SECRET

MONTHLY SUMMARY OF

SPACE

Systems Div

ACTIVITIES

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SSLPR-59

a foreword to...

SPACE

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

SSLPR

20 October 1961

Monthly Summary of SPACE SYSTEMS DIVISION ACTIVITIES

SEPTEMBER 1961

FOREWORD

The SNAPSHOT Program is included for the first time in this month's report. This program will provide on-orbit testing of the SNAP 10A and SNAP 2 nuclear auxiliary power systems (reactors which will provide electrical power). During the month, the capsule for DISCOVERER XXX was recovered after two days orbit by one of the C-130 aircraft of the Aerial Recovery Force. This was the fifth capsule to be recovered during descent, three others have been retrieved from the ocean. Photographic coverage of the booster and glider at the DYNA SOAR 620A Mock-up held at Boeing, Seattle, during September, is included. MERCURY MA-4 was successfully placed in orbit 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. The mission is considered extremely successful. As a result of the data obtained from the first RANGER flight, several changes have been made in procedures and to the AGENA vehicle. The next launch is scheduled late in October.

for [signature] BG USAF

O. J. RITLAND
Major General, USAF
Commander

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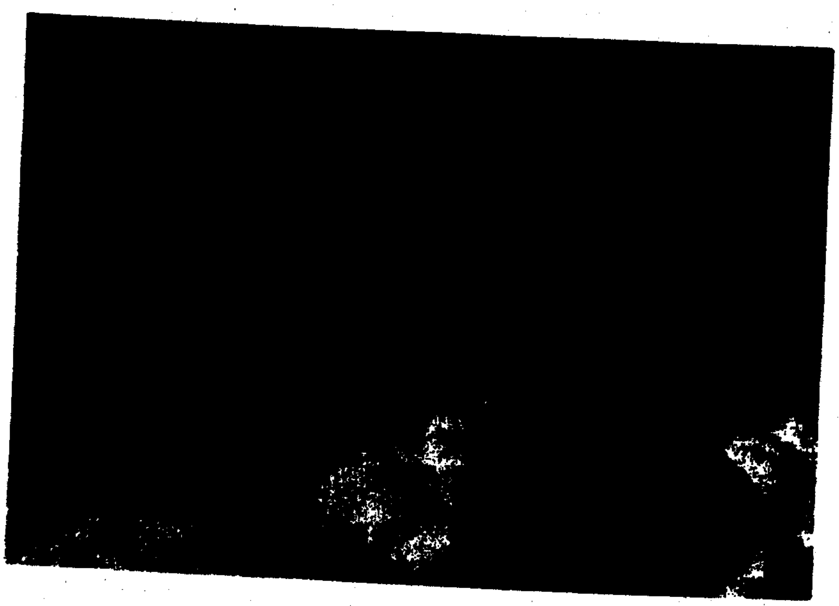
SATELLITE

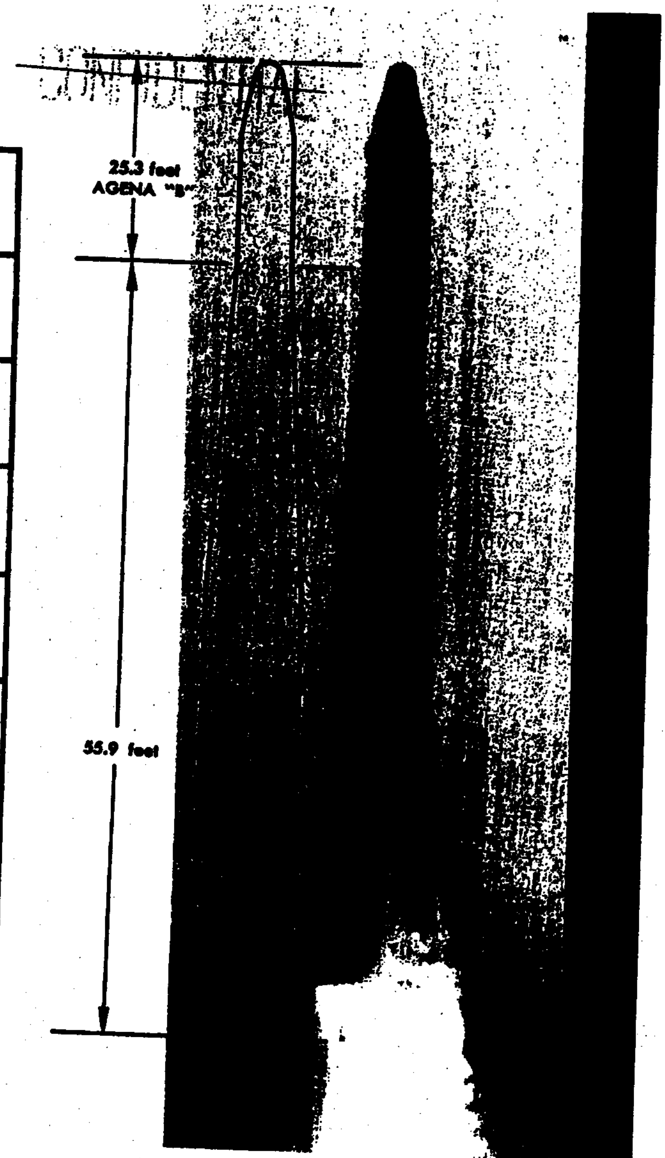
SYSTEMS



DISCOVERER
MIDAS
BIOASTRONAUTICS
BLUE SCOUT
SAINT
VELA HOTEL

Discoverer

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.



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. DISCOVERER vehicles are launched from Vandenberg Air Force Base, with orbital operational control exercised by the Satellite Test Center, Sunnyvale, California, and recovery operational control by the 6594th Recovery Control Group, Hickam AFB, Hawaii.

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

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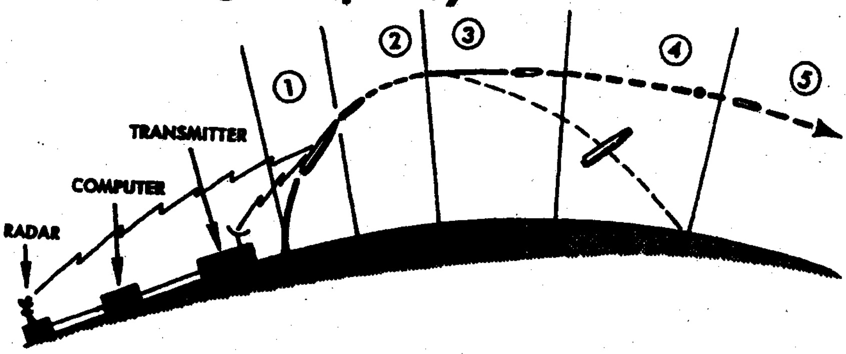
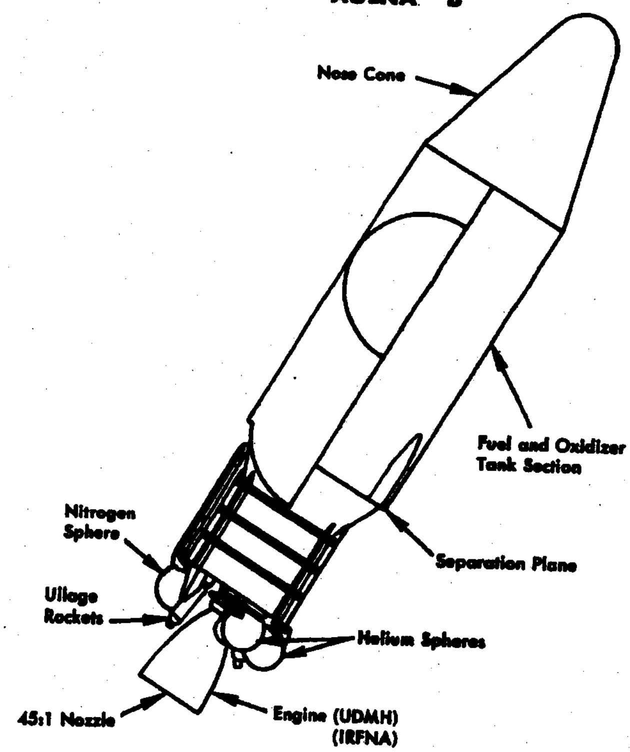
Powered Flight Trajectory



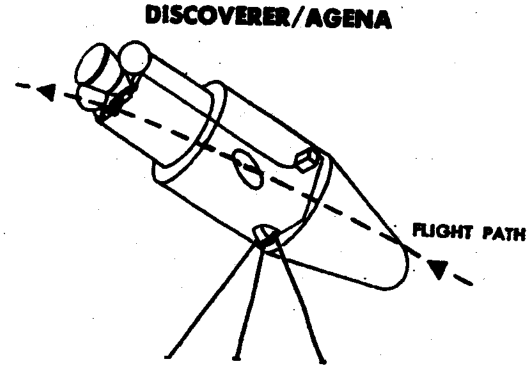
1. **First Stage Powered Flight** — 2.5 minutes duration, 78 n.m. downrange, guided by BTL guidance.
2. **Coast Period** — 2.4 minutes duration, to 380 n.m. downrange, attitude controlled by inertial reference package, horizon scanner, gas reaction jets. Receives AGENA time to fire and velocity to be 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.

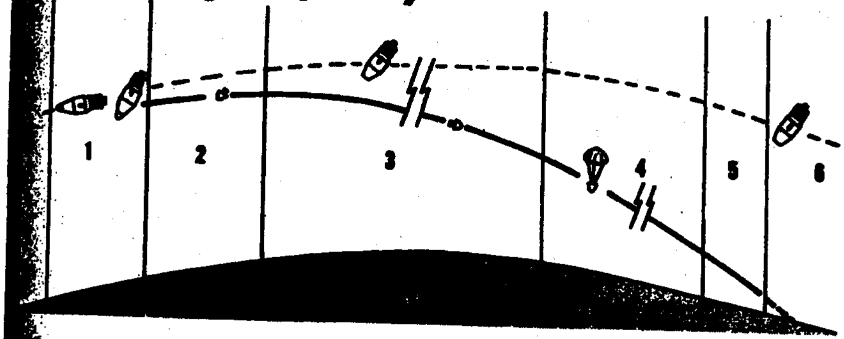
AGENA "B"



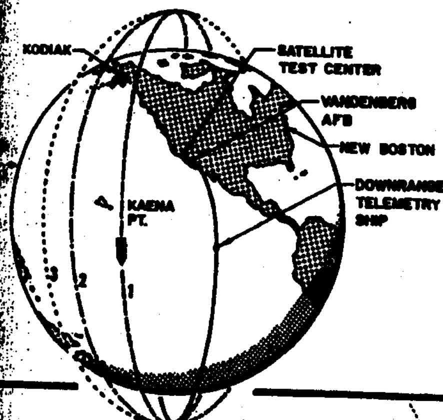
DISCOVERER/AGENA



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.

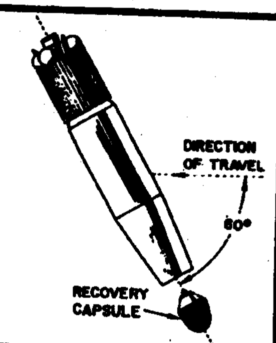


Orbital Trajectory

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.

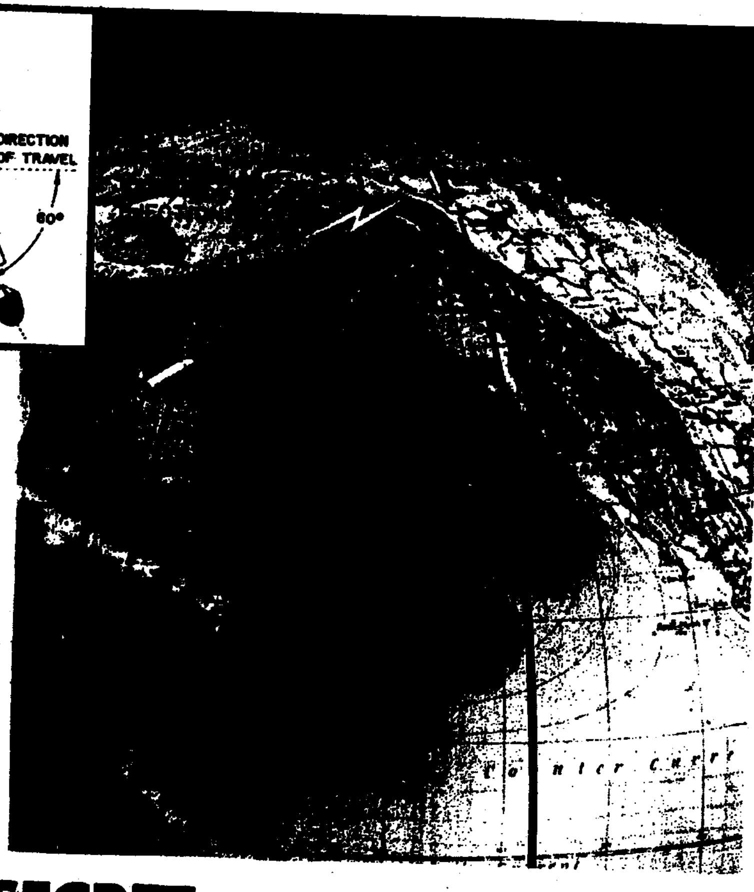
RECOVERY CAPABILITY

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 recovery vessels. A USAF Air Rescue Service para-rescue team aboard a JC-54 aircraft in the recovery area can be deployed to retrieve the capsule in the event of water impact. The team and the capsule are then picked up by surface vessel.*



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.

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Flight History

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks

DISCOVERER FLIGHTS 0 THRU XX ARE ON PAGE A-6

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
XXI	261	1102	18 February	*Attained orbit successfully. Non-recoverable, radiometric 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.*
XXX	310	1113	12 September	*Attained orbit successfully. Capsule was ejected on the 33rd orbit and aerial recovery was accomplished by a C-130. This was the first C-130 air retrieval. All objectives achieved.*
XXXI	324	1114	17 September	*Attained orbit successfully. Recovery was not achieved because of an on orbit AGENA electrical power malfunction.*

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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 XXX

• DISCOVERER XXX was launched into a near-polar orbit from Vandenberg Air Force Base at 1259 PDT on 12 September. All events during launch, boost, separation, coast, AGENA burn and orbital injection occurred as planned. Table I shows the predicted and attained parameters. (C)

• As planned, capsule ejection was initiated on the 33rd pass with ETPD at 1555 PDT on 14 September. Capsule re-entry occurred close to Tern Island, the predicted impact area. The recovery aircraft sighted the descending capsule at approximately 12,000 feet altitude. One of the C-130 aircraft of the mixed recovery force (composed of C-119's and C-130's) snagged the parachute canopy on its first pass and reeled the capsule aboard. It was just slightly over one year ago that a C-119 aircraft accomplished the first aerial recovery of an object that had orbited in space. This was the eighth recovery in the DISCOVERER series. (U)

• The DISCOVERER XXX capsule carried biomedical test samples. The contents of the capsule are currently undergoing analysis. (U)

• A special module to test both the Barnes and the General Electric horizon sensors under actual operating conditions was fabricated and installed on DISCOVERER XXX. These systems are being developed for future AGENA vehicles. The effects of clouds and cold land masses on the outputs of these units was determined. (U)

DISCOVERER XXXI

• DISCOVERER XXXI was launched into orbit from Vandenberg Air Force Base at 1400 PDT on 17 September. All ascent functions appeared normal and orbital status was verified. The predicted and attained parameters are given in Table I. Orbital tracking and telemetry data indicated nominal performance through pass 32 except for an intermittent operation of the orbital timer switches controlling the S-band beacon and the telemetry. Recovery was planned for nominal pass 33 but ejection did not occur. On subsequent passes, operation of the beacon and telemetry was erratic. (C)

• Telemetry contact with the satellite was again established on the 41st pass. At that time there was no report of 400 cycle power (single- or three-phase), control gas depletion was indicated, and the vehicle was unstable. Preliminary investigations have indicated a 400 cycle power failure sometime after the 26th pass was the cause of the capsule ejection failure. (C)

• VELA HOTEL instruments were flown on DISCOVERER XXXI. These instruments, mounted on the engines access door module, consisted of scintillator X-ray detectors and solid state spectrometer electron detectors. Useful data were obtained throughout the active life of the satellite, including the period of tumbling. These data are being processed and preliminary analysis indicates that valid and useful background radiation data have been obtained. (U)

• In addition to the VELA HOTEL instruments, DISCOVERER XXXI carried cosmic ray monitors and galactic radio frequency detectors provided by the

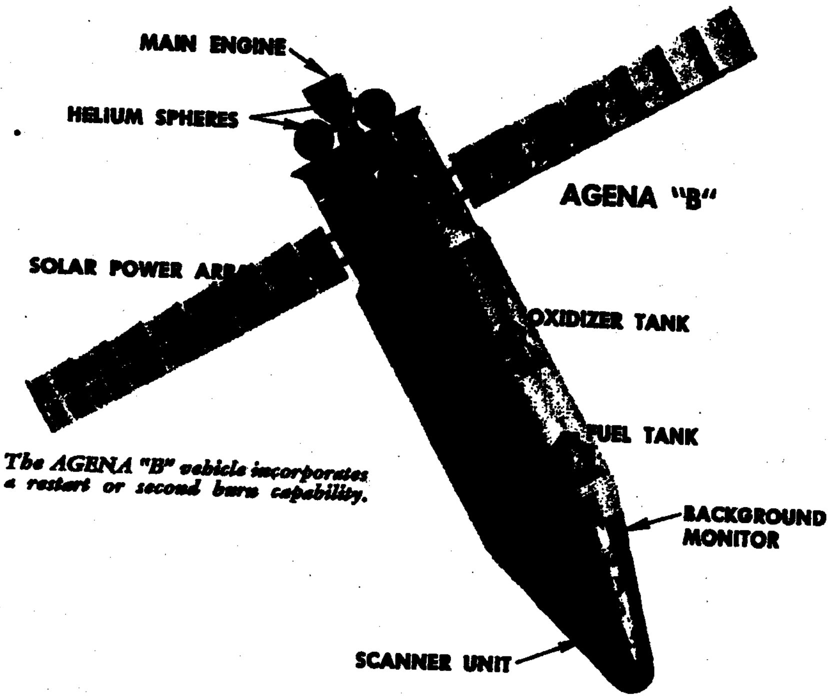
Event	DISCOVERER XXX		DISCOVERER XXXI	
	Programmed	Actual	Programmed	Actual
Apogee, statute miles	256.9	360	256.7	255.5
Perigee, statute miles	148.7	144	149.6	150.5
Period, minutes	91.0	92.41	91.0	90.56
Eccentricity	0.0130	0.0257	0.0130	0.0126

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

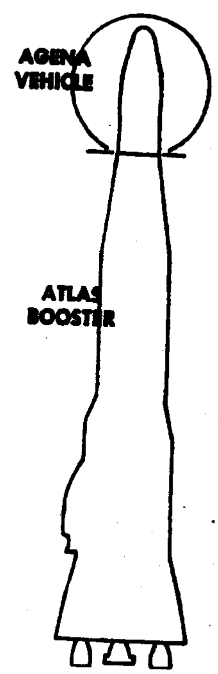
Air Force Geophysical Research Directorate. The cosmic ray monitor is similar to those carried on earlier DISCOVERER flights; the galactic detector is a radio frequency receiver for detecting background noise emanating from celestial galaxies. Both are part of a continuing series of experiments designed to measure the environment of space. Useful data were received from both the cosmic ray monitor and the galactic detector throughout the active life of DISCOVERER XXXI. The data are being processed and will be furnished to the Geophysical Research Directorate for analysis. (U)

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

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.

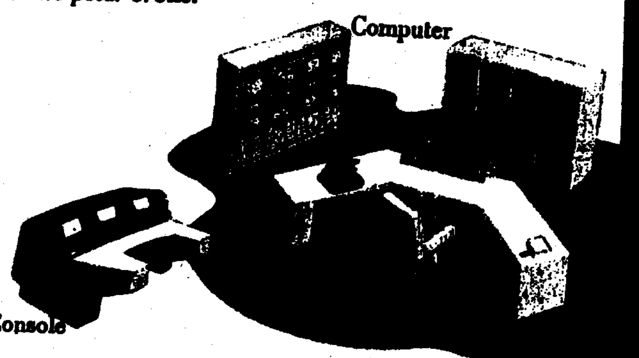
TECHNICAL HISTORY

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.

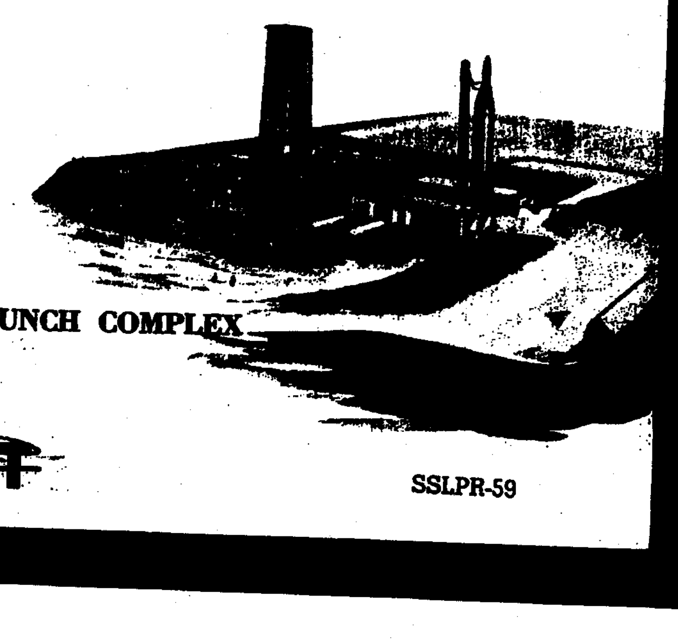
The first two R&D flights used the AGENA "A" and ATLAS "D" vehicle programmed to place the payload in a circular 261 nautical mile orbit. Subsequent R&D flights utilize the ATLAS "D"/AGENA "B" configuration programmed to place the payload in a circular 2,000 nautical mile polar orbit.

