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WDLPM-4

30 May 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 introduced by a concise history of the administration, concept and objectives, making possible a more meaningful evaluation of the monthly progress information. The program description information is revised monthly as necessary to reflect major technical and administrative changes. These programs must be sufficiently flexible to permit continuous and effective integration of rapidly occurring advances in the state-of-the-art.

This month's report includes information on the highly successful MIDAS II launch on 24 May. Performance with regard to planned orbital parameters was outstanding. This flight is a significant milestone in the MIDAS program.

The successful TIROS launch on 1 April marked the end of AFBMD's participation in this program. This report reviews the program and the launch and concludes the reporting on this program.

O. J. RITLAND
Major General, USAF
Commander

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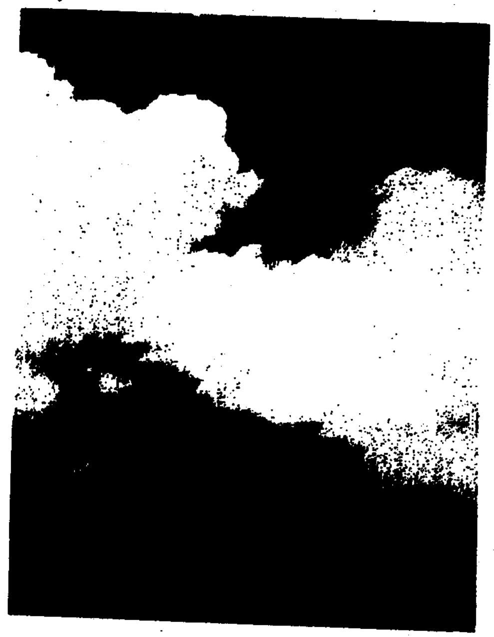
a foreword to...



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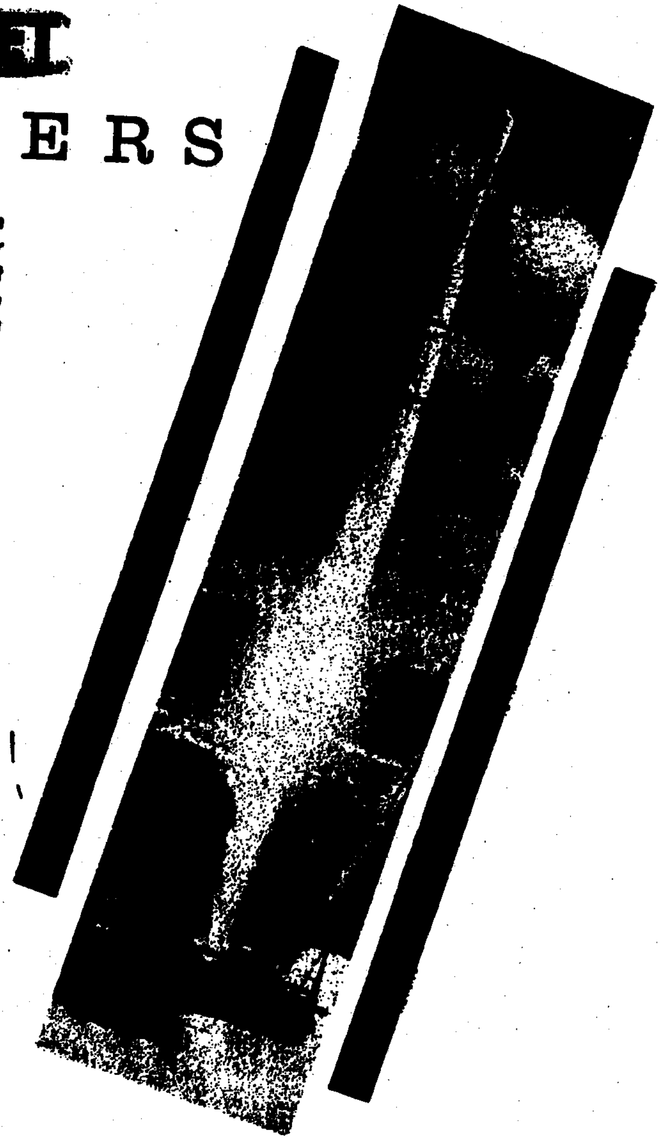
Space Program BOOSTERS



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 NASA and Department of Defense 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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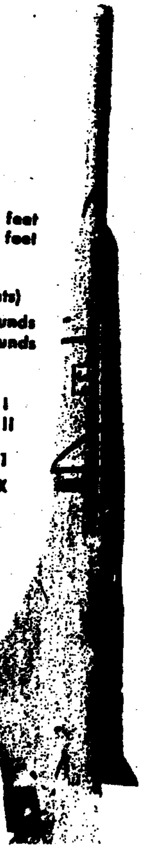
THOR



Prime contractor:
Douglas Aircraft Co.

