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SPACE

HEADQUARTERS
AIR FORCE BALLISTIC MISSILE DIVISION (ARDC)
UNITED STATES AIR FORCE
Air Force Unit Post Office, Los Angeles 45, California

WDLPM-4

30 April 1960

FOREWORD

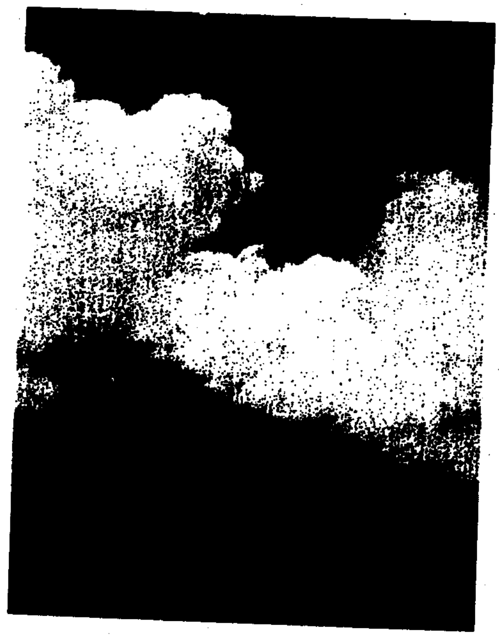
Activities summarized in this report include the major space systems, projects and studies for which the Air Force Ballistic Missile Division is wholly or partially responsible. Each space system and project is preceded by a concise history of administration, concept and objectives, making the monthly progress more meaningful in terms of total program objectives. The programs will be revised monthly to reflect major technical and administrative changes. Publication of this months report has been delayed slightly to permit the inclusion of information on the DISCOVERER XI, TRANSIT 1B and TIROS launches, and also to give an up-to-the minute report on the ABLE-4 THOR (PIONEER V). Information contained in these four sections only has been updated to include activities into the month of April. These programs must be sufficiently flexible to permit continuous and effective integration of rapidly occurring advances in the state-of-the-art.

This months report includes a Space Booster section containing program information, vehicle configurations, performance data and photographs of boosters used to support the programs covered in this report. This information will be revised when vehicle design changes occur or as new boosters are developed.

R W Curtin for.

O. J. RITLAND
Maj. Gen., USAF
Commander

a foreword to...



SPACE

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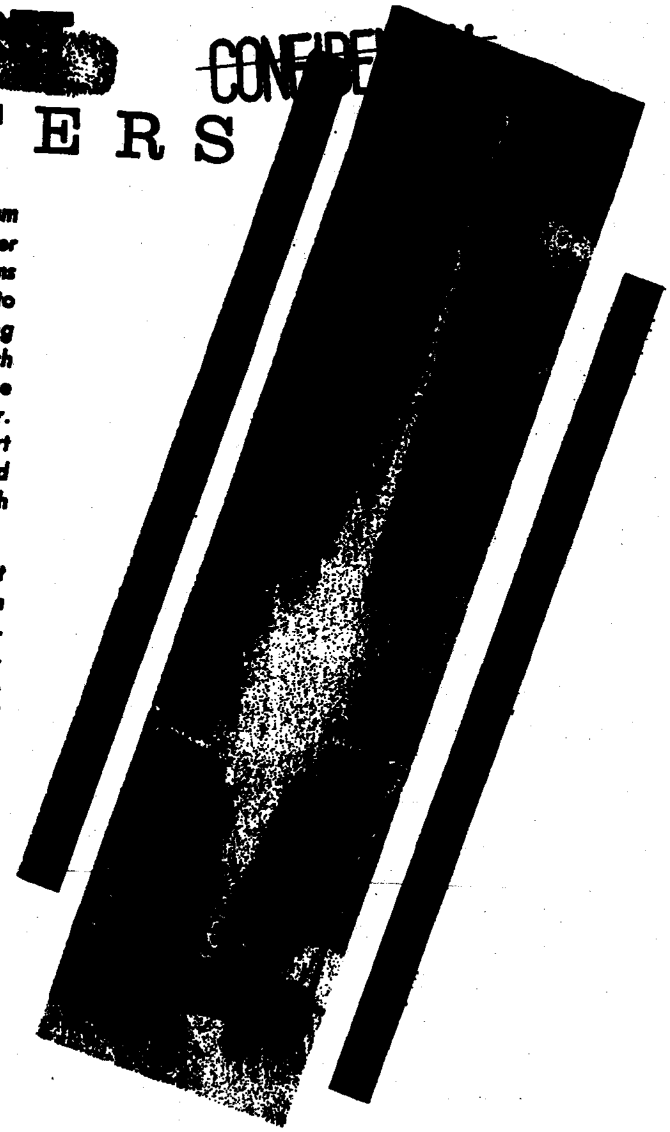
Space Program

BOOSTERS



Planning time schedules for the accomplishment of Space Program missions is based largely, at present, on the availability of booster vehicles. IRBM, ICBM, and upper stage development programs must be closely monitored. As modifications are incorporated into these programs: reducing weight, increasing thrust, lengthening burning periods, using improved fuels; in short, any change which improves overall performance, the use of the vehicle must be re-evaluated in terms of use as a satellite or space probe booster. As breakthroughs are achieved which advance the state-of-the-art in propulsion, guidance, re-entry; in more durable materials and more reliable components, new doors are opened through which additional space capabilities are made possible.

Because of the wide variety of space research missions which must be accomplished the problem of accommodating a maximum number of experiments within a given payload becomes very complex. Among other factors, solving this problem involves the selection of the most effective booster combination, the maximum use of booster subsystems, and the maximum use of existing ground tracking and support facilities and equipment.

Because of its signal success in providing the nation with an operational THOR IRBM and ATLAS ICBM within an unbelievably short period of time, as well as for its advanced work in TITAN and MINUTEMAN programs, AFBMD possesses a distinct advantage in evaluating booster capability in terms of specific space payloads or missions. The following pages are devoted to a brief presentation of the various boosters currently being used to support AFBMD space programs. Performance charts are given which make possible a comparison of several booster combinations now in use. Specific performance figures for each vehicle are given in the table of specifications. All data shown is nominal, with individual qualifications indicated where necessary.

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THOR

Prime contractor:
Douglas Aircraft Co.

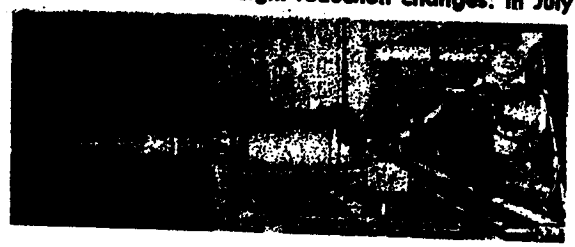
Engine manufacturer:
Rocketdyne Div., North American Aviation

Height	64 feet 10 inches (without re-entry vehicle)
Weight (no residual propellants)	
SM-75	106,546 pounds
DM-21	108,395 pounds
Engine	
SM-75	MB-3 Block I
DM-21	MB-3 Block II
Fuel	RJ-1
Oxidizer	LOX

Guidance — removed on space booster flights

Used as first stage for:
DISCOVERER
ABLE-3 and -4
TRANSIT
COURIER
TIROS

Early in 1958, the decision to accelerate the national space effort was made effectively possible only because of the availability of the THOR IRBM. THOR No. 127 was diverted from the R&D flight test program for use as the ABLE-1 space probe first stage. With top national priority assigned to the space research effort, THOR No. 163 was used to boost the DISCOVERER I into orbit on 28 February 1959. Since then, the THOR has become a reliable operational IRBM and highly reliable also as a booster for space vehicles. During 1959 all THOR boosted space flights achieved completely successful first stage performance. THOR performance has been increased through weight reduction modifications and use of RJ-1 (instead of RP-1) fuel. In April 1960 a modified THOR, designated DM-21, will be available, incorporating a shortened guidance compartment and additional weight reduction changes. In July 1960 THOR thrust will be increased to 167,000 pounds through installation of the MB-3-Block II engine. The first DM-21 vehicle will be used to boost DISCOVERER XVII.



