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SPACE

Systems Divi

ACTIVITIES

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FOREWORD

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RETURN TO
HQ USAFHRC
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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 June 1961

Monthly Summary of SPACE SYSTEMS DIVISION ACTIVITIES

MAY 1961

FOREWORD

During this month a major effort was made to ready the MIDAS III vehicle, payload and tracking network for the scheduled 20 June launch. The BIOASTRONAUTICS Orbital Space System (BOSS) Development Plan has been approved by the Air Force Systems Command. This program will be an important step in our conquest of space. The TRANSIT 4A launch vehicles have been installed on stand and are ready to support the 27 June launch.

Significant changes have been made to the permanent portion of the BLUE SCOUT and RANGER Program report to reflect the types of payloads these programs will support. The format of the report has been changed to coincide with the current organization of the Space Systems Division, i.e. SATELLITE SYSTEMS, LAUNCH VEHICLES, and TECHNICAL DEVELOPMENT. The programs listed behind each of these dividers are the responsibility of the respective deputies. A Table of Contents has been provided on the FOREWORD Divider for the user's convenience.

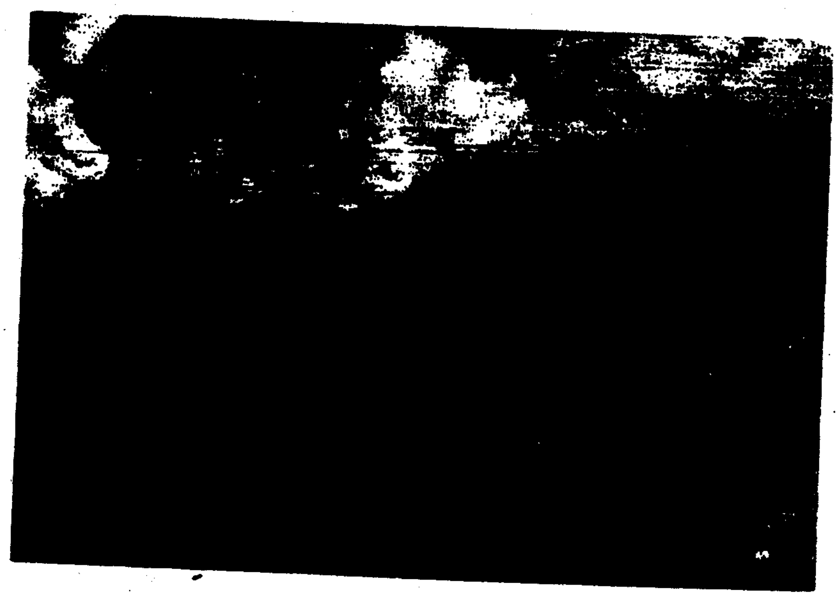
The Monthly Summary of Space Systems Division Activities has been determined to be a Group 3 document in accordance with paragraph 6, AFR 205-2. This categorization applies to all previous issues. Holders of these documents are responsible for acting promptly to place the correct notation on the document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

for O. J. RITLAND
Major General, USAF
Commander

This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18 U.S.C., Section 793 and 794. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

SATELLITE

SYSTEMS



DISCOVERER
MIDAS
BIOASTRONAUTICS
BLUE SCOUT
SAINT
VELA HOTEL

The DISCOVERER Program consists of the design, development and flight testing of two-stage vehicles, using the Douglas DM-21 Space Booster as the first stage and the AGENA as the second stage, satellite vehicle. The program was established early in 1958 under the direction of the Advanced Research Projects Agency, with technical management assigned to Space Systems Division. 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.

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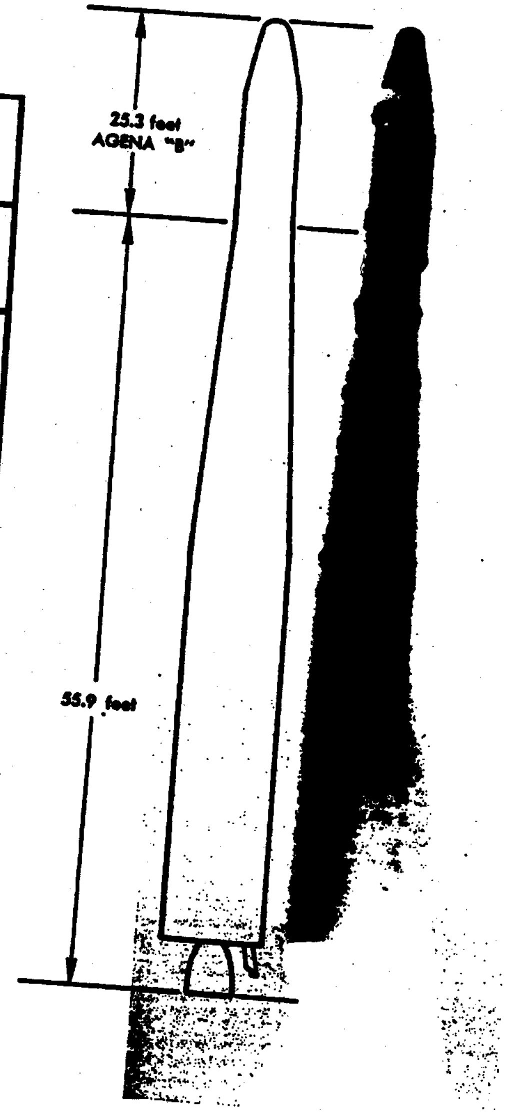


PROGRAM OBJECTIVES

(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 orbital operational control exercised by the Satellite Test Center, Sunnyvale, California.

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

SECOND STAGE	AGENA "B"
Weight—	
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

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.
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.

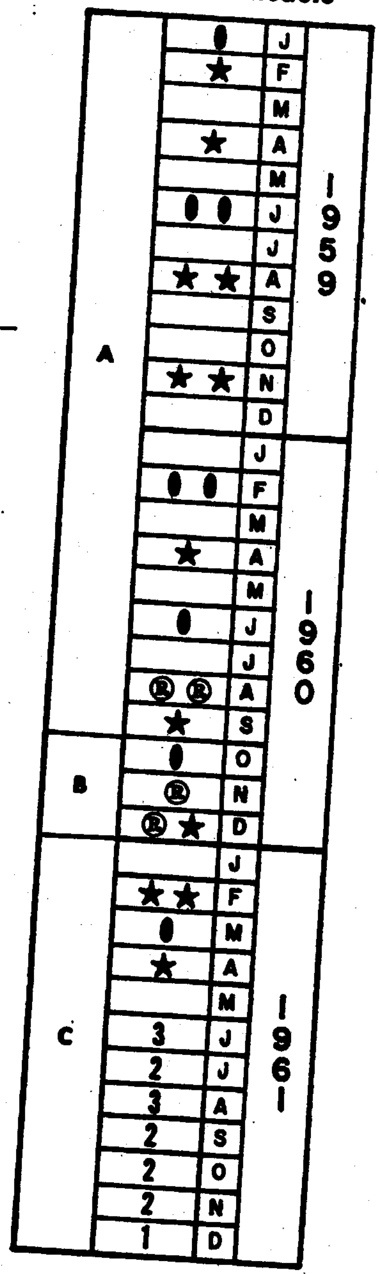
†Primary Tracking Stations (have command capability)

Equipment

A. General Purpose Computer(s) and Support Equipment
B. Data Conversion Equipment
C. Master Timing Equipment
D. Control and Display Equipment
E. BTL Tracking Station (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



★ Attained orbit successfully.

Ⓡ Capsule recovered.

⬮ Failed to attain orbit.

Flight History

DISCOVERER No.	DM-21 No.	AGENA No.	Flight Date	Remarks
DISCOVERER FLIGHTS 0 THRU XX ARE ON PAGE A-6				
XXI	261	1102	18 February	*Attained orbit successfully. Non-recoverable, radio metric data gathering MIDAS support flight.*
XXII	300	1105	30 March	*Launch, ascent, separation, coast and orbital stage ignition normal. Orbital velocity was not attained because of an AGENA hydraulic malfunction.*
XXIII	307	1106	8 April	*Attained orbit successfully. Loss of control gas prevented proper positioning of the satellite for capsule re-entry. Capsule was ejected into new orbit on re-entry pass.*

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 (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.*

Flight Test Progress

• DISCOVERER XXIV will be launched from Pad 4, Complex 75-3, Vandenberg Air Force Base, early in June. (S)

• DISCOVERER XXV will be the first vehicle launched from the newly converted Pad 1, Complex 75-1, at Vandenberg Air Force Base. This pad has been converted from a THOR IRBM to a DISCOVERER launch facility. Required modifications include extending the missile shelter to accommodate the DM-21/AGENA combination and adding the DISCOVERER fuel transfer, ground support and launch control systems. The launch of DISCOVERER XXV is scheduled for mid-June. (S)

Parameter	Discoverer XXIV	Discoverer XXV
Apogee, statute miles	382	290
Perigee, statute miles	190	150
Eccentricity	0.023	0.017
Period, minutes	93.8	91.6
Inclination Angle, degrees	81.7	81.75
Recovery Pass (nominal)	63	64

TABLE I. DISCOVERER XXIV and XXV Programmed Orbital Parameters

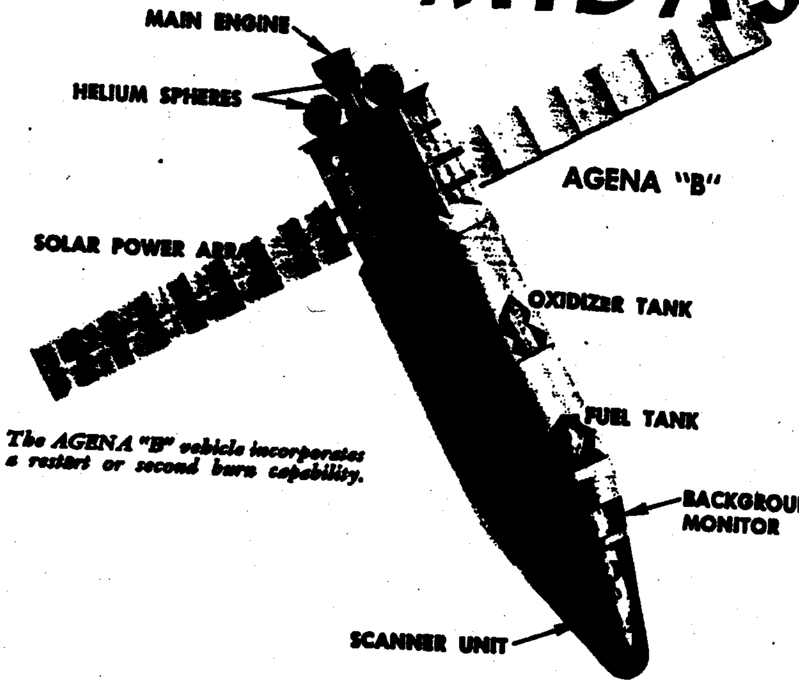
• Both DISCOVERER XXIV and XXV will carry recoverable payloads with recovery planned after four days in orbit. Programmed orbital parameters for the two flights are given in Table I. (S)

Space Research Experiments

• Extensive equipment for space research will be carried on DISCOVERER XXV. Equipment furnished by the Geophysical Research Directorate will include a cosmic ray monitor, a micrometeorite detector, two atmospheric density gages and associated electronics. This module and its instruments will replace an AGENA vehicle engine access door on DISCOVERER XXV. Data from this equipment will be telemetered to tracking stations during the flight. Several devices for measuring and determining the effects of space radiation will be carried in the capsule and will be recovered for later study after four days in orbit. Small discs of gold, nickel, titanium, magnesium, iron and lead will be attached to the capsule and will be analyzed after exposure to space radiation. Dosimeters and film packs will also be included in the capsule. (C)

MIDAS

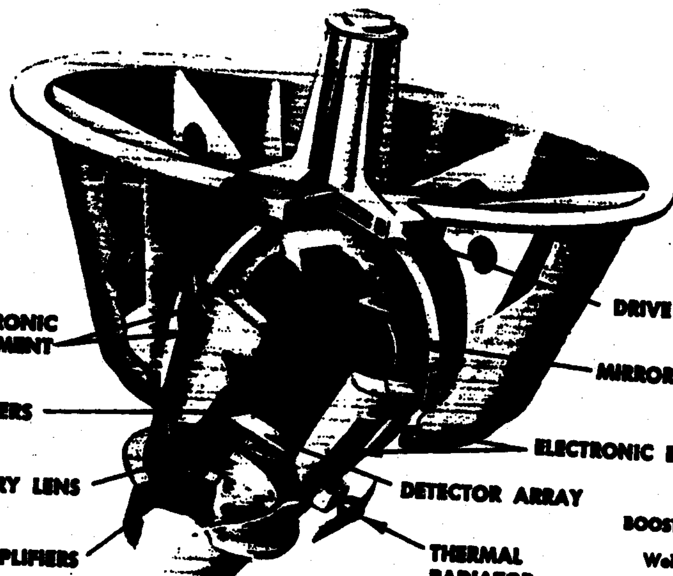
SECOND STAGE	AGENA "B"
Weight—	
Inert	1,763
Payload equipment	1,641
Orbital	3,404
Impulse Propellants	12,950
Fuel (UDMH)	
Oxidizer (IRFNA)	
Other	758
GROSS WEIGHT (lbs.)	17,112
Engine	XLR81-Ba-9
Thrust, lbs. (vac.)	16,000
Spec. Imp., sec. (vac.)	290
Burn Time, sec.	240
Restart Provisions	Yes

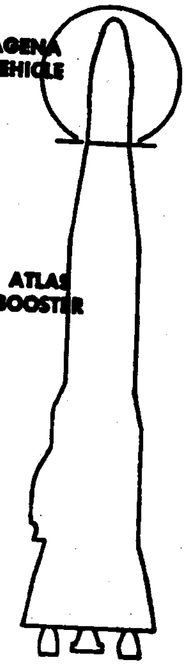


The AGENA "B" vehicle incorporates a restart or second burn capability.

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

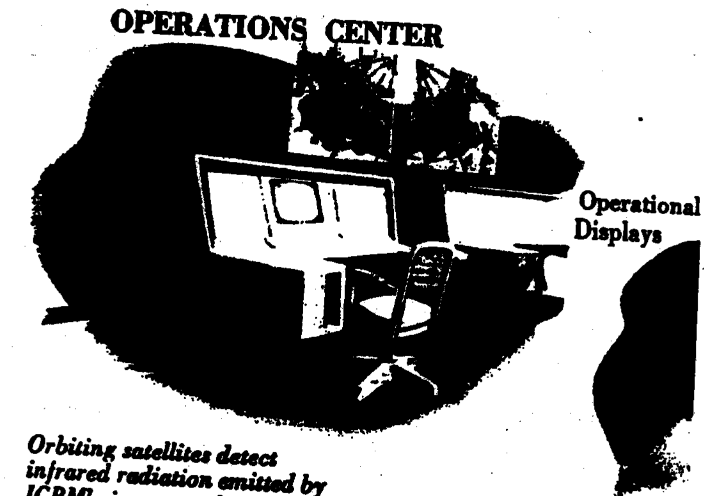
The MIDAS Program was included in Weapon System 117L when WS 117L was transferred to the Advanced Research Projects Agency. ARPA subsequently separated WS 117L into the DISCOVERER, SAMOS and MIDAS Programs, with the MIDAS objectives based on an infrared early warning system. The MIDAS (Missile Defense 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.

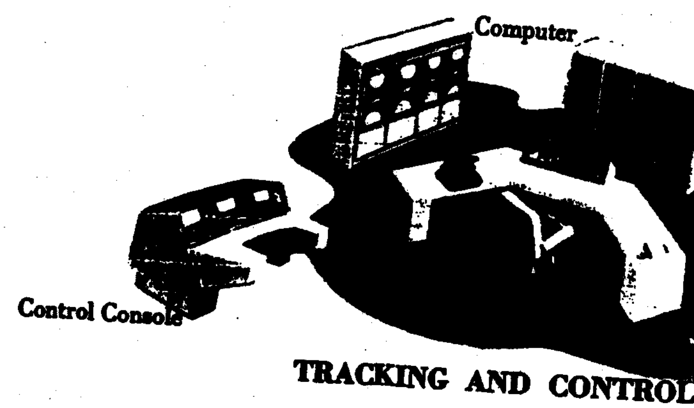
TECHNICAL HISTORY

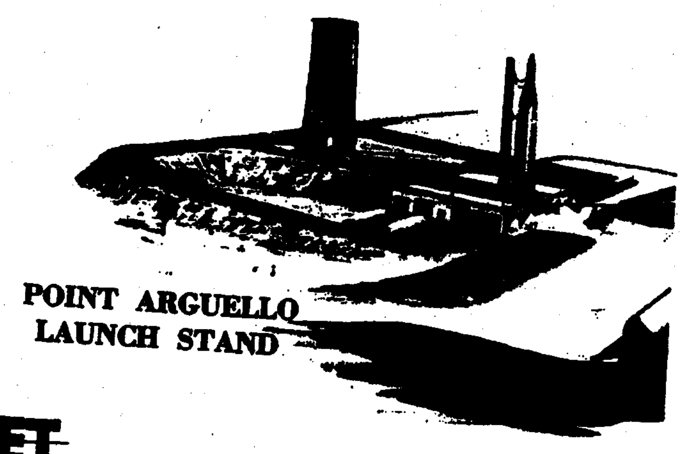
The MIDAS infrared early warning payload is engineered to use a standard launch vehicle configuration. This consists of an ATLAS missile as the first stage and the AGENA vehicle, powered by a Bell Aircraft rocket engine as the second, orbiting stage. The final configuration payload weight will be approximately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



Orbiting satellites detect infrared radiation emitted by 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 and controls the status of the orbital network and the ground environment. The Point Arguello stands are used to launch the MIDAS satellites into polar orbits.





