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MONTHLY SUMMARY OF

SPACE

Systems Division

ACTIVITIES

EXEMPTED FROM DECLASSIFICATION IAW E.O. 12958

REVIEWED BY ______

DATE 4-7-97

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WDLPR-4-285

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

WDLPR-4

12 May 1961

Monthly Summary of SPACE SYSTEMS DIVISION ACTIVITIES

APRIL 1961

FOREWORD

This month's report includes information about: DISCOVERER XXIII launched on 8 April, BLUE SCOUT (D-5) launched on 12 April, and MERCURY MA-3 launched on 25 April. Project ANNA, a tri-service geodetic satellite program, is presented this month at the end of the BOOSTER SUPPORT PROGRAMS Section. BAMBI is the new program title for the ORBITAL INTERCEPTOR Program. This will be the last month that the ABLE Program will be reported; preparation of the ATLAS/ABLE-5B Final Mission Report marks the end of this scientifically beneficial program. For the first time each paragraph in the Monthly Progress section has its security classification indicated. Many of the completed questionnaires, which were attached to the December report, suggested that this would be desirable. Other suggestions will be included in subsequent reports.

The Monthly Summary of Space Systems Division Activities has been determined to be a Group 3 document in accordance with paragraph 6, AFR 205-2. This categorization applies to all previous issues. Holders of these documents are responsible for acting promptly to place the correct notation on the document in accordance with this regulation.

for [signature] Col USAF

O. J. RITLAND
Major General, USAF
Commander

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SATELLITE
systems

DISCOVERER
MIDAS
ADVENT

The DISCOVERER Program consists of the design, development and flight testing of 39 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 the advanced military reconnaissance 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.

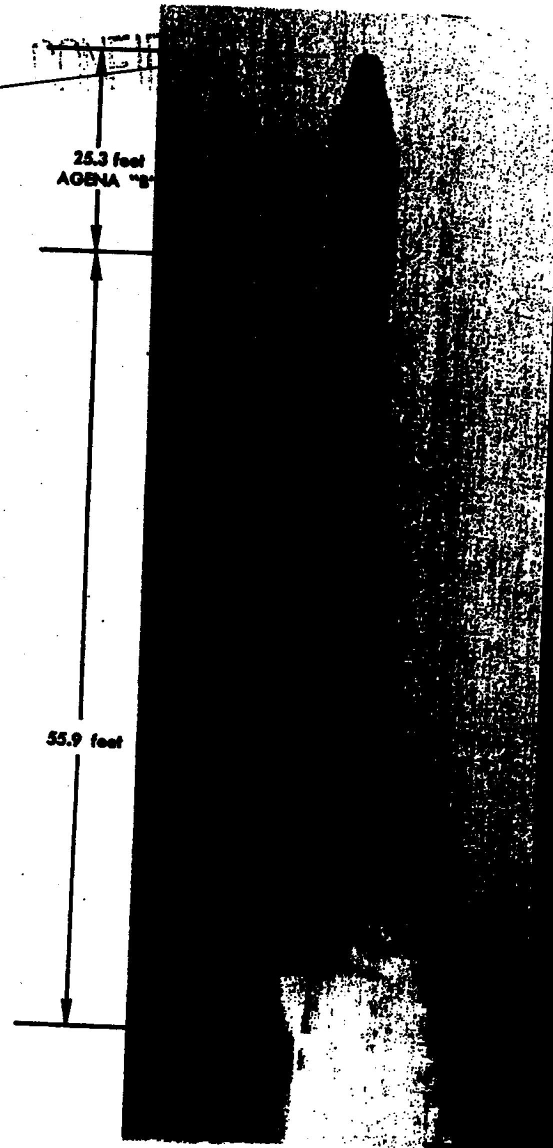
(f) Conducting bio-medical experiments with mice and small primates, including injection into orbit, re-entry and recovery.

PROGRAM SUMMARY

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

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

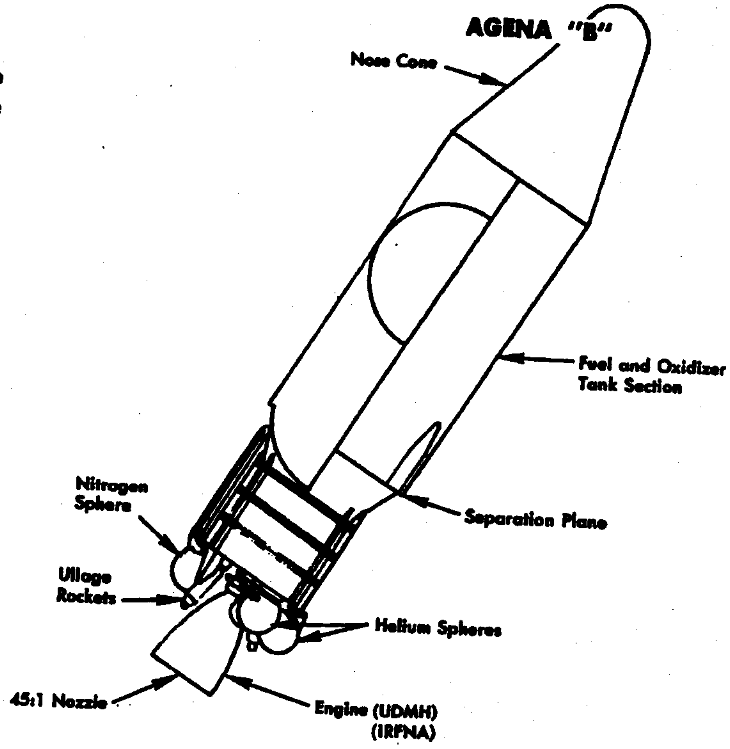
D i s c o v e r e r



SECOND STAGE	AGENA "B"
Weight—	
Inert	1,346
Payload equipment	915
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

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 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, including the return of a manned satellite from orbit.

AGENA "B"

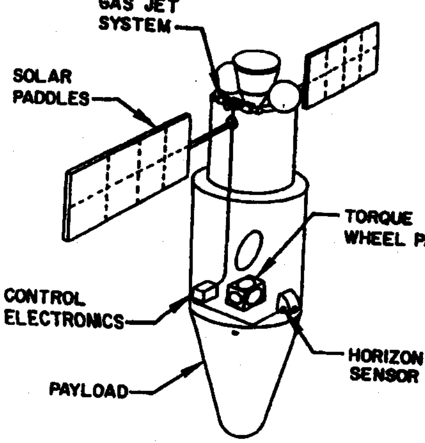


AGENA VEHICLE DEVELOPMENT

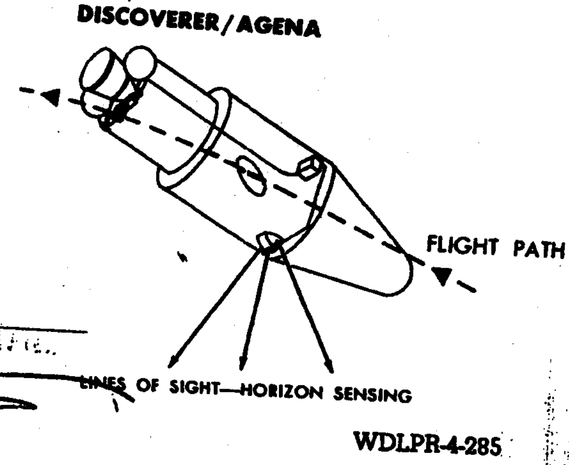
The AGENA vehicle was originally designed by the Air Force as the basic satellite vehicle for Advanced Military Reconnaissance Satellite Systems Programs. The first AGENA satellites or "A" configuration employed the YLR-81Ba-5 engine which developed 15,600 pounds thrust at altitude. The development of an optical inertial system for vehicle stabilization and an attitude control system for orbit injection resulted from the advanced programs stringent eccentricity requirements.

By increasing the tank capacities on the AGENA "A" an improved performance capability was achieved. This new configuration or AGENA "B" used the bell XLR-81Ba-7 engine and was first flown on DISCOVERER XVI. The latest AGENA "B" vehicles use the 16,000 pound thrust XLR-81Ba-9 engine which has a restart capability. This larger vehicle permits achieving higher injection altitudes with equivalent weight payloads and the restart provision permits orbital adjustment.

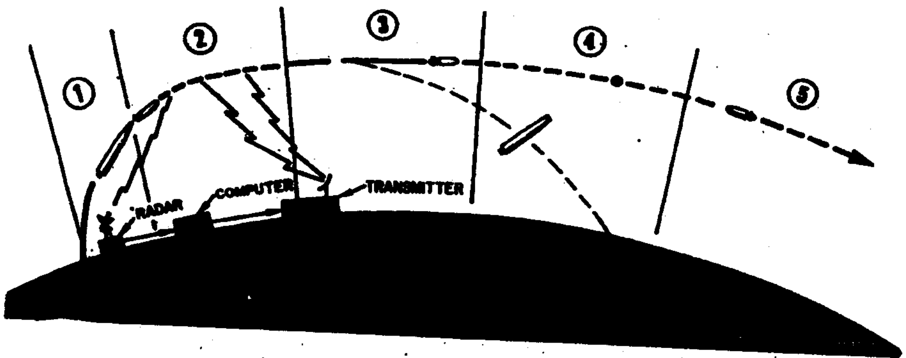
SAMOS and MIDAS AGENA VEHICLE



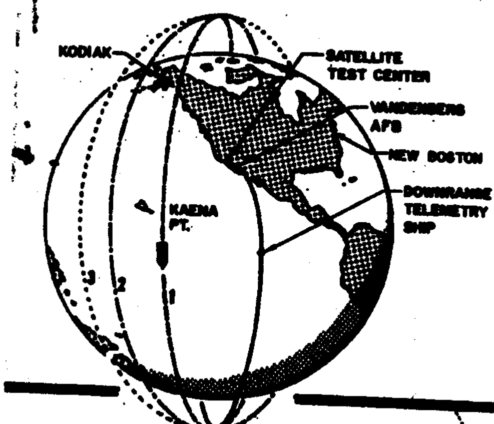
DISCOVERER/AGENA



Powered Flight Trajectory



1. **First Stage Powered Flight** — 2.5 minutes duration, 78 n.m. downrange, guided by programmed autopilot and 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.
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).

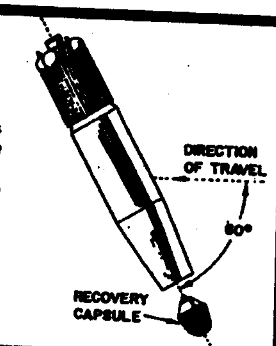


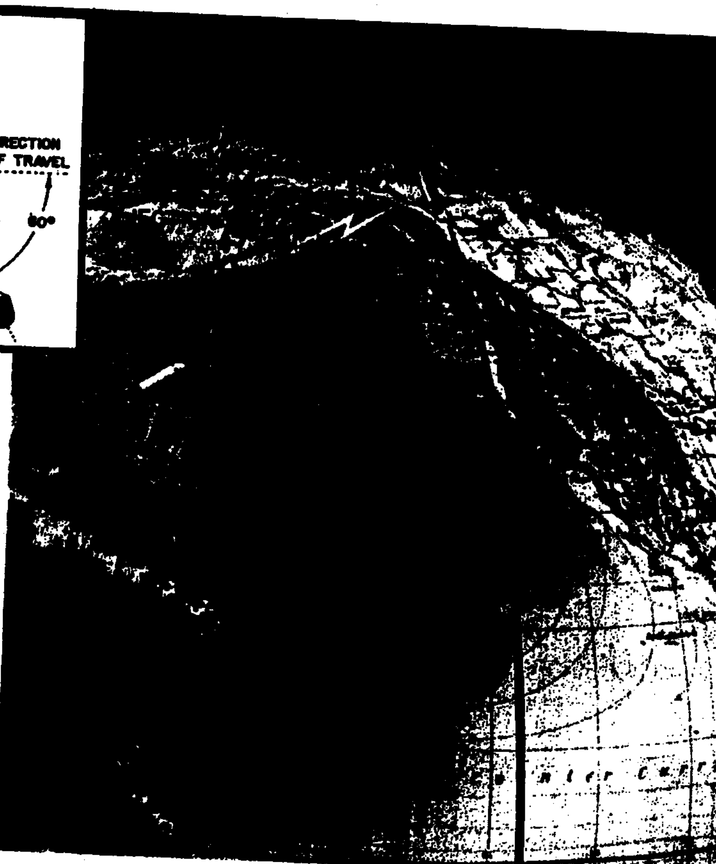
Orbital Trajectory

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 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 just 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 re-entry. 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, WVII and JC-54 aircraft supplemented by 2 or 3 surface vessels that receive and record telemetry data. If it is necessary to retrieve the capsule from the sea, these ships are available.*

Facility	Equipment*	Flight Function
Satellite Test Center	ABCD	Over-all control, orbit computations and predictions, acquisition data for tracking stations, prediction of recovery area.
†Vandenberg AFB Tracking Station	BDEFGHIJ	Ascent and orbital tracking, telemetry reception, trajectory measurements, command transmission.
†Mugu Tracking Station	BDEFGHIJ	Ascent tracking, telemetry reception, computation and transmission of ignition and shutdown corrections.
Downrange Telemetry Ship	BGIJK	Telemetry reception and tracking during ascent and orbit injection.
†New Hampshire Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception, commands to satellite.
†Kodiak Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception, initial acquisition on pass 1, monitor events in recovery sequence.
†Hawaiian Tracking Station	BDFGHIJ	Orbit tracking, telemetry reception and transmission of commands to satellite.
Hickam AFB Oahu, Hawaii	D	Over-all direction of capsule recovery operations.
Tern Island	BGHJ	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. Guidance and Command Equipment (DISCOVERER ascent only)
F. VERLORT
G. VHF FM/FM Telemetry Station
H. VHF Direction Finding Equipment
I. Doppler Equipment
J. VHF Telemetry Antenna
K. APL Doppler Equipment

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

Launch Schedule

Vehicle	Launches	Month	Year
A	●	J	1959
A	★	F	1959
A		M	1959
A	★	A	1959
A		M	1959
A	● ●	J	1959
A		J	1959
A	★ ★	A	1959
A		S	1959
A		O	1959
A	★ ★	N	1959
A		D	1959
A		J	1960
A	● ●	F	1960
A		M	1960
A	★	A	1960
A		M	1960
A	●	J	1960
A		J	1960
A	Ⓡ Ⓡ	A	1960
A	★	S	1960
B	●	O	1960
B	Ⓡ	N	1960
B	Ⓡ ★	D	1960
C		J	1961
C	★ ★	F	1961
C	●	M	1961
C	★	A	1961
C	1	M	1961
C	2	J	1961
C	3	J	1961
C	2	A	1961
C	1	S	1961
C	3	O	1961
C	2	N	1961
C	1	D	1961

★ Attained orbit successfully.

Ⓡ Capsule recovered.

● Failed to attain orbit.

VEHICLE CONFIGURATIONS

A. THOR—DM-18/AGENA "A"

B. THOR—DM-21/AGENA "B" MB-3 Block 1/XLR81-Ba-7

C. THOR—DM-21/AGENA "B" MB-3 Block 2/XLR81-Ba-9

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.*

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 Program

Flight Test Progress

• DISCOVERER XXIII was launched from Vandenberg Air Force Base Pad 5, Complex 75-3 at 1121 PST on 8 April. Recovery of the vehicle's capsule was scheduled after four days on orbit. All ascent operations: boost, separation, coast, and orbital boost were accomplished as planned and the DISCOVERER satellite was injected into a near nominal orbit. Table I shows the predicted and attained parameters. The AGENA operation proved the effectiveness of the hydraulic modification resulting from the malfunction recorded on DISCOVERER XXII. (S)

	Programmed	Actual
Apogee, nautical miles	366	351
Perigee, nautical miles	165	162
Eccentricity	0.0274	0.0257
Period, minutes	94.40	94.074

Table I. Comparison of Programmed and Actual Orbital Parameters for DISCOVERER XXIII

• Tracking and telemetry data received on the first and second passes showed that the satellite had satisfactorily reoriented to an engine first attitude and was stable. On the next contact with the vehicle (pass seven) abnormalities in horizon scanner operation were noted. Between pass nine and ten, all control gas was expended and the satellite became unstable. This resulted in intermittent radar lock-on and cyclical fluctuations in signal strength from satellite RF transmissions although ground stations were able to command the satellite and received usable telemetry data. (S)

• The decision was made to attempt recovery of the capsule on pass 32 instead of the nominal pass 63. The New Hampshire Station transmitted the command for ejection on the alternate pass (command five) but the satellite verified receipt of two commands (five and six). Command six causes the orbital timer to skip a subcycle. As a result, the capsule was ejected on pass 31. The capsule retro-sequence operated satisfactorily, but since the satellite was not in the proper attitude at separation, the capsule was ejected into a new orbit. The capsule's orbit has an apogee of 850 nautical miles, a perigee of 120 nautical miles and a period of 101 minutes. (S)

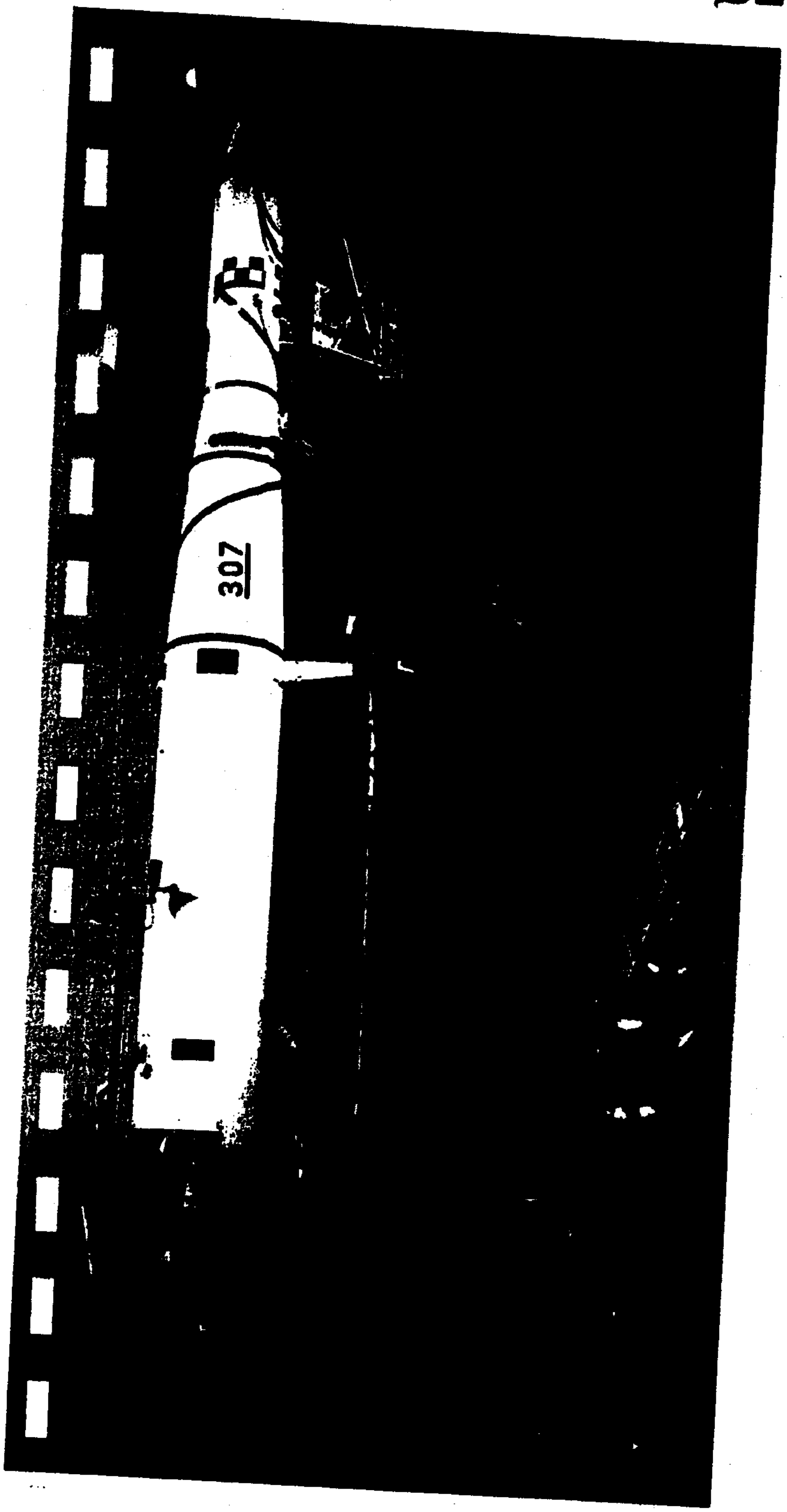


Figure 1. DISCOVERER XXIII during final checkout at Complex 75-3, Pad 5, the morning of 8 April. The satellite's orbit was very close to that planned for the flight. Satellite instability caused the capsule to be ejected into a more elliptical orbit.

• As a result of the continuing effort to improve reliability, a modified horizon scanner will be flown on future DISCOVERER satellites. The major change is the replacing of the aluminum gear box with one constructed of steel. One of the improved units completed 210 hours of bench tests and was then placed in a vacuum chamber to be operated until it fails. At the end of April the gear box was still operating after being in the chamber over 800 hours. (S)

• The problem with the radar beacon, which resulted in the satellite receiving two commands when only one was sent, is attributed to the difficulty of commanding an unstable satellite where radar lock cannot be held. The characteristics of the command signal tones and the rotation rate of the radar antenna operating on an unstable satellite can produce the results recorded on DISCOVERER XXIII. An intensive investigation has been made and changes proposed to the command beacon circuitry and operating procedures which will minimize this kind of problem. (S)

• Analysis of data indicates that sub-normal temperatures caused erratic operation of the gas jet control valves and resulted in the rapid expenditure of control gas. Temperature pickups located near some of the valves recorded below zero temperatures. This is considerably colder than temperatures recorded on previous DISCOVERER flights and probably resulted from the screening of the earth and solar radiation by the new flame shield. An analog simulation of the conditions demonstrated that the observed satellite behavior could have been caused by sluggish, sticky operation of the control valves. To prevent a recurrence of this difficulty on subsequent DISCOVERER satellites, control valves will be

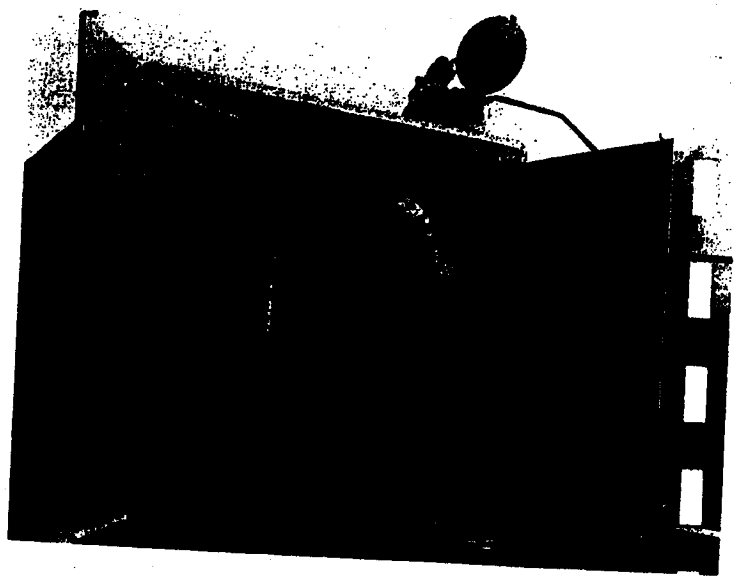


Figure 2. These photographs show the transfer of inhibited red fuming nitric acid from a railroad tank car to an acid truck at Vandenberg Air Force Base. Adequate protection is provided the men who handle this active compound which is used as the oxidizer in the AGENA satellite vehicles. A fire truck is standing by in case an accident should occur. The acid is forced from the tank car by gas from the bottles on the trailer in the foreground.

coated with a heat absorbent material and will be wrapped with thermostatically controlled electric blankets. (S)

- Additional accelerometers installed on DISCOVERER XXIII isolated the particular point on the vehicle where maximum 20 cycles-per-second longitudinal oscillations occur. The magnitude on this flight, however, was less than experienced on previous MB-3 Block 2 flights. (S)

Technical Progress

Second Stage Vehicles

- Production of XLR-81Ba-9 engines at the Bell Aerosystems Company has been practically halted because of a substantial stretch-out in engine delivery requirements by Lockheed Missile and Space Division. (S)

- All firings of the XLR-81Ba-9 rocket engine reliability test program have been completed. Forty tests were conducted at Bell Aerosystems Company, ten were restart and thirty were full-duration firings. Twenty-five restart firings were made in an Arnold Engineering Development Center altitude chamber. The tests were satisfactory and demonstrated a major component life for in excess of specification requirements. (C)

Geophysical Research Directorate Experiments

- The first of the new modules to be used for carrying Geophysical Research Directorate instruments for measuring the space environment is at Vandenberg Air Force Base awaiting launch on DISCOVERER XXIV. This module includes a cosmic ray monitor, micrometeorite detector, two atmospheric density gages and associated electronics. The equipment is powered by the satellite vehicle power supply and data is transmitted by the vehicle's telemetry system. (C)

Figure 3. The first Geophysical Research Directorate module. This module and its instruments will replace an engine access door on DISCOVERER XXIV. The atmospheric density gages are held against the module during ascent and will pop-out to the position shown after orbit is attained.

• This is the first of several modules scheduled for flight on DISCOVERER satellites in a program designed to utilize the weight carrying capability available on some flights for space research purposes. The modules replace the engine access door and are designed with universal mounting rails upon which a variety of instruments can be mounted. Nearly all units and wiring are mounted on the modules so that installation and removal can be accomplished with minimum interference to prelaunch operation. (C)

Facilities

• Conversion of Vandenberg Air Force Base Complex 75-1 is proceeding according to the recently revised activation schedule. All facility-type modifications have been completed. Leak checks, single propellant flow tests, and simultaneous liquid oxygen and fuel flow checks have been successfully accomplished. The pad should be activated in time to permit the launch of DISCOVERER XXIV late in May. This pad has been converted from a THOR IRBM facility to a DM-21/AGENA facility. The equipment being installed is of an improved design which will permit faster, more reliable launch operations. (C)

• Modernization of DISCOVERER launch pads 4 and 5 of Complex 75-3 including installation of new propellant transfer sets and up-dated launch control system equipment has been started. No launches are scheduled from these pads until June. (C)

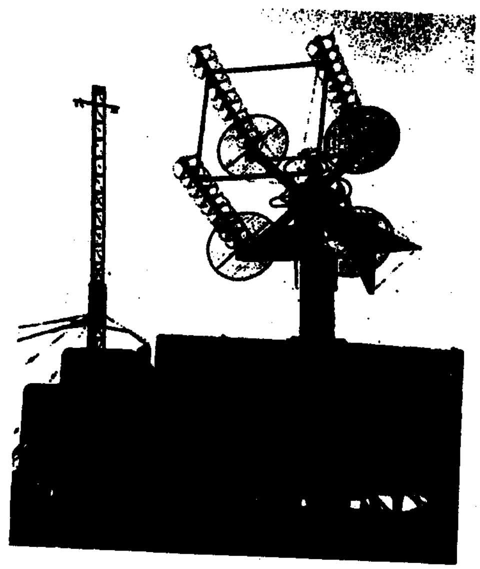
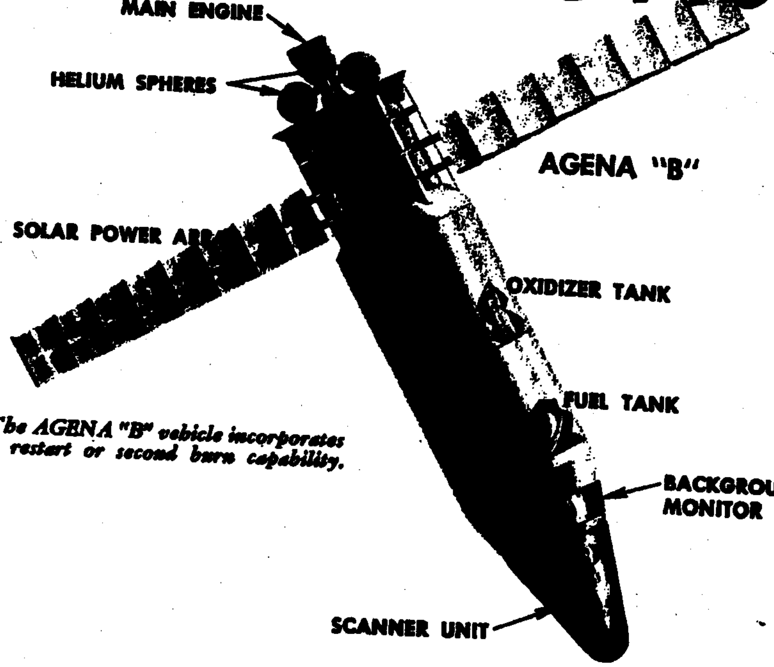


Figure 4. First photographs of the DISCOVERER Tern Island facilities. This installation is located approximately 500 miles northwest of Hawaii. This station is used for automatic tracking and acquisition of DISCOVERER re-entry vehicles during recovery operations. The photo (right) shows the equipment vans and the automatic tracking quadhelix antenna.

MIDAS

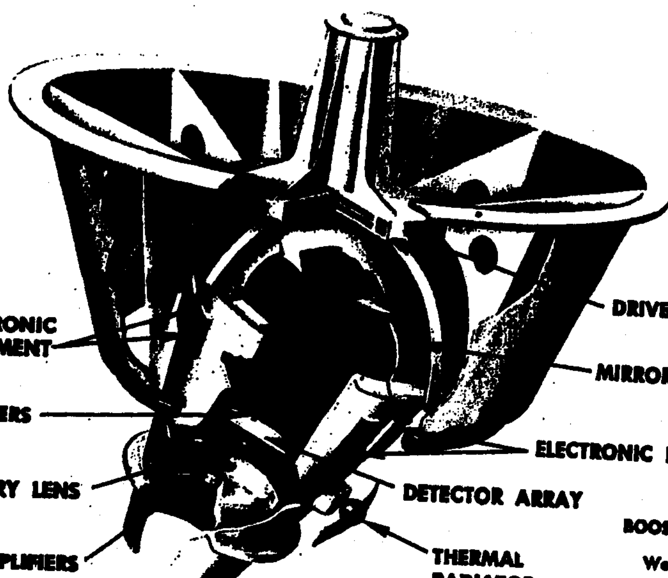
SECOND STAGE	AGENA "B"
Weight—	
Inert	1,763
Payload equipment	1,641
Orbital	3,404
Impulse Propellants	12,950
Fuel (UDMH)	
Oxidizer (IRFNA)	
Other	758
GROSS WEIGHT (lbs.)	17,112
Engine	XLR81-Ba-9
Thrust, lbs. (vac.)	16,000
Spec. Imp., sec. (vac.)	290
Burn Time, sec.	240
Restart Provisions	Yes

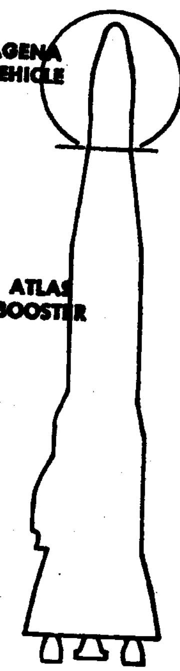


The AGENA "B" vehicle incorporates a restart or second burn capability.

MIDAS Infrared Detection Payload

Payload Operation: Incident radiation passes through the primary lens, then is reflected by the mirror which brings the energy into sharp focus on the detector array. The filter is located in front of the detector array to exclude unwanted radiation. Preamplifiers are mounted in back of the detectors.





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. The launch schedule of that program, 31 March 1961 MIDAS R&D Development Plan, is shown on page B-5. 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.

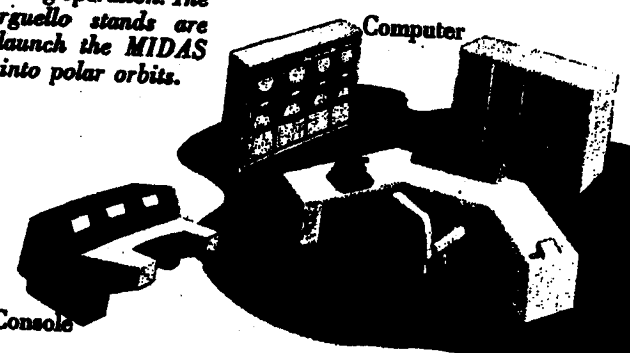
TECHNICAL HISTORY

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.

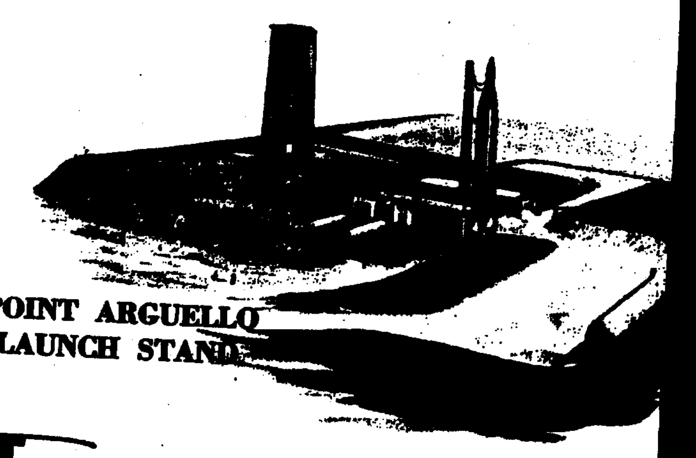
The first two R&D flights used the AGENA "A" and ATLAS "D" vehicle programmed to place the payload in a circular 261 nautical mile orbit. Subsequent R&D flights will utilize the ATLAS "D"/AGENA "B" configuration which will be programmed to place the payload in a circular 2,000 nautical mile polar orbit.

OPERATIONS CENTER

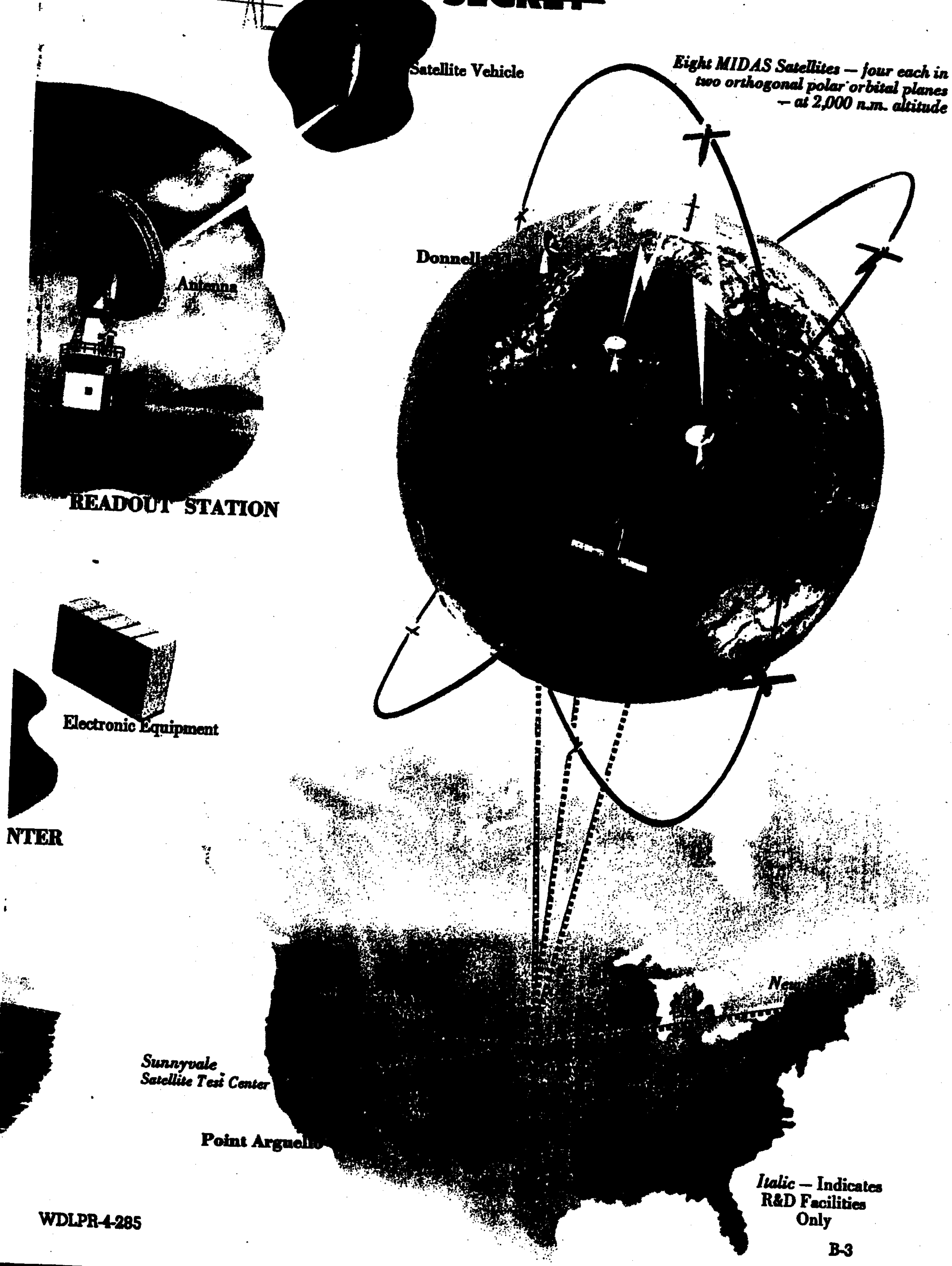
Orbiting satellites detect infrared radiation emitted by Soviet ICBM's in powered flight. Data is telemetered instantaneously to Midas Control Center via far north Readout Stations. Decoded data reveal approximately the number of missiles launched and launch location, direction of travel and burning characteristics. This data is graphically displayed on the control consoles and operational displays at the Operations Center. The Tracking and Control Center monitors the whole tracking operation. The Point Arguello stands are used to launch the MIDAS satellites into polar orbits.



TRACKING AND CONTROL C

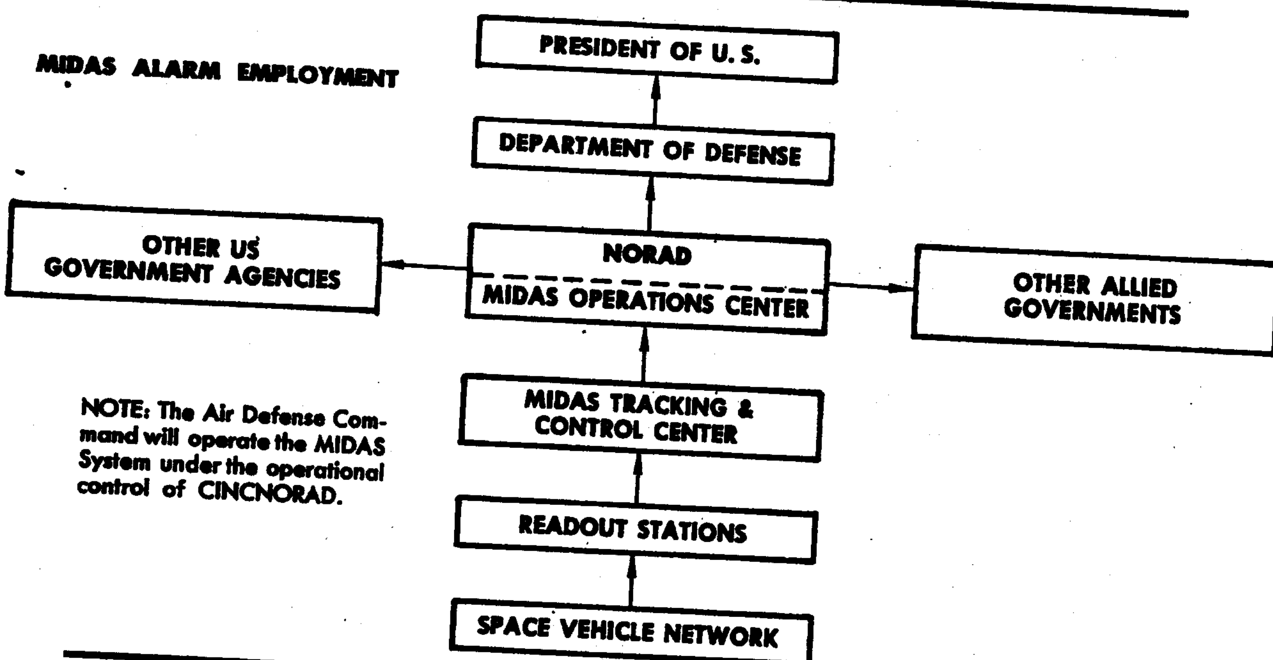


POINT ARGUELLO LAUNCH STAND


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

Probabilities of less than 1.00 on this map indicate the probability of at least one MIDAS satellite detecting an ICBM launch. Probabilities of 1.00 indicate that more than one MIDAS satellite will always be in position to detect an ICBM launch. These figures are based on geometric considerations of the family of satellites and ground readout station locations. Darker areas indicate most probable Russian ICBM launch site locations.

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 Operations Center. 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 all national retaliatory and defense agencies.

