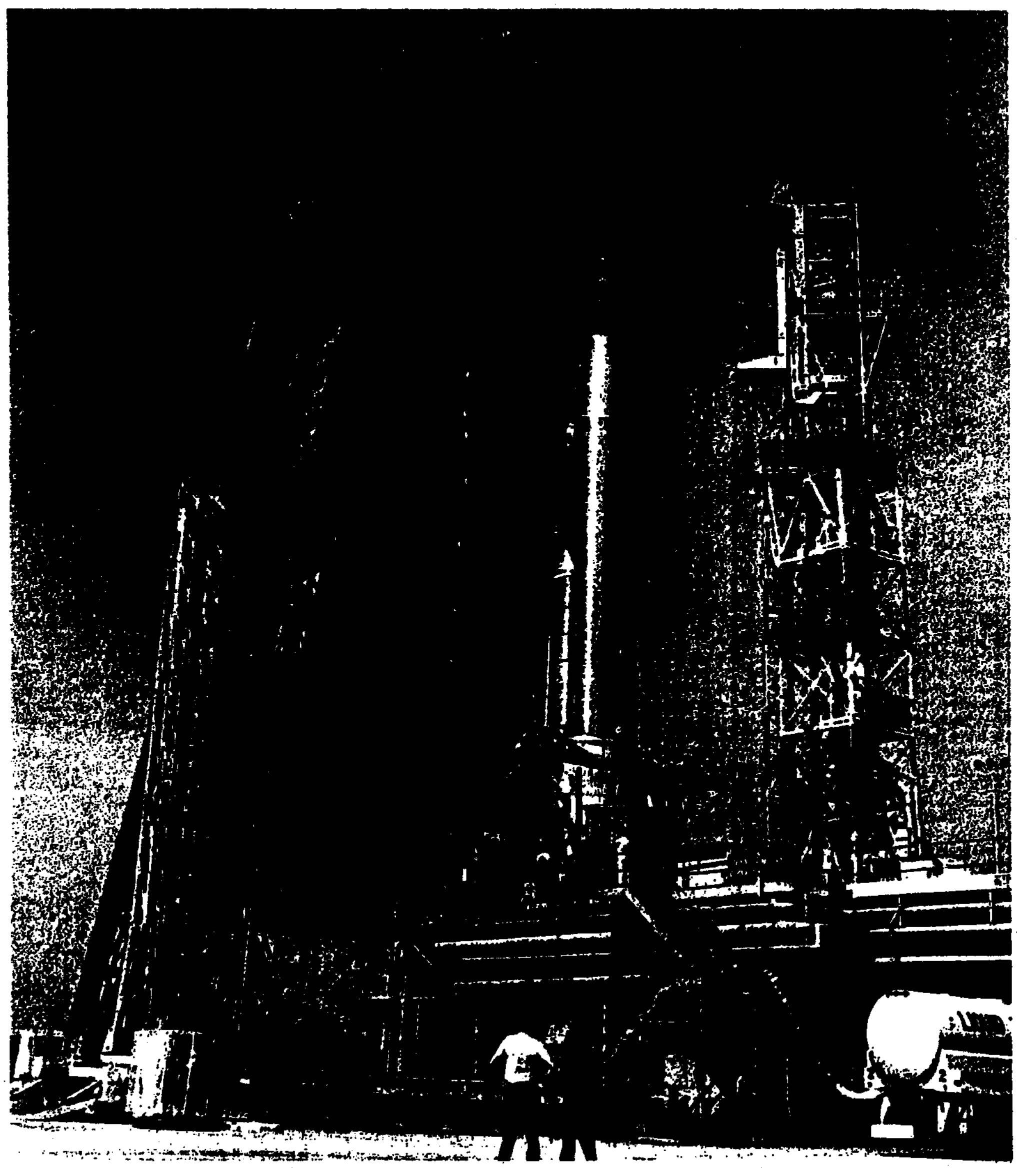
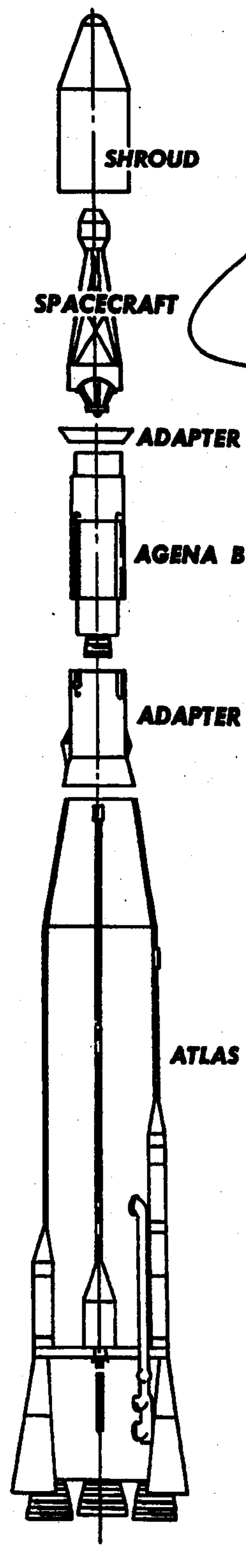
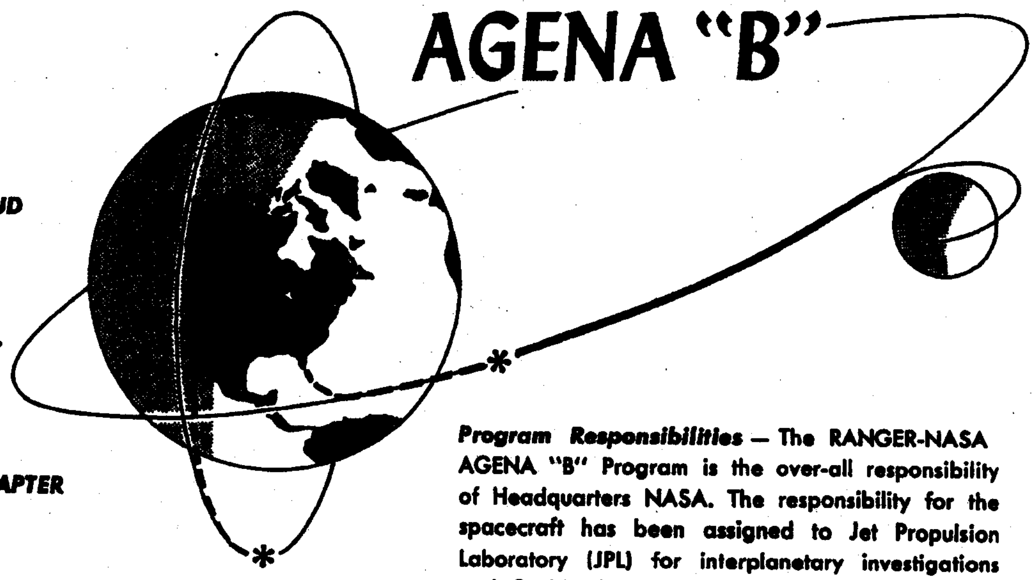


Figure 3. The MA-4 vehicle on Atlantic Missile Range Pad 14 prior to its successful launch on 13 September. ATLAS 88D is the first "thin skinned" booster to be sent through a factory modification program to convert it to the "thick skin" configuration.

RANGER – NASA AGENA "B"





RANGER vehicle showing ATLAS, AGENA B, and Spacecraft. Represented above are the lunar and earth satellite flights. The dotted line indicates Space Systems Division responsibility and the "" indicates the spacecraft injection point.*

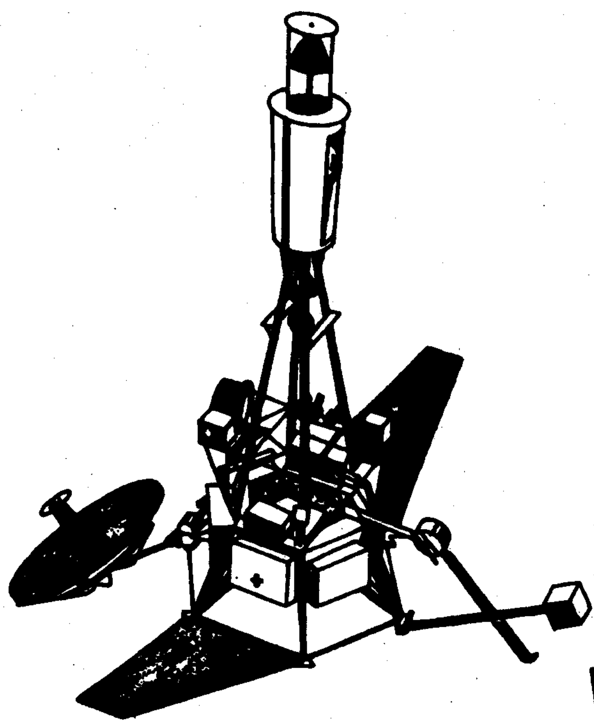
Program Responsibilities – The RANGER-NASA AGENA "B" Program is the over-all responsibility of Headquarters NASA. The responsibility for the spacecraft has been assigned to Jet Propulsion Laboratory (JPL) for interplanetary investigations and Goddard Space Flight Center (GSFC) for the earth satellite programs. The booster system was delegated to Marshall Space Flight Center (MSFC) who in turn assigned Space Systems Division the responsibility and authority for the over-all accomplishment of the booster program.