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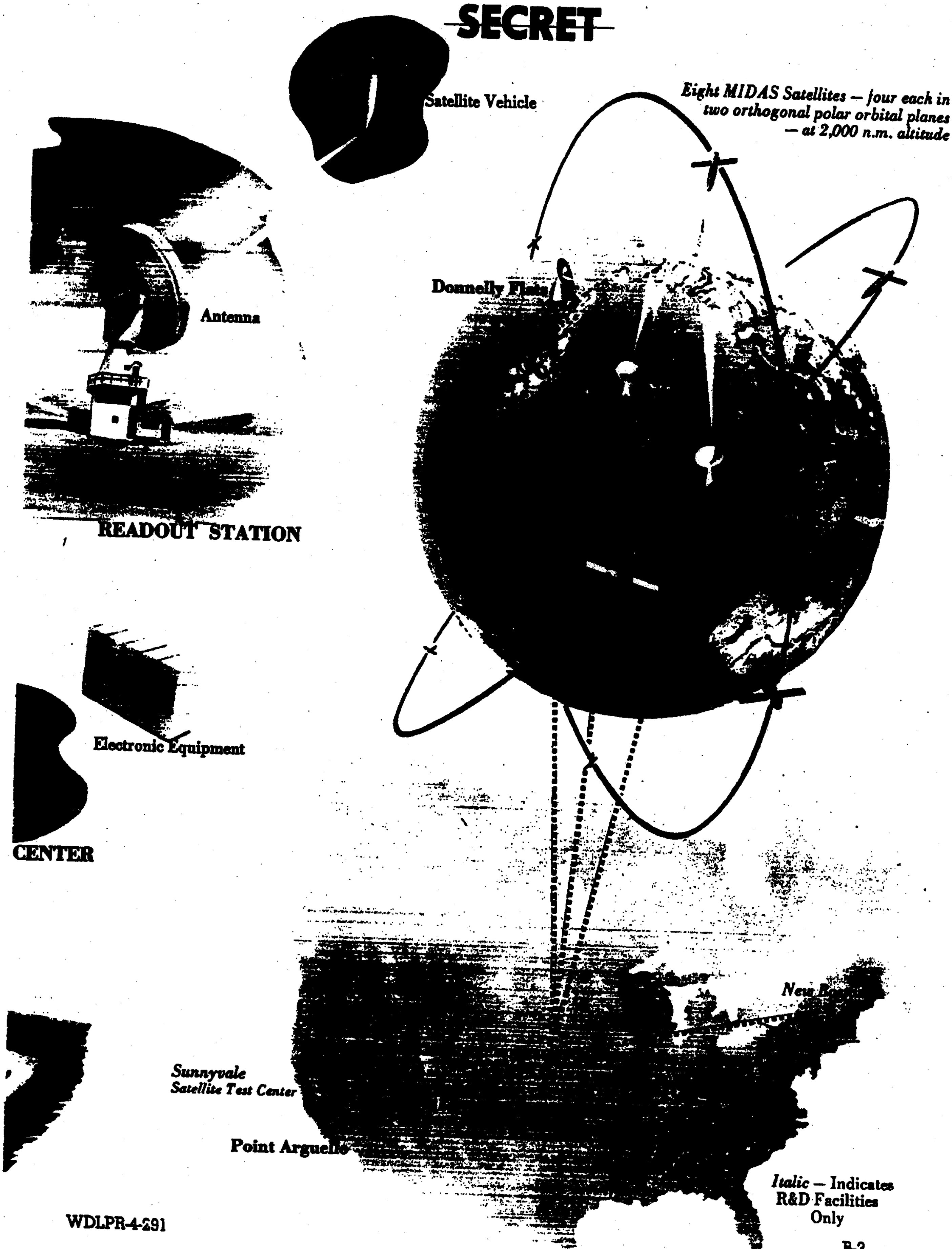
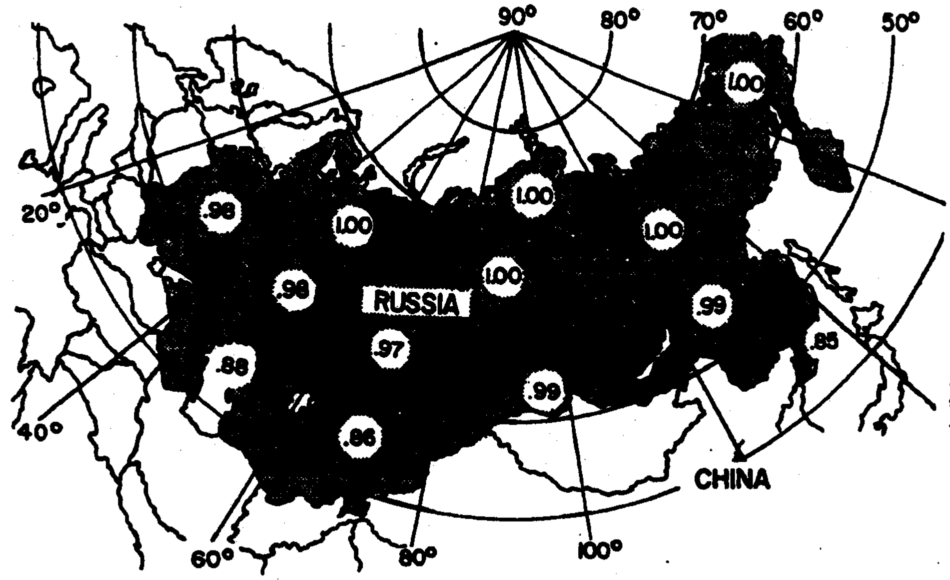
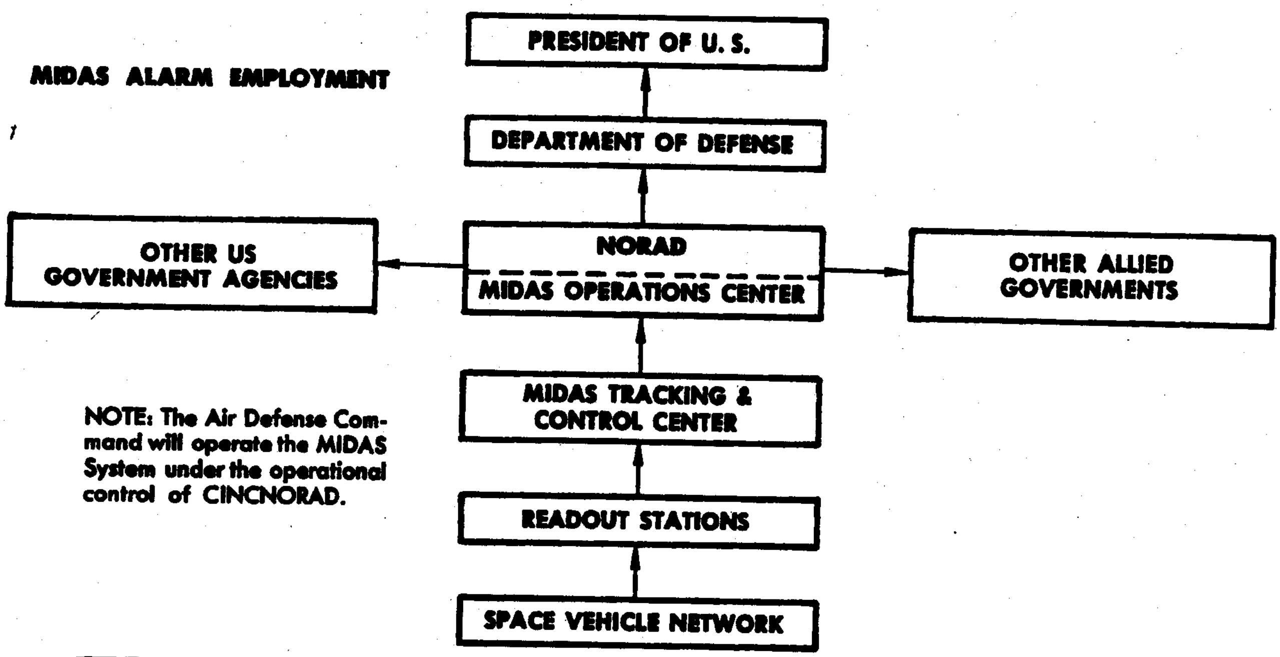

Satellite Vehicle
Eight MIDAS Satellites — four each in two orthogonal polar orbital planes — at 2,000 n.m. altitude
Antenna
READOUT STATION
Electronic Equipment
CENTER
Sunnyvale
Satellite Test Center
Point Arguello
Italic — Indicates R&D Facilities Only



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

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

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

Monthly Progress — MIDAS

Program Administration

• The MIDAS Operational system concept is being reviewed to define in greater detail, based on present knowledge, the operational philosophy and requirements for each system element. (U)

• The Space Systems Division is presently analyzing and evaluating a Lockheed Missiles and Space Division proposal for simplification of the MIDAS Series IV prototype system. Primary emphasis is placed on vehicle simplification with ancillary reduction of complexity in the design and manufacture of support, checkout, and launch control equipment. Substantial increases in reliability and life expectancy are proposed benefits of this simplified system. Some of the concepts of the proposed simplified system are:

1. Twelve satellites randomly spaced in orbit, four in each plane, two would orbit in one direction and the other two would orbit in the opposite direction.

2. All satellite equipment would operate on a continuous duty cycle.

3. Provisions for orbital adjustment would not be required.

4. The solar auxiliary power array would be static following its initial extension — no constant adjustment to provide maximum sun exposure.

5. The attitude control requirements would be reduced.

6. All data transmission would be accomplished on UHF.

7. No command system would be required, eliminating the need for the orbital programmer and the power control unit.

8. Reduced tracking accuracy requirement of 20 nautical miles would allow tracking to be accomplished with the 60-foot tracking and data acquisition antenna by angle tracking only. (C)

While the proposal has many desirable and attractive possibilities, it must be carefully analyzed as to impact on mission capability, vulnerability, cost, schedules, productibility and logistic support, etc., to positively assure that this approach is optimum for this time period. (C)

Technical Progress

Booster

• ATLAS 97D is installed on Pt. Arguello Pad No. 2 and checkout is on schedule. This booster originally went "on stand" on 9 December and successfully completed its flight readiness firing on 9 March. (C)

Second Stage Vehicles

• The AGENA vehicle for the MIDAS III flight completed systems test in the Vandenberg Air Force Base Missile Assembly Building (MAB). Changes incorporated during or subsequent to the tests included the following:

1. The horizon sensors were modified to avoid possible sun saturation. New sensor harnesses and

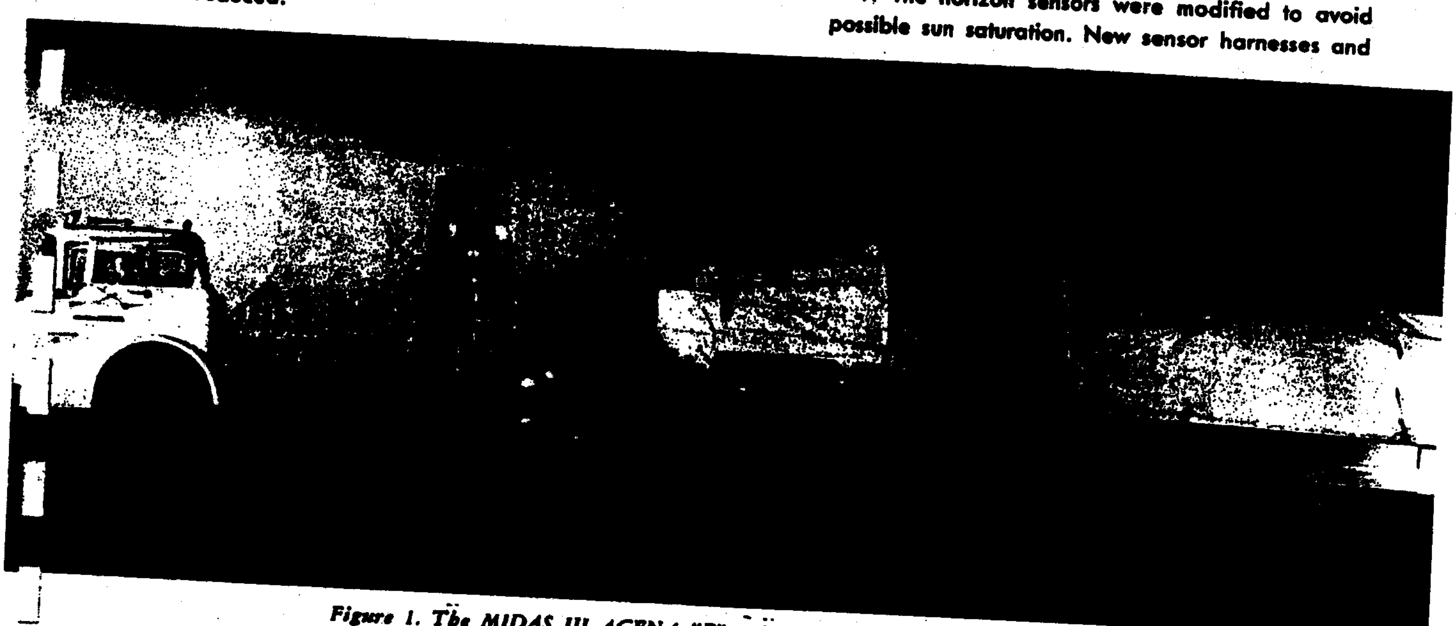

Figure 1. The MIDAS III AGENA "B" vehicle in transit to Point Arguello Launch Complex No. 1. ATLAS 97D is on Stand 2 waiting for the satellite vehicle and payload. This launch is scheduled for 20 June.

heads were installed permitting the vehicle to be satisfactorily stabilized in pitch even though one sensor was scanning the sun.

2. A propellant tank venting problem required that a propellant tank vent and engine drain line nullifiers be installed.

3. A power control unit access door was installed that permits the emergency reset timer to be set without removing the power control unit. (C)

• On 12 May, the satellite vehicle completed a successful simulated countdown and flight, and on 24 May following a series of final alignments, was delivered to Pad 2 of Pt. Arguello Launch Complex No. 1. The launch in now scheduled for 20 June. (S)

• The AGENA vehicle for the MIDAS IV flight is completing the integrated systems tests at the Lockheed manufacturing facilities. Upon completion of system tests the vehicle will be transported to the Santa Cruz Test Base for flushing only. Since MIDAS vehicles are being produced under the "block" concept, every modification made to MIDAS III is being made to MIDAS IV and V vehicles. The MIDAS IV launch could be delayed because of possible conflict with a SAMOS vehicle in the Vandenberg Air Force Base missile assembly building. (C)

Infrared Scanners

• A contract is being negotiated with the Electronics Corporation of America, Cambridge, Massachusetts, for the development and improvement of reliability of lead-sulfide detectors. It is anticipated that negotiations will be completed and a contract awarded early in June. (U)

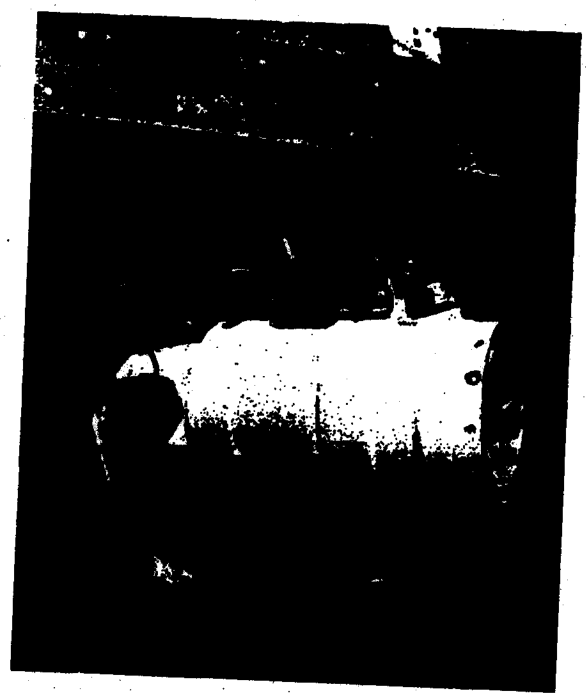

Figure 2. MIDAS III payload and AGENA vehicle (below) during system run at Vandenberg Air Force Base. New horizon sensor (right) installed on the MIDAS III AGENA vehicle.