Engine manufacturer:
Rocketdyne Div., North American Aviation

Height	
SM-75	61.3 feet
DM-21 (without re-entry vehicle)	56.9 feet
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
NASA/AGENA B
DELTA

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

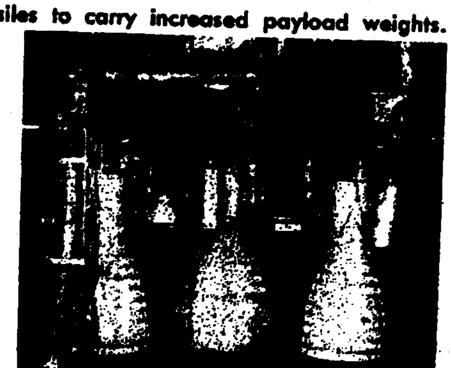
Engine manufacturer:
Rocketdyne Div., North American Aviation

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 ATLAS-boosted flight test vehicle in Project Mercury was launched on 7 September with all objectives essentially achieved. ATLAS performance on both the 26 February and 24 May MIDAS launches was exceptional. Future flights will use modified ATLAS series "D" missiles to carry increased payload weights. 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.



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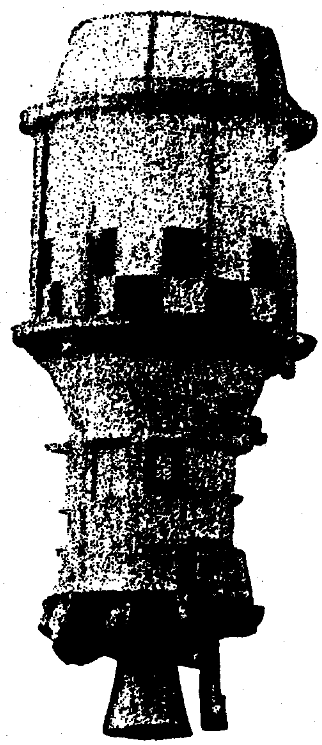
AGENA

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

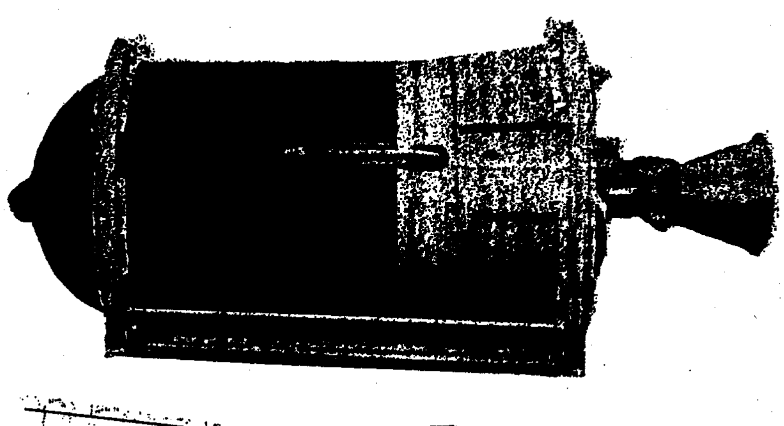
Engine manufacturer:
Bell Aircraft Corp.

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

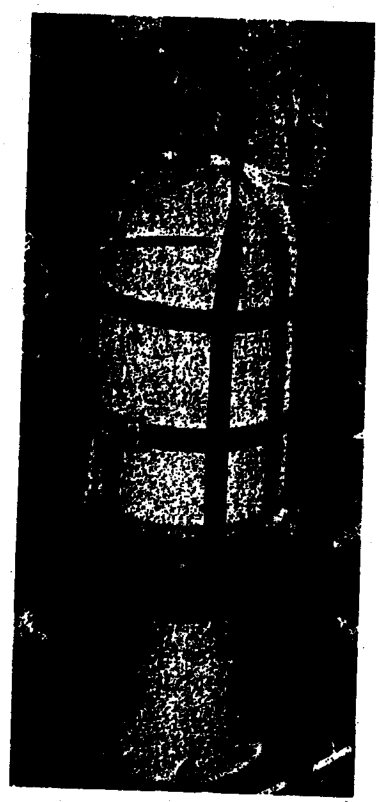
Oxidizer
Inhibited White Fuming Nitric Acid

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

Specifications....