Launch Schedule

ATLAS "D" / AGENA "A"

Year	Month	Launch
1960	J	
	F	⬮
	M	
	A	
	M	★
	J	
	J	
	A	
	S	
	O	
	N	
	D	★

♦

Year	Month	Launch
1961	J	
	F	★

ATLAS "D" / AGENA "B"

Year	Month	Launch
1961	M	
	A	
	M	
	J	1
	J	1
	A	1
	S	
	O	
	N	
	D	
1962	J	1
	F	
	M	1
	A	1
	M	1
	J	
	J	
	A	
	S	1
	O	1
	N	1
	D	1
1963	J	1
	F	
	M	
	A	2
	M	2
	J	3
	J	
	A	
	S	
	O	1
	N	1
	D	1

Flight History

MIDAS No.	Launch Date	ATLAS No.	AGENA No.	Remarks
I	26 February	29D	1008	*Did not attain orbit because of a failure during ATLAS/AGENA separation.*
II	24 May	45D	1007	*Highly successful. Performance with respect to programmed orbital parameters was outstanding. Useful infrared data were observed and recorded.*
RM-1	20 December	DISCOVERER Vehicle		*Despite satellite oscillations, sufficient data were obtained for evaluation of payload operation. Information obtained in the 2.7- micron region agrees with data obtained from balloon-borne radiometric equipment. Data in the 4.3- micron region is somewhat higher than had been anticipated from theoretical studies.*
RM-2	18 February	DISCOVERER Vehicle		*All channels functioned properly and valid data were obtained on six stable orbits. Data confirmed previous radiometric measurements.*

♦ DISCOVERER vehicles carrying MIDAS radiometric payloads

★ Attained orbit successfully

⬮ Failed to attain orbit

MIDAS GROUND SUPPORT FACILITIES

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

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

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

**Equipment*

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

~~SECRET~~

~~CONFIDENTIAL~~

Launch Schedule

Vehicle	Year	Month	Schedule
ATLAS "D" / AGENA "A"	1960	J	
		F	⬮
		M	
		A	
		M	★
		J	
		J	
		A	
		S	
		O	
		N	
♦		D	★
	1961	J	
		F	★
ATLAS "D" / AGENA "B"		M	
		A	
		M	
		J	1
		J	1
		A	1
		S	
		O	
		N	
		D	
	1962	J	1
		F	
		M	1
		A	1
		M	1
		J	
		J	
		A	
		S	1
		O	1
		N	1
		D	1
	1963	J	1
		F	
		M	
		A	2
		M	2
		J	3
		J	
		A	
		S	
		O	1
		N	1
		D	1

Flight History

MIDAS No.	Launch Date	ATLAS No.	AGENA No.	Remarks
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RM-2	18 February	DISCOVERER Vehicle		*All channels functioned properly and valid data were obtained on six stable orbits. Data confirmed previous radiometric measurements.*

♦ DISCOVERER vehicles carrying MIDAS radiometric payloads

★ Attained orbit successfully ⬮ Failed to attain orbit

~~CONFIDENTIAL~~

WDLPR-4-285

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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.
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- G. VHF FM/FM Telemetry Station
- H. PAM FM Ground Station
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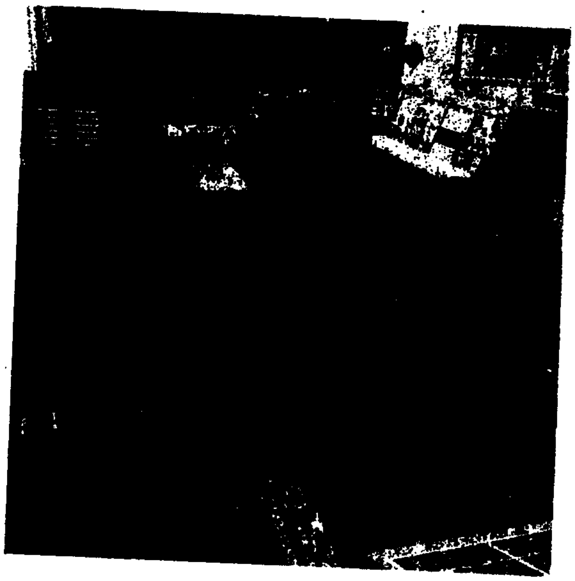
- L. UHF Angle Tracker
- M. UHF Command Transmitter
- N. APL Doppler Equipment
- O. SPQ-2 Radar
- P. Midas Payload Evaluation and Command Equipment

Monthly Progress — MIDAS Program

Program Administration

• On 24 April representatives from the Space Systems Division (SSD) briefed the AFSC on the MIDAS R&D Development Plan, dated 31 March. The plan received Command approval and the following day a briefing on its background, content and objectives was presented to members of the Department of Defense and to the Defense Panel of the Weapons Board, Hq USAF. Authority has been given to SSD to proceed against the plan pending final detailed approval by the Air Force Ballistic Missiles and Space Committee. (U)



Technical Progress

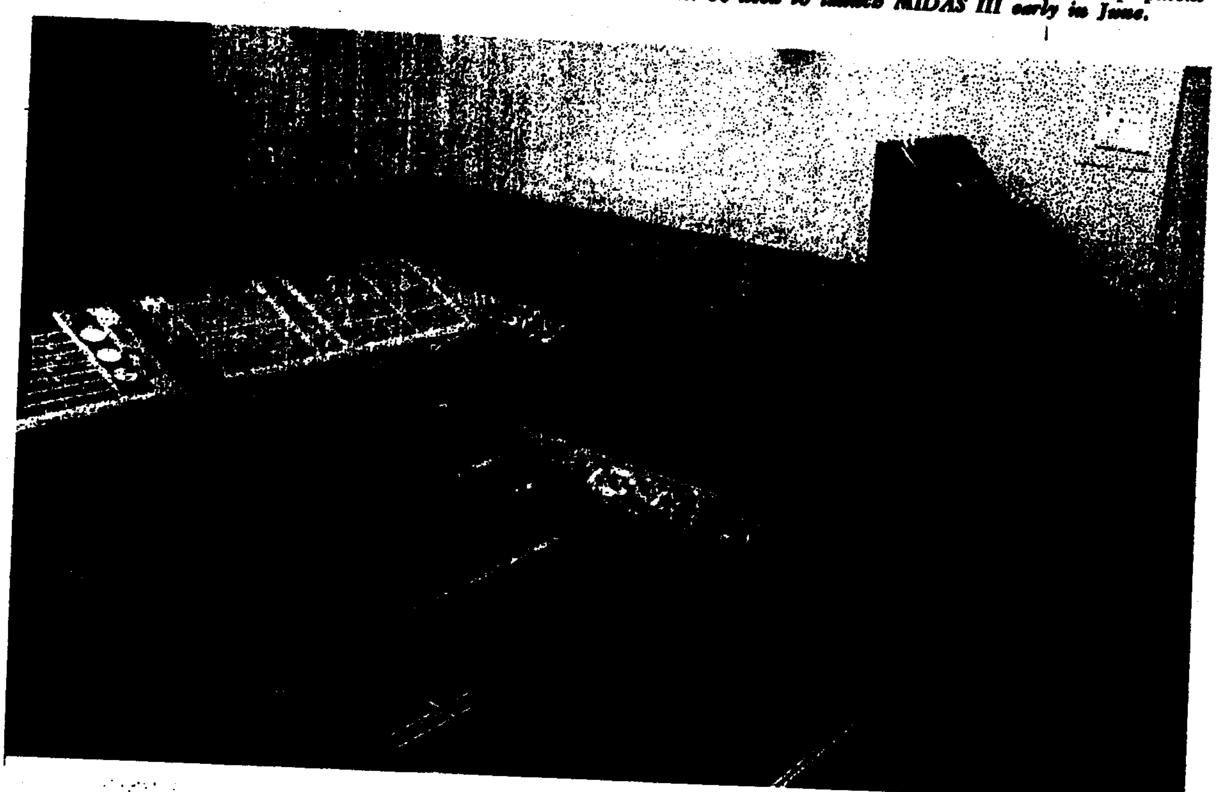
Boosters

• ATLAS 97D is installed on Pt. Arguello Pad No. 2 and is being used to complete stand and APCHE validation checks. The booster is also being prepared for final validation for flight which begins on the AGENA "on-stand" date. Booster progress is satisfactory to support the launch schedule of MIDAS III. (U)

Second Stage Vehicles

• MIDAS II, launched from the Atlantic Missile Range on 24 May 1960, was tracked by the Hawaiian Tracking Station on pass 5054, 20 April 1961, and pass 5070, 21 April, for a total of 21 minutes and 43 seconds of auto-track with a TLM-18 antenna. The SAPUT (Solar Auxiliary Power Unit Telemeter) was still operating normally with a signal strength of four microvolts. (U)

Figure 1. The launch consoles in the blockhouse at Pt. Arguello Launch Complex No. 1. This equipment will be used to launch MIDAS III early in June.



• The AGENA vehicle for MIDAS III is at Vandenberg Air Force Base undergoing prelaunch operations in the missile assembly building. System testing, which was delayed because the vehicle could not satisfy the requirements for low data-link noise, was resumed on 27 April and should be completed early in May. During the delay, the vehicle was removed from Complex 2A while validation checks were completed on the guidance system. The vehicle is scheduled to be delivered to the launch pad in mid-May with the launch scheduled for early June. The launch delay of over two months since the first of the year has been caused by vehicle subsystem checkout problems. Delays in construction and installation and checkout of ground station equipment have also caused slippages. (S)

• The AGENA vehicle for MIDAS IV is nearing completion in the systems test area at LMSD, Sunnyvale. Technical problems delayed completion of the final integrated systems check. This vehicle is scheduled for shipment to Santa Cruz Test Base early in May for vehicle flushing and then to Vandenberg Air Force Base for a scheduled mid-July launch. This launch could be delayed because of conflict with SAMOS vehicle 2120 in Complex 2A in the Vandenberg Air Force Base missile assembly building.

Infrared Scanners

• The payload for MIDAS III is now at Vandenberg Air Force Base undergoing final testing prior to mating to the vehicle. The payload for MIDAS IV is also at Vandenberg and will be checked for use in the field tests to prove compatibility between the payload and the ground presentation units prior to being tested and maintained as a spare for MIDAS III. (C)

• The design and development of an infrared detection payload as a backup to the Series IV payload design has been awarded to Baird-Atomic, Inc. The basic Series IV payload is being developed by the Aerojet-General Corporation. (C)

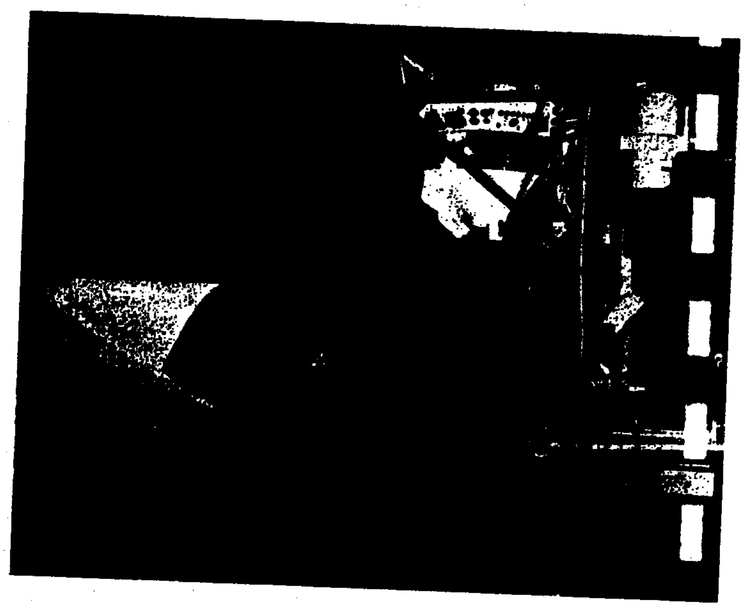


Figure 2. Checking MIDAS payload systems response (below) at Vandenberg Air Force Base. The scanner unit is being exposed to sunlight and the readout is being fed into the console recorder. The MIDAS payload (right) is mounted on the optical bench in front of the collimator for alignment.

• A contract was awarded to Infrared Industries, Waltham, Massachusetts, for the development and product engineering of lead-sulfide detectors for the MIDAS Program. (U)

Background Radiometer Flights

• A series of high-altitude U-2 flights were completed from Eielson Air Force Base, Alaska, to obtain terrestrial radiation and horizon measurements under Arctic conditions. Similar flights to gather data under tropical conditions are underway at Patrick Air Force Base, Florida. The first of the background radiometer flights, which were conducted from Edwards Air Force Base, were completed in March. (C)

System Development

• A system design emphasizing data processing for the MIDAS operational system is being prepared for the Space Systems Division by MIT Lincoln Laboratory. During a coordination trip of 20-21 April, Lockheed representatives briefed Lincoln Laboratory personnel on: launch considerations, recent results of orbital radiometric measurements, and a simplified MIDAS system configuration. Simplification is being investigated to facilitate manufacture, operations and launch. A proposal is being prepared on this system. Analyses and descriptions of the Series III MIDAS system are also being prepared for inclusion in an engineering analysis report which will be published shortly. (U)

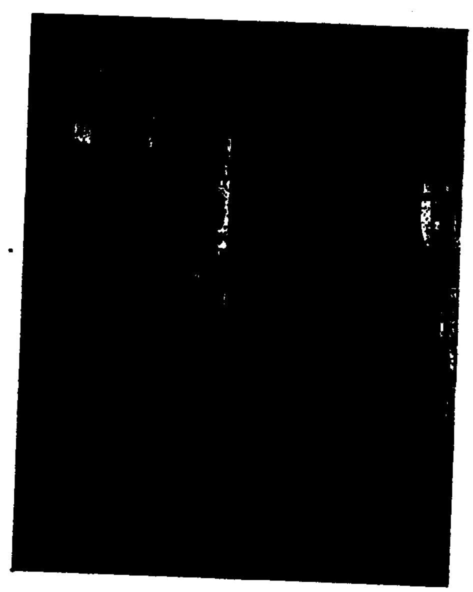
Aerospace Ground Equipment

• The T-29 fly-by aircraft which is supporting the New Hampshire Tracking Station activation has had the equipment installed and is supporting the checkout. The T-29 aircraft from Edwards Air Force Base had been supporting the New Hampshire activity until the second T-29 arrived at Hanscom Air Force Base. (U)

• Space Systems Division has submitted the MIDAS AGE requirements for Pt. Arguello Launch Complex No. 2 to LMSD. These requirements covered the aspects of the MIDAS Program requisite to accomplishment of the Category II (AFR 80-14) Systems Test. The contractor was requested to report immediately whether this would have a significant effect on either the costs or schedules previously planned for the complex. (C)

• Installation and checkout of Aerospace ground equipment in launch complex and tracking facilities, which will support the MIDAS III flight is scheduled for completion late in May. By mid-May, the computer program at the Vandenberg Tracking Station will be fully operational and technical integration of the PICE at the New Hampshire Station will be complete. (C)

Figure 3. The T-29 fly-by aircraft which is supporting the New Hampshire Tracking Station activation. The radome is visible forward of the wing. The interior view shows some of the electronic equipment required for this operation.



Facilities

- Plans and specifications for the Vandenberg Air Force Base technical support facilities will be forwarded to the construction agency on or about 11 May. A construction directive for the headquarters building for the 6565th Test Wing has been issued to the construction agency with beneficial occupancy scheduled for late in July. (U)

- A preliminary review (in progress) of the New Hampshire MIDAS technical building plans was conducted on 18 April. The architect-engineer was authorized to proceed with the final design. (U)

- Preliminary concept plans of the Ottumwa Tracking and Control Center were reviewed on 27 April and comments furnished the architect-engineer. In-progress preliminary design plans are scheduled for a review on 5 June. (U)

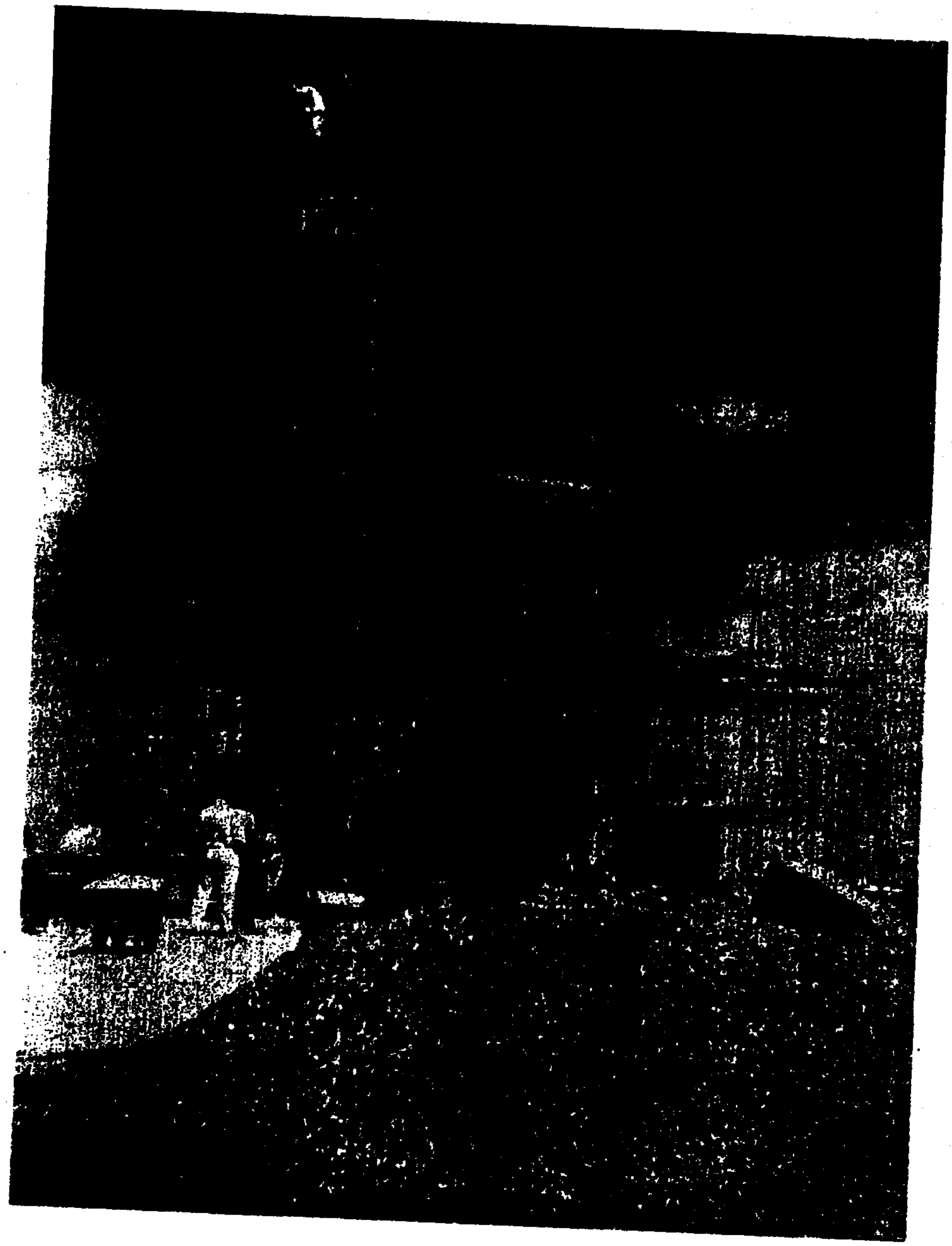
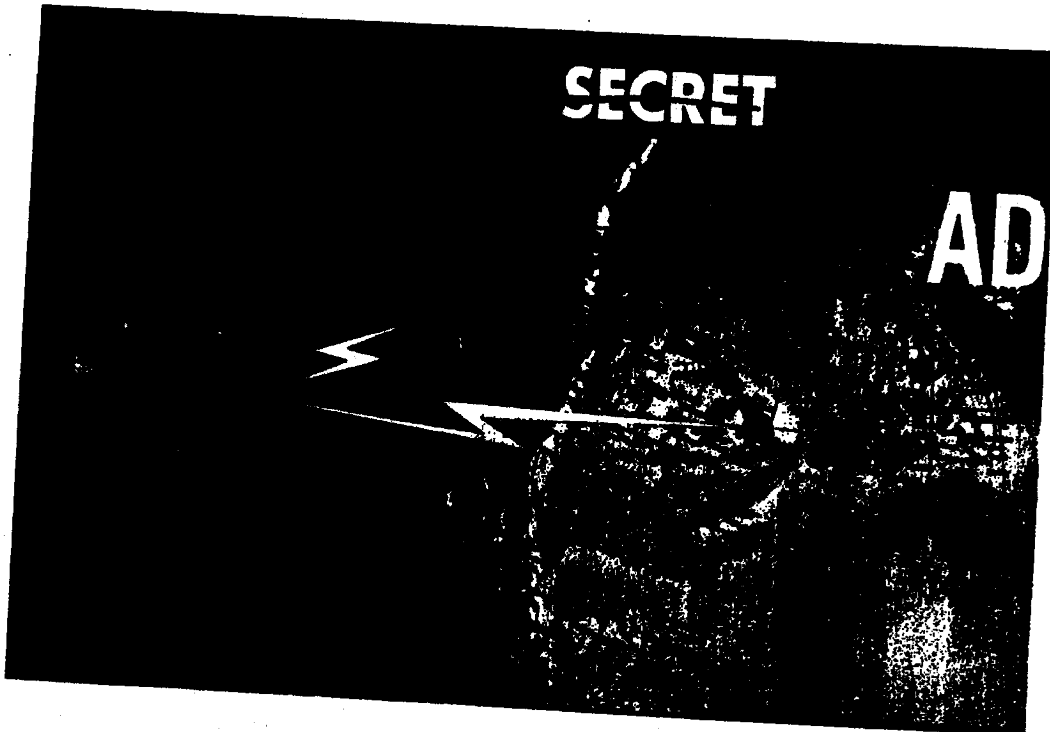


Figure 4. Construction progress at the Southeast Africa tracking station (Atlantic Missile Range Station 13) near Pretoria. This station will be ready to record AGENA second burn data on the MIDAS III flight.



ADVENT

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

PROGRAM HISTORY

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

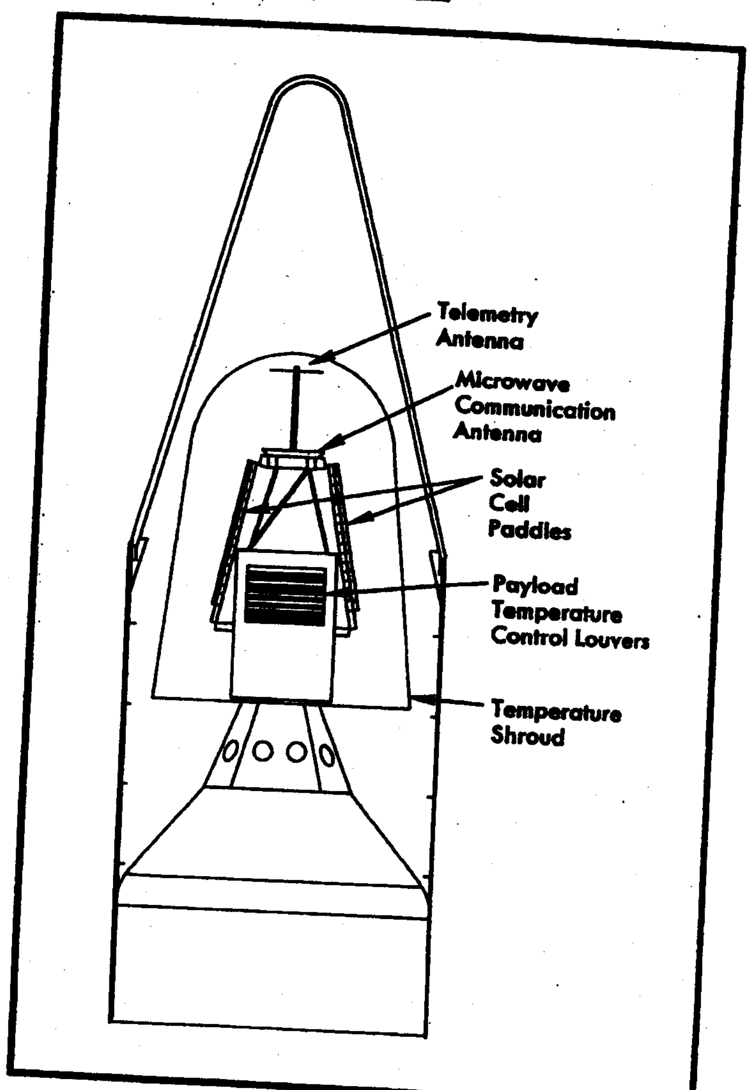


Figure 1. Proposed satellite with jettisonable fairing mounted on CENTAUR second stage.

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

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

PROGRAM OBJECTIVES

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

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

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

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

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

Launch Schedule

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

Monthly Progress — ADVENT Program

Technical Progress

Booster Vehicles

• A four part wind tunnel program has been developed for the ADVENT Phase I vehicles. It consists of the following:

1. The first part will be carried out in conjunction with NASA. They have agreed to add the AGENA configuration of ADVENT to their studies of turbulent flow around the hammer-head fairing in the transonic velocity region. This is a "state-of-the-art" development program and will have no financial support from the ADVENT Program. The model for these tests has been completed by Lockheed Missile and Space Division and has been delivered to the Ames Research Center for instrumentation. The tests are scheduled to start early in May. (U)

2. The second part is a more complete transonic test to be held in the Langley Research Center's 8-foot tunnel with two models, a 1/29th scale pressure model and a 1/35th scale force model. (U)

3. The third part consists of supersonic testing in the Lockheed four-foot tunnel using the same models as the second part. (U)

4. The last part is a ground wind test for on-stand conditions. This portion of the series is still under discussion and will be coordinated with Convair and Aerospace. Preliminary discussions indicate that the tests could be conducted in the Ames Research Center's nine-foot pressure tunnel during August or September. Assignment of test responsibility is under review. (U)

• AGENA B design and manufacture are essentially on schedule with components for the first vehicle due to be completed by mid-June. Because of the excellent progress made on the ATLAS/AGENA configuration, a design freeze of the Phase I booster and satellite has been instituted. (U)

• A revised Program Plan, Preliminary Design Report, ADVENT/AGENA Specification, Preliminary Reliability Estimate, and Structural Test Plan have been published and released. Inputs have also been received from Lockheed for trajectory studies and the Program Requirements Document. (U)

• Convair's Proposal and Program Plan for ADVENT/CENTAUR has been reviewed by the Space Systems Division and Aerospace Corporation. Comments have been forwarded to the CENTAUR procurement office. (U)

Final Stage Vehicle

• Representatives from the Space Systems Division, General Electric, Philco and Aerospace Corporation discussed the security aspects of the Tracking Telemetry and Control Subsystem with the National Security Agency (NSA) on 22 March. NSA advised that the General Electric Missiles and Space Vehicles Department (GE/MSVD) electronic code generator logic circuitry was not crypto secure. Aerospace Corporation provided NSA with additional details on the TTC subsystem. On 4 April, the group revisited NSA and were provided with a code generator circuitry which NSA considered crypto secure. This circuitry was considered inadequate for ADVENT Program use since there was no re-start provision if some malfunction caused the missing of bits. NSA renewed their study and on 18 April provided a code generator circuitry which provided a re-start capability and is also considered crypto secure. (C)

• A review of the propulsion subsystem was made on 4 April. Representatives of GE/MSVD, Aerospace and the Space Systems Division visited Marquardt, the propulsion subsystem contractor, on 5 April. The progress on thrust nozzle design, tank design, and fuel expulsion methods was reviewed in detail. (U)

Tracking, Telemetry and Command

• The second Technical Direction meeting of Space Systems Division, Aerospace, and Philco was held on 4 April at Aerospace. Items reviewed, on which actions were initiated, were: Kaena Point facilities and antenna modification and operation; Satellite Test Center integration, general design review, specification tree and specification up-dating and review of action items from the previous meeting. (U)

• A General Electric, Aerospace, Philco Interface Meeting was held at Philco Western Development Laboratories on 20 April. Arrangements were made between Philco and General Electric regarding compatibility and checkout testing of the ground equipment and the final stage vehicle equipment. (U)

BOOSTER

support programs

ABLE
TRANSIT
MERCURY
BLUE SCOUT
DYNA SOAR
NASA AGENA "B"
VELA HOTEL
ANNA

BOOSTER SUPPORT PROGRAMS

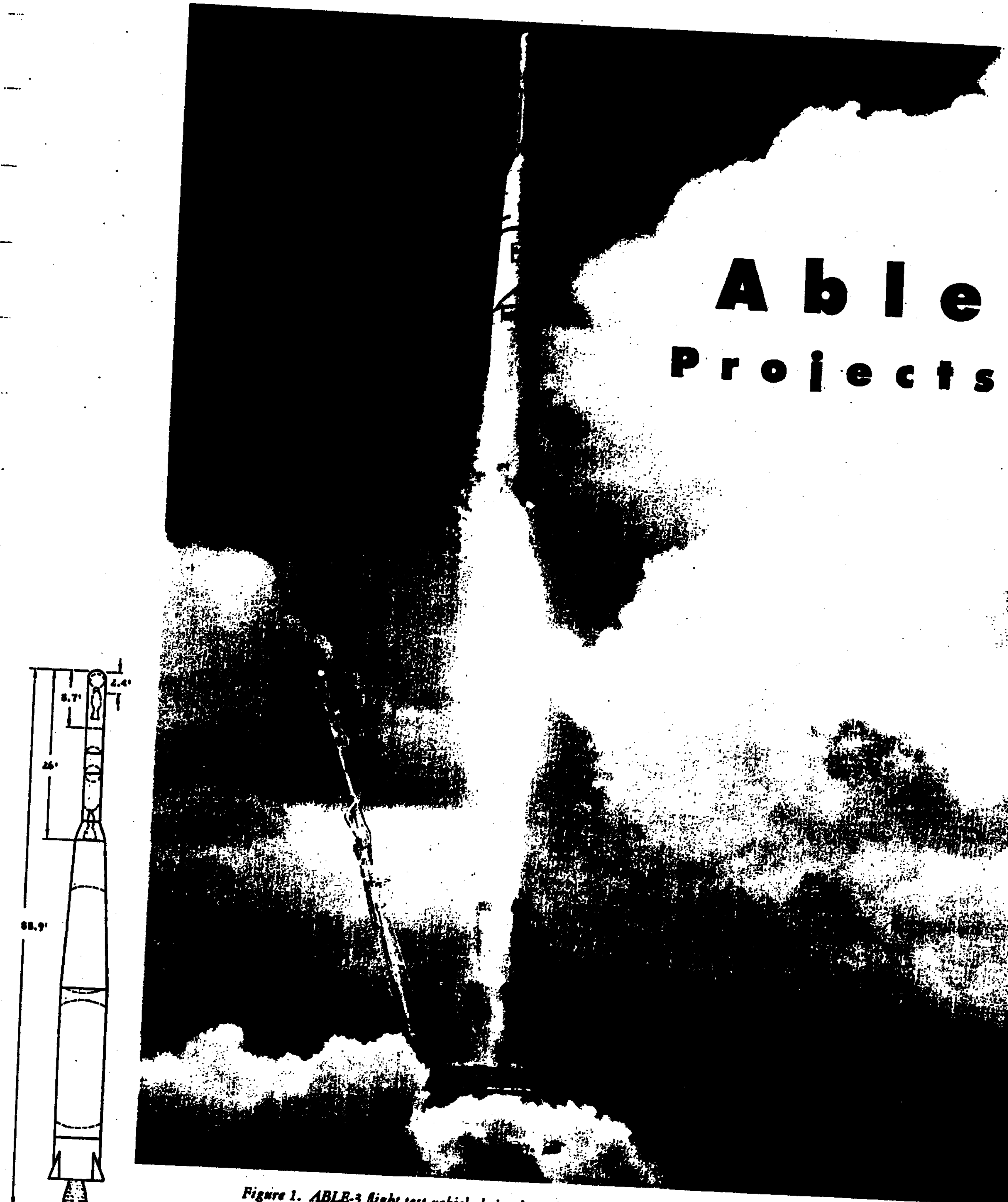
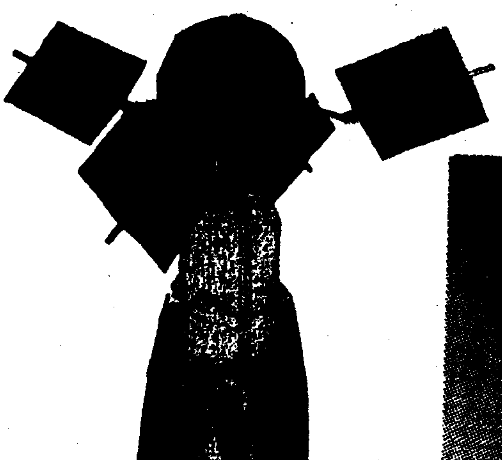


Figure 1. ABLE-3 flight test vehicle being launched from Atlantic Missile Range. Dimensional drawing (left) of four-stage ABLE-3 vehicle.

The ABLE series of space probes was initiated with ABLE-1 program in March 1958. This program, undertaken by AFBMD under direction of the Advanced Research Projects Agency, had as its over-all objective, the acquisition of data on the extra-terrestrial space environment. The design and construction of a four-stage space vehicle was initiated. The vehicle, consisting of a THOR IRBM first stage, an ABLE second stage, ABL-248 solid propellant third stage and the satellite vehicle fourth stage was successfully demonstrated in the fall of 1958. In October 1958, the National Aeronautics and Space Administration, given cognizance over the space exploration effort, authorized the ABLE-3 and ABLE-4 programs. General objectives included the demonstration of vehicle and communications capability and performance of scientific research experiments over interplanetary distances. An extensive network of ground support stations was simultaneously established, the most powerful of which is the 250-foot antenna at the Jodrell Bank Experimental Station, University of Manchester, England. Central control and data computation is accomplished at the Space Navigation Center, Los Angeles, California, and other military and NASA centers assisting in tracking and telemetry according to the specific requirements of each mission. The ABLE-4 program led to the development of a space booster utilizing the ATLAS ICBM as the first stage, providing a greatly increased payload capacity. A hydrazine engine with multi-start capability was developed for the ATLAS boosted vehicles to permit mid-course vernier control and to provide controlled thrust to inject the vehicle into orbit about another planet. Under the ABLE-3 and 4 programs, a solar cell power supply system was developed and extensive original design of satellite vehicle command, telemetry, and communication equipment was accomplished.

ABLE-1—The ABLE-1 program consisted of three flights with the object of placing a payload within the moon's gravitational field. The ABLE-1 four-stage vehicle consisted of three booster stages and a terminal stage composed of eight vernier rockets, an orbit injection rocket (solid propellant TX8-6) and a payload. The booster stages were THOR first stage, Advanced Re-entry Test Vehicle (AJ10-101 engine) second stage, and a third stage utilizing the ABL X-248-A3 solid propellant rocket engine. The first lunar probe was launched on 17 August 1958. The flight was normal until 73.6 seconds after liftoff when a turbopump bearing failure caused the booster to explode. The second lunar probe was launched on 10 October 1958. Although the payload did not reach the vicinity of the moon, a maximum altitude of 71,700 statute miles was attained and useful scientific data were obtained from the instrumentation. The third lunar probe was launched on 8 November 1958. Because the third stage failed to ignite, the maximum altitude attained was 970 statute miles. The primary program objectives, obtaining scientific data in cislunar space, were achieved by the October flight.



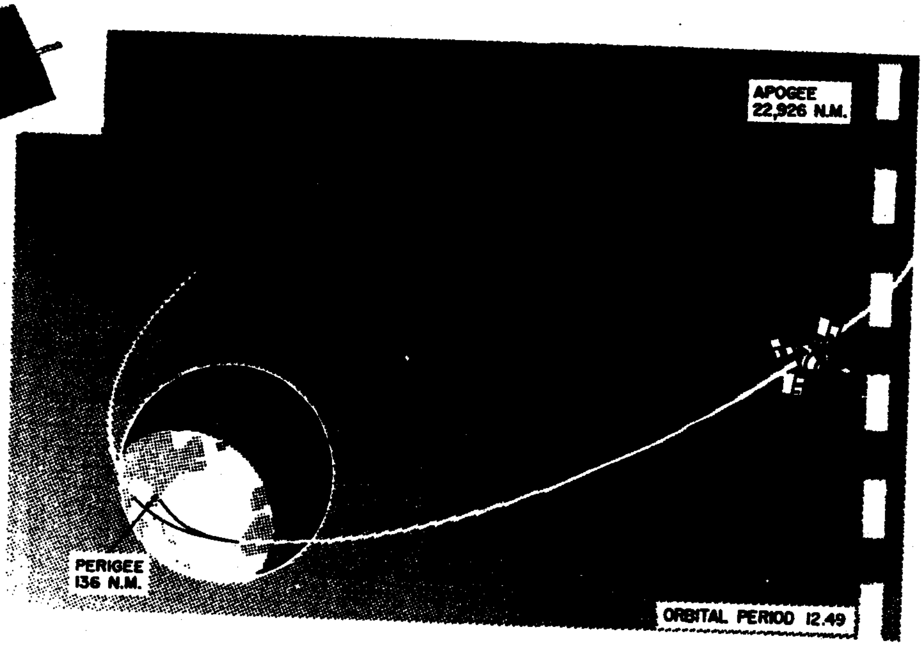


Figure 2. ABLE-3 third stage and payload (above) with solar paddles fully extended. Drawing of extremely elliptical orbit achieved by ABLE-3 (EXPLORER VI).

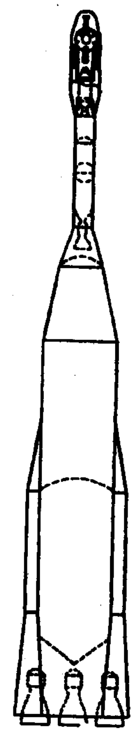


Figure 3. ABLE-4 ATLAS vehicle configuration drawing and photo of vehicle installed on Atlantic Missile Range launch stand 12.

ABLE-3 — This four stage flight vehicle was launched from the Atlantic Missile Range on 7 August 1959. The vehicle consisted of a THOR booster, a second stage using the AJ10-101A rocket engine, a third stage powered by the ABL-248-A3 engine, and a fourth stage consisting of the payload and an injection rocket. In addition to carrying a highly sophisticated payload, the ABLE-3 (EXPLORER VI) flight was used to demonstrate the validity of the ABLE-4 vehicle and component configurations. All phases of the launching were successful and the advanced scientific observatory satellite was placed in an extremely elliptical geocentric orbit. Trajectory and orbit were essentially as predicted with deviations in apogee and perigee well within the range of expected values. The payload was the most sophisticated to have been placed in orbit by this nation at the time and contained provisions for conducting 13 experiments in space environment and propagation. A wealth of valuable data was obtained from satellite telemetry until the last transmission was received on 6 October. Among the significant achievements of EXPLORER VI were:

1. The first comprehensive mapping of Van Allen radiation belts.
2. The first study of dumping and filling of outer Van Allen radiation belts during a magnetic storm.
3. The first still TV photo of earth from a satellite.
4. The first computer (Telebit) operating in space with instrumentation.
5. The first direct flux measurements of low-energy electrons in the outer radiation belt.
6. Discovery of large electrical current system in the outer atmosphere.
7. Discovery of betatron acceleration in outer atmosphere.

It is believed that the satellite, while yet in orbit, is incapable of generating sufficient power for transmitting signals due to solar paddle damage suffered during initial paddle extension and the resultant unfavorable sun "look" angle.

ABLE-4 ATLAS — This vehicle differed from the ABLE-3 primarily in that an ATLAS ICBM was used as the first stage instead of a THOR IRBM, permitting installation of a hydrazine engine for midcourse velocity corrections and to accomplish the ejection of the satellite into lunar orbit. The unsuccessful launch of the ABLE-4 ATLAS occurred on 26 November 1959. Structural breakup resulted in the third stage and payload parting from the vehicle approximately 48 seconds after launch. The ATLAS performed as planned over its entire powered flight trajectory. The trajectory of this flight, from the Atlantic Missile Range to the vicinity of the moon, was established to achieve the tightest possible circular lunar orbit consistent with the highest probability of success. The final burnout conditions were to have provided an inertial velocity of 34,552 feet per

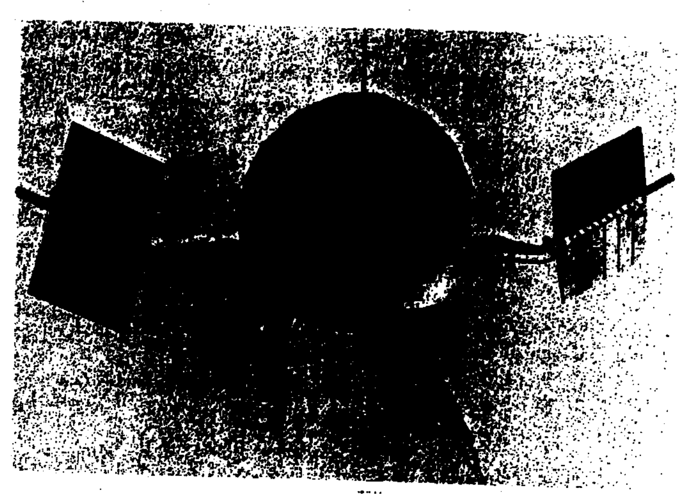
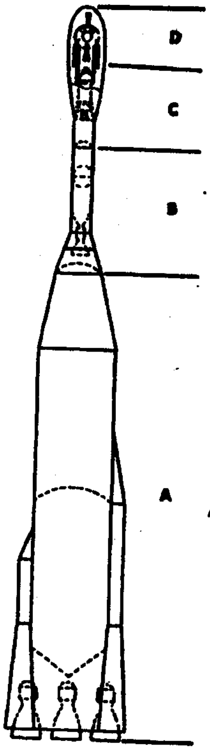


Figure 4. PIONEER V satellite vehicle shown in orbital flight position. This solar satellite was launched from the Atlantic Missile Range on 11 March 1960.



D. Satellite Vehicle

Gross Weight	380.2 lb
Gross Weight (Burnout)	229.4 lb
Specific Impulse (vac)	230 sec
Thrust (vac)	18.3 lb

C. THIRD STAGE ABL 248-A9

Gross Weight	903.2 lb
Gross Weight (Burnout)	547.4 lb
Specific Impulse (vac)	250.5 sec
Thrust (vac)	3100 lb

B. SECOND STAGE AJ 10-101

Gross Weight	5107.3 lb
Gross Weight (Burnout)	1816.1 lb
Specific Impulse (vac)	268 sec
Thrust (vac)	7575 lb

A. FIRST STAGE ATLAS "D"

Gross Weight	266,390 lb
Gross Weight (Burnout)	11,790 lb
Thrust (S. L.)	316.5 sec
Specific Impulse (vac) Sustainer	81,863 lb
Thrust (vac) Sustainer	290.6 sec
Specific Impulse (vac) Booster	251 sec
Specific Impulse (S. L.) Booster	367,787 lb

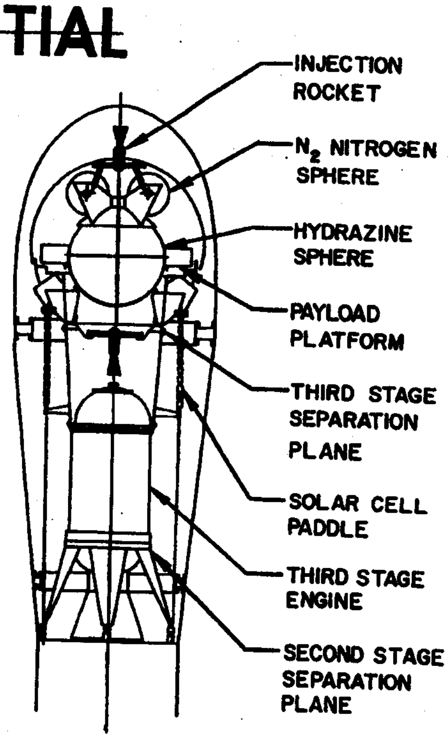
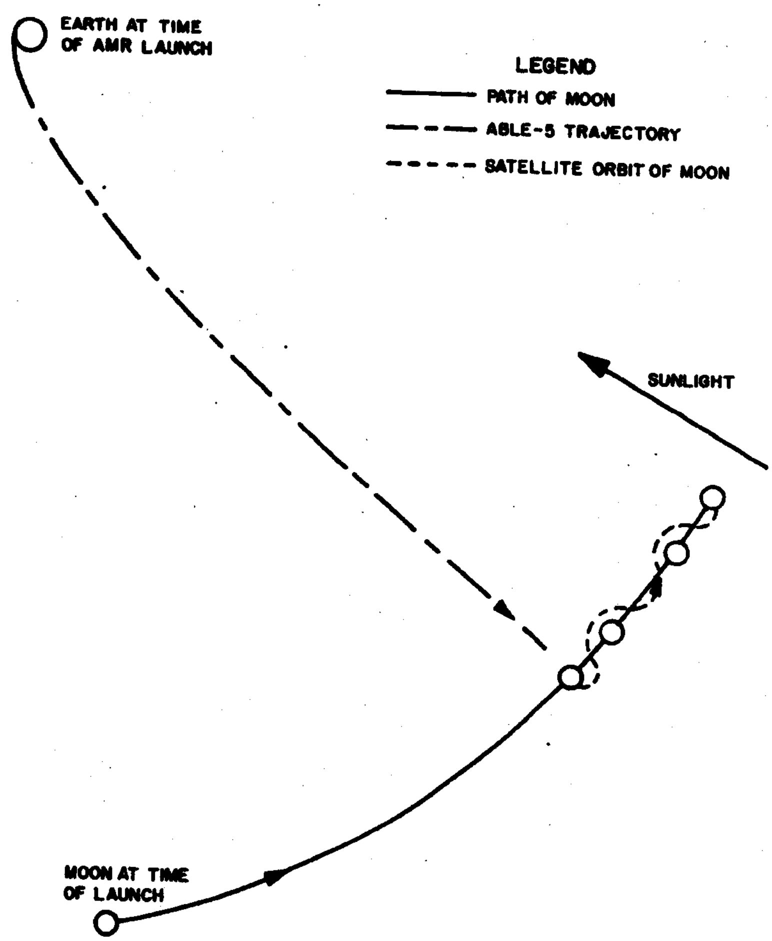


Figure 5. ABLE-5 vehicle configuration drawing and specification list. Third stage and payload configuration (right). Trajectory of ABLE-5 into lunar orbit is shown in drawing (below).

second. The payload was designed to investigate space environment and propagation effects and to transmit crude television images of the far side of the moon. This was the first flight in which an ATLAS ICBM was used as the booster for a multi-stage space flight.