ATLAS

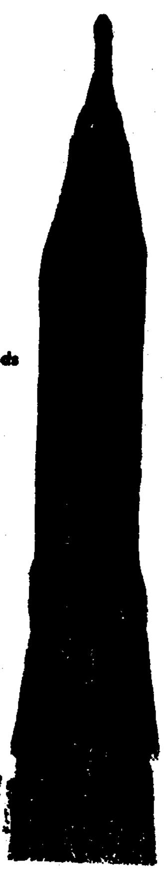
Prime contractor:
Convair

Engine manufacturer:
Rocketdyne Div., North American Aviation

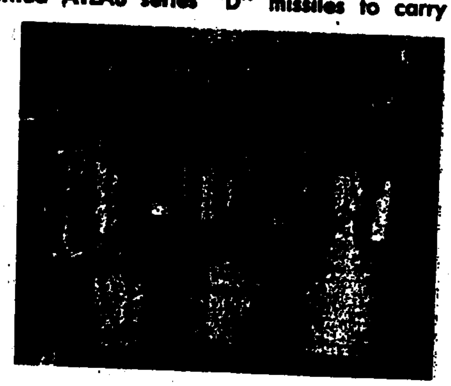
Height	69 feet
Diameter	10 feet
Weight	261,206 pounds
Engine	
Series D ATLAS	MA-2
Fuel	JP-4
Oxidizer	LOX

Guidance — Radio-inertial
General Electric (radar)
Burroughs Corp. (computer)

Used as first stage for:
SAMOS
MIDAS
COMMUNICATIONS SATELLITE
ABLE-4
PROJECT MERCURY

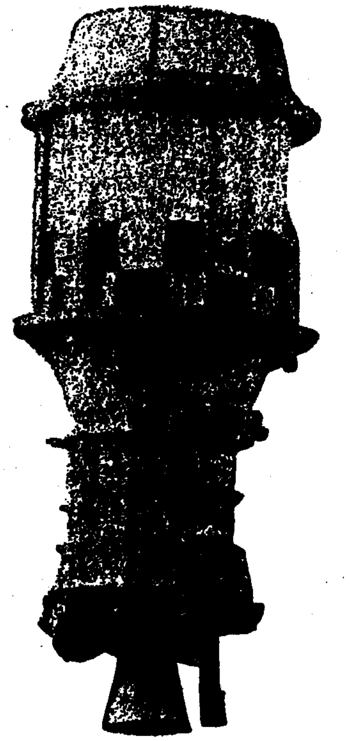


The ATLAS ICBM, providing over twice the thrust of the THOR, will be used as the first stage booster for the three Advanced Military Satellite Programs and for Project Mercury man-in-space. The first ATLAS boosted space flight was launched from the Atlantic Missile Range on 18 December 1958. Designated Project Score, this vehicle (ATLAS 10B) successfully placed a communications payload satellite into orbit around the earth. In November 1959 the ABLE-4 space probe did not attain orbit; however, the ATLAS first stage performance was entirely successful. The first flight test vehicle in Project Mercury was launched on 7 September with all objectives essentially achieved and excellent ATLAS booster performance realized. Future flights will use modified ATLAS series "D" missiles to carry increased payload weights. Project Mercury boosters are being modified also to include abort-sensing and other pilot safety features. The success of the first three ATLAS boosted space flights, plus the increased performance and reliability being demonstrated in the ATLAS R&D flight test program, lend confidence in this booster as a means of realizing advanced space objectives.



AGENA

Although originally designed as the basic satellite vehicle for the Advanced Military Satellite Programs, flight testing of the AGENA was accelerated when the DISCOVERER program was created, using the THOR/AGENA combination. Because of its availability, the Bell Aircraft LR81-Ba-3 rocket engine was selected for AGENA propulsion, and later modified to use unsymmetrical di-methyl hydrazine instead of JP-4 fuel. Subsequent modifications resulted in the AGENA "B" configuration, in which propellant tank capacity was doubled and the engine modified to provide single restart and extended burn capabilities. The increased performance of this design greatly enhanced the potential of the THOR/AGENA combination. An optical inertial system for guidance and orbital attitude control was developed to meet the critical orbital eccentricity and attitude requirements for the programs involved. Gas jets and reaction wheels are used to control attitude. Payloads may be installed on the forward equipment rack or distributed throughout the vehicle. The flight test program also has been used to develop a recovery capability for a payload capsule which is ejected from the orbiting satellite.



Prime contractor:
Lockheed Missile and Space Division

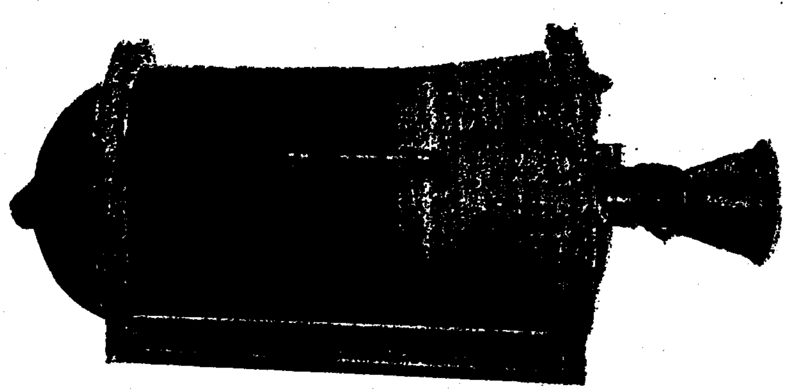
Engine manufacturer:
Bell Aircraft Corp.

Length	
"A" version	14 feet
"B" version	19.5 feet*
	21 feet**
Diameter	60 inches
Weight	
"A" version	7,987 pounds
"B" version	14,800 pounds
Engine	
"A" version	YLR81-Ba-5
"B" version	XLR81-Ba-7*
	XLR81-Ba-9**
Fuel	UDMH
Oxidizer	IRFNA
Guidance	optical-inertial

Used as second stage for:
DISCOVERER (XVII & subs)
SAMOS (flight 4 and subs)
MIDAS (flight 3 and subs)

ABLE-STAR Vehicle

The ABLE-STAR upper stage vehicle contains an AJ10-104 propulsion system which is an advanced version of earlier Aerojet-General systems. In addition to providing increased performance capability, the system includes automatic starting, restarting, shutdown, ground control, coast period pitch and yaw control, and ground monitoring systems. Propellants are fed to the thrust chamber by a high pressure helium gas system. The thrust chamber is gimballed by electrical signals to provide pitch and yaw control during powered flight. Roll control during powered flight is achieved by expelling nitrogen through a system of nozzles in response to electrical signals. Roll control during coast periods uses a parallel circuit at lower thrust. Attitude control for coast periods up to one-half hour provided in the current design can be extended by increasing the nitrogen supply.



Contractor:
Aerojet-General

Height	14 feet 3 inches
Diameter	4 feet 7 inches
Weight	9772 pounds
Engine	AJ10-104

with Restart Capability
Nozzle Expansion Ratio—40.1

Fuel
Unsymmetrical Dimethyl Hydrazine

Oxidizer
Inhibited Red Fuming Nitric Acid

Guidance
STL Advanced Guidance System
Burroughs J-1 Computer

Used as second stage for:
TRANSIT 1B, 2A, 2B
COURIER 1A, 1B

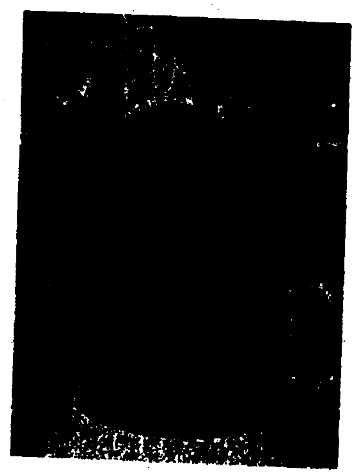
ABLE Vehicle

The ABLE upper-stage vehicle has been flight tested successfully as the second stage on THOR re-entry vehicle tests, ABLE Projects and TRANSIT 1A. The vehicle uses AJ10-42 or AJ10-101 propulsion systems (improved versions of systems used originally on the Vanguard Program), guidance systems, and electronic and instrumentation equipment. The ABLE vehicles are guided during second stage engine burning. Vehicles using the AJ10-101 system are spun with the third stage and payload prior to second stage engine burnout to provide spin stabilization of the unguided third stage and payload. On flight vehicles using the AJ10-42 propulsion system, only the third stage and payload are spun prior to second stage separation by a spin table bearing system located at the second to third stage separation plane. Only minor differences exist between the two propulsion systems.

Contractor:
Aerojet-General Corp.

Height	18 feet 7 inches
Diameter	4 feet 8 inches
Weight	
AJ10-42	4622 pounds
AJ10-101	4178 pounds

Fuel
Unsymmetrical Dimethyl Hydrazine



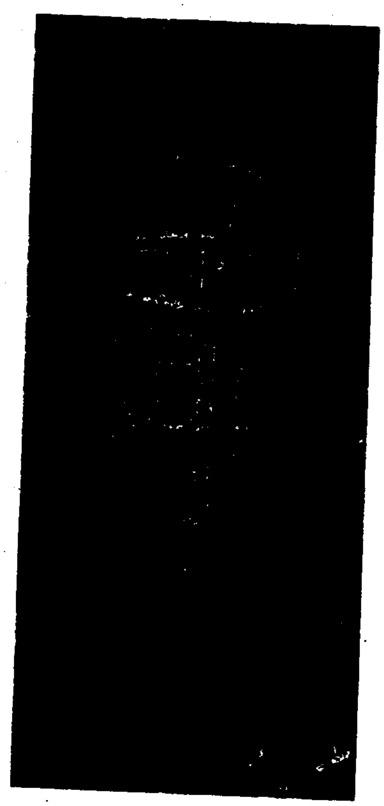
Oxidizer
Inhibited White Fuming Nitric Acid

Guidance
AJ10-42
Radio-Inertial (BTL)
AJ10-101
Advanced Guid. Syst. (STL)
Computer (Burroughs J-1)

Used as second stage for:
AJ10-42 — TRANSIT 1A, TIROS
AJ10-101 — ABLE 3 and 4

ABL 248 Vehicle

Development of the Allegany Ballistics Laboratory X-248 engine for the Vanguard Program was accelerated when it was selected as the third stage for Project ABLE-1. The unit represented the most advanced solid propellant engine of its size available at the time. Since the engine had not been qualification of flight tested, test firings were conducted in a vacuum chamber simulating approximately 100,000 feet altitude. Design modifications involving the igniter, nozzle, and internal insulation were found to be required. The modified engine performed with complete satisfaction on the successful flight of ABLE-1 and subsequently on ABLE-3 and ABLE-4 THOR.