Under NASA Order No. S4601-G the Air Force is supporting the NASA AGENA "B" Program. This will permit NASA to take full advantage of the technical and operational background and experience developed by the Air Force in space booster projects; permit contractors to discharge their contractual obligations with NASA and USAF utilizing already established management relationships, insofar as practicable; and provide NASA the benefits of contract administration services and procedures already established for USAF programs employing the same basic vehicles as those scheduled for this program.

The ATLAS and THOR first stage boosters were allocated to NASA for the missions planned through 1964. Contractual action was initiated with General Electric (GE) and Bell Telephone Laboratories (BTL) for the guidance systems necessary for the respective boosters.

Letter contract AF 04(647)-592 was awarded to Lockheed Missiles and Space Division (LMSD) for procurement of nine AGENA "B" second stage boosters. This contract also includes modification to Stand 12 at AMR: conversion of the Polaris static test stand at Santa Cruz Test Base; and procurement of Aerospace Ground Equipment to checkout, handle. and launch the AGENA "B" booster.

RANGER Program



Lunar Test Missions

The RANGER Program is a series of five deep space probes to be launched from the Atlantic Missile Range (AMR) on the ATLAS/AGENA B booster system. Jet Propulsion Laboratory (JPL) under contract from the National Aeronautics and Space Administration (NASA) is responsible for the missions and providing the spacecraft hardware. The mission of the first two RANGER launches will be an interplanetary investigation in support of the follow-on lunar impact mission. The orbit will be highly elliptical (near escape velocity) and have an apogee of approximately 625,000 nautical miles. The space craft is planned for one orbit with approximately a 50 day period.

Lunar Impact Missions

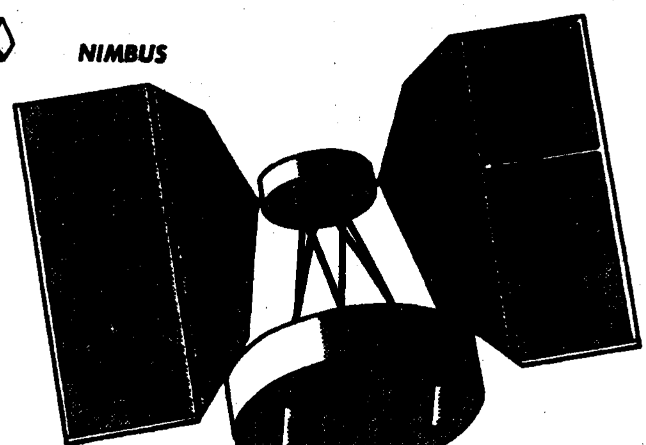
The remaining three launches will impact the surface of the moon and transmit scientific information back to the earth. Experiments are designed to measure seismographic disturbances, temperature changes and impact acceleration. These Ranger spacecrafts will also have the capability of accomplishing a mid-course maneuver to correct for minor errors in the trajectory.

The ATLAS/AGENA "B" booster system will include the standard ATLAS "D" first stage booster with GE Mod III G guidance system. The second stage will be a modified AGENA B second stage booster similar to those used in several Air Force space programs. The only major change to be incorporated for these missions is the capability to separate the RANGER spacecraft and fire a retro rocket to prevent the AGENA "B" from hitting the moon. Lunar impact of the AGENA "B" is not desired due to its unsterile condition.

The RANGER Program will be the initial launch by NASA of the Air Force developed AGENA "B" second stage. Maximum effort is being given toward using the same components that have been flown on Air Force missions.

Scientific Satellite Program

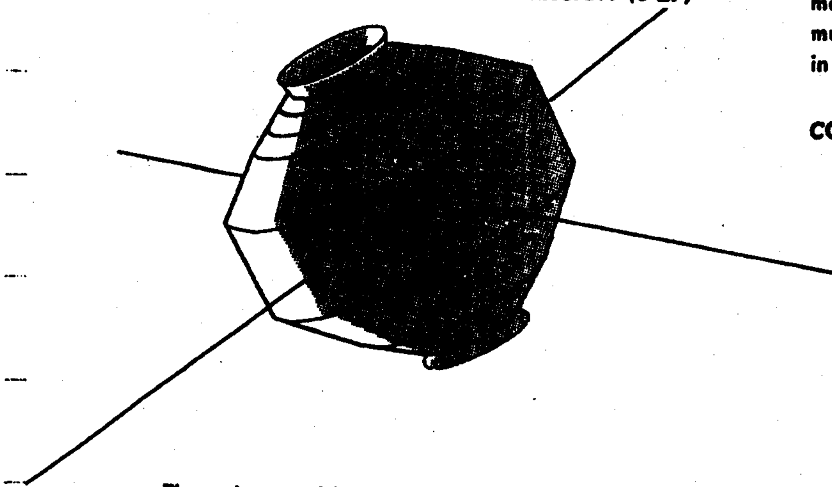
NIMBUS



NIMBUS is a 650 pound earth oriented stabilized satellite to be placed in a "high noon" circular orbit at 600 miles altitude. This satellite is intended to serve as a platform for experiments designed to explore the meteorological process of the earth's atmosphere. Experiments include full picture coverage of the clouds over the entire earth, electromagnetic radiation maps of the earth, and the atmosphere around the earth and other experiments to determine the effect of the sun on the atmosphere.

A total of five NIMBUS satellites will be put into orbit by the THOR/AGENA B booster from Vandenberg Air Force Base. The first launch is scheduled for June 1962 with subsequent launches every six months. The booster system will be the same as used on Topside Sounder and the Communication Satellite with slight modification to accept the larger payload.

TOPSIDE SOUNDER SATELLITE MISSION (S-27)

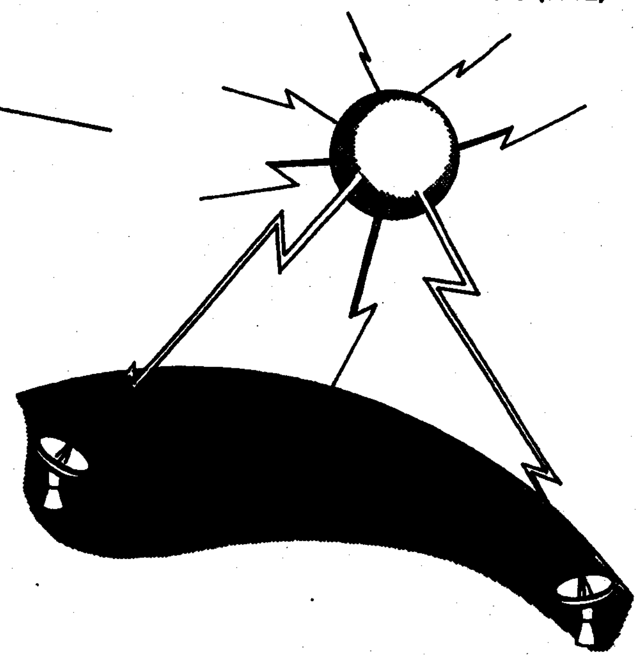


The primary objective of the S-27 Satellite is the examination of the structure of the ionosphere from above in a manner similar to that now being done by ground-based ionospheric sounders. In particular the objective is to obtain information about the ionosphere in the region above the F layer maximum. Other objectives are to measure the cosmic noise level and determine the plasma frequency at the altitude of the satellite.

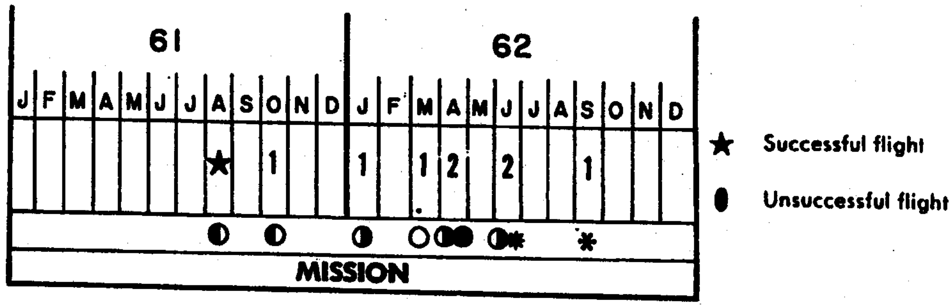
The Topside Sounder (S-27) will be launched on board a THOR/AGENA "B" booster system from Vandenberg Air Force Base into a 540 n.m. circular orbit. This will be the first Pacific Missile Range launch in this program; however, it will be similar to previous Air Force THOR/AGENA B launches from Vandenberg Air Force Base.