ABLE-4 THOR—This vehicle was launched on 11 March from the Atlantic Missile Range and succeeded in placing the PIONEER V satellite into a solar orbit. At its closest approach to the sun, the satellite will pass near the orbit of Venus, and return to intersect the orbit of earth at its greatest distance from the sun. The vehicle consisted of a THOR first stage, ABLE second stage with AJ10-101 liquid fueled propulsion system and an STL guidance system, and an ABL-248A-3, solid fuel third stage. The 95 pound payload contains instrumentation for conducting scientific experiments related to magnetic field and radiation phenomena in deep outer space. At 0733 hours EST, on 26 June, the last radio signal was received from PIONEER V. The transmitter has been operated throughout the three and one-half month period and has demonstrated that, except for the batteries, the communications link could have been maintained for a distance significantly greater than the 50 to 60 million miles originally estimated. At the time of the last transmission the vehicle was 22,462,000 miles from earth.



Our knowledge of space, of the sun, and of the solar system has been substantially increased by the information transmitted by PIONEER V. Analysis of the data obtained during the satellite's journey into space has revealed the following major scientific discoveries:

1. An interplanetary magnetic field exists with a steady magnitude of more than one Gamma and a peak of up to ten Gamma. This field fluctuates in a manner that is connected to solar flare activity.
2. The planar angle of the interplanetary magnetic field forms a large angle (about 90 degrees) with the plane of the elliptic.
3. The exospheric ring current of 25,000 miles diameter encircles the earth as a giant doughnut at a distance of 40,000 miles from earth. The five million ampere current moves westward around the earth.
4. The geophysical magnetic field extends at times to 65,000 miles and this field oscillates in intensity in the outermost exosphere.
5. The sudden decrease in galactic cosmic rays (the Forbush decrease) always associated with large solar flares does not depend on the presence of the earth's magnetic field. This unexpected discovery will require formulation of a new theory to explain the Forbush decrease.
6. Penetration radiation in space is not limited to the Van Allen belts. At least during periods of solar activity 5 to 50 Roentgens per hour are incident on the satellite.
7. Energetic particles in the Van Allen radiation belts are not ejected directly from the solar wind. Some process for particle acceleration must exist in the belt.

ABLE-5

The ABLE-5 program provides for launch of two ATLAS-ABLE vehicles to place satellites into lunar orbits late in 1960. A proposed ATLAS/ABLE lunar program was submitted to AFBMD by NASA on 4 February 1960, following discussions between AFBMD and the NASA Goddard Space Flight Center in January.

Program Objectives

1. Place a satellite into lunar orbit with an apolune of 2,500 nautical miles and perilune of 1,400 nautical miles.

2. Maintain adequate earth-satellite communications and establish communications parameters for future space probes.

3. Demonstrate effective guidance system performance, particularly for the satellite vehicle.

4. Successful conduct of payload experiments.

Program Vehicle (Figure 5.)

First Stage—ATLAS series D missile General Electric/Burroughs Corp. Mod 3 guidance system.

Second Stage — ABLE vehicle with Aerojet-General AJ10-101A propulsion system.

Third Stage—Allegany Ballistic Laboratory ABL-248 solid propellant rocket, unguided, spin stabilized by spin rockets fired at termination of second stage thrust.

Fourth Stage (Satellite Vehicle)—Space Technology Laboratories designed, incorporating an injection rocket capable of being restarted four times to increase payload velocity and two times to decrease payload velocity. The satellite also contains a telemetry system (capable of continuous operation), four solar cell paddles, and scientific equipment for conducting the experiments. Satellite vehicle weight is 380 pounds.

Launch and Powered Flight

These vehicles will be launched from the Atlantic Missile Range on a true azimuth of 98.0 degrees. ATLAS performance parameters have been based on results obtained from Series "D" R&D flight tests. Parameters for all four stages are shown on figure 5. Final burnout of ABLE-5A was programmed to occur 23,971,428 feet from the center of the earth at an inertial velocity of 34,051 ft./sec. Final burnout for ABLE-5B was programmed to occur 23,927,683 feet from the center of the earth at an inertial velocity of 33,901 ft./sec.

Orbital Characteristics — ABLE-5A

Major Axis	0.3470×10^{8} feet
Eccentricity	0.190
Orbital period	575 minutes
Apolune	2,460 nautical miles
Perilune	1,380 nautical miles
Duration of eclipses	less than 90 minutes

Orbital Characteristics — ABLE-5B

Major Axis	0.33388×10^{8} feet
Eccentricity	0.1854
Orbital period	543 minutes
Apolune	2,318 nautical miles
Perilune	1,300 nautical miles
Duration of eclipses	less than 90 minutes

Payload Experiment

Scintillation Counter and Pulse Height Analyzer — measure electron energy (greater than 100 KEV per particle) and proton energy (greater than 2.0 MEV per particle).

Ion Chamber and Geiger-Muller Tube — flux and rate data for electron particles (greater than 1.25 MEV per particle) and proton particles (greater than 20 MEV per particle).

Proportional Counter Experiment — measure integrated intensity of cosmic ray particles: electrons (greater than 12 MEV per particle) and protons (greater than 75 MEV per particle).

Spin Search Coil Magnetometer and Phase Comparator — map the magnetic field (normal to vehicle spin axis) and investigate very low frequency secular magnetic field variations. Phase comparator circuit uses Spin Search Coil and Flux Gate inputs to determine magnetic field direction relative to inertial space.

Flux Gate Magnetometer — measure magnetic field parallel to vehicle spin axis.

Micrometeorite Flux and Momentum Experiment — count impacts of micrometeorites and interplanetary dust particles on two differing thresholds.

Plasma Probe Experiment — measure the energy and density of streams of protons having energies of the order of a few kilovolts per particle.

Low Energy Scintillation Counter — measure the flux intensity of electrons above 50 KEV and protons above 500 KEV.

Solid State Detector — (carried on ABLE-5B in addition to the above experiments) measure the flux of protons of energies from 0.5 to 9 MEV.

Ground Support Program

Atlantic Missile Range — track vehicle for first 12 hours after launch (except for a three hour period starting a few minutes after liftoff), provide ATLAS guidance, provide first vernier correction for payload stage.

Manchester, England — track vehicle for 6 hours, starting 13 minutes after launch, provide second vernier correction for payload stage (and additional corrections as required).

South Point, Hawaii — track vehicle for 11 hours starting 6 hours after launch, transmission of commands, including vernier corrections as necessary. Other support stations that will track and record data from the vehicle during periods of tracking by the primary stations include Singapore, Goldstone, Millstone Hill, and NASA minitrack stations. Central control and data collection for the flight will be accomplished at the Span Center at Los Angeles.

ABLE-5A — The vehicle configuration and trajectory for this flight are given in Figure 5. The unsuccessful launch of the ABLE-5A vehicle occurred on 25 September at 0713 PST. The launch had been postponed for one day because of high winds and unfavorable weather in the launch area. The countdown was normal and the flight proceeded as planned through the completion of first stage operation. Performance of the ATLAS booster was excellent with all systems operating properly. ATLAS sustainer engine cutoff occurred 271.7 seconds after liftoff and Stage I/II separation occurred 1.5 seconds later. However, a malfunction occurred at second stage ignition, causing a substantial loss in thrust and subsequent loss of control, and as a result, the objectives of this flight were not met.

ABLE-5B — Technical difficulties with the ground support equipment caused a one-day postponement of the flight. On 15 December, at 0110 PST, ABLE-5B was launched from the AMR. Powered flight appeared normal until approximately 67 seconds after liftoff. The flight test data indicate that all measured parameters were normal until T plus 66.7 seconds, when a transient was noted in the first and second stage axial accelerometers, followed by a decrease in booster liquid oxygen pressure. Film data show a change in flame pattern at this time, followed by structural failure of the combined vehicle, resulting in impact 8-12 miles off shore. Examination of recovered structure revealed no second stage propellant leakage or combustion. The cause of the malfunction has not been determined.

Monthly Progress — ABLE Program

ABLE-5B Flight Analysis

• Since the failure of ABLE-5B approximately 67 seconds after liftoff on 15 December the ATLAS/ABLE-5B Review Group, which consists of representatives from Aerospace, Space Technology Laboratories, Aerojet, Rocketdyne, Convair, National Aeronautics and Space Administration, and the Space Systems Division has been charged specifically with the task of analyzing and evaluating data and conducting tests to determine mode and mechanism of failure of the ATLAS/ABLE-5B flight. The program established to accomplish this task has been conducted in three phases: (C)

Phase I — Consisted of the collection, calibration, and analysis of all data to provide a common time basis, establish data validity, and determine the mode of vehicle failure. (C)

Phase II — Consisted of analysis and evaluation of data to identify the mechanism(s) which could have caused the mode of failure as established in Phase I. (C)

Phase III — Consisted of test programs designed to prove the validity of the hypotheses relative to the mechanism(s) identified in Phase II. (C)

• On 15 February, the ATLAS/ABLE-5B Review Group completed Phase II of the flight evaluation. The Review Group has also completed Phase III which consisted of some minor tests and recommended test programs designed to prove the validity of the hypotheses relative to the mechanism(s) which could have caused the failure. The study was concluded with the completion of Phase III and the Final ABLE-5B Failure Investigation Report is now being coordinated. Two hypotheses are being retained which could explain the mechanism of failure. These are: a failure of the ATLAS liquid oxygen tank as the first incident; or the loss of a portion of the upper stages as the first incident which subsequently struck the ATLAS liquid oxygen tank, causing it to fail. The report states that initial failure of the LOX tank is the more probable cause. (C)

• The ATLAS/ABLE-5B Final Mission Report is scheduled to be issued by 1 June 1961 and with this the ABLE-5 Program will be concluded. (U)

Facilities

• Equipment from the ABLE overseas tracking stations is being returned to McClellan Air Force Base to await disposition. Much of the equipment from the Singapore Station has been returned and the station has been deactivated. Pacific Missile Range personnel were trained in the operation of the South Point, Hawaii, station and on 3 April 1961, this station was turned over to the Pacific Missile Range. (U)

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

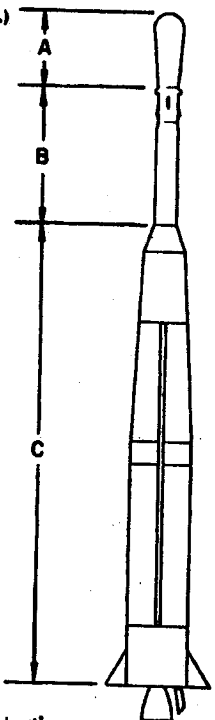
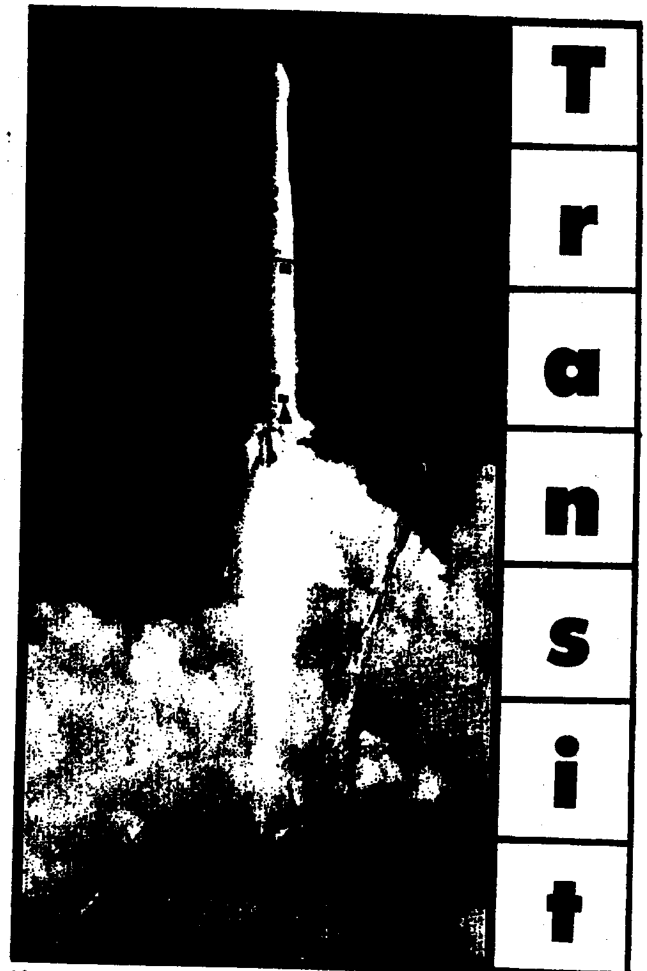


Figure 1. TRANSIT 1A three stage flight vehicle.



TRANSIT 3A launched from Atlantic Missile Range

The TRANSIT Program consists of the flight testing of nine 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 has 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.

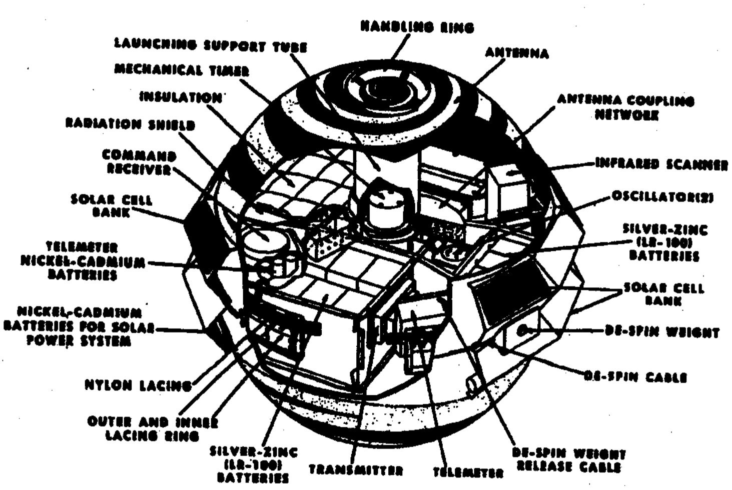
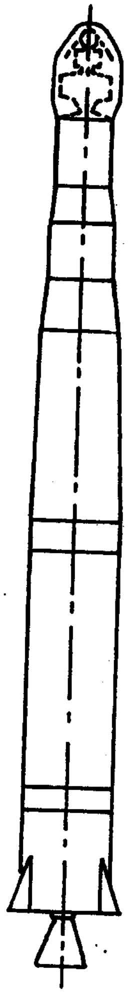


Figure 2. Cut-away drawing of TRANSIT 1A payload (NAV 1).

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 and 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	IWFNA 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.

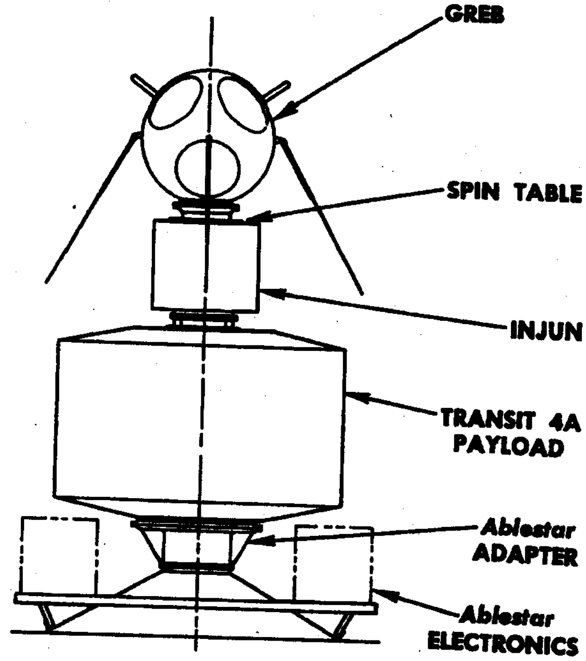


Figure 4. Payload arrangement for TRANSIT 4A flight.

Program Objectives

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

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

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

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

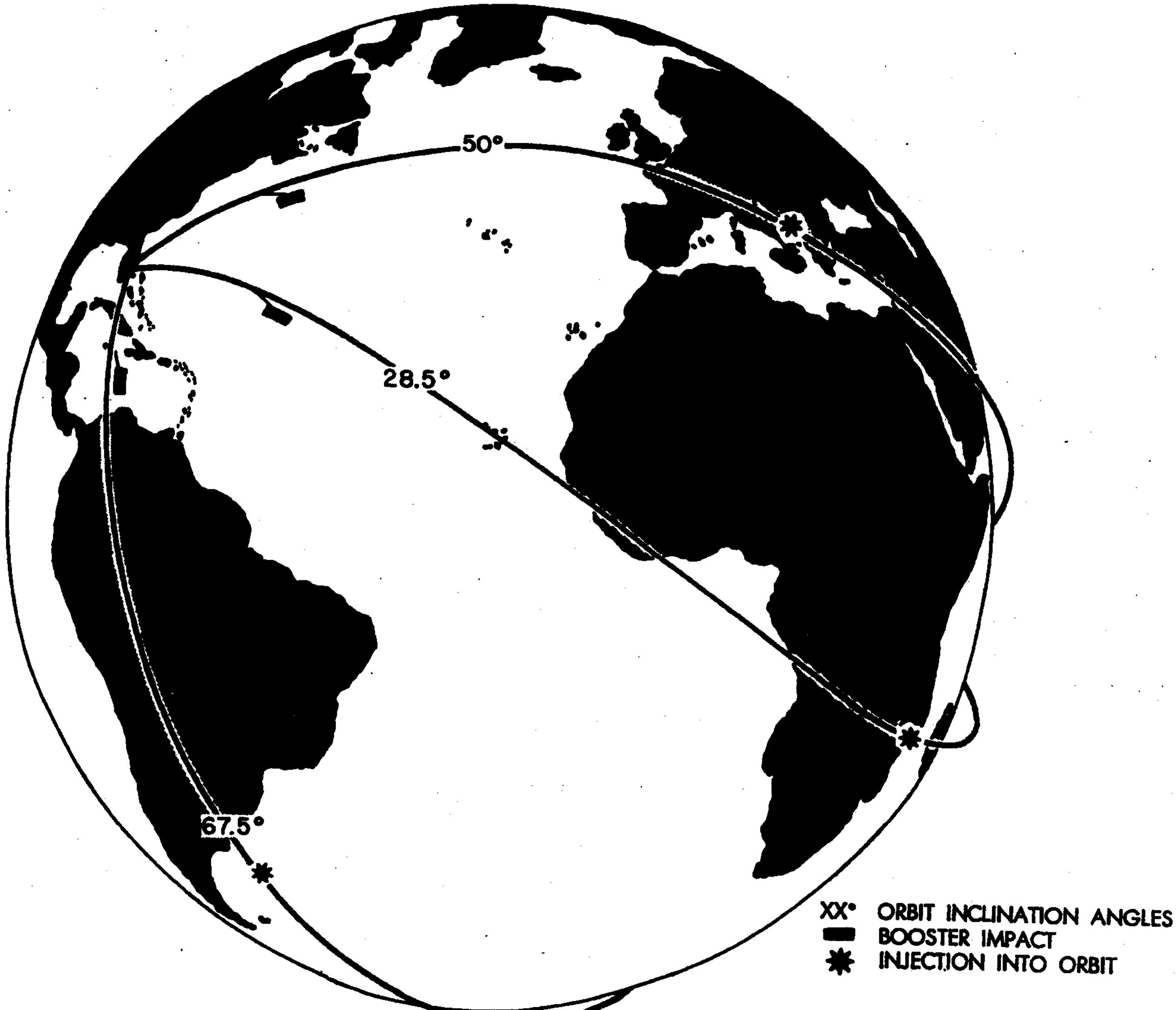
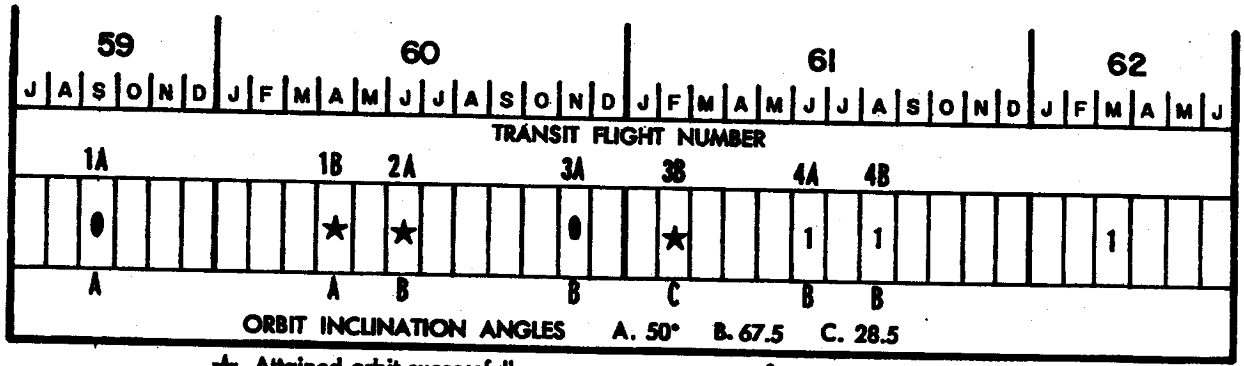


Figure 4. Typical TRANSIT launch trajectories showing flight path, booster impact areas, and orbital injection points.

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 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



★ Attained orbit successfully ⬮ Failed to attain orbit

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.*

Monthly Progress — TRANSIT PROGRAM

Program Administration

- On 4 April 1961, the Navy announced that because of new payload developments, the status of the TRANSIT 5A and 5B launches had been placed in doubt. The THOR/Ablestar booster which was scheduled for launch as TRANSIT 5A in January 1962, has now been rescheduled to support the ANNA Program's first launch which is scheduled for late November 1961. The TRANSIT 5B booster is presently being held for a March 1962 launch but with an unspecified payload. Since the ANNA Program's funding, booster configuration, and basic characteristics are similar to the TRANSIT Program, the booster can be easily interchanged. (C)

- At a Systems Coordination meeting held on 8 March, BUWEPS stated that because of a Naval Research Laboratory payload problem, they desired that TRANSIT 4A be rescheduled from the week of 8 May to the week of 29 May. The launch is now scheduled for 1 June. (C)

- Because of other payload changes BUWEPS has requested that the launch of TRANSIT 4B be rescheduled from the week of 24 July to the week of 21 August. Since no stand availability problems were created, the launch was rescheduled. (C)

- The State Department has given approval for the TRANSIT Project to overfly land, as is necessary for a 67.5° launch from the Atlantic Missile Range. This approval permits the launch of TRANSIT 4A. (C)

Technical Progress

TRANSIT 4A

- The booster vehicles for TRANSIT 4A are on schedule. The DM-21A, serial number 315, has been at the Atlantic Missile Range for over a month. The second stage Ablestar, serial number 008, was airlifted to the Atlantic Missile Range on 24 April. All systems are presently on schedule except the movement of the downrange tracking station. The downrange tracking station will be moved from Pretoria, Union of South Africa to Puenta Arenas, Chile, as soon as project clearance is obtained for the move. Because of the project clearance problem, a twelve day delay is contemplated. However, no slip has been programmed as yet. (U)

TRANSIT 4B

- The necessary effort for the incorporation of the BTL guidance system into the booster is proceeding on schedule. (U)

- The orbit determination task for TRANSIT 4B and subsequent THOR/Ablestar launches will be performed at the facilities of the 6594th Test Wing at Sunnyvale, California. (U)

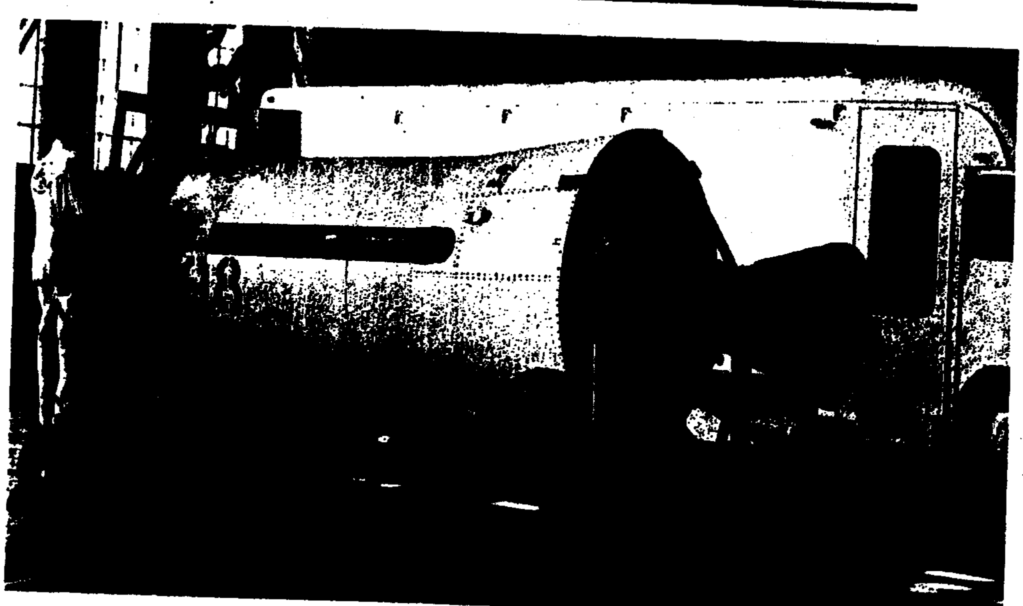
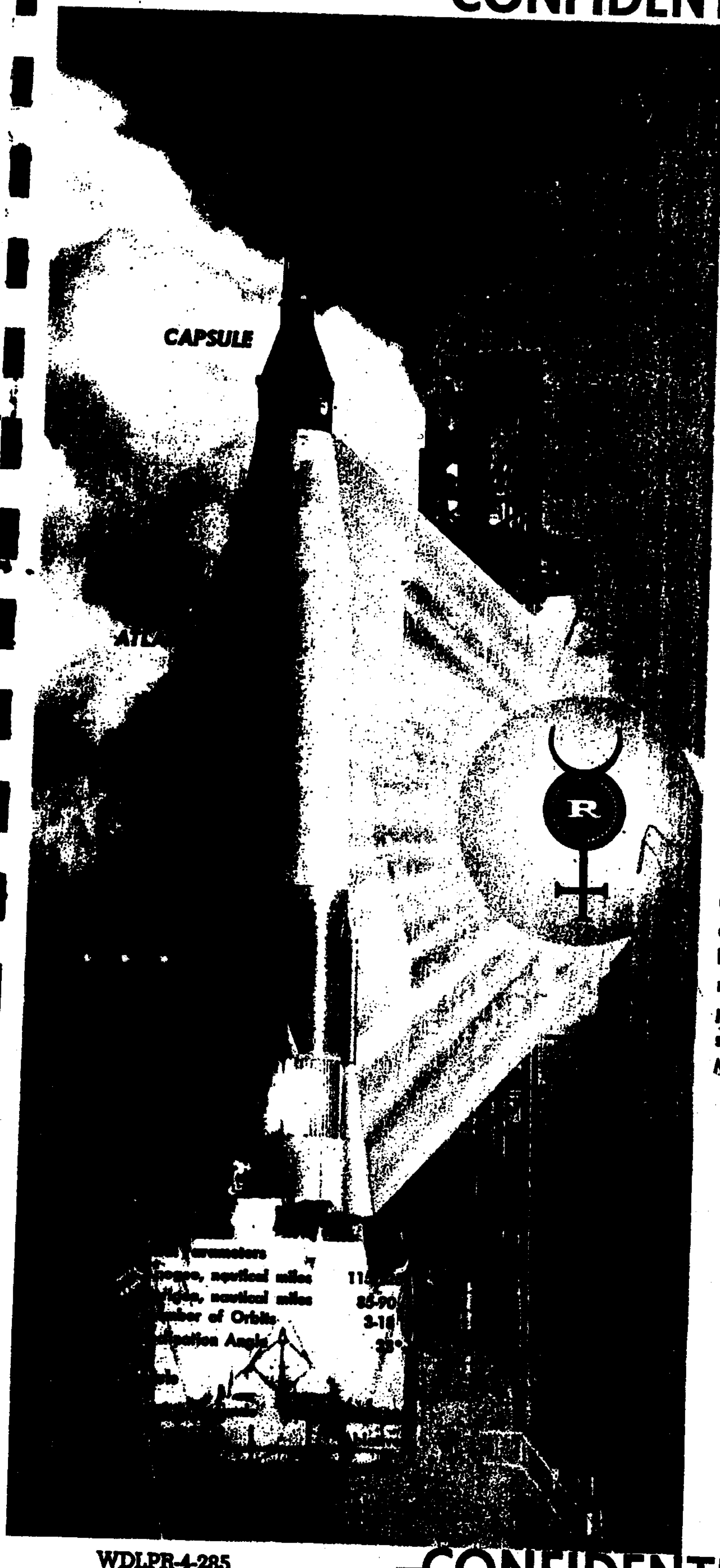


Figure 5. Ablestar vehicle for the TRANSIT 4A flight during installation on a handling fixture. This vehicle arrived at the Atlantic Missile Range on 24 April.



ERCURY

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

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

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

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

Following an initial hold of either 2 or 4.25 seconds, the vehicle will lift-off Atlantic Missile Range Stand 14. Upon a General Electric ground guidance command the booster engine will shut down and staging will occur. Twenty seconds after booster staging, the pylon ring separation explosive bolts fire, the pylon clamp ring is separated, and the escape rocket is fired separating the pylon from the capsule. The sustainer engine accelerates the capsule to the predetermined velocity. The sustainer and vernier engines will shut down upon ground guidance command and the capsule separation explosive bolts will fire. The posigrade rockets will fire and separate capsule from the booster. After five seconds of damping the capsule initiates a 180° yaw maneuver and pitches to a 34° blunt-end-forward attitude. The capsule will maintain a 34° attitude throughout its orbit. At a specified time the Automatic Stabilization and Control System is commanded from the ground to start the orientation mode. If the capsule is in the proper attitude the retro-rockets fire. Sixty seconds after retro-fire the retro and posigrade package will be jettisoned and the capsule will assume a re-entry attitude. When the capsule has descended to 21,000 feet, the drogue parachute is deployed. At 10,000 feet, the drogue parachute and antenna fairing will be jettisoned and the main parachute deployed. At impact the parachute is jettisoned and the recovery aids are deployed.

Space System

MERCURY Supp

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

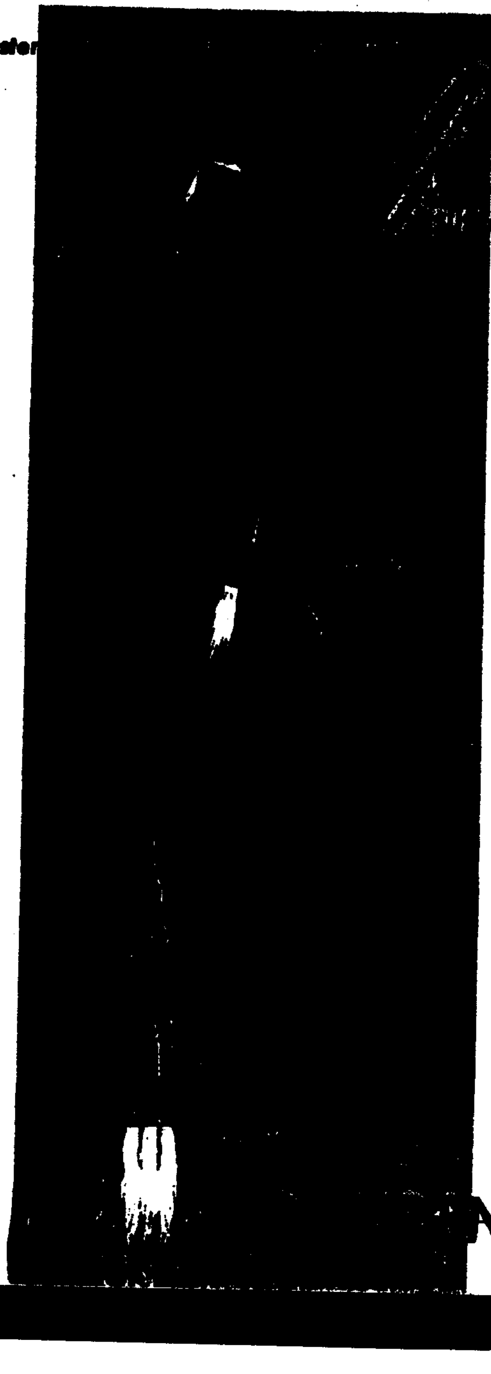
Trajectory Outline

ROTATION

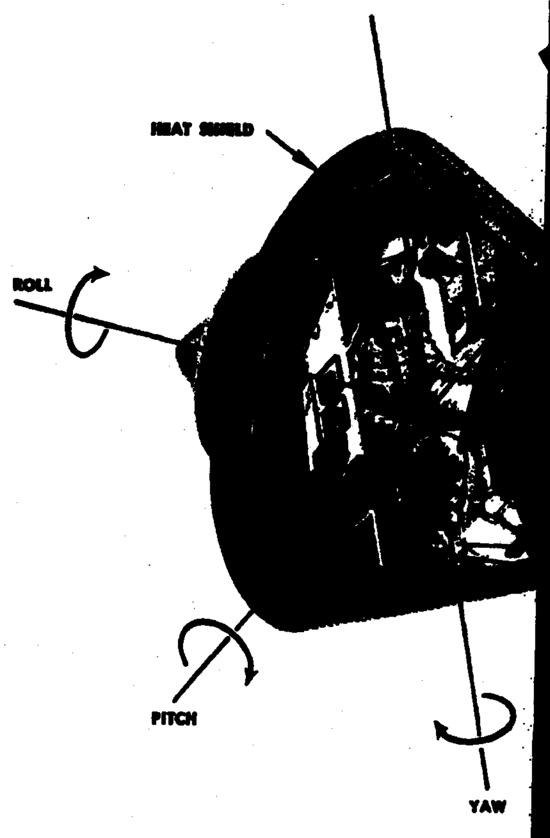
ORI

Space Syste

CAPSULE SEPARATION



INER ENGINE CUTOFF



DENTIAL

Division

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S "D" boosters

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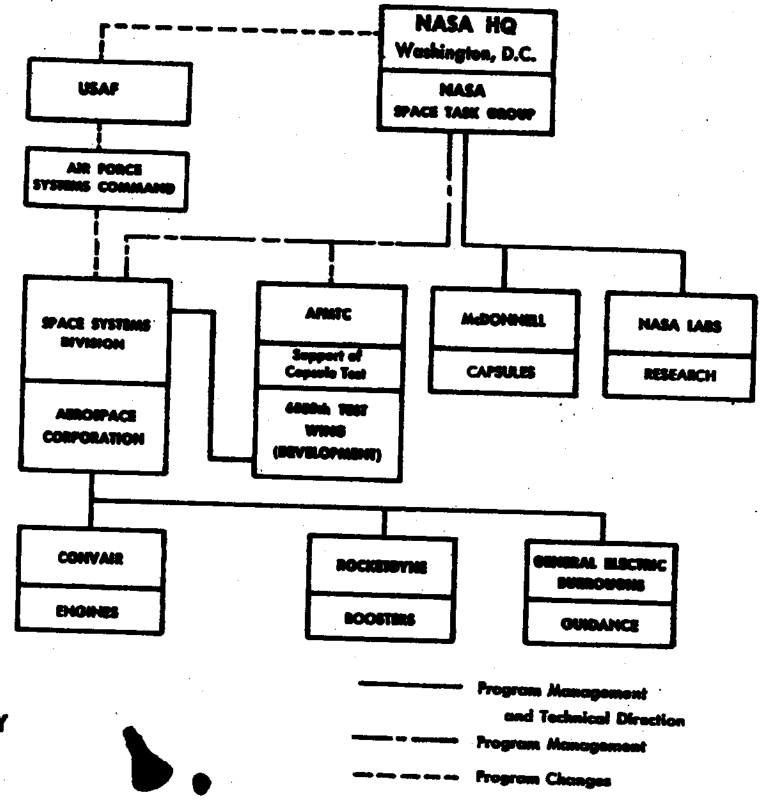
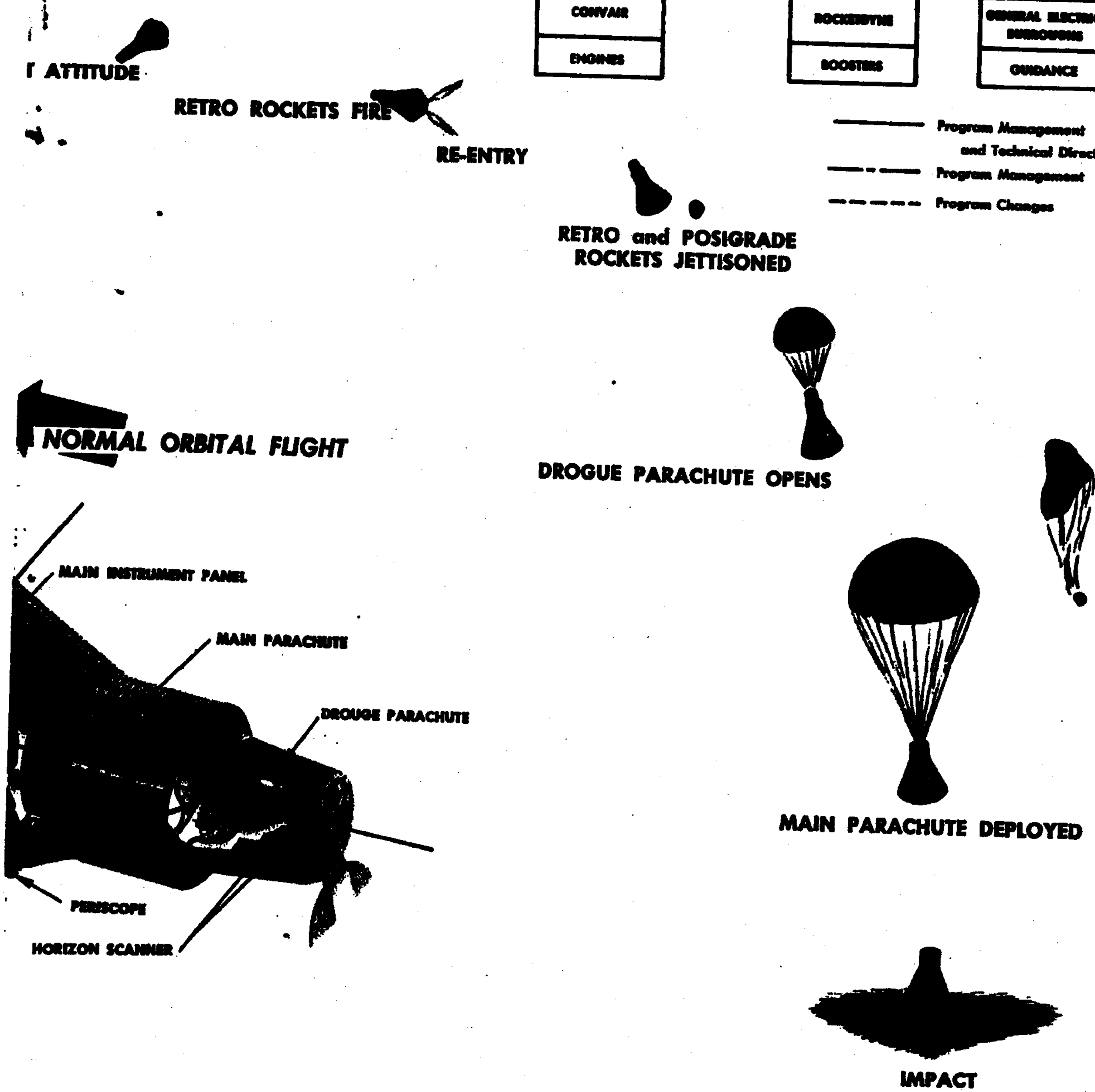


MA-4 Flight



Launch Schedule

Year	Month	Mark
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1961	J	
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	M	
	A	⬮
	M	
	J	1
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	A	1
	S	1
	O	1
	N	1
	D	
1962	J	
	F	
	M	
	A	1
	M	
	J	
	J	1
	A	
	S	
	O	1
	N	
	D	
1963	J	
	F	
	M	1
	A	
	M	
	J	
	J	1
	A	
	S	
	O	
	N	1
	D	

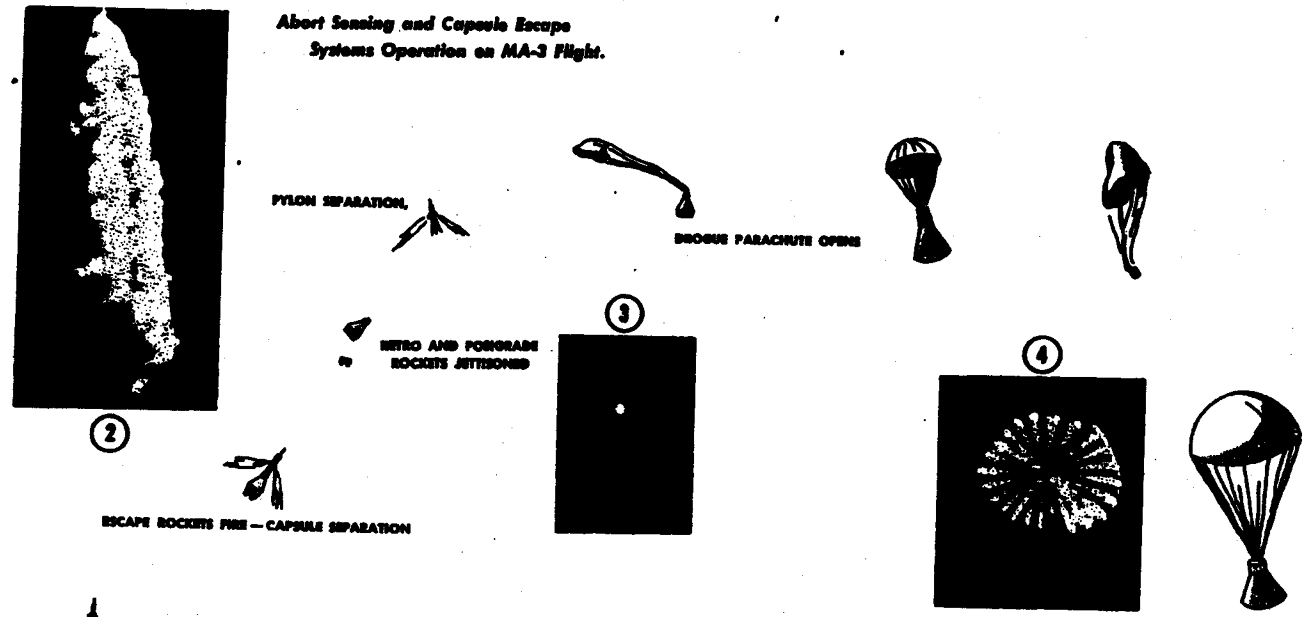
Flight History

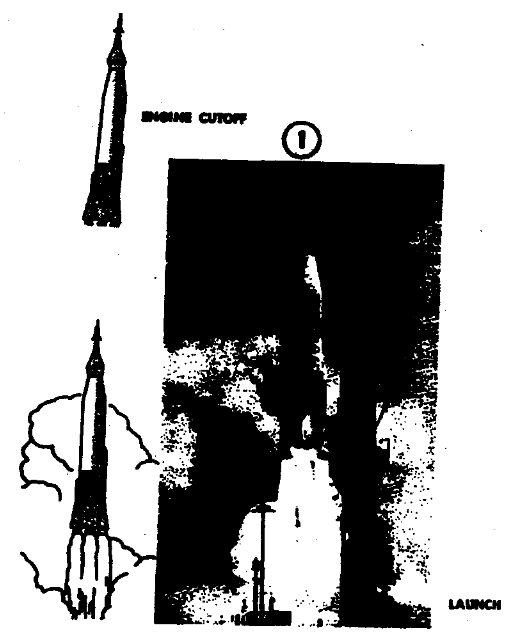
MERCURY Flight	Launch Date	ATLAS No.	Remarks
Big Joe I	9 September	10D	*Flight test objectives were achieved to such a high degree that a second, similar flight was cancelled. The capsule was recovered intact.*
MA-1	29 July	50D	*After one minute of normal flight guidance, rate, track lock, and telemetry 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 been initiated.*

★ Successful flight

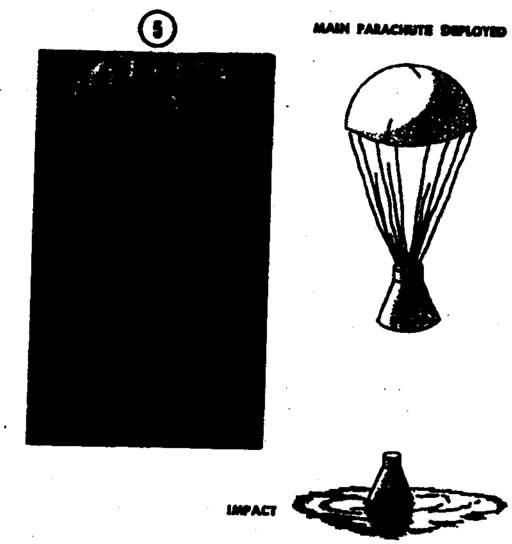
⬮ Unsuccessful flight

Abort Sensing and Capsule Escape Systems Operation on MA-3 Flight.