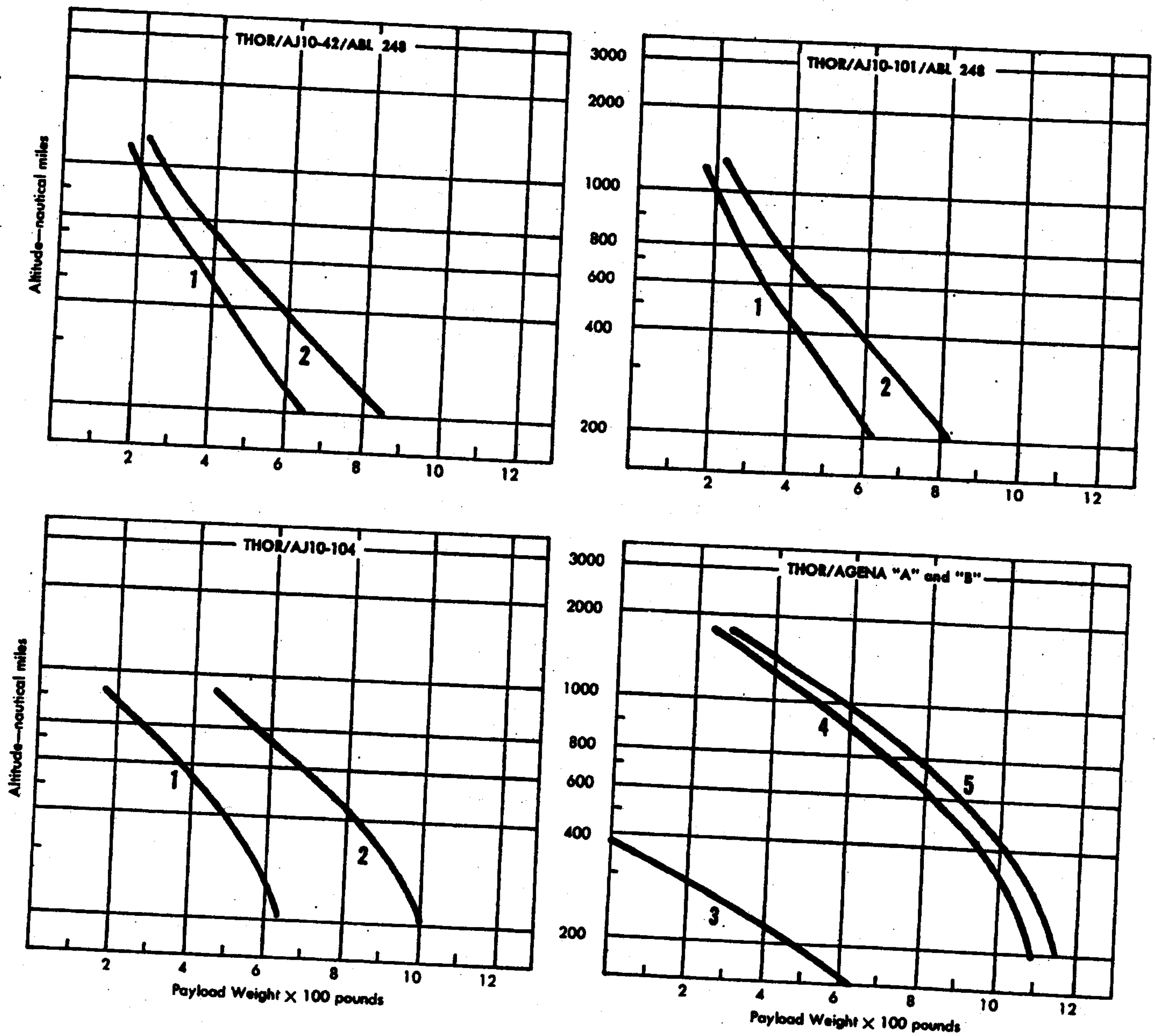


Contractor:
Allegany Ballistic Laboratory

Height	4 feet 10 inches
Diameter	1 foot 6 inches
Weight	515 pounds
Fuel	Solid

Used as third stage on:
ABLE 3 and 4
TRANSIT 1A, TIROS

Performance Graphs — THOR BOOSTED



1. Polar—AMR or VAFB
2. AMR—90 degrees
3. VAFB—AGENA "A"
4. VAFB—AGENA "B" (XLR81-Ba-7)
5. VAFB—AGENA "B" (XLR81-Ba-9)

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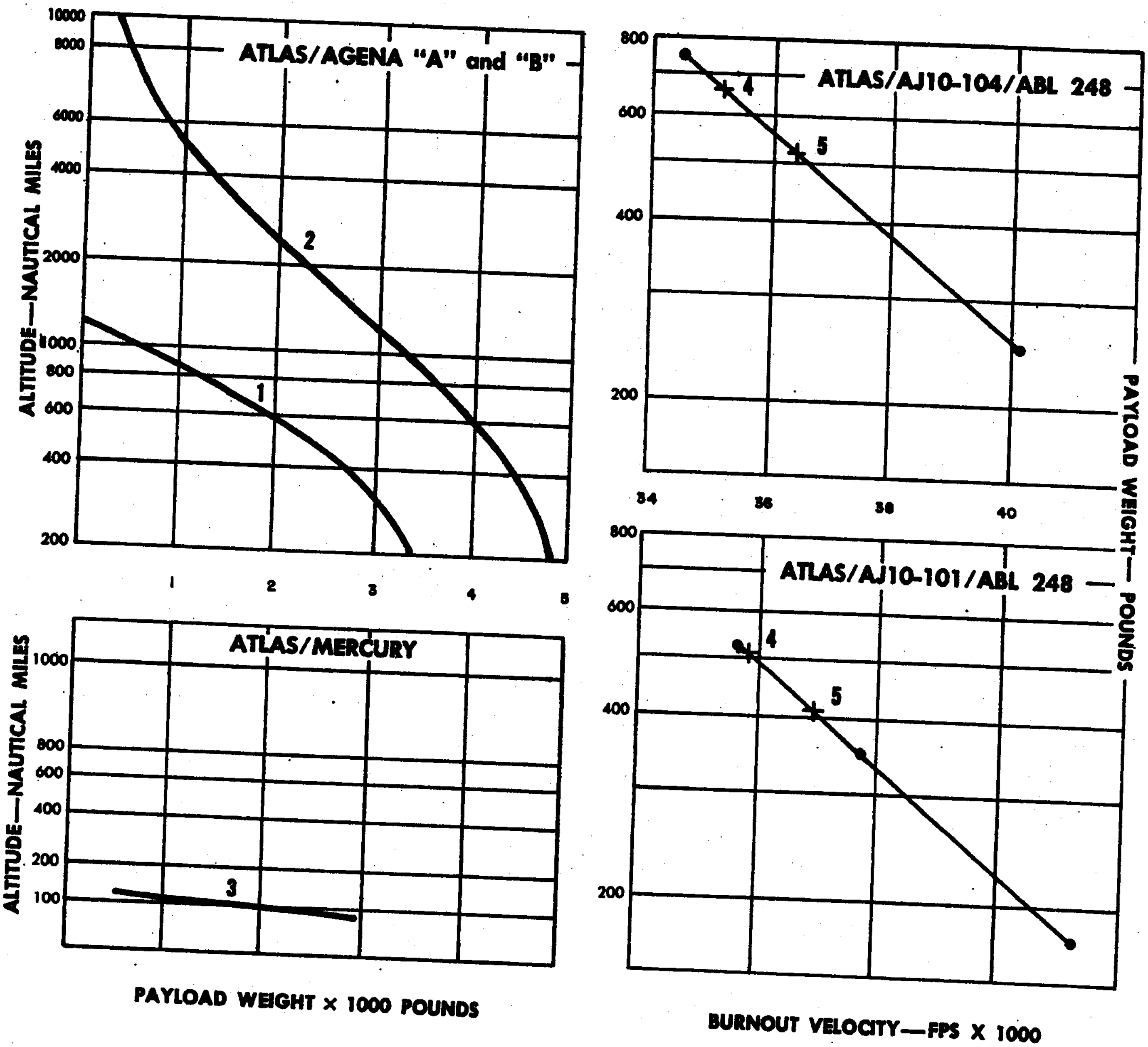
Performance Graphs — ATLAS BOOSTED



1. AGENA "A"—Polar Orbit
2. AGENA "B"—Polar Orbit
3. AMR—90 degrees

4. Lunar Probe
5. Venus Probe

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Specifications....