Aerospace Ground Equipment

• The required ground equipment to support the MIDAS III test has been installed and checkout has been completed at the Hawaii tracking station, the Southeast Africa station, and the telemetry and control facilities. The shipboard equipment has been installed aboard the downrange tracking ships and is currently being checked out. (C)

• Noise has been encountered during daytime transmission over the New Hampshire tracking station's data circuit and is being investigated. The MIDAS Intercept Assembly Register (MIAR) is being modified; as soon as these modifications are completed, checks will be made with the GP-1 PAM/FM ground station. Validation and acceptance of the computer program awaits resolution of the equipment and programming problems. (U)

• Acceptance of the computer program at the Satellite Test Center by operation and integration of the GP-1 PAM/FM ground station has not been completed. Because of the existence of many computer programming problems, acceptance is forecast for mid-June. Problems associated with the data line translators will be corrected early in June. U

Facilities

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• Final design plans for the MIDAS Technical Support Building at the New Hampshire tracking station were completed on 19 May. Contract documents will be turned over to the construction agency on or about 9 June with contract award scheduled for 30 June. (U)

• Preliminary design of the Ottumwa, Iowa, tracking and control center technical facilities was completed on 26 May. The preliminary design review will be held on 9 June. Authorization to proceed with the design of the Ottumwa base support facilities rehabilitation was given to the AFRCE at Omaha, Nebraska on 7 May. (C)

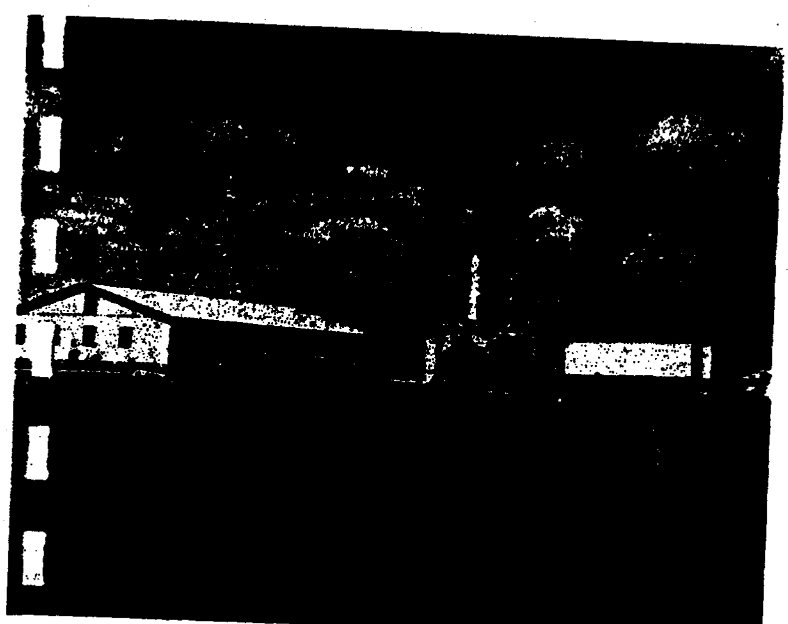

Figure 3. Construction progress at the Southeast Africa tracking station (Atlantic Missile Range Station 13) near Pretoria. The tracking station support buildings and the power vans (left) and the communication building (left) and power supply building (right) (above) are nearing completion. This station will be ready to record AGENA second-burn data on the MIDAS III flight.

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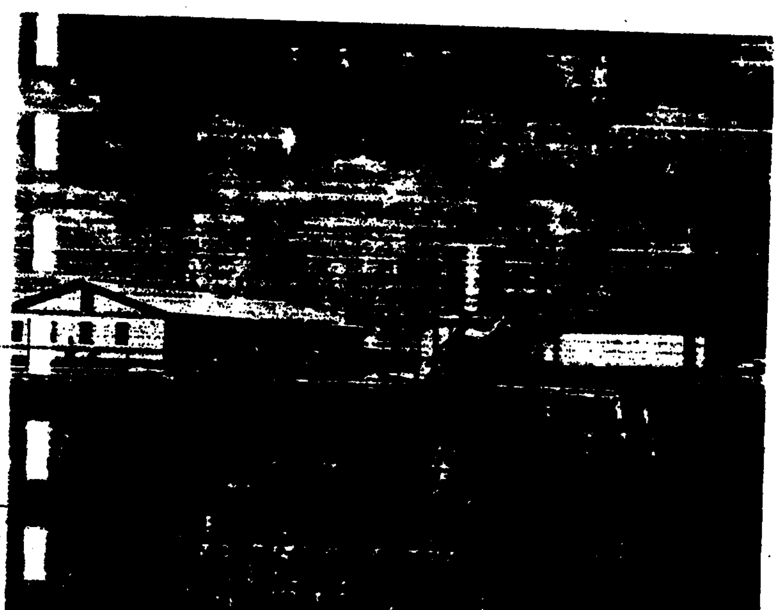

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~~CONFIDENTIAL~~

BIOASTRONAUTICS

ORBITING SPACE CAPSULE

Program History

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

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

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

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

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

Program Concept

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

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

Monthly Progress — BIOASTRONAUTICS

Cellulose Space Radiation Studies Started

• An exploratory investigation of the possible effects of space radiation below the lower Van Allen belt upon cellulose samples is being undertaken. In particular, the behavior of the hydroxyl bonds and linkages in samples exposed to space radiation will be compared to the corresponding behavior in similar samples exposed to gamma radiation in the laboratory and to unexposed samples. The comparison is to be made on the basis of infrared spectra. The samples will be placed in space on a "space available" basis in conjunction with the DISCOVERER Program. This study of organic material is of biological interest since the hydroxyl is common to many life processes. (U)

BIOASTRONAUTICS ATLAS Passenger Pod No. 1.

• Passenger Pod No. 1, when attached to the side of an ATLAS Series "E" missile, will carry five BIOASTRONAUTIC experiments over a ballistic trajectory. These experiments consist of the supercritical cryogenic fluid storage system, the gravity independent photosynthetic gas exchanger, the zero gravity potassium superoxide gas diffusion experiment and two tissue equivalent radiation experiments. The pod and its experiments were described in the March and April "Space Systems Division Activities" Report. (U)

• Pod No. 1 was scheduled for flight on ATLAS 18E on 19 May. At T-104 minutes in the countdown, passenger pod personnel were informed that they would not be allowed to eject the pod from the missile as previously planned and were required to disarm the ejection mechanism. Losing the capability to eject meant an intermittent loss of valuable data since the pod antenna would be shielded by the booster section of the vehicle during portions of the flight. After several holds imposed by minor vehicle difficulties, downrange tracking reported technical difficulties. The launch was scrubbed at approximately T-30 minutes in the countdown and rescheduled for 26 May. (C)

• On 25 May, passenger pod personnel were ordered to remove Pod No. 1 from ATLAS 18E. ATLAS 18E was launched at approximately 2115 hours on 26 May and all major flight objectives were accomplished. The ATLAS Passenger Pod Program is presently being re-evaluated. It has not yet been decided whether or not Pod No. 1 can be flown at a later date. (C)

BIOASTRONAUTICS ORBITAL SPACE SYSTEMS

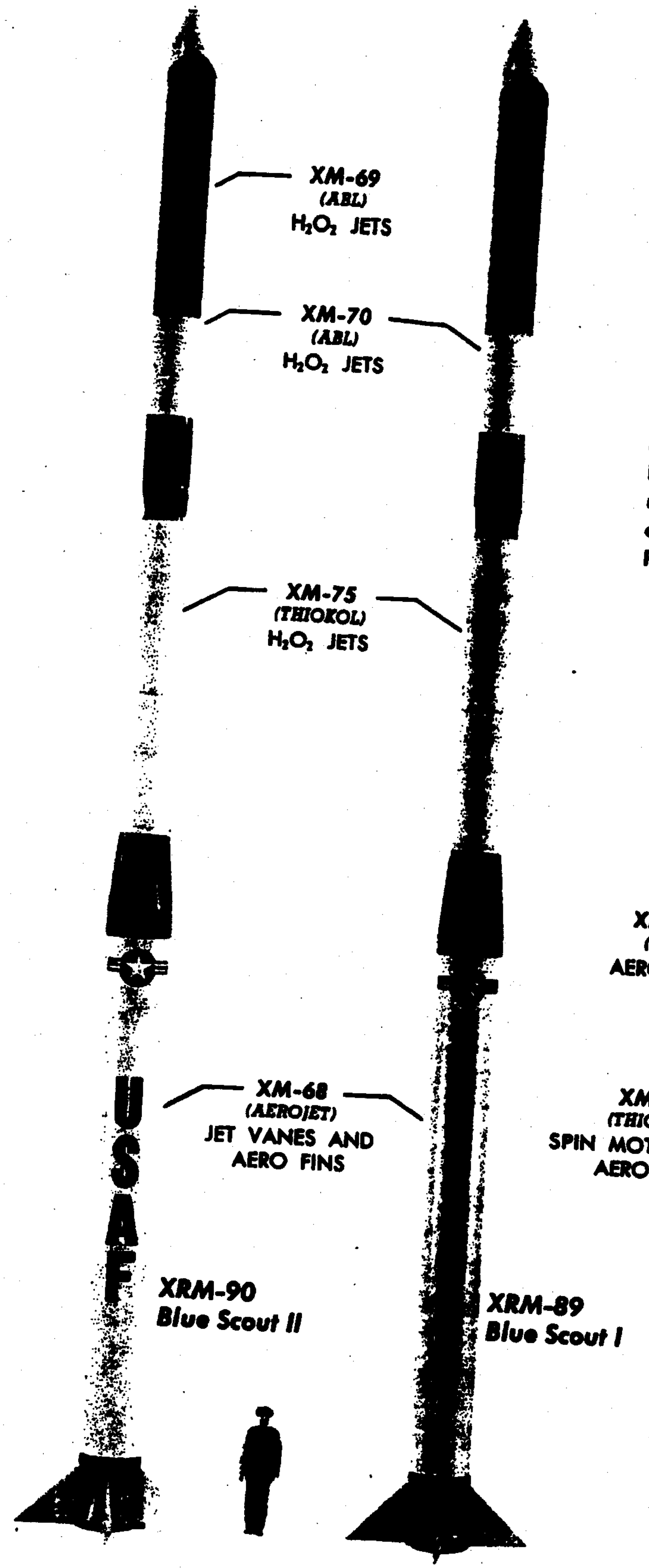
• The BIOASTRONAUTICS Orbital Space Systems (BOSS) Development Plan was reviewed in Headquarters Air Force Systems Command on 8 May. It was approved as an Air Force Systems Command Plan and forwarded to Headquarters USAF for final approval and funding. (C)

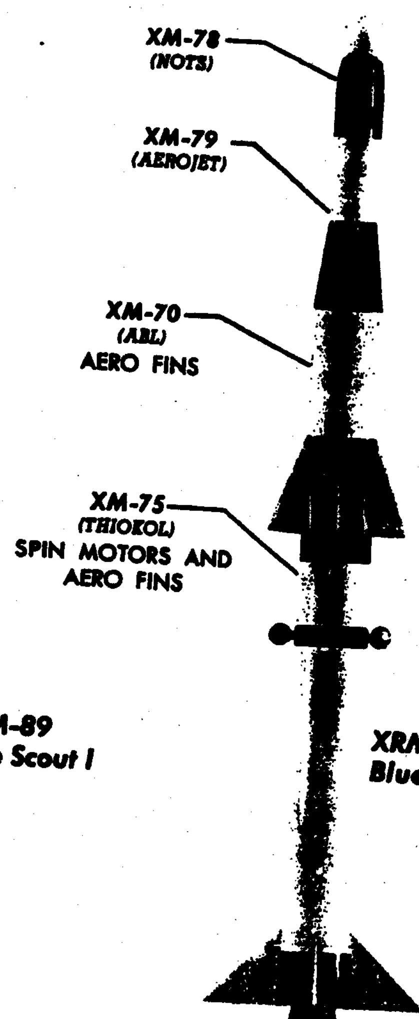
BLUE SCOUT

(Hyper-Environmental Test System)

Program Description

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





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

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

Performance

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

Missions

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

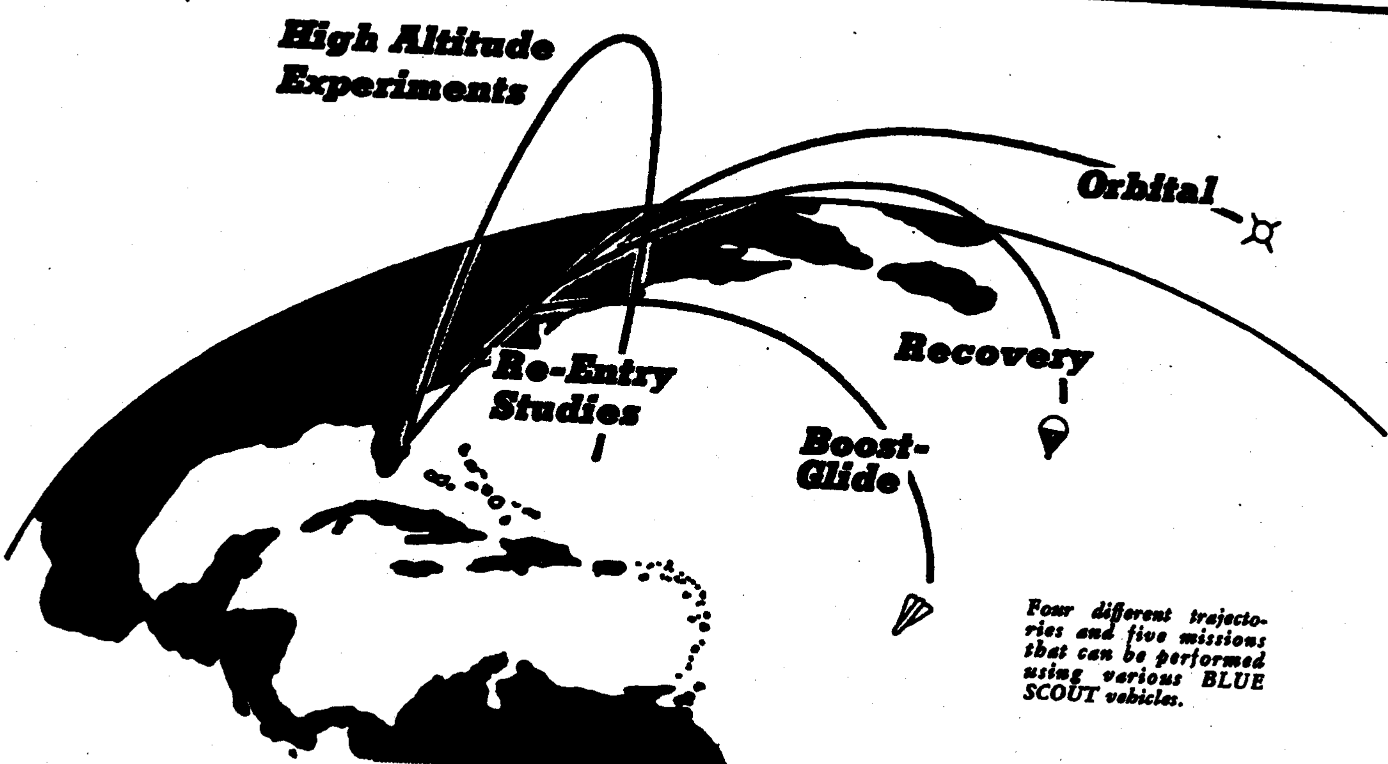
SAINT: Two BLUE SCOUT vehicles required, first launch from Atlantic Missile Range in mid-1962.

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

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

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

MISS: Sixteen BLUE SCOUT vehicles required, first launch from Pacific Missile Range in mid-1962; interval between first four launches of two months, with



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

four month intervals between subsequent launches. (The MISS program provides data for SAMOS operations).

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

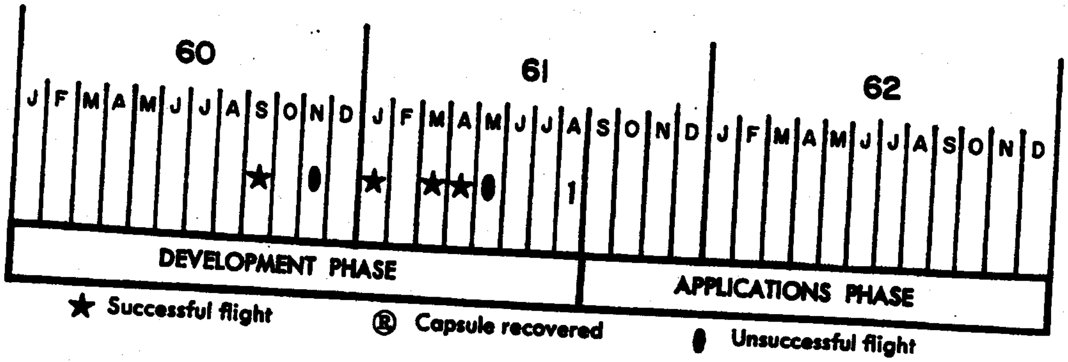
BEANSTALK: This program is under the management of Electronics Systems Division. Present information indicates that ten BLUE SCOUT JUNIOR vehicles will be furnished to Electronics Systems Division for launch operations from Pacific Missile Range during 1962.