These photographs, except for the missile launch, were copied from motion picture footage of the MA-3 launch. They show the successful operation of the Abort Sensing and Implementation System and the Capsule Escape System. Photo 1 shows lift-off of 100D from Pad 14; 2 shows the firing of the escape rockets to pull the capsule out of danger; 3 shows the drogue parachute opening with the capsule visible below; 4 shows the opening of the main parachute, the capsule is the black spot on the lower edge of the canopy; 5 shows the main parachute and capsule moments before impact. This demonstrates the system's ability to perform its function under the most difficult abort conditions.



Monthly Progress — Project MERCURY
Flight Test Progress
MA-3 Flight

• Approximately one and one-half weeks prior to launch of MA-3 the general mission objectives were changed by the NASA Space Task Group. The original objectives required immediate re-entry from near orbital insertion. The revised objectives included actual insertion into orbit and a one-orbit revolution of the earth prior to re-entry. The change did not present any great booster problems, since the original trajectory for near-orbital conditions required only minor modifications to achieve orbit. (C)

• MERCURY/ATLAS-3 was launched from Atlantic Missile Range Pad 14 at 1115 EST on 25 April. Final vehicle checkout was accomplished with no significant problems; engine start and transition to main stage were normal. Liftoff appeared normal, however, the programmed events of pitch and roll did not occur and the vehicle violated the range safety launch criteria. The signal for engine shutdown was sent by the Range Safety Officer at approximately T+40 seconds. A three second time delay between engine cutoff and booster destruction is incorporated to permit functioning the Abort Sensing and Implementation System and allow capsule separation. At MA-3 engine cutoff, a drop in fuel inlet manifold pressure was sensed and the abort signal was sent. At T+43 seconds the booster was destroyed. (C)

• Although none of the original test objectives were met, a highly successful "close-in" abort of the capsule was accomplished. The capsule recovery sequence was 100% completed and the capsule was recovered a few hundred yards off shore approximately twenty-one minutes after launch. It is hypothesized that had a human been aboard, he would have survived the launch with no difficulty. This unexpected test of the Abort Sensing and Implementation System and the Capsule Escape System provided an additional demonstration of the system's ability to perform its function under the most difficult abort conditions. (C)

• An ATLAS 100D investigation board was immediately established by the Space Systems Division to determine the cause of the malfunction and to initiate the necessary corrections to preclude its recurrence in subsequent launches. It is anticipated that the cause of the malfunction will be found in the flight control system, however, the board will make a thorough examination of all ATLAS booster systems. (U)

MA-4 Flight

• The MA-3 capsule (Capsule No. 8) will be mated with ATLAS 88D to form the MA-4 vehicle scheduled for launch late in June. ATLAS 88D is the first booster modified to the "thick skin" configuration. It is one of five "thin skin" version MERCURY boosters that had completed or had almost completed manufacture at the time the decision to change skin thickness was made. These boosters are being sent through a special modification line and will be integrated into the launch schedule as they are converted. (C)

ATLAS No.	Configuration
50D (MA-1)	*"Thin skin" booster*
67D (MA-2)	*Manufactured as a "thin skin" booster; field modified to incorporate a restraining band around the upper liquid oxygen tank.*
100D (MA-3)	*Produced in the "thick skin" configuration.*
88D (MA-4)	*"Thin skinned" booster sent through a factory modification program to convert it to the "thick skin" configuration.*

Table I. ATLAS Booster Skin Configuration

NASA Capsule MA-4 Flight Objectives (C)

The flight objectives for the NASA capsule are:

1. Demonstrate the integrity of the capsule structure ablation shield and afterbody shingles for a normal re-entry from orbital flight.
2. Evaluate capsule system performance for an orbital flight.
3. Determine the capsule motions during a normal re-entry from an orbital flight.
4. Determine the capsule vibration environment during flight.
5. Demonstrate the operation of the ground command control equipment.
6. Evaluate the performance of the equipment and operational procedures used in establishing the launch trajectory, booster cutoff conditions, and the prediction of landing points.
7. Evaluate the ground communications network and communication procedures.
8. Evaluate the performance of the network acquisition aids, the radar tracking system and the associated procedures.
9. Evaluate the telemetry-received system performance and telemetry displays.

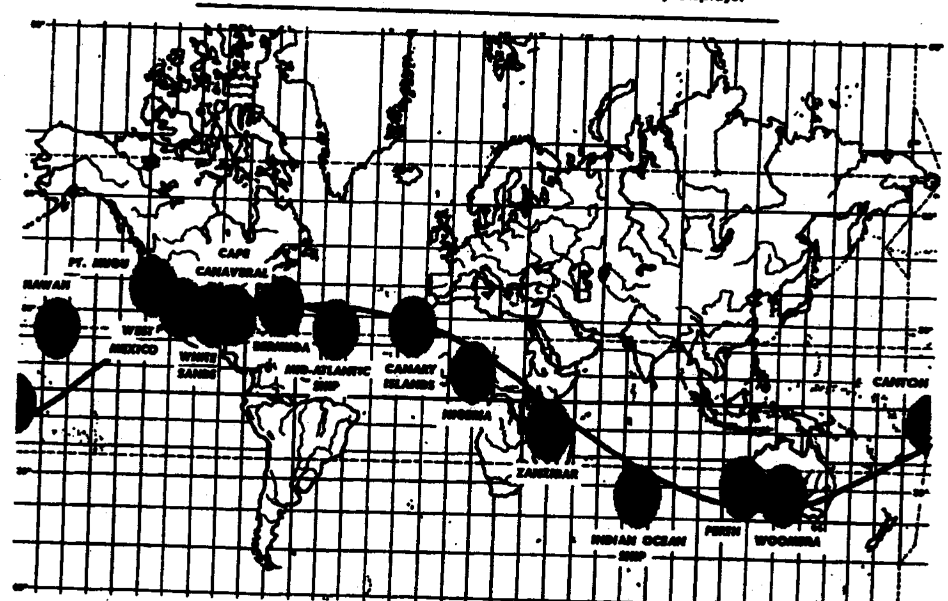


Figure 1. MERCURY tracking network facilities, ground track for MA-4 orbital flight and predicted landing area.

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

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

12. Develop and evaluate MERCURY network countdown and operational procedures.

ATLAS System MA-4 Flight Objectives (C)

The flight objectives for the ATLAS booster are:

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

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

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

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

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

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

Technical Progress

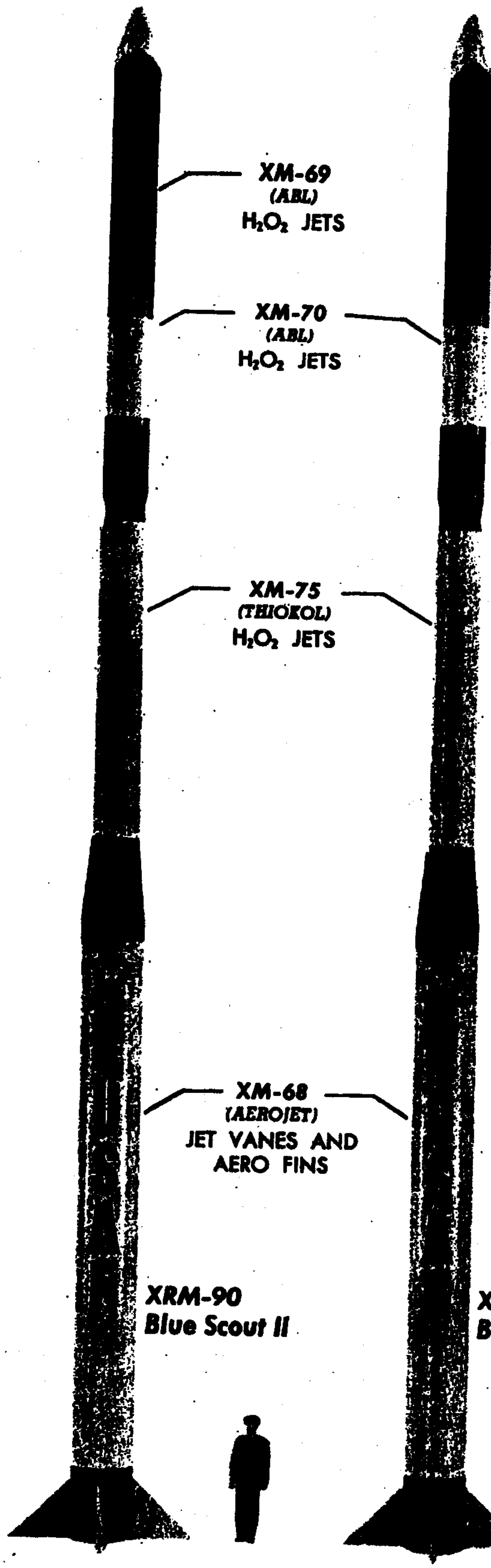
- An investigation is currently underway to determine the feasibility of reducing the holddown time following ignition and prior to launch from four and one-quarter seconds to approximately two seconds. The four and one-quarter second hold-down was incorporated to provide a period of instrumented control, thereby insuring a safe shut down should rough combustion occur following ignition. A decision will be made prior to the June MA-4 launch. (C)

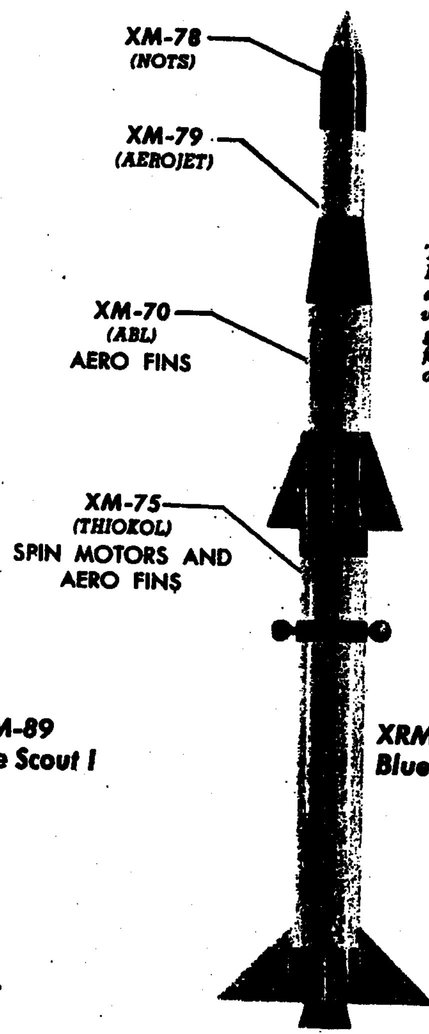
BLUE SCOUT

(Hyper-Environmental Test System)

Program Description

The BLUE SCOUT Program provides the Air Force and other governmental agencies with a hyper-environmental test system. The program is divided into Development and Operational Phases. The Development Phase is being used to develop and flight test the solid propellant vehicles, to train Air Force personnel how to process the vehicles for launch, and to accomplish useful space environment experiments. The vehicles under development will boost a 25-pound payload to 75,000 nautical miles altitude, boost a 200-pound payload to 4,000 nautical miles altitude, or place a 170-pound payload into a circular orbit of 600 nautical miles.





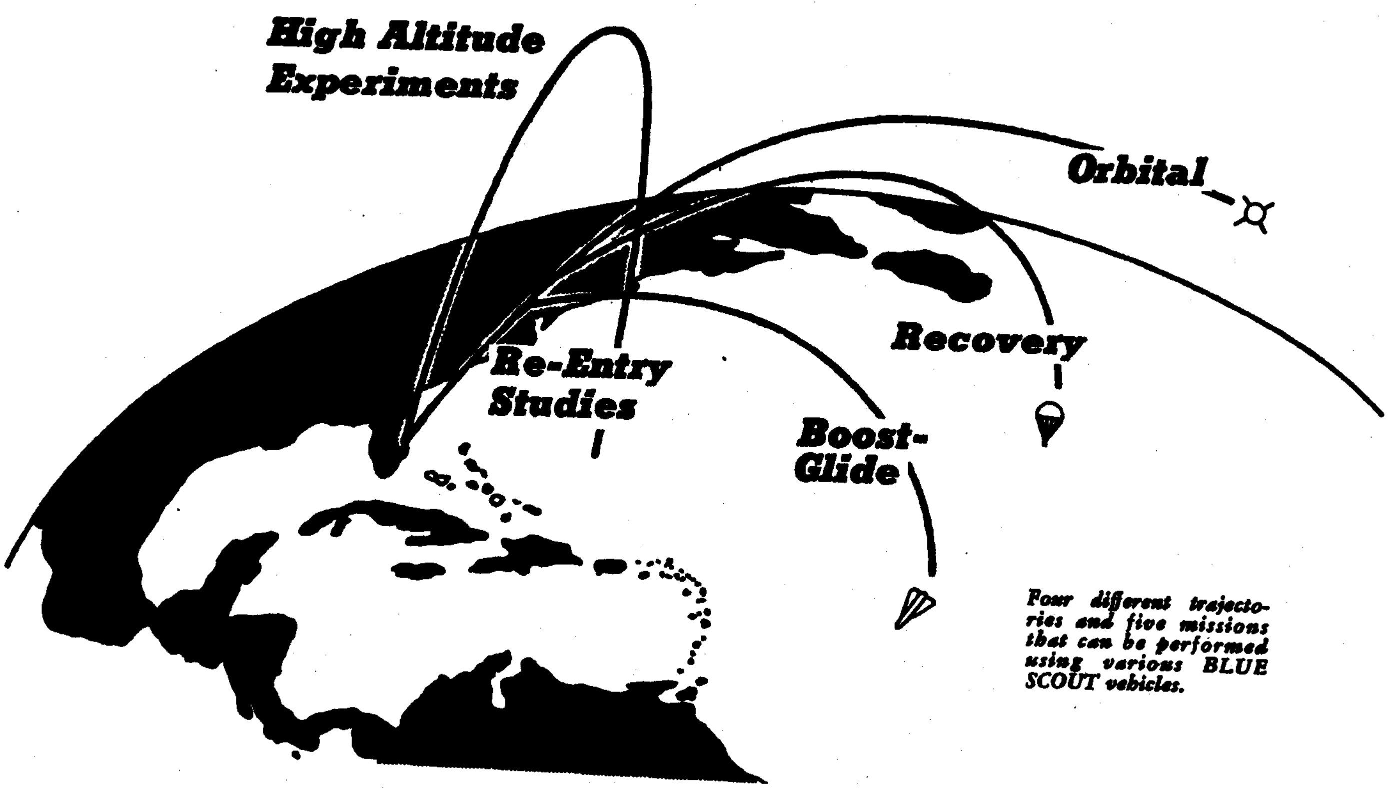
Three variations of BLUE SCOUT vehicles demonstrate the mission versatility of the program. The Air Force officer permits comparison of vehicle sizes.

Economy-Reliability-Versatility

ECONOMY in the Development Phase is being achieved by modifying the basic four-stage solid propellant NASA SCOUT vehicle to accomplish BLUE SCOUT program objectives. Modifications include provisions for stabilizing the fourth stage without spinning and using the vehicle in less than the full four-stage configuration. The development flight test program is being conducted by using existing assembly and checkout building and an existing launch complex. ECONOMY in the Operational Phase will be achieved by the use of this low-cost vehicle, launched by Air Force personnel, as a standard platform for supporting space systems, subsystems, and research projects. RELIABILITY will be obtained by a seven vehicle BLUE SCOUT development flight test program, in addition to the eight vehicle NASA SCOUT development flight test program, plus a continuous quality control and improvement program throughout the life of the system. VERSATILITY will be achieved by having a series of configurations capable of being readily adapted to a wide range of payload variations, and capable of being flown in several combinations of four stages or less. This VERSATILITY results in the following flight capabilities: vertical probes having a wide variance of payload weight/altitude combinations; boost-glide trajectories; ballistic missile trajectories; downward boosted, high-speed re-entry profiles, and orbital flights.

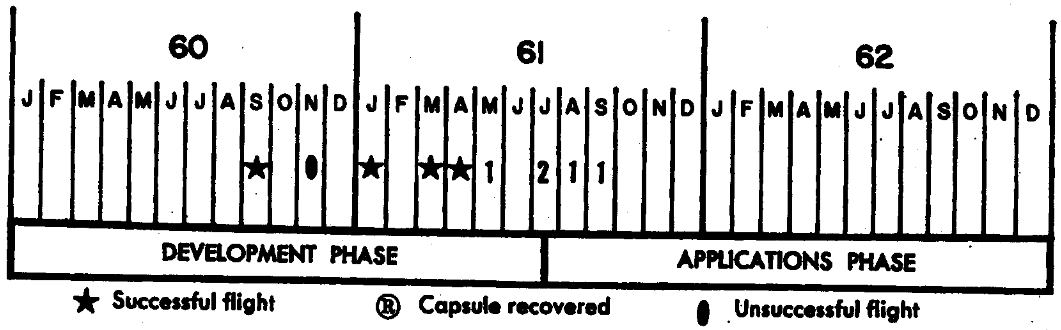
Program Management

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.



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

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. The trajectory to this point was as planned and the payload probably reached an altitude of 14,000 n.m. 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 successfully launched to an apogee of 960 nautical miles and impacted 1025 nautical miles downrange (175 nautical miles short of that programmed). The recovery capsule survived re-entry but was not recovered. Except for this, all primary objectives were achieved as were the majority of secondary objectives.*
D4	3 March	A	XRM-90	*The 172-pound payload was successfully launched to an apogee of 1,380 nautical miles and impacted 1,720 nautical miles downrange. 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 to an apogee of approximately 1,000 nautical miles on a probe trajectory. Seven of the eleven primary test objectives were accomplished and one was partially achieved.*

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

Monthly Progress — BLUE SCOUT

Program Administration

• The BLUE SCOUT Development Test Program has been reduced from nine vehicles to seven. The present program will consist of vehicles D-1 through D-6 and D-8. This will permit two launches of each configuration except the orbital version. Since NASA will have launched at least five orbital-type Scouts by mid-1961, sufficient flight test data should be available on this type of vehicle. The remaining two vehicles, D-7 and D-9, will be utilized in the follow-on Applications Program. Three XRM-91 vehicles (0-1, 0-2, and 0-3) will also be launched under the current program, but are not considered a part of the Development Program. (U)

• Information has been received from Headquarters AFSC that programming action is now in progress to provide a limited amount of FY 61 funds for the follow-on Applications Program. Receipt of these funds, expected by 15 May, would reduce the delay in procurement of hardware for the FY 62 probes program and permit completion of vehicles D-7 and D-9 for the Applications Program. (U)

• NASA and the Air Force are investigating the possibility of having joint facilities for NASA Scout and BLUE SCOUT operations at Point Arguello/Vandenberg Air Force Base. Utilization of existing facilities is one of the objectives of this investigation. This launch site is required to provide a polar orbit capability for Scout-type vehicles. (U)

• A preliminary plan has been prepared for launching a Military Meteorological satellite with a BLUE SCOUT vehicle. This satellite may support future SAMOS operations. (C)

• A review of the SAINT System Package Program has been completed. A BLUE SCOUT vehicle will be used to place a target into a circular West to East orbit for the SAINT to inspect. A backup vehicle is also required. The schedule for procurement, delivery and launching the BLUE SCOUT was found acceptable. (C)

• The feasibility of launching a two-stage configuration BLUE SCOUT vehicle from the X-15 rocket research aircraft is being investigated by North American Aviation, Inc., at the request of the Aeronautical Systems Division. The vehicle under consideration consists of a XM-70 rocket motor, an XM-69 rocket motor and an XRM-90 payload carrier. The B-52 mother ship and the X-15 would essentially replace the XRM-90 first and second stages. The X-15 would be equipped with a suitable release and launch mechanism, and after launch of the missile, would complete its primary flight objectives. Payloads would consist of the same type experiments as those normally launched with BLUE SCOUT vehicles and would be secondary flight objectives. (U)

Flight Test Progress

• The fifth BLUE SCOUT vehicle (D-5) was launched from the Atlantic Missile Range at 0607Z on 12 April. The vehicle boosted a 365-pound payload, consisting of seven USAF geodetic and radiation measuring experiments to an altitude of approximately 1,000 nautical miles on a probe trajectory. Seven of the eleven primary test objectives were successfully accomplished, and one other primary test objective was partially achieved. Since the vehicle's 95-pound data recovery capsule did not separate from the vehicle as planned, three of the primary test objectives were not met. Although the capsule was not recovered, most of the experiment data was successfully obtained through the telemetry system. The success of this mission brings the record of combined NASA-Air Force launches of guided Scout-type vehicles to six successes out of seven attempts. (U)

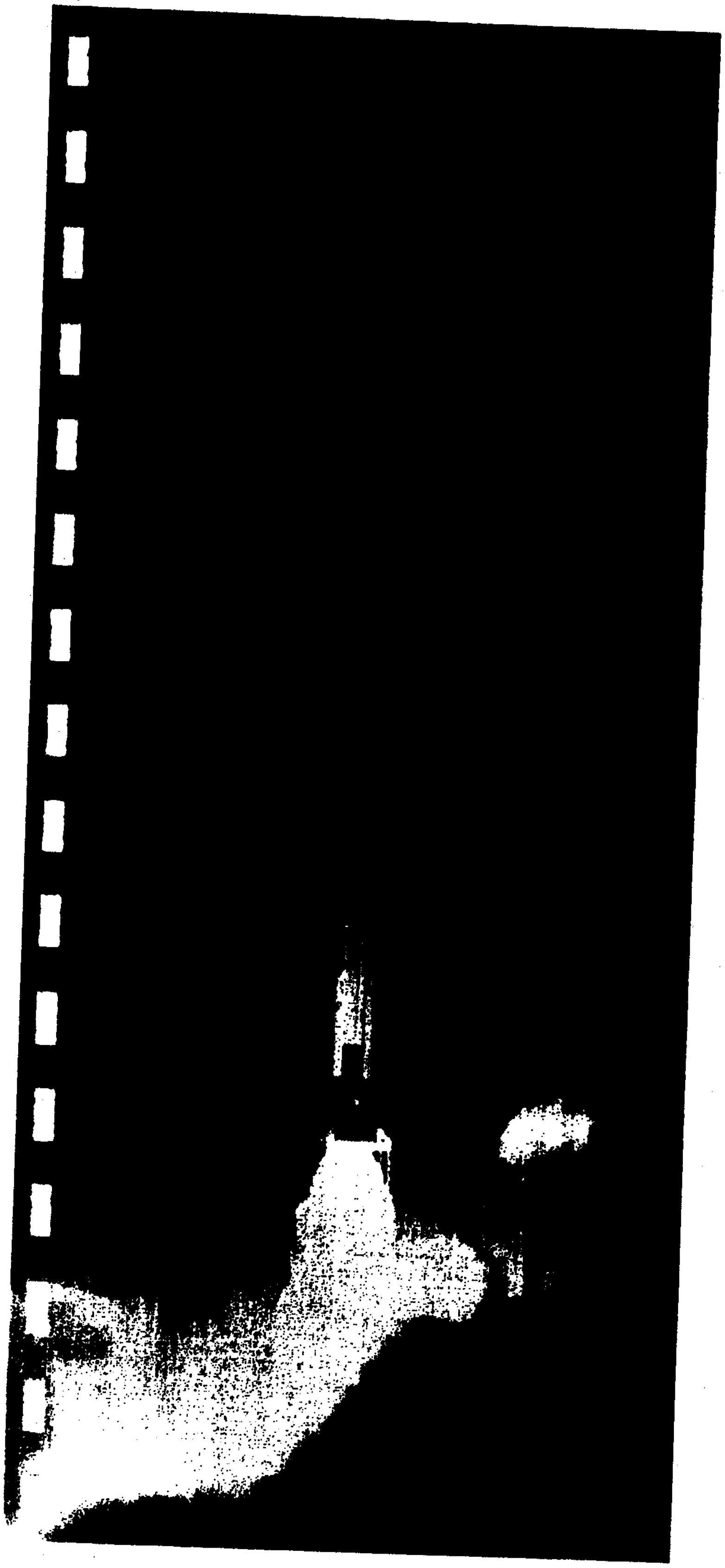
• The launch of the sixth BLUE SCOUT vehicle (D-6) is scheduled for mid-May. The guided three-stage BLUE SCOUT I (XRM-89) vehicle will boost a

Figure 1. An Air Force officer and an enlisted man checking the shroud installation on the BLUE SCOUT D-5 payload carrier.

444-pound payload to an apogee of 874 nautical miles with impact planned for 1,181 nautical miles down-range. The payload contains four Air Force Special Weapons Center experiments and one Air Force Cambridge Research Laboratories experiment which will make radiation measurements. The vehicle will have a 90-pound data recovery capsule. (U)

Facilities

• Design effort has been temporarily deferred on the facilities for support of the follow-on program. Amended construction project justification data (Form 161) reflecting minimum facility requirements have been forwarded to Headquarters USAF for review. The missile assembly facility now in use at the Atlantic Missile Range is being condemned by AFMTC. (U)



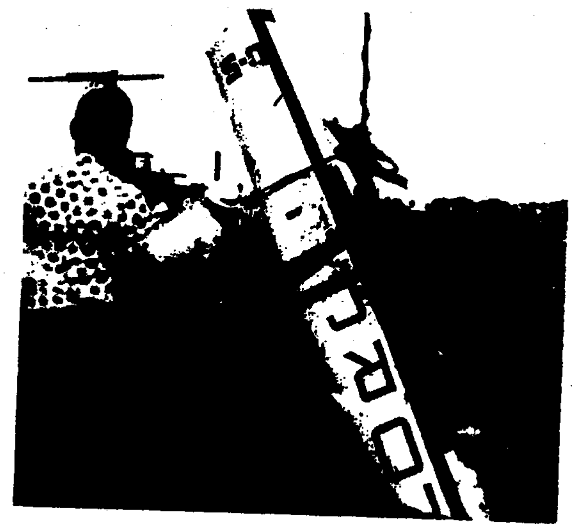
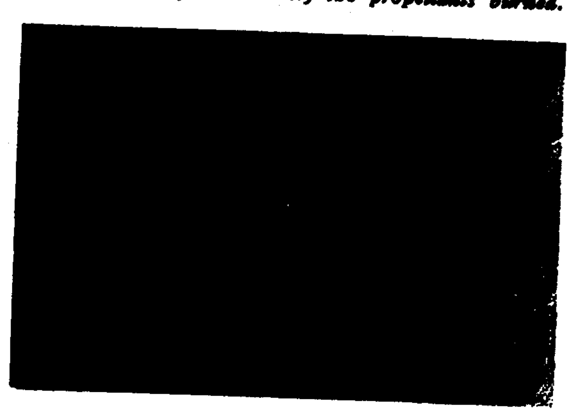
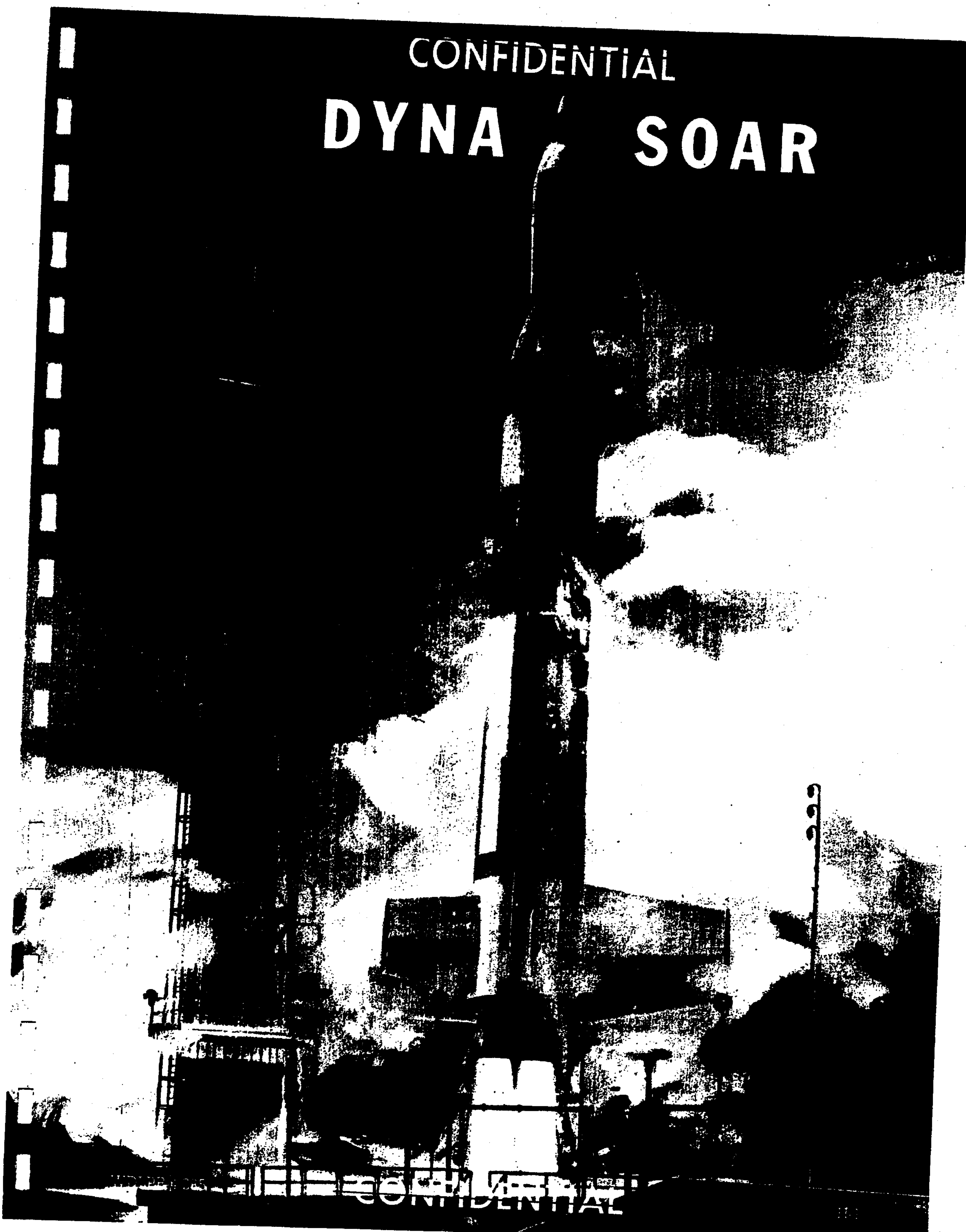


Figure 2. Launch of the BLUE SCOUT II vehicle on 12 April from Atlantic Missile Range Complex 18. First stage motor case (above) being recovered from the ocean for inspection. Its components will eventually be used as training aids. Inside the XM-68 motor case (below) showing how evenly the propellants burned.



CONFIDENTIAL

DYNA SOAR



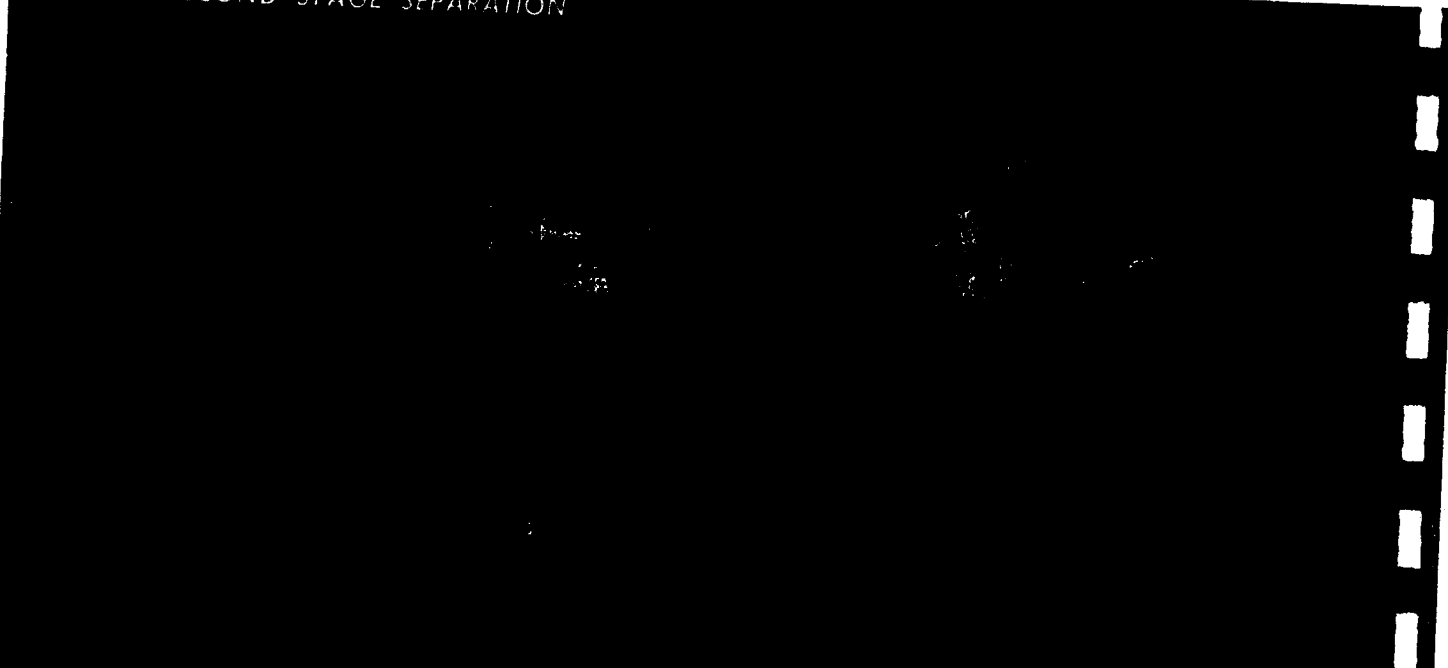
CONFIDENTIAL

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), 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.

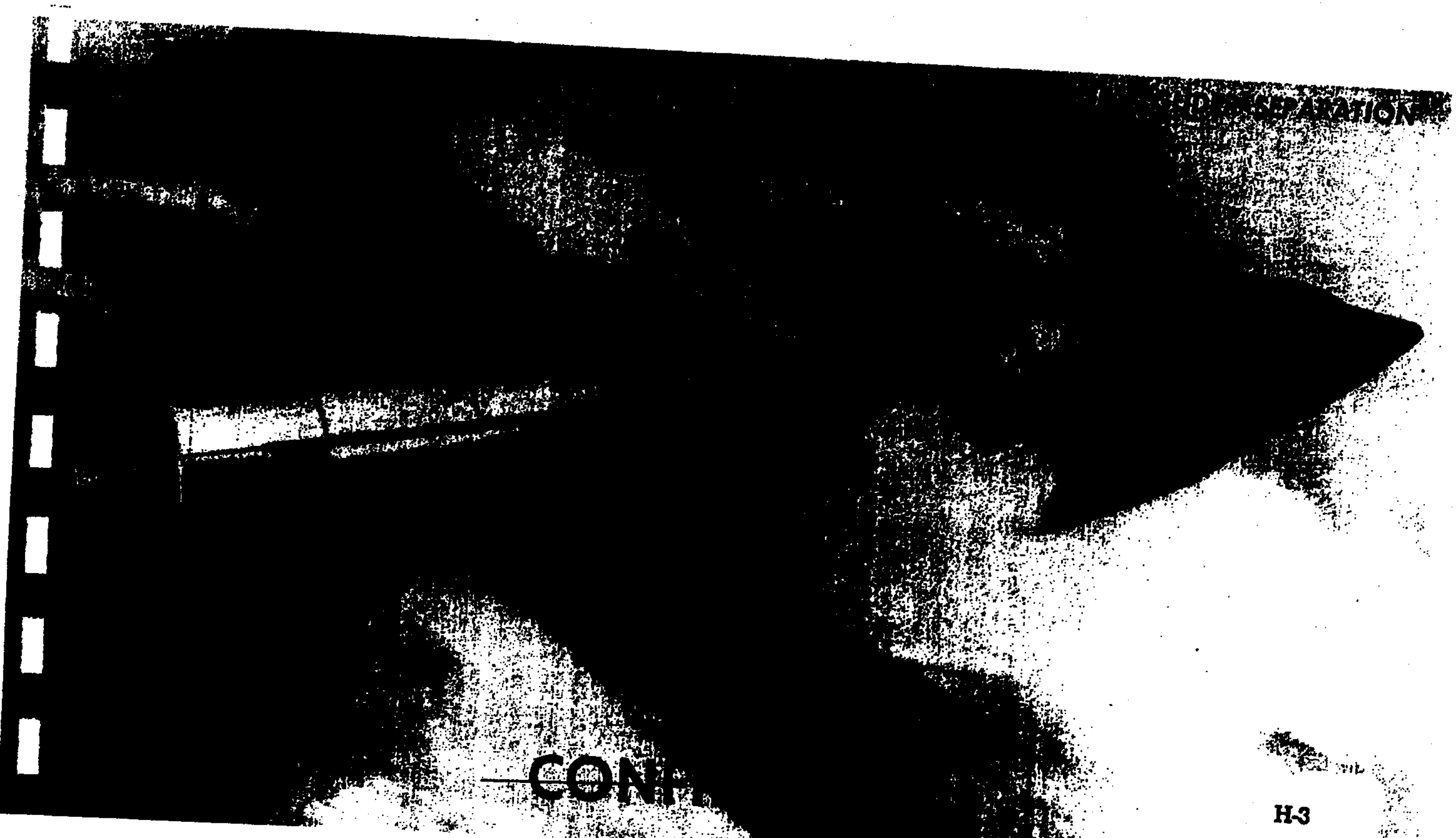
Technical Approach—AFBMD's technical approach to meet the objectives of the program are:

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

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

3. Modification of an AMR launch pad.

4. Provide an integrated launch countdown.

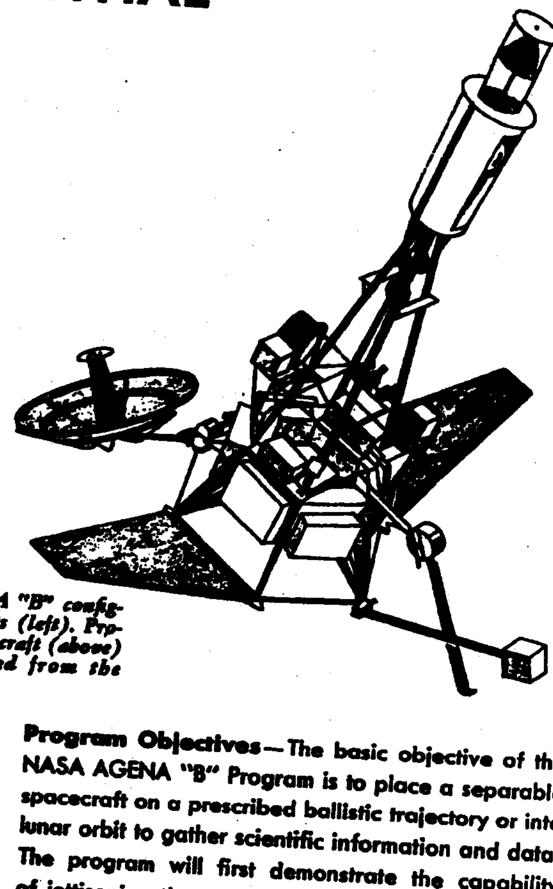


Monthly Progress – DYNA SOAR Program

Program Administration

- The initial Technical Direction meeting covering the DYNA SOAR booster was held at the Space Systems Division on 31 March. The primary objective was to establish philosophy, policies, and procedures and to delineate the Aerospace Corporation role and relationship with the DYNA SOAR booster program. Representatives from the Martin Company, Aerojet-General Corporation, and the General Electric Company attended. (U)
- Design criteria for the launch complex at the Atlantic Missile Range have been received from The Martin Company. Space Systems Division review is now complete in preparation for action by the Facilities Working Group meeting to be held in May. (U)
- The statement of Work for the booster radio guidance subsystem associate contractor has been drafted and forwarded for System Program Office approval. (U)
- A Technical Evaluation Board has been convened for 1-12 May at the Space Systems Division. The board will utilize procedures directed by the Systems Program Office and will recommend the booster to be used for DYNA SOAR, Step II. (U)
- A DYNA SOAR System Design Review meeting was held at Boeing, Seattle, Washington, on 20-25 April. Presentations were given by the system contractor and the associate contractors for the booster, booster engine, primary guidance and communications and data link. The results of the review will be incorporated in the final System Description which will be used in the Development Engineering Review and mockup. (U)

NASA AGENA "B" PROGRAM



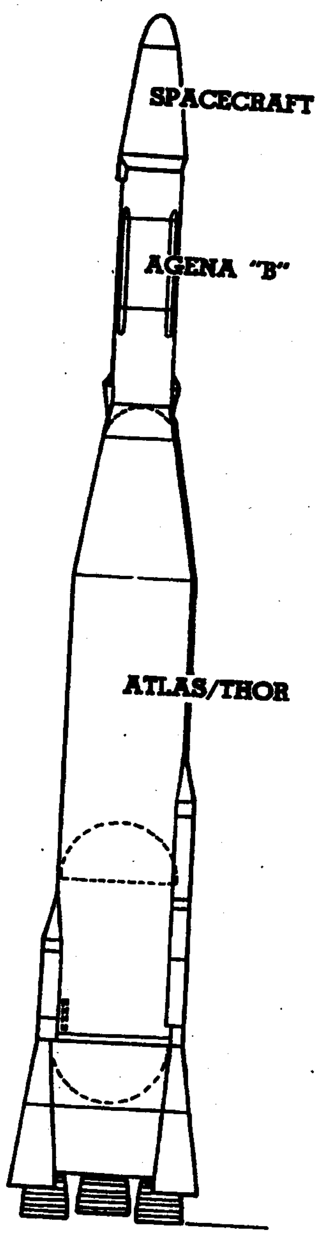


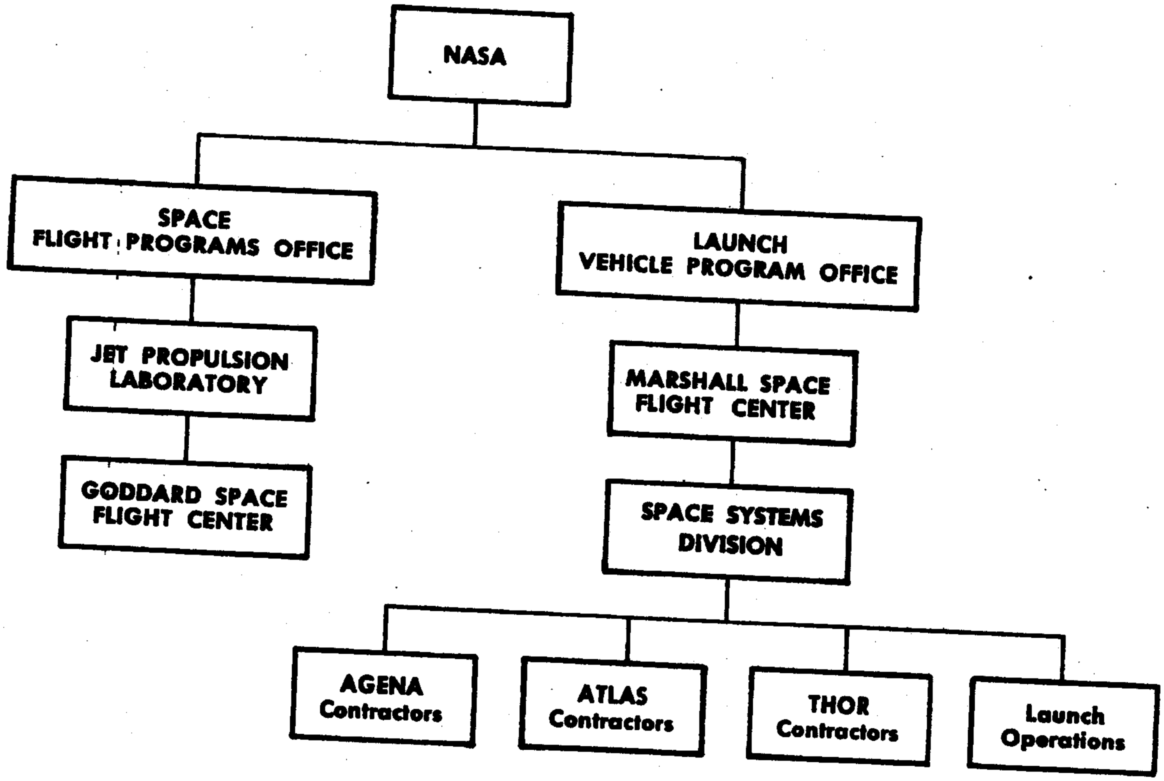
Figure 1. NASA AGENA "B" configuration for Ranger flights (left). Proposed Ranger lunar spacecraft (above) which will be launched from the Atlantic Missile Range.