The THOR/AGENA "B" booster system will be composed of the standard DM-21 THOR booster with Bell Telephone Laboratory guidance systems and AGENA "B" second stage similar to the one used in the RANGER launches from Atlantic Missile Range. Minor modifications will be made to the AGENA to make it compatible to the mission; however, maximum use will be made of the experience developed in the RANGER Program.

COMMUNICATION SATELLITE MISSION (A-12)



The primary objective of Project Echo A-12 is the demonstration of a spacecraft deployment and rigidization technique applicable to passive communications satellites. Development of the space craft will be undertaken by the Langley Research Center. The Communication Satellite (A-12) will be launched into a 650 n.m. orbit aboard the THOR/AGENA "B" booster. The shroud which surrounds and protects the Communication Satellite will be the same general shape as the S-27 except the length is reduced to accommodate the shorter space craft.



LEGEND

◐ LUNAR TEST VEHICLE (ATLAS)
◑ LUNAR IMPACT (ATLAS)
○ SCIENTIFIC SATELLITE (THOR)
● COMMUNICATION SATELLITE (THOR)
✱ METEOROLOGICAL SATELLITE (THOR)
✱ BACKUP VEHICLE (THOR)

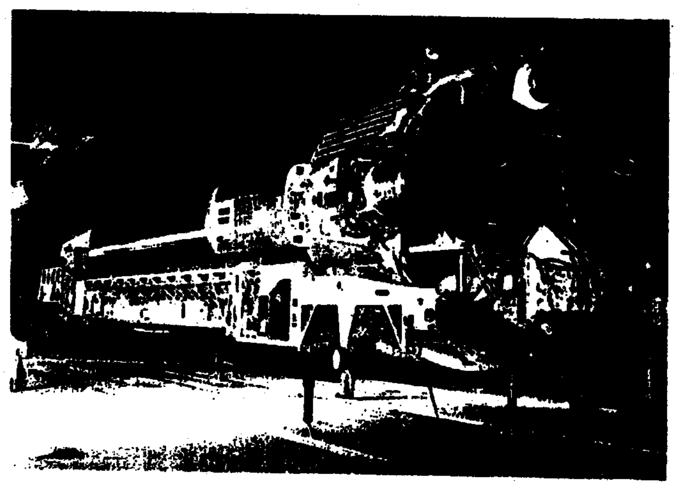
Note: Lunar flights will be launched from the Atlantic Missile Range; all others will be made from Vandenberg Air Force Base.

Flight	First Stage Booster	AGENA No.	Launch Date	Remarks
RA-1	111D	6001	23 August	*ATLAS performance and AGENA performance during first burn was nominal. Ignition of the AGENA engine for the second burn was not obtained. Commands were transmitted to the spacecraft and telemetry from the spacecraft confirmed that all experiments were functioning.*

Monthly Progress — RANGER

Program Administration

• During August the RANGER Program was expanded to a total of 24 launches through 1963. Actions have been initiated to obtain the required first stage boosters, and to ammend the Lockheed contract to provide for additional AGENA B vehicles and booster/spacecraft integration efforts. The program now consists of 9 RANGER Lunar Probes, 3 NIMBUS meteorological satellites, 2 APOLLO reentry missions, 2 Geophysical Observatories on eccentrical orbits, 2 active communications satellites, 2 rebound passive communications satellites, 1 ECHO passive communications satellite, 2 S-27 ionosphere sounders, and 1 orbiting astronomical observatory. Information on pages L-1 through L-4 of this report will be revised in accordance with these changes for the September report. (C)



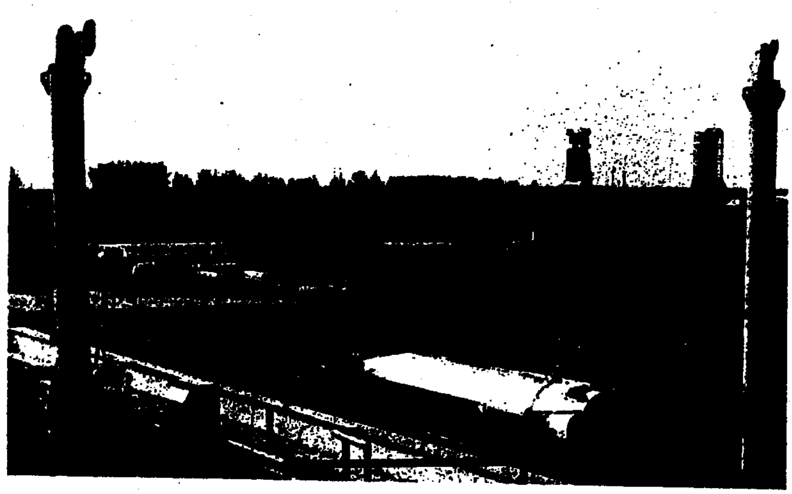


Figure 1. Acceptance checks, top, of the ATLAS 111D booster which was scheduled for the RANGER I flight. Unloading ATLAS 111D at the Atlantic Missile Range on 26 May. Transporting the RA-1 booster to the Launch Stand 12. In the right background is the ganiry for Stand 36A.

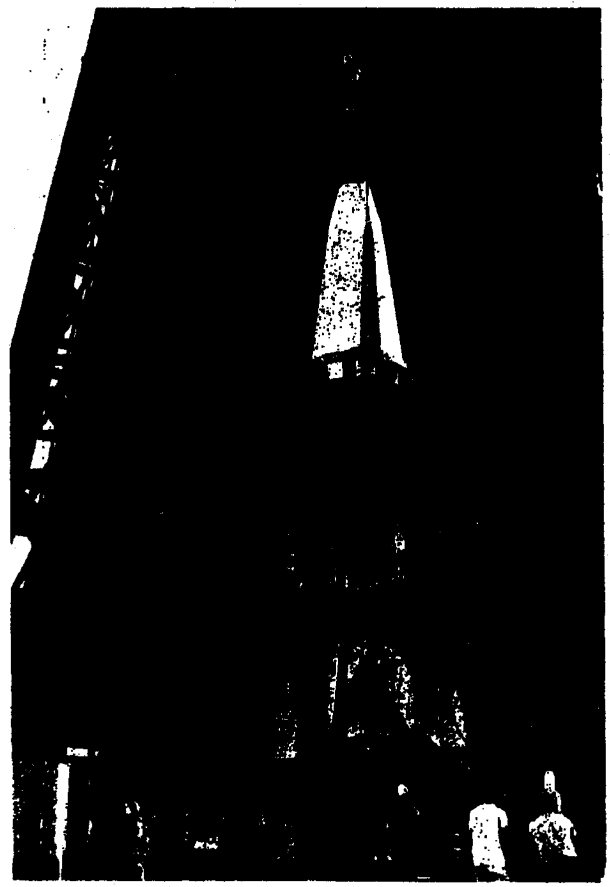


Figure 2. Checking out the RANGER I payload. The omni antenna is on the top, below it the magnetometer; the white cylinder in the center is the Lyman Alpha telescope and the unit in front of the technicians' knee houses the earth sensor and high gain antenna drive motor. Lifting the payload and payload shroud prior to mating on AGENA 6001 and ATLAS 111D. Monitoring the check-out panels during the Joint Flight Acceptance Test (J-FACT). Launch of Ranger I, opposite, on 23 August.