CONTROL AND DISPLAY FACILITY

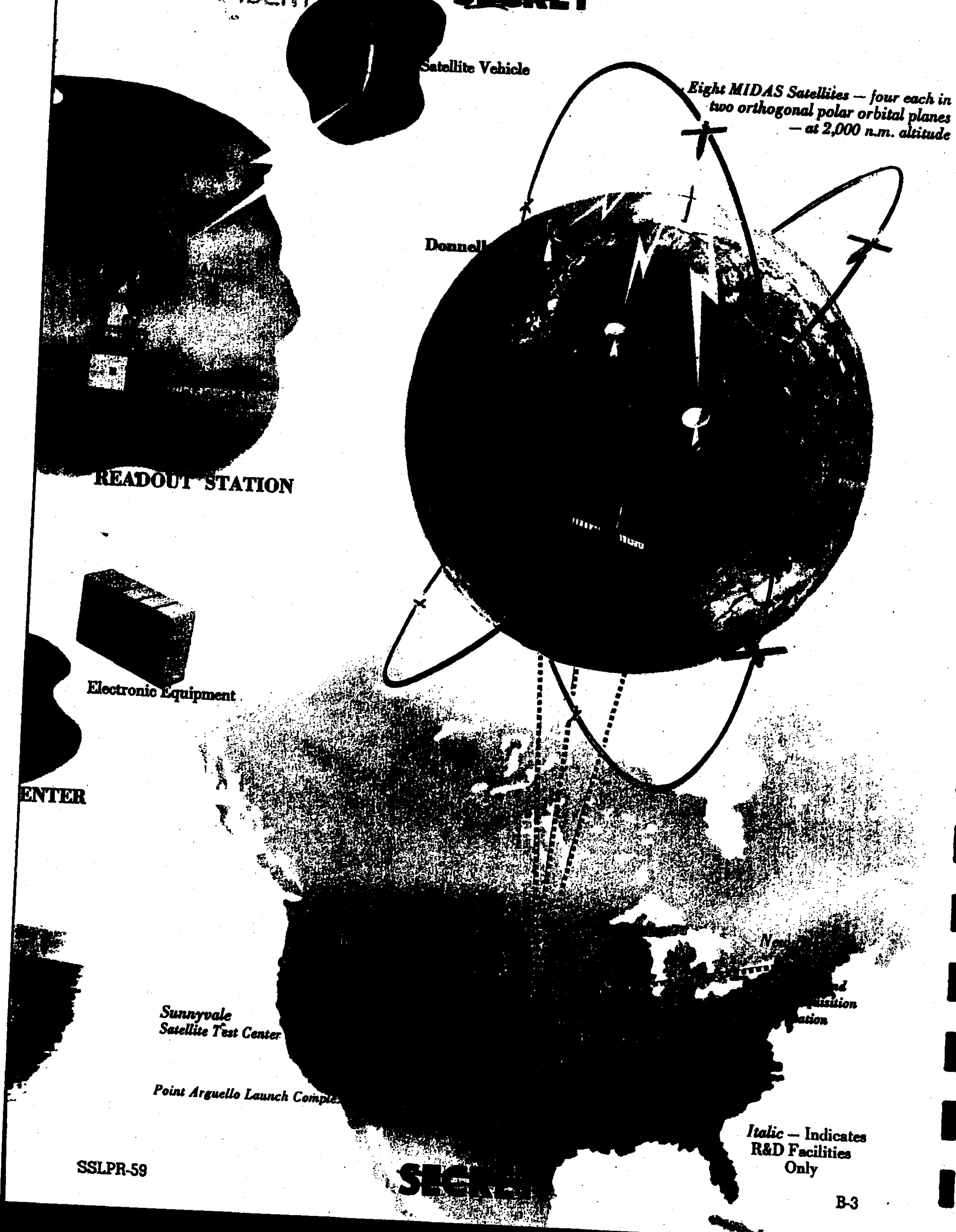
Orbiting satellites detect infrared radiation emitted by ICBM's in powered flight. Data is telemetered instantaneously to Midas Tracking and Control Center via far north Readout Stations. Decoded data reveal approximately the number of missiles launched and launch location, direction of travel and burning 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.



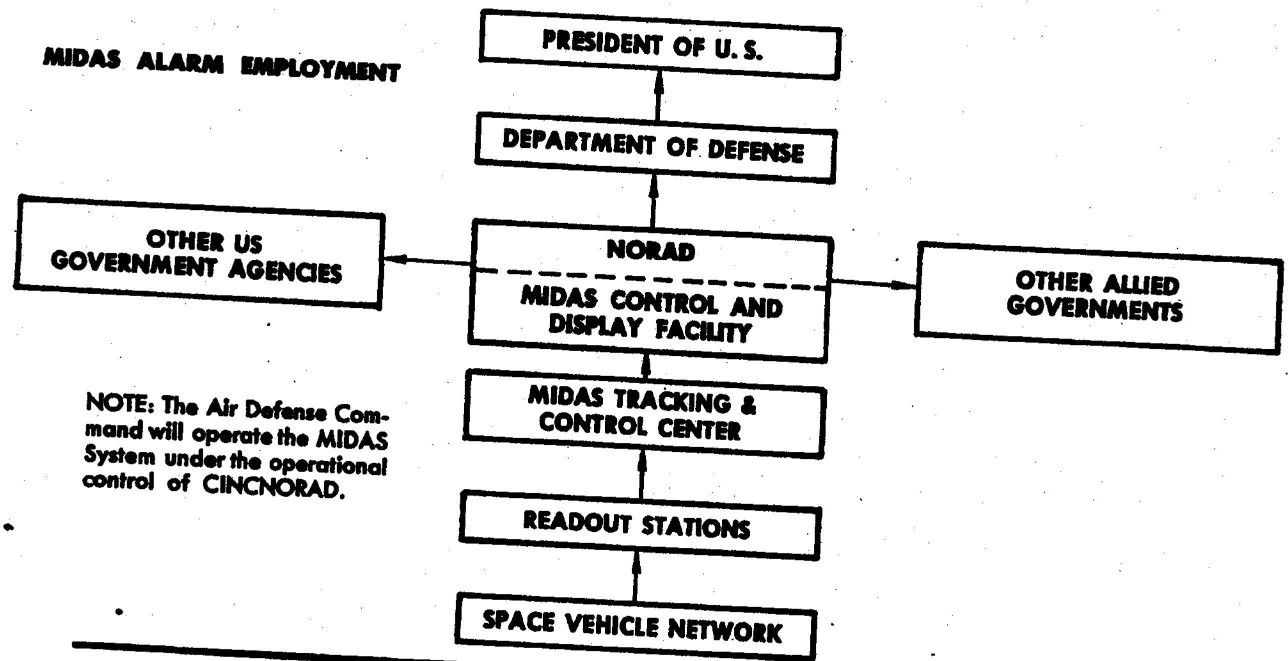
TRACKING AND CONTROL C



LAUNCH COMPLEX


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
Point Arguello Launch Complex
Italic — Indicates R&D Facilities Only

MIDAS ALARM EMPLOYMENT



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

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.

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. Intensities in the 4.3- micron region were 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	BCEHKP	Satellite and payload data reception.
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

• A Task Group, established by the Director of Defense, Research and Engineering, to study ballistic missile defense, reviewed the MIDAS Program on 27-29 September 1961. The objective of the group was to investigate: (1) MIDAS technical feasibility and capability, (2) system reliability, and (3) use and value of MIDAS warning data. An ADC/SAC presentation to the group was accomplished on 5 October relative to threat analyses requirements and planned utilization of MIDAS warning capability. Six subcommittees have been established to evaluate specific technical areas in more detail. The Task Group plans to reconvene during 26-29 October and to publish a report of its findings by 1 November 1961. (C)

Flight Test Progress

• Midas II, vehicle 1007, was tracked for approximately eleven (11) minutes on pass 6764 by the Hawaiian Tracking Station. This Solar Auxiliary Power Unit Telemetry (SAPUT) signal track was accomplished on 10 August 1961. Continued efforts to acquire this vehicle have been unsuccessful and the SAPUT is considered inoperative after nearly 15 months known operation. (Launch date: 24 May 1960) (U)

• MIDAS III, HEPDEX (High Energy Proton Density Experiment) telemetry was last obtained on the 59th day. This was as anticipated due to nominal 56 day battery life of the power source. Due to apparent vehicle orientation during the latter two days, additional data was obtained of importance to the experiment. The data are currently under analysis. (U)

• A draft of a report analyzing the data obtained from the MIDAS III payload has been completed. The report will be released for distribution early in October. This report describes the major payload elements used on the mission and their function. It also discusses the methods used in gathering and processing the readout data. An analysis and evaluation of payload performance and the data processed is presented. Included in the report are analyses of the payload thermal design and weather conditions while the satellite was on orbit. (U)

• On the MIDAS III flight some degradation of payload performance resulted from a solar array system malfunction. This failure limited the satellite payload data readout capability and usable information was received during only two passes over the tracking station. The analysis of this data demonstrates that when scanning is done in a narrow filter mode, background IR sources are greatly suppressed. The fact that no change in system noise was detected when the payload IR scanner passed from darkness into sunlight led to the conclusion that background contributes less toward degrading system performance than system noise. The sensitivity of the IR detector cells was also in agreement with the values expected for the recorded temperatures. (S)

Figure 1. ATLAS 105D, the booster for MIDAS IV on Point Arguello Launch Stand No. 12

Figure 2. MIDAS V AGENA vehicle during pressure and temperature test in the systems test area. The payload shroud is suspended on the left.

Technical Progress

Second Stage Vehicles

• Changes have been made in the High Energy Proton Density Experiment (HEPDEX) installation on MIDAS IV. Data from the solar damage portion of the experiment on MIDAS III indicated that the proton count in the higher energy ranges was less than predicted, while the count in the lower energy ranges was higher than predicted. The proton radiation measurements were extended into lower energy ranges for better definition of the low energy levels. Minor AGENA discrepancies have been corrected and solar array fit checks have been satisfactorily completed. A Barnes Horizon Sensor has been installed to replace the General Electric unit. The MIDAS IV vehicle entered the simulated flight phase of prelaunch testing on 25 September. (C)

• After progressing through the early portions of system test on schedule, MIDAS V encountered difficulties during the communications and control tests and in the guidance and flight control response test. Many of the Communications and Control components have been reworked and/or replaced. The roll and yaw control moment gyros were found to be out of alignment. Correction of these difficulties and re-run of the response test was accomplished before the end of the report period. (U)

• Difficulty in mounting Geophysical Research Directorate experiments caused a delay during final assembly of the MIDAS VI satellite vehicle. Discrepancies in equipment drawings for several units resulted in mounting rework. Two units were returned to the manufacturer for rework because mounting provision changes were not feasible. (U)

Infrared

• The Aerojet-General MIDAS payload development effort was redirected this month to provide increased efficiency and keep within budget allocations. Among the actions that resulted were:

1. Deletion of one Series III payload
2. Redirection of Series III reliability program

3. Deletion of two Series IV payloads (one test and one spare)

4. Reduction in test equipment quantity

Recap of payloads being procured:

SERIES III — Aerojet-General

4 Flight test
2 Reliability ground tests
6 TOTAL

SERIES IV — Aerojet-General

5 Flight test
3 Reliability ground tests
8 TOTAL

SERIES IV — Alternate Design (Baird Atomics)

1 Engineering test model (C)

Facilities

• Facility design plans have been completed for the Ottumwa, Iowa, Tracking and Control Center technical facilities. Advertising for construction contract award is delayed pending release of funds. (U)

• Construction of Point Arguello Launch Complex No. 2 is progressing satisfactorily. Earthwork is approximately 70% complete. Foundations and walls are being poured for Launch Stand No. 3, the Technical Support Building and the Launch Operations Building. (U)

• Modification of Building 6007, one of the Vandenberg Air Force Base technical support buildings, is approximately 80% complete. Completion is scheduled for October. Modification work on 18 of the 20 buildings in the second increment of this package is approximately 15% complete, with completion scheduled for January 1962. The remaining portion of the second increment package will be awarded if FY-62 Military Construction Program funds can be made available. (U)

• Modification to technical equipment room areas at Donnelly Flats, Alaska, were essentially completed on 15 September. Installation of supplementary air conditioning equipment is scheduled for completion by 31 December. (U)

• Construction of the Technical Support Building at the New Hampshire Tracking and Telemetry Station has been started and satisfactory progress is being made. (U)

• Design concepts for the Satellite Test Annex (ADDN)-Administration Building are scheduled for review on 11 October. (U)

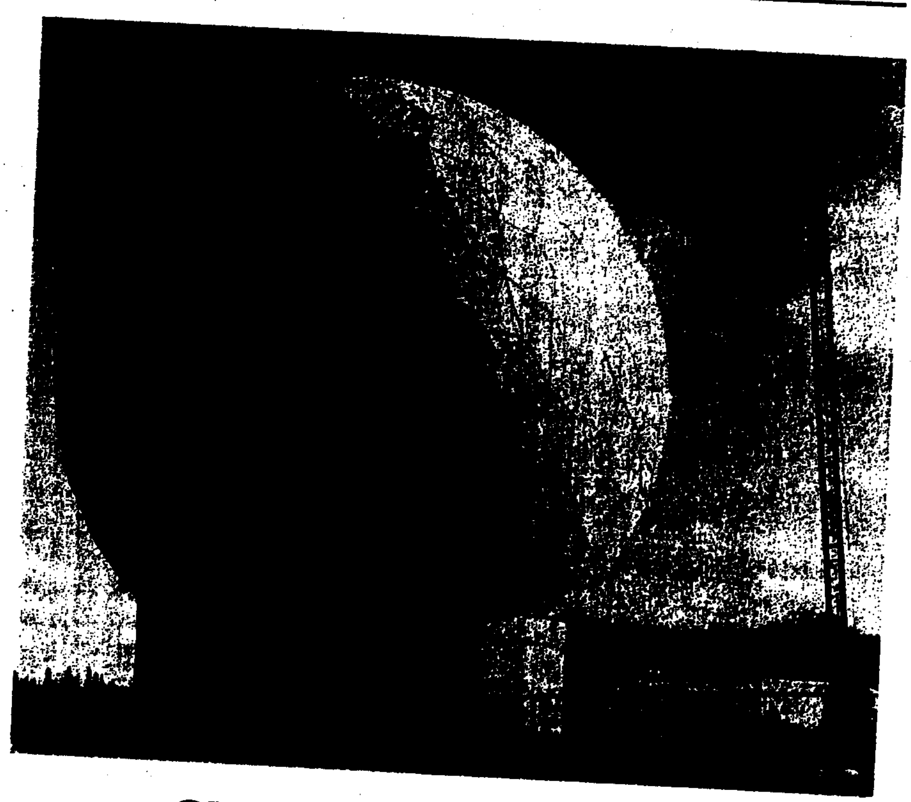


Figure 3. The completed radome at one of the three Donnelly Flats, Alaska UHF telemetry receiver buildings.

~~SECRET~~

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. On 13 May 1959, a MARK I biomedical capsule was successfully flown on DISCOVERER III 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 of 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 which has not been flown.

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 10,000 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. In July 1961, Hq USAF approved the Advanced Technology Program entitled "Bioastronautics Orbital Space Satellite" (BOSS). This program describes a Bioastronautics Orbital Space System utilizing the ATLAS D/AGENA B vehicle combination for launch, orbit, and recovery of living subhuman specimens. The system will be used for six earth orbit launches during which large primates will be exposed to the space environment for periods from 3 to 14 days so that effects of long term weightlessness, radiation fields, and extended isolation can be measured and evaluated for periods of from 3 to 14 days. Results can easily be projected directly to a manned system since large primates are quite similar to man physiologically and are known to have a rather high order of intelligence. This is not a biomedical program to collect a great amount of data from animal orbital flights, but is a system to determine the feasibility of manned military operations in space.

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 of 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 Satellite (BOSS), which is now an approved Air Force Space Program, will not be limited by piggy-back 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.

Monthly Progress — BIOASTRONAUTICS

Small Primate Unrestrained (Project SPURT)

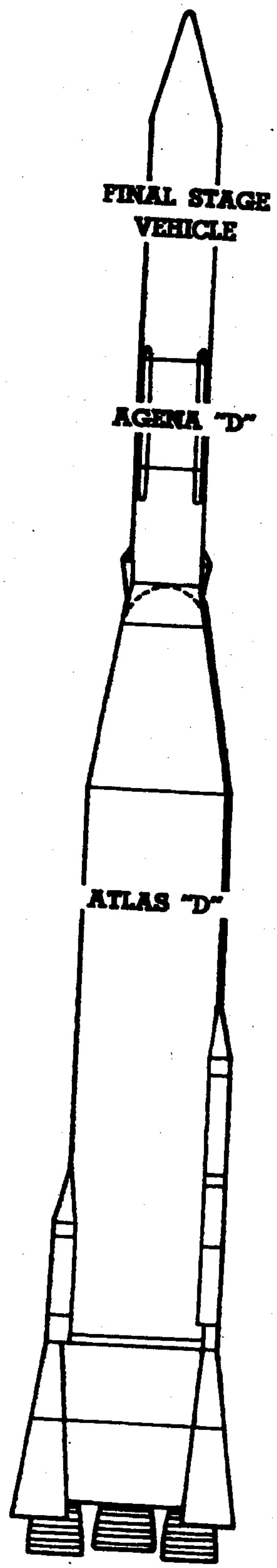
• Six squirrel monkeys are in the final stages of psycho-motor training and conditioning to the capsule environment for Project SPURT. The animals appear well and have demonstrated good performance on the water feeder psycho-motor task. During the final eighty-hour capsule test on 11 July, the primate failed to respond to the water flow from the feeder. Because of this, plans were made to condition several monkeys to the capsule environment and the mission profile. (~~C~~)

• The capsule and associated hardware are in flight-ready condition. The launch of the capsule and primate aboard ATLAS 32E is presently scheduled from the Atlantic Missile Range in late October. (~~C~~)

Arterial Blood Pressure Transducer Implant

• A research program has been initiated to develop and test an internally implanted blood pressure sensor in animals. Initial efforts are directed toward incorporating a pressure transducer in a Hofnagel valve and the technique of implanting such a sensor within an abdominal artery. The first animal implant of a prototype sensor was accomplished on 19 September. The present post-operative condition of the animal is good. This program represents further effort to provide better biomedical instrumentation for use in animal space flight experiments. (U)

SAINT



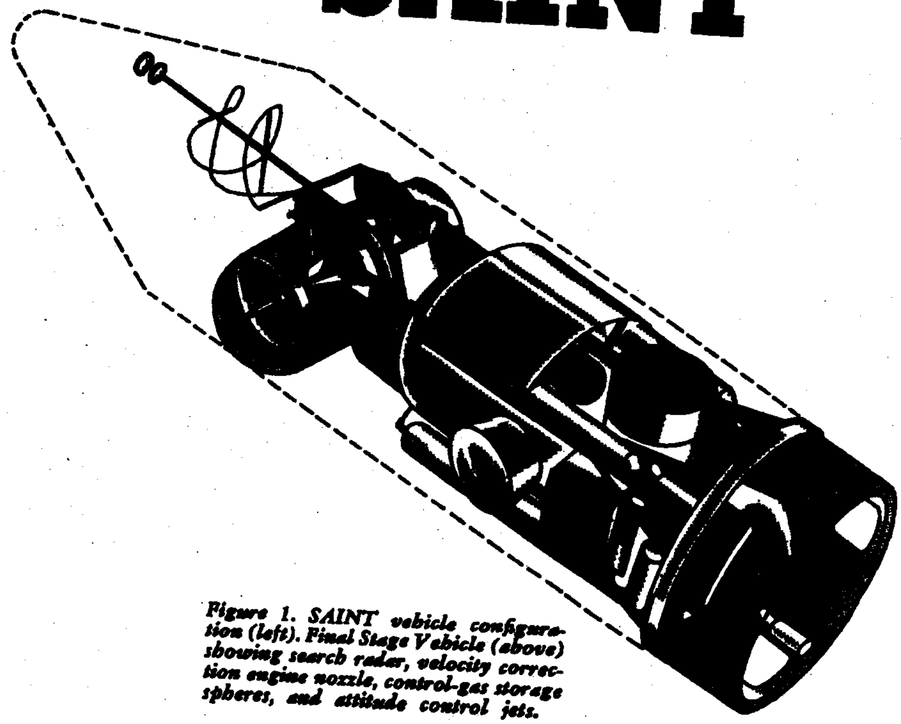


Figure 1. SAINT vehicle configuration (left). Final Stage Vehicle (above) showing search radar, velocity correction engine nozzle, control-gas storage spheres, and attitude control jets.

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.

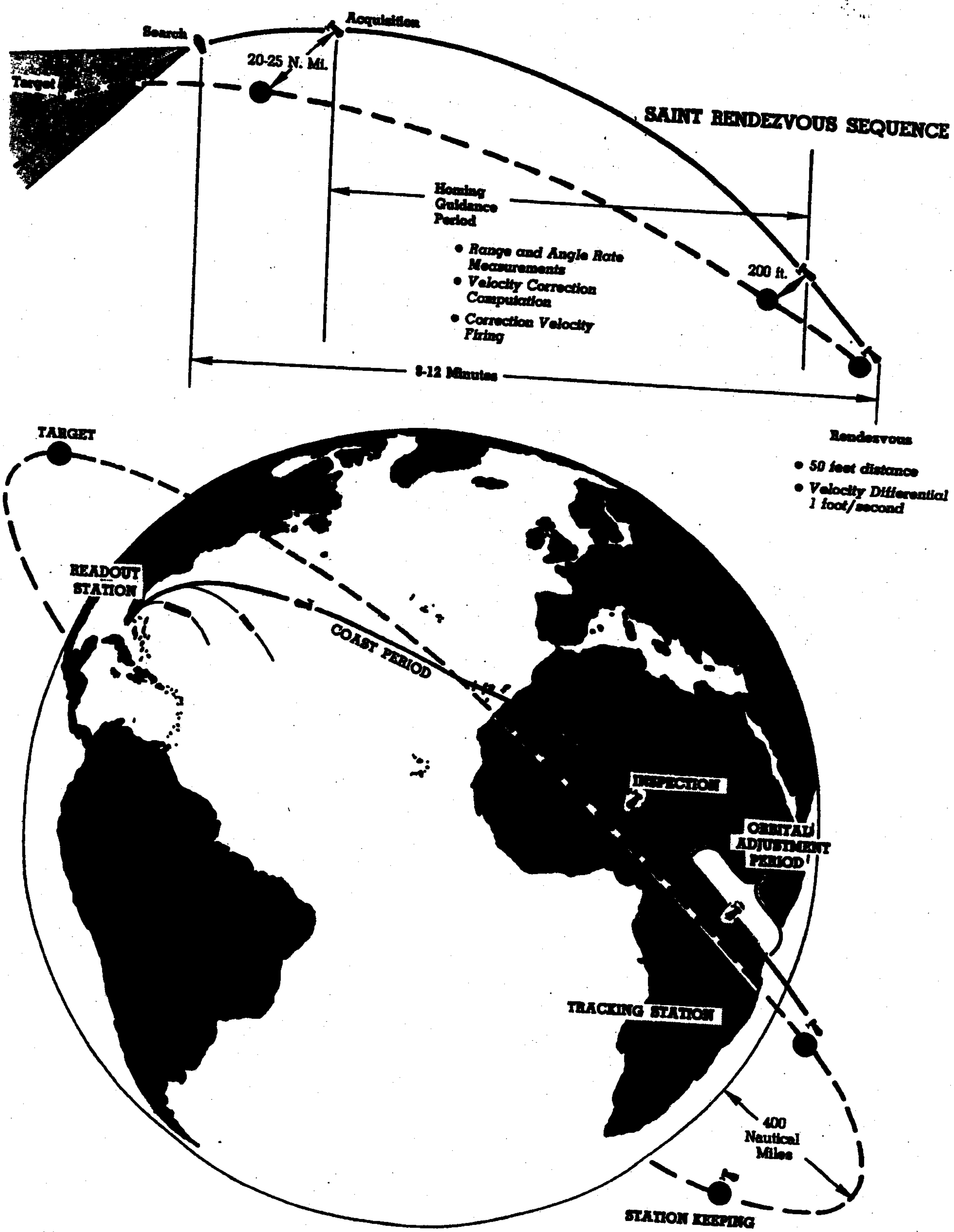


Figure 2. SAINT Program feasibility demonstration flight and rendezvous sequence.