Program Objectives—The basic objective of the NASA AGENA "B" Program is to place a separable spacecraft on a prescribed ballistic trajectory or into lunar orbit to gather scientific information and data. The program will first demonstrate the capability of jettisoning the spacecraft shroud and separating the spacecraft from the AGENA "B" vehicle. The program will also develop and demonstrate the capability of the AGENA "B" retro system to retard the second stage. To achieve these objectives the NASA will use the background and experience gained by the USAF in their Satellite System programs in terms of AGENA engineering, procedures and launch operations.

Flight Program—Although it is intended that this program will continue for several years beyond 1962, only the launches through 1962 are firm. The current schedule is as follows:

Launch Date		Booster	Mission
July	1961	ATLAS	Lunar Test Vehicle
October	1961	ATLAS	Lunar Test Vehicle
January	1962	ATLAS	Lunar Impact
March	1962	THOR	Scientific Satellite
April	1962	ATLAS	Lunar Impact
April	1962	THOR	Communication Satellite
June	1962	ATLAS	Lunar Impact
June	1962	THOR	Meteorological Satellite
September	1962	THOR	Backup

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



NASA AGENA "B" Project Organization Chart

Program Responsibilities—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.

Program Status — The Space Systems Division has taken the following action to support the NASA AGENA "B" Program:

1. Awarded Lockheed Missile and Space Division a contract (letter Contract -592) dated 12 April 1960, for the procurement of modified AGENA "B" second stage vehicles, jettisonable spacecraft shrouds, overall systems engineering and vehicle launch.

2. Issued a contract change notice to Convair Astronautics for five modified ATLAS "D" boosters to support the lunar flights.

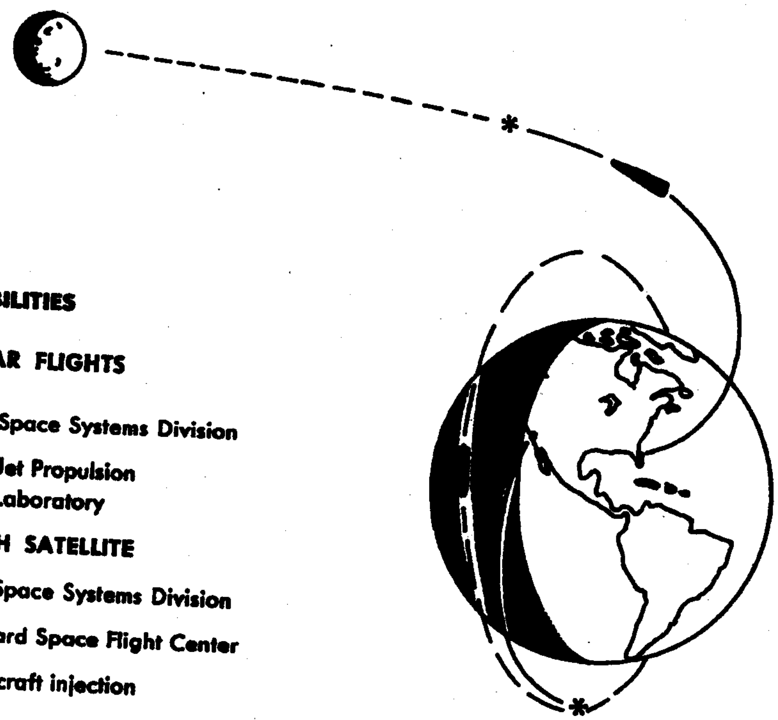
3. Allocated eight THOR boosters to NASA.

4. Initiated contractual action with General Electric and Bell Telephone Laboratories for guidance systems to be used on the ATLAS and THOR boosters, respectively.

5. Published the program requirements document setting forth the requirements to be imposed upon the Atlantic Missile Range to support this program.

6. The Space System Development Plan for the NASA AGENA "B" Program was approved on 12 August. Headquarters AFSC is responsible for distribution of the Development Plan to appropriate NASA organizations.

NASA AGENA "B" Program Flights



RESPONSIBILITIES

LUNAR FLIGHTS

——— Space Systems Division

- - - - - - Jet Propulsion Laboratory

EARTH SATELLITE

——— Space Systems Division

— — Goddard Space Flight Center

* Spacecraft injection

Monthly Progress – NASA AGENA "B"

Program Administration

• A meeting was held at Goddard Space Flight Center on 17-18 April in which each satellite mission scheduled for the NABA AGENA B Program was discussed. The purpose of the meeting was to brief the management personnel of all organizations supporting the program on the requirements and objectives of Nimbus, Topside Sounder, Communications Satellite, Orbiting Geophysical Observatory, Orbiting Astronomical Observatory and the Orbiting Solar Observatory. The briefing was very beneficial to those organizations participating exclusively in the booster program. (U)

Technical Progress

Ranger Lunar Program

• The AGENA B vehicle for the first flight successfully completed static firings at Santa Cruz Test Base on 3 May. The second AGENA B vehicle completed final assembly on 2 May and is presently undergoing subsystem checkout prior to the integrated systems test scheduled for June. (U)

• The ATLAS 111D, the booster for RA-1, is undergoing final system checkout at the Convair-Astronautics facility. General Electric guidance system compatibility tests are currently in progress. Booster delivery to the Atlantic Missile Range is scheduled for 15 May. (U)

• As a result of the presentation made to Range Safety at Atlantic Missile Range, a waiver was obtained permitting land over-flight. The requirement for a command destruct system in the second stage of the RANGER Program was also removed. This decision relieves the possibility of having to alter the schedule to include a destruct system in the AGENA "B" booster. (U)

• A presentation was made by Convair-Astronautics and Rocketdyne on the effects of using RJ-1 fuel in the ATLAS booster. The initial estimate of an increased payload capability of 80-100 pounds was found to be closer to 20 pounds. This was due to some simplifying assumptions which proved to be erroneous. Other problems were encountered with the effects of the change in fuel density on the propellant utilization system. Based on these facts, AFSSD recommended to NASA that RJ-1 fuel not be utilized in the RANGER Program. (U)

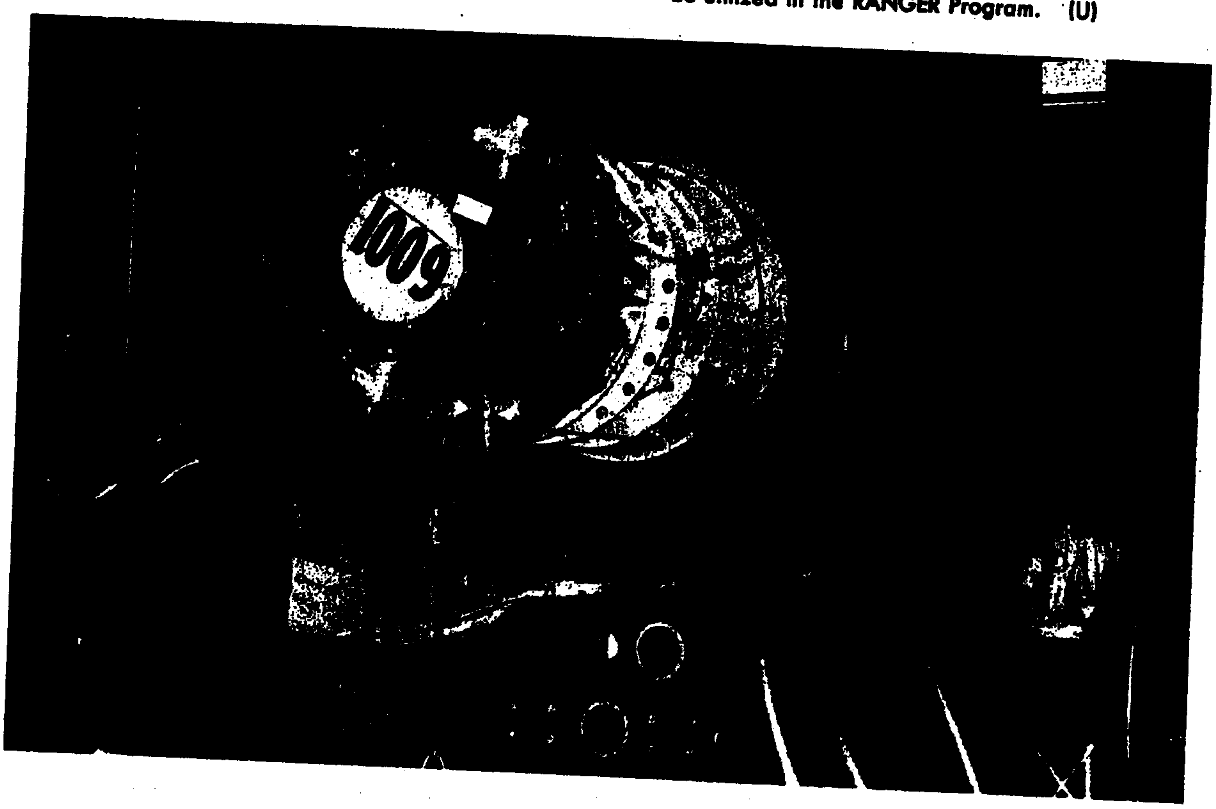


Figure 2. AGENA "B" vehicle for the 26 July launch during installation on a semi-trailer for its trip to the Santa Cruz Test Base for "hot firing" tests.

Topside Sounder

• Approximately half of the Topside Sounder engineering for the AGENA vehicle has been completed and no significant problems are seen at this time. The 14-foot shroud encompassing the space craft will be available for separation tests early in June. (U)

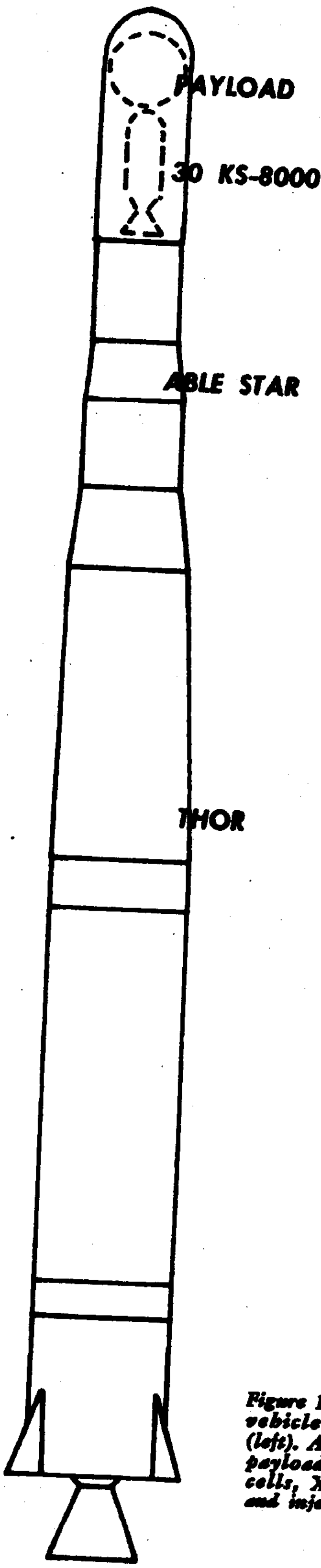
Communications Satellite

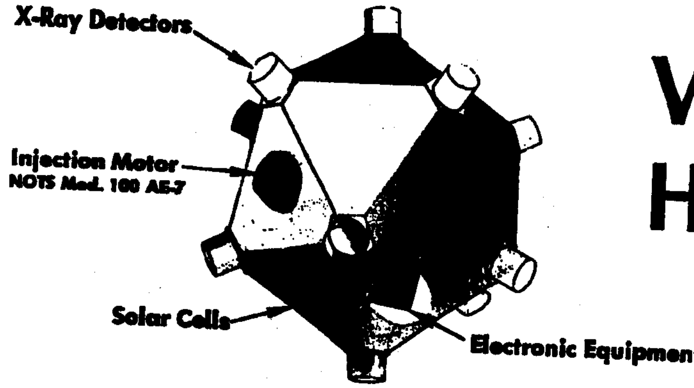
• The engineering release schedule has been established and engineering has been started. (U)

Facilities

• Modification of Pad 12 at AMR is nearing completion. No problems are envisioned in meeting the 6 June final completion date. (U)

Figure 3. Ranger payload for the July flight. The zero antenna is at the top of the tower, the rubidium vapor magnetometer is in the cylinder below the antenna, the electrostatic analyzer is extended at right, and one of the solar panels is being lowered into position.





VELA HOTEL

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

Program Objectives

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

Program History

- The Panofsky Panel on High Altitude Detection, reporting to the President's Scientific Advisory Committee, made several recommendations with respect to research and development work which should be accomplished in order to increase basic understanding of the physical mechanisms involved. The Department of Defense agreed to assume over-all responsibility with Atomic Energy Commission support in the high-altitude detection area. Further, it was agreed that the AEC would undertake laboratory development of the nuclear detection instrumentation and that the portion of the effort concerning measurements of natural radiations in space should be implemented jointly by the DOD and the NASA.
- Within the Department of Defense, the Advanced Research Projects Agency was assigned the management responsibility for Project VELA on 22 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 Technical Working Group was to recommend a research and development program which would investigate the concept of nuclear detonation detection from satellites. To facilitate conducting the work involved,

the Joint Working Group formed subcommittees for payload, space boosters, and communications and control.

Program Concept

• The program recommended by the Joint Working Group included placing in orbit three full-scale experimental satellites from each of nine ATLAS/AGENA launches. These launches would start two years after program initiation. The satellites were to be placed in orbits outside the natural radiation belts of the earth and were to contain X-ray, gamma ray and neutron detectors. Because of the high cost, the research program was not approved; instead a "limited scope" program was authorized by ARPA.

• With its funds, AEC is initiating a piggyback flight program aboard Rangers (Lunar probes), NASA Scouts and Mariners (Venus probes). Some low-altitude experimentation and a few long-life satellites will be required in addition to these AEC flights. Therefore, additional AFSC/AEC programs will be implemented as follows:

1. Several DISCOVERER piggyback low-altitude polar orbit flights which obtain background radiation data below the Van Allen belts.

2. A limited number of small long-life satellites in elliptic orbits with apogees of about 50,000 nautical miles.

• The DISCOVERER piggyback flights as proposed will 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 small satellites as now envisioned will be launched into an orbit having a 200 nautical mile perigee and a 50,000 nautical mile apogee. A small injection motor contained in the satellite will be fired at apogee, thus raising the perigee to approximately 35,000 nautical miles. The instrumentation planned for these small satellites is of a pre-prototype design and will consist of X-ray, gamma ray and neutron detectors, Geiger counters, electrostatic analyzer and a differential detector system. Launches of the THOR boosted vehicles are tentatively scheduled for October and December 1962 and February 1963.

Monthly Progress — VELA HOTEL

Program Administration

• The "Limited Scope" Development Plan briefings were conducted by a joint Space Systems Division, Atomic Energy Commission, and Aerospace Corporation briefing team on 18-19 April in Washington, D.C. Personnel of Headquarters USAF, Headquarters AFSC, ARPA, AEC (DMA), and the State Department attended the briefings. The reaction to the briefings was favorable and there was no disagreement with any portion of the Development Plan. Informal discussions with ARPA personnel indicate that the earliest possible date that a decision could be made relative to this plan is 31 May. (C)

• The Phase I Piggyback Program of VELA HOTEL is proceeding on schedule. At present, four DISCOVERER vehicles are scheduled to carry VELA HOTEL radiation detectors. Two of these vehicles will be launched in August and one each during September and October. (C)

Project ANNA

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

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

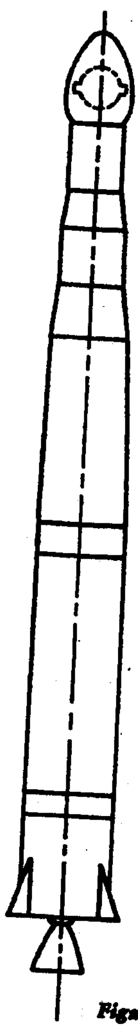


Figure 1. Two stage ANNA vehicle.

Program Description

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

Payload Description

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

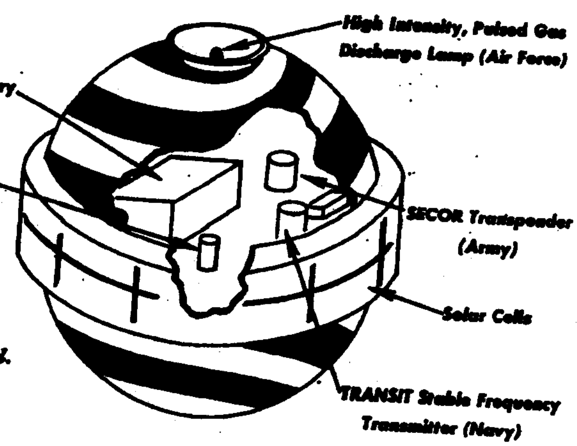


Figure 2. Cutaway drawing of ANNA payload.

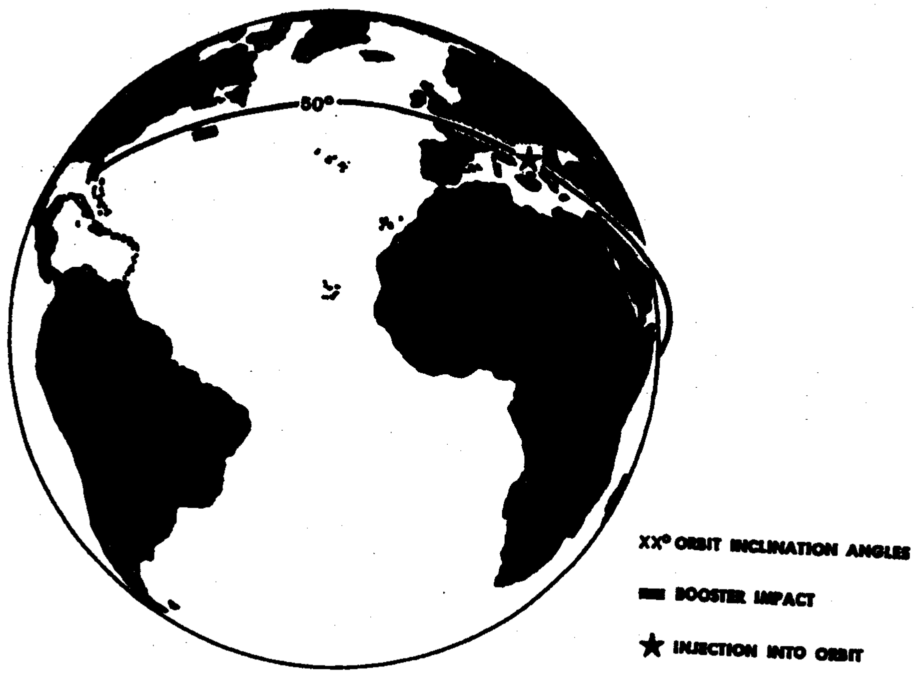


Figure 3. ANNA launch trajectory (50° orbit inclination angle) showing flight path, booster impact area, and orbital injection point.

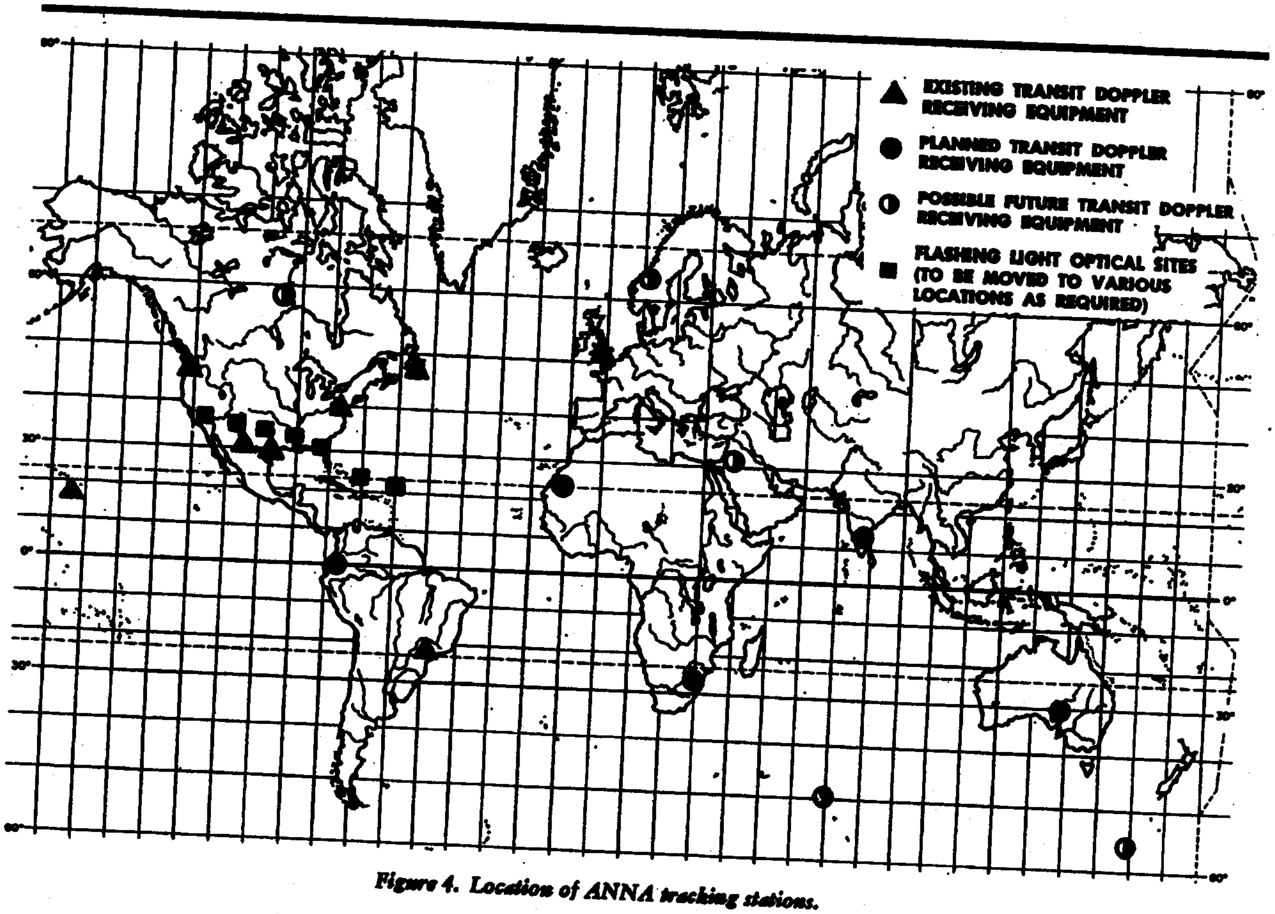


Figure 4. Location of ANNA tracking stations.

Program Objectives

The Objectives of the ANNA Program are to:

1. Relate the major datums to each other and to the earth's center of mass.

2. Determine the structure of the earth's gravitational potential.

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

Orbital Performance

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

1. The *orbital method* requires extremely precise determination of the satellite orbit, including minor variations from the Keplerian Ellipse, and then uses this information as a "measuring rod" for connecting the various datums over which it passes.

2. The *inter-visible method* uses the satellite as a point of simultaneous observation from known and unknown data. It does not require precise knowledge of the satellite ephemeris but it does require simultaneous sightings from several locations.

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

Ground Support and Tracking Stations

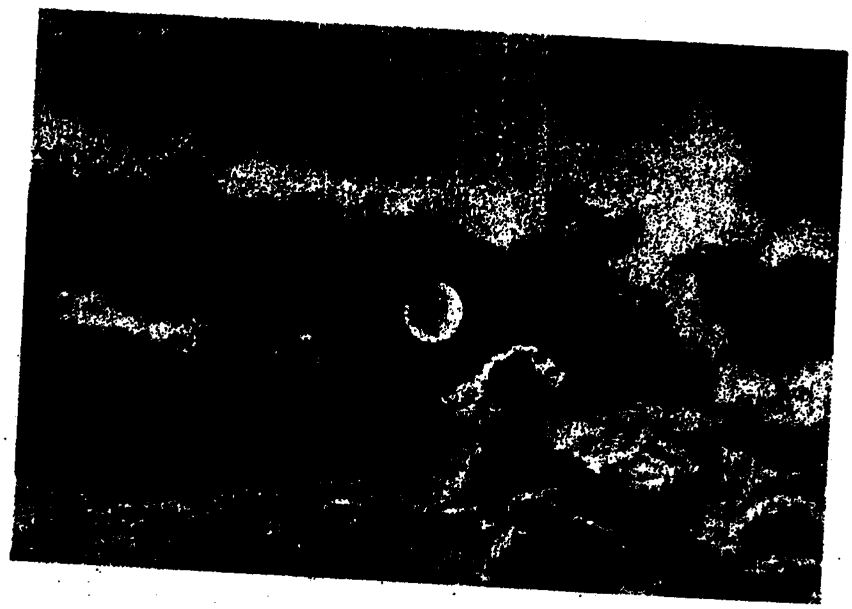
In regard to satellite tracking, each of the services is providing a system of tracking stations corresponding to its component in the satellite; i.e., the Air Force is providing for optical tracking, the Navy is providing for doppler ground support facilities, and the Army is providing ground facilities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

Monthly Progress — Project ANNA

Program Administration

- The launch date has been rescheduled from 5 December to 28 November 1961.

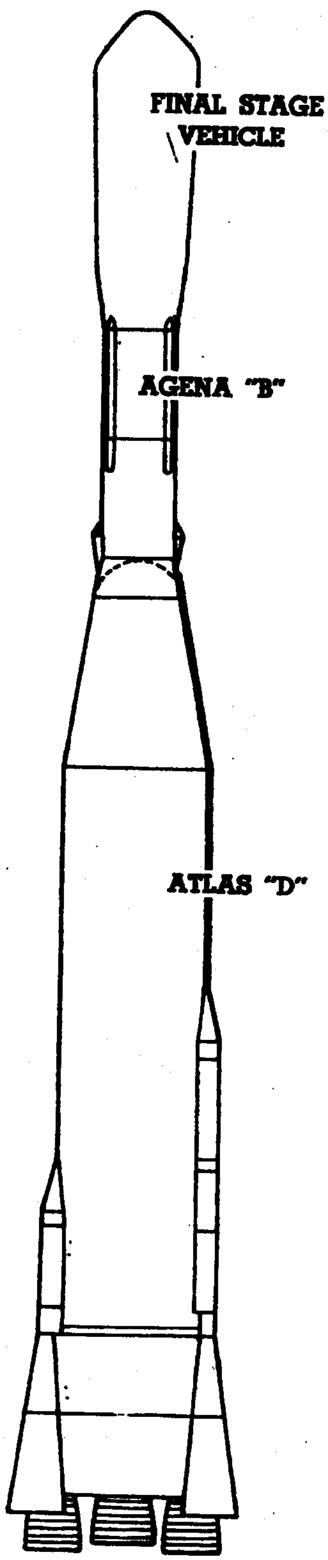
SPACE
defense programs



SAINT
BAMBI

SPACE DEFENSE PROGRAMS

SAINT



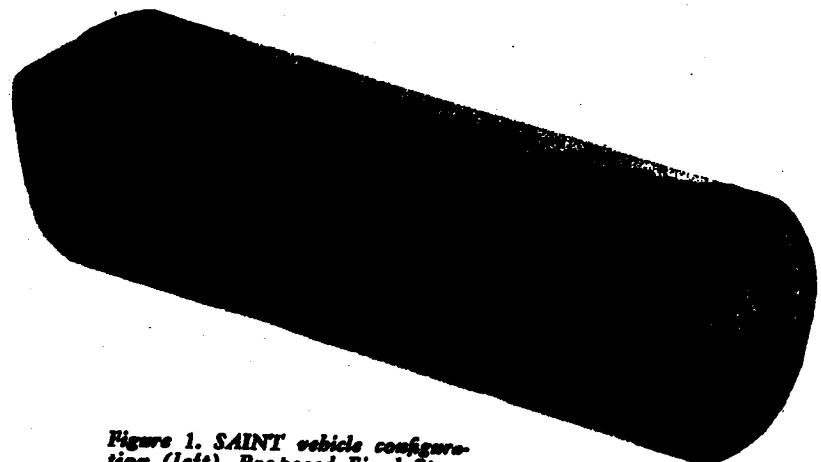


Figure 1. SAINT vehicle configuration (left). Proposed Final Stage Vehicle (above) showing search radar, velocity correction engine nozzle, control-gas storage spheres, and attitude control jets.

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 1,000 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.

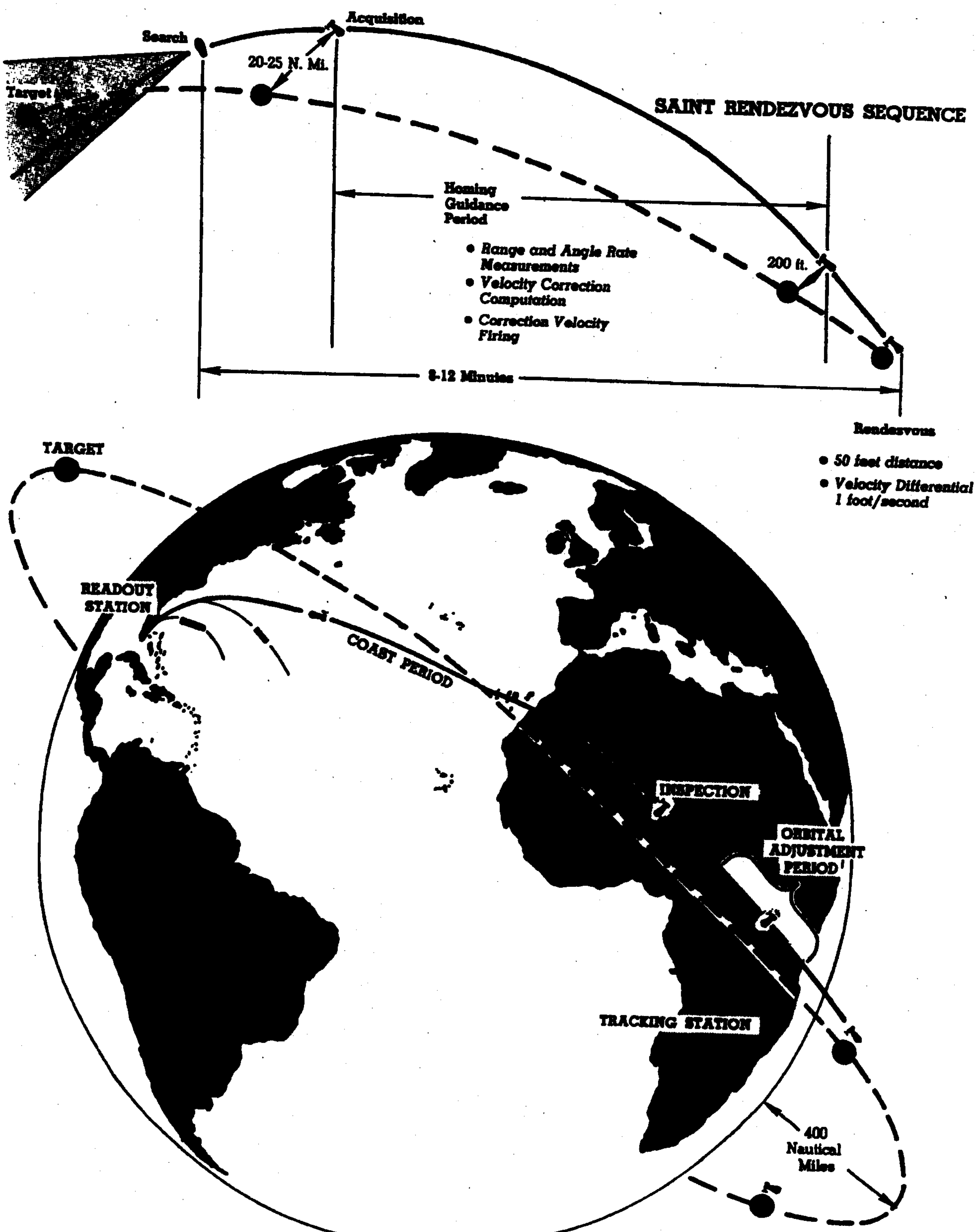


Figure 2. SAINT Program feasibility demonstration flight and rendezvous sequence.

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

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

Feasibility Demonstration — Four flights launched from the Atlantic Missile Range, are planned for the feasibility demonstration. The first flight is scheduled in March 1963 with the subsequent flights scheduled at three month intervals. The feasibility demonstration configuration of the SAINT vehicle will consist of a Series "D" ATLAS booster, AGENA "B" second stage and a SAINT final stage vehicle. The demonstration final stage vehicle weighs approximately 2,400 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 BLUE 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 1,000 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 National Space Surveillance Control Center through the Air Force Command and Control Development Division, and by the 6594th and 6555th Missile Test Wings.

Facilities

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

Monthly Progress — SAINT Program

Program Administration

- The second Final Stage Vehicle systems engineering and technical direction meeting at the Radio Corporation of America, Burlington, Massachusetts, facility was attended by representatives from Space Systems Division and the Aerospace Corporation. Monthly meetings are held to review the contractor's progress and direct their efforts in the design of the Final Stage Vehicle. (U)

- Contracts have been finalized with Convair-Astronautics (CV-A) and Lockheed Missiles and Space Division (LMSD) to furnish design data on the ATLAS and AGENA vehicles for use in the SAINT Program. (U)

- Contracts have been finalized with Convair and LMSD to conduct a study of Atlantic Missile Range Stand 13 requirements to accommodate the SAINT vehicle. RCA has forwarded preliminary design information to be incorporated into the design criteria for the stand modification. Convair will be responsible for integrating all design criteria for Stand 13. (U)

- The SAINT Program Office is reviewing subcontractor proposals for the inertial measurement unit and the digital computer for the Final Stage Vehicle. (U)

- The SAINT System Package Program, in accordance with AFR 375 series, has been completed and forwarded to Headquarters AFSC for approval. (U)

BAMBI PROGRAM

The BAMBI Program has been established to develop an operational, space based, anti-intercontinental ballistic missile defense system.

Program Objective

• The primary objective of the BAMBI Program is to develop a space based defense system which will detect, intercept, and destroy hostile intercontinental ballistic missiles during the powered phase of their trajectory. A second and equally important system objective is to develop the capability of detecting, intercepting, and destroying space vehicles launched from a hostile nation.

Program History

• In mid 1959, both the Air Force and ARPA, by independent studies, became aware of the potential of a space based system for ballistic missile defense. Convair, under an ARPA sponsored study, had developed a concept for a Space Patrol Active Defense (SPAD) system which showed considerable promise. A Space Systems Division study, directed by Headquarters AFSC, concluded that a space based system which intercepted ballistic missiles during the boost phase was extremely attractive. In January 1960, by agreement between the Office of the Secretary of the Air Force and the Director of Defense Research and Engineering, the Air Force and ARPA entered into a joint program whereby ARPA would retain responsibility for system study, and AFSC would supplement this work with applied research. SSD was designated as the agency to integrate both efforts and serve as executive project agent for both organizations. In February 1960, the Ramo-Wooldridge Corporation was placed on contract for a study of their Random Barrage System (RBS) which was another design approach to a boost phase AICBM system. At the conclusion of the SPAD and RBS studies in May 1960, both the Air Force and ARPA carried on an extensive evaluation of the results. At the direction of ARPA, an AFSC Technical Evaluation Board was convened at SSD to evaluate the technical validity, operational capability, and program feasibility of the system concept and to recommend a follow-on program. Other evaluations were carried on by ARPA, the Air Force Scientific Advisory Board, AFMDC, and the RAND Corporation. All agreed essentially that the concept was valid, that no acceptable system design was yet in evidence, that more detailed design studies were required, and that an extensive applied research effort must be undertaken to collect the data required for design implementation.

Program Concept

• The BAMBI system will consist of a large number of space based interceptors deployed at random along inclined orbits which are distributed so that defense coverage of hostile nation areas of interest is provided. The altitude of the orbital interceptors will be approximately 200 nautical miles. Each of the satellite/interceptors will be independent, automatic, and self contained. They will not have communication with each other but will have contact with the ground based defense network when they pass over a secure communications "fence" in mid-United States. Under normal circumstances, each satellite will have a pre-set program which will cause it to search for targets only over hostile territory. By employing an infrared search set, the satellite will detect an ICBM as it emerges from the atmosphere. Upon determination that this target is within its area of kill, an interceptor containing an infrared seeker will be launched to home in on the target. Upon approaching the ICBM, the interceptor will deploy a large number of light weight pellets designed to strike the missile booster while it is still burning. The combination of orbital velocity and interceptor incremental velocity provide the pellets with extremely high energy. This energy is sufficient to cause major damage to the booster motor, thereby destroying the ICBM or causing the warhead to fall as much as 1,000 miles short of its target.

• The size of the orbital interceptors is such that a fairly large number can be deployed into orbit simultaneously from one booster. A booster such as the ATLAS/CENTAUR could be used as an interim booster for research and development test and initial operational deployment of the system. Economic feasibility of the system, however, is dependent upon the development of a large low cost booster, such as the PHOENIX, since 50 to 70 percent of the system cost is that of deploying the payload in orbit.

• As in any defense system, the BAMBI system can be saturated. A hostile nation could reduce the effectiveness of the system by concentrating his launch sites in a given area and launching his missiles in a salvo of less than one minute. The possibility of a nation resorting to this strategy is difficult to evaluate. The system does possess, however, very attractive characteristics which enable it to be extremely effective against dispersed launches and against missiles with long burning times. These characteristics enable the system to be particularly suited to defense against mobile ICBM launches, space launches, attacks from minor missile powers, accidental launches both friendly and hostile, and against sustained ICBM launches after the first onslaught of a general war. The number of orbital interceptors required for these missions is considerably less than that required for compact salvos.

Program Status

• The current BAMBI FY 61 program consists of four parts: system design studies; support system studies; Orbital Interceptor oriented applied research studies; and test vehicles (R&D test program).

• ARPA directed SSD to undertake three or more competitively selected system design studies. The objectives of each of these studies included: performing detailed design studies of the satellite, interceptor and deployment package; analyzing the design requirements for the support systems; and analyzing the technical, economic, and operational feasibility of the system design. A second part of the study will be to conduct detailed analyses, simulation, and experimental testing of the critical components and techniques essential to establishing technical validity of the design. A Space Systems Division Source Selection board convened on 13 February 1961 and reviewed the proposals submitted by the various bidders. On 15 March the board results were briefed to Hq AFSC and on 15-16 March ARPA was briefed. In April 1961, an announcement was made to the bidders in the competition that in ARPA's opinion no sufficiently unique or promising proposal was received which warranted a system design contract. Because of this, SSD was requested to prepare a detailed FY 61/62 BAMBI Program briefing to be presented to General Schriever, Commander AFSC, the Under Secretary of the Air Force, and Dr. Ruina, Director of ARPA. ARPA ground rules to be considered in developing the FY 61/62 program include: only one complete system design study contract would be authorized; that certain portions of the proposals submitted as a result of the competition could be funded; and that a non-industry contractor, e.g. Aerospace Corporation, could be considered for a system design study. The briefing is scheduled to be presented to General Schriever on 2 May, but no date for presentation to the Under Secretary of the Air Force and/or Dr. Ruina has been established.

• SSD has been working with ARPA and the cognizant Divisions and Centers of AFSC to define a program of BAMBI oriented applied research which will provide essential data and techniques. Extensive and expanded effort is required in: infrared target radiation, background, and blackout measurements; hypervelocity kill mechanisms, hypervelocity interceptor guidance and control techniques; interceptor propulsion; and countermeasures and infrared equipment techniques. A substantial program of kill mechanisms has been approved by ARPA. The briefing being prepared includes all required efforts in the other areas. It is essential that these applied research programs be initiated as soon as possible so that the data collected can be integrated into the system feasibility effort.