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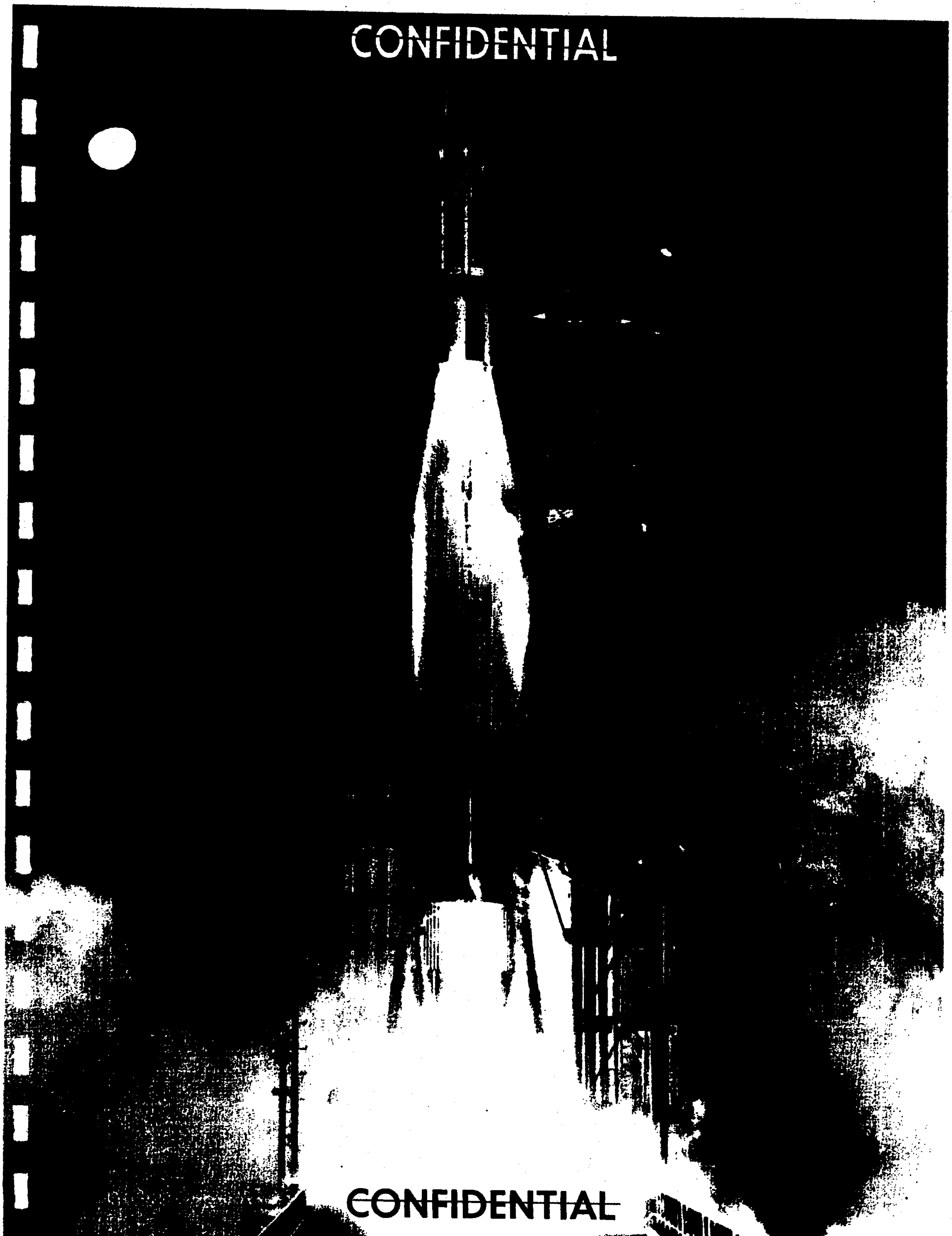

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Flight Test Progress

• RA-1, the first RANGER Lunar Probe vehicle, was launched from Atlantic Missile Range Complex 12 at 0504 hours, EST, on 23 August. Liftoff and ATLAS booster performance was nominal, with no discrepancies being experienced. Separation of the spacecraft shroud, and of the AGENA vehicle from the ATLAS booster, occurred satisfactorily and as planned. At the completion of its first burn period, the AGENA was in its prescribed circular "parking" orbit at an altitude of 100 nautical miles. Ignition of the AGENA engine for the second burn period was not obtained. The second ignition had been programmed to occur at a specific point in the "parking" orbit which would start the vehicle and RANGER spacecraft on a highly elliptical earth orbit, with a "near escape" apogee of approximately 750,000 miles. (U)

• Telemetry data show normal performance for 1,284 seconds of flight, followed by a malfunction of the AGENA engine during the start sequence for the second burn phase. In spite of the malfunction, the spacecraft separated from the AGENA vehicle and remained in orbit for several days. During this time commands were transmitted to the spacecraft and telemetry from the spacecraft confirmed that all experiments were functioning. However, because of the low orbit, the magnitude of technical data obtained was less than had been expected. (U)

• Evaluation of flight test data indicate that the following test objectives were accomplished successfully:

a. Compatibility of ATLAS/AGENA/RANGER spacecraft configuration.

b. ATLAS capability to boost AGENA B into predetermined coast ellipse as defined by the guidance equations.

c. Shroud separation within tip-off limits defined by spacecraft envelope.

d. Spacecraft separation within limits defined by the capability of the spacecraft attitude control system.

e. Retrorocket capability to maneuver AGENA (to prevent lunar impact). (C)

Technical Progress

• Progress toward launch of the second RANGER Lunar Probe (RA-2) on 22 October is on schedule. The ATLAS booster and the AGENA B second stage will be shipped to the Atlantic Missile Range early in September. No design changes are planned to either booster or spacecraft systems as a result of the RA-1 flight. (C)

Facilities

• Final plans for modification of Vandenberg Air Force Base Complex 75-1 in accordance with RANGER Program launch requirements were given to the Army Corps of Engineers on 14 August. Advertising for bids was delayed because NASA funds for this construction project are not expected to be made available until late in September. (U)

Figure 3. Topside Sounder (S-27) during mating to AGENA forward section for spin table checks. This payload will be launched from Vandenberg Air Force Base early in 1962.

A. THIRD STAGE—X-248 (Allegany Ballistic Lab.)

Thrust at altitude	3150 pounds
Specific impulse (vac)	250 seconds
Total impulse	116,400 lbs/sec
Burning Time	37.5 seconds
Propellant	Solid

B. SECOND STAGE—AJ10-42 (Aerojet-General)

Thrust at altitude	7700 pounds
Specific impulse (vac)	271 seconds
Total impulse (min)	870,000 lbs/sec
Burning time	115 seconds
Propellant	Liquid

C. FIRST STAGE—THOR IRBM

Thrust (s. l.)	151,500 pounds
Specific impulse (s. l.)	248 seconds
Specific impulse (vac)	287 seconds
Burning time	158 seconds
Propellant	Liquid

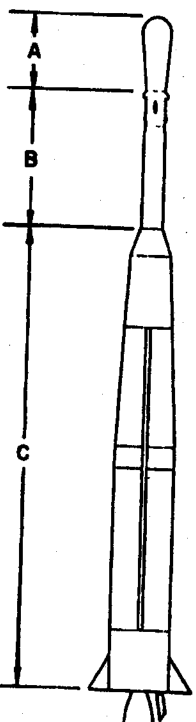
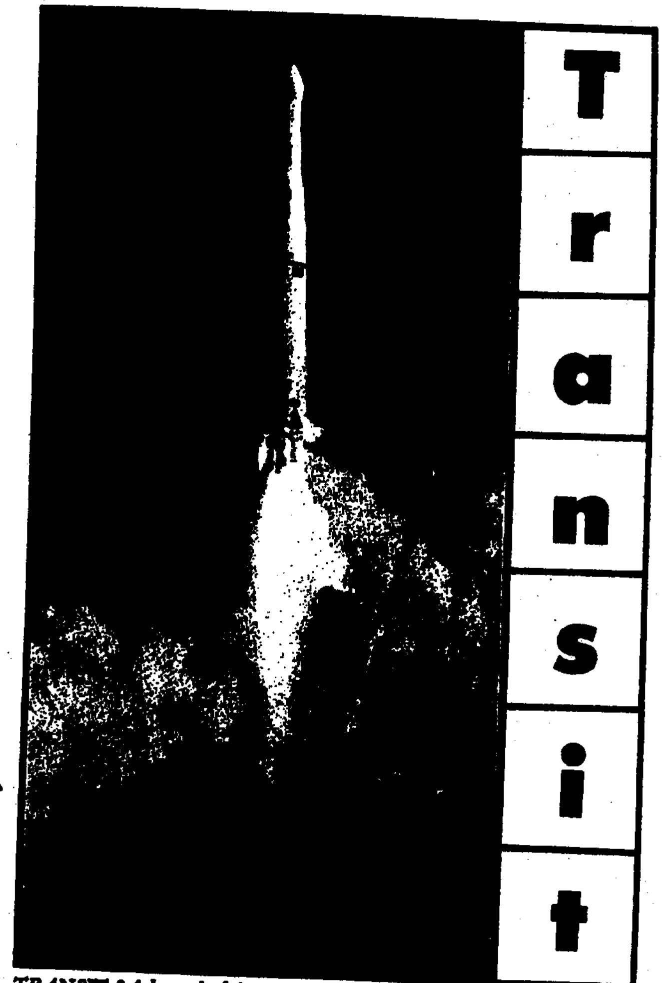


Figure 1. TRANSIT 1A three stage flight vehicle.



TRANSIT 3A launched from Atlantic Missile Range

The TRANSIT Program consists of the flight testing of eight vehicles to place 200-350-pound satellite payloads into circular orbits of 400 to 500 nautical miles. The program is designed to provide extremely accurate, world-wide, all-weather navigational information for use by aircraft, surface and subsurface vessels, particularly in relation to POLARIS missile firings. The ARPA Order for TRANSIT 1A was initiated in September 1958 and amended in April 1959 to add TRANSIT 1B, 2A and 2B flights. The TRANSIT 3A and 3B flights were initiated by a Navy MIPR, dated 18 May 1960. Because of the successful TRANSIT 2A launch and excellent payload performance the Navy elected to launch TRANSIT 3A rather than 2B. TRANSIT 2B was scheduled to carry the same type payload as was carried on the 2A flight. Subsequently, the Navy initiated requests for TRANSIT 4A, 4B, 5A and 5B.