Program Management

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

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

Launch Schedule



Flight History

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

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

Monthly Progress — BLUE SCOUT

Program Administration

• A Meteorological Information Satellite System (MISS) Development Plan was published, and briefings were prepared for presentation to higher headquarters. The MISS Program will use BLUE SCOUT vehicles for placing the 150-pound MISS payload into a 400 nautical mile orbit. (S)

• The section of the SAINT contract work statement pertaining to BLUE SCOUT support was received and comments were furnished. Two BLUE SCOUT vehicles will be used to place reflector targets in orbit for the SAINT Program during the BLUE SCOUT Application Phase. (C)

• As requested by Headquarters USAF, information on proposed methods for BLUE SCOUT support of the TRANSIT Program has been furnished Headquarters AFSC. (C)

• A Program Requirements Document for the ASSET Program was received from Aeronautical Systems Division. This document lists all of the test support requirements for the Atlantic Missile Range flight testing of seven ASSET boost-glide models with BLUE SCOUT booster support. The document was reviewed and forwarded to the Atlantic Missile Range with appropriate comments. (U)

• NASA has requested BLUE SCOUT vehicle D-8 support for an August orbital test of a payload that would check out the airborne and ground-based components of the MERCURY tracking and communications network. (C)

• Funding continues to be critical on BLUE SCOUT. No funds have been released to provide for long leadtime production requirements; likewise, no funds have been made available to meet current requirements for completion of the final development test vehicle (D-8). Notification of funding for the NASA MERCURY payload flight has been received. (C)

Flight Test Progress

• The sixth BLUE SCOUT vehicle (D-6) was launched from the Atlantic Missile Range at 1600Z on 9 May. The guided, three-stage BLUE SCOUT I (XRM-89) vehicle was programmed to boost its 444-pound payload on a probe trajectory with an apogee of 874 nautical miles with impact planned to occur 1,181 nautical miles downrange. Lift-off, first stage burning and separation were normal. Second-stage burning was normal for approximately 18 seconds. At T plus 81 seconds the vehicle rapidly turned left of the programmed course and a range safety destruct signal was transmitted. Indications are that a control motor failed to function as a result of a power lead which became disconnected or broken during second stage burning, causing the vehicle to veer off course. Vehicle impact occurred approximately 160 nautical miles downrange. Seventy-five percent of the combined NASA-Air Force guided SCOUT-type vehicle launches have been successful. (U)

• A contractor, NASA, and Air Force review group has been established to investigate the D-6 BLUE SCOUT flight test failure. The initial meeting of this review group will be held on 6 June. (U)

• The launch of the seventh BLUE SCOUT vehicle (D-8) is scheduled for early August. A guided four stage Air Force SCOUT (XRM-92) will be launched on an azimuth of 073 degrees from the Atlantic Missile Range and will place a 150 pound payload into a 300 nautical mile circular orbit with a 32.5 degree inclination angle for checkout of the MERCURY tracking network. (C)

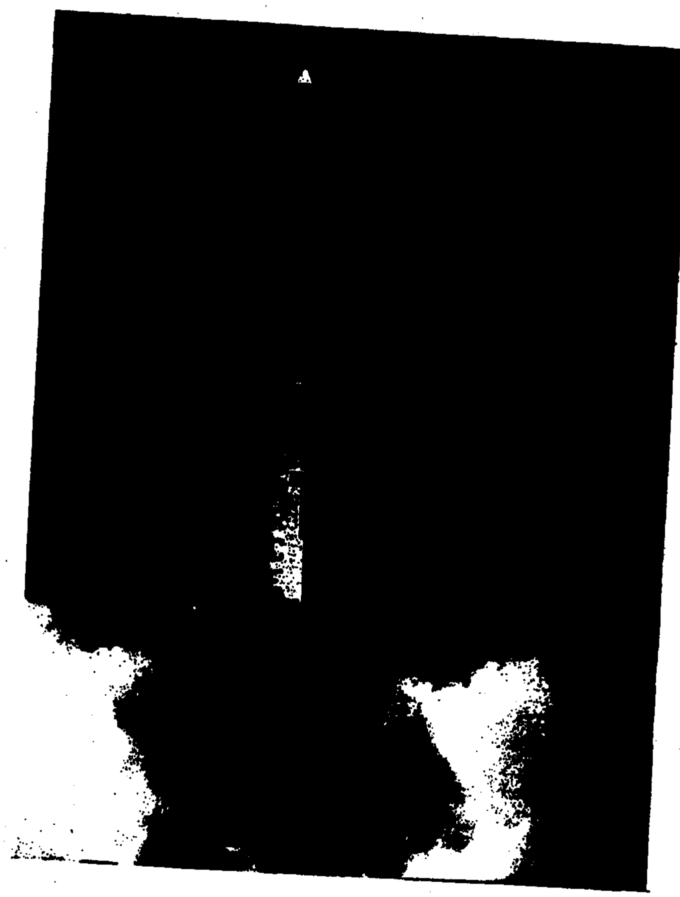
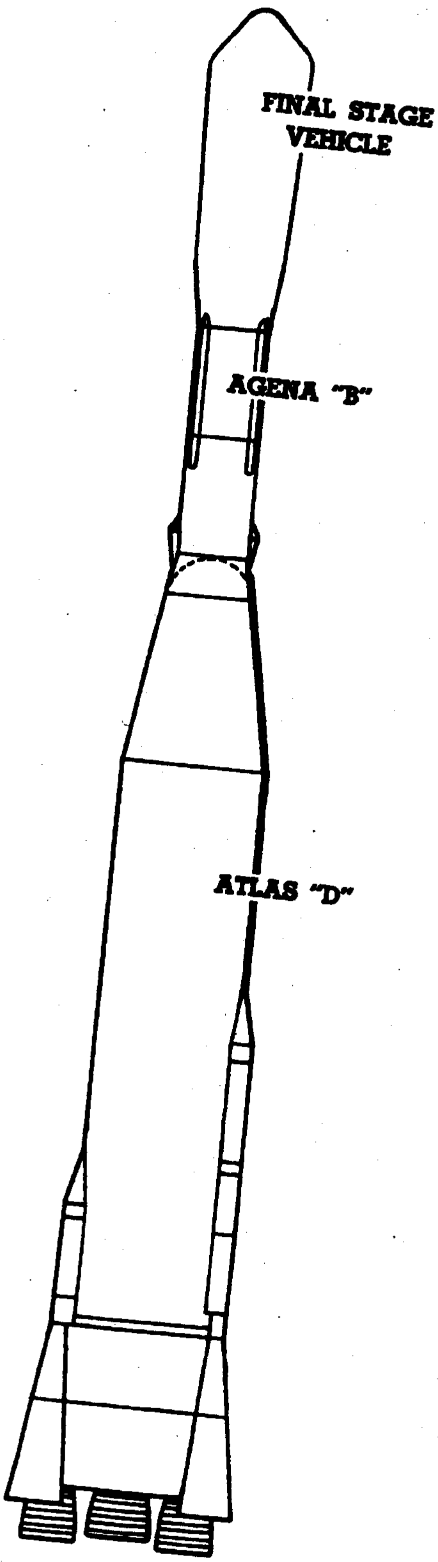


Figure 1. Launch of the sixth BLUE SCOUT vehicle from Atlantic Missile Range Complex 18 on 9 May. This was a guided XRM-89 vehicle.

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)

SAINT



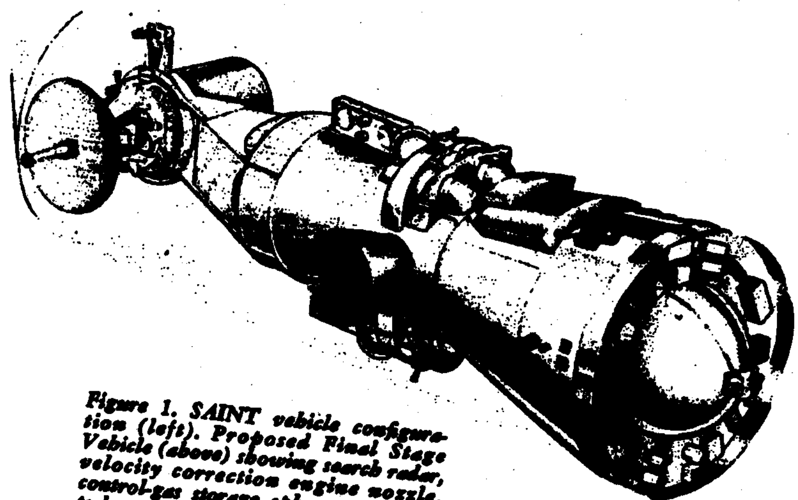


Figure 1. SAINT vehicle configuration (left). Proposed Final Stage Vehicle (above) showing search radar, velocity correction engine nozzle, control-gas storage spheres, and attitude control jets.

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.

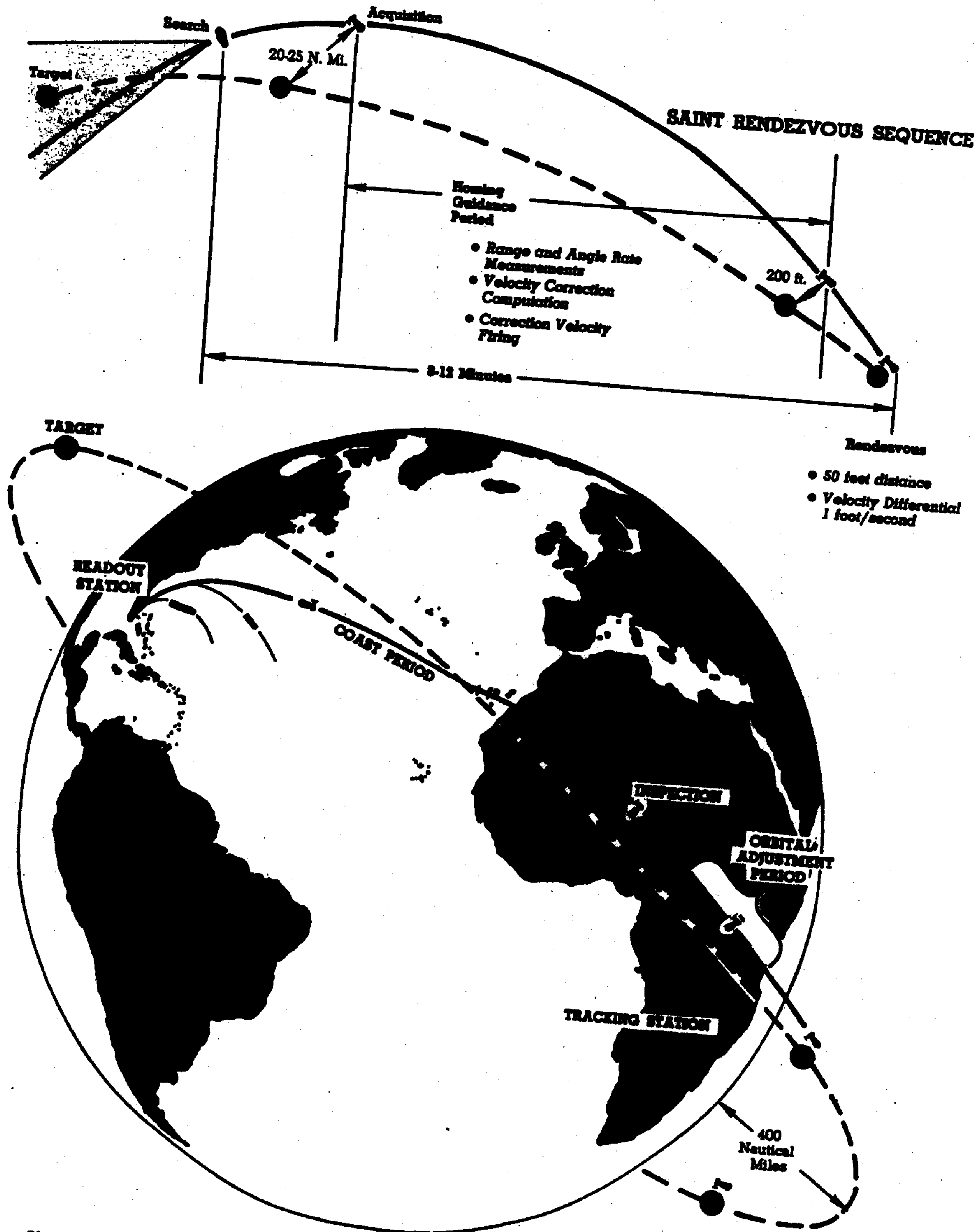


Figure 2. SAINT Program feasibility demonstration flight and rendezvous sequence.

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

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

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

Facilities

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

Monthly Progress — SAINT

Program Administration

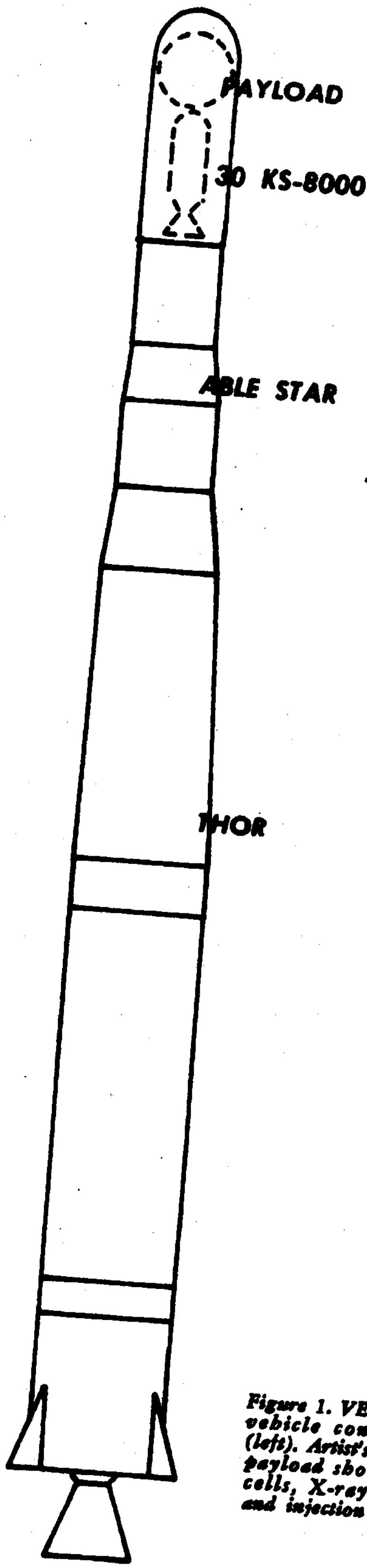
- The second management meeting was held at the Space Systems Division on 17 May with the Final Stage Vehicle contractor (RCA). In discussing management procedures, Space Systems Division disapproved RCA's request for a considerable amount of overtime and stressed the necessity for keeping overtime to a minimum. RCA is hiring additional people (within funding ceilings) to bring the SAINT Project Office up to required strength and alleviate the in-house overtime problem. RCA, in reporting the status of subcontracting, indicated that a major portion of the subsequent negotiations would be completed by mid-June. (U)

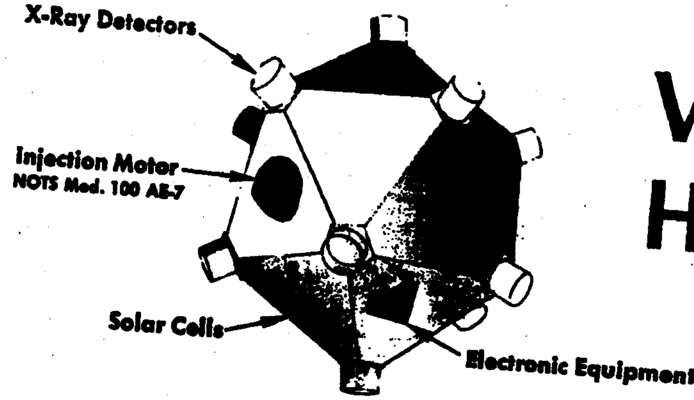
- The third technical direction meeting was held at the Aerospace Corporation facilities on 19 May. The basic design of the Final Stage Vehicle is undergoing detailed review to optimize the configuration for best performance. It has been determined that, to provide the required probability of successful intercept, modification of the DPN-34 acquisition and tracking radar to increase its scan angle to something greater than the present ±15% will be required. RCA is conducting an analysis to determine what the scan angle must be. (C)

- Representatives from the Space System Division, Aerospace Corporation, RCA, Lockheed Missiles and Space Division, and Convair-Astronautics have attended several interface meetings. Definition of the vehicle interface is continuing, the initial interface drafts were published on 16 May. Major differences between the SAINT and current ATLAS/AGENA launch vehicle interface designs result from the SAINT concept of effecting guidance and control from the Final Stage Vehicle. (C)

- The work statement for the SAINT target has been completed and will be forwarded to selected prospective contractors in June. (C)

- The SAINT Program Office has contracted with RCA to accomplish a system study to provide preliminary design data for the complete SAINT Inspector System. Aerospace Corporation and possibly the RAND Corporation will independently conduct similar studies. These studies will be completed by 31 October. (C)





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 Panofsky Panel on High Altitude Detection met in Washington, DC, on 19 May to discuss the proposed "limited scope" program. As a result of the meeting it was decided that the "limited scope" program would not meet the Geneva Treaty obligations incurred by the United States. To replace the "limited scope" program, the Panofsky Panel recommended to ARPA that an ATLAS/AGENA Program be approved which is capable of placing two satellites in orbit simultaneously. A decision on this program is expected before July. (C)

• Representatives from the Space Systems Division, Aerospace Corporation, Lockheed Missiles and Space Division, and the Atomic Energy Commission met on 23 May at the Lawrence Radiation Laboratory, Livermore, California, for the monthly VELA HOTEL/DISCOVERER Piggyback Program Technical Coordination Meeting. At present, four DISCOVERER vehicles are scheduled to carry VELA HOTEL nuclear radiation detectors. Two of these vehicles will be launched in August and one each in October and December. (C)

LAUNCH
VEHICLES

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

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 Administration

• A formally appointed Management Survey Team composed of eighteen Hq Space Systems Division and Hq Ballistic Systems Division personnel will initiate a management survey of the General Electric Missiles and Space Vehicles Department (GE/MSVD) on 13 June. (U)

• The GE Orbital Test Plan has been reviewed and general orbital program requirements have been discussed at a meeting with GE. Revisions and modifications to the test plan have been initiated and will be reflected in forthcoming documentation. The third major revision of the ADVENT Orbital Program Requirements Document, including requirements for the entire ADVENT Orbital Network, has been prepared and distributed to the participating contractors and agencies. (U)

Technical Progress

Booster Vehicles

• The final draft of a work statement for a consolidated "ground" wind tunnel test program for all vehicle configurations using ATLAS as the Stage I booster has been reviewed and approved by the Space Systems Division and Aerospace Corporation. When coordination is completed by all interested programs, the work statement will be forwarded to Convair-Astronautics for preparation of a detailed test proposal. (U)

• Space Systems Division has directed Lockheed Missiles and Space Division (LMSD) to proceed with the initial efforts required to accomplish a consolidated "transonic and supersonic" wind tunnel test program for ADVENT and all other projected ATLAS/AGENA vehicle configurations. LMSD has been instructed to submit a detailed test plan and proportion of costs to be borne by each program involved in the consolidated test program. (U)