FIRST STAGE

THOR	A SM-75	B DM-21
Weight—dry		
Fuel	7,746	6,510
Oxidizer	30,500	33,695
	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	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

SECOND STAGE

AGENA	D "A"	E "B"	F
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.	15,500	15,500	16,000
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.*

SECOND STAGE

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

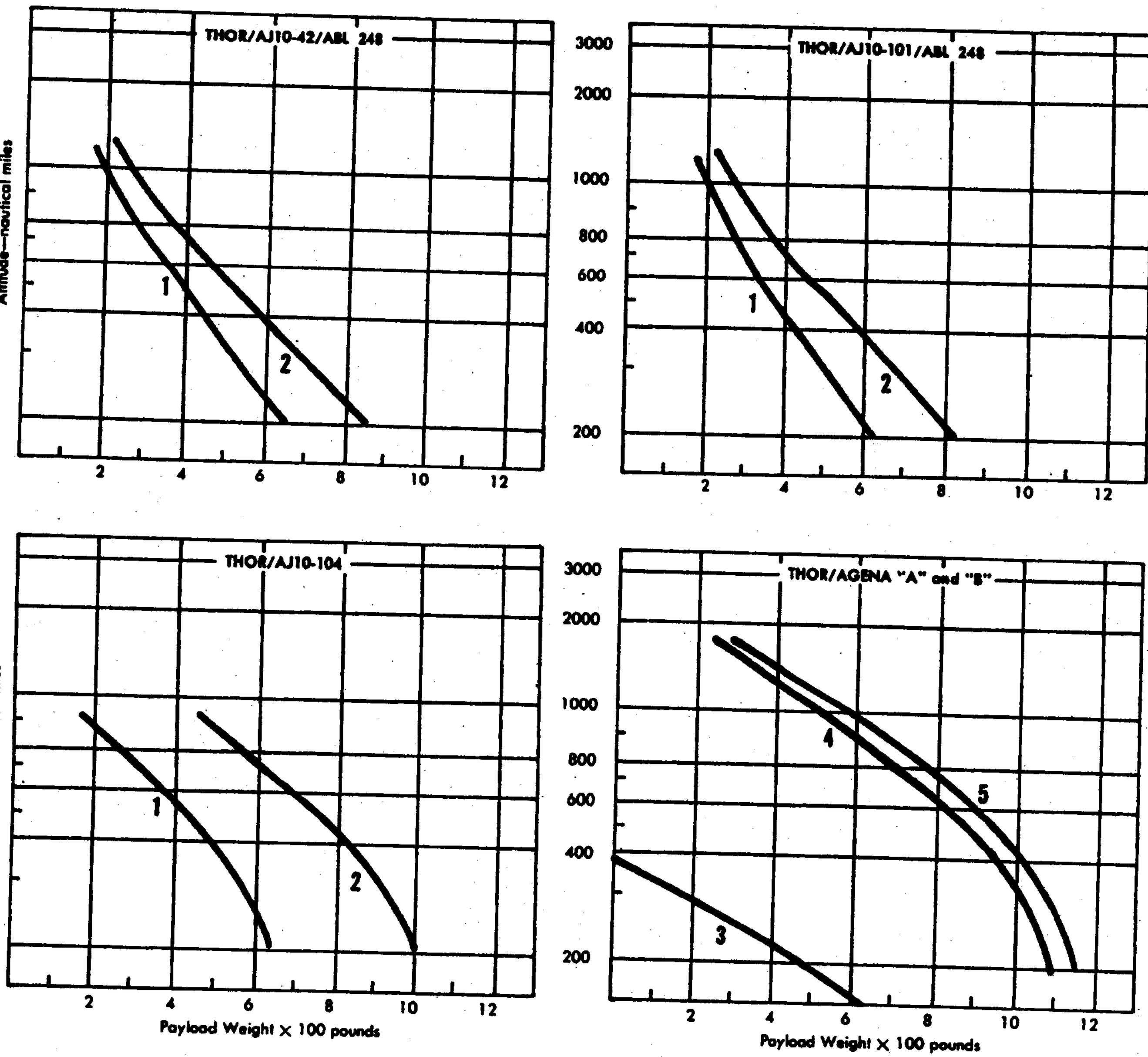
THIRD STAGE

⑤ABL 248	K
Weight—wet	59.5
Fuel	455.5
Oxidizer	(solid)
TOTAL WEIGHT	515
Burnout Weight	50.5
Thrust-lbs., vac.	3,100
Spec. Imp.-sec., vac	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