• A Development and Funding Plan will be prepared based upon the program approved as a result of the May briefings. It is contemplated that all aspects of the program will be included in the plan regardless of whether ARPA or USAF sponsored.

Management

• In October 1960, a decision was reached that ARPA would retain program responsibility and fund the major part of the program in FY 61. SSD was retained as the executive project agency to integrate the system and applied research parts of the program.

• All the work under the present phase of the BAMBI program, whether it be on contract with industry or placed through another AFSC organization, is under the technical management and direction of SSD. The Aerospace Corporation is assisting SSD by providing system analysis, technical analysis, and evaluation services. Under present plans, this phase of the program will provide data by July 1962, from which an evaluation can be made as to the technical, economic, and operational feasibility of the BAMBI system. If feasible, it is planned to initiate development or demonstration of the system by October 1962. By this time, program responsibility will transfer from ARPA to the USAF.

Ground Facilities

• The large number of satellites required for full operational deployment of the system will demand production type launches from facilities located at both the Atlantic Missile Range and Vandenberg Air Force Base. The frequency of launch will require new facilities at each location.

• A major element of the system is the ground based portion of the satellite control system. This system will provide the facilities for secure communications with individual satellites so as to transmit necessary programming instructions, and to receive information on operational status. This complex will be linked with the Air Defense Commander and the National Space Surveillance Control Center. Wherever possible, existing facilities will be utilized. However, there will be satellite control requirements peculiar to the BAMBI system which must be designed and procured as an integral part of the system.

Monthly Progress — BAMBI Program

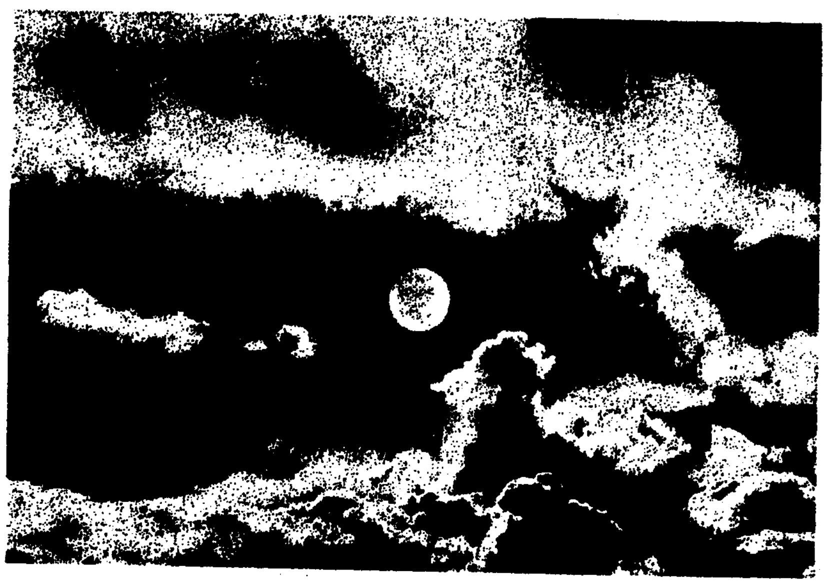
Program Administration

• Funding and work statements for an infrared background measurement program were released to the U. S. Naval Test Station on 6 April. In addition, funds and work statements were released to the Air Proving Ground Center for an infrared target radiation program. Both of these programs will employ infrared measurement equipment launched from relatively small, inexpensive space probes. The first of several launchings will occur within the next quarter. If these programs prove successful a major effort will be undertaken in FY 62 utilizing these techniques. (C)

• ARPA has decided against awarding any system contract to the participants in the BAMBI study competition. The Hughes, North American and Westinghouse companies, participants in the competition, have been notified. (C)

• In response to a request from ARPA, Space Systems Division (SSD) prepared a formal briefing for the Commander AFSC, the Under Secretary of the Air Force, and the Director of ARPA which covers the SSD proposed FY 61/62 BAMBI Program. It is expected that these briefings will result in a definitized BAMBI Program and that this program will be documented in the form of a Development Plan on approximately 15 June. (C)

BIOASTRONAUTICS



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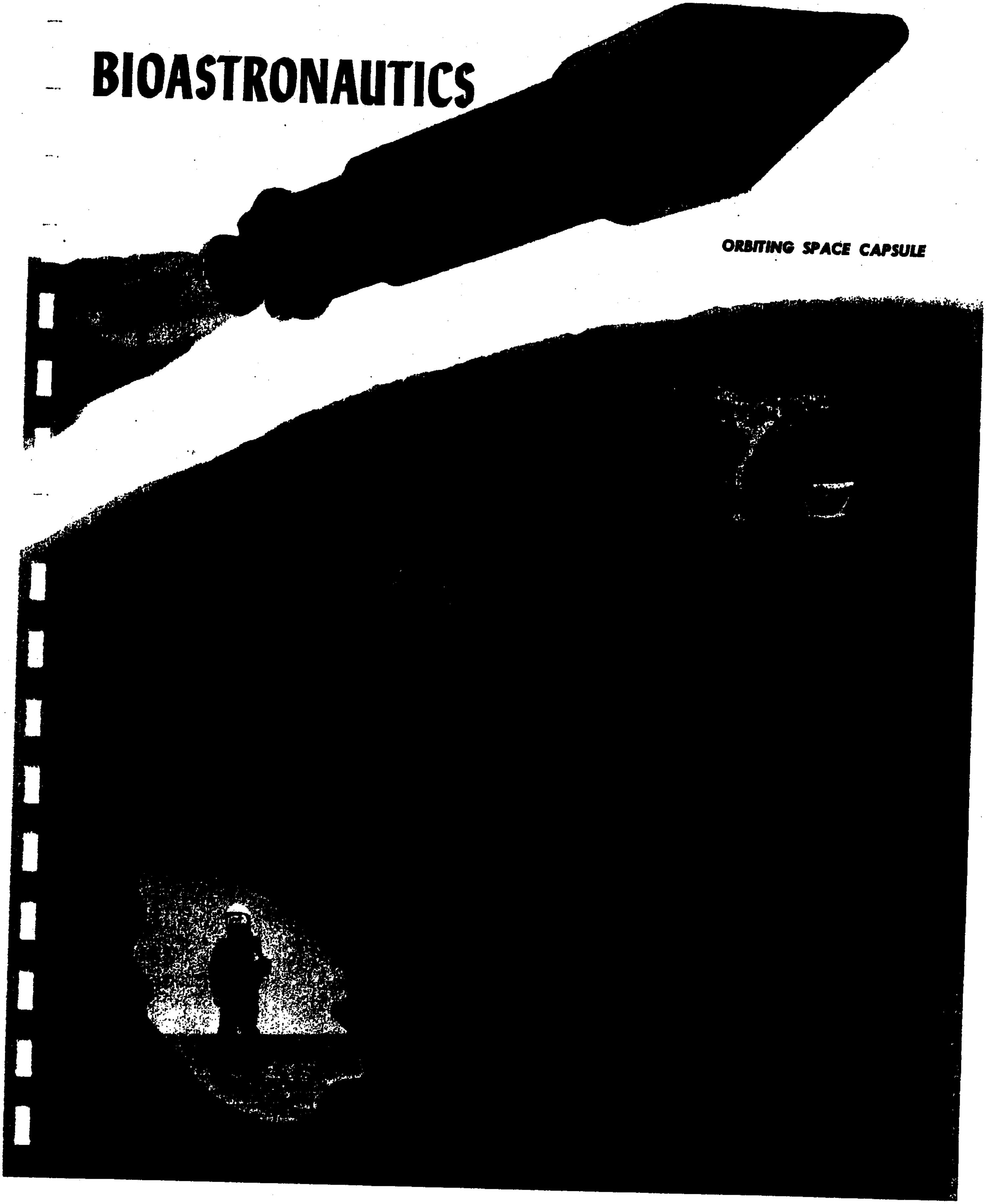
BIOASTRONAUTICS



ORBITING SPACE CAPSULE

Program History

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

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

error III, 3 June 59

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

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

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

Program Concept

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

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

AVIATION WEEK
27 March 1961

USAF Will Form New Systems Command

Development command will become nucleus, gaining procurement of major weapons from AMC.

By Larry Booda

Washington—Air Force is creating a new Systems Command that will serve as a single agency to control its aircraft, missile and space systems from the beginning of their development until they are in the field ready for operational use.

Until now, this responsibility has been divided between the Air Research and Development Command and the Air Materiel Command. In essence, the new command will consist of the old ARDC with the procurement and production functions of AMC added to it, and AMC will be re-named the Air Force Logistics Command.

The move is being made partly to answer criticism of the way Air Force has handled construction and activation of intercontinental ballistic missile sites, and partly to provide better all-round management of all types of weapon systems.

It represents a personal victory for Lt. Gen. Bernard A. Schriever, commander of ARDC, who will head the new command. It also represents the end of a 10-year cycle that began when ARDC was created to remove research and development from the dominating influence of procurement and production. As the pace of technology continued to accelerate, ARDC grew in strength to the point where it now is taking the procurement and production of major weapon systems away from AMC.

The new command, which will be completely formed by July 1, also follows recommendations of President Kennedy's space task force, headed by Dr. Jerome B. Wiesner, which reported to the President earlier this year (AW Jan. 16, p. 26) that "the nation's ballistic missile program is lagging . . . We believe that re-establishing an effective, efficient, technically competent management for the program is the overriding necessity."

Streamlining Move

Considered in combination with the recent directive giving USAF responsibility for most space development work, establishment of the new command also represents a streamlining of military space program management.

Most basic research and some applied research will be spun off from ARDC and centered in a new Office of Aerospace Research, which will report directly to the chief of staff. This also is the culmination of a 10-year effort by USAF supporters of basic research to elevate the work to an echelon where it would not suffer from the fact that more immediate development problems demanded most of the attention and funds.

The Air Force Systems Command will have its headquarters at Andrews AFB, Md., near here, and the Air Force Logistics Command will have headquarters at Wright-Patterson AFB, Ohio. It will be headed by Gen. Samuel E. Anderson, who is now head of AMC, and will operate and control the world-wide logistics systems that support the Air Force.

The Systems Command will have four major divisions—two of them located at Inglewood, Calif., under a deputy commander for aerospace systems, and two reporting directly to headquarters, with no deputy commander. The two Inglewood divisions are:

- **Ballistic Systems Division**, which will be composed of elements of BMD, AMC's Ballistic Missile Center, and the Ballistic Missile Office of the Army Corps of Engineers.
- **Space Systems Division**, which will also be composed of portions of BMD and BMC, plus representatives of other services concerned with space programs.

Reporting directly to headquarters will be:

- **Aeronautical Systems Division**, which will be composed of most of what is now the current ARDC Wright Air Development Division and the AMC Aeronautical Systems Center. The division will be located at Wright-Patterson AFB.
- **Electronics Systems Division** which will be located at Hanscom AFB, Mass. This will be a combination of the Command and Control Development Division of ARDC and the AMC Electronics Systems Center.
- **Six test centers**, formerly under ARDC, will be transferred to the new command. They are the Flight Test Center, Edwards AFB, Calif.; Missile Development Center, Holloman AFB, N. M.; Missile Test Center, Patrick AFB, Fla.; Special Weapons Center, Kirtland AFB, N. M.; Air Proving Ground Center, Eglin AFB, Fla.; and Arnold Engineering Development Center, Tullahoma, Tenn.

Although members of Gen. Schriever's staff, located principally in the office of Deputy Chief of Staff for Research and Engineering Maj. Gen. Marcus F. Cooper, had been working on a reorganization plan for some time, the final spur to their efforts came when Rep. Harry Sheppard (D.-Calif.), chairman of the House Appropriations Military Construction Subcommittee, charged that the missile base construction program is in "a terrible mess."

Another reason for their efforts was the recently issued directive which strengthened the role of the Air Force in the space mission.

Since the ARDC plan, prepared by Col. Otto J. Glasser, Col. J. T. Stewart and Col. J. C. Maxwell, already was prepared, the chief of staff directed that it be used as the basis for the new plan. Although the final result was a compromise, it reflected many of the ideas of Gen. Schriever, who probably will be promoted to full general after the change takes effect July 1.

In terms of civilian and military personnel, the new command will have approximately 60,000. AMC will lose 14,000 in the transfer, but, as the Logistics Command, will still have 165,000 people. ARDC strength as of Jan. 1 was 45,153, including some 6,300 officers, 15,500 airmen and 23,400 civilians.

About 30% of the procurement money now handled by AMC will go to the Systems Command—$3.2 billion in Fiscal 1962 and $2.2 billion in Fiscal 1963.

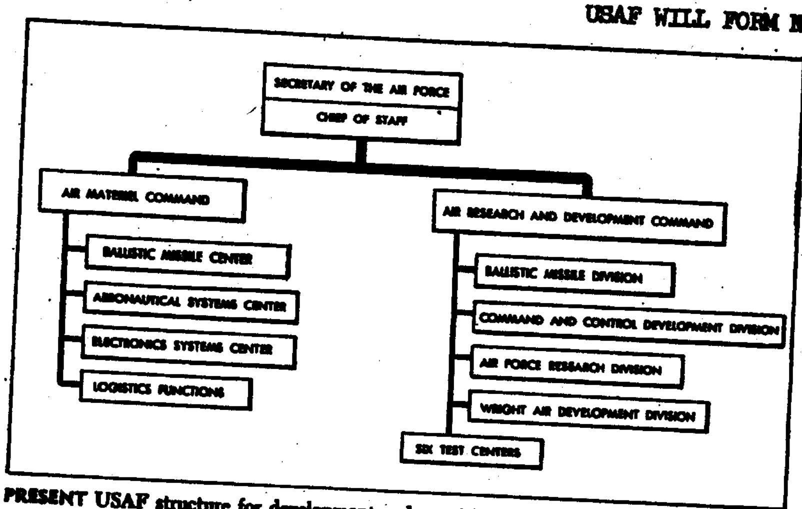
Headquarters Strength

Present ARDC headquarters strength is 1,150. Although no estimate has been made of how the reorganization will affect this, Gen. Schriever believes generally in decentralization of authority and responsibility. This was reflected in ARDC shifts in the past two years which saw system management responsibility shifted down to the division level. Little increase in the Systems Command staff at Andrews can be expected.

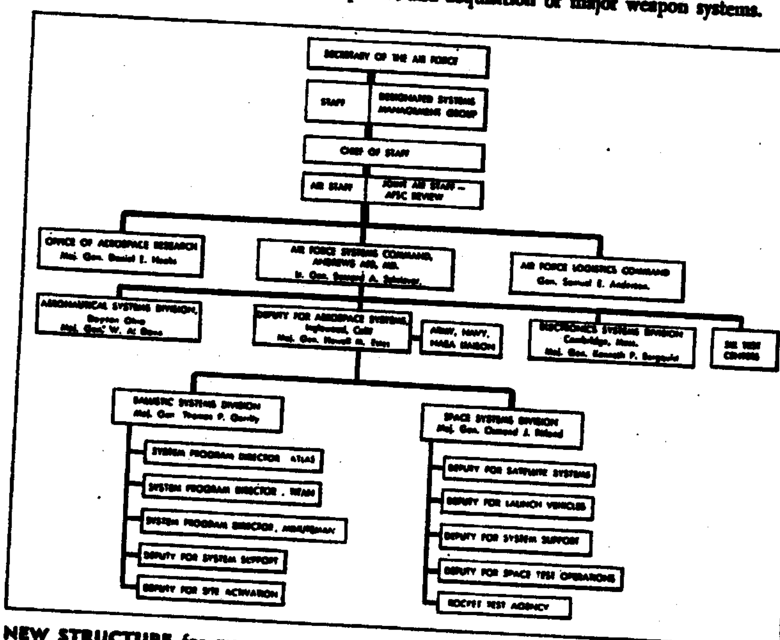
Maj. Gen. Howell M. Estes, now assistant deputy chief of staff for operations, will be deputy commander for aerospace systems, located at Inglewood, Calif. Assistant deputy commander will be Maj. Gen. Joseph R. Holzapple, present commander of WADD.

Under Estes will be Maj. Gen.

AFBMD NEWS DIGEST
31 March 1961



PRESENT USAF structure for development and acquisition of major weapon systems.



NEW STRUCTURE for weapons systems management, which will be in force by July 1.

Thomas P. Gerrity, who presently is commander of BMC, as commander of the Ballistic Systems Division, and Maj. Gen. Osmond J. Ritland, present head of BMD, as commander of the Space Systems Division. Deputy to Ritland will be Brig. Gen. Robert E. Greer.

Reporting directly to Systems Command Headquarters will be Maj. Gen. W. Austin Davis as head of the Aeronautical Systems Division. He is now head of AMC's ASC at Wright-Patterson. For the Electronics Systems Division the commander will be Maj. Gen. Kenneth P. Bergquist, now commander of ARDC's CCDD.

Present commander of the Air Force Research Division, Maj. Gen. Daniel E. Hooks, will head the Office of Aerospace Research.

Each of the new divisions will have representatives of using commands, such as Tactical Air Command, Strategic Air Command and Military Air Transport Service, on the staff to monitor the tasks of their organizations.

When an AFSC division is doing work for other services, representatives of those services will participate. The Logistics Command will be represented and will participate in support functions.

Operations of the Ballistic Systems Division will be a representative example of the others. The commander will have available all resources required for development, test, evaluation, procurement, production, site activation and planning for support and operation of ballistic missiles.

He will have as his deputy Army Brig. Gen. A. C. Welling, who presently heads the Corps of Engineers office in charge of site construction. For the first time, direct military control of the construction function will be held by an Air Force commander. Welling will have both Army and Air Force officers reporting to him. Currently the construction program is run on a cooperative basis. The new line of authority was planned with the consent of the Army and may indicate a trend for other Air Force-Army construction operations.

Each site activation task force, formerly under AMC, will be combined with ARDC and Corps of Engineers detachments as integrated site activation task force (SATAF) teams under the BSD commander.

Aerospace Research Office

The present Air Force Research Division with its field offices—the Air Force Office of Scientific Research here, the Aeronautical Research Laboratory at Wright-Patterson AFB, and the Cambridge Research Laboratories at Hanscom Field, Mass.—will form the Office of Aerospace Research.

Unresolved in the new plan is the relationship of the Aerospace Medical Center at Brooks AFB, Texas, which is under the Air Training Command. There are bioastronautics and aviation medical representatives on every staff where the human factor is involved. Much of the research in this field is done at Brooks.

Secretary of the Air Force Eugene M. Zuckert explained that the Brooks activity would be "very closely coordinated." There is a possibility, however, that the center could eventually become a division of the systems command.

In placing research directly under the chief of staff in the form of the Office of Aerospace Research, the Air Force has taken the same research organization approach as the Army and Navy.

Research Mission

In describing its mission, Dr. Joseph V. Charyk, under secretary of the Air Force, said: "The office . . . could well be involved in the study of techniques which at some stage of the game would indicate the possibility of accomplishing an important military job in space.

"So there might well be outgrowths from the Office of Aerospace Research that would lead to space projects. On the other hand, the Space Systems Division will also be engaged in applied research relative to space systems, and of course, will conduct all the supporting research for Air Force systems."

Office of Aerospace Research also is expected to engage in applied research and these activities will be coordinated with the system commands.

Although determination of the division of activities involved in forming the current BMC and BMD into the new Ballistic Systems Division and Space Systems Division was the subject of conferences at Inglewood last week, certain shifts appear logical.

Moving to Ballistic Systems Division from BMC will be the site activation task forces, the directorate of ballistic missiles and most of the directorate of systems support. From BMD will come the activities under the deputy commander for ballistic missiles and the deputy commander for civil engineering, except the director of space systems engineering.

Shifting to the Space Systems Division from BMC will be the directorate of space and satellites, composed of a space studies division, a satellite division and an advanced systems division. Space engines support will also go to SSD. From BMD will come the deputy commander for space programs, whose organization includes boosters, defense, communications, bioastronautics, and a Huntsville, Ala. office. Under civil engineering, the director of space systems engineering will go to SSD.

The administrative organizations of BMC and BMD do not lend themselves to transfer intact. There will have to be piecemeal shifting of personnel and offices such as personnel, manpower, plans, management, procurement and production, logistics, judge advocate, inspector general, intelligence, etc.

Some of the philosophy which has gone into the new plan was reflected in the report of a special ARDC task force on reorganization which Schriever organized in 1959 and which submitted its report July 31.

It stated that development of useful military systems must be conducted within a philosophy of concurrency, with all elements of a total military system funded in an integrated manner and developed concurrently under a single plan. First steps at following such a system was the adoption of the PEP management system for several programs. This was based on the Navy's PERT system applied to the Polaris missile (AW Nov. 28, p. 85).

Too much headquarters effort was spent on peripheral, and second and third echelon tasks, the report said, and decentralization was carried out with the formation of four divisions. There is a lack of clear, vertical decision-making channels, an uncoordinated variation in the assignment of priorities and allocation of resources at all levels, and confusion arising out of a lack of clear definition of responsibility and authority, it said.

Monitoring the whole research, development and acquisition effort of the Air Force for the Secretary is a designated systems management group reporting directly to him.

AVIATION WEEK
27 March 1961

EDITORIAL

New Pattern Emerges

Establishment of the new USAF Systems Command (see p. 22) marks the end of a decade of evolution and struggle that began with a historic Air Council meeting on Jan. 3, 1950, when the late Gen. Muir Fairchild formally announced the decision to form an Air Research and Development Command and establish a voice for research and development at the air staff level. At this time, USAF was already being rocked by the technological revolution that has dominated the past decade and shows no signs of abating in the future. For those who could see the straws in the technical wind, it was evident that USAF's basic single line of development aimed at airplanes that could fly higher, faster, farther and carry heavier loads was about to fan out into an incredibly broad technical spectrum that would defy the efforts of any traditional military command structure to understand or manage it effectively.

In 1950, USAF's meager research and development facilities were scattered through a half dozen commands and had no central direction. The largest single bloc of technical talent lay in the old engineering division of the Air Materiel Command at Dayton. It was inevitable that wrenching this talented group out of AMC into the new command sowed many of the seeds for the decade of AMC-ARDC discord that we hope has now ended.

The strong technical tide ran against AMC philosophy. It became clear that USAF's prime problem no longer would be the production of thousands of aircraft of a single type involving hundreds of suppliers of standardized parts and components. Increasing pressure of the technical revolution made it inevitable that USAF weapon systems would evolve into increasingly complex items capable of enormous performance improvements. But because of the combination of their increased mission effectiveness, enormous cost and shorter obsolescence cycle, they would be produced in such relatively small quantities that they would never really emerge from the development cycle into the traditional standardized mass production runs.

At the same time, the Soviet Union's increasing technical challenge emerged and made it imperative that new management techniques be found to compress the time cycle from development to operational readiness sufficiently for the new weapons to be significant in the world balance of power. From this urgency developed the ARDC philosophy of concurrency that has been the hallmark of Ballistic Missile Division operations and will continue as the dominant policy of the new Systems Command.

The role of basic research that had been virtually ignored under the pre-1950 USAF organization began to emerge slowly, painfully but surely in the new ARDC organization. Its elevation to the status of a separate unit reporting directly to the USAF Chief of Staff is certainly a progressive step for this increasingly important function of exploring for basic new knowledge.

During the early years of ARDC, the larger and more powerful AMC fought hard to strangle this lusty infant before it grew too muscular for parental dominance. During the mid-decade period, there were some sincere but never very effective attempts to glue the two organizations together in critical areas through such devices as the joint Weapon System Project Offices at Dayton, where ARDC and AMC officers worked side by side to manage specific systems. But except for a brief period when Gen. Edwin Rawlings headed AMC and Gen. Thomas Power commanded ARDC and they personally caulked the worst of the spreading seams, the ARDC-AMC feud flared and sputtered to no good purpose.

The ICBM program was the first real test of ARDC's effectiveness, and thus it is not surprising that the current dominance of the command has evolved under the leaders who organized and managed that program in the Ballistic Missile Division of ARDC. It is also significant that the complexities and urgency of the ICBM program provided the strain that made the increasing inadequacies of trying to weld ARDC and AMC capabilities into a single national effort most painfully obvious and critical, and that sparked the reorganization which produced the new Systems Command.

Certainly the assignment to the new Systems Command of full management responsibility for weapon system development through the spawning cycle to full operational readiness is a solid attempt to eliminate the gaps in management and responsibility that yawned too often between AMC and ARDC in the past. It is hard to quarrel with the management philosophy that combines responsibility and authority in a single executive hand. Industry, which has so often played the unenviable role of the shuttlecock in the ARDC-AMC badminton game, will certainly welcome a change that eliminates duplicate management layers and affixes authority in clearly defined channels.

AMC may feel it has suffered a loss of face in losing the final and decisive battle with ARDC, but we believe it will find ample work to occupy its energies with refining the techniques for global logistics and applying the advancing techniques of the computer and airlift to provide more effective and less costly logistic support for USAF's far-flung combat organizations.

Although most of their efforts in the early days of the fight to establish research and development in a position to provide USAF with the fruits of the technical revolution are now all but forgotten, it is worth recalling the sound technical vision and courage of the small group of men who fought military traditionalists so hard to open the door for ARDC and the Systems Command—among them the late Louis Ridenour, Jimmy Doolittle, Trevor Gardner, the late John von Neumann, Don Putt, Guy Stever and Theodore von Karman.

USAF has taken what looks like an intelligent and decisive step to solve a management problem whose continued festering could endanger the entire nation and cause an unnecessary economic drain on defense resources. The new Systems Command will assume an awesome responsibility, but USAF will apparently back it with adequate authority and resources. The nation will be watching closely to see how well it does its job.

—Robert Hotz

ARMY NAVY AIR FORCE JOURNAL
25 March 1961

Fourth Star Seen Certain For L/G Schriever;

Maj. Gen. Estes May Win Third In New Slot

THE reorganization of Air Force missile and space functions (see Page 11) is certain to be followed by the advancement of Lt. Gen. Bernard A. Schriever, head of the new Air Force Systems Command, to four-star rank.

That would give him equal rank with General S. E. Anderson, who heads the Logistics Command.

General Schriever has been ARDC Commander, and General Anderson has been AMC Commander.

Maj. Gen. Howell M. Estes, jr., Assistant Deputy CofS (Operations) at USAF Headquarters, will be Deputy Commander for Aerospace Systems, and will be responsible for the Ballistic Systems Division, under Maj. Gen. Thomas P. Gerrity, who has been Commander of the AMB Ballistic Missile Center, and Maj. Gen. Osmond J. Ritland, Commander Space Systems Division who has been in command of ARDC's Ballistic Missile Division.

It would appear likely that General Estes, 46, USMA '36, is in line for advancement to three-star rank. He holds temporary rank as a major general from 24 October 1956.

General Estes participated in the atomic test program in the Pacific from 1951 to 1954, then became Director of Weapon Systems Operations of the Wright Air Development Center of ARDC at Wright-Patterson AFB, Ohio, later becoming Director of Systems Management for ARDC Headquarters.

Here is a complete rundown on the officers who figure in the Air Force Systems Command activation:

Maj. Gen. Howell M. Estes, jr., Assistant Deputy CofS (Operations), Washington, D. C., will be Deputy Commander for Aerospace Systems.

Maj. Gen. Joseph R. Holzapple, Commander, Wright Air Development Division, ARDC, Wright-Patterson AFB, Ohio, will be Assistant Deputy Commander for Aerospace Systems.

Maj. Gen. Clyde H. Mitchell, Commander, AMC Electronics Systems Center, Laurence G. Hanscom Field, Bedford, Mass., will be Deputy CofS, Materiel, Air Force Systems Command.

Maj. Gen. Thomas P. Gerrity, Commander, AMC Ballistic Missile Center, Los Angeles, will be Commander, Ballistic Systems Division.

Maj. Gen. Osmond J. Ritland, Commander, Air Force Ballistic Missile Division, ARDC, Los Angeles, will be Commander, Space Systems Division.

Brig. Gen. Robert E. Greer, Vice Commander for Sattellite Systems, AFBMD, ARDC, El Segundo, Calif., will be Deputy Commander, Space Systems Division.

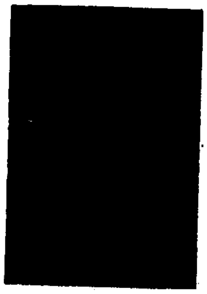
Maj. Gen. Waymond A. Davis, Commander, AMC Aeronautical Systems Center, Wright-Patterson AFB, Ohio, will be Commander, Aeronautical Systems Division.

Maj. Gen. Kenneth P. Bergquist, Commander, Air Force Command and Control Development Division, ARDC, Laurence G. Hanscom Field, Bedford, Mass., will be Commander, Electronics Systems Division.

ARMY NAVY AIR FORCE JOURNAL
25 March 1961

Shift Of Generals, Changes In Air Staff, Secretariat, Will Follow USAF Reorganization

THE 1 July reorganization of the Air Force's management of aeronautical, ballistic missile, space and electronic systems, which transfers 30% of the Air Materiel Command's procurement money and 14,000 of its personnel to a new Air Force Systems Command growing out of the Air Research and Development Command, will be followed by:



L/G Schriever

1) Shifts in a number of general officers in the present ARDC and AMC,

2) Changes in the duties of some Assistant Secretaries of the Air Force, notables those for research and materiel, and

3) Realignments at the top levels of the Air Force Staff.

The new Air Force Systems Command, to be headed by Lt. Gen. Bernard A. Schriever, present ARDC commander, will be responsible for the procurement of about $7 billion in "hardware." A fourth star for General Schriever also is expected. (see Back Page).

While the reorganization follows closely on the announcement that the Air Force will be responsible for all future space R&D, Secretary Eugene M. Zukert and Chief of Staff General Thomas D. White said that the new plan has been under study for some time before the space decision.

One effect of the new organization will be to integrate the Army Corps of Engineers Ballistic Missile Construction Office, under Brig. Gen. A. C. Weeling, USA, into the Air Force organization and increase its responsibilities. When the new system goes into effect General Welling will report to the Commander of the Ballistic Missile Division instead of to the Chief of Staff of the Army, as now. Administration and support, however, will continue to come from the Army. General Welling will become a Deputy for Site Activation and will be in charge of facility design, construction, installation and checkout.

The official DoD annoucement of the organization of the new command—printed textually elsewhere on this page—was followed by a press conference with Secretary Zuckert and General White.

Asked about the names of the generals who will command the various divisions of the new organization, General White replied:

"We are not prepared to announce the names of these commanders at this moment, because while we know who we intend to put in, there are some personnel who will be moved, whose names have not yet been attached to a new assignment; and it just wouldn't be fair to them to announce the new slate, and some people not have an assignment. It doesn't mean that I'm dissatisfied with anyone where he is now, but in the shuffle there will be some changes in commanders."

The new Air Logistics Command, which will embrace what remains of AMC, will continue to have responsibility for the depots. AMC's successor will be out of the contracting business as far as systems are concerned, but will continue to purchase other common items for the Air Force. Asked about the purchase of spares, Secretary Zuckert said he doesn't yet know how that will be handled.

Secretary Zuckert pointed out that while 14,000 people will be transferred from the old AMC over to the new Air Force Systems Command there will be little physical movement—they will merely draw their pay checks through the Systems Command instead of the Logistics Command.

AF Systems Command Has Great Responsibility

The Air Force Systems Command, whose organization will be completed before 1 July, will have a burden of support responsibility and importance greater than any other component of any of the Armed Services. It will be charged with spending the bulk of the Air Force's funds by investing in research, pursuing the development of new aeronautical, ballistic missile, electronic, and space systems, and the purchase of the final end product for issuance to operational units.

In addition, the Air Force's new role as the one Service in charge of research, development and engineering of all future space programs, regardless of which Service originates a new program or which Service or specified command will be given operational control, will require a close liaison with the space thinking and space requirements of both the Army and the Navy. For this purpose, the contact between the other Services and the Air Force will be in the Space Systems Division of the new Systems Command. The Space Systems Division will comprise the present elements of the ARDC Ballistic Missile Division and the AMC Ballistic Missile Center.

The earlier space directive provides that when an individual Service originates a space plan to meet a projected requirement it shall submit it to the office of Dr. Herbert F. York, Director, Research and Engineering, who shall evaluate it and make recommendations to the Secretary of Defense, after which, if it is approved, it shall be turned over to the Air Force for development and engineering. While no such specific responsibility has been assigned, there would appear to be a strong likelihood that Dr. York's office would depend heavily upon the facilities of the new Systems Command for guidance in making his evaluation of such projects.

While the new organization achieves the single, direct line, control which is sought for in this vast field, Lt. Gen. Bernard A. Schriever will have an enormous task in holding the reins on such a widespread and diversified organization, ranging as it does from basic research, through development and testing, to final procurement. Involved, too, will be the correlation of his work with that of the National Aeronautics and Space Administration to assure the best end results for the National Defense.

One danger which must be avoided is the subjugation of basic research, for it is evident that there will be a temptation to over-direct basic research into channels leading to pre-determined ends rather than giving it the free hand it must have to seek new facts without regard to where they may lead. A free basic research is the life source of the future

The new organization offers great promise. Nevertheless it is only a first step, for as it gets into operation the need for further changes and modifications will become evident. That these will be made promptly is evident by the speed with which the new administration has proceeded thus far.

McNamara Asks Review of Current Defense Programs for Possible Major Revisions

By Louis Kraar
Staff Reporter of The Wall Street Journal

WASHINGTON—The Kennedy Administration's defense leaders have opened the way for possible major revisions in U.S. weapons and strategy in the months ahead.

Defense Secretary McNamara ordered a wide-ranging review of current Pentagon programs. In a confidential memo to top defense officials, he launched more than 90 separate studies, many of which are due for completion during the next few months.

Among the topics getting high-level scrutiny: The future role of Naval aircraft carriers; possible new manned bombers, other than the B-70, to succeed the present B-52 bombers, and the success of Army management of the Advent communications satellite project.

Other studies show the Pentagon high command is at least considering cutbacks in some areas. Among them: Making the cruiser Long Beach a command and control ship rather than equipping it with Polaris missiles as approved earlier, and canceling the 1,500-nautical-mile version of the submarine-launched Polaris missile in favor of the future 2,500-mile-range version.

Several other studies ordered by the Defense Secretary indicate the Administration could even switch the present "mix" among Atlas, Titan and Minuteman intercontinental missiles. One study, for instance, orders an assessment of substituting additional Minuteman missiles for the last four squadrons of Titan II missiles. Another part of the same study—due for completion April 17—suggests possibly dropping railroad-car bases for the Minuteman in favor of more fixed sites for the weapon.

Mr. McNamara has also raised questions about the future of the initial, relatively vulnerable bases for Atlas missiles after the faster-firing, underground Minuteman missiles are battle-ready.

President's Defense Message

The studies, ordered by Mr. McNamara on March 8, disclose that the Administration is weighing changes in defense emphasis that could go far beyond those the President will propose right now. Mr. Kennedy is due to spell out his immediate plans for Pentagon changes in a special message to Congress today.

In reviewing the future role of aircraft carriers, defense leaders will be weighing long-standing arguments among military men, but this time with a May 1 deadline. Naval leaders stress the value of these mobile airfields for big and little wars. Other military men, however, have questioned the need for continuing to build and maintain large carrier forces, arguing that they are vulnerable to air and missile attacks.

The Navy has 14 attack carriers in operation and four more under active construction. Still another attack carrier will soon be built by Newport News Shipbuilding & Drydock Co.; the funds are in the budget for this fiscal year ending June 30.

In an apparent effort to find possible alternatives to the B-70 Valkyrie bomber, under development by North American Aviation, Inc., Mr. McNamara ordered a study of other means for launching air-to-ground missiles, such as the Skybolt. This weapon, with a range of more than 1,000 miles, is being developed by Douglas Aircraft Co., Inc., for combat use by 1964 or 1965. Deadline for this study is May 1.

Advent Project

In requesting a study of Army management of the Advent communications satellite project, Mr. McNamara posed a question: What is the Pentagon project's relationship to similar projects of the civilian space agency and private companies? The implication is that defense leaders are wondering if the military and civilian efforts overlap. The Advent project might also be given over to supervision by another branch of the military, for Mr. McNamara's assignment pointedly stated that the study would center on the project "as presently assigned to the Army."

The Advent project seeks to develop a system of 1,000-pound satellites to handle military communications. Principal contractors include General Electric Co. and Bendix Corp. Deadline for the study, supervised by the Office of Defense Research and Engineering, is April 3.

Former Defense Secretary Gates approved installation of Polaris missiles aboard the nuclear-powered cruiser Long Beach in January as the first move to put the sub-based weapon aboard a surface ship. Now, Mr. McNamara wants the Navy to examine a plan for using the Long Beach as a command and control ship from which military leaders could direct their forces. That examination is scheduled to be completed by April 3.

By considering the pros and cons of canceling the so-called A-2 Polaris, the 1,500-mile-range model, Mr. McNamara suggests in effect the possibility that the Navy skip a step in its present plans. Current versions of the Polaris have a range of about 1,200 nautical miles. Within another year or so, the Navy hopes to complete development of the A-2 model. If this model is dropped, the Navy would presumably concentrate on the 2,500-nautical-mile range version due for completion in 1964. Lockheed Aircraft Corp. is prime contractor for the Polaris missile. Deadline for this review is April 3.

SAN DIEGO UNION
28 March 1961

DAVIS MERWIN SAYS:

Air Force Space Rule To Be Costly

PENTAGON BIGWIGS say the decision handing the Air Force direction of all military space development projects and programs was based on the USAF's control of 90 per cent of our 850 million space dollars. Regardless of the "why" behind the defense secretary's directive, he had the authority, and thus the monopoly assignment is a fact. Only Congress—the constitutional custodian of our defenses—could change his mind.

Recently an Armed Services officer regarded as outstanding in practical warfare as well as research and development gave a congressional committee questioner a straight answer that struck at the heart of the situation. He pointed out that the Air Force had spent 90 per cent of the total funds available, but accomplished only 10 per cent in results. That meant that with a mere 10 per cent of the money, the Army and Navy had produced 90 per cent of the over-all gain.

Had the lesson of this officer's words been heeded, the U.S. might have been spared what may well prove to be another stultifying swipe at the vitals of its space research and development program.

He might have added that since politicking the Army out of its pioneer position in rocketry, the USAF has seized and held the top priorities — the indispensables in procurement preference. Yet in terms of concrete gains for national defense as measured by truly operational satellites and missiles, it has shown sorry failure to seize the initiative.

The USAF waited long to admit the virtues of the Navy-developed solid propellant, but it is now patterning its white hope ICBM Minuteman after the Navy's already-operational Polaris. Clearly, without "inter-service rivalry," the near-miraculous, 1,500-mile Polaris—with its safe, stable, ready-to-go propellant and now its fiberglass second stage — never would have come into being. The Strategic Air Command made public demand for control which if granted would have all but destroyed the submarine's essential team play in the balanced fleet.

The USAF still leads in political maneuvering and propaganda and there was more than pure coincidence in the appointment of Sen. Symington of Missouri to make the opening gambit in the new administration's defense maneuvers.

Symington's first move was to appoint a Defense Reorganization Committee loaded with Air Force friends who came up with a unanimous plug for the USAF party line approximating the single service concept. The White House was non-committal. Everyone who took a close look at the move in the light of influential thinking in Congress knew that this gimmick, if presented in one hunk, would fail. It has been pointed out here that Pentagon merger would have to be reached by an "evolutionary" process—by inching its way and resorting to diversionary measures.

PRECURSORS were the appointments as NATO ambassador of ex-Air Force secretary and single service fanatic, Thomas S. Finletter; then of Roswell L. Gilpatric to the second most potent job in Defense. Gilpatric comes to the defense deputyship from a background of the Air Force secretariat.

Whether Sen. Symington selected Secretary McNamara is apparently not known. That Mr. McNamara is an Air Force Reserve colonel may be of no significance. We're disposed to further await the test of time.

DENVER POST
26 March 1961

Coming Missile Saturation Forces Builders to Look Ahead

By RALPH DIGHTON

LOS ANGELES, March 25.—(AP)—By 1965 the United States expects to have:

- 708 Atlas, Titan and Minuteman ICBMs; most of them stored in deep, bombproof pits.
- 288 Polaris missiles in nuclear submarines; hidden, but within easy reach of enemy targets.
- 150 additional Minuteman on trains, roving 100,000 miles of railroad tracks; hard to spot and harder to hit.
- Total: 1,094 ready-to-launch nuclear warheads, any one of which could wipe out a city.

This probably is two or three times the fire power needed to blast any likely combination of enemies off the face of the globe.

Even if Russia by 1965 has a reasonably good anti-missile missile, with this "overkill" of 200 to 300 pct. the United States should be able to get enough missiles through to make any future war a literal hell.

So, in 1965, will we need more missiles?

If we don't, what happens to America's vast missile industry?

The missile industry last year grossed $9 billion, and gave jobs to 800,000 people. By 1965, if future growth matches past performance, it could begin to rival the $12-billion, 700,000-worker automobile industry.

Any serious dislocation of this money and manpower would have a depressing effect on the entire nation.

FULLY AWARE

A survey of missile executives indicates full awareness of the problem.

Although none believes there will be an abrupt end to missile manufacturing in 1965, most concede that a "leveling-off" period lies ahead.

They plan to meet this by "diversification"—finding supplemental items to manufacture—as the aircraft industry did after World War II and the Korean conflict when aircraft makers suddenly found themselves almost out of business.

Employment nose-dived, then gradually rose as the big companies branched out into new technologies, chiefly electronics.

After the lessons of the 1940s, the aircraft industry is not likely to be caught napping again. The continuing search for new products has spread over an almost incredible range.

Says Board Chairman Robert E. Gross of Lockheed Aircraft Corp., maker of the Polaris:

"For Lockheed these new areas have included relatively small but important penetrations of electronics, undersea research, ship building, heavy construction, architectural products and others.

"These are small activities now, but one should not discount their possibilities. Surely I am not the one to say that in another 5 to 10 years Lockheed won't be just as important in industrial products or industrial automation as we are today in space."

LOOK ELSEWHERE

L. L. Waite, senior vice president for engineering and planning of North American Aviation, Inc., which makes the engines for this nation's only operational ICBM, the Atlas, believes the saturation point in missiles is some years away. New types will be developed, and there will be a "continuous rehabilitation."

"However, there is no doubt that the aerospace manufacturer will also have to turn to other activities if his company is to retain engineering and manufacturing capabilities," says Waite.