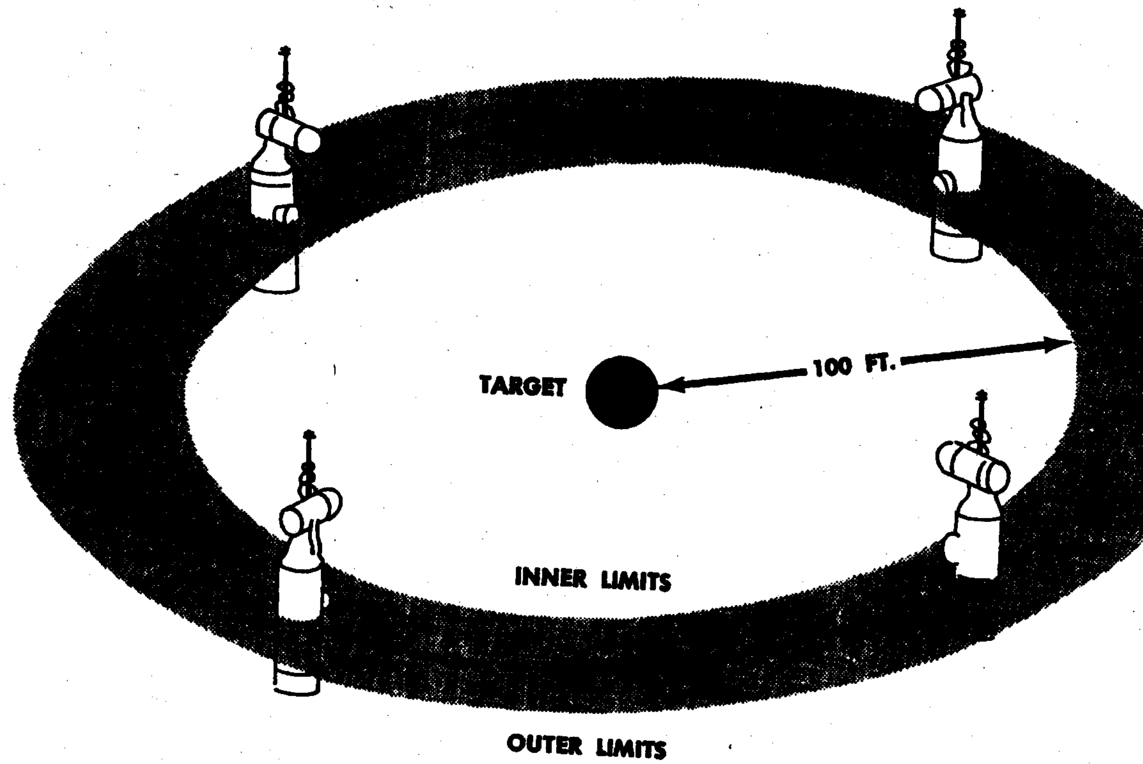


Figure 3. During station keeping, the Final Stage Vehicle will remain at a nominal distance of 125 feet from the target with the payload sensors pointed at the target. The Final Stage Vehicle will move around the target in a plane parallel to the surface of the earth at the rate of one revolution every 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 "D" 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 "D" 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 — SATELLITE INSPECTOR

Program Administration

- Aerojet-General Corporation was selected on 29 September to design, fabricate and test the SATELLITE INSPECTOR target. The target is a lightweight, collapsible, cluster of eight trihedral corner reflectors formed by partially metalized Mylar panels. (C)

- Preliminary letter contract for ATLAS "D" hardware and launch services was signed with General Dynamics-Astronautics on 8 September. (U)

- Representatives of Lockheed Missiles and Space Company, RCA, Aerospace Corporation and Space Systems Division attended an integration meeting to discuss interface considerations between the final stage vehicle and the AGENA "D" second stage booster. Another meeting is scheduled for early October with General Dynamics-Astronautics, first stage booster contractor, also in attendance. (U)

SNAPSHOT

[redacted]

Objectives

For the SNAPSHOT Program the Air Force will provide ATLAS D/AGENA D vehicles, launch facilities, data acquisition and reduction, and system integration for the on-orbit testing of two Atomic Energy Commission developed Subsystems for Nuclear Auxiliary Power (SNAP). These SNAP units are being developed to meet space system requirements in the low-kilowatt range. They will precede larger, more complex systems which will provide up to several megawatts of power. Payloads representative of anticipated applications will be provided by the Air Force and operated on orbit to demonstrate their compatibility with the SNAP units. Additional secondary scientific and engineering payloads may be flown providing the original mission is not placed in jeopardy.

History

The Atomic Energy Commission Program to develop Subsystems for Nuclear Auxiliary Power (SNAP) was initiated in 1956 in response to Air Force identified requirements for long duration auxiliary power in earth satellite reconnaissance systems. In mid-1957 a joint AFBMD/AEC SNAP Coordination Committee was established with the approval of General Schriever, AFBMD, and General Keirn, AEC. The purpose of this committee was to coordinate the SNAP activities of AFBMD and AEC and make recommendations on matters pertinent to Development Programs.

The need for nuclear auxiliary power flight testing was recognized by Hq USAF in March 1960. The Abbreviated SNAPSHOT Development Plan was submitted on 14 June 1960. Approval by Hq USAF and the Department of Defense was granted on 27 December 1960 and Atomic Energy Commission concurrence followed on 7 March 1961. Subsequently, the following actions have been taken:

1. SNAPSHOT Proposed Advanced Technology Program Plan published .... 17 April 1961
2. AF Advanced Development Objective No. 28 issued....... 4 May 1961
3. Prime Contract Award to LMSC .... 17 June 1961
4. AF Development Directive No. AT-1 issued .... 28 June 1961
5. Assigned Advanced Development No. 660A .... 14 August 1961

Reactors

The SNAP 10A and SNAP 2 auxiliary power systems being developed by the Atomic Energy Commission use the same basic nuclear reactor as a heat source and employ a liquid metal heat transfer loop to the converter. The SNAP 10A generates 500 watts with a static thermoelectric converter and the SNAP 2 generates three kilowatts with a dynamic turbine-alternator. SNAP 10A has been conceived and designed for MIDAS applications and will be used in advanced versions of that system if proven in SNAPSHOT tests. Both units will be designed to minimize radioactive hazards. Among the advantages of the SNAP systems as opposed to solar power supplies is their ability to provide power during prolonged eclipses, the 350-hour lunar night, and at great distances from the sun. Electrochemical and/or thermal energy storage devices can be eliminated from nuclear systems if they prove to be unreliable, whereas such devices are vital to solar power units. Furthermore, nuclear power units do not require vehicle orientation and stabilization as do solar supplies.

Radiological Safety

The Atomic Energy Commission, by law responsible for reactor safety during development, will share with the Department of Defense the responsibility for safety through the flight testing period. The operating agencies will pursue radiological safety as a range safety matter. The Air Force Special Weapons Center has been assigned Air Force responsibility for radiological safety and will provide direction to LMSC in preparation of an Operational Safety Plan. SNAPSHOT payloads must be injected into circular orbits exceeding 600 nautical miles for radiological safety reasons. This orbit will insure an orbital lifetime of 200 years. By that time the material produced during reactor operation will have decayed to safe levels before vehicle re-entry occurs. The reactor will not be started until it is on orbit and it has been determined that a sufficiently long orbital life is assured.

Management

Lockheed Missiles and Space Company has been selected by the Space Systems Division as the prime system contractor. They will be responsible for the AGENA D satellite vehicle and for general systems engineering and technical direction. General Dynamics-Astronautics, an associate contractor, will provide ATLAS D boosters and launch services. The Atomic Energy Commission Division of Reactor Development has selected Atomics International to develop, ground test, and produce the nuclear reactors. A joint advisory committee will coordinate activities and identify interface problems.

Facilities

A launch site facility required by Atomics International, the AEC payload contractor, for checkout of SNAP units prior to delivery in flight-ready condition will be provided by the Air Force. This may be regarded as a non-nuclear facility, since on-site reactor operation will be unnecessary. Post delivery SNAP/AGENA mating and checkout will be accomplished by LMSC.

LAUNCH SCHEDULE

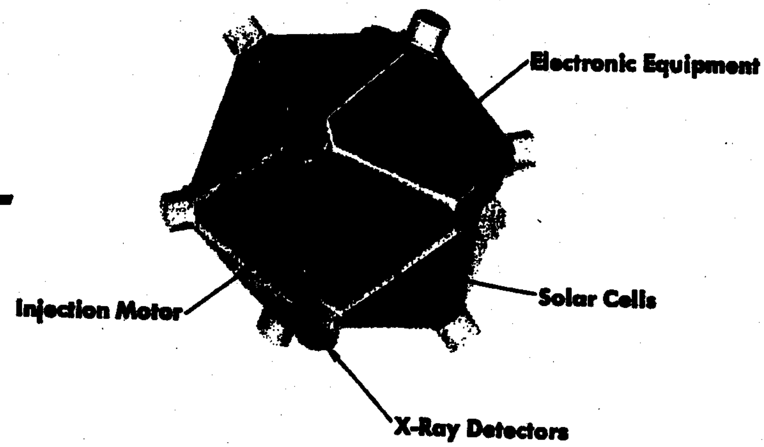
1963												1964											
J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
		1			1									1						1			
SNAP 10A												SNAP 2											

Monthly Progress – SNAPSHOT

Program Administration

• A SNAPSHOT secondary payload briefing was presented at Space Systems Division on 21 September to representatives from the Space Systems Division program offices and Aerospace Corporation. Lockheed Missiles and Space Company defined configurational and environmental restraints imposed by vehicle design and mission profile as well as power, telemetry and other services to be provided. Hardware deliveries to meet integration and checkout test schedules were indicated. Copies of the Preliminary Specifications for SNAPSHOT secondary payloads were made available and attendees were requested to submit comments indicating the degree of their interest, and, to the extent possible, outline the characteristics of suggested payloads.

VELA HOTEL



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.

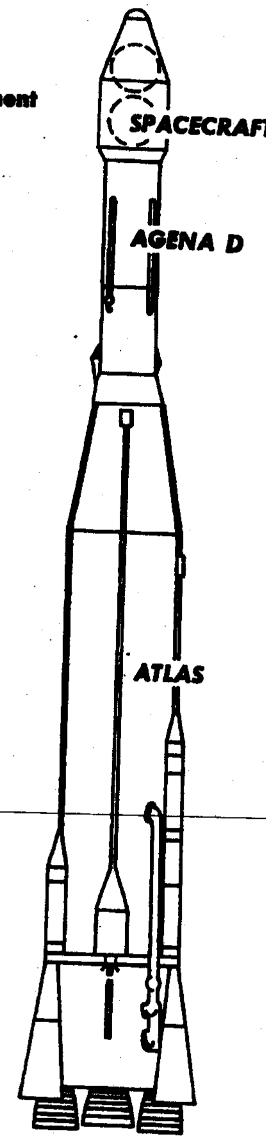


Figure 1. VELA HOTEL vehicle configuration (right). Artist's concept of payload showing solar cells. X-ray detectors and injection motor.

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 D. 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,

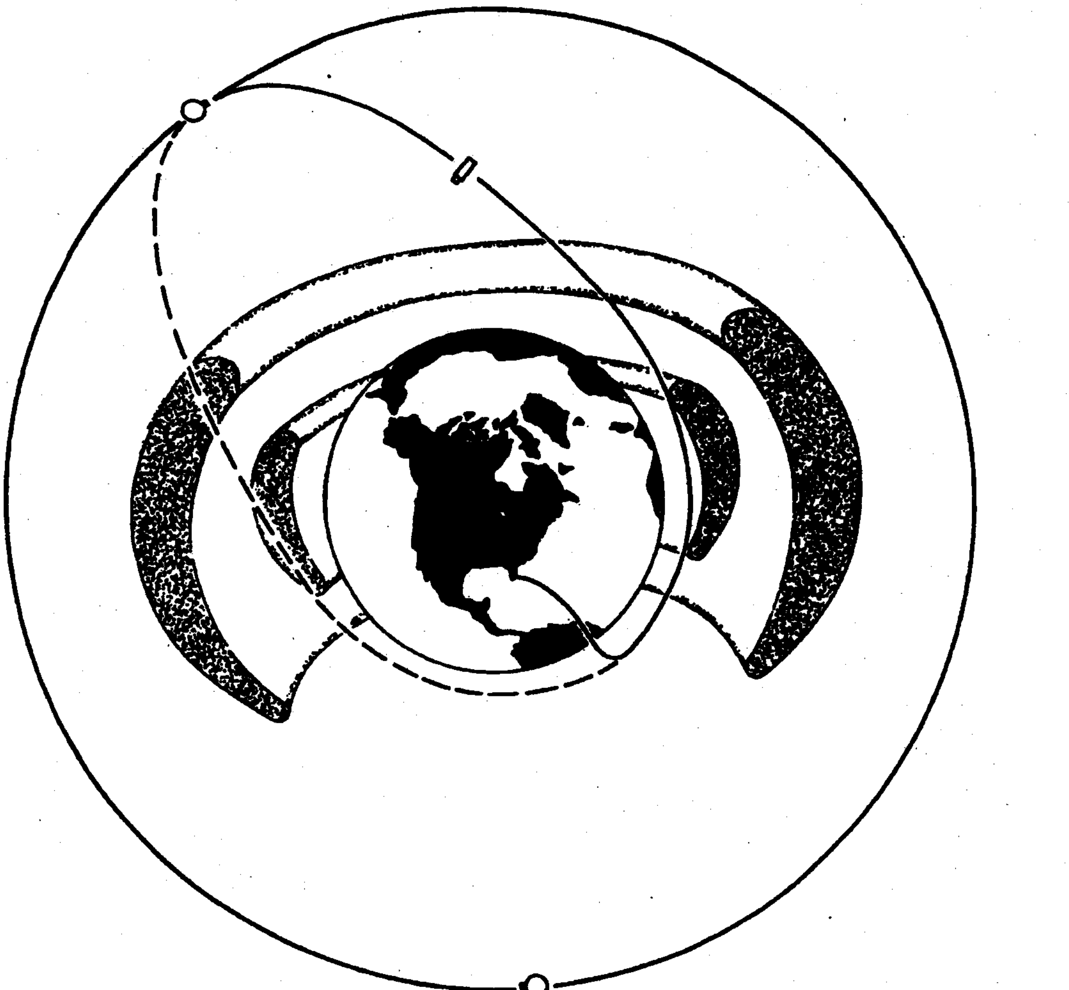


Figure 2. VELA HOTEL trajectory showing the elliptical transfer orbit which has a 200 n.m. perigee and a 50,000 n.m. apogee. On the first orbit one payload will be ejected, on the next orbit, the second payload will be fired and placed into orbit approximately 140 degrees behind the first payload.

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 D separation from the ATLAS D, the AGENA D will program through two burns with final cutoff over Australia. A spin table on the AGENA D 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 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, DISCOVERER XXIX was launched carrying the first of the VELA HOTEL/DISCOVERER "Piggyback" payloads. A second set of the same experiments was carried aboard DISCOVERER XXXI on 17 September. These experiments, which were developed by the Lawrence Radiation Laboratory for VELA HOTEL, consisted of scintillator X-ray detectors and solid state spectrometer electron detectors. During the DISCOVERER XXIX flight, approximately 35 hours of monitoring was accomplished. On the DISCOVERER XXXI flight, useful VELA HOTEL data was received throughout the active life of the satellite, including the period of tumbling. These data are being processed and preliminary analysis indicates that valid and useful background radiation data have been obtained and that the flights can be considered successful. (U)

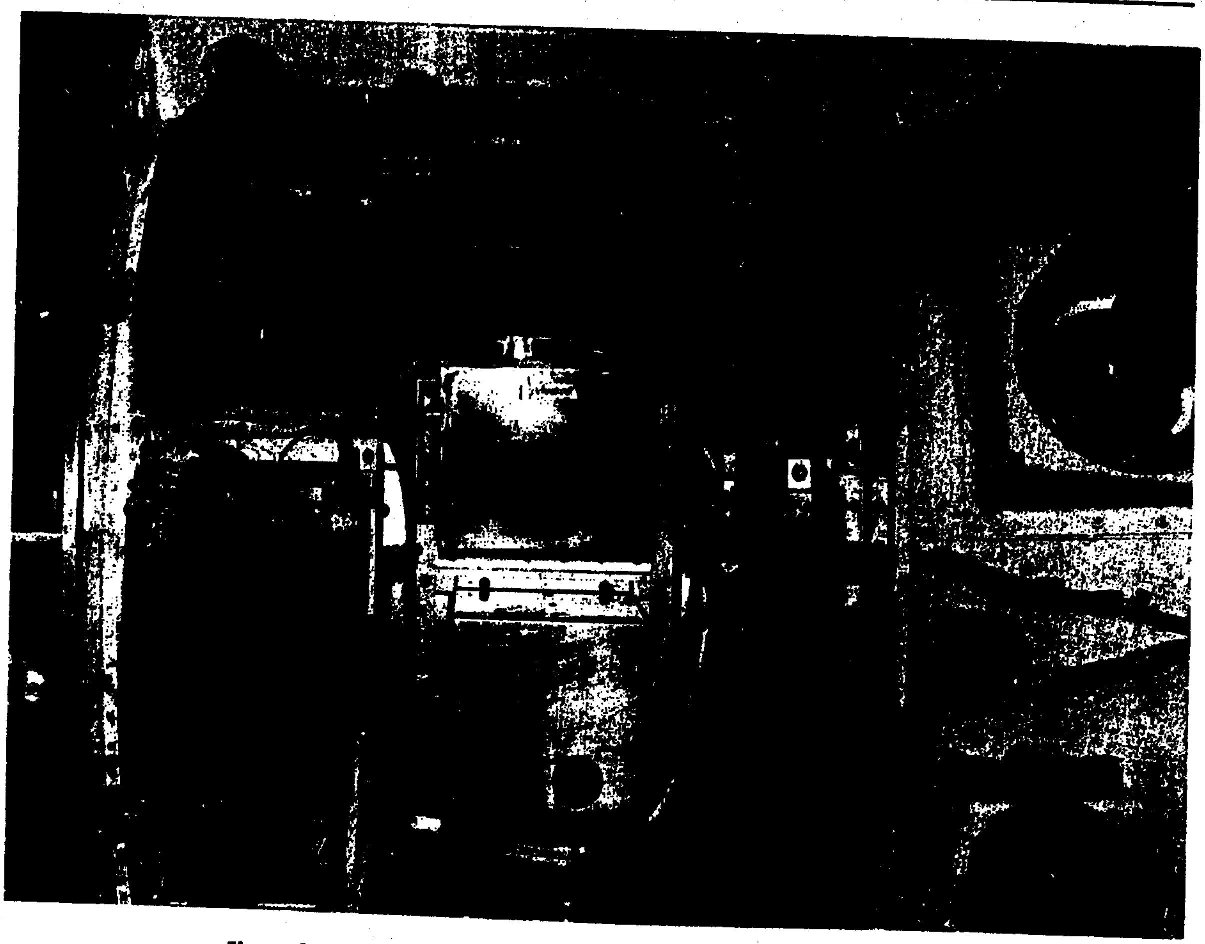
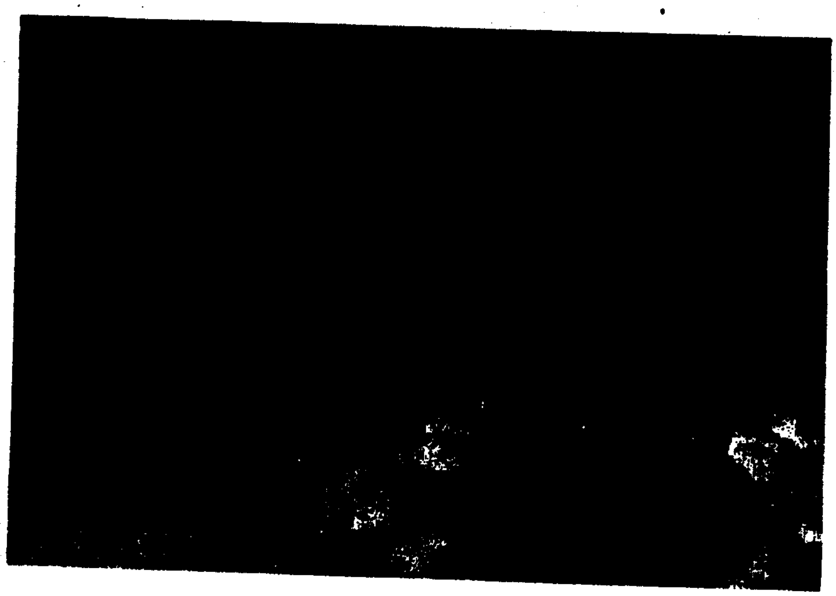


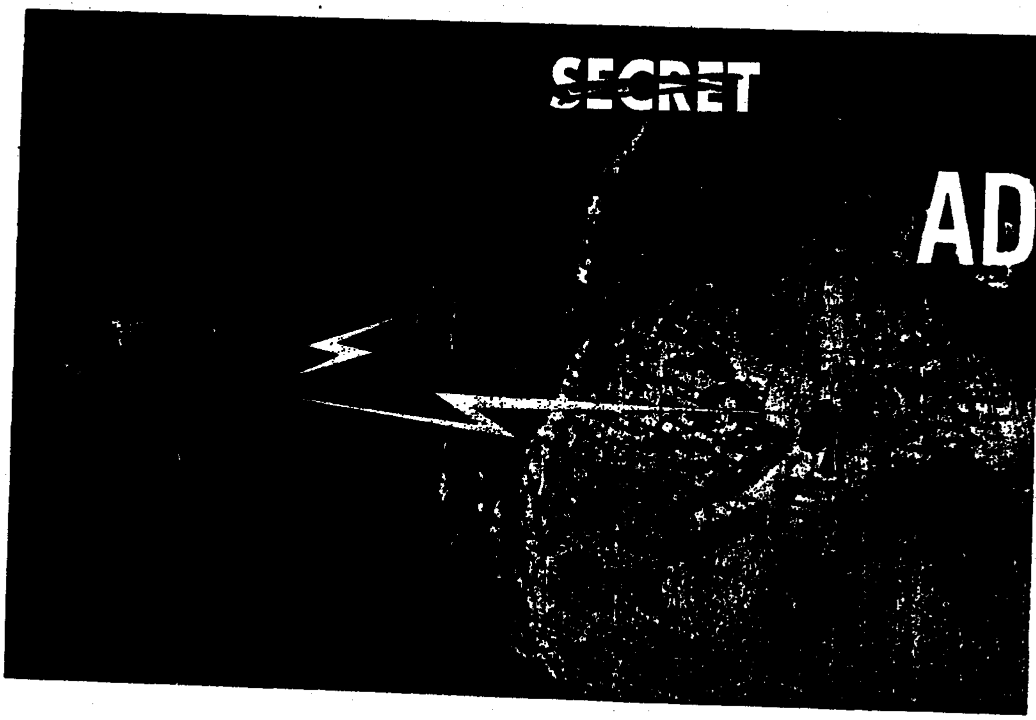
Figure 3. DISCOVERER XXXI engine access door module showing VELA HOTEL instruments. The scintillator X-ray detectors, top, the power supply, lower left, and the solid state spectrometer, upper right. A Geophysical Research Directorate radiation detector is in the lower right. The AGENA fuel and oxidizer quick disconnects are on the far right.

LAUNCH
VEHICLES



ADVENT
ANNA
DYNA SOAR
MERCURY
RANGER-NASA AGENA "B"
TRANSIT

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.