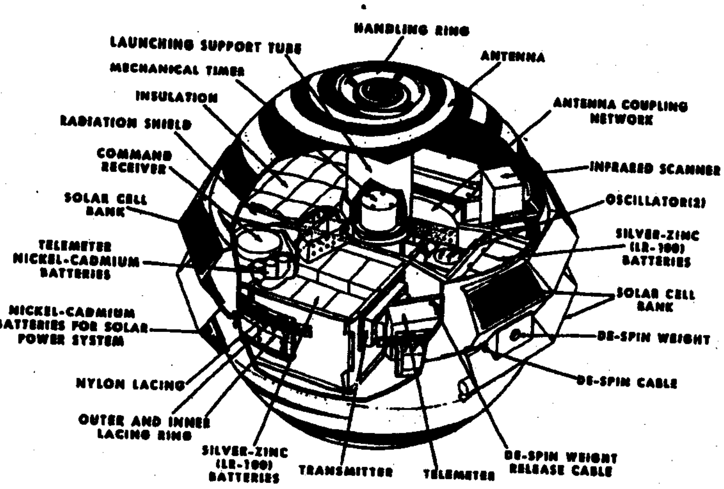
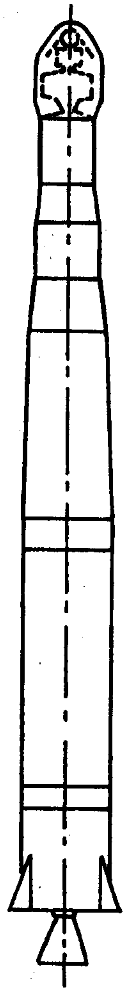


Figure 2. Cut-away drawing of TRANSIT 1A payload (NAV 1).

The program was originally authorized by ARPA Order No. 97-60, which assigned AFBMD responsibility for providing the booster vehicles, integrating payloads to the vehicles, and flight operations from launch through attainment of orbit. The TRANSIT project was transferred to the Navy on 9 May 1960. The Navy has now assumed both the administrative and technical responsibility for the TRANSIT program. Payload tracking responsibility has been assigned to the USN Bureau of Weapons. Applied Physics Laboratory is the payload contractor.



SECOND STAGE — ABLESTAR (AJ10-104)

Thrust (vacuum)	7900 pounds
Specific impulse (vacuum)	277 seconds
Burning time	296 seconds
Propellant	IRFNA UDMH

FIRST STAGE — THOR IRBM

Thrust (sea level)	152,000 pounds
Specific impulse (sea level)	247 seconds
Burning time	163 seconds
Propellant	Liquid Oxygen RP-1

Figure 3. Two stage vehicle used for TRANSIT 1B and subsequent flights.

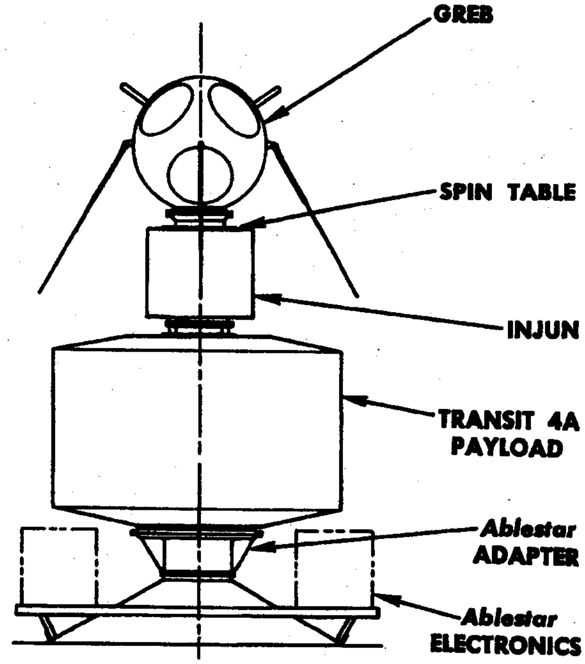


Figure 4. Payload arrangement for TRANSIT 4A flight.

Program Objectives

1. Provide accurate navigational reference information for POLARIS launches.
2. Precise determination of satellite position by measuring the doppler shift of satellite transmitted radio signals.
3. Investigate the refractive effect of the ionosphere on radio transmissions.
4. Acquire additional geodetic and geographical data by precision tracking of the orbiting satellite.

Flight Vehicles TRANSIT 1A was a three stage vehicle as shown in Figure 1. TRANSIT 1B and subsequent vehicles are two stage vehicles as shown in Figure 3.

Launch Plans All vehicles will be launched from Complex 17 at the Atlantic Missile Range. Launch azimuth will vary between 45.5° and 140° for each flight.

Payload Description The TRANSIT 4A payload is shown in Figure 4. The payload consists of three separate assemblies and has a total weight of 300 pounds. The TRANSIT payload (175 lbs) is the next step in the Navy Program to develop an operational navigation system. The payload is a short cylindrical shape as opposed to the spherical shape of all the previous payloads. The new shape is close to that which is proposed for the operational system payloads. The TRANSIT 4A payload is the first satellite to contain a Radioactive Isotope Power Supply (a SNAP Power Supply). This radioactive supply provides power for the operation of several satellite systems. The second satellite, the INJUN payload, (40 lbs) is under the cognizance of Dr. Van Allen of the State University of Iowa. It will perform radiation measurements. The third satellite (55 lbs) is a Naval Research Laboratory GREB with detectors to study solar emissions. There is also 30 pounds of interconnecting structure consisting of a spin table to spin the GREB, springs to separate the payloads, and supporting brackets for the launch phase.

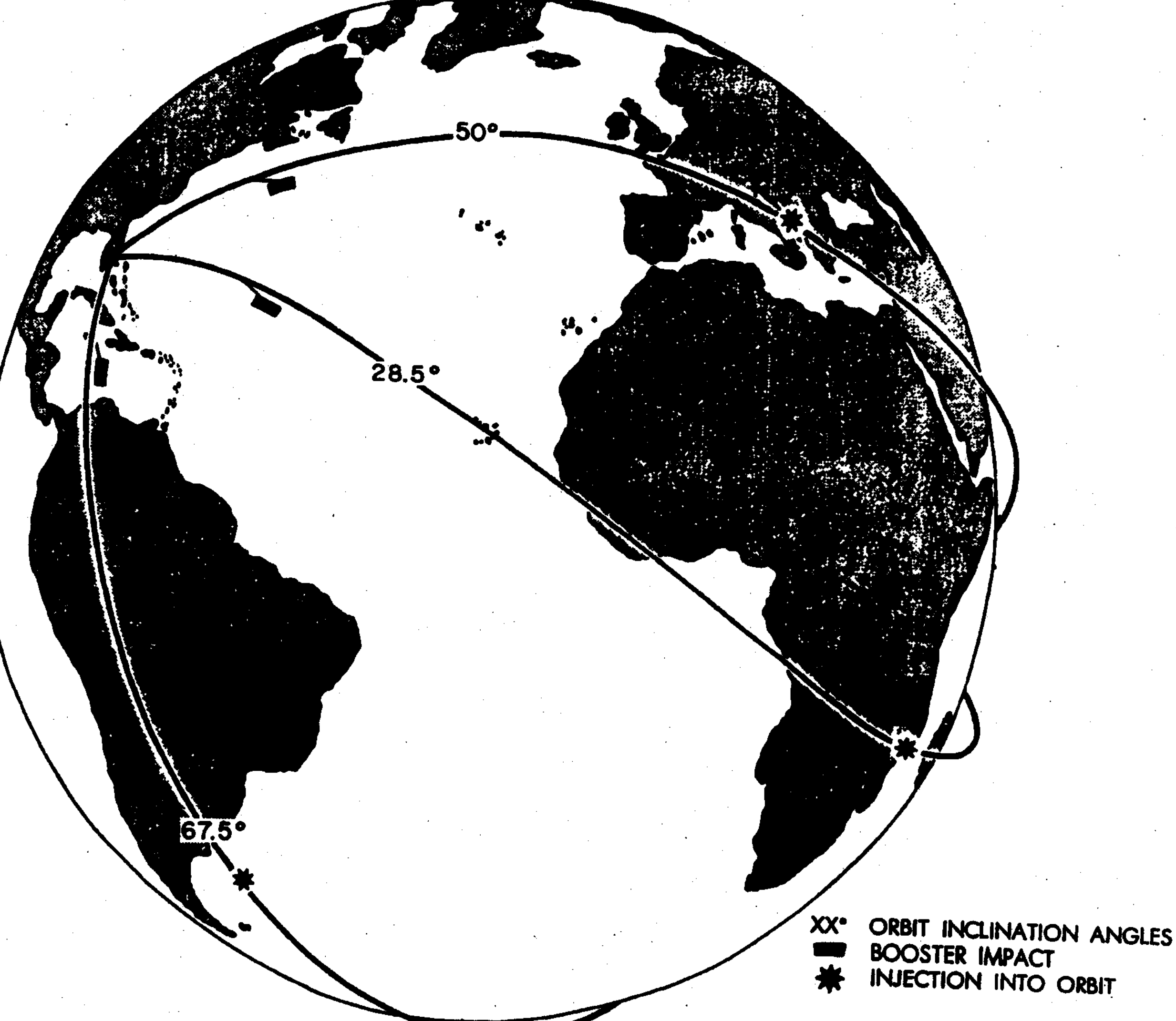
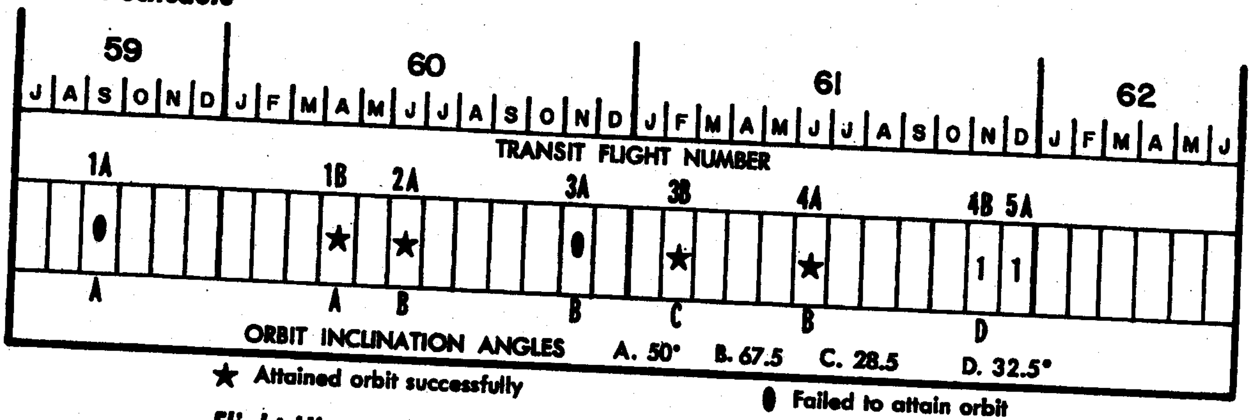