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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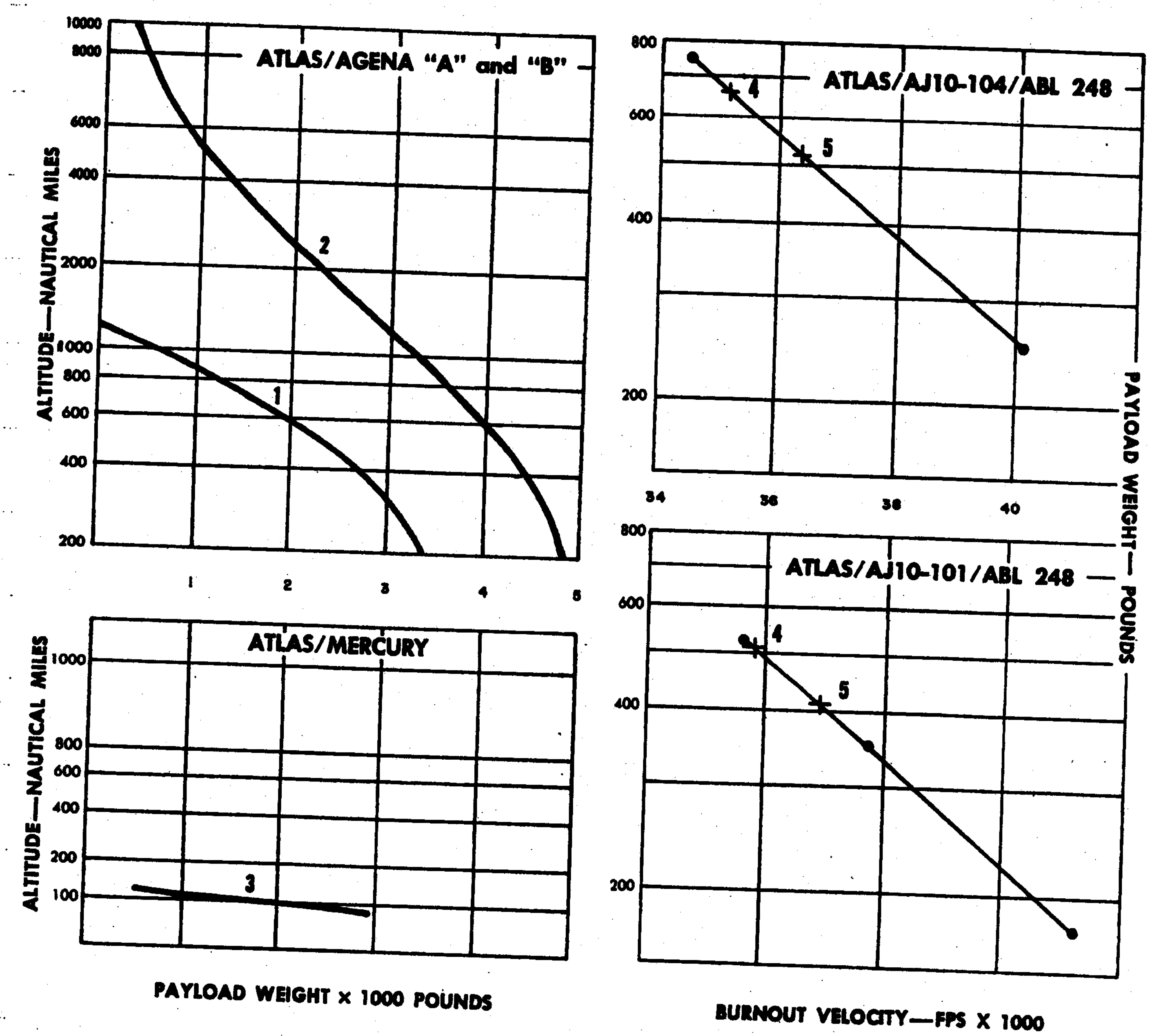
Performance Graphs — ATLAS BOOSTED