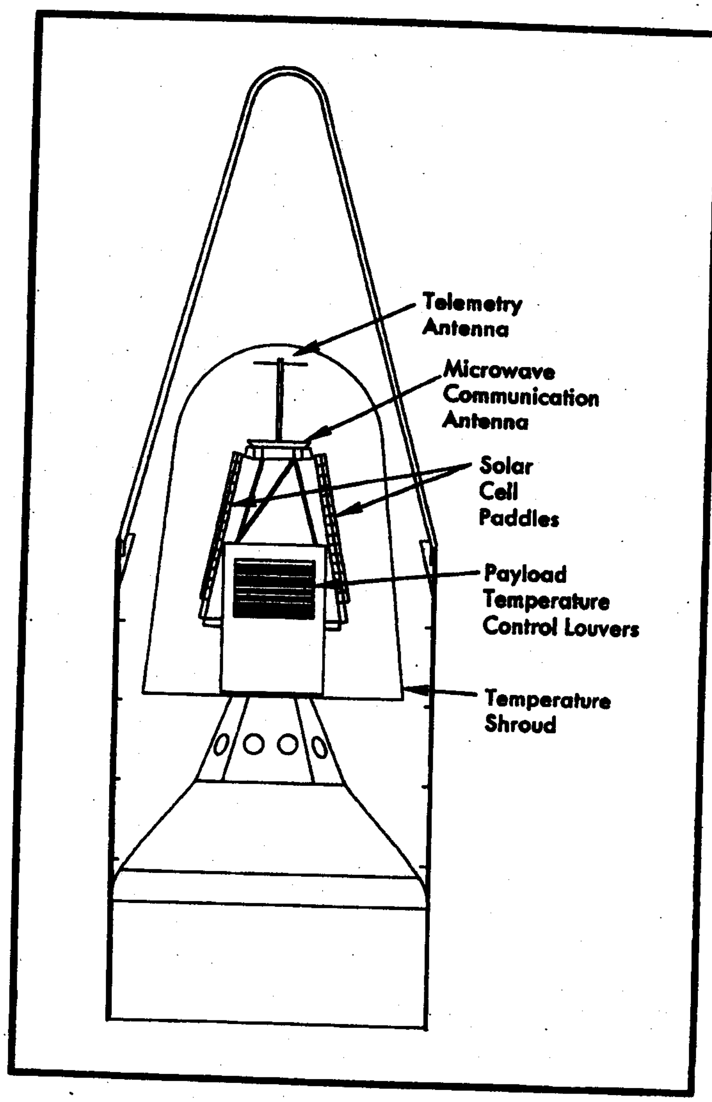


Figure 1. Proposed satellite with jettisonable fairing mounted on CENTAUR second stage.

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

	1962												1963*												1964*					
	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			
Launch Vehicles provided by	ARMY									NASA									ARMY											
Vehicle Configuration	ATLAS/AGENA "B"									ATLAS/CENTAUR																				

**A revision of the 1963 and 1964 portion of the launch schedule is now under study.*

Monthly Progress — ADVENT

Technical Progress

System Studies

• Studies into the effects of equator ellipticity (deviations of the earth's shape from a sphere) on a stationary satellite were presented by Space Technology Laboratories (STL). This effect, not previously considered, can cause a drift of 60 degrees or more per year if the STL findings are valid. The present specified drift is one degree per year and the orbit control system is designed accordingly. (C)

• Aerospace Corporation reviewed the affect of equatorial ellipticity on ADVENT missions for Space Systems Division. It appears that there is a true affect, but the actual magnitude is not clearly established. Since control capabilities of the present design should not be changed until the extent of the changes required is determined, the following action is being undertaken:

1. Determine whether gravitational effects were considered in the ellipticity investigations. If not, the studies should be repeated to include this.

2. Initiate a three-dimensional study to examine the limits of orbit inclination.

3. Obtain experimental data for the ellipticity effect from Phase I and II with the existing vehicle configuration.

4. Finally, evaluate the theoretical and experimental results to determine whether design changes are required. (C)

• A report of an Aerospace Corporation study on the feasibility of using direct satellite injection was submitted to the Space Systems Division. The report stated that direct Final Stage Vehicle injection is operationally as effective as direct CENTAUR injection and is superior in payload capability. (C)

Booster Vehicles

ATLAS

• A draft of documentation defining launch vehicles pre-flight data exchange requirements for Phase I launches has been completed by Aerospace Corporation and forwarded to Lockheed Missiles and Space Company and General Dynamics-Astronautics. Detailed review of data requirements was accomplished during the 26 September interface meeting. (U)

• General Dynamics-Astronautics is presently designing the ADVENT pneumatic system to program ATLAS Phase I liquid oxygen tank pressurization in a step function. Pressurization of the liquid oxygen tank will be increased at launch + (X) time. This type of pneumatic system is necessary to insure that the structural integrity of the ATLAS booster will be capable of meeting ADVENT structural design criteria requirements without danger of intermediate bulkhead reversal due to over-pressurization of the liquid oxygen tank.

• Investigation is continuing into the feasibility of improving the ATLAS/CENTAUR performance by improving the Phase III ATLAS. Items under study are:

1. Fluoride additive to oxidizer for additional performance.

2. Substitution of RJ-1 for RP-1 for performance gain.

3. Utilization of the Acoustica propellant utilization system in place of the General Dynamics-Astronautics system.

4. Increased performance propulsion system.

5. Thicker ATLAS skin to insure tank integrity for optimized CENTAUR vehicle.

6. Increase liquid oxygen tank pressure to meet ADVENT requirements. (C)

CENTAUR

• The Space Systems Division and Aerospace Corporation have been maintaining close coordination with General Dynamics-Astronautics during preparation of the new ADVENT/CENTAUR proposal. There has been approximately a six-week delay in submitting this proposal. Preliminary analysis of data included in the proposal indicates that the recommended ADVENT/CENTAUR configuration will not completely satisfy ADVENT requirements. (C)

AGENA

• During the first nose fairing separation test on 23 August the fairing failed to separate from the AGENA vehicle. A design evaluation performed by LMSC resulted in separation system hardware modifications. During the week of 11 September three successful nose fairing separation tests were conducted utilizing the modified separation system.

Figure 1. AGENA 1501 during guidance and control subsystem checkout in the systems test area. This vehicle is scheduled for the first ADVENT launch early in 1962.

- Compressor problems at the Langley facility have delayed the transonic and supersonic wind tunnel test program. The new schedules are:

  1. NASA Langley Facility
     Force model tests . . . 25 September-6 October
     Pressure model tests . . . . 9-20 October
  2. Lockheed Rye Canyon Facility
     Force model tests . . . . 16-27 October
     Pressure model tests . 20 October-3 November

- AGENA vehicle 1501 (ADVENT 1) has completed guidance and control subsystem checkout and is currently undergoing electrical power supply subsystem checks. (U)

- A review of range safety requirements revealed that insufficient justification exists for an AGENA vehicle waiver. LSMC has been notified of this decision and instructions will be issued for procurement and installation of the ADVENT/AGENA destruct package. (U)

Final Stage Vehicle

- Approval from USAAMA is pending on the recommendation to eliminate the requirement for transmitting random kits. The recommendation was based on studies which determined that eliminating the requirement would not affect security to any appreciable degree. (S)

- Crypto access clearances for Philco Air Force personnel are awaiting action by the Philco Air Force Plant Representative. (U)

- An engineering development model of the Aerospace proton spectrometer was delivered to General Electric-Missile and Space Vehicle Department on 7 September. GE-MSVD indicated that it appeared practical to schedule the instrument on the OTV-1 flight. (U)

- Considerable effort has gone into an internal review of the Final Stage Vehicle gears and bearing program. With some exceptions, the present GE-MSVD program is sound. (U)

Tracking, Telemetry, and Command

- The ADVENT TT&C training program was finalized and an approved training plan was published and distributed. (U)

- As a result of the decision to replace the Sylvania hard tube preamplifier and broad band AM receiver with the Philco parametric preamplifier and narrow band receiver, the Philco contract has been amended. (U)

- Follow-on meetings were held with Atlantic Missile Range and Pacific Missile Range personnel to discuss the possible use of DPN-71 or DPN-66 to provide AGENA second burn coverage. Since the DPN-71 beacon has not been developed it was eliminated. The use of the DPN-66 with a TRANSIT doppler-stabilized oscillator is under consideration; however, preliminary indications are it will not be useful on the AGENA flights. The Space Systems Division suggestion to examine the possibility of using the Woomera station for AGENA second burn tracking is being pursued. (C)

- It has been determined that no interference will occur between the Keana Point TT&C station and the Navy Communications Moon Relay station as long as they are operated under existing conditions. (U)

Systems Test

- The sequence of operations from vehicle preparation to launch was reviewed and it was determined that for the first launch the work flow could be aided by merging the combined radiation tests with the Flight Acceptance tests during launch pad operations. This plan was coordinated with the affected contractors and Atlantic Missile Range personnel responsible for launch preparation and found to be feasible and worthwhile. This change in work flow is reflected in Revision 1 of the Launch Test Plan. Preliminary copies of the plan have been distributed for coordination to all DOD agencies participating in the ADVENT Program. (U)

- Revision 4 of the Launch PRD No. 1600 is approximately 95% complete. The final draft will be forwarded to USAAMA on 13 October. (U)

Facilities

- Detailed launch base facility requirements to support GE-MSVD remote propellant loading and servicing of the Orbital Test Vehicle have been established and forwarded to the 6555th Test Wing. The 6555th is currently conducting a survey of existing Atlantic Missile Range facilities to establish the most feasible and economical method of satisfying this requirement. Results of these studies will be reflected in a detailed design criteria document which is scheduled for submission to the Space Systems Division on 4 October. (U)

- Modification of Hanger AA for support of GE-MSVD and Bendix pre-launch servicing and check-out activities is proceeding on schedule. (U)

- Definition of responsibilities and detailed direction for modification of Atlantic Missile Range Complex No. 12 have been issued to LMSC and GD-A. The major portion of the electrical modifications will be accomplished by LMSC; all other modifications will be accomplished by GD-A. (U)

- A preliminary draft of Pad 36 facility modification requirements for ADVENT Phase III launches has been prepared and is currently being reviewed by the Space Systems Division and Aerospace Corporation. (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

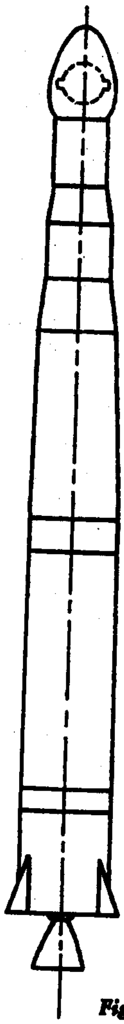


Figure 1. Two stage ANNA vehicle.

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. This has subsequently been rescheduled for 6 March 1962.

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 350 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.

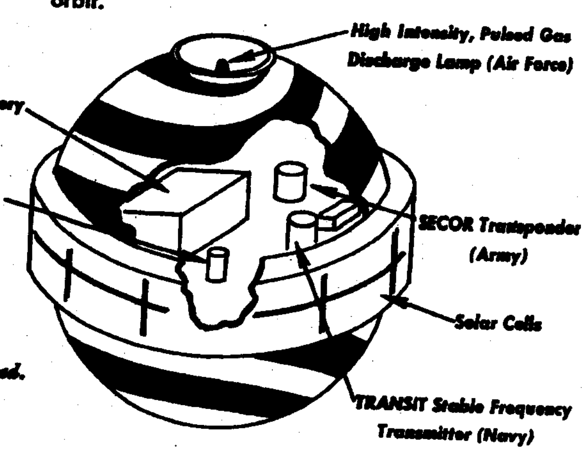


Figure 2. Cutaway drawing of ANNA payload.

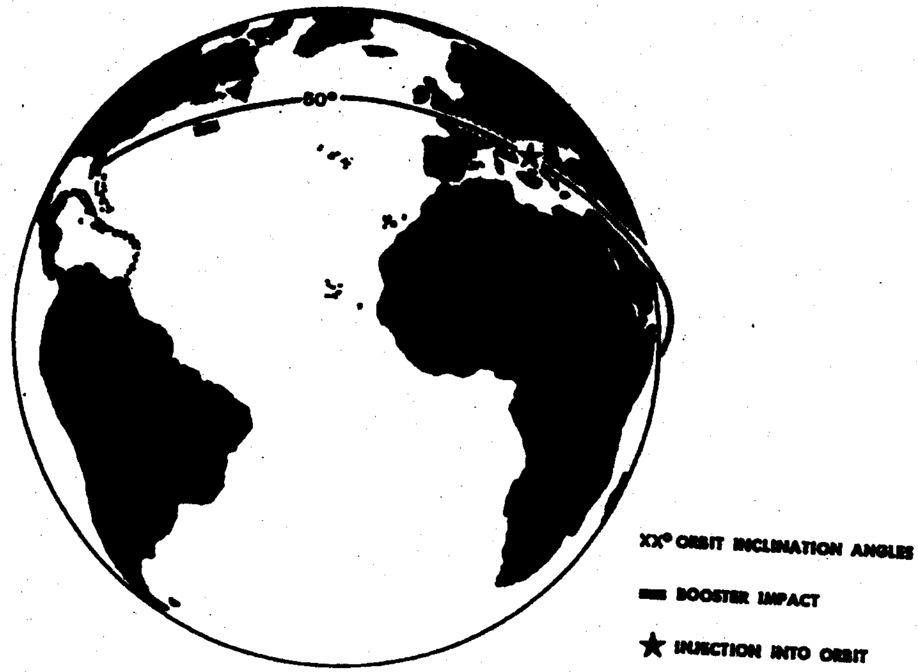


Figure 3. ANNA launch trajectory (50° orbit inclination angle) showing flight path, booster impact area, and orbital injection point.

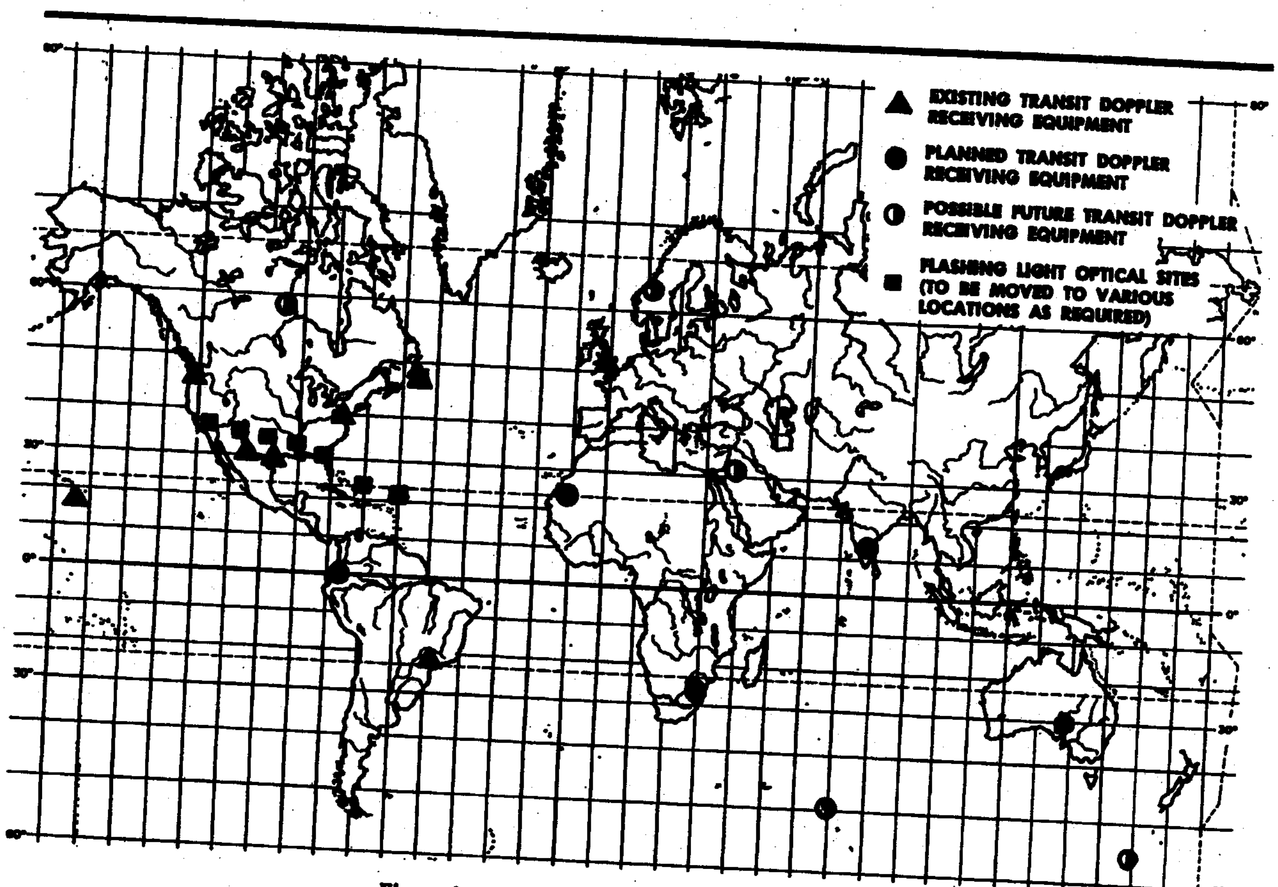


Figure 4. Location of ANNA tracking stations.

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

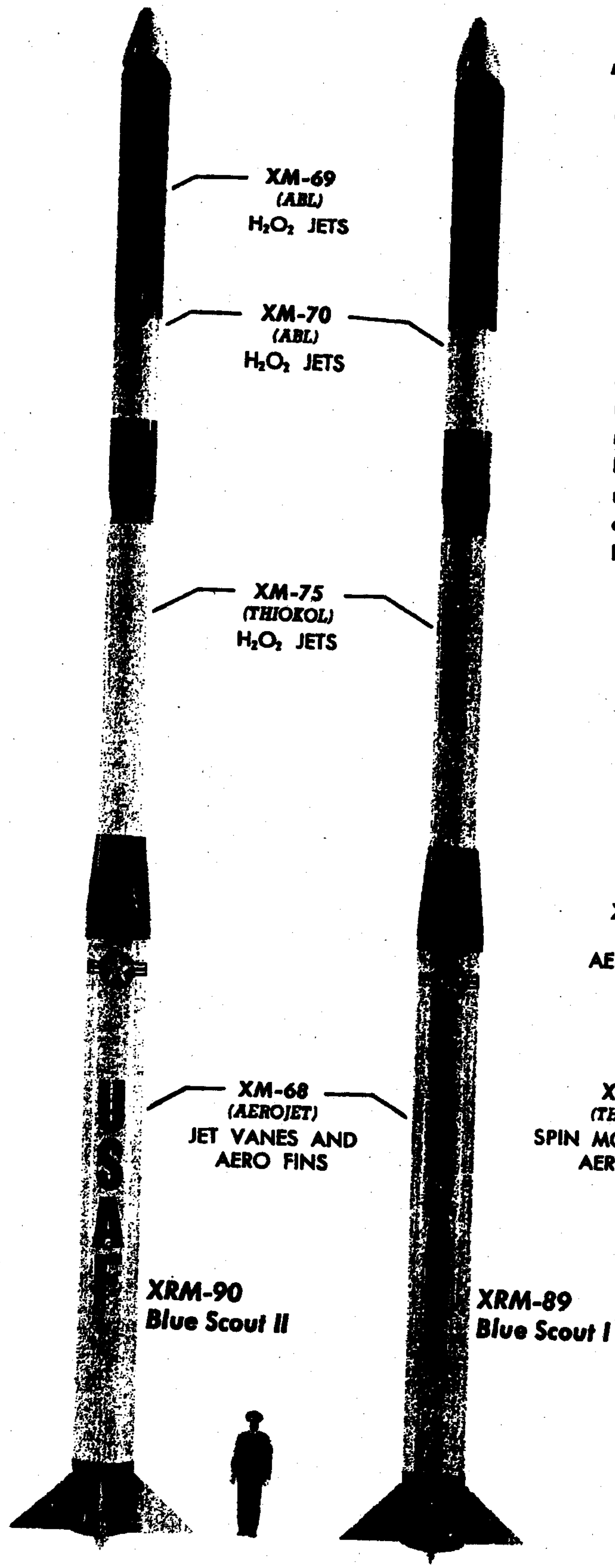
In regard to satellite tracking, each of the services is providing a system of tracking stations corresponding to its component in the satellite; i.e., the Air Force is providing for optical tracking, the Navy is providing for doppler ground support facilities, and the Army is providing ground facilities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

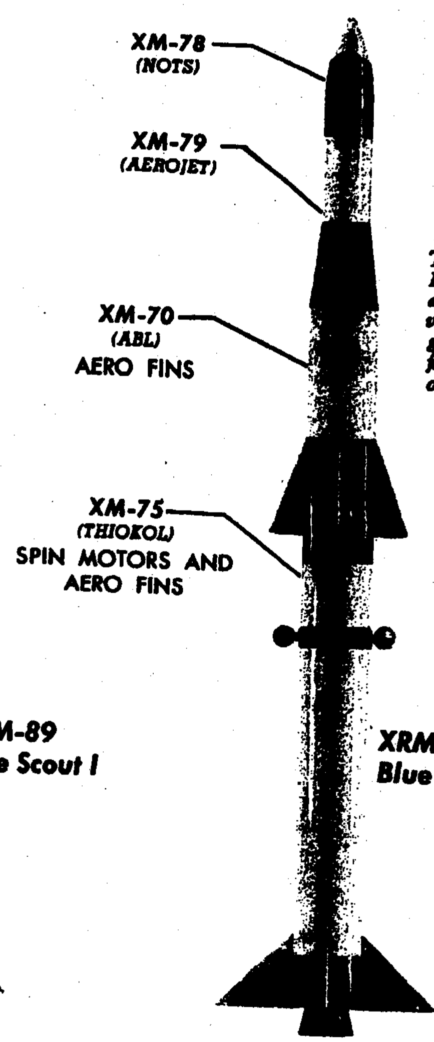
BLUE SCOUT

(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.

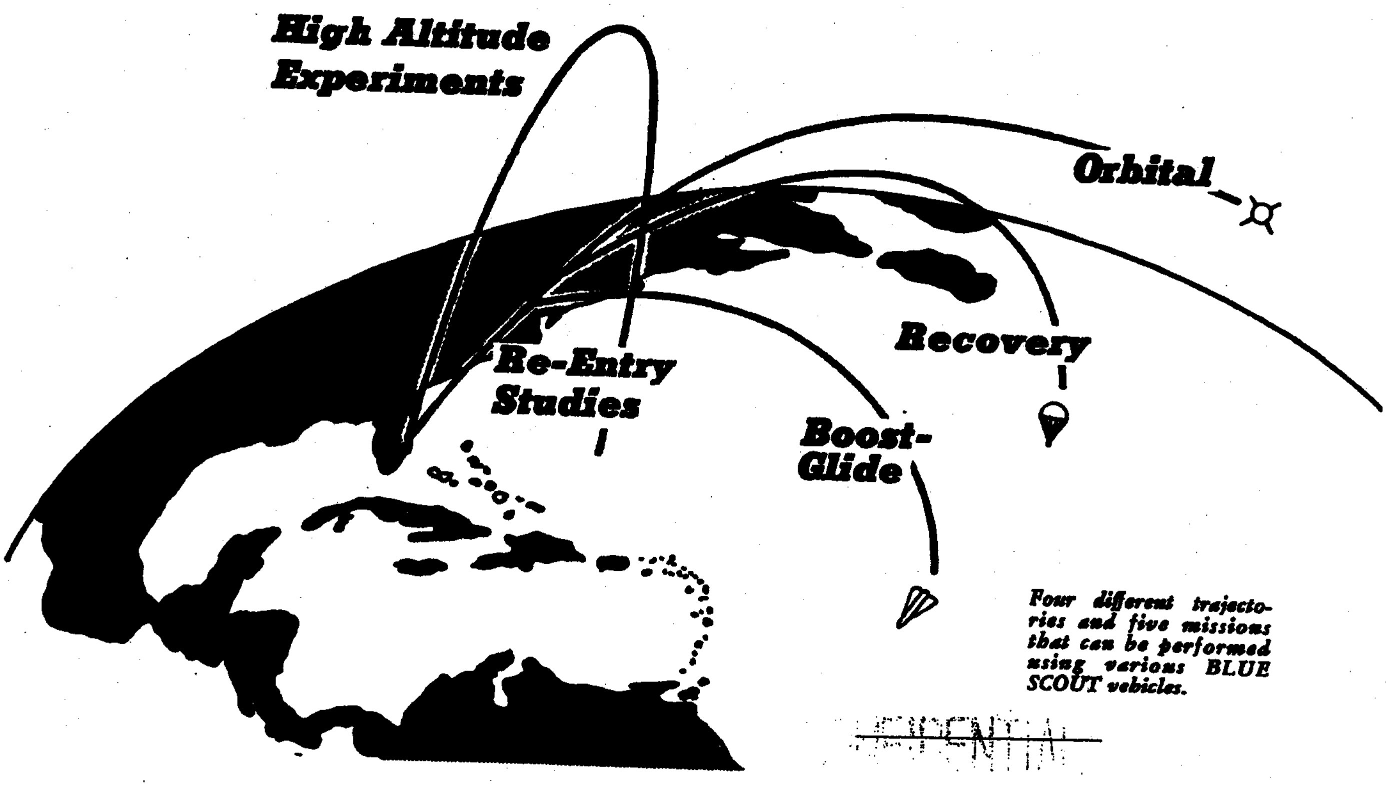
Performance

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 are required with the first launch occurring at Wallops Island early in 1962. The remaining launches will occur at the Pacific Missile Range from August through December 1962.