Vice President John H. Richardson of Hughes Aircraft Co. said:

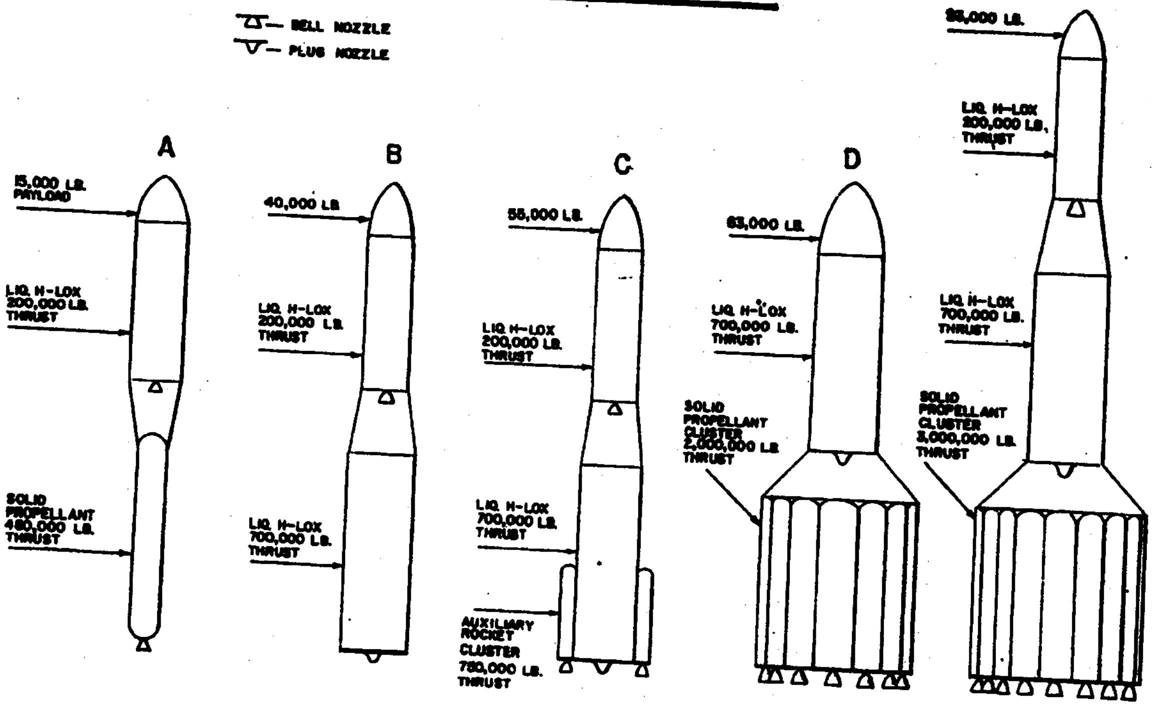
"When all the holes are filled with missiles, space programs will increase and partially take up slack created by a missile production saturation. How much slack depends on how big the space business becomes."

It is apparent that most industry planners assume that taxpayers will be willing for their government to spend as much on space research as it has on missiles.

Privately, however, there are some who point out this vital difference: Missiles are weapons designed to save our skins; space ships are tools of science designed to seek new knowledge that may or may not be worth its cost.

"Every man wants a fence around his house," they say, "but how many have scientific laboratories in their basements?"

Probably the worst thing that could befall the industry would be an outbreak of peace. But even if this happened, say some planners, the manpower and money now devoted to missiles could be channeled quickly into another area: devices to develop hydrospace, the oceans that cover seven-tenths of the globe.



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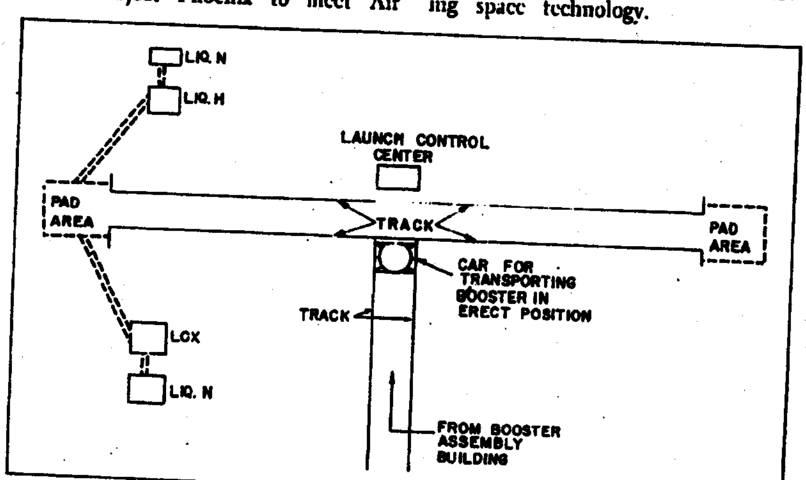
PROJECT PHOENIX Phase II study envisions specific family of boosters with flexible staging to loft spacecraft ranging from 15,000 lb. to 93,000 lb. Booster A (left) with total thrust of 680,000 lb. and weighing 330,000 lb. is projected for greatest utilization under Phoenix, which anticipates Air Force requirements extending through 1975. Other booster combinations may increase thrust to 6,000,000 lb.

Project Phoenix Aims at Economical Super Space Probes

Extensive study to devise a rock-bottom economy launch system of facilities and rocket boosters for lofting more than 1,000 space vehicles weighing up to almost 50 tons is being advanced by a broad Air Research and Development Command team effort under Project Phoenix to meet Air Force space requirements substantially through 1975.

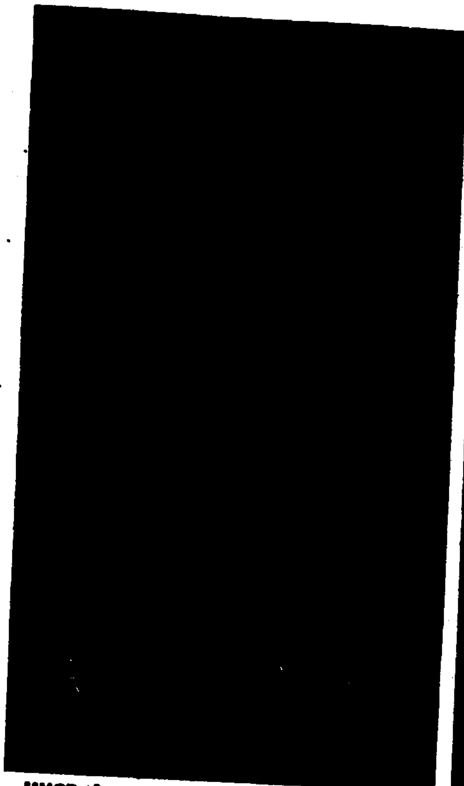
The system study, scheduled for completion by June 30, is analyzing in detail the application of all the factors affecting efficiency and costs involved in the changing demands of fast-moving space technology.



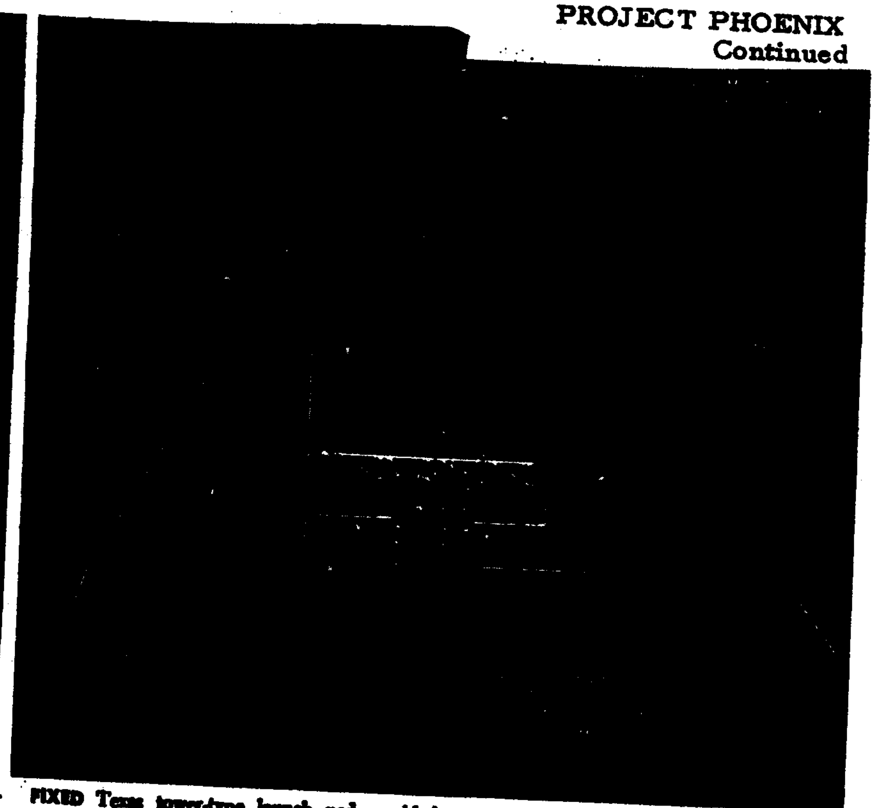
LAND-BASED launch site under Project Phoenix concept would be serviced by system of tracks from booster assembly building. Booster in erect position would be supported on transport table on which booster would be put together, checked in assembly building.

Items being studied include:

- Family of solid- and liquid-propellant stage combinations with capabilities up to nearly 4 million lb. thrust. Extensions of this boost capability to 6 million lb. thrust also may be considered, with payload capacity correspondingly larger than 50 tons.
- All-liquid and all-solid propellant boosters.
- Booster recovery techniques and economics.
- Land-based on-the-surface sites and fixed and mobile Texas tower-type off-shore pads.
- Associated booster assembly buildings with bays almost 300-ft. high to accommodate huge integrated boosters assembled in the vertical position.



HUGE booster considered under all-liquid propellant configurations in Project Phoenix analysis would weigh between 55,000 lb. and 60,000 lb. empty.



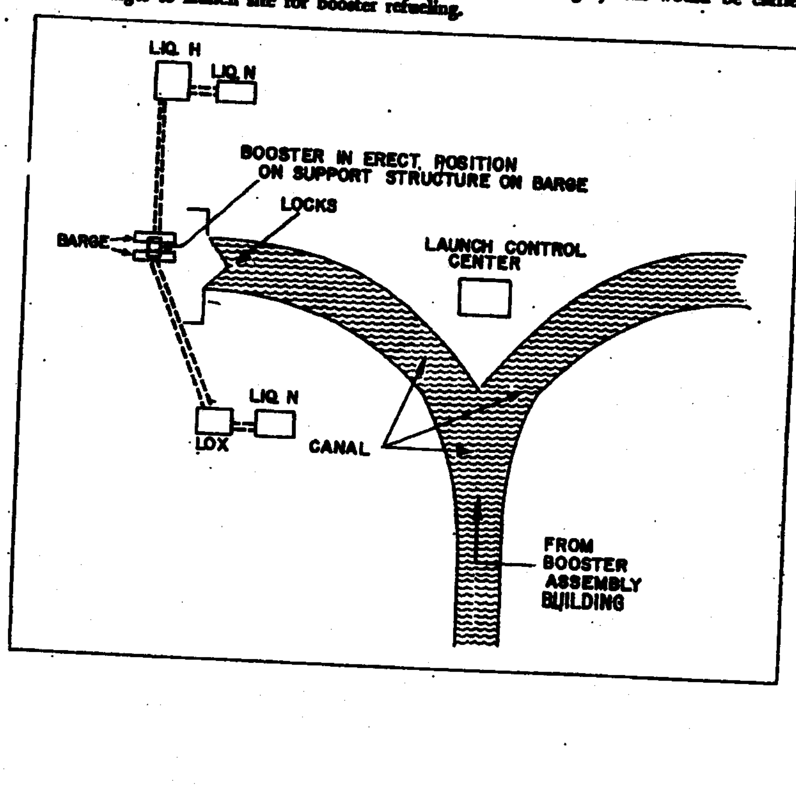
FIXED Texas tower-type launch pad would be serviced by catamaran-type barge. After barge is removed, elevator would raise boosters to firing height—about 60 ft. above water. For servicing water-based site, booster would be transported through canals from assembly building (below). Propellant-loading system would be carried on barges to launch site for booster refueling.

- Systems of trackage and transport tables, and canals, locks and barges, for conveying erected boosters from assembly buildings to launch sites.
- Special and conventional launch control schemes.
- Booster manufacturing and propellant loading alternatives, transportation and handling aspects.

The research and development portion of the program, targeted to begin not later than the middle of 1962, is seen extending to 1965. The subsequent 10-year period to 1975 may encompass as many as 1,065 launches—of which approximately 400 would be for operational-type space vehicles.

Launch site projections contemplate first installation at Cape Canaveral for the Atlantic Missile Range, then for the Pacific Missile Range, and possibly at a Hawaiian base for both east-west and north-south trajectories.

Project Phoenix presentations were made early in January to Headquarters, USAF and Headquarters, ARDC, by personnel from the Ballistic Missile Division as the cognizant military agency; Aerospace Corp., its nonprofit technical-support arm, which is establishing the Phoenix concept and design parameters; and the nonprofit Rand Corp., which is analyzing the economics of Phoenix, aimed at slashing booster-payload costs from a present-day round figure of $1,000 a pound to a target price of about $100 a pound (AW Dec. 19, p. 37).



At the time of these Phoenix briefings, the original approach to the program, comprising a single phase, had been completed. This encompassed booster comparisons of all-liquid systems versus all-solid propellant stages, which was resolved in favor of the all-liquid boost vehicle. The program analysis then was extended to include a second phase which is now considering various configurations of boosters with solid-propellant base stages in combination with liquid-hydrogen/liquid-oxygen upper stages, as well as all-liquid systems. The Phase 1 over-all analysis involved consideration of these highlights:

• Determination of the most suitable, minimized-cost launch systems, including aspects of standardization, flexibility for adaptation to various booster configurations, and use-repeatability, with the same facilities serving for both R & D and operational phases.

• Definition of the applied research and development that will be involved.

• Feasibility of booster recovery, which included analysis of six possible techniques, including flexible-wing recovery, air snatch with supplemental helicopter participation for delivery to base, and use of retrorockets and chute on booster for slowdown prior to impact and subsequent recovery from the water. Indications are that analysis has revealed that recovery systems would be only "marginal" in effect—that savings would be "modest" at best, not likely to exceed 15%. Arguments against recovery include resulting extensive impact damage and effects on booster materials of high temperature combined with immersion in the ocean. Another indication that booster recovery may not be supported is that it is not being considered in relation to the Phase 2 family of vehicles.

• Establishment of boost vehicle sizes and configurations. In this Ballistic Missile Division/Aerospace/Rand analysis under Phase 1, seven industry members assisted with recommendations for booster schemes. Ten boost plans were considered ultimately, most being all-liquid-propellant combinations. One of the very few all-solid configurations was a four-stage arrangement with a cluster of seven segments as the first stage, seven as the second stage, and clusters of three segments for the third and fourth stages.

Details of one of the most promising liquid-propellant configurations considered under Phase 1 indicate the magnitude of the design and operational problems involved in Project Phoenix. This two-stage rocket would use liquid-hydrogen/liquid-oxygen as the propellant and would be pump-fed because a pressure-fed installation probably would be too heavy. Stage 1 would develop approximately 800,000 lb. thrust and, supplemented by Stage 2, would be capable of putting a 25-ton payload into space. Stage 1 would be fitted with a plug nozzle; the upper stage would have a conventional bell nozzle.

The configuration would have a length, without payload, of more than 180 ft., maximum body diameter of approximately 20 ft., widening at the skirt to about 23 ft., and extending to approximately 35-ft. diameter at the vernier rocket area. Total weight empty would be between 55,000 and 60,000 lb.

On a land-based pad it would stand about 70 ft. above the bottom of the fire pit and would require a 290-ft.-high gantry supported on a rail truck measuring 100 ft. x 125 ft. A monorail hoist would be located at the 270-ft. level of the gantry.

As a separate input under Phase 1, the general position of nuclear rockets of the Rover type and the Orion successive-explosion type were considered but could not be included because of the time required for development and subsequent test effort.

At the end of Phase 2, which is an extension of Phase 1, detailed presentations will again be made to USAF and ARDC Headquarters and the program will be implemented. One of the most promising groups of solid- and liquid-propellant combinations studied under Phase 2 affords a high degree of flexibility through utilization of interchangeable staging for achieving payload capabilities ranging from 15,000 to 93,000 lb.

Details of this family of rockets, which also includes one all-liquid configuration, are:

• Rocket A—Two-stage configuration has a solid-propellant first stage weighing 110,000 lb. which develops 480,000 lb. thrust and uses a bell-shaped nozzle. Second stage uses liquid-hydrogen/liquid-oxygen, weighs 120,000 lb., develops 200,000 lb. thrust and also uses a bell nozzle. Payload capability is 15,000 lb. This specific configuration probably would be the most extensively used in this family of rockets projected under Phase 2.

• Rocket B—Two-stage configuration has a first stage using liquid-hydrogen/liquid oxygen which weighs 400,000 lb. and develops 700,000 lb. thrust with plug nozzle. Second stage (200,000 lb. thrust), is the same as the second stage on Rocket A. With total thrust of 900,000 lb., this configuration will loft a payload of 40,000 lb. Rocket B is similar to the all-liquid booster studied under Phase 1.

• Rocket C—Two-stage configuration uses the same staging (900,000 lb. combined thrust) as that on Rocket B, but has the first stage augmented at its base by a cluster of solid-propellant rockets weighing 110,000 lb. and developing 750,000 lb. additional thrust. This configuration (1.65 million lb. total thrust) permits a payload of 55,000 lb. to be boosted.

• Rocket D—Two-stage configuration has a first stage composed of a cluster of solid-propellant rockets weighing 500,000 lb. and developing 2 million lb. thrust, using bell nozzles. Second stage (700,000 lb. thrust) is the same as the liquid-hydrogen/liquid-oxygen first stage on Rockets B and C. With total thrust of 2.7 million lb., this configuration will lift a 63,000-lb. payload.

• Rocket E—Three-stage configuration has a first stage composed of a cluster of solid-propellant rockets weighing 400,000 lb. and developing 3 million lb. thrust, using bell nozzles. Second stage (700,000 lb. thrust) is the same as the liquid-hydrogen/liquid-oxygen first stages on Rockets B and C and the second stage on Rocket D. The third stage (200,000 lb. thrust) on Rocket E is the same as the liquid-hydrogen/liquid-oxygen second stages on Rockets A, B and C. Developing a total thrust of 3.9 million lb., Rocket E will boost 93,000 lb. into space.

Since a prime objective of the Phoenix study is to establish the most economical launching system for military space vehicles, cost analysis includes the interplay of all factors involved in the range of tasks from the end result of launching through all the phases down to manufacturing alternatives, and tradeoffs must be weighed in arriving at a favorable balance between economy and efficiency.

Under consideration is a launch complex using a pad of standard configuration, with a gantry to erect the staging for mating into an integrated booster and space vehicle (payload). The gantry could be eliminated if the booster were mated and erected elsewhere, then transported in vertical position to the site.

Both fixed and mobile types of Texas tower launch pads are being studied for deployment in open water. The Texas tower type launch pad is considered feasible to reduce congestion at a land-based complex such as Cape Canaveral. It also minimizes hazard and damage in the event of booster blow-up on the pad, which, if the booster were very large, as in the case of Phoenix, conceivably could destroy not only its own pad but adjacent pads and installations.

The fixed-type Texas tower would rest on concrete piers and would have an elevator platform below water to allow the flotation above it of a catamaran-type barge which supports the erected booster on a table structure. The barge would be removed before the Texas tower pad's elevator platform raises the booster to the firing height so the nozzle is about 60 ft. above water. The umbilical mast, which is part of the Texas tower equipment, would extend as the booster is elevated to firing height.

The propellant loading system for a liquid-fueled booster could be carried on barges which would be towed to the Texas tower launch pad.

For the conventional launch pad configuration, a control blockhouse of the type being used for the Titan ICBM is being considered. Probably this same type of control center also would be used for a Texas tower launch pad located less than 1,000 ft. from the shore. Cabling from the control center to the pad would be carried on a pier or through an underwater conduit. For a Texas tower pad beyond the 1,000-ft. distance, the control center could be located on a barge, with connecting cabling resting on floating supports or carried in a submerged conduit.

Manufacture of booster stages at existing facilities and shipment of the stages to the launch site for checkout of each stage and mating would involve more ground support equipment at the pad than if a booster assembly building at the site were used for stage checkout and mating.

If individual-stage and mated-booster checkout is made in a horizontal position in the booster assembly building, with erection and final checkout at the launch pad, only a relatively low assembly building would be required, but erecting mechanism and a service tower would be required at the launch pad. The assembly building also could be used for assembly and checkout of the payload.

Checkout and mating of the booster in the vertical position at the booster assembly building would require a very high bay and transportation facilities to the launch site. No gantry would be required at the site, since the umbilical tower could afford approach to the rocket for emergency service.

Complete manufacture of the booster at the launch site could eliminate the need for a booster assembly building there, and would also eliminate the need for transportation over great distances of large individual or mated stages. Transportation of assembled boosters from an on-site factory to the launch pad would be similar to the requirements introduced with use of a booster assembly building receiving stages from off-site (existing) manufacturing facilities.

Maximum-size boosters envisioned under Project Phoenix could be transported between existing manufacturing facilities and launch site if adequate transport access were available from the facility to the loading point and from the unloading point to the launch site. Special barges could be constructed to accommodate the large boosters. Craft of the LST (landing ship, tank) type could accommodate boosters with diameters up to 50 ft., and LSD (landing ship, dock) type craft could handle boosters up to 30 ft. in diameter.

For transport from the on-site booster assembly building or the on-site manufacturing building, the erected mated stages (integrated booster) could be supported on a transport table or car rolling on tracks to a land-based launch site, or carried erect on a barge to a water launch site.

If the booster stages were transported horizontally from the on-site booster assembly building or on-site manufacturing facility, they could be carried by rail, barge or by highway.

SPACE FLIGHT:

What a Dog Can Do . . .

The countdown for the epochal flight of the first man into space has now reached its final moments.

Over the weekend, the Korabl Sputnik V—Satellite Ship V—orbited the earth three times and landed a cabin-capsule carrying a dog named Zvesdochka (Little Star) on a meadow within the Soviet Union. It was the fifth test of the 10,000-pound ship, the third time the ship had returned animal passengers safely, and its second straight success—just sixteen days earlier Korabl Sputnik IV brought back a dog named Chernushka (Blackie) from a similar orbital flight.

Based on the performance of Zvesdochka and Chernushka, U.S. spacemen believe the Soviets are now ready to send man, a dog's best friend, into orbit. Perhaps within a month, a Russian cosmonaut (maybe two cosmonauts) will blast off in Korabl Sputnik VI from Southwest Russia shortly after dawn and ride around the earth 150 miles high at speeds of 18,000 mph. After three orbits, or four and one-half hours in space, a radio signal will separate a 5,000-pound cabin from the carrier frame. The cabin will bring the occupant back to a triumphant return in the same meadow where Zvesdochka was landed last week.

No announcement will be made, of course, until the passenger is safely down; thus, if anything should go wrong, Radio Moscow has the option of describing Korabl Sputnik VI as unmanned and undogged.

▶At Cape Canaveral, Fla., the U.S. man-in-space countdown was also in its final moments, although for a much more modest trip. Last week, a Redstone rocket passed what may very well be its final flight test before it carries the first astronaut and his 2,000-pound Mercury capsule on a flashing, fifteen-minute trip 120 miles high and 290 miles across the Atlantic Ocean. Estimated launching date for this first of the U.S. up-and-down flights: Sometime in May, after one more test of the capsule system.

SATELLITES:

Shhhhh!

The U.S. has put up some strange space vehicles since its first satellite three years ago. But none is stranger than Samos, the "satellite that isn't there."

Samos is a forerunner of the Air Force's "spy in the sky"—a photo-reconnaissance satellite capable of taking U-2 type pictures of ground installations. The political implications are such that the Administration has been understandably silent about its fate. When Samos was launched Jan. 31, the U.S. "Satellite Situation Report" noted it but gave no data. Three weeks ago, its altitude was finally listed, after Samos stopped transmitting test patterns.

Last week, Samos popped up again when CBS Laboratories showed off a space transmission system called Photoscan. The 150-pound system scans a photograph with a light beam and televises the "bits" to a ground station. The result is an image with 500 times the resolution of the standard TV picture.

Ostensibly the first Photoscan is going into a Navy fighter plane for aerial recon work. But most insiders believe Photoscan may be flying soon—in Samos.

KWAJALEIN, the Pacific Ocean atoll wrested from the Japanese sixteen years ago, is now being turned into a launching pad for the Army's Nike-Zeus program—a $14 billion gamble that a missile can knock down an ICBM. As this photo shows, a staggering array of equipment is being crammed into Kwaj's scant 602 acres: Four concrete launching cells for the Nike-Zeus (bottom), radars and airstrip at mid-island. In 1962, a Nike-Zeus will be fired toward a point some 100 miles to the northeast where, the Army hopes, the missile will prove its ability to hit an "enemy" traveling at 15,000 mph.

INDUSTRY OBSERVER

► Ten test flights are scheduled in 1962-63 as part of the effort to check out the Army's Project Advent communications satellite. First three launchings will use the Agena B, and the other seven will be made with the Centaur upper stage.

► NASA will ask the Air Force to fly its research payload containing a chimpanzee and two monkeys in an Agena satellite if the vehicle can meet requirements before the space agency's Mercury capsule can be used with an Atlas booster. Agena would have to be able to put 500 lb., including environmental instrumentation and food, into orbit for 14 days. NASA has given the University of California a $90,000 contract to develop some of the components of this adaptable 500-lb. package.

► Air Force believes that the surprising success of its first free-flight firing of the Minuteman missile may allow it to eliminate 8-10 test shots from the development schedule. Structural weight and probably the amount of protective heat coating at upper ends of the first and second stages will be reduced before the next missile is fired.

► Air Force may ask soon for industry proposals for a long-distance earth current communication system, possibly to link Washington with North American Air Defense Command and Strategic Air Command headquarters. Earth current technique originally was developed as a communications link between Minuteman ICBM silos and their central command post, but it now appears suitable for long-range communications.

NEW YORK TIMES
29 March 1961

Text of President Kennedy's Special Message to Congress on Defense Spending Cutback in Bases Requested by President

Special to The New York Times.

WASHINGTON, March 28—Following is the text of the special message to Congress today on the defense budget by President Kennedy:

In my role as Commander in Chief of the American armed forces, and with my concern over the security of this nation now and in the future, no single question of policy has concerned me more since entering upon these responsibilities than the adequacy of our present and planned military forces to accomplish our major national security objectives.

In January, while ordering certain immediately needed changes, I instructed the Secretary of Defense to reappraise our entire defense strategy, capacity, commitments and needs in the light of present and future dangers. The Secretary of State and others have been consulted in this reappraisal, and I have myself carefully reviewed their reports and advice.

Such a review is obviously a tremendous task and it still continues. But circumstances do not permit a postponement of all further action during the many additional months that a full reappraisal will require. Consequently we are now able to present the most urgent and obvious recommendations for inclusion in the fiscal 1962 budget.

Meaningful defense budget decisions, however, are not possible without preliminary decisions on defense policy, reflecting both current strategic assumptions and certain fundamental principles. These basic policies or principles, as stated below, will constitute the essential guidelines and standards to be followed by all civilian and military personnel who work on behalf of our nation's security. The budget which follows, if enacted by the Congress under its own solemn duty "to provide for the common defense," is designed to implement these assumptions as we now see them, and to chart a fresh, clear course for our security in a time of rising dangers and persistent hope.

I. Basic Defense Policies

1. The primary purpose of our arms is peace, not war—to make certain that they will never have to be used—to deter all wars, general or limited, nuclear or conventional, large or small—to convince all potential aggressors that any attack would be futile—to provide backing for diplomatic settlement of disputes—to insure the adequacy of our bargaining power for an end to the arms race. The basic problems facing the world today are not susceptible to a military solution. Neither our strategy nor our psychology as a nation—and certainly not our economy—must become dependent upon our permanent maintenance of a large military establishment. Our military posture must be sufficiently flexible and under control to be consistent with our efforts to explore all possibilities and to take every step to lessen tensions, to obtain peaceful solutions and to secure arms limitations. Diplomacy and defense are no longer distinct alternatives, one to be used where the other fails—both must complement each other.

Disarmament, so difficult and so urgent, has been much discussed since 1945, but progress has not been made. Recrimination in such matters is seldom useful, and we for our part are determined to try again. In so doing, we note that, in the public position of both sides in recent years, the determination to be strong has been coupled with announced willingness to negotiate. For our part, we know there can be dialectical truth in such a position, and we shall do all we can to prove it in action. This budget is wholly consistent with our earnest desire for serious conversation with the other side on disarmament. If genuine progress is made, then as tension is reduced, so will be our arms.

National Tradition Cited

2. Our arms will never be used to strike the first blow in any attack. This is not a confession of weakness but a statement of strength. It is our national tradition. We must offset whatever advantage this may appear to hand an aggressor by so increasing the capability of our forces to respond swiftly and effectively to any aggressive move as to convince any would-be aggressor that such a movement would be too futile and costly to undertake. In the area of general war, this doctrine means that such capability must rest with that portion of our forces which would survive the initial attack. We are not creating forces for a first strike against any other nation. We shall never threaten, provoke or initiate aggression—but if aggression should come, our response will be swift and effective.

3. Our arms must be adequate to meet our commitments and ensure our security, without being bound by arbitrary budget ceilings. This nation can afford to be strong—it cannot afford to be weak. We shall do what is needed to make and to keep us strong. We must, of course, take advantage of every opportunity to reduce military outlays as a result of scientific or managerial progress, new strategic concepts, a more efficient, manageable and thus more effective defense establishment, or international agreements for the control and limitation of arms. But we must not shrink from additional costs where they are necessary. The additional $650,000,000 in expenditures for fiscal 1962 which I am recommending today, while relatively small, are too urgent to be governed by a budget largely decided before our defense review had been completed. Indeed, in the long run the net effect of all the changes I am recommending will be to provide a more economical budget. But I cannot promise that in later years we need not be prepared to spend still more for what is indispensable. Much depends on the course followed by other nations. As a proportion of gross national product, as a share of our total budget, and in comparison with our national effort in earlier times of war, this increase in defense expenditures is still substantially below what our citizens have been willing and are now able to support as insurance on their security—insurance we hope is never needed—but insurance we must nevertheless purchase.

Civilian Control Stressed

4. Our arms must be subject to ultimate civilian control and command at all times, in war as well as peace. The basic decisions on our participation in any conflict and our response to any threat—including all decisions relating to the use of nuclear weapons, or the escalation of a small war into a large one—will be made by the regularly constituted civilian authorities. This requires effective and protected organization, procedures, facilities and communication in the event of attack directed toward this objective, as well as defensive measures designed to insure thoughtful and selective decisions by the civilian authorities. This message and budget also reflect that basic principle. The Secretary of Defense and I have had the earnest counsel of our senior military advisers and many others—and in fact they support the great majority of the decisions reflected in this budget. But I have not delegated to anyone else the responsibilities for decisions which are imposed upon me by the Constitution.

5. Our strategic arms and defenses must be adequate to deter any deliberate nuclear attack on the United States or our allies—by making clear to any potential aggressor that sufficient retaliatory forces will be able to survive a first strike and penetrate his defenses in order to inflict unacceptable losses upon him. As I indicated in an address to the Senate some thirty-one months ago,

this deterrence does not depend upon a simple comparison of missiles on hand before an attack. It has been publicly acknowledged for several years that this nation has not led the world in missile strength. Moreover, we will not strike first in any conflict. But what we have and must continue to have is the ability to survive a first blow and respond with devastating power. This deterrent power depends not only on the number of our missiles and bombers, but on their state of readiness, their ability to survive attack, and the flexibility and sureness with which we can control them to achieve our national purpose and strategic objectives.

Deployment of Forces

6. The strength and deployment of our forces in combination with those of our Allies should be sufficiently powerful and mobile to prevent the steady erosion of the free world through limited wars; and it is this role that should constitute the primary mission of our overseas forces. Non-nuclear wars, and sublimited or guerrilla warfare, have since 1945 constituted the most active and constant threat to free world security. Those units of our forces which are stationed overseas, or designed to fight overseas, can be most usefully oriented toward deterring or confining those conflicts which do not justify and must not lead to a general nuclear attack. In the event of a major aggression that could not be repulsed by conventional forces, we must be prepared to take whatever action with whatever weapons are appropriate. But our objective now is to increase our ability to confine our response to non-nuclear weapons, and to lessen the incentive for any limited aggression by making clear what our response will accomplish. In most areas of the world, the main burden of local defense against overt attack, subversion and guerrilla warfare must rest on local populations and forces. But given the great likelihood and seriousness of this threat, we must be prepared to make a substantial contribution in the form of strong, highly mobile forces trained in this type of warfare, some of which must be deployed in forward areas, with a substantial airlift and sealift capacity and prestocked overseas bases.

7. Our defense posture must be both flexible and determined. Any potential aggressor contemplating an attack on any part of the free world with any kind of weapons, conventional or nuclear, must know that our response will be suitable, selective, swift and effective. While he may be uncertain of its exact nature and location, there must be no uncertainty about our determination and capacity to take whatever steps are necessary to meet our obligations. We must be able to make deliberate choices in weapons and strategy, shift the tempo of our production and alter the direction of our forces to meet rapidly changing conditions or objectives at very short notice and under any circumstances. Our weapon systems must be usable in a manner permitting deliberation and discrimination as to timing, scope and targets in response to civilian authority; and our defense must be secure against prolonged re-attack as well as a surprise first strike. To purchase productive capacity and to initiate development programs that may never need to be used—as this budget proposes—adopts an insurance policy of buying alternative future options.

8. Our defense posture must be designed to reduce the danger of irrational or unpremeditated general war—the danger of an unnecessary escalation of a small war into a large one, or of miscalculation or misinterpretation of an incident or enemy intention. Our diplomatic efforts to reach agreements on the prevention of surprise attack, an end to the spread of nuclear weapons—indeed all our efforts to end the arms race—are aimed at this objective. We shall strive for improved communication among all nations, to make clear our own intentions and resolution, and to prevent any nation from underestimating the response of any other, as has too often happened in the past. In addition our own military activities must be safeguarded against the possibility of inadvertent triggering incidents. But even more importantly, we must make certain that our retaliatory power does not rest on decisions made in ambiguous circumstances, or permit a catastrophic mistake.

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It would not be appropriate at this time or in this message to either boast of our strength or dwell upon our needs and dangers. It is sufficient to say that the budgetary recommendations which follow, together with other policy, organizational and related changes and studies now under way administratively, are designed to provide for an increased strength, flexibility and control in our defense establishment in accordance with the above policies.

II. Strengthening and Protecting Our Strategic Deterrent and Defenses

A. Improving our missile deterrent. As a power which will never strike first, our hopes for anything close to an absolute deterrent must rest on weapons which come from hidden, moving, or invulnerable bases which will not be wiped out by a surprise attack. A retaliatory capacity based on adequate numbers of these weapons would deter any aggressor from launching or even threatening an attack—an attack he knew could not find or destroy enough of our force to prevent his own destruction.

1. Polaris—The ability of the nuclear-powered Polaris submarine to operate deep below the surface of the seas for long periods and to launch its ballistic, solid fuel nuclear-armed missiles while submerged gives this weapons system a very high degree of mobility and concealment, making it virtually immune to ballistic-missile attack.

In the light of the high degree of success attained to date in its development, production and operation, I strongly recommend that the Polaris program be greatly expanded and accelerated. I have earlier directed the Department of Defense, as stated in my State of the Union message, to increase the fiscal year 1961 program from five submarine starts to ten, and to accelerate the delivery of these and other Polaris submarines still under construction. This action will provide five more operational submarines about nine months earlier than previously planned.

For fiscal year 1962, I recommend the construction of ten more Polaris submarines, making a total of twenty-nine, plus one additional tender. These ten submarines, together with the ten programmed for fiscal year 1961, are scheduled to be delivered at the rate of one a month or twelve a year, beginning in June 1963, compared with the previous rate of five a year. Under this schedule, a force of twenty-nine Polaris submarines can be completed and at sea two months before the present program called for nineteen boats, and two years earlier than would be possible under the old five-a-year rate. These twenty-nine submarines, each with a full complement of missiles, will be a formidable deterrent force. The sooner they are on station, the safer we will be. And our emphasis upon a weapon distinguished primarily for its invulnerability is another demonstration of the fact that our posture as a nation is defensive and not aggressive.

I also recommend that the development of the long-range Polaris A-3 be accelerated in order to become available a year earlier, at an eventual savings in the procurement of the A-3 system.

This longer range missile with improved penetration capability will greatly enhance the operational flexibility of the Polaris force and reduce its exposure to shore-based antisubmarine warfare measures. Finally, we must increase the allowance of Polaris missiles for practice firing to provide systematic "proving-ground" data for determining and improving operational reliability.

The increases in this program, including $15,000,000 in new obligational authority for additional crews, constitute the bulk of the budget increases—$1,340,000,000 in new obligational authority on a full funded basis over a four year period, though only $270,000,000 in expenditures in fiscal 1962. I consider this a wise investment in our future.

The Minuteman Discussed

2. Minuteman—Another strategic missile system which will play a major role in our deterrent force, with a high degree of survivability under ballistic missile attack, is the solid-fuel Minuteman. This system is planned to be deployed in well-dispersed hardened sites and, eventually, in a mobile mode on railroad cars. On the basis of the success of tests conducted to date and the importance of this system to our over-all strategy, I recommend the following steps:

1) Certain design changes to improve the reliability, guidance accuracy, range and re-entry of this missile should be incorporated earlier than previously planned, by additional funding for research and development.

2) A more generous allotment of missiles for practice firing should, as in the case of the Polaris, be provided to furnish more operational data sooner.

3) The three mobile Minuteman squadrons funded in the January budget should be deferred for the time being and replaced by three more fixed-base squadrons (thus increasing the total number of missiles added by some two-thirds). Development work on the mobile version will continue.

4) Minuteman capacity production should be doubled to enable us to move to still higher levels of strength more swiftly should future conditions warrant doubling our production. There are great uncertainties as to the future capabilities of others; as to the ultimate outcome of struggles now going in many of the world's trouble spots; and as to future technological breakthroughs either by us or any other nation. In view of these major uncertain-

ties, it is essential that, here again, we adopt an insurance philosophy and hedge our risks by buying options on alternative courses of action. We can reduce lead-time by providing now additional stand-by production capacity that may never need to be used, or used only in part, and by constructing additional bases which events may prove could safely have been postponed to the next fiscal year. But that option is well worth the added cost.

Together, these recommendations for Minuteman will require the addition of $96,000,000 in new obligational authority to the January budget estimate.

Skybolt Program

3. Skybolt—another type of missile less likely to be completely eliminated by enemy attack is the air-to-ground missile carried by a plane that can be off the ground before an attack commences. Skybolt is a long-range (1,000 mile) air-launched, solid-fuel nuclear-warhead ballistic missile designed to be carried by the B-52 and the British V bombers. Its successful development and production may extend the useful life of our bombers into the missile age—and its range is far superior to the present Hound Dog missiles.

I recommend that an additional $50,000,000 in new obligational authority be added to the 1962 budget to enable this program to go forward at an orderly rate.

B. Protecting our bomber deterrent. The considerably more rapid growth projected for our ballistic-missile force does not eliminate the need for manned bombers—although no funds were included in the January budget for the further procurement of B-52 heavy bombers and B-58 medium bombers, and I do not propose any. Our existing bomber forces constitute our chief hope for deterring attack during this period prior to the completion of our missile expansion. However, only those planes that would not be destroyed on the ground in the event of a surprise attack striking their base can be considered sufficiently invulnerable to deter an aggressor.

Bomber Deterrence Plan

I therefore recommend the following steps to protect our bomber deterrent:

1. Airborne alert capacity. That portion of our force which is constantly in the air is clearly the least vulnerable portion. I am asking for the funds to continue the present level of indoctrination training flights, and to complete the stand-by capacity and materials needed to place one-eighth of our entire heavy bomber force on airborne alert at any time. I also strongly urge the re-enactment of Section 512(B) of the Department of Defense Appropriation Act for 1961, which authorizes the Secretary of Defense, if the President determines it is necessary, to provide for the cost of a full airborne alert as a deficiency expense approved by the Congress.

2. Increased ground alert force and bomb alarms. Strategic bombers standing by on a ground alert of fifteen minutes can also have a high degree of survivability provided adequate and timely warning is available. I therefore recommend that the proportion of our B-52 and B-47 forces on ground alert should be increased until about half of our total force is on alert. In addition, bomb alarm detectors and bomb alarm signals should be installed at key warning and communication points and all S. A. C. [Strategic Air Command] bases, to make certain that a dependable notification of any surprise attack can not be eliminated. $45,000,000 in new obligational authority will pay for all of these measures.

C. Improving our Continental defense and warning systems. Because of the speed and destructiveness of the intercontinental ballistic missile and the secrecy with which it can be launched, timely warning of any potential attack is of crucial importance not only for preserving our population but also for preserving a sufficient portion of our military forces—thus deterring such an attack before it is launched. For any attacker knows that every additional minute gained means that a larger part of our retaliatory force can be launched before it can be destroyed on the ground. We must assure ourselves, therefore, that every feasible action is being taken to provide such warning.

Warning System Cited

To supplement the Ballistic Missile Early Warning System (BMEWS), on which construction is now proceeding as fast as is practical, the satellite-borne Midas system, now under development, is designed to provide about thirty minutes of warning by detecting missiles immediately after launching. Together with B. M. E. W. S., Midas would greatly increase the assurance and reliability of timely warning. I recommend that an additional $60,000,000 in new obligational authority be added to the 1962 budget to accelerate completion of the development phase of the Midas program, with the goal of achieving an operational system at an earlier date.

For the next several years at least, however, we shall have to continue to provide a defense against manned bomber attack. Such an attack is most likely to coincide with, or follow, a ballistic-missile attack seeking to incapacitate our antibomber defense system. Measures must therefore be taken to enhance the ability of the Air Defense System to cope with a combined attack. I recommend $23,000,000 in new obligational authority be added to the 1962 budget for this purpose.

D. Improving the command and control of our strategic deterrent. The basic policies stated at the beginning of this message lay new emphasis on improved command and control—more flexible, more selective, more deliberate, better protected and under ultimate civilian authority at all times. This requires not only the development and installation of new equipment and facilities, but, even more importantly, increased attention to all organizational and procedural arrangements for the President and others. The invulnerable and continuous command posts and communications centers provided in these recommendations (requiring an additional $16,000,000 in new obligational authority) are only the beginning of a major but absolutely vital effort to achieve a truly unified, nation-wide, indestructible system to insure high-level command, communication and control and a properly authorized response under any conditions.

E. There are a number of other space and research programs related to our strategic and continental air defense forces which I find require additional support. These include missile defense and penetration aids, Dynasoar, Advent, Defender, Discoverer and certain other programs. An additional $226,000,000 in new obligational authority is requested to finance them.

III. Strengthening Our Ability to Deter or Confine Limited Wars

The free world's security can be endangered not only by a nuclear attack, but also by being nibbled away at the periphery, regardless of our strategic power, by forces of subversion, infiltration, intimidation, indirect or nonovert aggression, internal revolution, diplomatic blackmail, guerilla warfare or a series of limited wars.

In this area of local wars, we must inevitably count on the cooperative efforts of other peoples and nations who share our concern. Indeed, their interests are more often directly engaged in such conflicts. The self-reliant are also those whom it is easiest to help—and for these reasons we must continue and reshape the military-assistance program which I have discussed earlier in my special message on foreign aid.

But to meet our own extensive commitments and needed improvements in conventional forces, I recommend the following:

A. Strengthened capacity to meet limited and guerilla warfare—limited military adventures and threats to the security of the free world that are not large enough to justify the label of "limited war." We need a greater ability to deal with guerilla forces, insurrections and subversion. Much of our effort to create guerilla and antiguerilla capabilities has in the past been aimed at general war. We must be ready now to deal with any size of force, including small externally supported bands of men; and we must help train local forces to be equally effective.