THOR

THOR	A SM-75	B DM-21
Weight—dry	7,746	6,510
Fuel	30,500	33,695
Oxidizer	68,300	68,190
TOTAL WEIGHT	106,546	108,395
Thrust-lbs., S.L.	152,000	167,000
Spec. Imp.-sec.	246.42	248.3
Burn Time—sec.	163.59	148.0

ATLAS (FIRST STAGE)

ATLAS	C Series D
Weight—wet	15,100
Fuel	74,900
Oxidizer	172,300
TOTAL WEIGHT	262,300
Thrust-lbs., S.L.	
Boost	356,000
Sustainer	82,100
Spec. Imp.-sec.	
Boost	286
Sustainer	310

AGENA (SECOND STAGE)

AGENA	D "A"	E "B"	F "B"
Engine Model	YLR81-Ba-5	XLR81-Ba-7③	XLR81-Ba-9④
①Weight—inert	1,155	1,370	1,400
Impulse propellants	6,550	13,100	13,100
Pyrotechnics	67	108	108
②TOTAL WEIGHT	7,772	14,578	14,608
Separation Weight	7,746	14,552	14,582
Thrust-lbs., vac.	15,000	15,000	15,000
Spec. Imp.-sec., vac.	277	277	290
Burn Time—sec.	120	240③	240④

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 operation.*

⑤ *Allegany Ballistic Laboratory.*

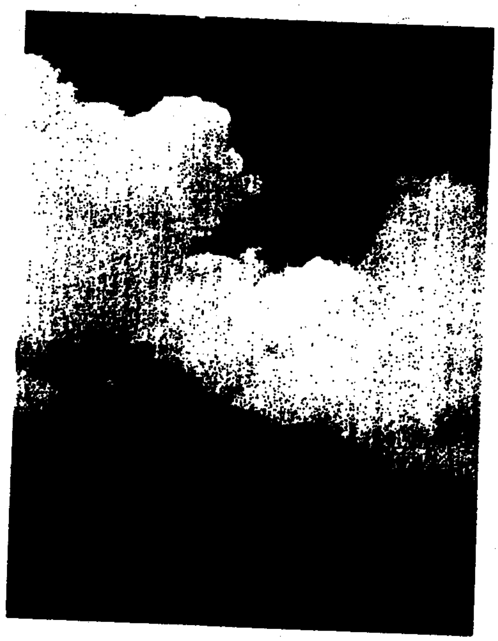
AEROJET-GENERAL (SECOND STAGE) / ⑤ABL 248 (THIRD STAGE)

AEROJET-GENERAL	G AJ 10-42	H AJ 10-101	J AJ10-104 ABLE-STAR	⑤ABL 248 K
Weight—wet	1,247.1	847.9	1,297	59.5
Fuel	875.1	869.0	2,247	455.5
Oxidizer	2,499.6	2,461.0	6,227	(solid)
TOTAL WEIGHT	4,621.8	4,177.9	9,771	515
Burnout Weight	1,308.6	944.1	1,419	50.5
Thrust-lbs., vac.	7,670	7,720	7,900	3,100
Spec. Imp.-sec., vac	267	267	278	250.5

Program Vehicle Combinations

- DISCOVERER (1 thru 16) ...... A-D
- DISCOVERER (16 thru 21) ..... A-E
- DISCOVERER (21 thru 29) ..... B-F
- COMM. SATELLITE .... C-E
- COMM. SATELLITE .... C-F
- MIDAS (1 and 2) .... C-D
- MIDAS (3 and subs) .... C-F
- SAMOS (1 thru 3) .... C-D
- SAMOS (4 and subs) .... C-F
- ABLE-3 .... A-H-K
- ABLE-4 .... C-H-K
- ABLE-4 .... A-H-K
- TRANSIT IA .... A-G-K
- TRANSIT IB, 2A, 2B .... A-J
- COURIER .... A-J
- TIROS .... A-G-K

SPACE



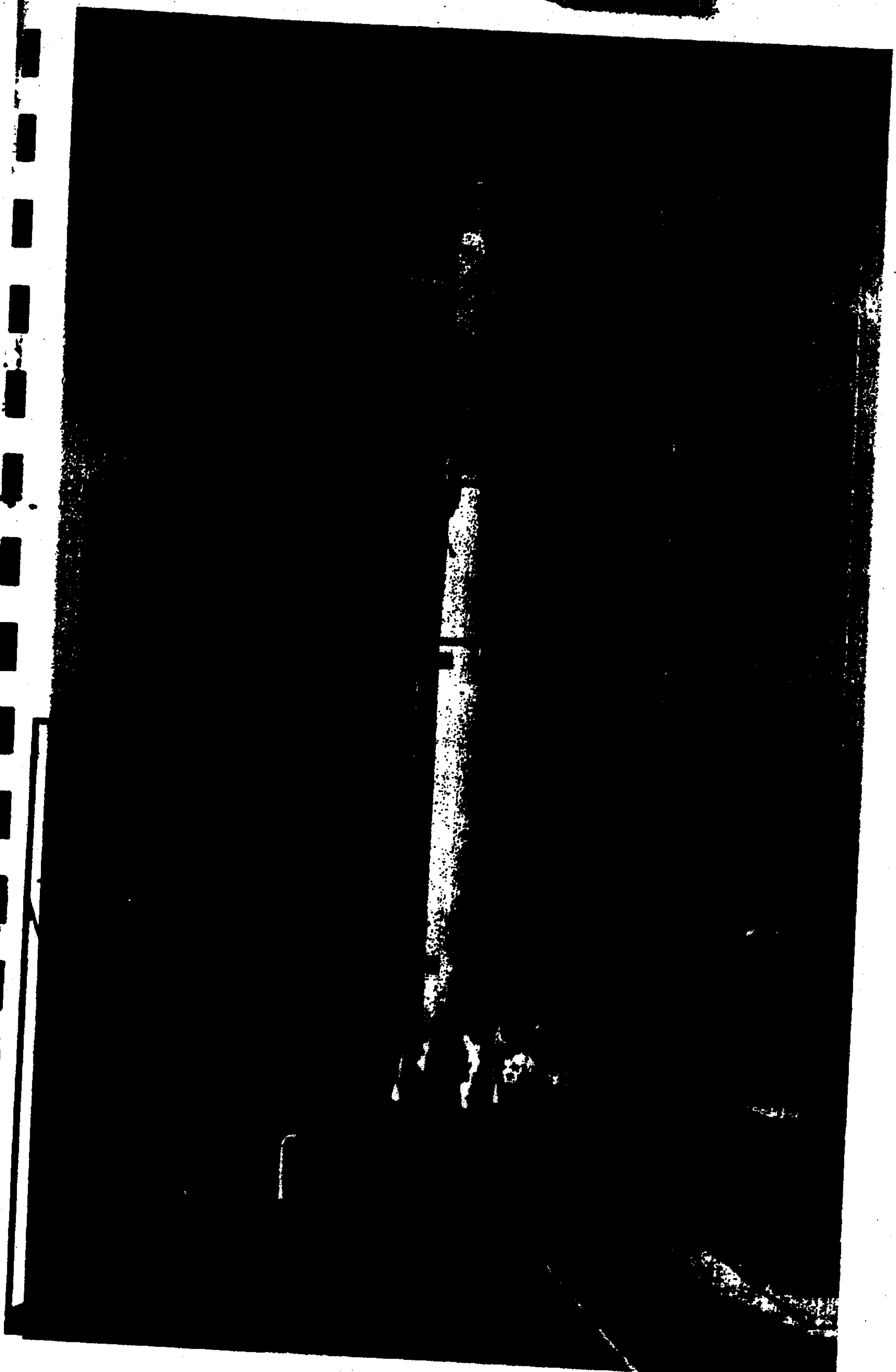
systems

DISCOVERER

SAMOS

MIDAS

COMMUNICATIONS
SATELLITE



Discoverer

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SECOND STAGE	AGENA "A"	AGENA "B"
Weight—Inert	1,370	1,600
Impulse Propellants	6,550	13,100
Fuel (UDMH)		
Oxidizer (IRFNA)		
Pyrotechnics	67	100
GROSS WEIGHT (lbs.)	7,987	14,800
Engine	YLR81-Ba-5	XLR81-Ba-7
Thrust, lbs. (vac.)	15,000	15,000
Spec. Imp., sec. (vac.)	277	277
Burn Time, sec.	120	240
Restart Provisions	No	Yes
THOR BOOSTER	SM-75	DM-21
Weight—Dry	6,950	5,950
Fuel	33,750	33,750
Oxidizer (LOX)	68,300	68,300
GROSS WEIGHT (lbs.)	109,000	108,000
Engine	MB-3 Block 1	MB-3 Block 2
Thrust, lbs. (S.L.)	152,000	167,000
Spec. Imp., sec. (S.L.)	247.8	247.8
Burn Time, sec.	163	163

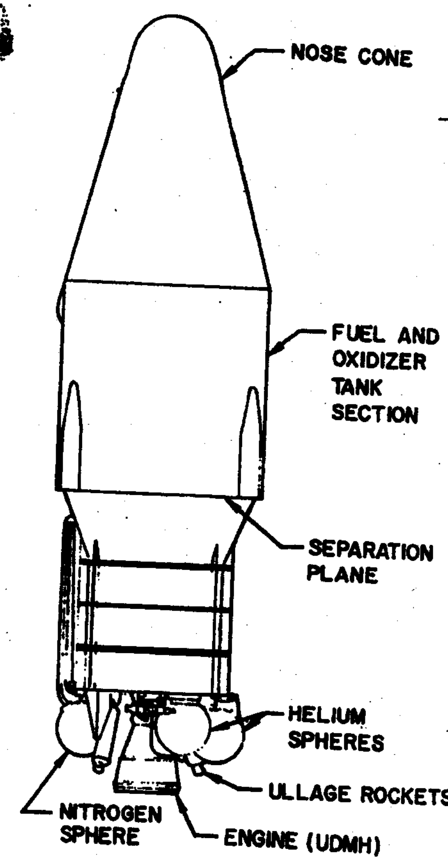

Figure 1. Photograph of two-stage DISCOVERER vehicle (left) and detailed drawing of AGENA, second stage (right).