SOLAR RADIATION: Two BLUE SCOUT vehicles will be required in support of this Department of the Navy experiment. Launches will be from the Pacific Missile Range in April and June 1962.

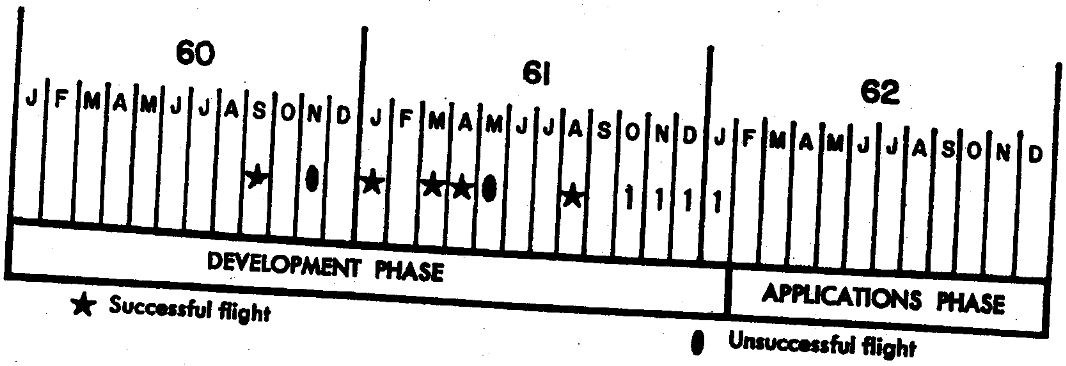
PROBES PROGRAM: Fourteen BLUE SCOUT vehicles are required, one will be launched from the Pacific Missile Range in December 1962 and the remaining thirteen will be launched from the Atlantic Missile Range between January 1962 and March 1963.

NUCLEAR WEAPONS PHENOMONOLOGY: Three BLUE SCOUT vehicles are required for launch from the Atlantic Misile Range in mid-1962.

ION ENGINES: Two BLUE SCOUT vehicles are required for launch in mid-1962 at a currently undetermined range.

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

• Representatives of the Air Force Systems Command, Navy BuWeps and NASA attended the 13-14 September meeting of the Scout Coordination Committee at Hq NASA. Launch schedules (based upon a newly established vehicle delivery schedule) were established for TRANSIT and ANNA vehicles from the Atlantic Missile Range, the Pacific Missile Range, and Wallops Island. (U)

• Representatives of the Air Force Systems Command, Aeronautical Systems Division, and the Air Force Office of Aerospace Research attended a 15 September meeting at Hq AFOAR regarding the PROBES Program. Launch dates were reviewed and revised where necessary. Specific requirements for the ASSET Program were defined. (U)

• Space Systems Division representatives attended a 25-26 September meeting at the Electronic Systems Division to discuss proposals for an interim BEANSTALK mobile system. Electronic Systems Division (ESD) will present a proposal to Hq AFSC-Hq USAF for the manufacture of three BLUE SCOUT Juniors and three transport-erectors. (S)

• A Space Systems Division representative conferred with Navy BuWeps and ESD personnel to review requirements and specifications for the ABL X254 motors. The specifications were agreed upon by all organizations in attendance. (U)

Flight Test Progress

• The eighth BLUE SCOUT vehicle (D-8) is now scheduled for launch late in October or early November. This guided, four-stage XRM-92 vehicle will be launched from the Atlantic Missile Range and will

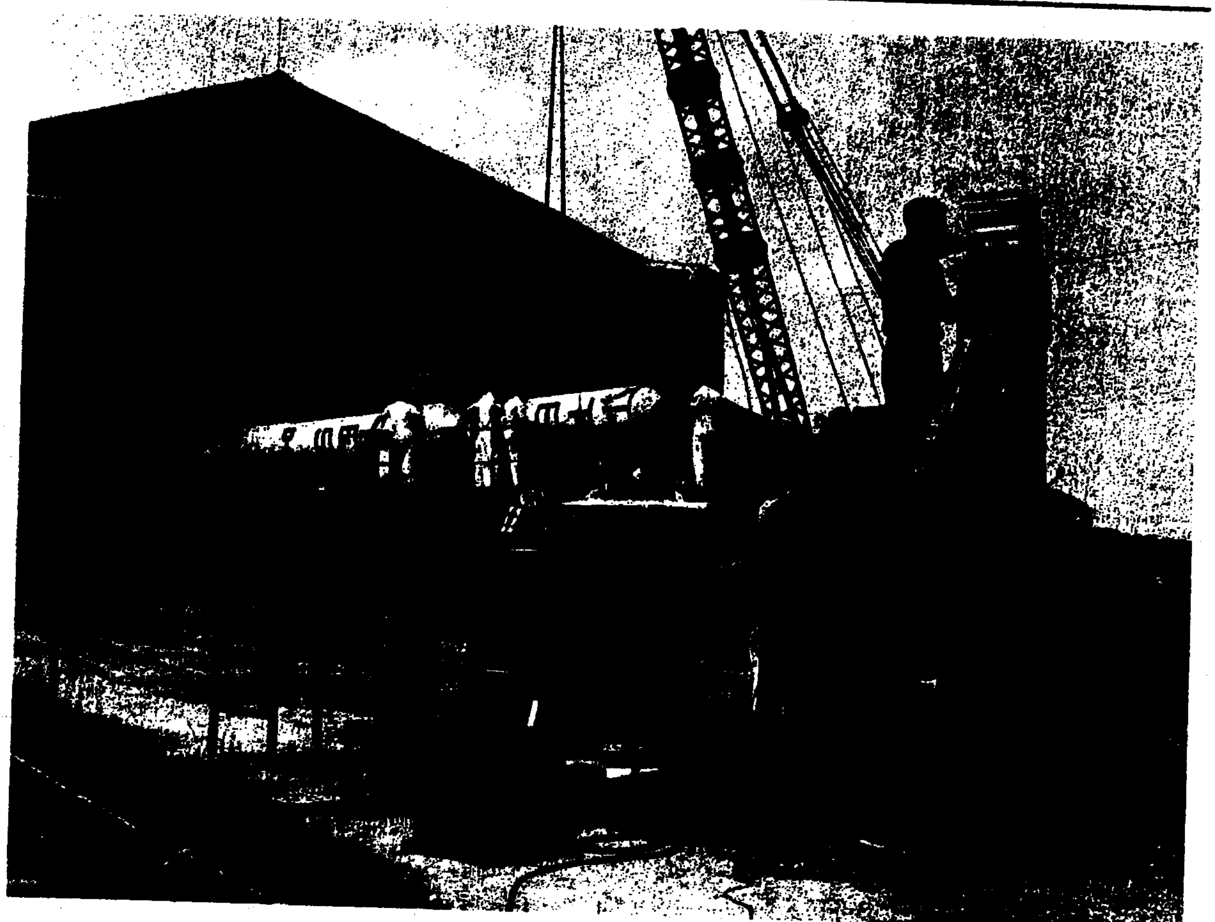


Figure 1. Checkout of the BLUE SCOUT D-8 payload, foreground, and first-second stage mating, background. A payload, designed to checkout the airborne and ground based units of the MERCURY tracking network, will be launched by a four-stage XRM-92 vehicle late in October or early November.

place a 150-pound payload into a 300 nautical mile circular orbit with a 32.5 degree inclination angle. The payload will check-out airborne and ground based units of the world-wide MERCURY tracking network. It will contain S-band and C-band radar beacons, a Mini-track system beacon, command equipment for controlling the payload equipment during flight, and telemetry equipment for obtaining payload operational data and for assisting in the control and tracking of the satellite. Vehicle objectives were reported in last month's activities report. (U)

- The launch of D-8 was originally scheduled for August. NASA payload equipment changes subsequently caused postponement until mid-October. Although Aeronutronic completed the equipment changes and payload delivery to the Atlantic Missile Range was accomplished, problems encountered during the recent NASA ST-6 Scout launch have caused this further postponement. The ST-6 failed to achieve the desired orbit because of either improper separation of the fourth stage from the third stage or asymmetric ignition of the fourth stage motor. The NASA decision to delay the launch permits the following D-8 vehicle modifications to be accomplished:

1. Two electrical disconnects between the third and fourth stages were changed and relocated to eliminate the possibility of asymmetrical loading during separation.

2. The ABL X248A5 motor igniter mount was altered to prevent possible asymmetric ignition. This change required that the motor be removed from the vehicle and shipped to Allegany Ballistic Laboratories. (U)

- The launch of the ninth BLUE SCOUT vehicle (D-7) is scheduled during January 1962. The BLUE SCOUT I (XRM-89) vehicle will boost an ERD-2 re-entry vehicle from the Atlantic Missile Range on a hypersonic re-entry trajectory. The re-entry vehicle is designed to withstand a velocity of from 16,500 to 18,000 feet per second at altitudes between 418,000 and 125,000 feet. It contains five transmitters (one S-Band, one C-Band, one X-Band and two L-Band) mounted inside a nonablative sphere-cylinder-cone heat shield. Flight objectives are:

1. To obtain BLUE SCOUT I performance data.

2. To measure the effect of re-entry ionization on radio frequency.

3. To return the five transmitters contained in the partial re-entry vehicle into the atmosphere at a hypersonic velocity.

4. To receive transmitted signals on the ground with reflected signals monitored in the vehicle for all ERD-2 frequencies.

5. To provide data on absorption and reflection of RF signals as a function of frequency.

6. To gather vehicle instrumentation data by means of X-Band pulse duration telemetry. (U)

- The launches of BLUE SCOUT Junior vehicles 0-2 and 0-3 from the NERV pad at Point Arguello are scheduled for mid-November and December, respectively. These vehicles were originally scheduled for launch in mid-October but delays in delivering the Air Force Special Weapons Center payloads caused the postponement. (U)

Facilities

- BLUE SCOUT launch facilities under construction at Point Arguello by NASA are scheduled for completion in March 1962. Operational control will then be assigned to the Air Force Systems Command. (U)

- Approval for initiation of BLUE SCOUT facilities design at the Atlantic Missile Range 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)

CONFIDENTIAL

DYNA SOAR

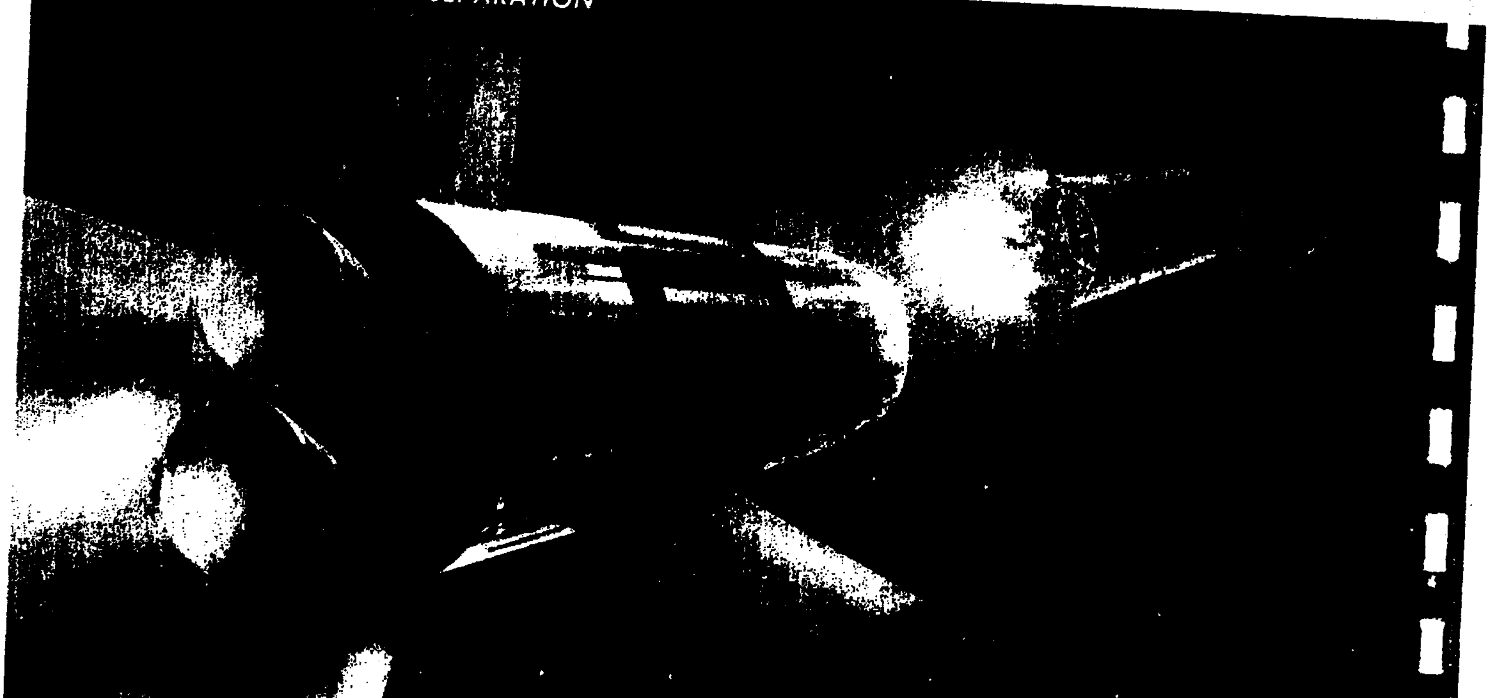
CONFIDENTIAL

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.

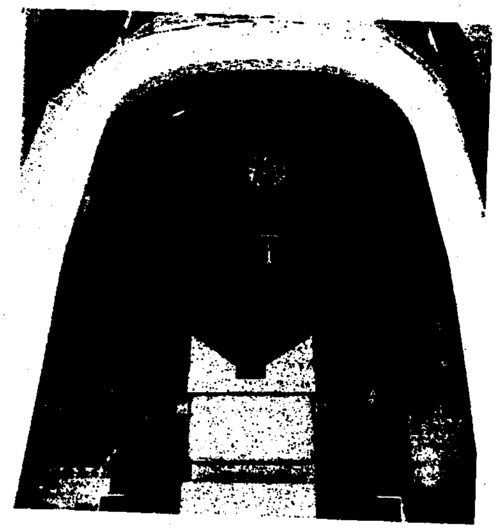
DYNA SOAR — 620A MOCK-UP

DYNA SOAR glider (above) with skids extended. On the left is the DYNA SOAR interstage structure and behind it the TITAN II second stage.

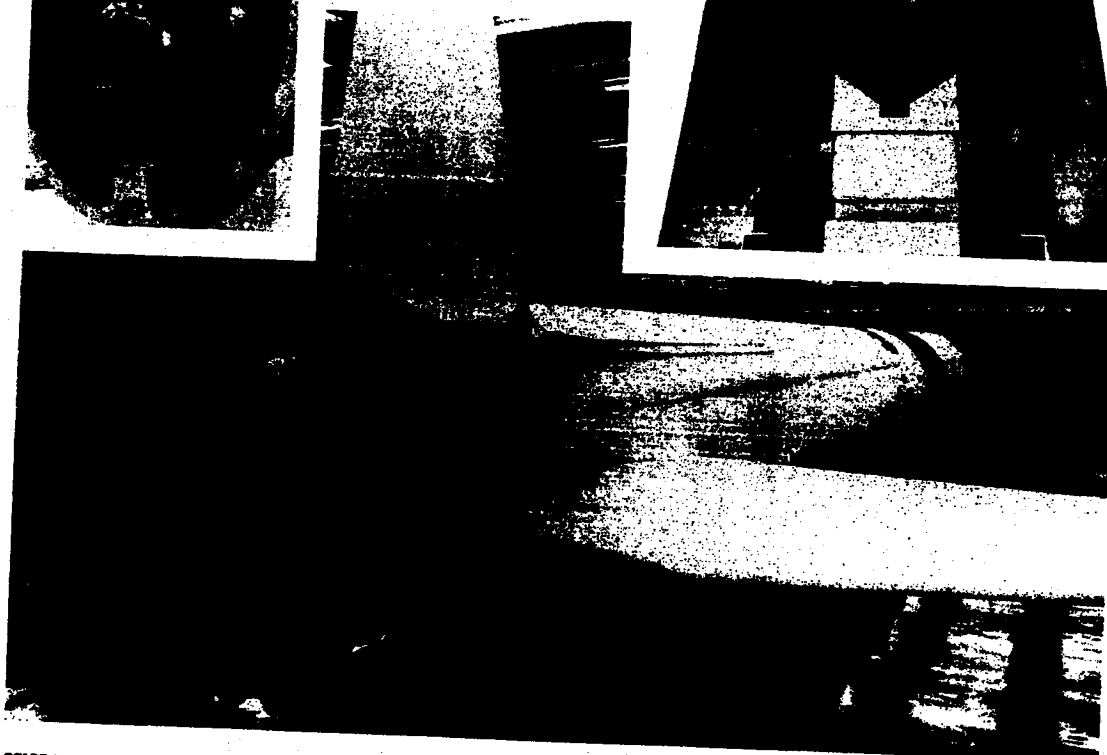
The DYNA SOAR air vehicle (booster and glider) review was held at Boeing, Seattle, from 11 through 20 September. These photographs show some of the significant items displayed at the review.

DYNA SOAR glider front view with wing panel removed to show structural members and component placement.

Four nozzles of the rocket engine contained in the DYNA SOAR interstage structure. When the supply of propellant in this tank is exhausted, the complete adapter is jettisoned from the glider.



Interior cockpit view showing control and instrument locations.



The TITAN II booster with the yaw (vertical) and pitch (horizontal) fins which have been added for the DYNA SOAR Program. The turbo-pumps and twin combustion chambers for the near half-million pound thrust first stage engine are in the foreground.

Monthly Progress — DYNA SOAR

Program Administration

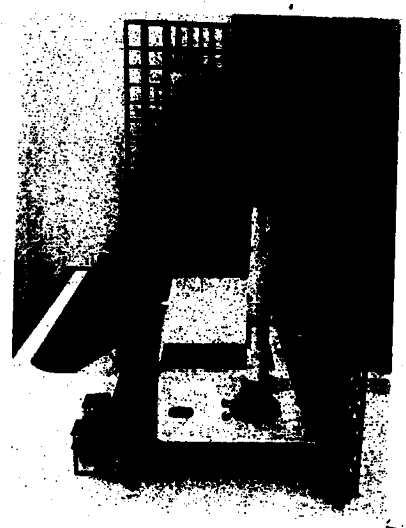
• On 19 September representatives from the Space Systems Division briefed the Golovin Committee regarding the DYNA SOAR Step II boosters which have been considered during the past year with the pros and cons for the accelerated DYNA SOAR program. The recommendations of this committee are expected to be released presently. (U)

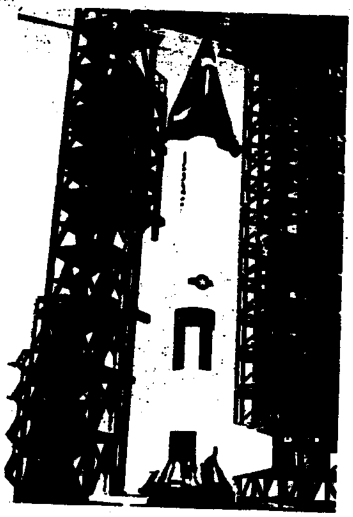
Technical Progress

• Representatives from the Space System Division participated in the DYNA SOAR 620A Mock-up which was held at Boeing, Seattle, from 11 through 20 September. A full scale TITAN II booster modified for DYNA SOAR requirements was included in the mock-up. A total of 269 RFA's (Request for Alteration/Change) were submitted on the complete air vehicle (booster and glider). Of these, thirty-five pertained to the booster. Mock-up Board action on the booster RFA's did not produce requirements for a major change. (U)

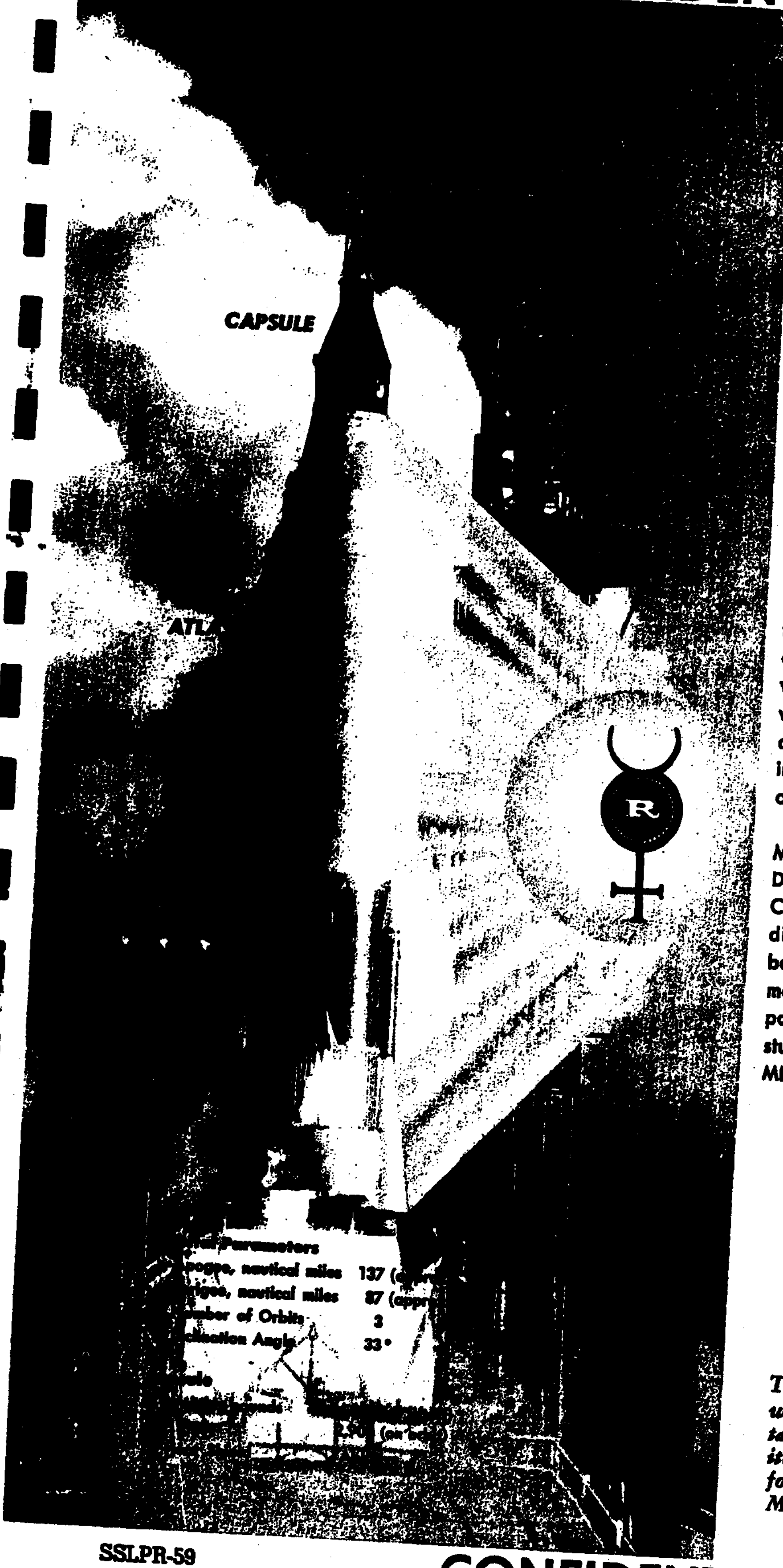
• On 23 September, approval was granted for DYNA SOAR to use Atlantic Missile Range Launch Complex No. 19. Among the advantages in using this complex rather than Complex No. 20 are earlier availability, new flame bucket installation, and recently installed electrical cabling. (U)

• On 15 September, during the Boeing Mock-up, it was decided that a Super High Frequency transmitter will be carried in the TITAN second stage. Use of this transmitter will insure that telemetry information is received during staging and the last portion of second stage flight when normal Very High Frequency telemetry would be attenuated because of the ion sheath. (U)





Display showing the TITAN II booster and DYNA SOAR glider on stand. The gantry and service tower are also shown. Approval for use of Atlantic Missile Range Launch Complex No. 19 was given on 23 September.