• The NASA Ames Research Center has agreed to conduct preliminary testing of the ADVENT ATLAS/AGENA configuration as part of a wind tunnel test program currently in progress. An instrumented AGENA vehicle has been forwarded to Ames for these tests. This is a "state-of-the-art" development program and will have no financial support from the ADVENT Program. (U)

• A detailed review of the Pratt & Whitney RL10A-3 engine specification has been completed by the Space Systems Division and Aerospace Corporation. Major objections and conclusions regarding the NASA work statement are:

Objections:

1. The engine as defined in the subject specification cannot be accepted for use in the ADVENT Program because its reliability characteristics are below the ADVENT Program requirements. (C)

2. The specification submitted describes a single thrust chamber engine while ADVENT requires a dual system. A dual engine system specification should be generated for ADVENT. (C)

3. The specification does not require qualification of the engine. The use of an unqualified rocket engine in the ADVENT Program is extremely undesirable. (C)

4. Further study of the relationships between the engine thrust controller mixture ratio control and the vehicle propellant utilization system is necessary to determine if all these subsystems are required for the CENTAUR vehicle. (C)

Conclusions:

1. The engine presented in the specification will not fulfill the function required of an ADVENT vehicle propulsion system. (C)

2. If a dual engine system based on the RL10A-3 common engine is to be utilized for ADVENT vehicles, a program to verify the following areas will be required: (a) reliability, (b) environmental capability, and (c) qualification test. (C)

• All agencies and contractors involved in ADVENT launches participated in a series of meetings held at Atlantic Missile Range on 8-9 May to discuss ADVENT Program launch support requirements. Coordination of Phase I and Phase III launches was discussed. Most of the problems have been resolved; however, some are still being studied and will be handled as action items for the next launch support meeting. (U)

Final Stage Vehicles

• A preliminary plan for making use of the four-month delay in the CENTAUR Program to obtain 37,500 hours of ambient reliability testing was initiated during 11-12 May meetings attended by Space Systems Division, United States Army ADVENT

Management Agency, General Electric Missiles and Space Vehicles Department, and Aerospace. Aerospace presented a program of acceptance and sequential testing for the Final Stage Vehicle to the reliability managment group on 18 May. This plan is now being written in final form. (U)

• Informal discussions were held with General Electric Missiles and Space Vehicles Department as a pre-review of their Final Stage Vehicle product improvement proposal. Weight savings of between 100-150 pounds were proposed as feasible if an additional 18 to 24 months development time were made available. (U)

Tracking, Telemetry and Command

• A meeting was held at the National Security Agency on 2 May to review the logic circuitry of the electronic code generator as designed by Philco and General Electric and also to discuss the re-start circuitry being studied by General Electric. Representatives of Space Systems Division, Aerospace, Philco, General Electric Missiles and Space Vehicles Division, and National Security Agency attended the meeting. NSA will study the Philco and GE proposals and will then issue a final design criteria document for the code generating subsystem. GE and Philco will submit complete design circuitry on their code generating subsystems to SSD and NSA by 5 June for final review. (U)

Facilities

• Design of the ADVENT addition to the Kaena Point, Hawaii VHF Administration building is being delayed pending re-evaluation of facilities required above those presently available for use. It appears that ADVENT requirements may be met by modifying existing facilities to satisfy space requirements. (U)

Project ANNA

Second Stage — ABLESTAR (AJ-10-104)

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

First Stage — DM-21A

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

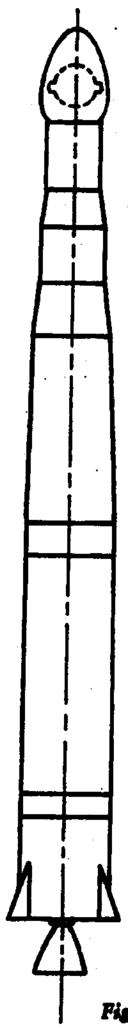


Figure 1. Two stage ANNA vehicle.

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.

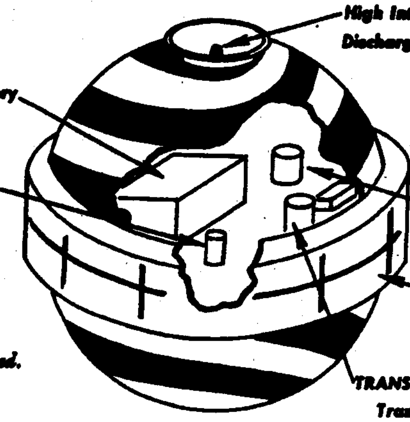


Figure 2. Cutaway drawing of ANNA payload.

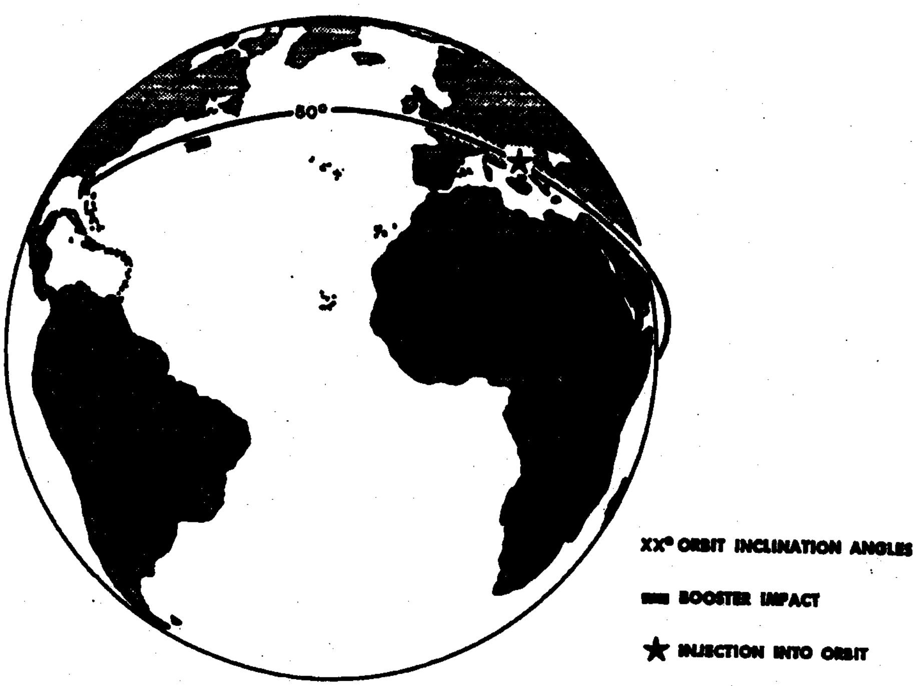


Figure 3. ANNA launch trajectory (50° orbit inclination angle) showing flight path, booster impact area, and orbital injection point.

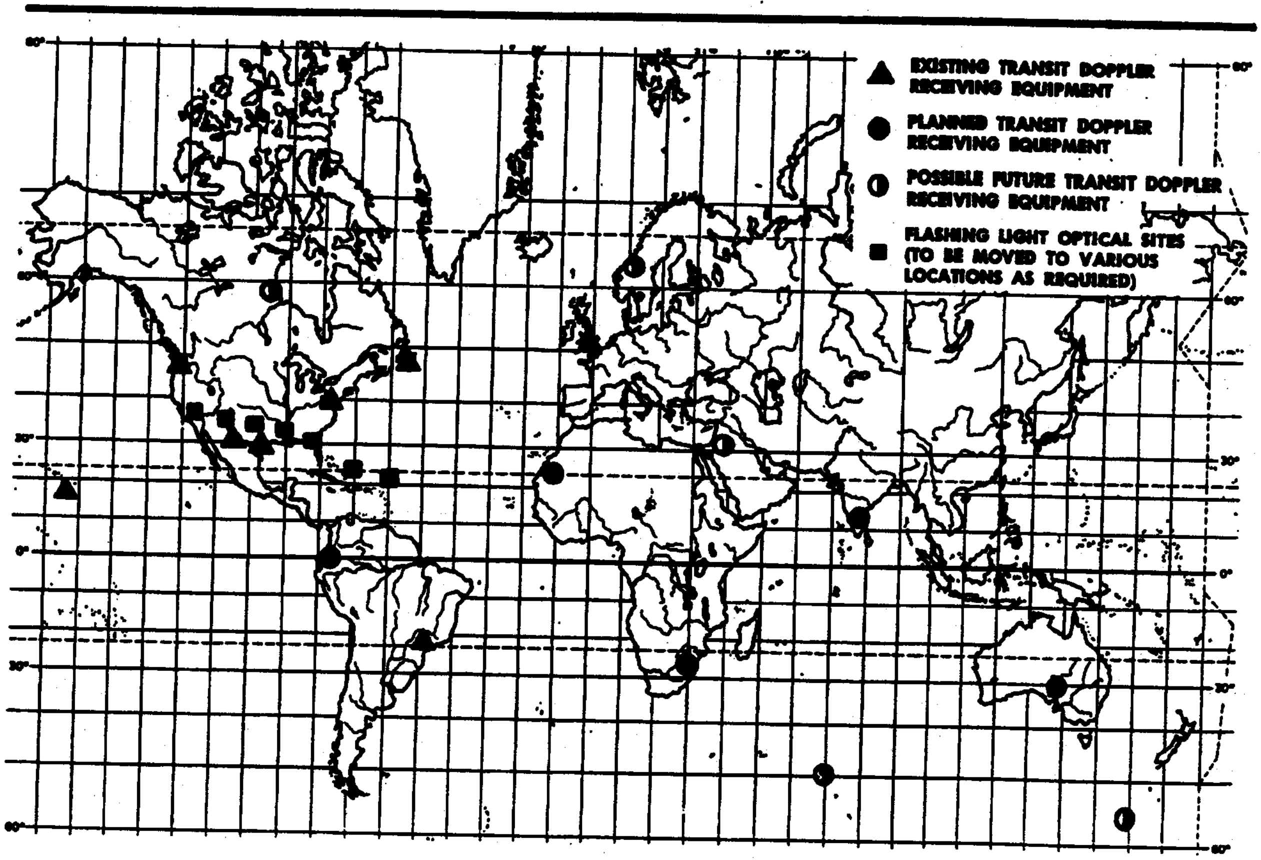


Figure 4. Location of ANNA tracking stations.

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

- On 24 May, representatives of the Navy BuWeps and the Applied Physics Laboratory expressed a desire to increase the payload weight and the orbital altitude of the Project ANNA satellite. To compensate for these changes a subsequent decrease in orbital inclination may be required. Previously, the original launch date of 5 December had been rescheduled to 28 November. A schedule conflict with a NASA launch may require that the ANNA launch be rescheduled for 21 November. (C)


DYNA SOAR

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

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

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

FIRST - SECOND STAGE SEPARATION

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

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

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

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

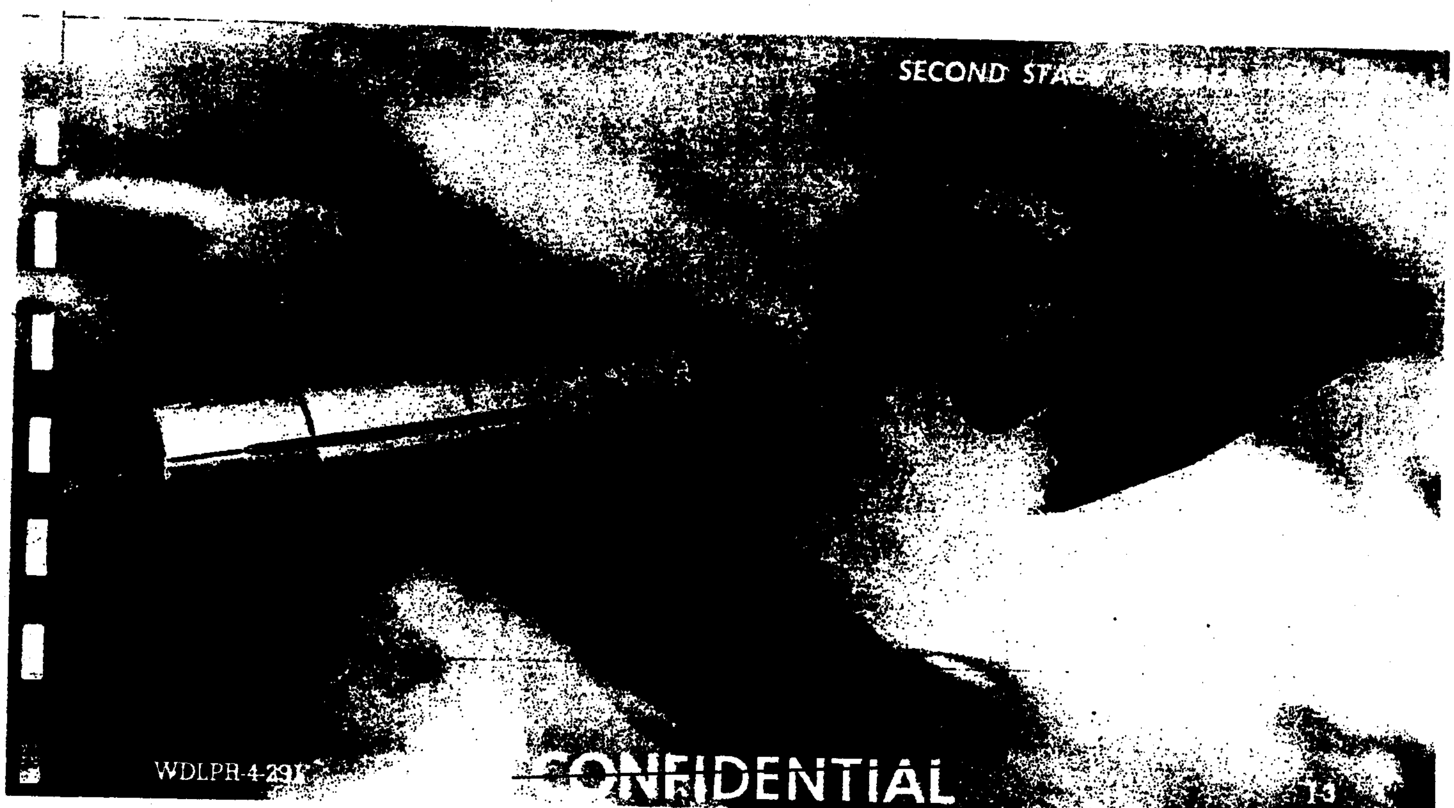
Technical Approach—AFBMD's technical approach to meet the objectives of the program are:

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 Administration

- Design criteria for the DYNA SOAR launch complex at the Atlantic Missile Range has been reviewed and approved by the Facilities Working Group (U)

- Aerospace Ground Equipment to support the auxiliary systems functional test stand has been released for fabrication. Release of this equipment at this time will allow the AGE design to parallel the airborne equipment engineering. (U)

- On 12 May, the DYNA SOAR Program — Step II Technical Evaluation Board determined their findings which were thereupon presented to and accepted by General R. E. Greer. The Board Chairman then presented the findings to the DYNA SOAR System Program Office on 16 May. (U)

- As a result of an Space System Division/Aerospace study of the DYNA SOAR booster ionization problem, an SHF telemetry transmitter has been recommended for installation in the second stage. It is believed that a VHF transmitter would be "blacked out" due to shock and plume ionization during staging and the last portions of boost. Loss of telemetry data is considered to be unacceptable during these times. (U)

- Pulse code modulated (PCM) telemetry with high level inputs is also recommended for the DYNA SOAR booster. PCM telemetry is scheduled for use on TITAN II. High level in lieu of low level inputs will be necessary due to the noise problems. (U)

- A decision has been made to use the three axis reference systems (TARS) which is presently installed in TITAN I, for the DYNA SOAR. While the TARS system is not considered to be a state-of-the-art development, it is felt that the cost of developing a new reference system for DYNA SOAR would be too high. (U)

- A Program Element Breakdown (PEB) which orients hardware and functional subject areas of the DYNA SOAR Program was revised at an 11-12 May meeting at the System Program Office, Wright-Patterson Air Force Base. The new PEB is intended for system-wide use for the System Package Program, Contractor Program Plans, Statements of Work, Program Evaluation Procedures (PEP), cost estimation and reporting, scheduling, and optionally internal files system. (U)

- On 16 May, negotiations for the definitization of Aerojet-General Corporation letter contract through 30 September 1961 were concluded. (U)

MERCURY

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.