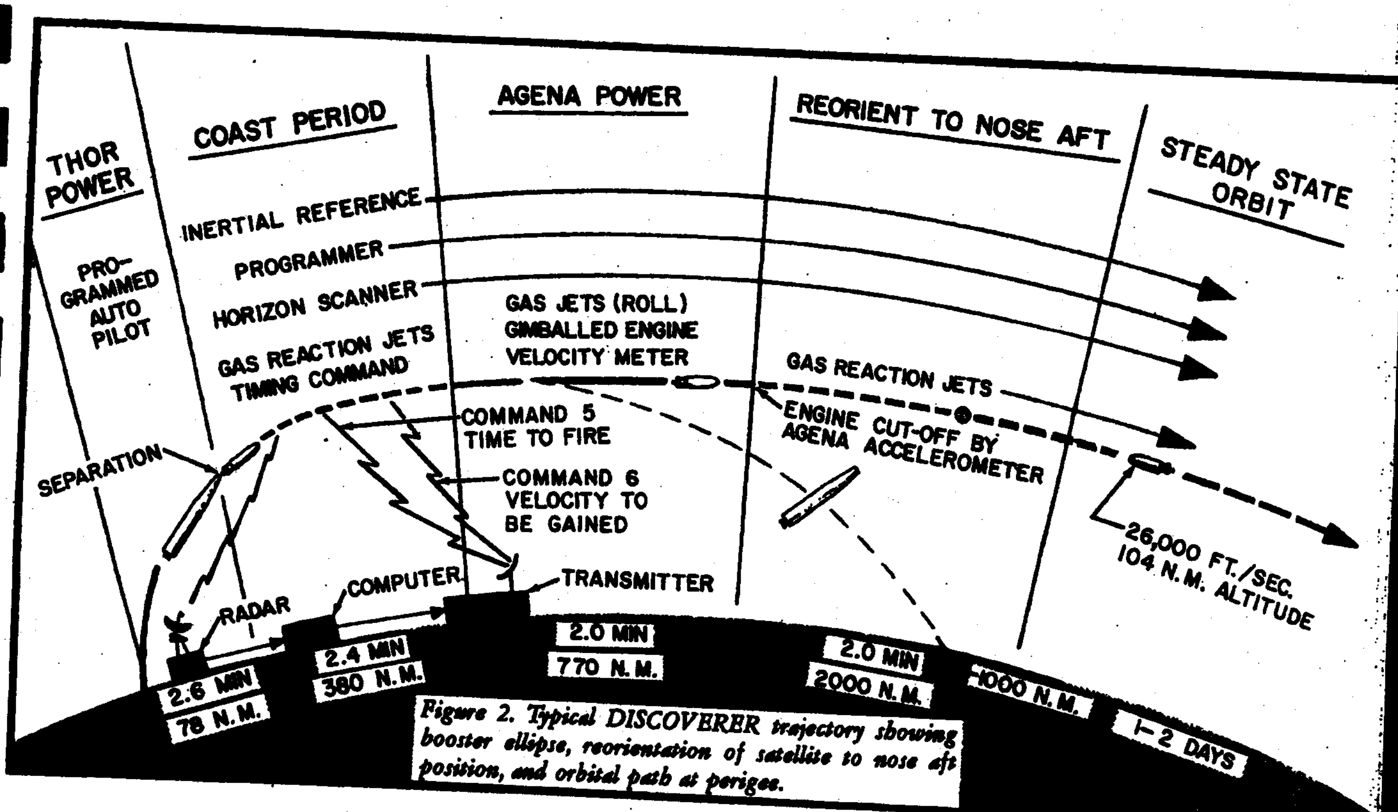

Figure 2. Typical DISCOVERER trajectory showing booster ellipse, reorientation of satellite to nose aft position, and orbital path at perigee.

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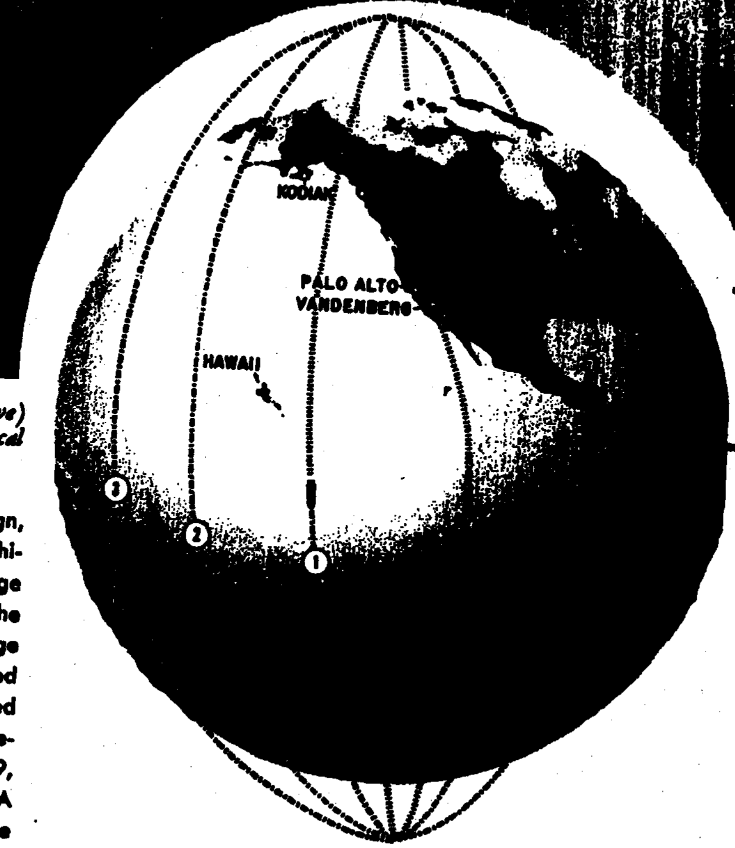

Figure 3. Typical DISCOVERER trajectory (above) from launching at Vandenberg AFB to orbit. Typical satellite orbital path around the earth (right).

The DISCOVERER Program consists of the design, development and flight testing of 29 two-stage vehicles (Figure 1), using the THOR IRBM as a first stage booster and the AGENA vehicle, powered by the Bell LR81 rocket engine series as the second stage satellite. The DISCOVERER Program was established early in 1958 under direction of the Advanced Research Projects Agency, with technical management assigned to AFBMD. On 14 November 1959, program responsibility was transferred from ARPA to the Air Force by the Secretary of Defense. Prime contractor for the program is Lockheed Missile and Space Division. The DISCOVERER Program will provide: (a) space research in support of the advanced military reconnaissance satellite systems programs, (b) test of the ground communications and tracking network for these programs, and (c) flight testing of the AGENA second stage vehicle.

Primary objectives include:

(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.

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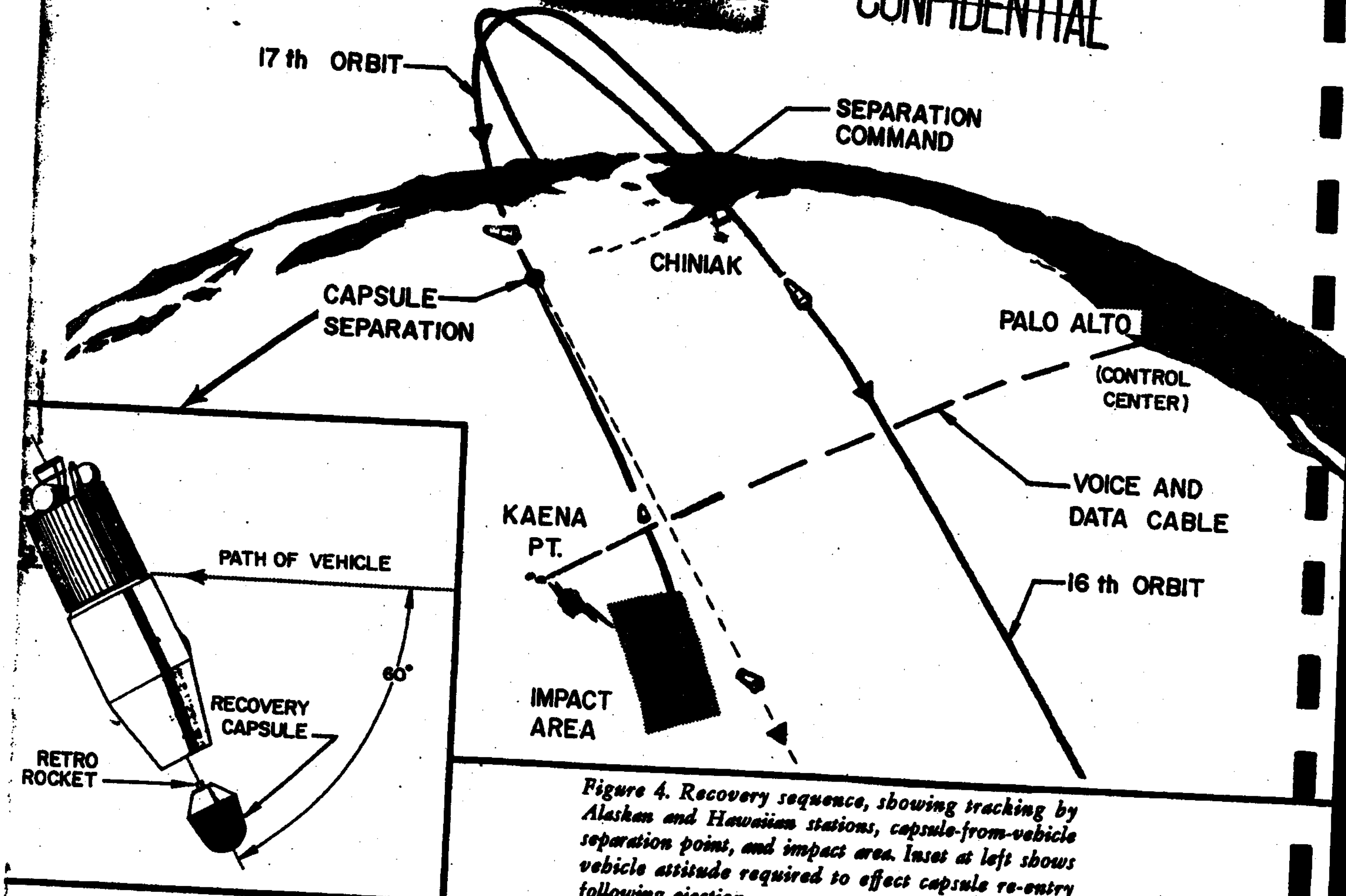


Figure 4. Recovery sequence, showing tracking by Alaskan and Hawaiian stations, capsule-from-vehicle separation point, and impact area. Inset at left shows vehicle attitude required to effect capsule re-entry following ejection.