B. Expanded research on non-nuclear weapons. A few selected high priority areas—strategic systems, air defense and space—have received the overwhelming proportion of our defense research effort. Yet, technology promises great improvements in non-nuclear armaments as well; and it is important that we be in the forefront of these developments. What is needed are entirely new types of non-nuclear weapons and equipment—with increased fire-power, mobility and communications, and more suited to the kind of tasks our limited-war forces will most likely be required to perform. I include here antisubmarine warfare as well as land and air operations. I recommend, therefore, an additional $122,000,000 in new obligational authority to speed up current limited warfare research and development programs and to provide for the initiation of entirely new programs.

More Airlift Aircraft

C. Increased flexibility of conventional forces. Our capacity to move forces in sizable number on short notice and to be able to support them in one or more crisis areas could avoid the need for a much larger commitment later. Following my earlier direction, the Secretary of Defense has taken steps both to accelerate and increase the production of airlift aircraft. A total of 129 new, longer range, modern airlift aircraft will be procured through fiscal year 1962, compared with the fifty previously programmed. An additional $172,000,000 new obligational authority will be required in the 1962 budget to finance this expanded program.

These additional aircraft will help to meet our airlift requirements until the new specially designed, long range, jet powered C-141 transport becomes available. A contractor for this program has been selected and active development work will soon be started. Adequate funds are already included in the January budget to finance this program through the coming fiscal year.

I am also recommending in this message $40,000,000 in new obligational authority for the construction of an additional amphibious transport of a new type, increasing both the speed and the capability of Marine Corps sealift capacity; and $84,000,000 in new obligational authority for an increase in the Navy's ship rehabilitation and modernization program, making possible an increase in the number of ship overhauls, (as well as a higher level of naval aircraft maintenance.)

But additional transport is not enough for quick flexibility. I am recommending $230,000,000 in new obligational authority for increased procurement of such items as helicopters; rifles, modern non-nuclear weapons, electronics and communications equipment, improved ammunition for artillery and infantry weapons, and torpedoes. Some important new advances in ammunition and bombs can make a sizable qualitative jump in our limited war capabilities.

Manned Aircraft Needed

D. Increased non-nuclear capacities of fighter aircraft. Manned aircraft will be needed even during the 1965-75 missile era for various limited war missions. Target recognition, destruction of all types of targets when extreme accuracy is required, and the control of air space over enemy territory will all continue to be tasks best performed by manned aircraft.

Expected phase-out of Navy and Air Force fighters by 1965, together with reduced numbers and increasing obsolescence of the remaining aircraft, make necessary the development of an advanced tactical fighter emphasizing non-nuclear capabilities. I am requesting $45,000,000 in new obligational authority for this purpose.

Meanwhile, I am recommending $25,000,000 in new obligational authority for the modification of the F-105 tactical fighter to improve its capability to handle conventionally armed ordnance items, and to increase its suitability for airstrips of all types of areas.

E. Increased personnel, training and readiness for conventional forces. I am recommending $39,000,000 in new obligational authority for increases in Army personnel strength to expand guerrilla warfare units and round out other existing units, and an increase in the Marine Corps to bring it up closer to authorized strength levels. (In addition, personnel is being added to the Navy for Polaris crews, and to the Air Force for the ground alert expansion.) The sum of these personnel additions is 13,000 men. I am also recommending $25,000,000 additional in new obligational authority for pay of retired personnel of the military forces.

But more personnel alone is not enough. I am recommending an additional $65,000,000 in new obligational authority for increased readiness training of Army and Air Force units. These funds will provide for additional field training and mobility exercises for the Army and test exercises for the composite air strike forces and M. A. T. S. [Military Air Transport Service] unit. We recognize the role of exercises and deployments in demonstrating to our friends and opponents our ability to deploy forces rapidly in a crisis.

IV. Savings Made Possible by Progress

The elimination of waste, duplication and outmoded or unjustifiable expenditure items from the defense budget is a long and arduous undertaking, resisted by special arguments and interests from economic, military, technical and other special groups. There are hundreds of ways, most of them with some merit, for spending billions of dollars on defense; and it is understandable that every critic of this budget will have a strong preference for economy on some expenditures other than those that affect his branch of the service, or his plant, or his community.

But hard decisions must be made. Unneeded facilities or projects must be phased out. The defense establishment must be lean and fit, efficient and effective, always adjusting to new opportunities and advances, and planning for the future. The national interest must be weighed against special or local interests, and it is the national interest that calls upon us to cut our losses and cut back those programs in which a very dim promise no longer justifies a very large cost.

Specifically:

1. Our decision to acquire a very substantial increase in second-generation solid-fuel missiles of increased invulnerability (Polaris and Minuteman) enables us to eliminate safely the last two squadrons of Titan originally contemplated. These would not have become operational until 1964, and at a cost of $270,000,000—a cost several times that of the Minuteman missiles we are purchasing for the same period and could increase without stand-by facility. $100,000,000 in the 1962 budget can be saved by this adjustment.

2. The phase-out of a number of B-74 medium bomber wings already planned will be accelerated to provide promptly the trained crews required for the expanded ground alert program. (Fiscal 1962 savings: $35,000,000.)

Snark to Be Dropped

3. Additional personnel will also be made available by the immediate phase-out of the subsonic Snark air-breathing long-range missile, which is now considered obsolete and of marginal military value in view of ICBM developments, the Snark's low reliability and penetrability, the lack of positive control over its launchings, and the location of the entire wing at an unprotected site. (Fiscal 1962 savings: $7,000,000).

4. The acquired missile capability programmed by this message also makes unnecessary and economically unjustifiable the development of the B-70 Mach 3 manned bomber as a full weapons system at this time. The B-70 would not become available in operational numbers until well beyond 1965. By that time we expect to have a large number of intercontinental ballistic missiles, fully tested and in place, as well as a substantial manned bomber force mostly equipped with air-to-ground missiles. In view of the extremely high cost of the B-70 system, its lesser survivability as a ground-based system and its greater vulnerability in the air compared to missiles, its capabilities as a second strike system do not appear to have sufficient advantages over a much less expensive missile, or even a B-52 or successor bomber equipped with Skybolt, to justify a request in fiscal 1962 for $358,000,000.

Uncertainties Perceived

We recognize, however, that there are still uncertainties with respect to the operational characteristics of our planned missile force. We also recognize that there are certain advantages inherent in a controlled force of manned bombers. To preserve the option of developing this manned bomber weapon system, if we should later determine such a system is required, I recommend that the B-70 program be carried forward essentially to explore the problems of flying at three times the speed of sound with an airframe potentially useful as a bomber, with the development of a small number of prototype aircraft and related bomb-navigation systems. We should also explore the possibility of developing a manned bomber system specifically designed to operate in an environment in which both sides have large ICBM forces.

Even on this more limited basis, the B-70 project will cost $1,300,000,000 before it is completed in 1967. Approximately $800,000,000 has already been provided, $220,000,000 is now requested for 1962—$138,000,000 less than the amount included in the January budget—and the balance will be required in subsequent years. The total development program which I am recommending will cost $1,400,000,000 less than that previously planned.

5. Nearly fifteen years and about $1,000,000,000 have been devoted to the attempted development of a nuclear-powered aircraft; but the possibility of achieving a militarily useful aircraft in the foreseeable future is still very remote. The January budget already recommended a severe curtailment of this project, cutting the level of effort in half by limiting the scope to only one of the two different engines under development, although not indicating which one. We believe the time has come to reach a clean-cut decision in this matter. Transferring the entire subject matter to the Atomic Energy Commission budget where it belongs, as a nondefense research item, we propose to terminate development effort on both approaches on the nuclear powerplant, comprising reactor and engine, and on the airframe; but to carry forward scientific research and development in the fields of high temperature materials and high performance reactors, which is related to A. E. C.'s broad objectives in atomic reactor development including some work at the present plants, making use of their scientific teams. This will save an additional $35,000,000 in the defense budget for fiscal 1962 below the figure previously reduced in January, and will avoid

a future expenditure of at least $1,000,000,000 which would have been necessary to achieve first experimental flight.

The 'Missileer' Program

6. The January budget did not include funds for the continued development of the Navy's "Missileer" fleet defense aircraft, but funds were included for the continued development of the Eagle missile—designed for use by the Missileer—in the hope that it could be adapted for use by some other aircraft. I am now advised that no such alternative use is in propect; and I have directed the cancellation of that project, with a saving estimated at almost $57,000,000 in 1961 and 1962.

7. The plan to install Polaris missiles on the cruiser Long Beach has been canceled. For effectiveness in a nuclear war, the money would be better spent on the far less vulnerable Polaris submarines. In a limited war, the cruiser's utility would be reduced by the presence of the missiles. (Savings in fiscal 1962: $58,000,000).

8. Finally, technological progress causes obsolescence not only in military hardware but also in the facilities constructed for their deployment. We must continually review our nearly 7,000 military installations in the light of our needs now and in the event of emergency. Those bases and installations which are no longer required must be inactivated, and disposed of where feasible, and I have so directed the Secretary of Defense. He has already taken steps to have seventy-three domestic and foreign installations discontinued as excess to our needs now and at any time in the future; and studies are continuing now to identify additional facilities which are surplus to our requirements.

I am well aware that in many cases these actions will cause hardships to the communities and individuals involved. We cannot permit these actions to be deferred; but the Government will make every practicable effort to alleviate these hardships, and I have directed the Secretary of Defense to take every possible step to ease the difficulties for those displaced. But if it is diffcult, with so many defense and other budgetary demands, to justify support of military installations, with high operating and payroll costs and property values, which are no longer required for the defense of the nation. The closing of excess

installations, with high operating and payroll costs and property values, which are no longer required for the defense of the nation. The closing of excess installations overseas will in many cases help aleiviate our balance-of-payments deficit.

No Net Savings Forecast

No net savings are expected to be realized in 1962 from these inactivations because of the added costs involved in closing, and no reductions in the 1962 budget are proposed on that account. Substantial savings, approximately $220,000,000 per year, will be realized, however, in subsequent years.

(I am also proposing that $820,000,000 of the obligational authority require be provided by transfer from the current balances of working capital funds in the Defense department.)

Our military position today is strong. But positive action must be taken now if we are to have the kind of forces we will need for our security in the future. Our preparation against danger is our hope of safety. Thec hanges in the defense program which I have recommended will greatly enhance the security of this nation in the perilous years which lie ahead. It is not pleasant to request additional funds at this time for national security. Our interest, as I have emphasized, lies in peaceful solutions, in reducing tension, in settling disputes at the conference table and not on the battlefield. I am hopeful that these policies will help secure these ends. I commend them to the Congress and to the nation.

SPECIAL MESSAGE TO CONGRESS
Continued

Defense Department Budget in Brief

Special to The New York Times.

WASHINGTON, March 28—Following is the summary of the Defense Department budget submitted to Congress today along with President Kennedy's message:

(Millions of Dollars)

	New Obligational Authority			Net Expenditures		
	Fiscal Yr. 1960.	Fiscal Yr. 1961.	Fiscal Yr. 1962.	Fiscal Yr. 1960.	Fiscal Yr. 1961.	Fiscal Yr. 1962.
1. Eisenhower Budget (Fiscal Year 1962 Budget Document)	40,627.9	41,308.1	41,840.3	41,214.8	41,500.0	42,910.0
a. Effect of actions taken prior to 1/20/61 and underestimate	....	....	....	....	†743.4	†190.0
b. Fiscal Year 1961 supplementals proposed for later transmission *	....	63.0	....	....	18.6	45.0
2. Adjusted Budget 1/20/61	40,627.9	41,371.1	41,840.3	41,214.8	42,261.4	43,145.0
c. Effect of actions taken after 1/20/61 to accelerate Fiscal Year 1961 ‡	....	....	....	....	214.1	5.0
3. Adjusted Budget with accelerations	40,627.9	41,371.1	41,840.3	41,214.8	42,475.5	43,150.0
d. Effect of President Kennedy's Budget Message	....	....	1,954.0	....	24.5	650.0
4. Budget proposed by President Kennedy	40,627.9	41,371.1	43,794.3	41,214.8	42,500.0	43,800.0

* Underestimate of Retired Pay ($15.0) and ($48.0) [aircraft carrier] CONSTELLATION fire damage.
† Underestimate of rate of expenditure of funds.
‡ Acceleration of approved procurement and construction actions in order to strengthen the military and stimulate the recovery.

Kennedy and Eisenhower Fiscal Estimates Compared

Special to The New York Times.

WASHINGTON, March 28—Following tables compare the estimates of President Kennedy and former President Eisenhower on Government spending in the current fiscal year, 1961, and next fiscal year, 1962, and their respective requests for "new obligational authority"—appropriations and other spending authorizations—in both years. The detail, supplied by the Budget Bureau, may not add to the end-of-column totals because rounded figures have been used.

AGENCY	1961 Eisenhower Estimate	1961 Kennedy Estimate	1962 Eisenhower Estimate	1962 Kennedy Estimate	1961 Eisenhower Request	1961 Kennedy Request	1962 Eisenhower Request	1962 Kennedy Request
Legislative branch of the Judiciary	$208	$200	$202	$207	$176	$176	$180	$184
Executive office of the President	61	72	92	92	72	72	116	116
Funds appropriated to the President:								
Mutual security—economic and contengcies	1,675	1,725	1,875	1,875	2,131	2,131	2,200	2,400
Other	43	58	75	175	507	607	13	13
Independent offices:								
Atomic Energy Commission	2,660	2,660	2,680	2,670	2,781	2,781	2,598	2,628
Export-Import Bank	—100	—50	—4	—4	0	0	0	0
Federal Aviation Agency	640	630	730	743	690	690	686	745
National Aeronautics and Space Administration	770	720	965	1,050	965	965	1,110	1,236
Veterans Administration	5,314	5,400	5,782	5,404	5,577	5,577	5,101	5,141
Other	770	750	676	704	756	780	755	832
General Services Administration	442	420	496	498	520	521	556	558
Housing and Home Finance Agency	544	525	728	948	1,119	1,819	948	1,368
Department of Agriculture	5,739	5,807	5,782	6,440	5,261	8,230	5,509	6,169
Department of Commerce	511	511	566	614	549	549	612	677
Department of Defense—military:								
Military functions	41,560	42,500	42,910	43,800	41,208	41,371	41,840	43,794
Military assistance	1,700	1,500	1,750	1,650	1,800	1,800	1,800	1,600
Department of Defense—civil	986	....	984	1,021	978	978	972	994
Department of Health, Education and Welfare	3,716	3,744	4,005	4,798	3,909	3,940	4,026	5,505
Department of the Interior	785	785	873	906	837	838	888	940
Department of Justice	285	285	294	296	297	297	297	299
Department of Labor	295	892	222	654	525	2,566	264	289
Post Office Department	786	926	63	63	728	876	63	63
Department of State	260	260	345	351	268	268	351	363
Treasury Department:								
Interest	8,993	8,992	8,593	8,693	8,993	8,993	8,593	8,693
Other	965	965	1,095	1,120	992	993	1,126	1,126
District of Columbia	48	42	66	66	79	73	63	63
Allowance for contingencies	25	25	100	100	150	150	200	200
Subtotal	$79,621	$81,369	$81,532	$84,926	$82,068	$87,141	$70,867	$86,026
Deduct interfund transactions	676	676						
Total	$78,945	$80,693						

Figure 1. Mating Passenger Pod No. 1 to ATLAS 18E missile. Pod contains five Bioastronautic experiments.

Monthly Progress — BIOASTRONAUTICS

BIOASTRONAUTICS ATLAS Passenger Pod No. 1

• This pod, attached to the side of an ATLAS Series E ballistic missile, will carry five BIOASTRONAUTIC experiments over a ballistic trajectory in mid-May. These include the supercritical cryogenic storage system, the gravity independent photosynthetic gas exchanger, zero gravity potassium superoxide gas diffusion experiment and two tissue equivalent radiation experiments. The first two experiments were described in last month's report. The two remaining experiments are described below. (U)

Air Regeneration Diffusion Studies

• This experiment was designed by the Aerospace Medical Laboratory, ASD, to study the diffusion and motion of typical gases found in manned space capsules under zero gravity conditions. The passive air regeneration system employs the principle of passively exposing large quantities of a suitable solid chemical to the sealed atmosphere. Air regeneration of the sealed environment is obtained solely by the passive interaction of the capsule air and the solid chemical without the use of blowers or fans. Such a system when adopted to manned flight, allows the astronaut to rebreath his exhaled air without imposing an electrical power requirement or reducing reliability with moving parts. Information about the effect of total pressures upon the motion of typical gases under the influence of weightlessness will also be provided. (U)

• Three identical devices (Figure 2) containing gases at 5, 10, and 14.5 psia, respectively, will be launched into outer space for the motion analysis. Each device will contain two cylindrical tubes separated by a gate valve. One tube will contain gaseous carbon dioxide and the other will contain gaseous nitrogen at the same pressure. Since nitrogen does not react with potassium superoxide; potassium superoxide-atmosphere sensors will be installed in the tube containing the gaseous nitrogen. Potassium superoxide is a solid-chemical used in passive air regeneration systems to supply metabolic oxygen and remove carbon dioxide, water vapor, odors, and gaseous contaminants from the air. (U)

• As the state of weightlessness is encountered, the gate will be opened allowing the two gases to mix. The rate of mixing will then be measured

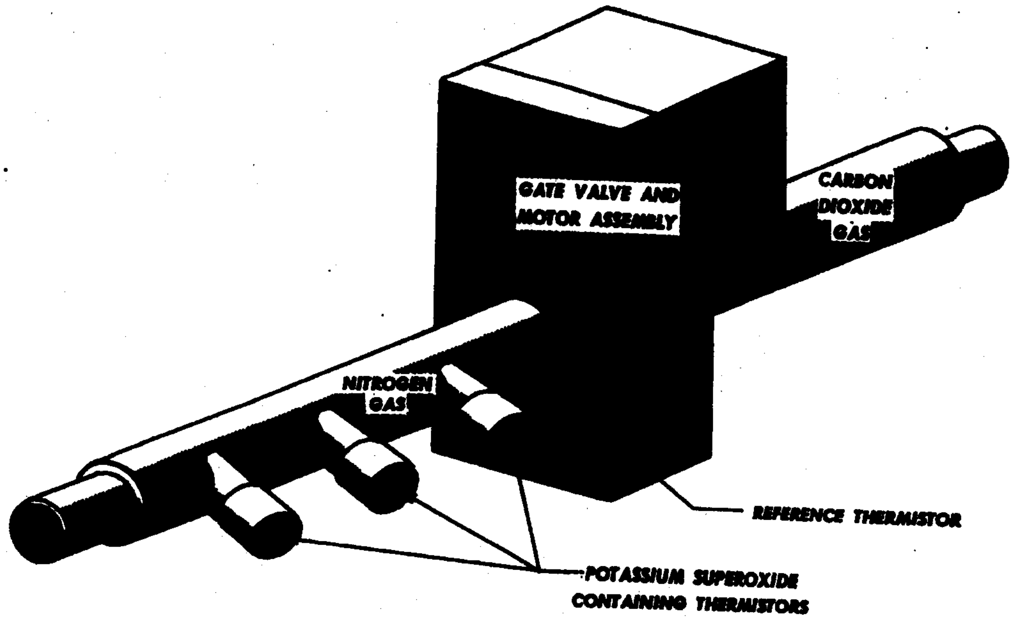


Figure 2. The Passive Air Regeneration System to be flown on the ATLAS B Pod in May. Three identical units containing gasses at 5, 10, and 14.5 psia, respectively, will be flown.

by the sensors. A thermistor embedded in potassium superoxide will sense the heat liberated as a result of the interaction of the carbon dioxide and potassium superoxide. A reference thermistor and three potassium superoxide-atmosphere sensors are located on each device so that the statistical average of three mixing rates can be reported. The maximum sensor temperature produced by the interaction of carbon dioxide and potassium superoxide is expected to be 40°F above ambient. A difference of sensor temperature and reference temperature will indicate that a mixing of the two gases has occurred at the sensor location. The magnitude of these temperature differences will be proportional to the amount of gases being mixed. (U)

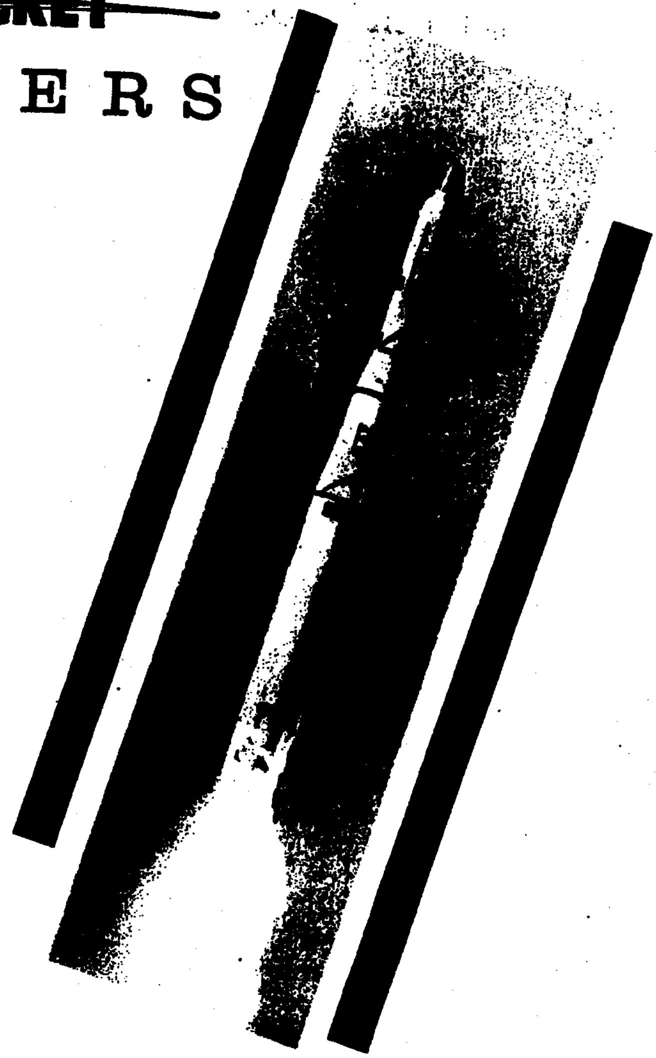
Tissue Equivalent Ion Chambers

- The experiment is designed by the Air Force Special Weapons Center to give radiation dose rate at one-quarter inch and one inch depths in lucite walls of the two AFSWC tissue equivalent ion chambers. These two dose rate measurements will give a depth dose rate curve which is the significant information needed in evaluating any radiation hazard encountered by the pod. (U)

SPACE
program boosters

Space Program

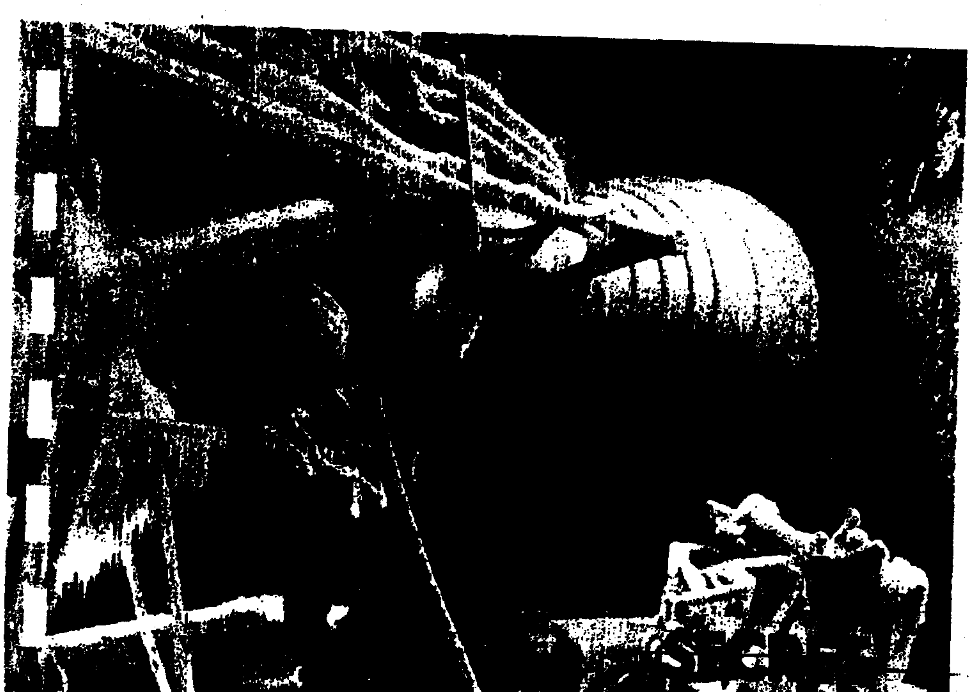
BOOSTERS

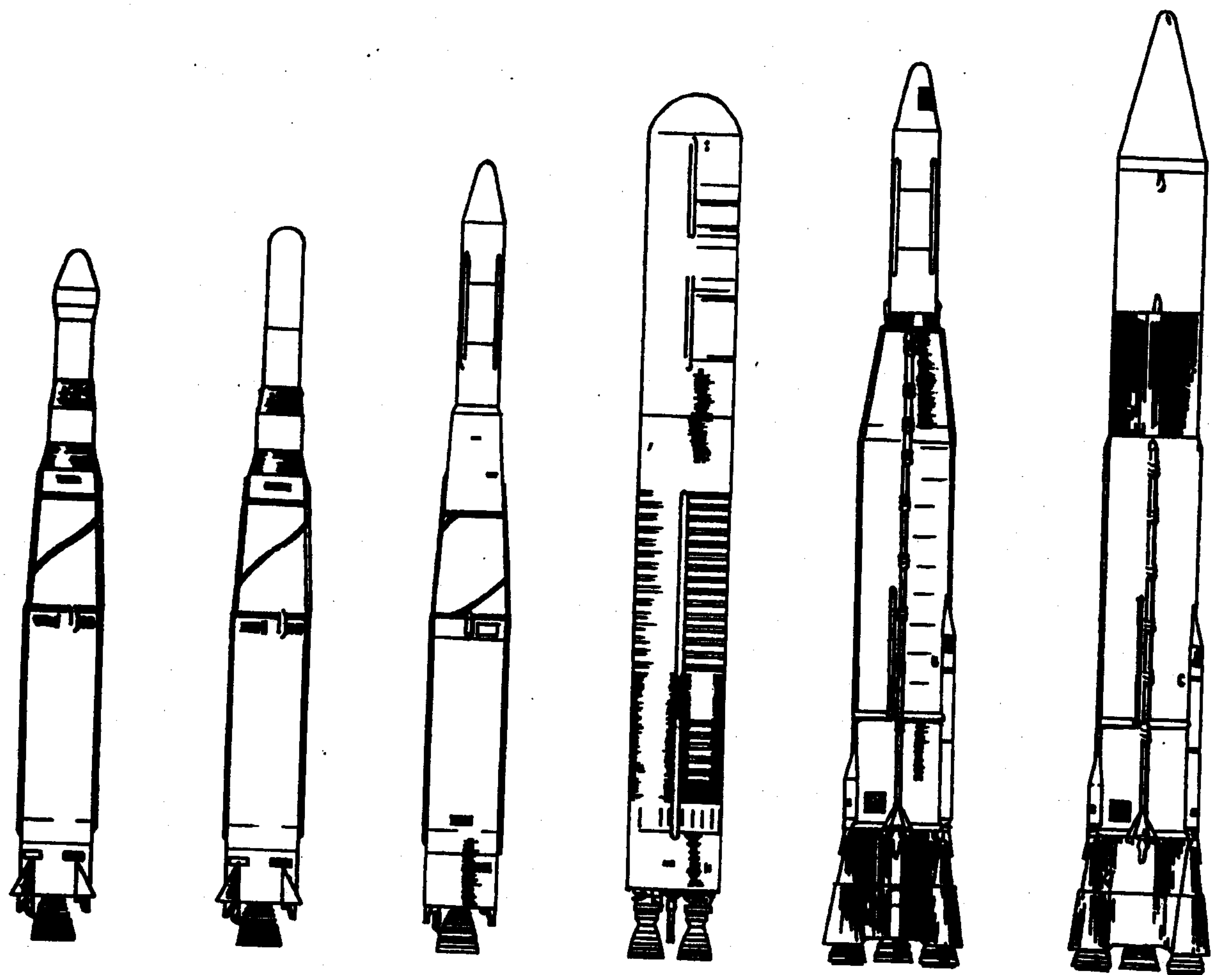


● The primary pacing factor in the accomplishment of space missions has been, and for some time will continue to be, the availability of Air Force ballistic missiles and upper stages to boost the payload vehicle. Space flight planning requires close examination of all technological areas wherein advances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

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

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



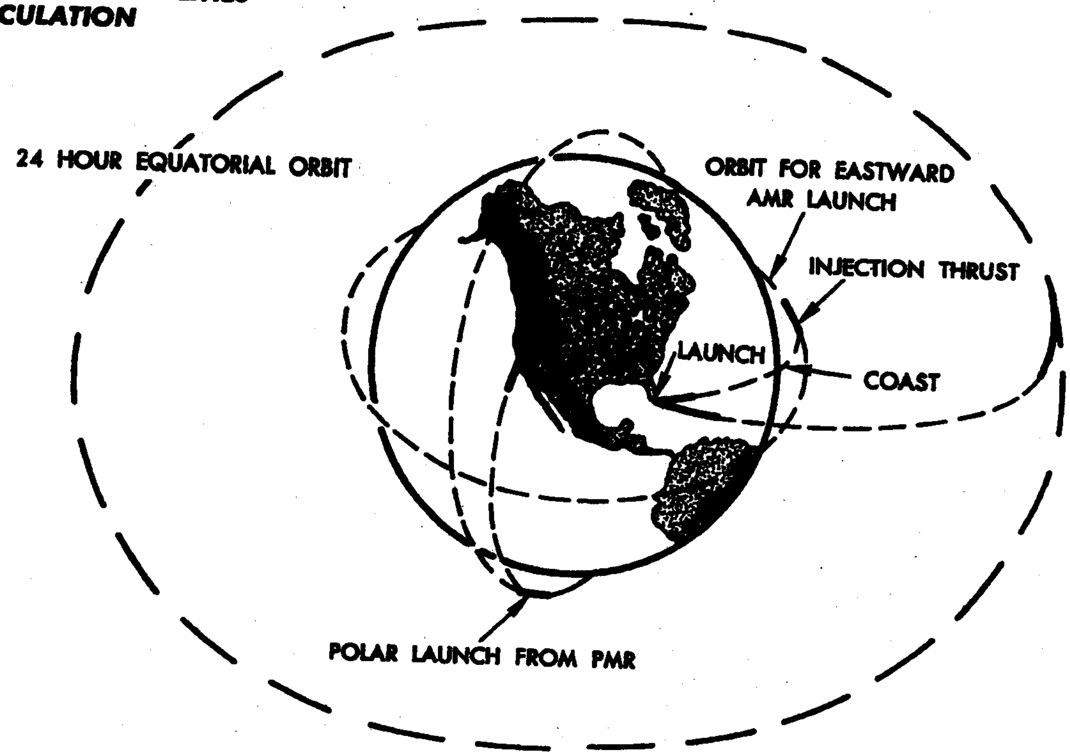


Program Vehicle Combinations

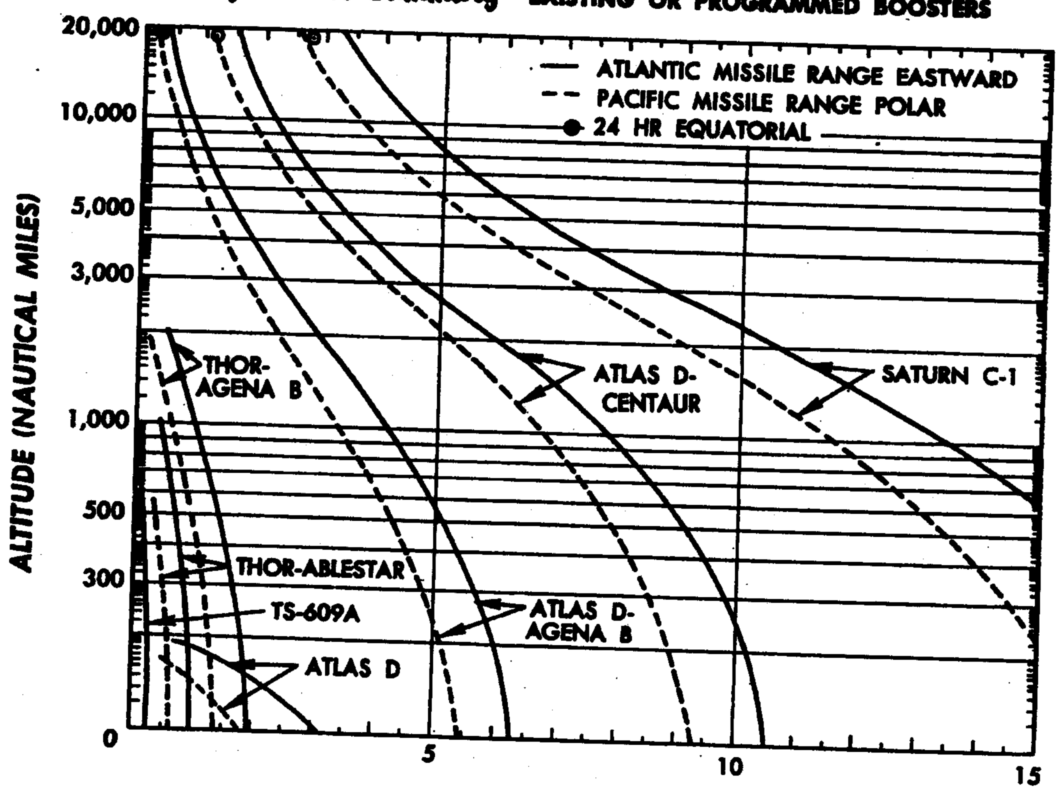
ABLE—1,—3 and —4	A — L — P
ABLE—4 and —5	D — L — P
ADVENT (Phase One)	D — H
ADVENT (Phases Two and Three)	D — N
COURIER	C — M
DISCOVERER (1 thru 15)	A — G
DISCOVERER (16 thru 19)	A — H
DISCOVERER (20 and subs)	B — J
DYNA SOAR	E — F
MERCURY	D
MIDAS (I and II)	D — G
MIDAS (III and subs)	D — J
NASA AGENA "B"	D — J
	B — J
ORBITAL INTERCEPTOR	D — N
SAINT	D — J
TIROS	A — K — P
TRANSIT 1A	A — K — P
TRANSIT 1B thru 5B	C — M
VELA HOTEL	B — M — Q

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-21	C DM-21A
Weight — dry	6,727	6,590	6,950
Fuel — RP-1	33,500	33,500	33,500
Oxidizer — Liquid Oxygen	68,000	68,000	68,000
Total	108,227	108,090	108,450
Height — feet	61.3	55.9	60.5
Engine — Rocketdyne Division of North American Aviation	MB-3 Block I	MB 3 Block II	MB 3 Block I
Thrust — lbs. (sea level)	152,000	167,000	152,000
Spec. Impulse — lb.-sec/lb. (sea level)	247.0	248	247
Burn Time — seconds	163	152	163
Guidance — Bell Telephone Laboratories series 400 or autopilot only.			
	(31) ⟨35⟩ (89)	(8) ⟨8⟩ (100)	(4) ⟨6⟩ (66)

ATLAS — Convair-Astronautics

	D Series D
Weight — wet	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-5
Thrust — lbs. (sea level)	
Booster	356,000
Sustainer	82,100
Specific Impulse — lb-sec/lb. (sea level)	
Booster	286
Sustainer	310
Guidance — Radio-inertial Mod II/III — General Electric (radar), Burroughs (computer)	
	(9) ⟨12⟩ (75)

TITAN II — The Martin Company

	E FIRST STAGE	F SECOND STAGE
Weight — dry	9,821	5,469
Fuel — N_2H_4/UDMH	84,046	20,200
Oxidizer — N_2O_4	162,800	37,702
Total	256,667	63,371
Height — feet (combined first and second stage)	89.38	
Engine — Aerojet-General Corporation	XLR87AJ-5	XLR91AJ-5
Thrust — lbs.	430,000 (sea level)	100,000 (vacuum)
Specific Impulse — lb-sec/lb.	260 (sea level)	315 (vacuum)
Burn Time — seconds	149.3	182.4
Guidance — ACSP all inertial in second stage		

UPPER STAGES

	P ABL X248-9 Allegany Ballistics Laboratory	Q 30 KS-8000 Aerojet-General Corporation
Weight — wet	60	100
Propellant — Solid	459	870
Total	519	970
Height — feet		6.5
Engine		
Thrust — lbs. (vacuum)	2,750	7,985
Specific Impulse — lb-sec/lb. (vacuum)	254	274
Burn Time — seconds	42.1	
	(8) ⟨10⟩ (80)	

Existing or Programmed Stages

SATELLITE VEHICLES

AGENA — Lockheed Missiles and Space Division

ENGINE MODEL — Bell Aerospace Systems	G YLR-81 Ba-5	H XLR-81 Ba-7	J XLR-81 Ba-9 (3)
(1) Weight — inert	1,262	1,328	1,346
Fuel — UDMH			
Oxidizer — IRFNA			
(2) Total	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	240 (4)	240 (4)
Successful flights / Launches attempted / Percentage of success	(12) ⟨17⟩ (71)	(3) ⟨4⟩ (75)	(3) ⟨4⟩ (75)

ABLE Series — Aerojet-General Corporation

	K AJ10-42 (and -118)	L AJ10-101 (and -101A)	M AJ10-104 (Ablestar)
Weight — wet	1,247	848	1,297
Fuel — UDMH	875	869	2,247
Oxidizer — IWFNA	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
Successful flights / Launches attempted / Percentage of success	(5) ⟨6⟩ (83)	(7) ⟨10⟩ (70)	(4) ⟨4⟩ (100)

N CENTAUR Convair-Astronautics

Weight — dry	2,891 (5)
Fuel — Hydrogen	—
Oxidizer — Liquid Oxygen	—
Total	32,000
Height — feet	45.5
Engine — Pratt & Whitney	LR-115
Thrust — lbs. (vacuum)	30,000
Specific Impulse — lb-sec/lb. (vacuum)	412
Burn Time — seconds	370

NOTES:

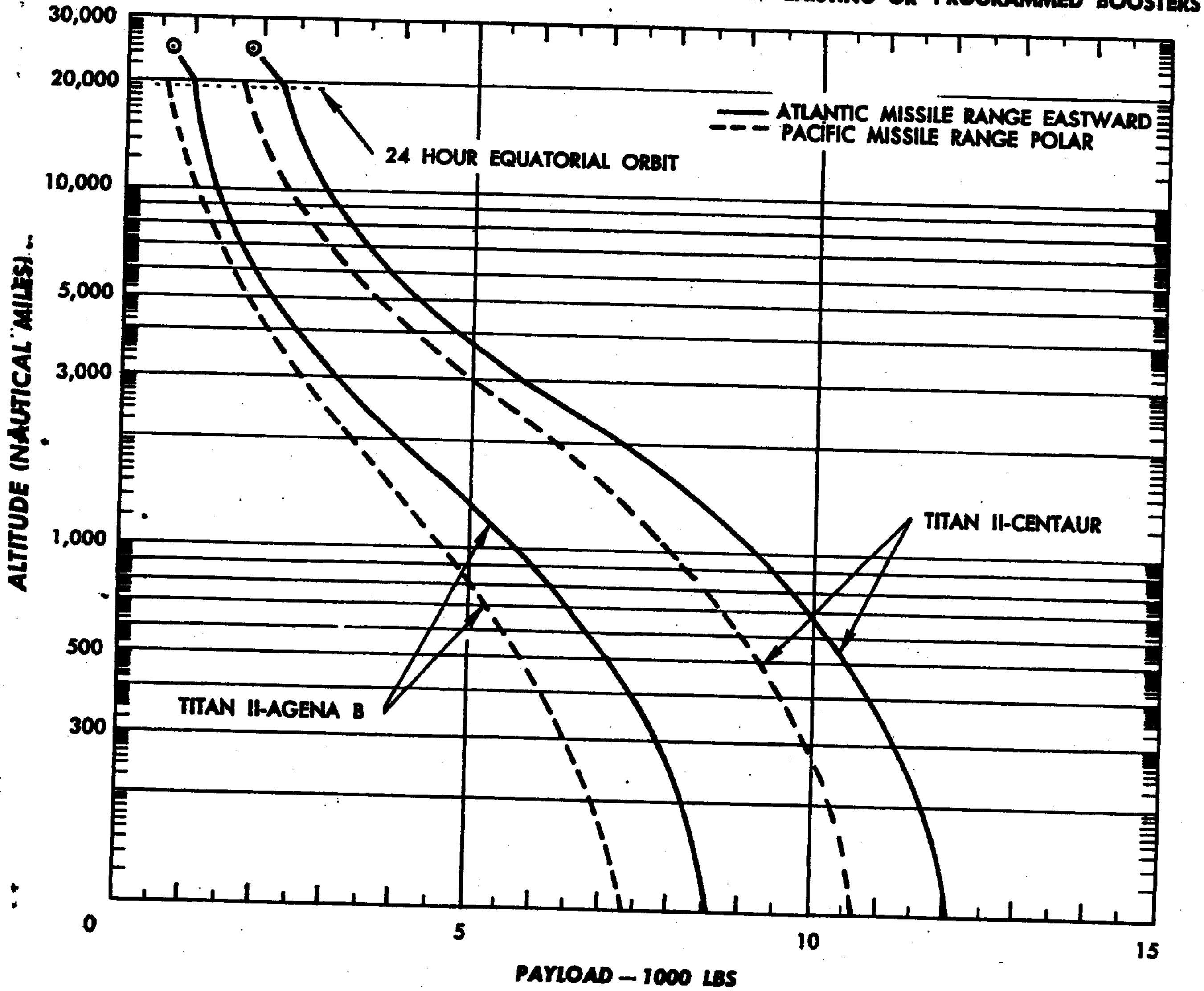
(1) Payload weight not included. Does include controls, guidance, APU and residual propellants.
(2) Does not include THOR adapter (225 lbs.) or ATLAS adapter (315 lbs.)
(3) Single restart capability
(4) Dual burn capability
(5) Changes in payload weight affect fuel and oxidizer weights, but not total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

○ Number of successful flights.

⬡ Number of launches attempted.

▭ Percentage of success.

Performance Summary — POSSIBLE COMBINATIONS OF EXISTING OR PROGRAMMED BOOSTERS



DISTRIBUTION

Headquarters, United States Air Force	69	6555th Test Wing	7
Headquarters, Air Force Systems Command	11	Space Systems Division (AFSC)	73
Strategic Air Command	15	Ballistic Systems Division (AFSC)	50
Electronics Systems Division	5	Assistant CINCSAC (SAC MIKE)	2
Air Force Flight Test Center	5	Aeronautical Chart and Information Center	1
Rome Air Development Center	1	Rand Corporation	3
Air Force Missile Development Center	1	Sacramento Air Material Area	8
Wright Air Development Division	9	6594 Test Wing (Satellite)	2
Air Force Special Weapons Center	3	6565 Test Wing (Development)	2
Air University	2	1002 Insp. Gen. Group	1
Arnold Engineering Development Center	4	3415 Technical Training Group	1
Air Proving Ground Center	5	Tactical Air Command	1
Air Defense Command	6	8th Air Force	1
Air Training Command	2	1st Missile Division	1
Air Photo and Charting Service	2	MIT, Lincoln Laboratory	3
Air Force Missile Test Center	3	Commander-in-Chief, Pacific	1
United States Air Force Academy	2	Convair AFPR	1
Continental Air Defense Command	6	1381st Geodetic Survey	1
Air Technical Intelligence Center	1	Air Force Staff College	1