Launch Schedule

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	N	1
	D	1
1962	J	1
	F	
	M	
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	J	1
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	O	1
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1963	J	
	F	
	M	1
	A	
	M	
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	J	1
	A	
	S	
	O	
	N	1
	D	

★ Successful flight

● Unsuccessful flight

Flight History

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

Monthly Progress — Project MERCURY

Flight Test Progress

MA-4 Flight

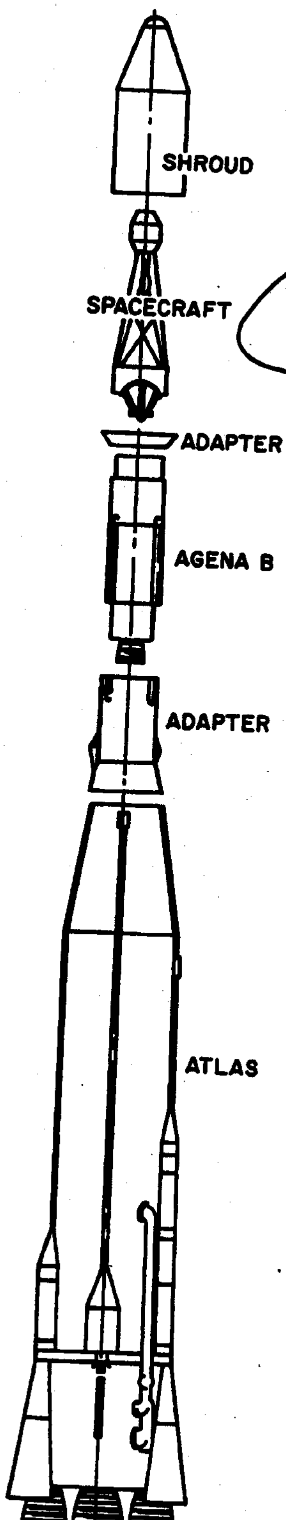
- The MA-4 launch has been rescheduled for early August. The decision to incorporate several engineering changes recommended by the ATLAS 100D (MA-3) investigation board resulted in this schedule slippqge. The autopilot system and the Abort Sensing and Implementation System were affected by these changes. The scope of the over-all MA-3 investigation was increased by a flight programmer failure discovered during preflight testing of ATLAS 12E (R&D). Analysis of this failure and the ATLAS 100D failure resulted in the recommendations mentioned above. The impact of these changes has been to delay booster delivery from early May to late June with a corresponding launch delay. (C)

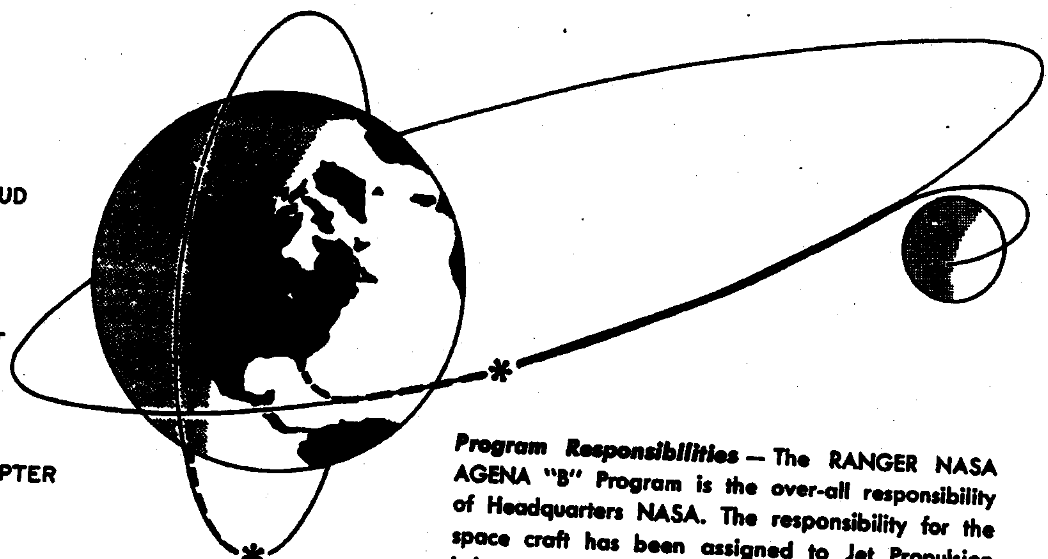
- ATLAS 88D, the first booster modified to the "thick" skin configuration, is scheduled to support the MA-4 launch. Capsule No. 8, recovered after a successful abort during the MA-3 launch, is being reworked by McDonnell Aircraft Corporation and will be mated with this ATLAS booster to form the MA-4 vehicle. (C)

- Flight objectives remain as reported in the April "Space Systems Division Activities" Report. (U)

Technical Progress

- The decision to proceed with a test program for incorporation of baffled injectors on the MA-5 (formerly MA-2) engine system has been temporarily delayed because of several anomalies which were exposed during a similar test program on the MA-3 engine system. This modification was to be incorporated in an effort to reduce the probability of rough combustion following engine ignition. (C)





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

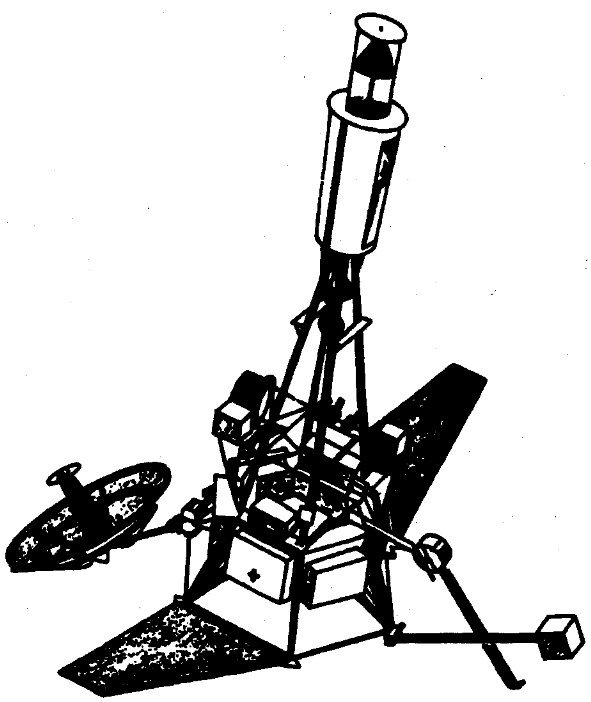
Under NASA Order No. S4601-G the Air Force is supporting the NASA AGENA "B" Program. This will permit NASA to take full advantage of the technical and operational background and experience developed by the Air Force in space booster projects; permit contractors to discharge their contractual obligations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

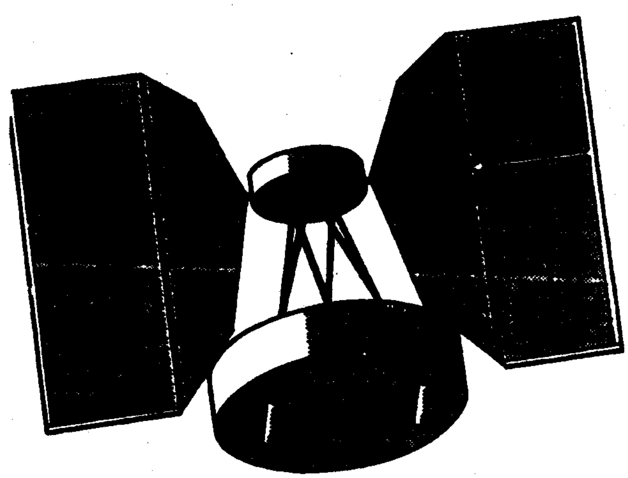
The ATLAS and THOR first stage boosters were allocated to NASA for the missions planned through 1964. Contractual action was initiated with General Electric (GE) and Bell Telephone Laboratories (BTL) for the guidance systems necessary for the respective boosters.

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

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

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





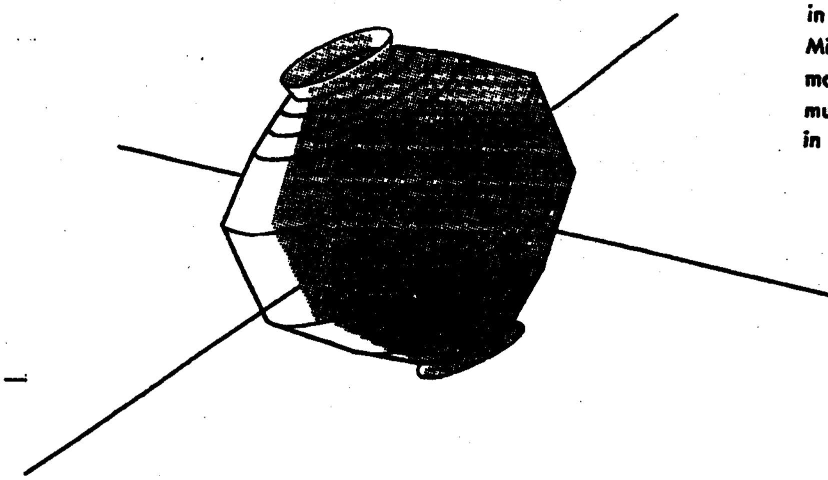
RANGER Satellite Missions

The RANGER Program is a series of five deep space probes to be launched from the Atlantic Missile Range (AMR) on the ATLAS/AGENA B boosters system. Jet Propulsion Laboratories (JPL) under contract from the National Aeronautics and Space Administration (NASA) is responsible for the missions and providing the space craft hardware. The mission of the first two RANGER launches will be an interplanetary investigation in support of the follow-on lunar impact mission. The orbit will be highly elliptical near escape velocity and have an apogee of approximately 625,000 miles. The space craft is planned for one orbit with approximately a 50 day period. The remaining three launches will impact the surface of the moon and transmit scientific information back to the earth. Experiments are designed to measure seismographic disturbances, temperature changes and impact acceleration. These Ranger space crafts will also have the capability of accomplishing a mid-course maneuver to correct for minor errors in the trajectory.

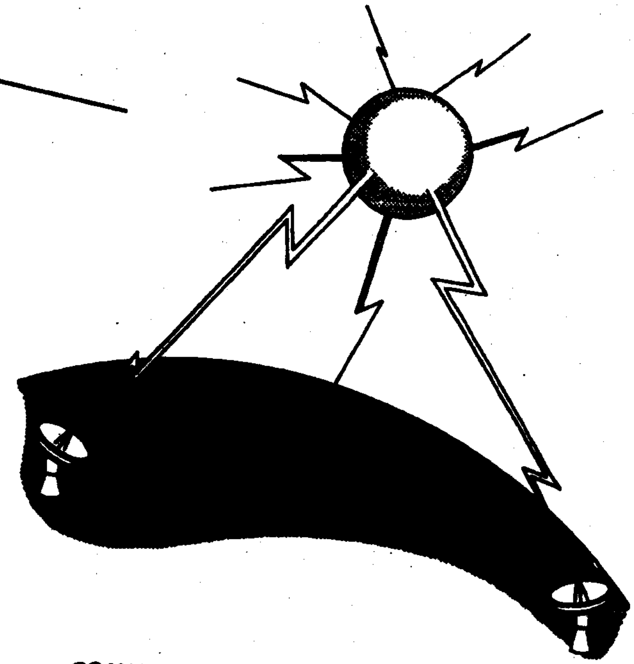
NIMBUS

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

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



in the RANGER launches from Atlantic Missile Range. Minor modifications will be made to the AGENA to make it compatible to the mission; however, maximum use will be made of the experience developed in the RANGER Program.



TOPSIDE SOUNDER SATELLITE MISSION (S-27)

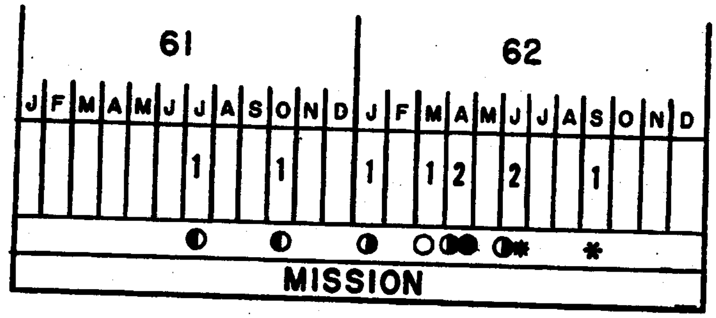
The primary objective of the S-27 Satellite is the examination of the structure of the ionosphere from above in a manner similar to that now being done by ground-based ionospheric sounders. In particular the objective is to obtain information about the ionosphere in the region above the F layer maximum.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

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

The THOR/AGENA "B" booster system will be composed of the standard DM-21 THOR booster with Bell Telephone Laboratory guidance systems and AGENA "B" second stage similar to the one used

COMMUNICATION SATELLITE MISSION (A-12)

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



LEGEND

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

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

Monthly Progress — RANGER-NASA
AGENA B

Technical Progress

• The ATLAS 111D booster (RA-1) was accepted by the Air Force on 25 May. Following air shipment to the Atlantic Missile Range, the booster completed its receiving inspection and was erected on Stand 12 on 29 May. No serious difficulties have been encountered to date. (U)

• The AGENA "B" second stage vehicle for RA-1 was accepted by the Air Force on 29 May. It was transported by air to the Atlantic Missile Range and arrived on 30 May. Present plans call for mating with ATLAS 111D on Stand 12 on 14 June. A daily work schedule has been established which will permit all work to be completed before the 26 July launch date. (C)

• Stand 12 modifications have been completed. Despite an initial delay incurred because ATLAS 90D was not launched on schedule, the modification of the stand, including the installation of a stronger umbilical tower, has proceeded on schedule. The AGENA facility checkout vehicle has been installed and stand checkout was accomplished satisfactorily. The only work remaining involves installing the ATLAS to checkout the ATLAS portion of the stand. This work is in process at the present time. No problems have been encountered. (U)

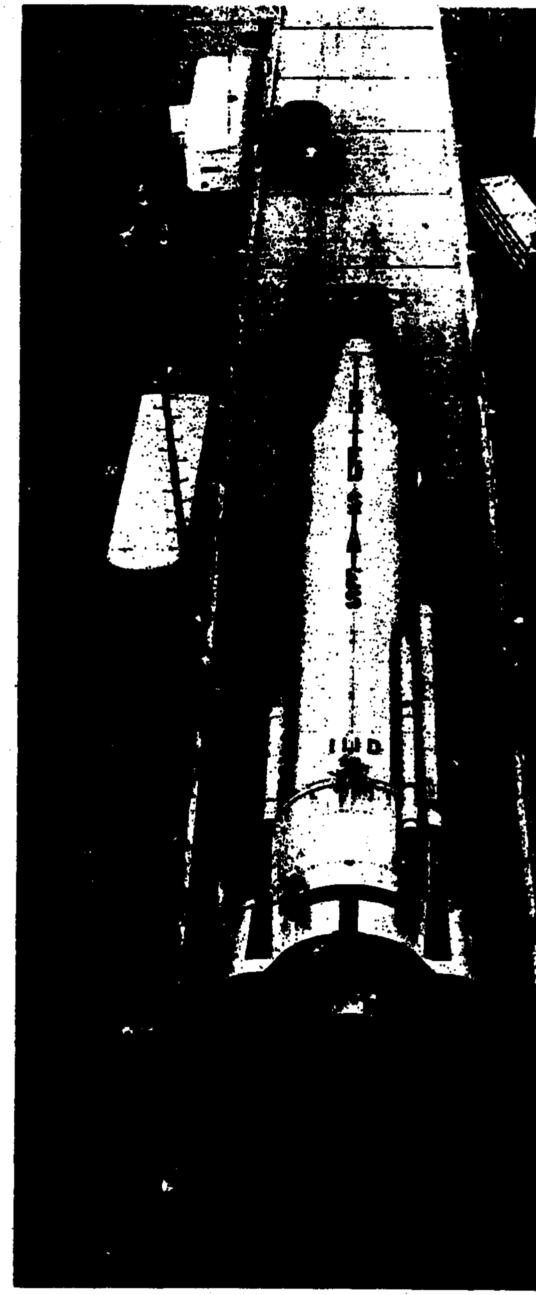


Figure 2. Arrival (right) of ATLAS booster 111D at Atlantic Missile Range Stand 12. Erection of the booster (below) occurred on 29 May in preparation for the 26 July RANGER launch.

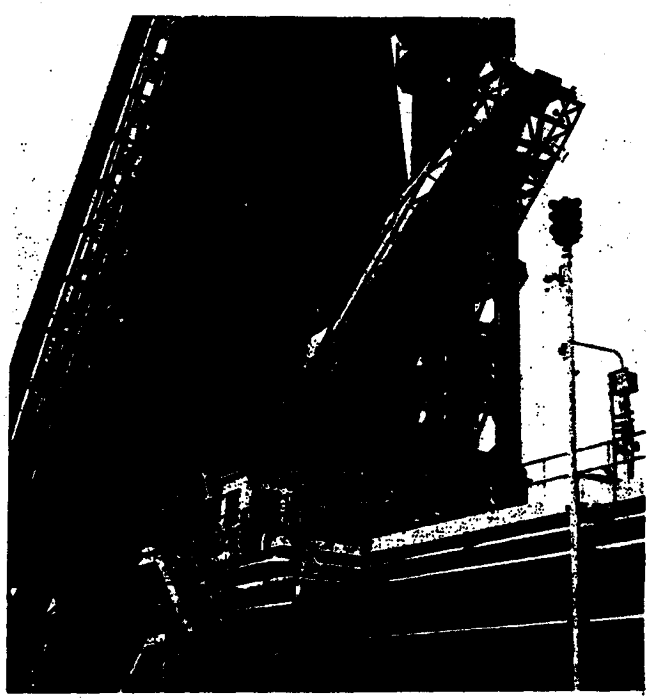


Figure 3. Inspection team checking the IRFNA valve complex at Atlantic Missile Range Stand 12. Although an initial delay was incurred, the modification proceeded on schedule.