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-5 Flight (Orbital)

Following the initial hold-down, the vehicle containing a primate 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 plyon 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 three orbits. 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.

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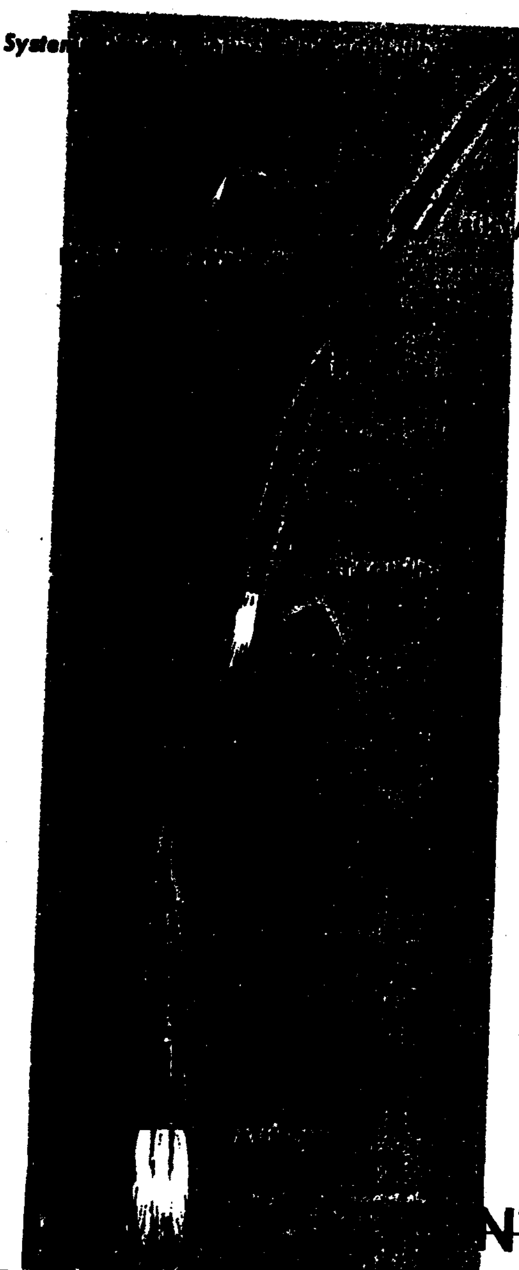

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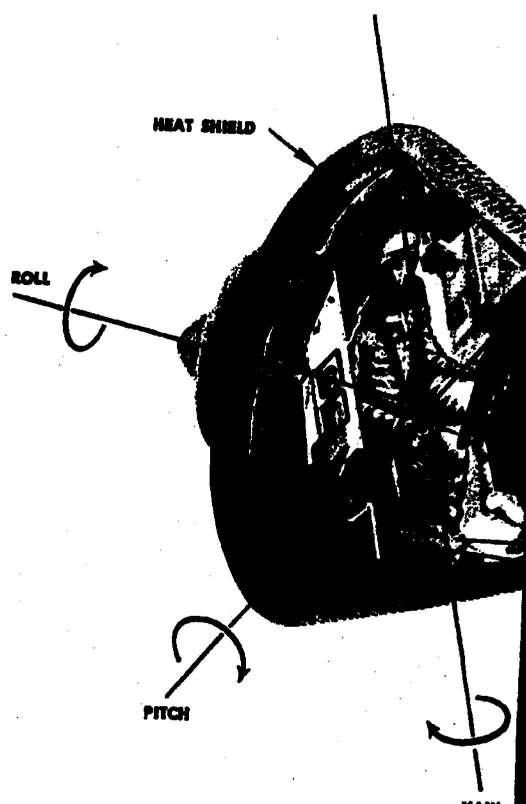

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AS "D" boosters

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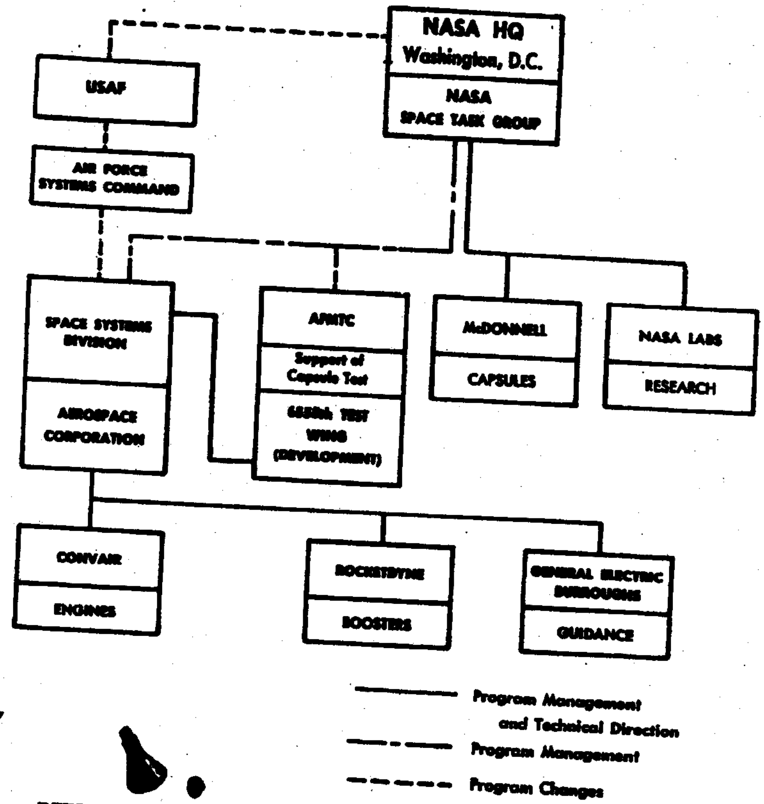

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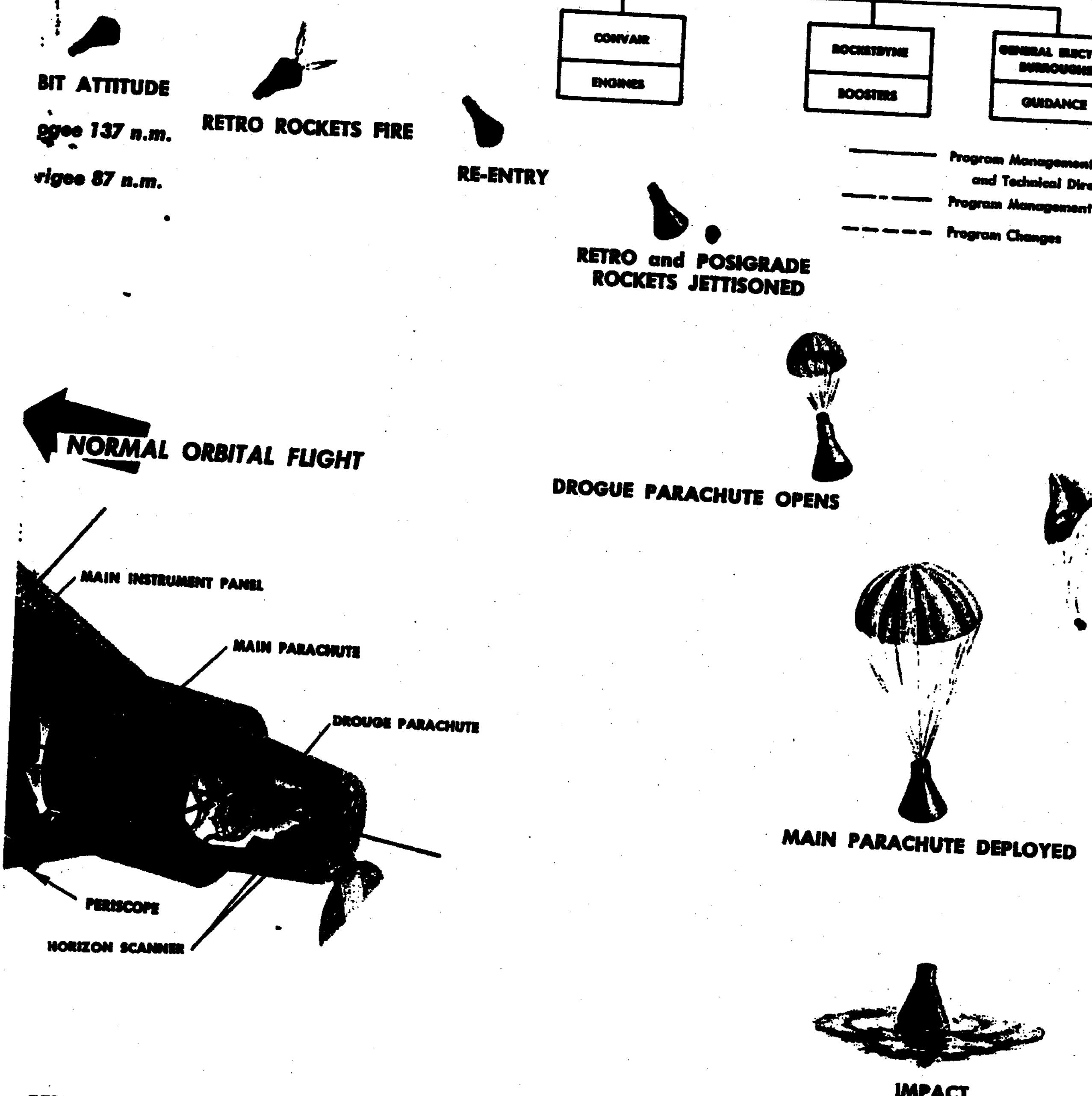

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★ Successful flight

● 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.*
MA-4	13 September	88D	*Quick-look determination has been completed and the entire test has been considered as highly successful.*

Monthly Progress – MERCURY

Flight Test Progress

MA-4 Flight

• The MA-4 capsule was successfully launched into orbit from Atlantic Missile Range Complex 14 at 0904 EST on 13 September. The launch vehicle was formed by mating a NASA adapter and production capsule Number 8A (refurbished from the MA-3 launch) with ATLAS 88D (first "thin skinned" booster converted by factory modification to the "thick skin" configuration). The capsule was equipped with an escape pylon and rocket, and both posigrade and retrograde rockets. The capsule escape system was connected closed-loop with the ATLAS Abort Sense and Implementation System. (C)

• The ATLAS programmer had been modified to incorporate programmer and abort system changes resulting from analysis of the MA-3 (ATLAS 100D) data. All critical electronic components containing certain transistors were reworked to replace the transistors prior to flight. Their replacement was required because loose solder globules were found inside certain transistors during a routine failure analysis shakedown test of a MERCURY/ATLAS autopilot at General-Dynamics/Astronautics. (C)

• This flight was the first successful orbital launch of a MERCURY capsule. The mission was planned for one orbit. Generally, the test objectives were concerned with the MERCURY capsule, the ATLAS launch vehicle, the MERCURY tracking network, and recovery procedures. A crewman simulator was installed aboard the capsule for the purpose of checking the Environmental Control System. (U)

• Capsule impact occurred approximately 70 n.m. west of the predicted impact point. Recovery of the capsule by a Navy destroyer was accomplished at 1214 EST. Quick-look determinations have been completed and the mission is considered to have been extremely successful with a few minor anomalies. The anomalies realized in the MA-4 ATLAS launch vehicle are now under review by the ATLAS Launch Vehicle Manned Flight Surveillance Board. This board was established by the Space Systems Division for the specific purpose of providing a formal and constant scrutiny of the MERCURY/ATLAS launch vehicle configuration. (C)

Figure 1. MERCURY Capsule No. 8 being lifted above ATLAS 88D by the Launch Stand 14 gantry crane. The posigrade and retrorocket package is visible at the bottom of the capsule.

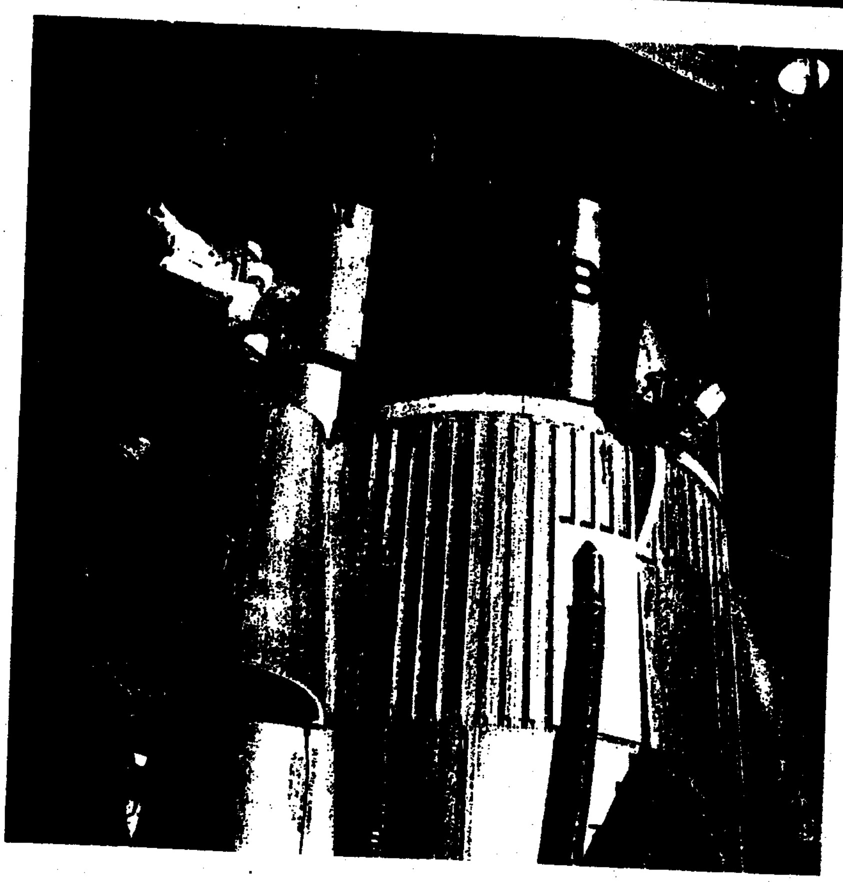


Figure 2. MA-4 blockhouse pre-launch activity. Pre-launch checkout of the ATLAS/MERCURY system was being conducted at this time. "Buttoning-up" ATLAS 88D prior to launch. On the left is a booster hold-down clamp.

MA-5 Prelaunch

- The MA-5 launch is now scheduled for the week of 6 November. The capsule with a primate aboard is scheduled to orbit the earth three times. ATLAS 93D, the MA-5 booster, is scheduled to complete the Factory Roll-out Inspection on 6 October. Following this, it will be airlifted to the Atlantic Missile Range and installed on Stand 14. (C)

- The test objectives for the MA-5 flight are:

1. Obtain information concerning the effects of prolonged weightlessness upon the performance of a medium size primate before subjecting man to a similar environment.

2. Demonstrate satisfactory performance of the capsule and its primary systems (environmental control, stabilization and control, sequence, rocket, electrical power, communications, and instrumentation) throughout a MERCURY orbital mission.

3. Provide detailed heating rate and thermal effect measurements throughout the capsule during all phases of an orbital mission.

4. Demonstrate satisfactory performance of the tracking network in supporting an orbital mission. The network facilities to be demonstrated are: launch, orbital, and landing point computing and display systems; the ground command system; the acquisition aid and radar tracking system; the telemetry receiving and display system, and the communications systems (air-ground, intersite, and intrasite).

5. Demonstrate the ability of the flight controllers to satisfactorily monitor and control an orbital mission.

6. Demonstrate the adequacy of the recovery plans for an orbital mission.

7. Determine the flight dynamic characteristics of the capsule during re-entry from orbit.

8. Evaluate MERCURY network countdown and operational procedures.

9. Determine the ability of the ATLAS booster to release the MERCURY capsule at the prescribed orbital insertion conditions.

Figure 3. Launch of MA-4 from Atlantic Missile Range Complex 14 on 13 September.

10. Evaluate the performance of the Abort Sensing and Implementation System.

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

12. Obtain data on the repeatability of the performances of all ATLAS missile and ground systems.

13. Evaluate the ATLAS booster with regard to engine start and potential causes for combustion instability. (C)

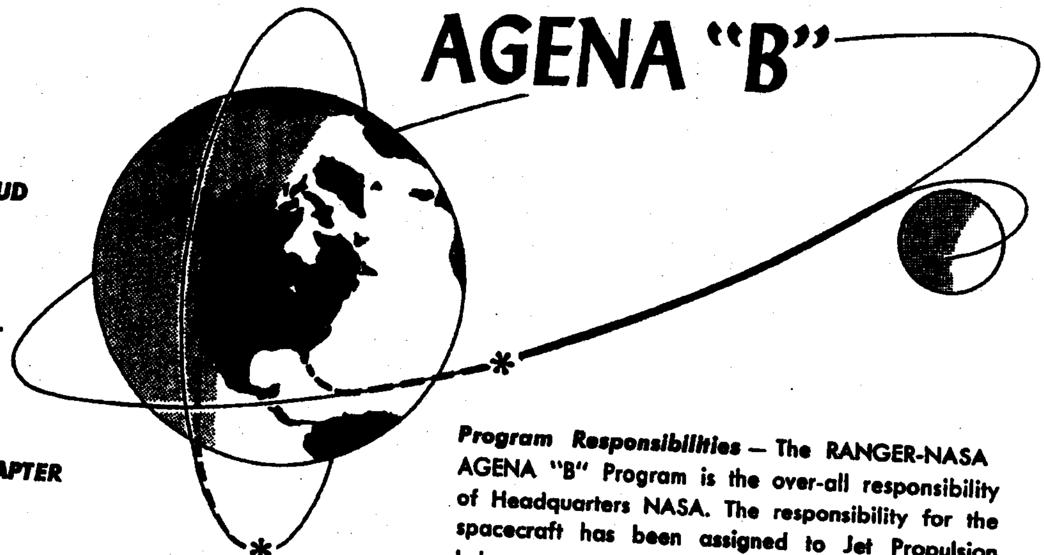
Technical Progress

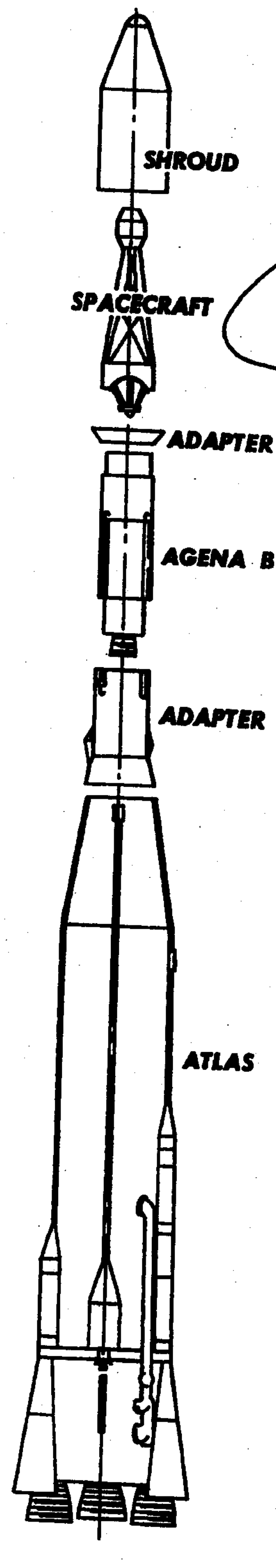
• Subsequent to a concentrated review by the ATLAS Launch Vehicle Manned Flight Surveillance Board held at the Space Systems Division on 26 September 1961, a recommendation was made to NASA that it will not be necessary to modify the ATLAS 93D booster engine with baffled injectors. Performance analysis of MA-4 indicated that MERCURY Capsule No. 9 could be boosted into orbit at the prescribed conditions established by NASA for MA-5, including the three second additional holddown time incorporated into the launch operation as a precautionary measure to prevent failure from possible rough combustion. The baffled injector modification has been established to prevent such rough combustion transients; however, rough combustion can be controlled during the critical period on unmodified engines through the use of rough combustion cutoff accelerometers which will automatically shut the engines down before liftoff, should rough combustion transients occur. (C)

• The board also agreed to accept a programmer modification to eliminate the 10.5 cycle per second oscillation encountered on MA-4 during the first few seconds of powered flight. This modification consists of utilizing the 85 second filtering arrangement during the 0 to 20 second time of flight. Incorporation of this modification will be accomplished on the autopilot programmer after acceptance of the composite test on ATLAS 93D. This will result in shipment of the booster without the programmer. The modified programmer will be shipped to the Atlantic Missile Range as soon as possible after booster shipment, but in any case, the programmer will arrive prior to the FACT. (C)

CONFIDENTIAL

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.*

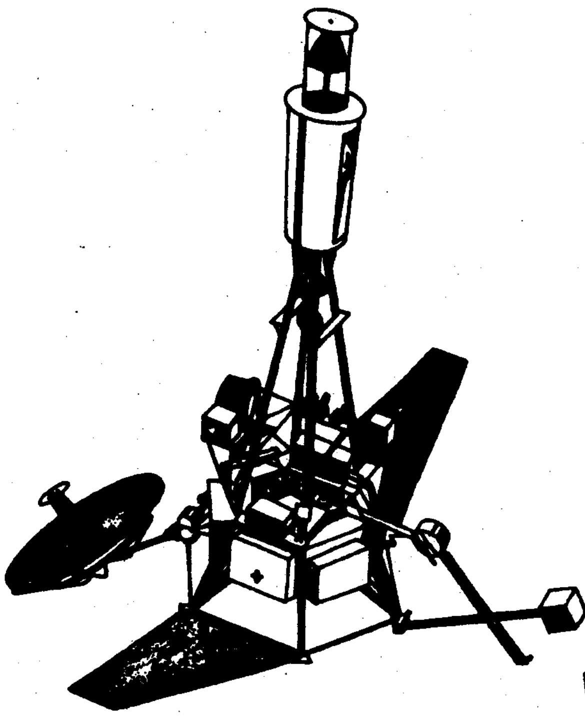
Program Responsibilities – The RANGER-NASA AGENA "B" Program is the over-all responsibility of Headquarters NASA. The responsibility for the spacecraft has been assigned to Jet Propulsion Laboratory (JPL) for interplanetary investigations and Goddard Space Flight Center (GSFC) for the earth satellite 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