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

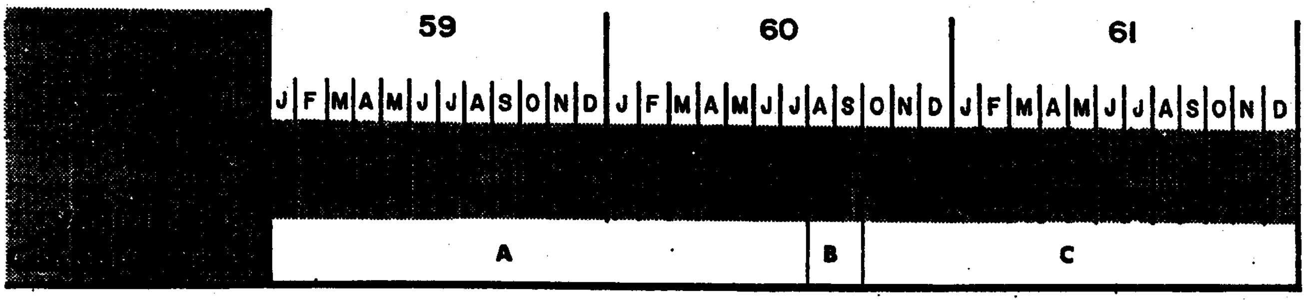
(e) Testing of ground support equipment and development of personnel proficiency.

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

Early tests confirmed vehicle flight and satellite orbit capabilities, developed system reliability and predictability, and established ground support, tracking, and data acquisition requirements. Subsequent flights are planned to acquire scientific data for design of advanced military reconnaissance payload components. Typical data gathering objectives include: cosmic and atomic radiation, magnetic field, total electron density, auroral radiation, micrometeorite measurement, Lyman alpha from space (or stars), solar radiation, and atmosphere density (drag) and composition.

A world-wide network of control, tracking, and data acquisition stations has been established. Overall operational control is exercised by the Control Center in Palo Alto, California. Blockhouse and launch operations are performed at the Vandenberg Air Force Base Control Center.

Telemetry ships are positioned as required by the specific mission of each flight. Figures 2 and 3 show a typical launch trajectory from Vandenberg Air Force Base, and figure 3 shows schematically a typical orbit. An additional objective of this program is the development of a controlled re-entry and recovery capability for the payload capsule (Figure 4). An impact area has been established near the Hawaiian Islands, and a recovery force activated. Techniques have been developed for aerial recovery by C-119 aircraft and for sea recovery by Navy surface vessels. The recovery phase of the program has provided advances in re-entry vehicle technology. This information will be used in support of more advanced projects, including the return of a manned satellite from orbit.



A. THOR—SM-75 / AGENA "A"

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

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

Flight History

DISCOVERER No.	AGENA No.	THOR No.	Flight Date	Remarks
0	1019	160	21 January	*AGENA destroyed by malfunction on pad. THOR refurbished for use on flight XII.*
I	1022	163	28 Feb 1959	*Attained orbit successfully. Telemetry received for 514 seconds after lift-off.*
II	1018	170	13 April	*Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.*
III	1020	174	3 June	*Launch, ascent, separation, coast and orbital boost successful. Failed to achieve orbit because of low performance of satellite engine.*
IV	1023	179	25 June	*Same as DISCOVERER III.*
V	1029	192	13 August	*All objectives successfully achieved except capsule recovery after ejection on 17th orbit.*
VI	1028	200	19 August	*Same as DISCOVERER V.*
VII	1051	206	7 November	*Attained orbit successfully. Lack of 400-cycle power prevented stabilization on orbit and recovery.*
VIII	1050	212	20 November	*Attained orbit successfully. Malfunction prevented AGENA engine shutdown at desired orbital velocity. Recovery capsule ejected but not recovered.*
IX	1052	218	4 February	*THOR shut down prematurely. Umbilical cord mast did not retract. Quick disconnect failed, causing loss of helium pressure.*
X	1054	223	19 February	*THOR destroyed at T plus 56 sec. by Range Safety Officer.*

Monthly Progress—DISCOVERER Program

Flight Test Progress

- DISCOVERER XI was launched from pad 5, Vandenberg AFB, at 1230 PST on 15 April. The countdown proceeded very smoothly despite high winds. No technical holds were encountered, but the launch, scheduled for 1100 hours, was delayed one and one-half hours by mandatory holds while trains passed through the area. Terminal countdown time was only 12 minutes, 45 seconds. Launch, first stage THOR performance, separation, AGENA ignition, and orbital injection were excellent. Damage to the launch pad was unusually light.

- THOR mainstage and vernier cutoff were very near nominal. AGENA separation was clean and positive. After the proper delay, AGENA engine ignition occurred as planned. Data confirmed that the AGENA engine was shut down by the integrator-accelerometer at a total velocity gain very close to nominal. The resulting orbit has a perigee of 109.5 statute miles, an apogee of 380 statute miles, an eccentricity of .033, and an orbital period of 92.3 minutes. Acquisition of the satellite on the first pass was within 2 seconds of the time predicted from ascent tracking.

- Orbital performance was outstanding. Acquisition was accomplished by every station on every pass. All commands were received and verified (a total of fifteen). The horizon scanner, inertial reference package, and gas jet control system functioned extremely well, resulting in excellent satellite attitude stabilization. The satellite power supply, including the two advanced design static inverters, performed efficiently. The main batteries lasted through the 26th orbit.

- This was the most completely instrumented DISCOVERER flown to date. Telemetry transmission was excellent and all stations acquired valuable data on satellite equipment functions. Telemetered satellite internal temperatures were well within specified limits, confirming modifications made to satellite thermal control design.

- In addition to a completely equipped AGENA and recovery capsule, an experiment was flown with a precision dual-frequency doppler beacon from the TRANSIT program. The beacon was accompanied by a programmed continuous-burning light visible at night as a seventh-magnitude star. This light was

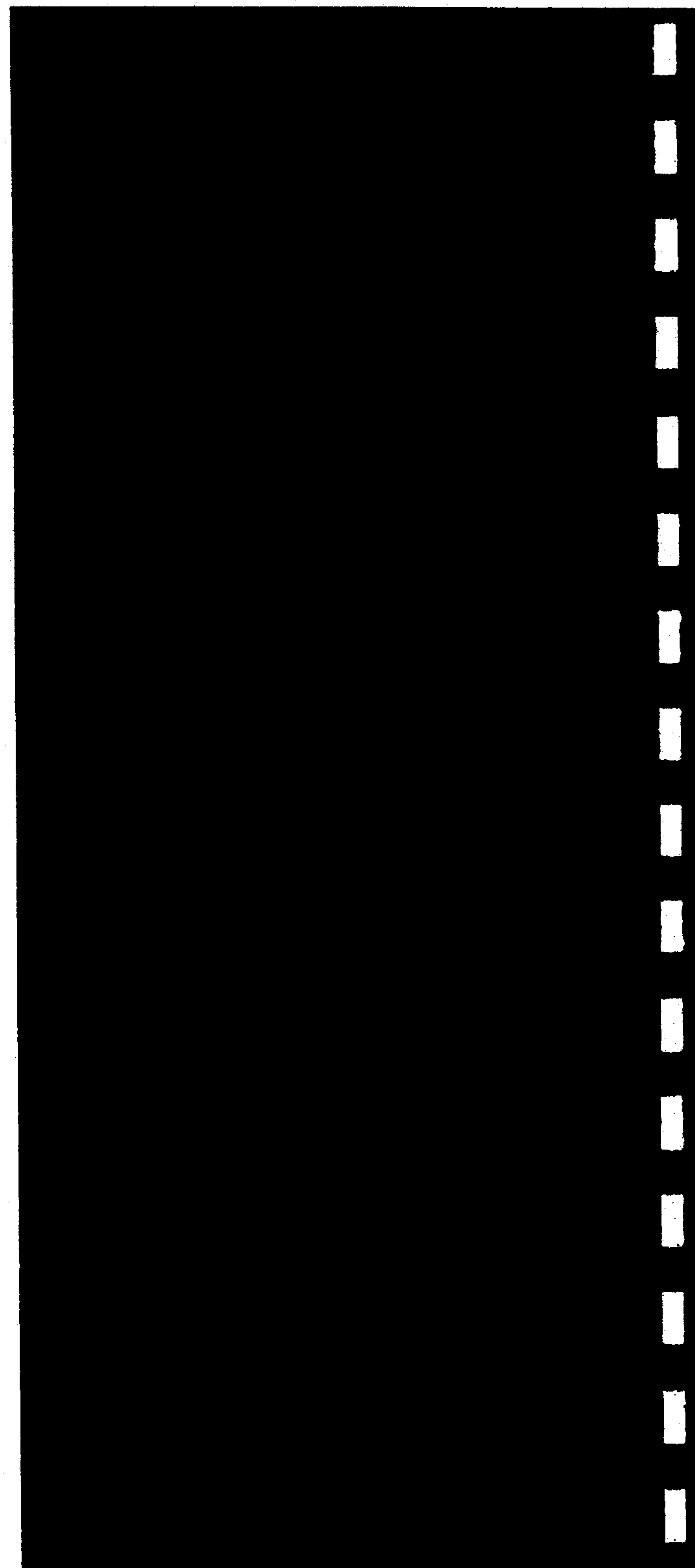


Figure 5. DISCOVERER XI just after liftoff.

successfully photographed by Baker-Nunn cameras of the Smithsonian Astrophysical Observatory, providing the most precise satellite tracking data ever obtained. Accuracy of the TRANSIT beacon and DISCOVERER verlort radar stations can now be closely determined by checking against this optical data. Both frequencies of the doppler beacon operated and were tracked. Photos of the light were made by the Cadiz, Spain camera station.