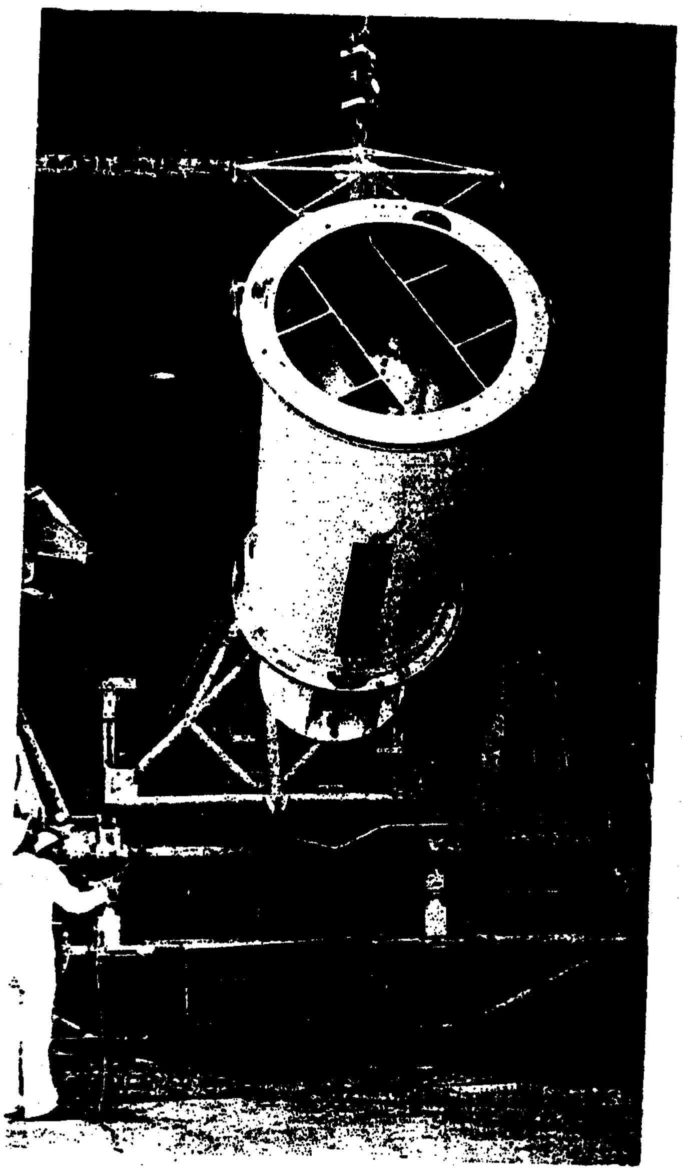
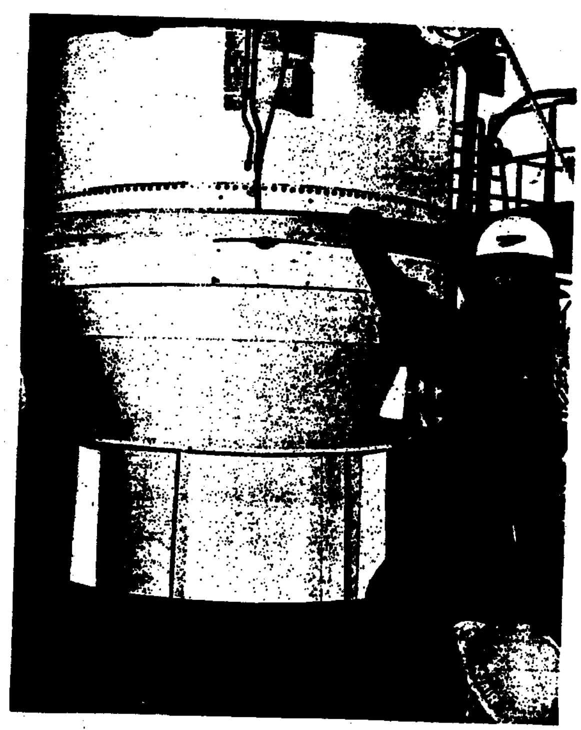


Figure 4. Lifting the AGENA checkout vehicle (left) at Atlantic Missile Range Stand 12. This stand has been modified to support RANGER Program launches. Checking stand clearance with the AGENA checkout vehicle (below).



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

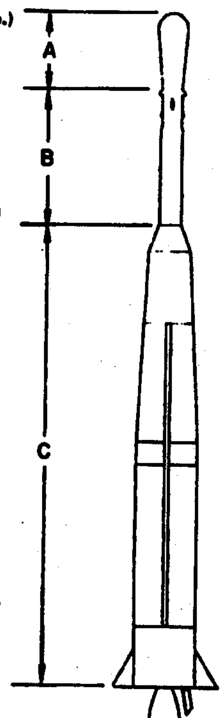


Figure 1. TRANSIT 1A three stage flight vehicle.

Transit

TRANSIT 3A launched from Atlantic Missile Range

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

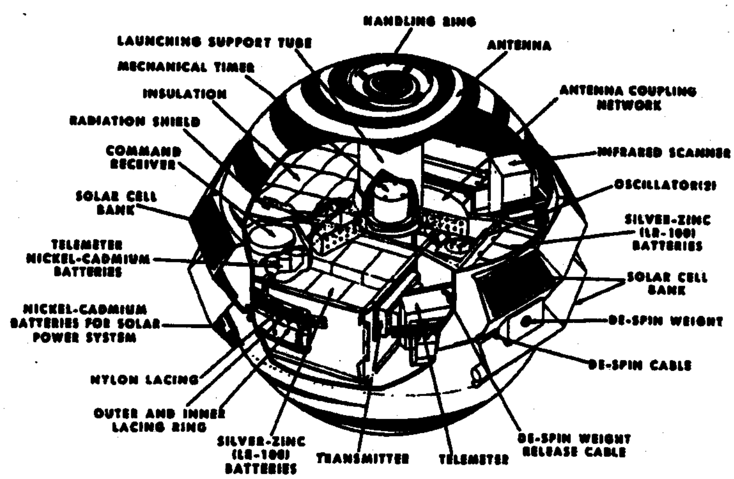
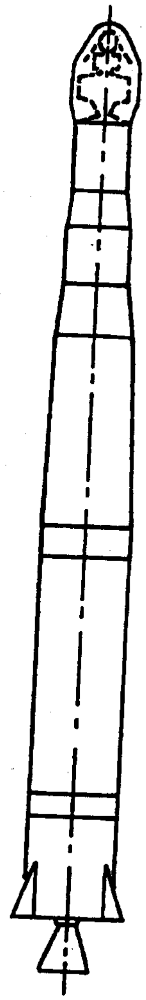


Figure 2. Cut-away drawing of TRANSIT 1A payload (NAV 1).

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



SECOND STAGE — ABLESTAR (AJ10-104)

Thrust (vacuum)	7900 pounds
Specific impulse (vacuum)	277 seconds
Burning time	296 seconds
Propellant	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-1

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

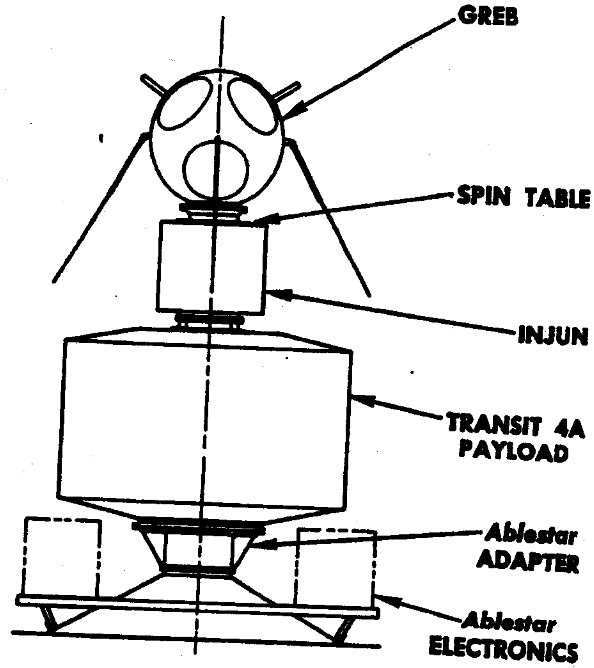


Figure 4. Payload arrangement for TRANSIT 4A flight.

Program Objectives

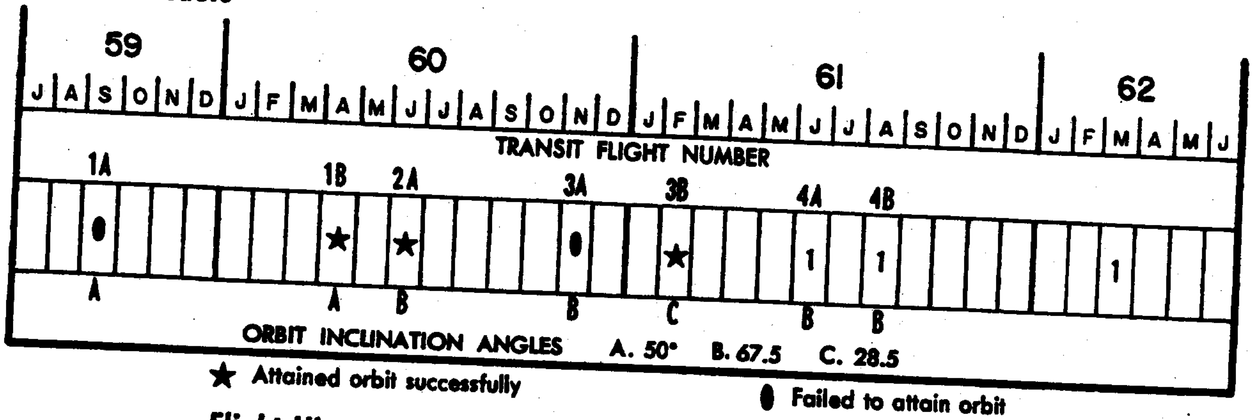
1. Provide accurate navigational reference information for POLARIS launches.
2. Precise determination of satellite position by measuring the doppler shift of satellite transmitted radio signals.
3. Investigate the refractive effect of the ionosphere on radio transmissions.
4. Acquire additional geodetic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

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

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

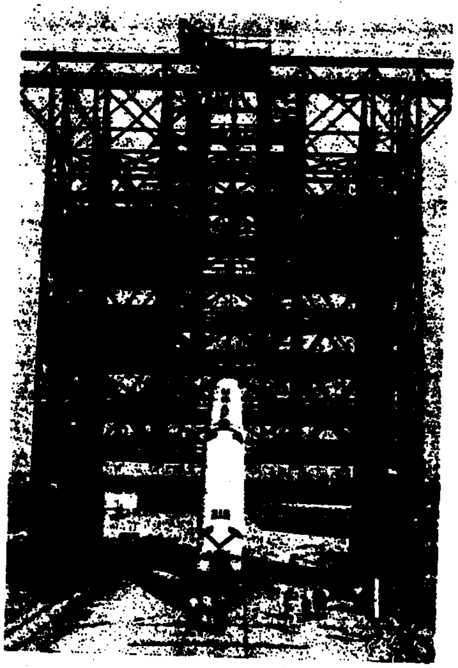
Payload Description The TRANSIT 4A payload is shown in Figure 4. The payload consists of three separate assemblies and has a total weight of 300 pounds. The TRANSIT payload (175 lbs) is the next step in the Navy Program to develop an operational navigation system. The payload is a short cylindrical shape as opposed to the spherical shape of all the previous payloads. The new shape is close to that which is proposed for the operational system payloads. The 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.

Launch Schedule



Flight History

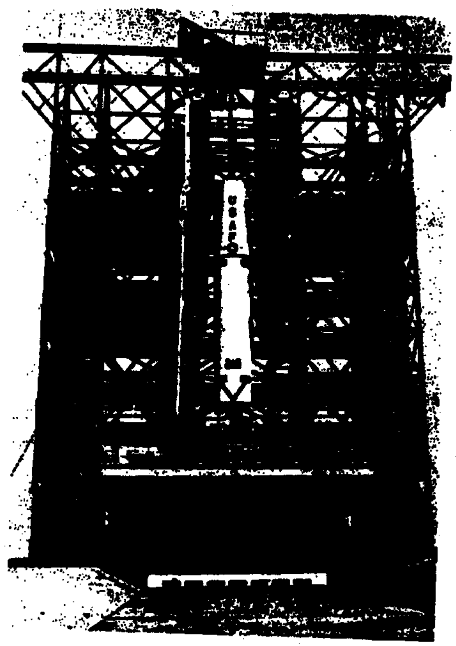
TRANSIT No.	Launch Date	Thor No.	Ablestar No.	Remarks
1A	*17 September*	*136*	—	*The three-stage vehicle was launched from Stand 17A at the Atlantic Missile Range. The payload was not injected into orbit, because the third stage motor failed to ignite.*
1B	*13 April*	*257*	*002*	*The Thor Ablestar boosted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



Monthly Progress — TRANSIT

Program Administration

• During the TRANSIT System Coordination meeting held on 27 and 28 April, U.S. Navy personnel, contractor representatives, and Space System Division personnel reviewed all aspects of the TRANSIT 4A and 4B launch vehicles. At this time TRANSIT 4A was rescheduled for launch on 1 June and TRANSIT 4B for 22 August. However, because of delays encountered by the Atlantic Missile Range in the movement of the downrange tracking station from Pretoria, Union of South Africa, to Puenta Arenas, Chile, the launch of TRANSIT 4A has been rescheduled to 27 June. (C)



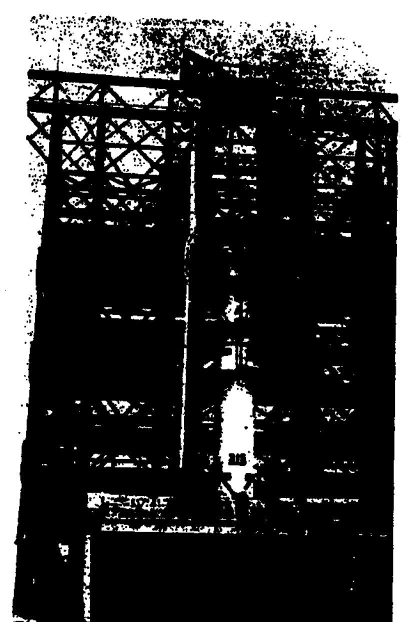


Figure 5. Installing TRANSIT 4A DM-21A booster on Atlantic Missile Range Stand 17B . . . Lifting the booster from the transporter . . . Lowering the booster on the stand . . . Work platforms being lowered around the booster.

• The TRANSIT 5A vehicle has been assigned to launch the ANNA-1 satellite. The vehicle formerly assigned to TRANSIT 5B is now scheduled for launch in March 1962 with an unspecified mission. (C)

Technical Progress

• Both stages for the TRANSIT 4A vehicle are presently undergoing checkout at the Atlantic Missile Range. The DM-21A first stage, serial number 315, was placed on stand on 11 May. Revised C-Band beacon antenna patterns have been transmitted to the Atlantic Missile Range. The revision of the patterns resulted from the addition of two antennae designed to facilitate tracking the Able-star second stage in orbit. (U)

TRANSIT 4B

• Integration of the Bell Telephone Laboratories guidance system into the TRANSIT 4B booster is proceeding on schedule. (U)

• The orbit determination task for TRANSIT 4B and subsequent vehicles has been assigned to the Satellite Test Center at Sunnyvale, California. (U)

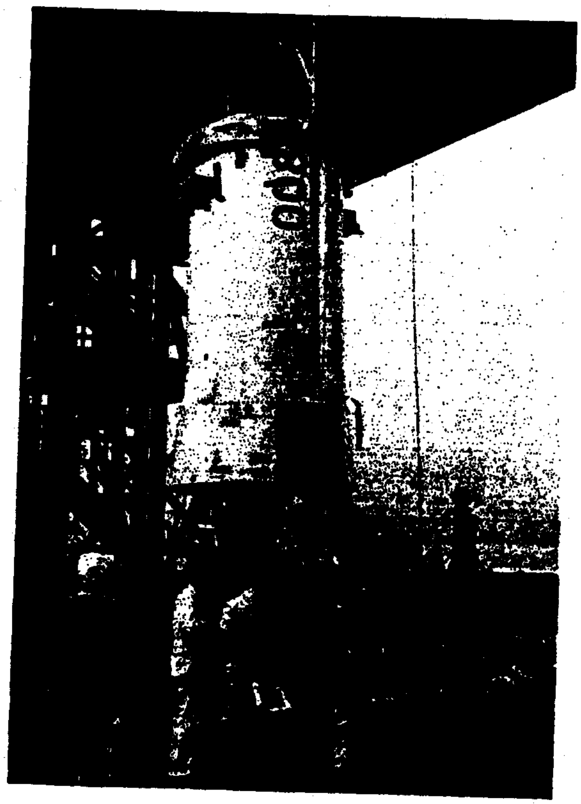
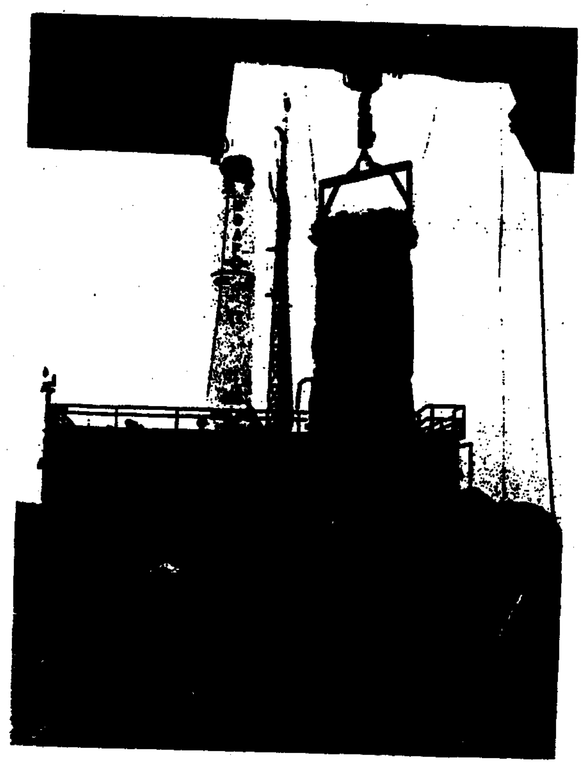


Figure 6. Installing the engine nozzle extension on the Ablestar vehicle . . . Raising the vehicle into the gantry for installation on the DM-21 booster . . . The liquid oxygen tank is in the background . . . This launch is scheduled to occur on ~~14~~ June.
17



TECHNICAL
DEVELOPMENT

BAMBI

• 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

• ARPA directed SSD to undertake three or more 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 presented a detailed BAMBI Program Briefing to General Schriever, Commander AFSC, on 15 May 1961, and Dr. Ruina, Director of ARPA on 16 May 1961. At his request, the Under Secretary of the Air Force was not briefed. In this briefing, it was proposed that three selected contractors conduct one-year technology studies on specific technical problems associated with a multiple interceptor satellite concept, a single interceptor satellite concept, and advanced interceptor concepts. In addition, it was proposed that primary system analysis, integration, and evaluation studies be accomplished by The Aerospace Corporation. As a result of this briefing ARPA will amend existing orders to implement a BAMBI Program effort essentially as that proposed by SSD.