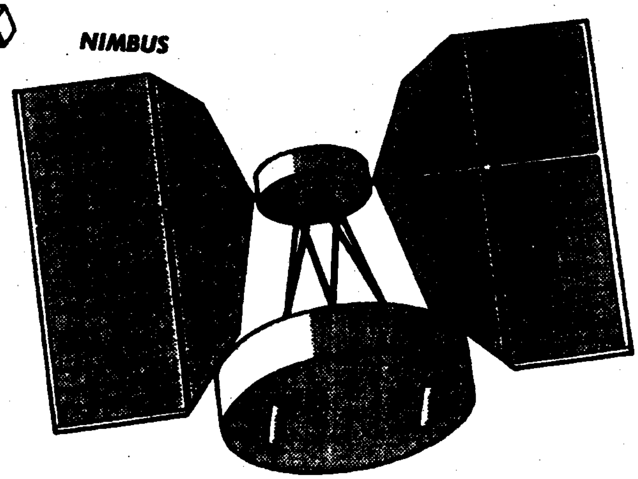
The remaining three launches will impact the surface of the moon and transmit scientific information back to the earth. Experiments are designed to measure seismographic disturbances, temperature changes and impact acceleration. These Ranger spacecrafts will also have the capability of accomplishing 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

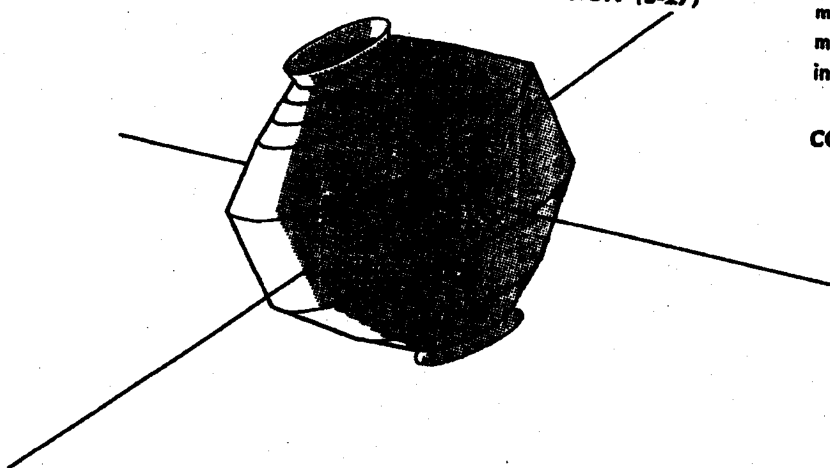
NIMBUS



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)

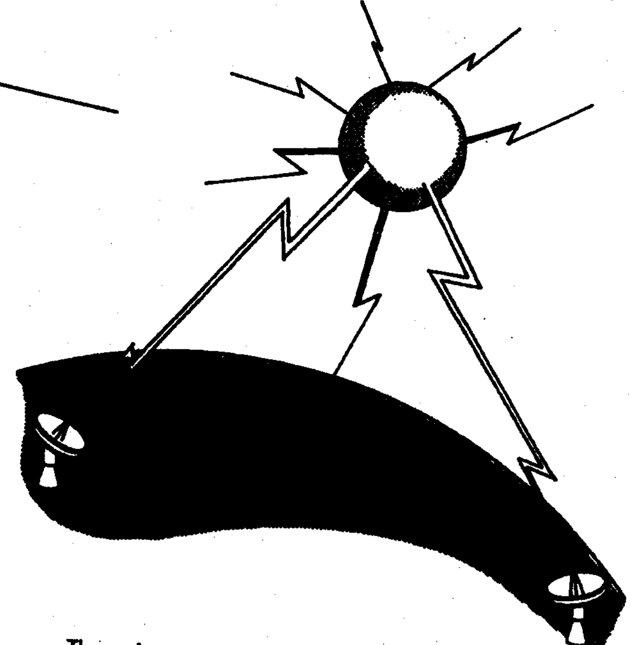


The primary objective of the S-27 Satellite is the examination of the structure of the ionosphere from above in a manner similar to that now being done by ground-based ionospheric sounders. In particular the objective is to obtain information about the ionosphere in the region above the F layer maximum.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

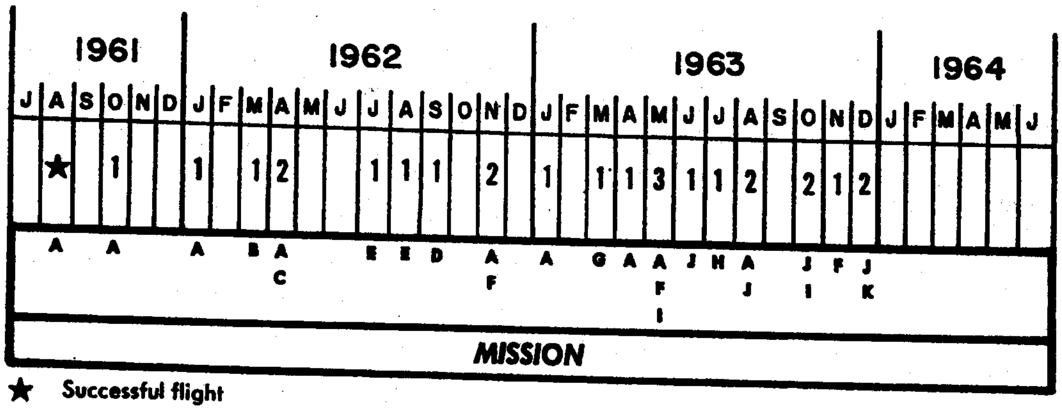
The Topside Sounder (S-27) will be launched on board a THOR/AGENA "B" booster system from Vandenberg Air Force Base into a 540 n.m. circular orbit. This will be the first Pacific Missile Range launch in this program; however, it will be similar to previous Air Force THOR/AGENA B launches from Vandenberg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



★ Successful flight

⬮ Unsuccessful flight

LEGEND

A	RANGER	ATLAS	AMR
B	Topside Sounder (S-27)	THOR	AMR
C	ECHO (A-12)	THOR	PMR
D	BACKUP (S-27 or A-12)	THOR	PMR
E	MARINER	ATLAS	AMR
F	NIMBUS	THOR	PMR
G	EGO	ATLAS	AMR
H	BACKUP (EGO)	ATLAS	AMR
I	REBOUND	ATLAS	PMR
J	CALORIE	ATLAS	AMR
K	OAO	ATLAS	AMR

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

Flight Test Progress

• The data from the RA-1 flight, the first RANGER Lunar Probe vehicle, have been reduced and analyzed. No changes were indicated for either the ATLAS booster or the Spacecraft systems. Some minor precedural changes have been made and a redundant pressure switch has been installed on the AGENA vehicle. This switch will insure more reliable operation of the Bell XLR-81 Ba-9 engine. (U)

• The second Lunar Probe vehicle (RA-2) is on schedule with no apparent problems. This launch is scheduled for the period of 20 through 27 October. The complete booster system and spacecraft have been mated and are on Launch Stand No. 12 undergoing final checkout. The combined systems test will be conducted on 9 October. Test objectives and flight plan for RA-2 are the same as those for RA-1. (C)

Figure 1. Backing ATLAS 117D up the ramp to Stand 12. Mating AGENA vehicle 6002 to form the RA-2 booster system. This launch is scheduled for late October.

Technical Progress

• The AGENA vehicle for RANGER 3 is at Santa Cruz Test Base with static firings scheduled to begin on 9 October. This vehicle is on schedule and will be used for the first lunar impact test mission which is scheduled for January 1962. ~~(C)~~

• The Topside Sounder (S-27) mission requirements have been finalized and procedures are being established to fulfill them. The AGENA B vehicle has entered the systems test area prior to shipment to Santa Cruz for hot firings. Several meetings have been held to integrate spacecraft and booster requirements. The preliminary countdown manual has been distributed. Launch stand modifications required to support this mission will start early in December. (U)

Facilities

• Bid advertisement for modifications to Complex 75-1 was delayed due to nonavailability of NASA construction funds. Funds are now scheduled to be released on 6 October. The Army Corps of Engineers will advertise the project for bid on or about 19 October. Bid opening is scheduled for 1 November. No delay in meeting the program need date is anticipated. (U)

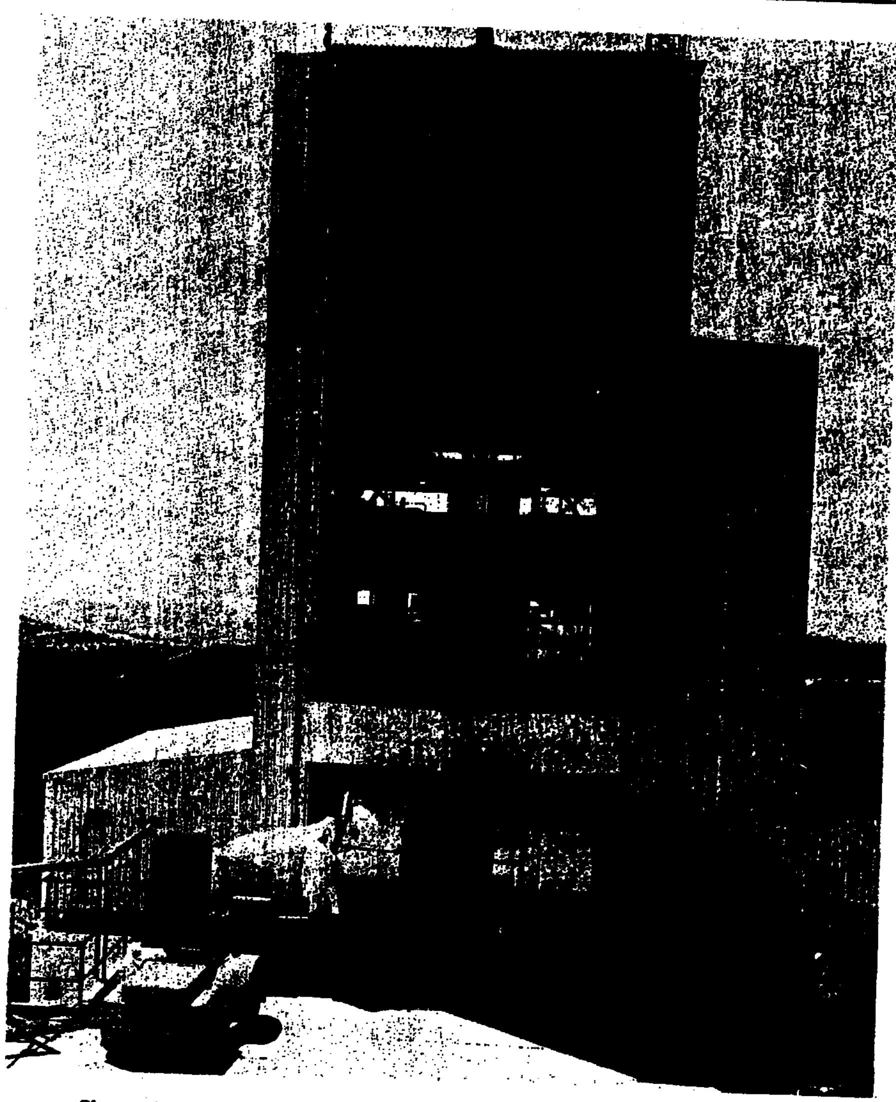


Figure 2. Delivering AGENA 6003 to the Santa Cruz Test Base test stand for static firings. This vehicle will be flown on the first lunar impact mission.

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

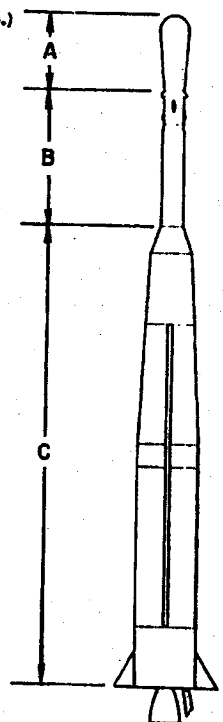
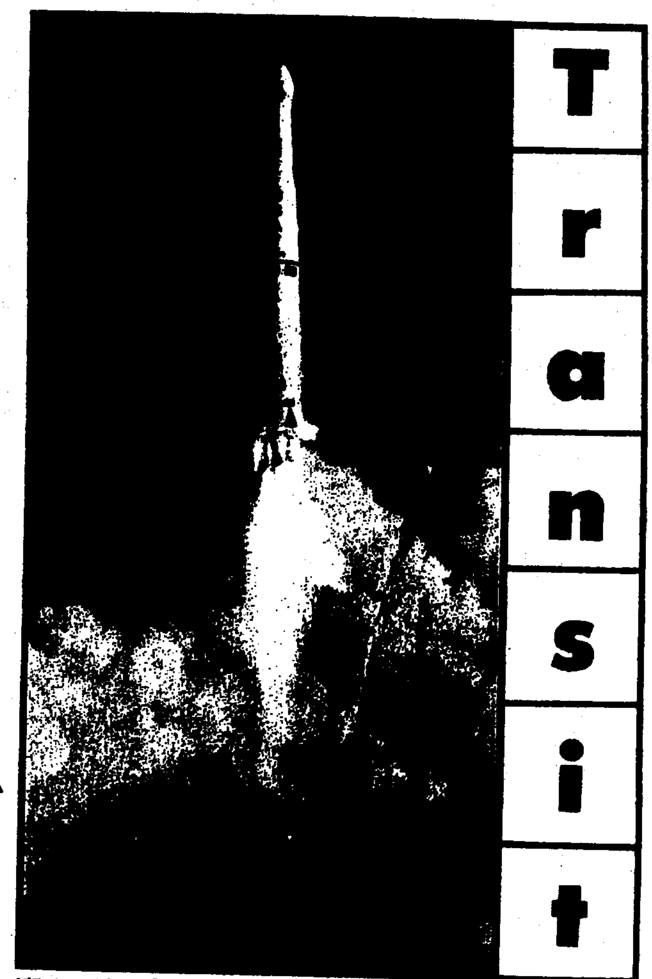


Figure 1. TRANSIT 1A three stage flight vehicle.



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.

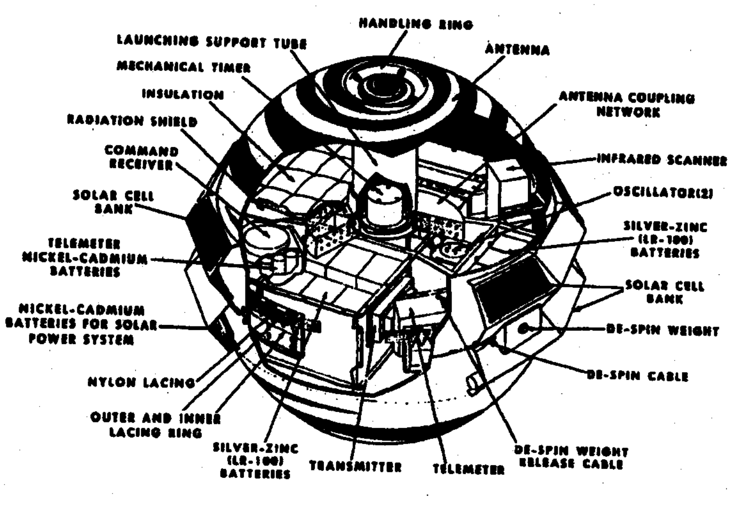
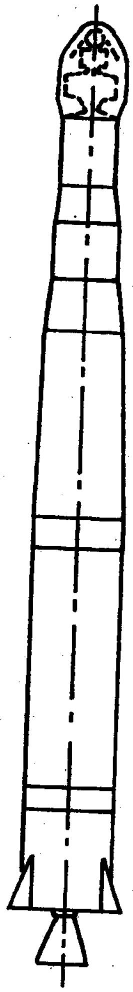


Figure 2. Cut-away drawing of TRANSIT 1A payload (NAV 1).

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-I

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

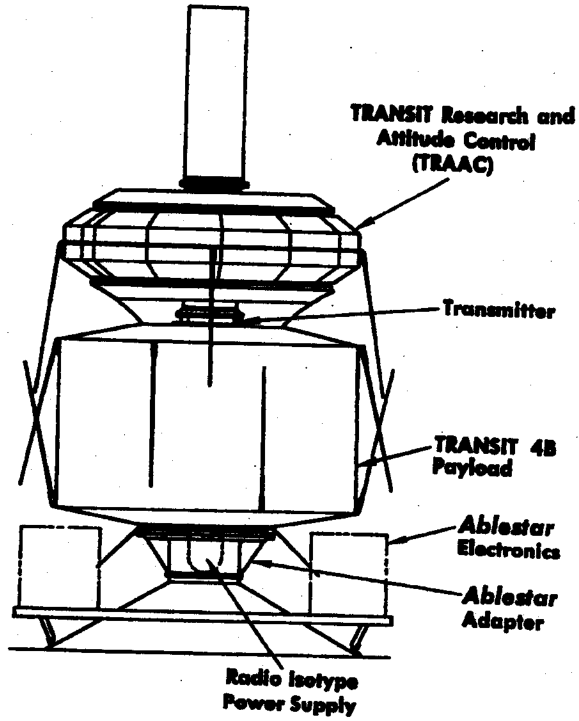


Figure 4. Payload arrangement for TRANSIT 4B flight.

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 4B vehicle will carry a dual payload consisting of TRANSIT 4B and TRANSIT Research and Attitude Control (TRAAC). The programmed payload weight is 445 pounds, which breaks down as follows: TRANSIT 4B — 192 pounds, TRAAC — 238 pounds and Ablestar adapter — 15 pounds. The TRANSIT payload is the next step in the Navy program to develop an operational navigation system. The payload is a short cylinder with slightly convex ends. This payload will carry a Radio Isotope Power Supply as did TRANSIT 4A. This radioactive power supply provides electricity for several satellite systems. The TRAAC payload consists of an old-style TRANSIT instrument platform surrounded by a band of solar cells with a cylinder on the top. The slender cylinder contains a magnetometer and radio antennae. This payload, as its name implies, will carry specialized experiments investigating problems associated with advanced TRANSIT payloads. Both payloads are under the cognizance of Applied Physics Laboratory.

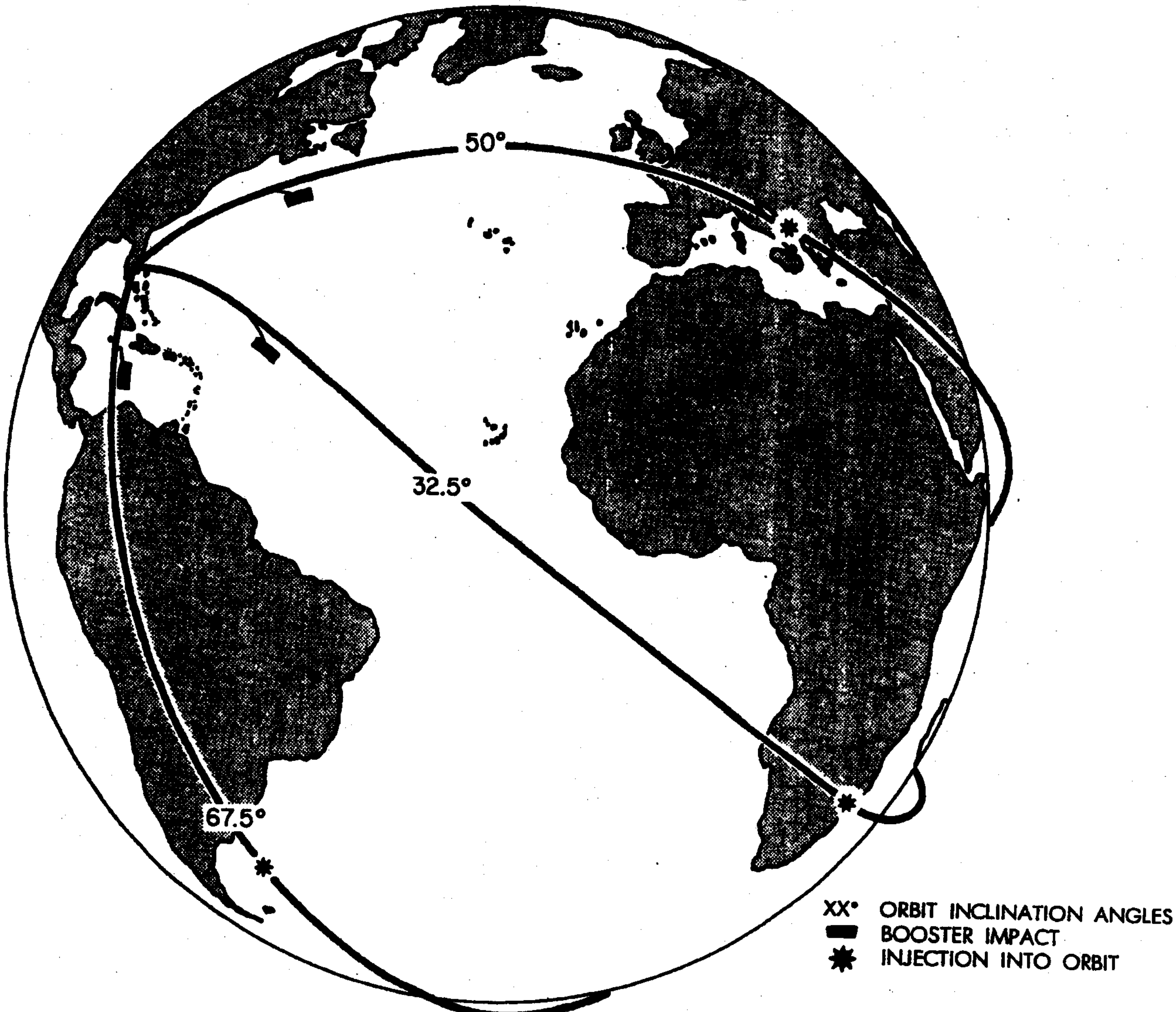
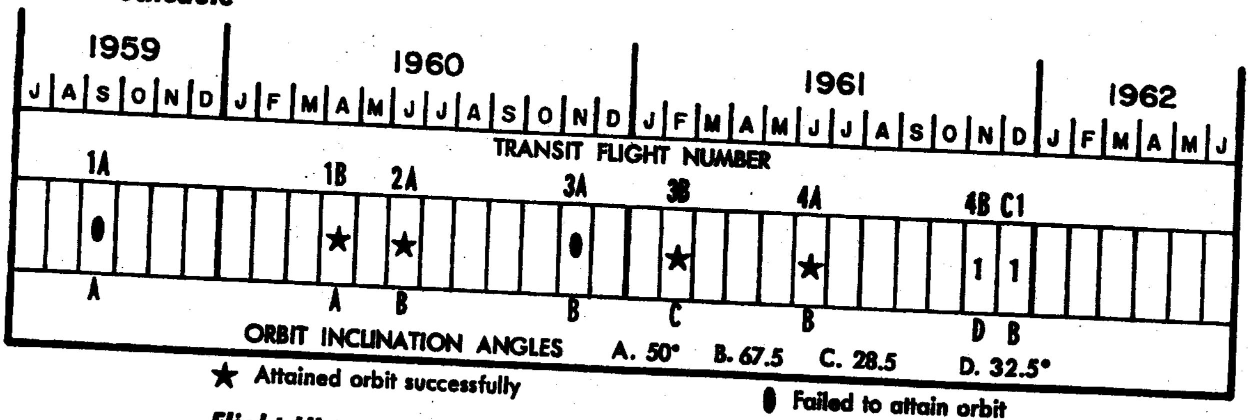


Figure 5. Typical TRANSIT launch trajectories showing flight path, booster impact areas, and orbital injection points.