- Although capsule separation and retro rocket ignition took place, the capsule did not descend in the recovery area. Verification of the ejection for re-entry sequence was indicated by telemetry, although there was considerable noise at this time and values are somewhat difficult to determine. The capsule telemetry transmitter was tracked by the Hawaiian station and the recovery aircraft received brief signals. Intensive efforts are underway to determine what occurred and take corrective action prior to the launch of DISCOVERER XII.

- This flight is of great significance to the SAMOS and MIDAS programs. The components that are critical for success of SAMOS and MIDAS functioned extremely well. The modifications made in the past, based on results of previous DISCOVERER flights, were proven to be very effective. The flight accomplished the outstanding feat of achieving near-perfect performance of all components except the de-orbit function. Since an advanced version of this satellite vehicle will be used for both SAMOS and MIDAS programs, the development and refinement of the complex satellite vehicle and subsystems at this point in time lends confidence to the success of these programs.

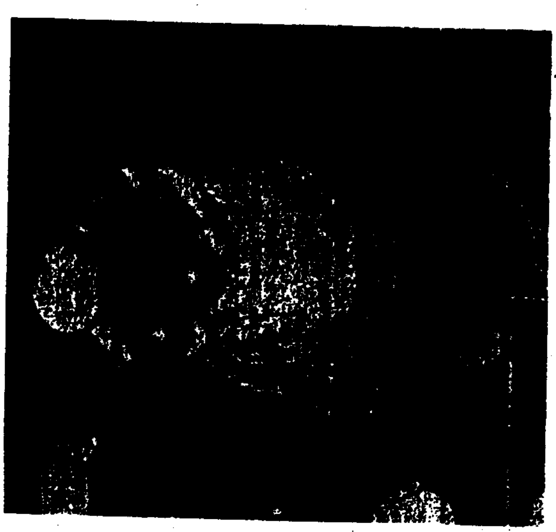


Figure 6. AGENA "B" vehicle being loaded on transporter for shipment to Santa Cruz Test Base. This is the initial AGENA "B vehicle for the DISCOVERER program (DISCOVERER XVIII).

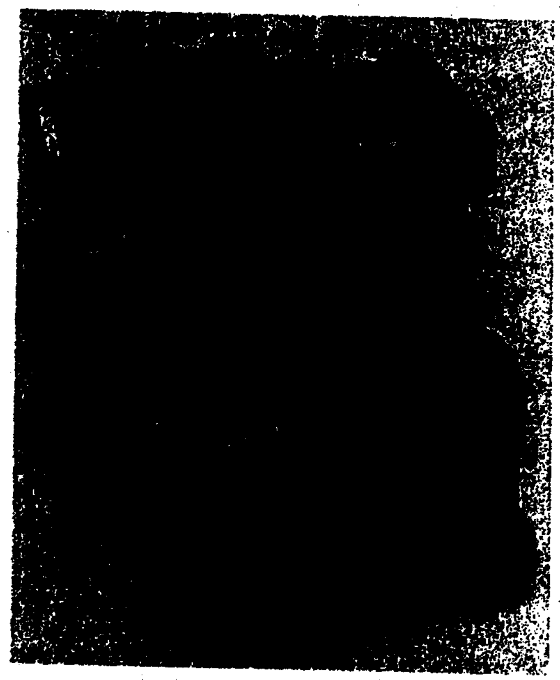


Figure 7. Hydraulic control package for gimbaling the XLR-81Ba-9 engine. This fuel-powered system will be used on DISCOVERER flight XVII.

Technical Progress

Second Stage Vehicles

Differences in DISCOVERER vehicle configurations are defined on page A-5.

- All AGENA "A" vehicles (for use on DISCOVERER flights XI through XV) have been delivered to Vandenberg AFB.

- The first AGENA "B" vehicle (XLR-81Ba-7 engine) was delivered to the Santa Cruz Test Base on 1 March. The vehicle has been installed in test stand 2 and preparations are being made for hot firing tests. The other three AGENA "B" vehicles using this engine model are in the LMSD Systems Test Area (formerly Modification and Checkout Center). Systems checks of the three vehicles are 90, 65 and 60 percent complete.

- The test firing program for the XLR-81Ba-9 engine was completed during March at the Santa Cruz Test Base. This engine, installed in an AGENA "B" vehicle, will be used on DISCOVERER flights XVII and subsequent. The test program consisted of nine firings, several of which were restart operations. An additional primary objective of the program was the testing of the fuel pressure powered hydraulic system, also planned for initial use on the DISCOVERER XVII flight.

● Testing of nozzle extensions for the XLR-81Ba-9 engine continued during the month at Bell Aircraft and Arnold Engineering Development Center (AEDC). The extensions are designed to increase the nozzle ratio from 20:1 to 45:1. Two successful firings of a titanium extension were conducted at Bell Aircraft. The extension has been sent to AEDC for additional testing and evaluation. Stainless steel test extensions providing area ratios of 45:1 and 60:1 were test fired with favorable results at AEDC during March.

Antennas

● The manufacturing of two transistorized S-band beacons was completed during the month. In order to expedite delivery of these items, formal acceptance testing was started by LMSD representatives on 14 March at the manufacturer's plant. One of the beacons will be used for type testing and the other will become the flight article for the first AGENA "B" flight.

Recoverable Capsule

● Intensive efforts were continued during the month to obtain additional data on which reliability studies and capsule recovery probability analyses could be based. Sufficient component data has not been received from the capsule contractor (General Electric Co.) to establish firm reliability estimates. LMSD reliability engineers are reviewing this problem with General Electric Co.

Ground Support Equipment

● Countdown time will be decreased and fabrication and checkout procedures standardized by the replacement of the present 200 pin umbilical system with a 100 pin system beginning with the launch of DISCOVERER XVII. The new system also will provide increased reliability by the simplification of checkout procedures, and will reduce over-all manhour requirements. Existing wiring in the vehicle is being divided according to launch countdown or component checkout function. The countdown wiring will make up the 100 pin umbilical system. The remaining wiring will be led into test plugs for simplification of component checkout. Blockhouse and trailer wiring will remain unchanged.

● Revised testing and component selection procedures for Fairchild programmers were completed during the month and given to the contractor. The new procedures will expedite future deliveries of this critically short component.

Facilities

● Interim measures to reduce personnel hazards related to propellant storage and handling methods at Vandenberg AFB launch sites have been incorporated until permanent facilities can be provided. These measures include: improved lighting facilities (including standby lighting power provisions), a water distribution and tanking system (including emergency showers and eye wash facilities), a reinforced flushing and dumping pit for IRFNA areas, improved water drainage around propellant shelters, and improved methods of maintaining access roads.

● Modifications to the Hawaiian tracking station, in support of the NASA TIROS project, were completed prior to the launch of that vehicle. Fly-by tests were completed successfully and exercises run to determine the time required to convert the radar equipment from DISCOVERER to TIROS use. Changeover time was determined to be approximately 20 minutes.