• 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.

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 studies and applied research programs.

• 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 technical assistance 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 feasibility of the BAMBI system.

Monthly Progress — BAMBI

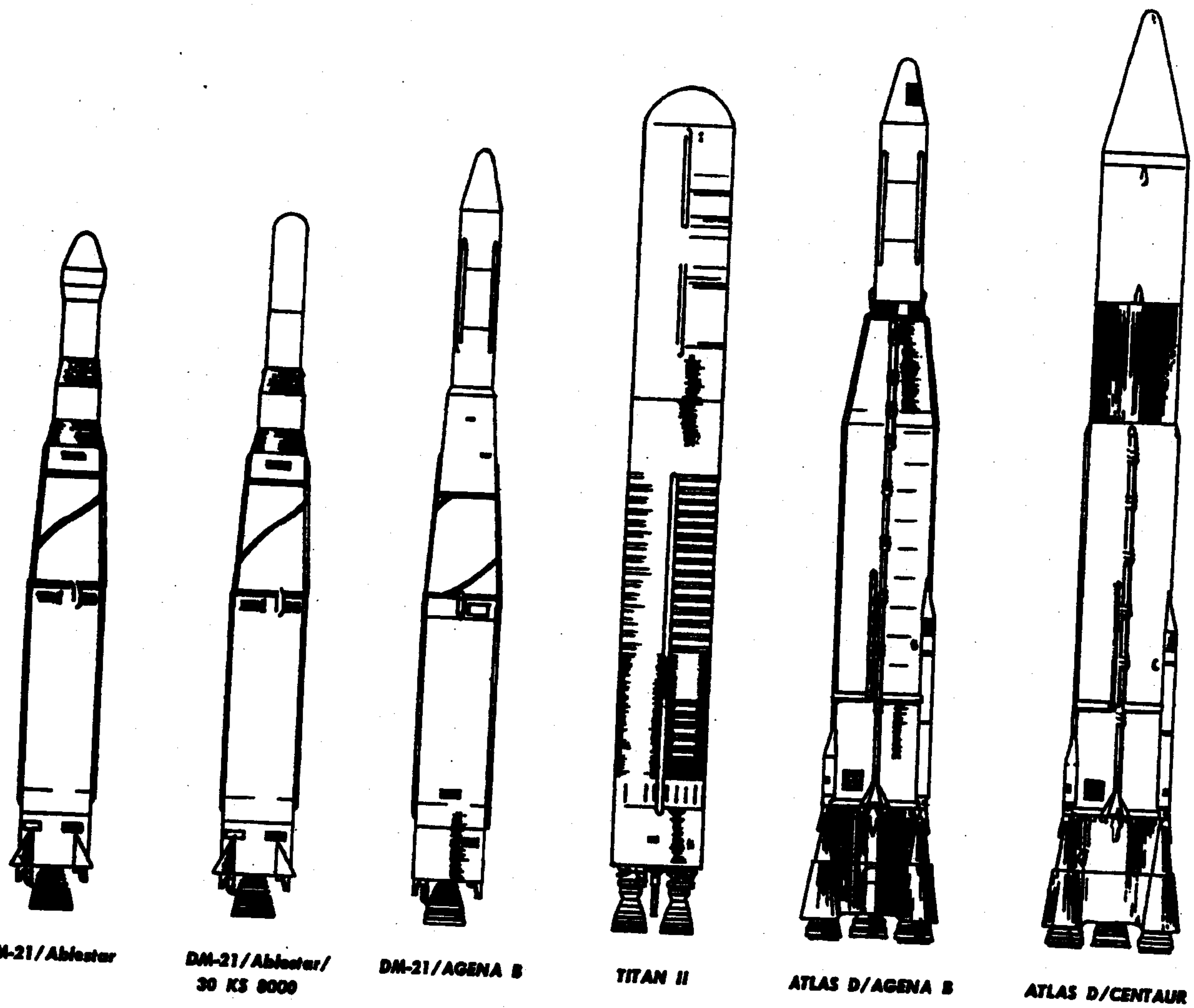
Program Administration

• ARPA has issued amendments to three standing ARPA Orders directing a one-year reoriented BAMBI study by Hughes Aircraft, Convair-Astronautics and Space Technology Laboratories. ARPA also issued an order directing a "study of target and background signal noise experiments" called TABSTONE. These orders have been accepted by the BAMBI Program. (U)

SPACE

BOOSTERS

EXISTING OR PROGRAMMED STAGES



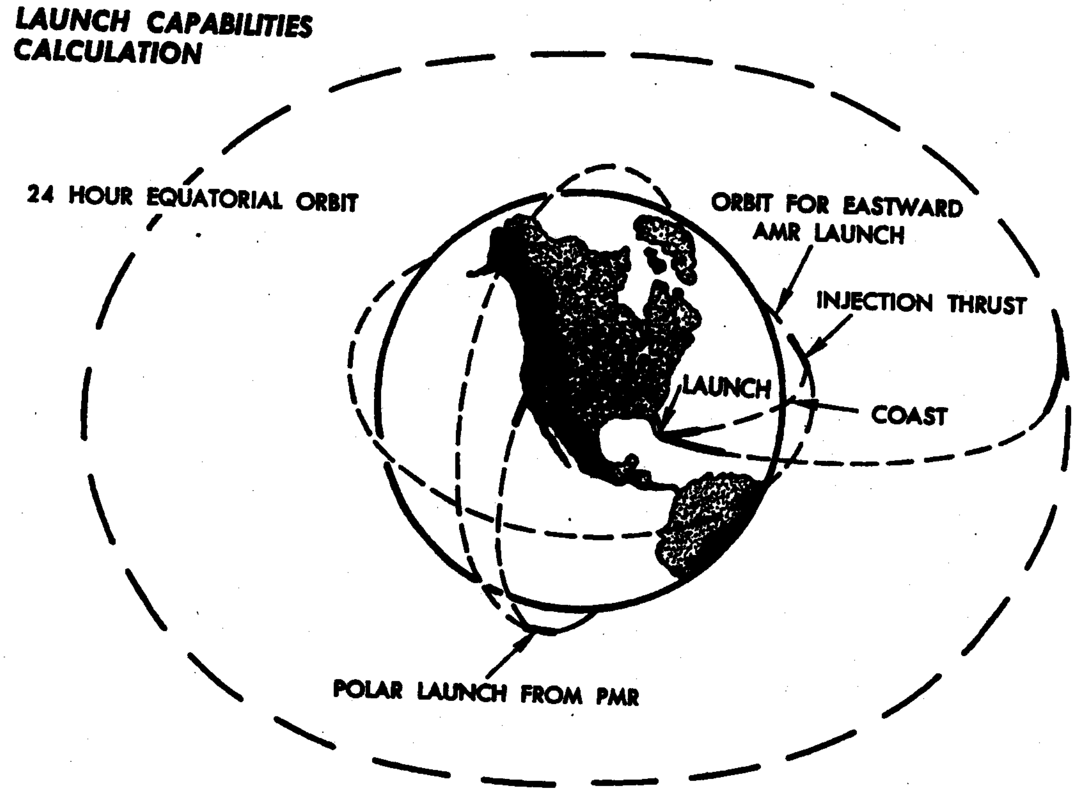
Program Vehicle Combinations

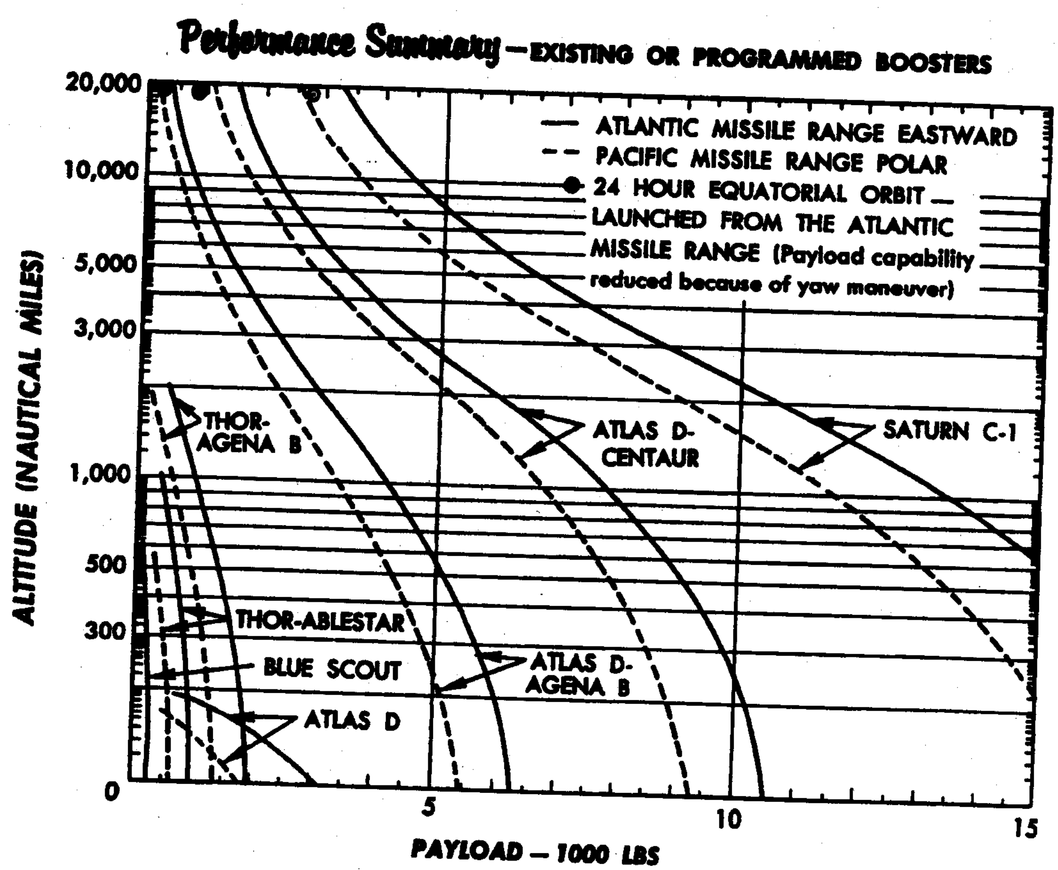
Program	Vehicle
ABLE—1,—3 and —4	A — L — P
ABLE—4 and —5	D — L — P
ADVENT (Phase One)	D J
ADVENT (Phase Two)	D N
ADVENT (Phase Three)	D O
ANNA	C M
BAMBI	D N

Program	Vehicle
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

Program	Vehicle
NASA AGENA "B"	D — J
	B — J
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
24 HOUR EQUATORIAL ORBIT
ORBIT FOR EASTWARD AMR LAUNCH
INJECTION THRUST
LAUNCH
COAST
POLAR LAUNCH FROM PMR


Performance Summary — EXISTING OR PROGRAMMED BOOSTERS
ATLANTIC MISSILE RANGE EASTWARD
PACIFIC MISSILE RANGE POLAR
24 HOUR EQUATORIAL ORBIT — LAUNCHED FROM THE ATLANTIC MISSILE RANGE (Payload capability reduced because of yaw maneuver)
THOR-AGENA B
ATLAS D-CENTAUR
SATURN C-1
THOR-ABLESTAR
BLUE SCOUT
ATLAS D-AGENA B
ATLAS D
ALTITUDE (NAUTICAL MILES)
20,000
10,000
5,000
3,000
1,000
500
300
0
5
10
15
PAYLOAD — 1000 LBS

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 — dry	15,100
Fuel — RP-1	74,900
Oxidizer — Liquid Oxygen	172,300
Total	262,300
Height — feet	69
Engine — Rocketdyne Division of North American Aviation	MA-5
Thrust — lbs. (sea level)	
Booster	309,000
Sustainer	57,000
Vernier	2,000
Specific Impulse — lb-sec/lb. (sea level)	
Booster	251
Sustainer	214.7
Guidance — Radio Mod II/III — General Electric (radar), Burroughs (computer)	
	(9) (12) (75)

TITAN II — The Martin Company

	E FIRST STAGE	F SECOND STAGE
Weight — dry	12,231	5,375
Fuel — N_2H_4/UDMH	83,713	20,200
Oxidizer — N_2O_4	161,632	37,702
Total	257,576	63,714
Height — feet (combined first and second stage)	90	
Engine — Aerojet-General Corporation	XLR87AJ-5	XLR91AJ-5
Thrust — lbs.	430,000 (sea level)	100,000 (vacuum)
Specific Impulse — lb-sec/lb.	258 (sea level)	31.4 (vacuum)
Burn Time — seconds	146.3	181.9
Guidance — Radio Mod III — General Electric (radar), Burroughs (computer)		

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)
Flights (successful / attempted / % 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
Flights (successful / attempted / % success)	(5) / ⟨6⟩ / (83)	(7) / ⟨10⟩ / (70)	(4) / ⟨4⟩ / (100)

CENTAUR Convair-Astronautics

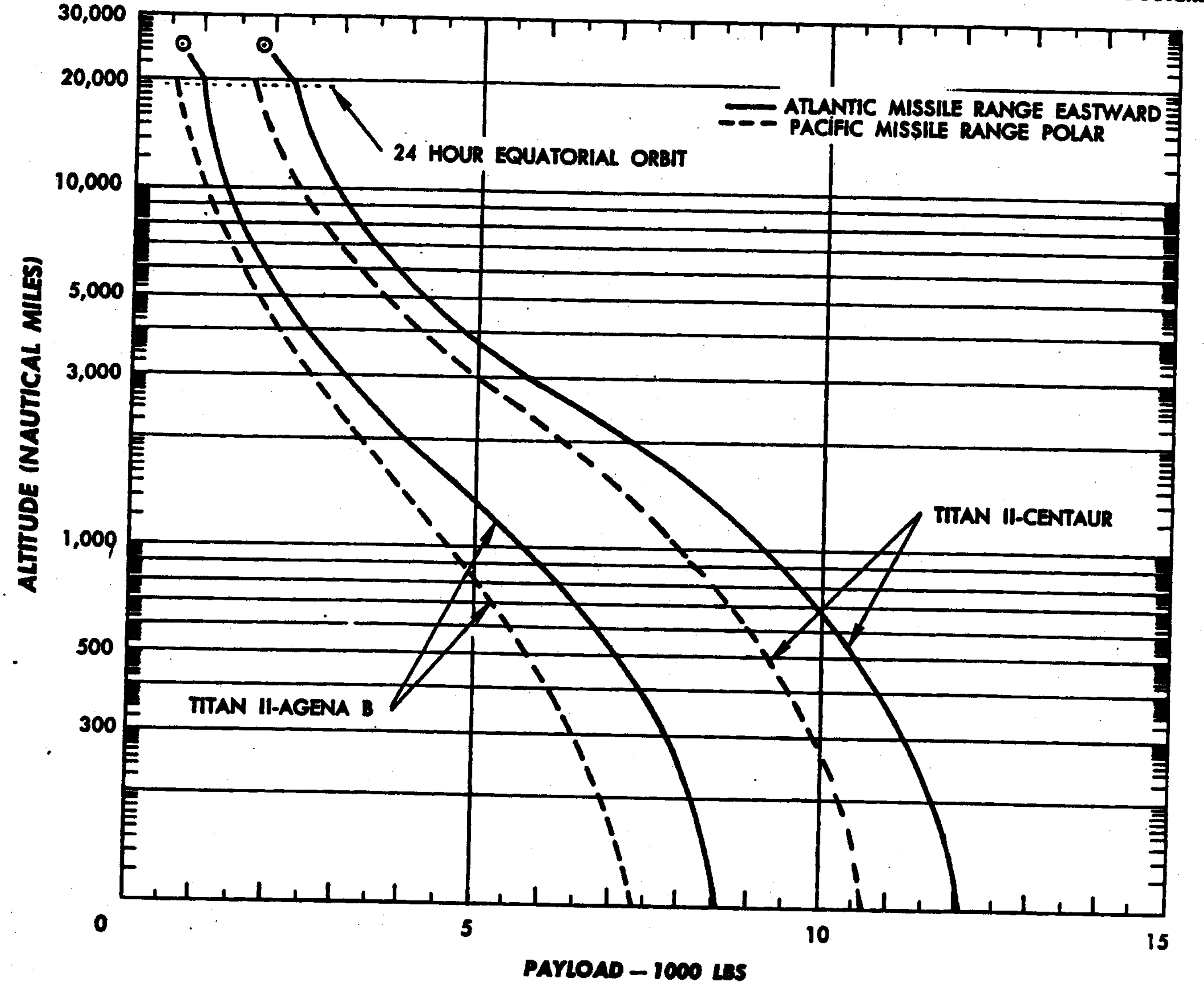
	N	O
Weight — dry	2,891 (8)	CENTAUR modifications necessary to meet ADVENT mission are being determined
Fuel — Hydrogen	—	
Oxidizer — Liquid Oxygen	—	
Total	32,000	
Height — feet	45.5	
Engines (Two) — Pratt & Whitney	RL10A-3	
Thrust — lbs. (vacuum) (15,000 each)	30,000	
Minimum Specific Impulse — lb-sec/lb. (vacuum)	420	
Burn Time — seconds	370	

NOTES:

(1) Payload weight not included. Does include controls, guidance, APU and residual propellants.
(2) Does not include THOR adapter (225 lbs.) or ATLAS adapter (315 lbs.)
(3) Single restart capability
(4) Dual burn capability
(8) 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



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