Figure 5. Typical TRANSIT launch trajectories showing flight path, booster impact areas, and orbital injection points.

Orbital Performance Achievement of program objectives is based primarily on measuring the doppler shift of satellite transmitted radio signals. During the first three months of flight, the four transmitters will be operated to obtain experimental confirmation of the theoretical mathematical relationship between the frequency and the refractive index of the ionosphere. Studies have shown that refraction effects on the doppler shift can be eliminated by using the transmission from two satellites. After four months of tracking the satellite by measuring the doppler shift of the satellite radio signal, the exact position of the satellite at any point in the orbit should be known. Using known orbital positions, ships and aircraft can then use satellite signals to make analogous computations to establish accurate position.

Ground Support and Tracking Stations The Navy Bureau of Weapons payload contractor provides a system of payload tracking stations which obtain information for precise orbit determination. These stations are located in Maryland, Texas, New Mexico, Newfoundland and Brazil. First and second stage tracking and telemetry, and second stage guidance will be provided by the facilities of the Atlantic Missile Range. A mobile downrange tracking station at Punta Arenas, Chile, will receive telemetry data and tracking information during the last portion of the second stage Ablestar coast, re-ignition and second burn, payload spin-up and payload injection periods. This station was located in Erding, Germany, for the TRANSIT 1B flight, Punta Arenas, Chile, for the TRANSIT 2A and 3A and Pretoria, Union of South Africa for TRANSIT 3B.

Launch Schedule



Flight History

TRANSIT No.	Launch Date	Thor No.	Ablestar No.	Remarks
1A	*17 September*	*136*	—	*The three-stage vehicle was launched from Stand 17A at the Atlantic Missile Range. The payload was not injected into orbit, because the third stage motor failed to ignite.*
1B	*13 April*	*257*	*002*	*The Thor Ablestar boosted satellite was launched from Stand 17B at AMR. The satellite was placed into orbit. The Ablestar second stage (on its first flight test) fired, shut off, coasted, and then restarted in space.*
2A	*22 June*	*281*	*003*	*A dual payload, consisting of TRANSIT 2A plus GREB (which studied solar emissions), was placed in orbit by the Thor Ablestar vehicle. A propellant slosh problem, discovered in the second stage, has been corrected.*
3A	*30 November*	*283*	*006*	*TRANSIT 3A failed to achieve orbit when the first stage Thor shut down prematurely, after a failure in the main engine cutoff circuitry. Staging occurred and the second stage performed nominally until it was cut off and destroyed by Range Safety.*
3B	*21 February*	*313*	*007*	*TRANSIT 3B was launched with only partial success. The Ablestar stage failed to restart in space and the payloads did not separate. Although no definite cause has yet been determined, the counting device in the Ablestar programmer is considered the most probable cause of malfunction.*
4A	*28 June*	*315*	*008*	*TRANSIT 4A was launched, with great success, into an orbit with a perigee of approximately 460 n.m. and an apogee of approximately 540 n.m. The payload consists of three separate satellites: the TRANSIT 4A, containing the first radioactive power supply to be used in space; INJUN, which studies radiation in the lower Van Allen and auroral zones; and GREB, which studies solar X-Ray emissions.*

Monthly Progress — TRANSIT

Flight Test Progress

- At the request of the Navy, the orbital inclination angle for TRANSIT 4B has been changed from 28.5° to 32.5°. The new launch azimuth of approximately 107° shortens the vehicle path across Africa which results in a lower total probability of land impact. Because of the increased payload weight and the new orbit inclination, Space Systems Division is currently conducting an investigation to determine if it is possible to attain the 600 n.m. circular orbit required by the Navy. (C)

- Because of extremely heavy Atlantic Missile Range stand loading during November and December, TRANSIT 4B can slip only two days before affecting other NASA and Space Systems Division misisons. A delay of more than two days will affect the Composit I launch scheduled for 12 December. TRANSIT 4B is currently on schedule. (C)

Technical Progress

- Analysis of tracking data revealed that Ablestar vehicle 008, which injected the TRANSIT 4A payloads into a highly successful orbit, broke up at approximately 0608Z on 29 June. Space Systems Division has initiated a study to determine the possible causes of this in-orbit fragmentation. One Ablestar modification resulting from the study is the venting of the unsymmetrical dimethyl hydrazine (fuel) tank. This will prevent mixing and combustion of the propellants should the tank leak or be punctured. (U)

- Checkout and installation of the Bell Telephone Laboratories guidance equipment in the Ablestar second stage is proceeding on schedule. TRANSIT 4B will be the first Ablestar to use this system. (C)