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S a m o s

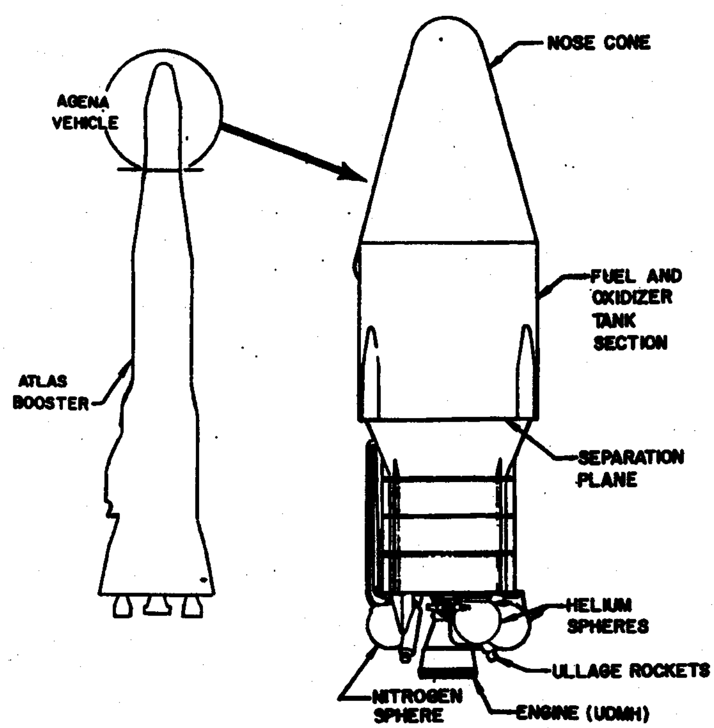
BOOSTER—ATLAS ICBM

Weight—Wet	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

SECOND STAGE	AGENA "A"	AGENA "B"
Weight—Inert	1,370	1,600
Impulse Propellants Fuel (UDMH) Oxidizer (IRFNA)	6,550	13,100
Pyrotechnics	67	100
GROSS WEIGHT (lbs.)	7,987	14,800
Engine	YLR81-Ba-5	XLR81-Ba-7
Thrust, lbs. (vac.)	15,000	15,000
Spec. Imp., sec. (vac.)	277	277
Burn Time, sec.	120	240
Restart Provisions	No	Yes

Figure 1.

Artists' concept of SAMOS satellite. Line drawing of complete flight vehicle (right) and detailed view of basic AGENA upper stage (left).



PROGRAM HISTORY

The SAMOS Program was included in Weapon System 117L when WS 117L was transferred to the Advanced Research Projects Agency early in 1958. ARPA separated WS 117L into the DISCOVERER, SAMOS and MIDAS programs with the SAMOS objectives based on a visual and ferret reconnaissance system. On 17 November 1959 responsibility for this program was transferred from ARPA to the Air Force by the Secretary of Defense.

PROGRAM MISSION

The primary mission of the SAMOS advanced reconnaissance system is to provide continuous visual, electronic (and other) surveillance of the USSR and its allied nations. Efforts include development of hardware to permit:

a. Determination of characteristics of enemy electronic emissions.

b. Verification of known targets, detection of unknown targets.

c. Location and evaluation of defenses.

d. Evaluation of military and industrial strength.

e. Assessment of high-yield weapons damage.

f. Reconnoitering of troop movements.

g. Location of naval forces throughout the world.

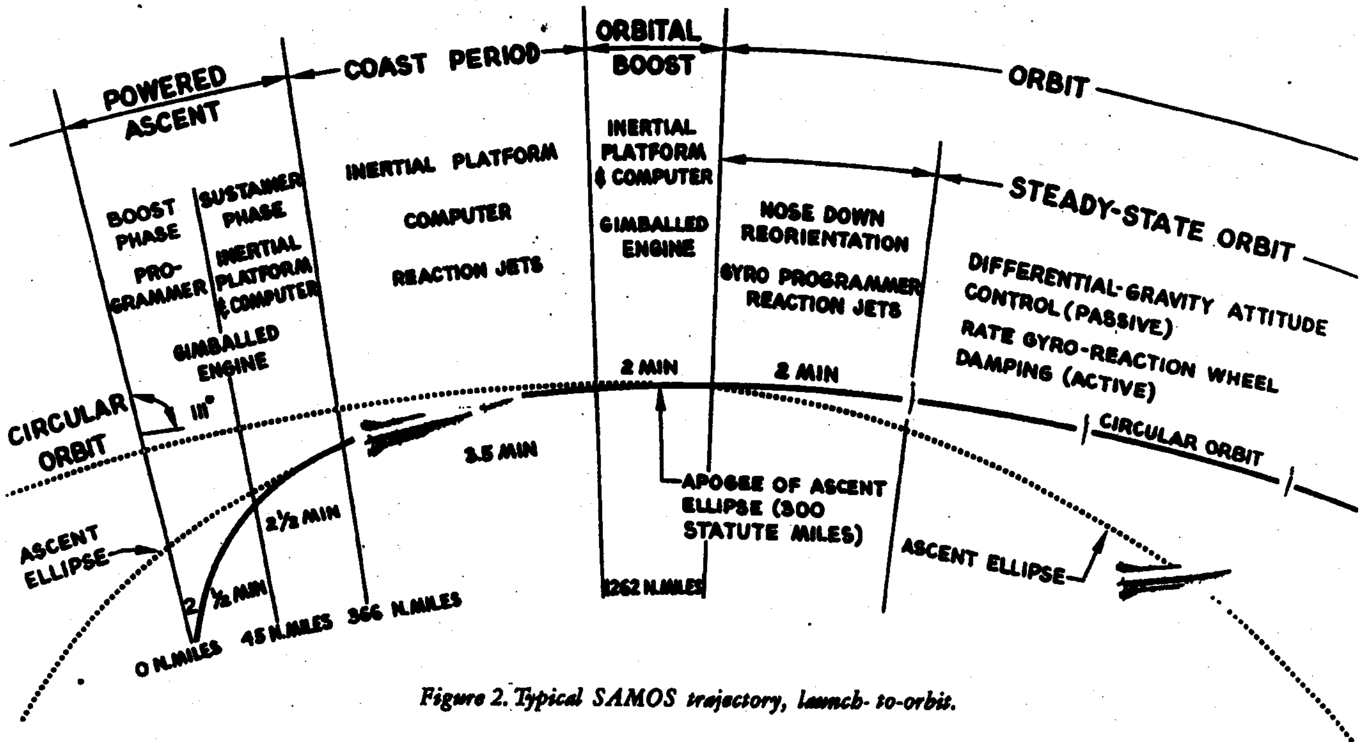


Figure 2. Typical SAMOS trajectory, launch- to-orbit.

- ***Ferret Reconnaissance . . .***

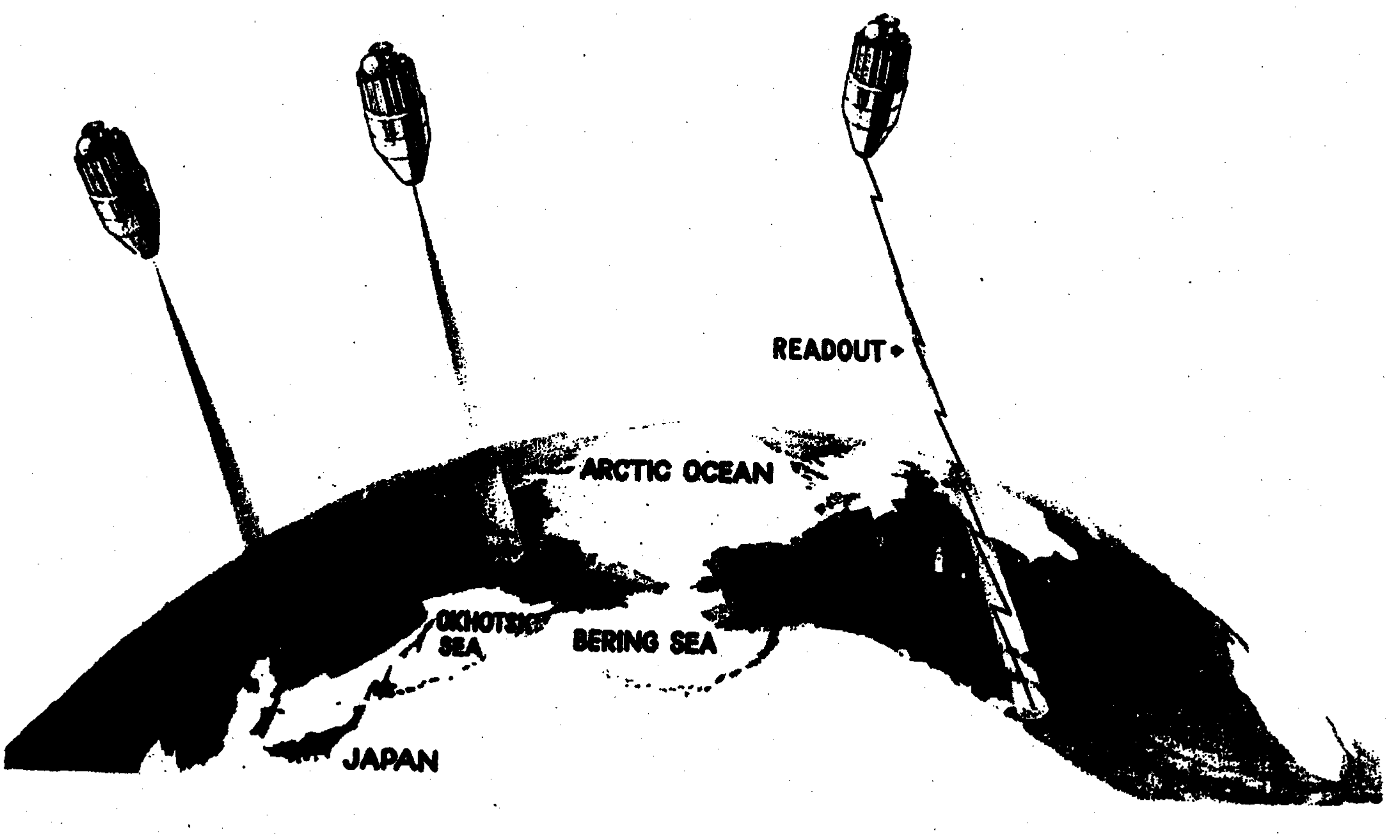


Figure 4. The Ferret reconnaissance system will gather data from electronic emissions over unfriendly territory.