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 requested 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 missions. A delay of more than two days will affect the Composit I launch scheduled for 12 December. (C)

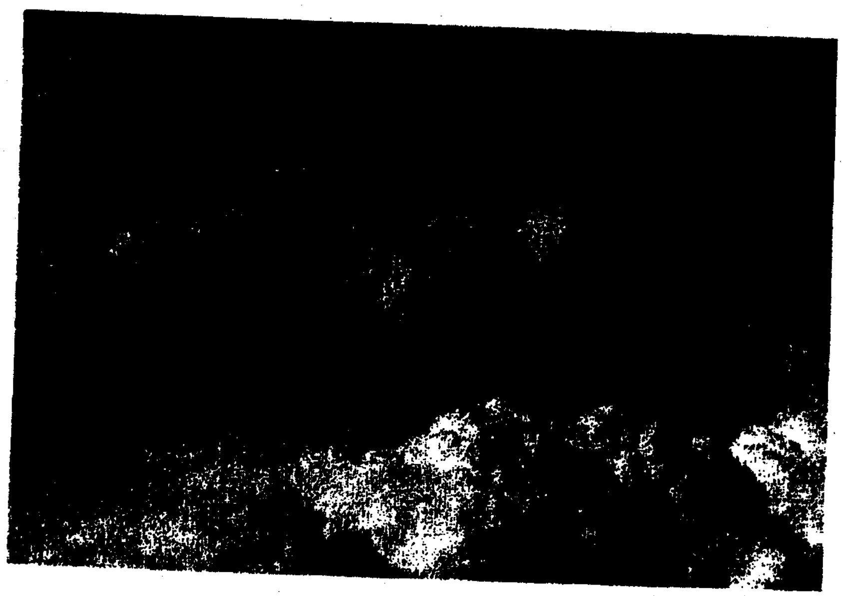
Technical Progress

- The TRANSIT 4B Ablestar stage, serial number 009, was accepted by the Air Force on 28 September. It will be airlifted to the Atlantic Missile Range on 2 October. All systems of the DM-21A/Ablestar launch vehicle were on schedule at the end of the report period. (U)

- Ablestar 009 is the first Ablestar stage to use a Bell Telephone Laboratory guidance system. This also will be the first flight test of the BTL Series 600 missileborne guidance equipments. The Ablestar stage will also carry a newly designed, solid-state programmer, a new integrating accelerometer and a modified telemetry transmitter. (U)

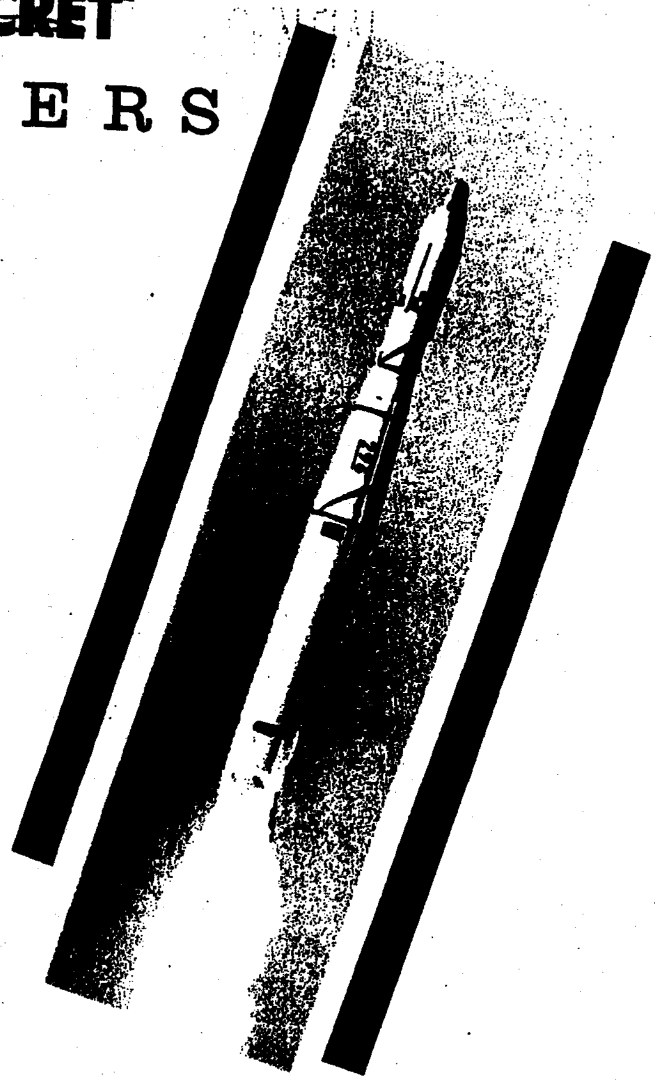
SPACE

BOOSTERS



EXISTING OR PROGRAMMED STAGES

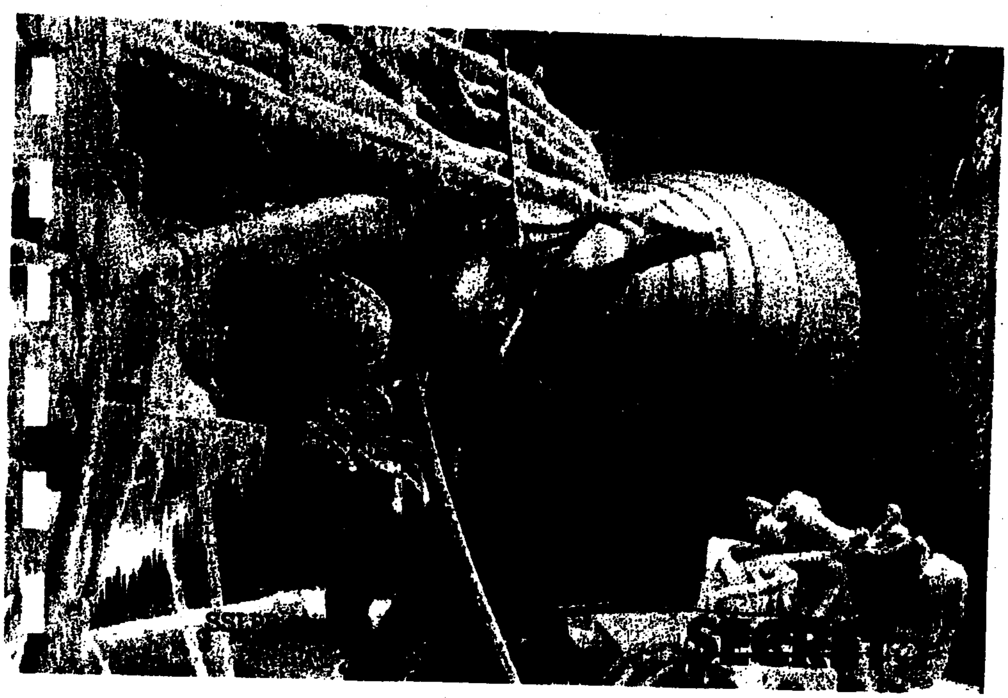
BOOSTERS

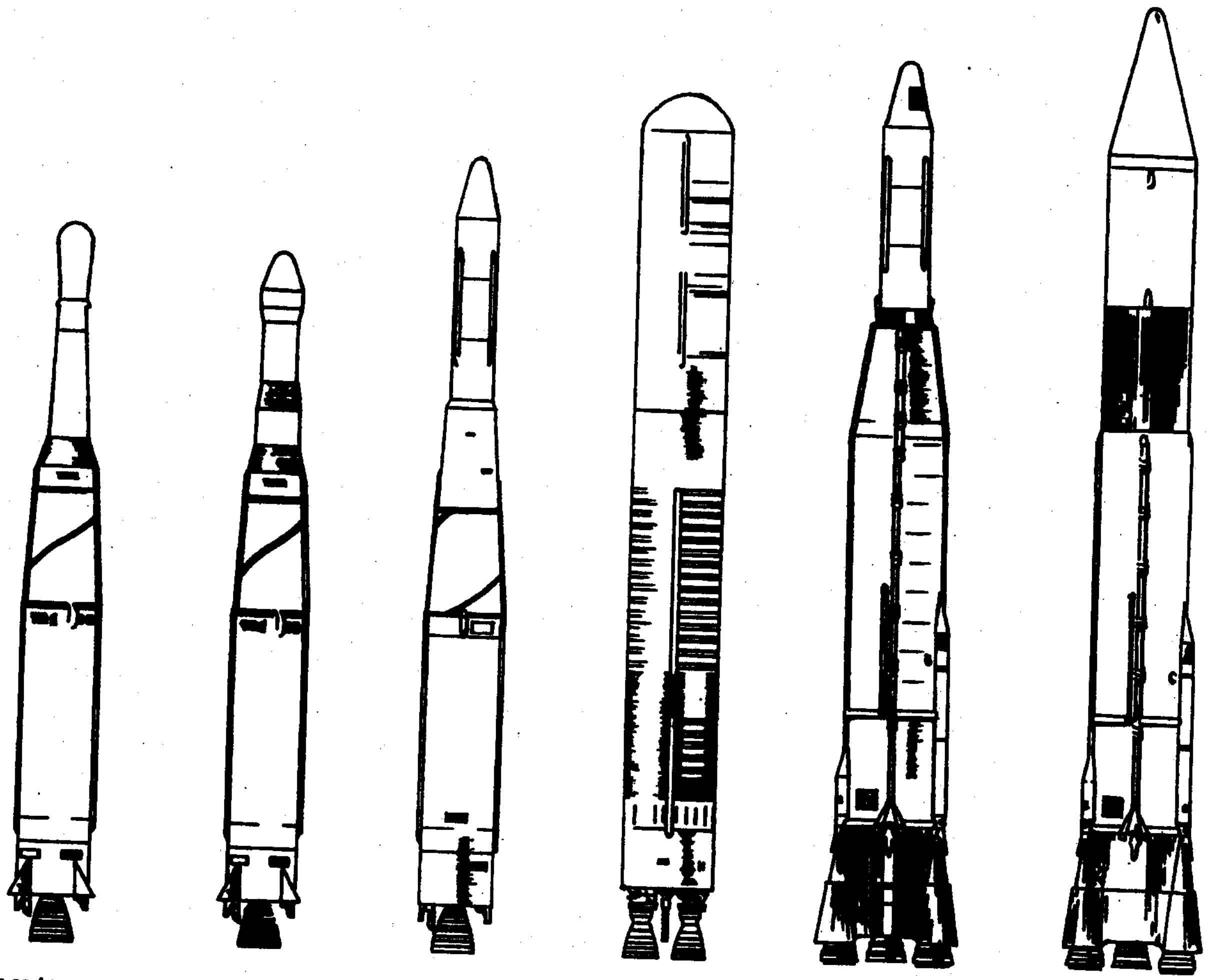


● The primary pacing factor in the accomplishment of space missions has been, and for some time will continue to be, the availability of Air Force ballistic missiles and upper stages to boost the payload vehicle. Space flight planning requires close examination of all technological areas wherein advances 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

ABLE — 1, — 3 and — 4. .
ABLE — 4 and — 5. . . . .
ADVENT (Phase One) . .
ADVENT (Phase Two) . .
ADVENT (Phase Three) .
ANNA . . . .
COURIER . . . .
DISCOVERER (1 thru 15)

[redacted]

DISCOVERER (16 thru 19)
DISCOVERER (20 and subs)
DYNA SOAR . . . .
MERCURY . . . .
MIDAS (I and II). . . . . .
MIDAS (III and subs). . .
NASA AGENA "B". . .

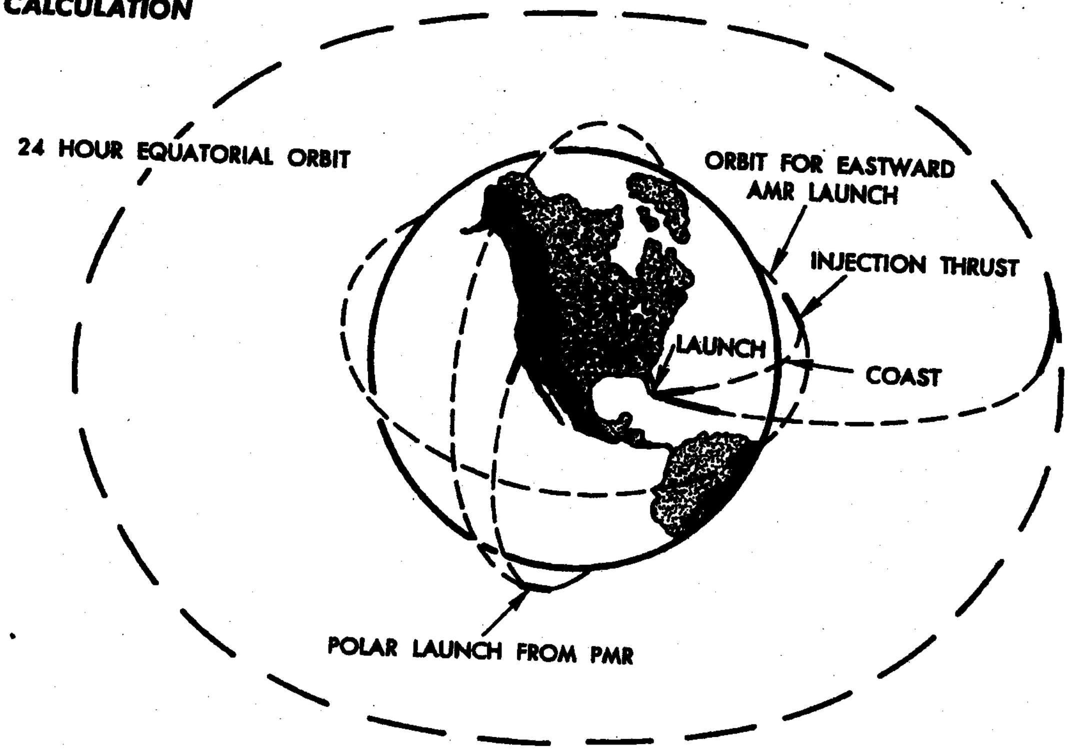
[redacted]

NASA Delta . . . .
SAINT . . . .
SNAPSHOT . . . .
TIROS . . . .
TRANSIT 1A . . . .
TRANSIT 1B thru 5B . .
VELA HOTEL. . . . .

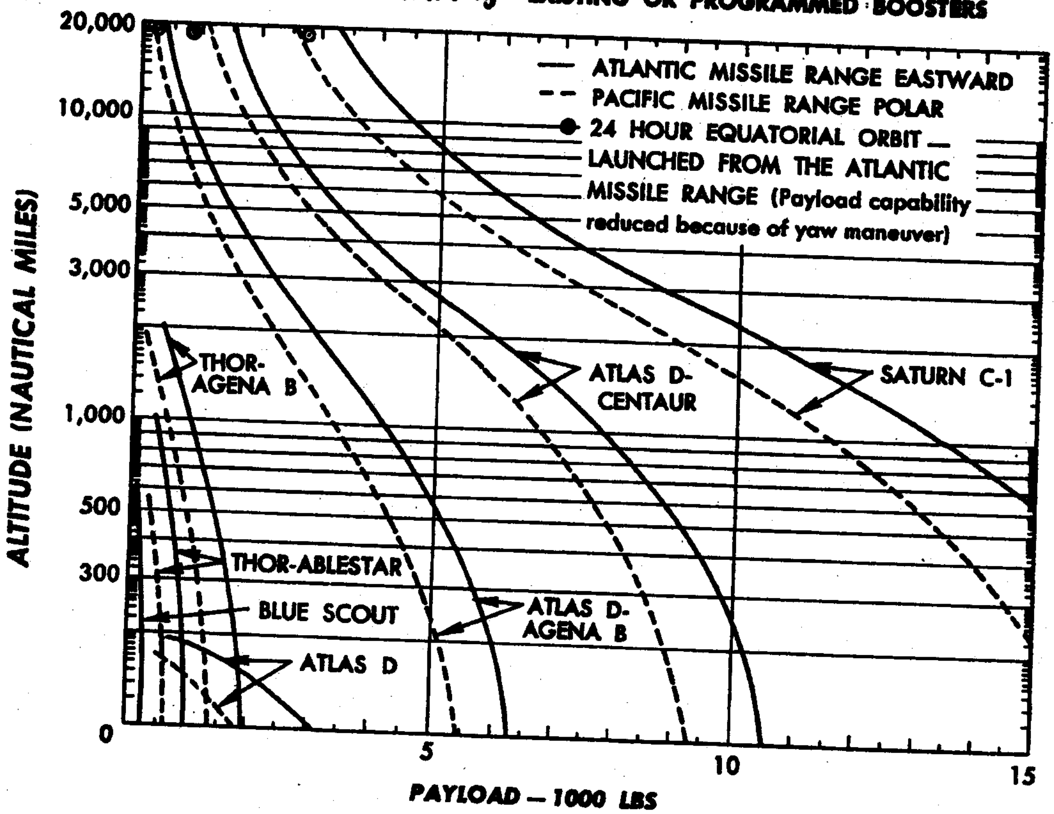
[redacted]

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

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	7,846	7,204	6,590	6,870
Fuel — RP-1/RJ-1*	31,500	31,500	33,500*	31,500
Oxidizer — Liquid Oxygen	68,000	68,000	68,000	68,000
Total	107,346	106,704	108,090	106,370
Height — feet	61.3	65.1	55.9	60.4
Engine — Rocketdyne Division of North American Aviation	MB-3 Block I	MB-3 Block I	MB-3 Block II	MB-3 Block I
Thrust — lbs. (sea level)	152,000	152,000	169,000	152,000
Spec. Impulse — lb.-sec/lb. (sea level)	247.0	247	250	247
Burn Time — seconds	160	160	149	160
Guidance — Bell Telephone Laboratories series 400 or autopilot only.				
	(27) ⟨31⟩ (87)	(6) ⟨6⟩ (100)	(15) ⟨16⟩ (93.7)	(5) ⟨7⟩ (72)

ATLAS — General Dynamics-Astronautics

	E Series D
Weight — dry	15,100
Fuel — RP-1	74,900
Oxidizer — Liquid Oxygen	172,300
Total	262,300
Height — feet	69
Engine — Rocketdyne Division of North American Aviation	MA-3
Thrust — lbs. (sea level)	
Booster	309,000
Sustainer	57,000
Vernier	2,000
Specific Impulse — lb-sec/lb. (sea level)	
Booster	251
Sustainer	214.7
Guidance — Radio Mod II/III — General Electric (radar), Burroughs (computer)	(10) ⟨15⟩ (72)

TITAN II — The Martin Company

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

UPPER STAGES

	R ABL X248-9 Allegany Ballistics Laboratory
Weight — wet	60
Propellant — Solid	459
Total	519
Height — feet	
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	7
Not tested because of first stage failure (□)			1
Number of launches attempted (⬡)	17	4	8
Percentage of success (⬭)	71	75	87.5

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

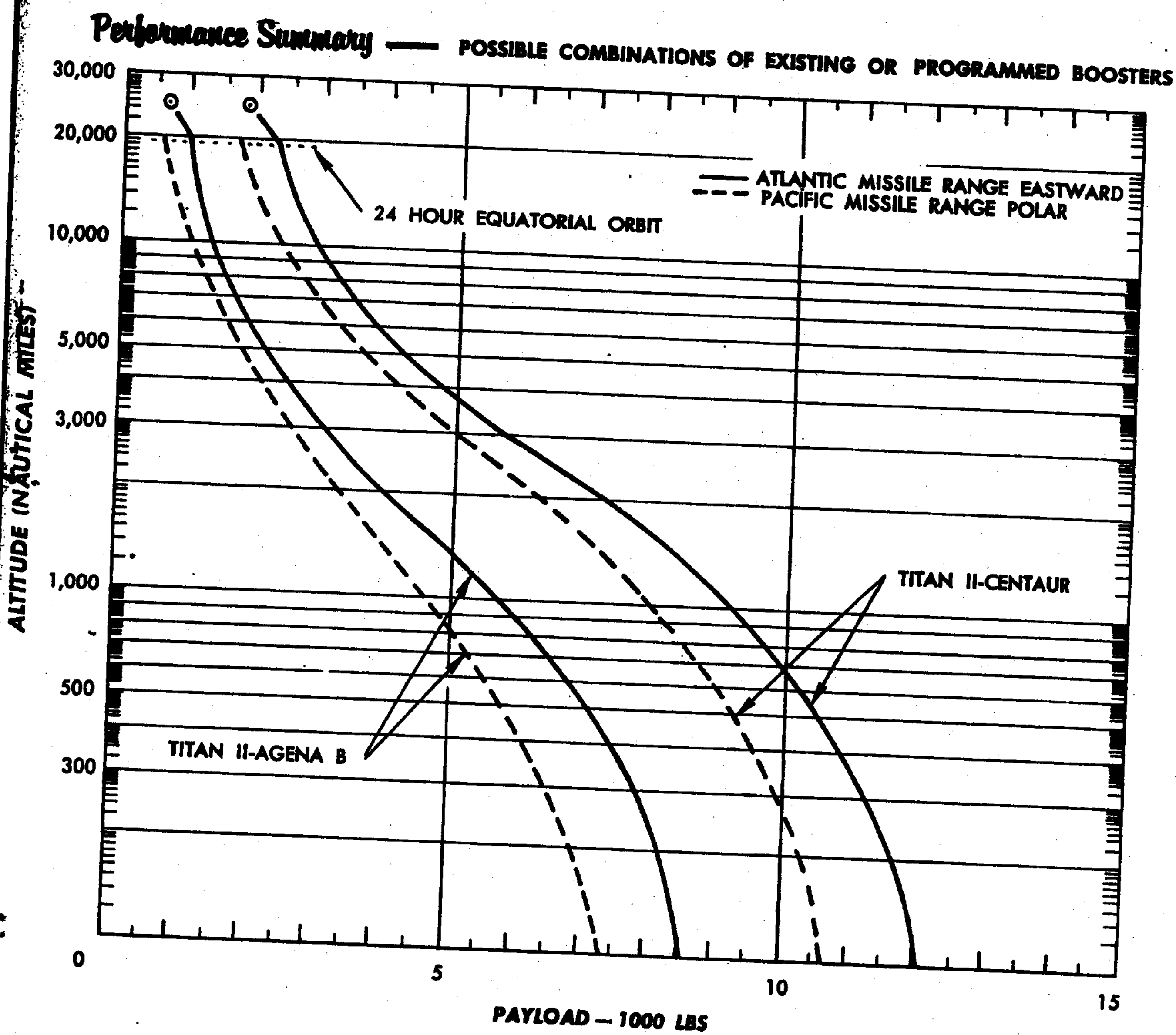
CENTAUR — General Dynamics-Astronautics

	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:

① Payload weight not included. Does include controls, guidance, APU and residual propellants.
② Does not include THOR adapter (225 lbs.) or ATLAS adapter (315 lbs.)
③ Single restart capability
④ Dual burn capability
⑤ Changes 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
ATLANTIC MISSILE RANGE EASTWARD
PACIFIC MISSILE RANGE POLAR
24 HOUR EQUATORIAL ORBIT
TITAN II-CENTAUR
TITAN II-AGENA B
ALTITUDE (NAUTICAL MILES)
30,000
20,000
10,000
5,000
3,000
1,000
500
300
0
5
10
15
PAYLOAD — 1000 LBS