SPACE
BOOSTERS

EXISTING OR PROGRAMMED STAGES

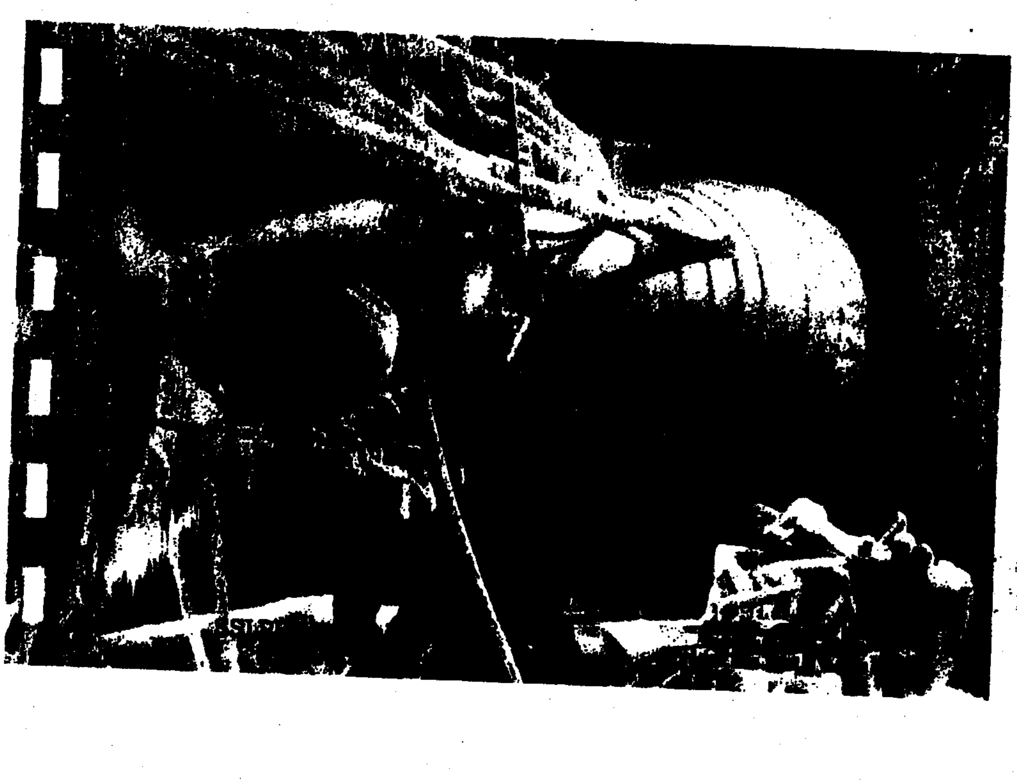
SECRET

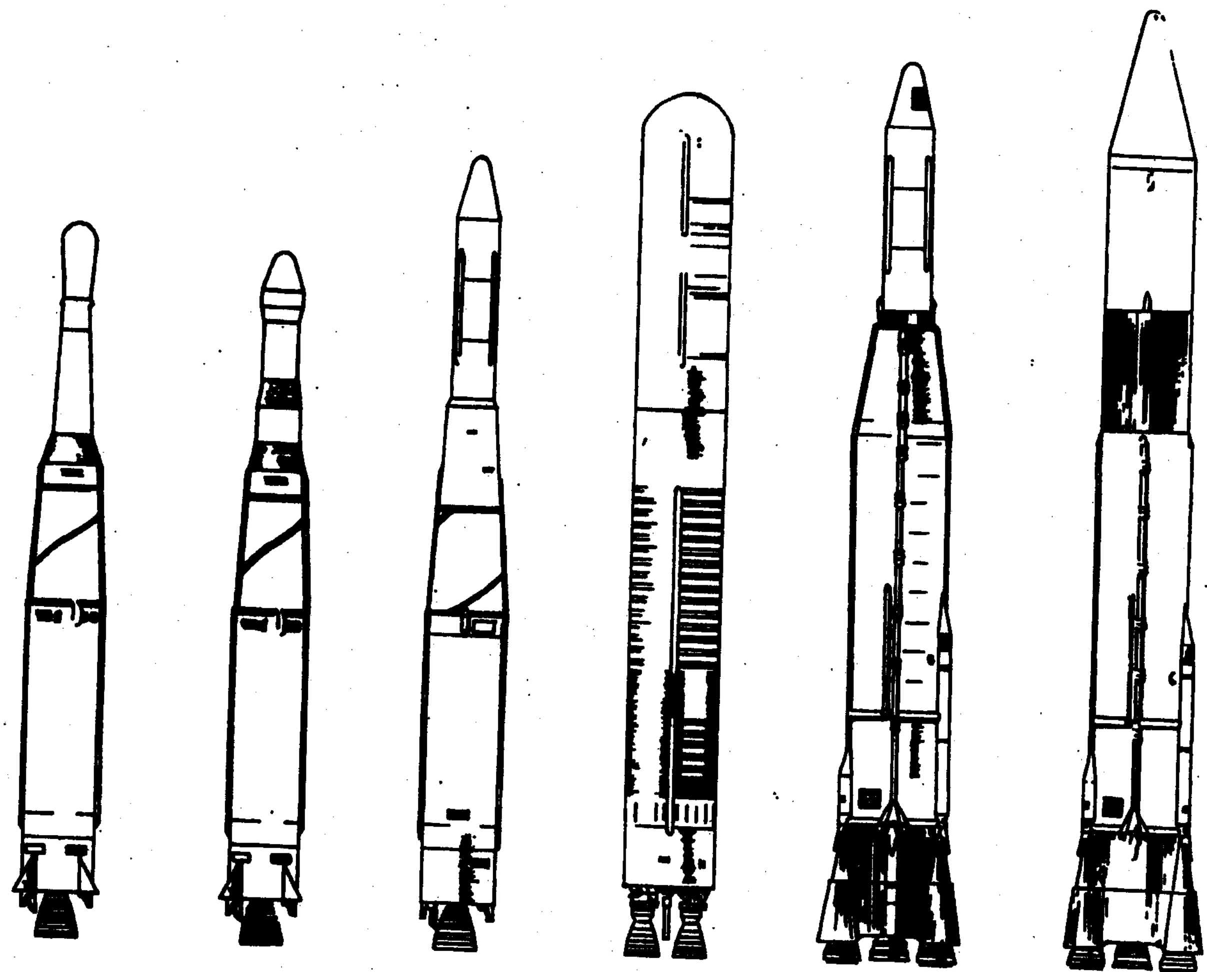
Space Program BOOSTERS

● The primary pacing factor in the accomplishment of space missions has been, and for some time will continue to be, the availability of Air Force ballistic missiles and upper stages to boost the payload vehicle. Space flight planning requires close examination of all technological areas wherein advances provide increases in booster and mission capability. This, in turn, has required that space schedules be sufficiently flexible to incorporate rapidly those advances in the state-of-the-art which increase the potential for reliable and predictable space research.

● Because of the wide range of its activities, The Air Force Space Systems Division has accumulated a broad base of experience in booster selection for space missions. Experience in ballistic missile R&D programs and in development of upper stage vehicles have provided much information. Research programs in the propellant and materials areas also are providing new capability for space research. The number and variety of boosters available permit the selection of a combination of stages tailored to provide specific capabilities for specific missions.

● The following pages describe briefly the booster vehicles currently being used by The Air Force Space Systems Division to support military and civilian space programs. Nominal performance data is given to permit nominal comparisons of vehicle capabilities. Specific qualifications are made where necessary for clarity.





DM-19/AJ10-118/ ABL X248-A5 | DM-21/Ablestar | DM-21/AGENA B | TITAN II | ATLAS D/AGENA B | ATLAS D/CENTAUR

Program Vehicle Combinations

Program			
ABLE—1, —3 and —4	A	M	R
ABLE—4 and—5	E –	M	R
ADVENT (Phase One)		E	K
ADVENT (Phase Two)		E	P
ADVENT (Phase Three)		E	Q
ANNA		D	N
BAMBI		E	P
COURIER		D	N

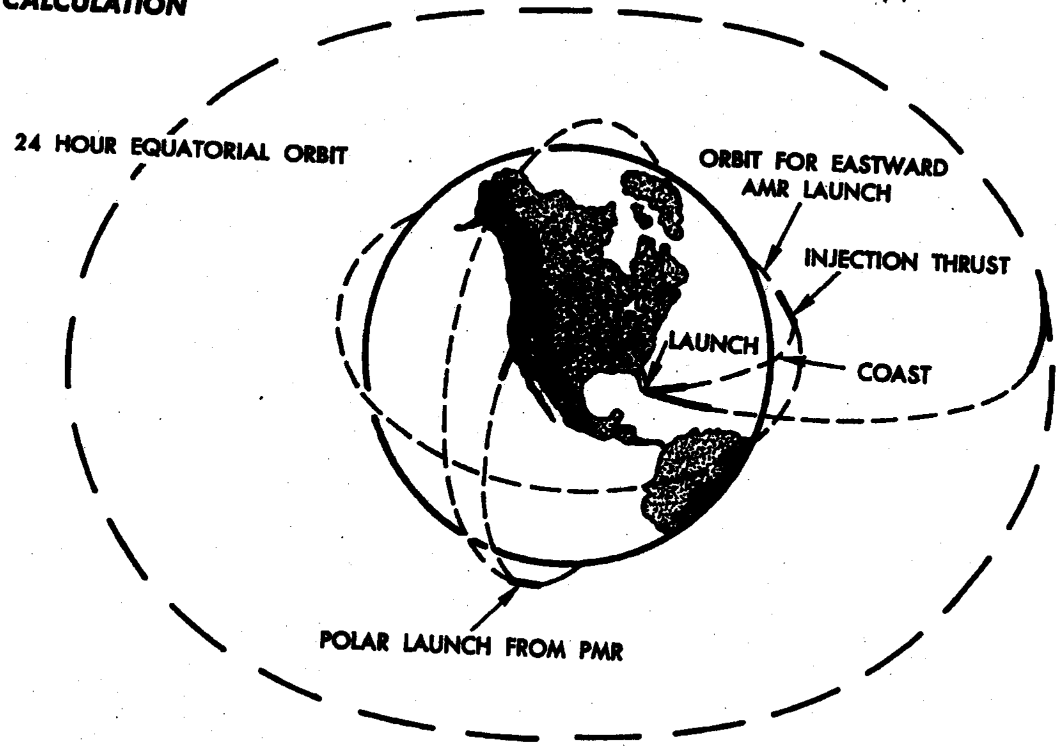
Program			
DISCOVERER (1 thru 15)	A		H
DISCOVERER (16 thru 19)	C		J
DISCOVERER (20 and subs)	C		K
DYNA SOAR	F		G
MERCURY			E
MIDAS (I and II)		E	H
MIDAS (III and subs)		E	K

Program			
NASA AGENA "B"		E	K
		C	K
NASA Delta	B	L	R
SAINT		E	K
TIROS	B	L	R
TRANSIT 1A	A	L	R
TRANSIT 1B thru 5B		D	N
VELA HOTEL		E	K

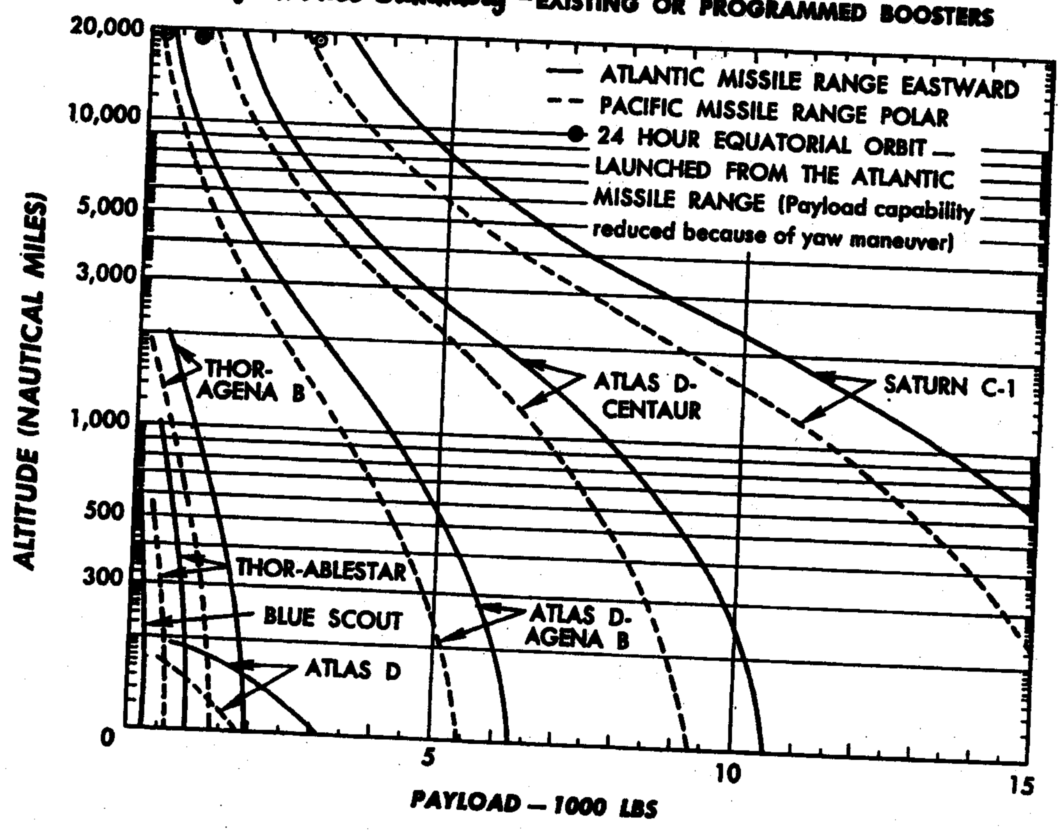
NOTE: Light type indicates completed programs Bold type indicates active programs

CONFIDENTIAL

LAUNCH CAPABILITIES CALCULATION



Performance Summary—EXISTING OR PROGRAMMED BOOSTERS



Specifications

BOOSTERS

THOR — Douglas Aircraft Company

	A DM-18	B DM-19	C DM-21	D DM-21A
Weight — dry				
Fuel — RP-1/RJ-1*	7,846	7,204	6,590	6,870
Oxidizer — Liquid Oxygen	31,500	31,500	33,500*	31,500
Total	68,000	68,000	68,000	68,000
Height — feet	107,346	106,704	108,090	106,370
Engine — Rocketdyne Division of North American Aviation	61.3	65.1	55.9	60.4
Thrust — lbs. (sea level)	MB-3 Block I	MB-3 Block I	MB-3 Block II	MB-3 Block I
Spec. Impulse — lb.-sec/lb. (sea level)	152,000	152,000	169,000	152,000
Burn Time — seconds	247.0	247	250	247
Guidance — Bell Telephone Laboratories series 400 or autopilot only.	160	160	149	160
	(27) (31) (87)	(6) (6) (100)	(14) (15) (93.4)	(5) (7) (72)

ATLAS — General Dynamics-Astronautics

	E Series D
Weight — dry	
Fuel — RP-1	15,100
Oxidizer — Liquid Oxygen	74,900
Total	172,300
Height — feet	262,300
Engine — Rocketdyne Division of North American Aviation	69
Thrust — lbs. (sea level)	MA-5
Booster	
Sustainer	309,000
Vernier	57,000
Specific Impulse — lb-sec/lb. (sea level)	2,000
Booster	
Sustainer	251
Guidance — Radio Mod II/III — General Electric (radar), Burroughs (computer)	214.7
	(10) (14) (72)

TITAN II — The Martin Company

	F FIRST STAGE		G SECOND STAGE
Weight — dry			
Fuel — N_2H_4/UDMH	12,231		5,375
Oxidizer — N_2O_4	83,713		20,200
Total	161,632		37,702
Height — feet (combined first and second stage)	257,576		63,714
Engine — Aerojet-General Corporation		90	
Thrust — lbs.	XLR87AJ-5		XLR91AJ-5
Specific Impulse — lb-sec/lb.	430,000 (sea level)		100,000 (vacuum)
Burn Time — seconds	258 (sea level)		314 (vacuum)
Guidance — Radio Mod III — General Electric (radar), Burroughs (computer)	146.3		181.9

UPPER STAGES

	R ABL X248-9 Allegany Ballistics Laboratory
Weight — wet	
Propellant — Solid	60
Total	459
Height — feet	519
Engine	
Thrust — lbs. (vacuum)	2,750
Specific Impulse — lb-sec/lb. (vacuum)	254
Burn Time — seconds	42.1
	(10) (12) (83.3)

Existing or Programmed Stages

SATELLITE VEHICLES

AGENA — Lockheed Missiles and Space Company

ENGINE MODEL — Bell Aerospace Systems	H YLR-81 Ba-5	J XLR-81 Ba-7	K XLR-81 Ba-9③
①Weight — inert	1,262	1,328	1,346
Fuel — UDMH			
Oxidizer — IRFNA			
②Total	8,165	14,789	14,807
Height — feet	14	19.5	21
Engine			
Thrust — lbs. (vacuum)	15,600	15,600	16,000
Specific Impulse — lb.-sec/lb. (vacuum)	277	277	290
Burn Time — seconds	120	240④	240④
Number of successful flights	12	3	6
Not tested because of first stage failure			1
Number of launches attempted	17	4	7
Percentage of success	71	75	85.7

ABLE Series — Aerojet-General Spacecraft Division

	L AJ10-42 (and -118)	M AJ10-101 (and -101A)	N AJ10-104 (Ablestar)
Weight — wet	1,247	848	1,297
Fuel — UDMH	875	869	2,247
Oxidizer — IRFNA	2,500	2,461	6,227
Total	4,622	4,178	9,771
Height — feet	18	16	15
Engine			
Thrust — lbs. (vacuum)	7,670	7,720	7,900
Specific Impulse — lb-sec/lb. (vacuum)	267	268	277
Burn Time — seconds		113	296
Number of successful flights	11	4	4
Not tested because of first stage failure	1	2	2
Number of launches attempted	15	4	5
Percentage of success	73.4	100	80

CENTAUR — General Dynamics-Astronautics

	P	Q
Weight — dry	2,891⑤	CENTAUR modifications necessary to meet ADVENT mission are being determined
Fuel — Hydrogen	—	
Oxidizer — Liquid Oxygen	—	
Total	32,000	
Height — feet	45.5	
Engines (Two) — Pratt & Whitney	RL10A-3	
Thrust — lbs. (vacuum) (15,000 each)	30,000	
Minimum Specific Impulse — lb-sec/lb. (vacuum)	420	
Burn Time — seconds	370	

NOTES:

①Payload weight not included. Does include controls, guidance, APU and residual propellants.
②Does not include THOR adapter (225 lbs.) or ATLAS adapter (315 lbs.)
③Single restart capability
④Dual burn capability
⑤Changes in payload weight affect fuel and oxidizer weights, but not total weight.

○ Number of successful flights.
□ Not tested because of first stage failure.
⬡ Number of launches attempted.
⬭ Percentage of success.

***Performance Summary* — POSSIBLE COMBINATIONS OF EXISTING OR PROGRAMMED BOOSTERS**