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

4. Lunar Probe
5. Venus Probe

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SPACE

systems

DISCOVERER

SAMOS

MIDAS

COMMUNICATIONS SATELLITE

The DISCOVERER Program consists of the design, development and flight testing of 33 two-stage vehicles, using the THOR IRBM as the first stage booster and the AGENA as the second stage, satellite vehicle. The program was established early in 1958 under direction of the Advanced Research Project's Agency, with technical management assigned to AFBMD. On 14 November 1959, program responsibility was transferred from ARPA to the Air Force by the Secretary of Defense. Prime contractor for the program is Lockheed Missile and Space Division. The DISCOVERER Program will perform space research in support of the advanced military reconnaissance satellite programs.

PROGRAM OBJECTIVES

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

(b) Attaining satellite stabilization in orbit.

(c) Obtaining satellite internal thermal environment data.

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

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

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

PROGRAM SUMMARY

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

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

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SECOND STAGE	AGENA "A"	AGENA "B"	
Weight—			
Inert	1,262	1,328	1,346
Payload equipment	497	887	915
Orbital	1,759	2,215	2,216
Impulse propellants	6,525	12,950	12,950
Other	378	511	511
TOTAL WEIGHT	8,662	15,676	15,722
Engine Model	YLR81-Ba-5	XLR81-Ba-7	XLR81-Ba-9
Thrust-lbs., vac.	15,600	15,600	16,000
Spec. Imp.-sec., vac.	277	277	290
Burn time-sec.	120	240	240
THOR BOOSTER		DM-18	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

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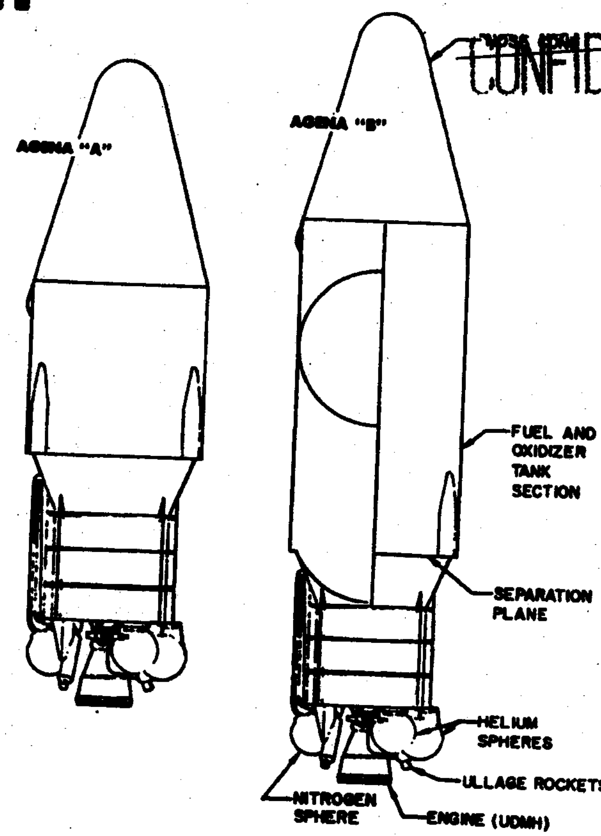
Telemetry-ships are positioned as required by the specific mission of each flight. Figures 2 and 3 show a typical launch trajectory from Vandenberg Air Force Base, and figure 3 shows schematically a typical orbit. An additional objective of this program is the development of a controlled re-entry and 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.

FLIGHT VEHICLE

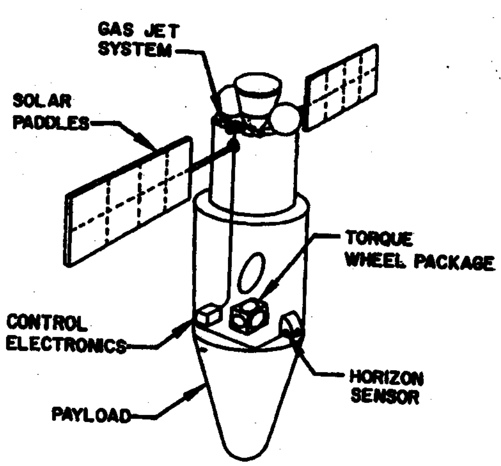
The three versions of flight test vehicles used in the DISCOVERER Program are defined in the launch schedule shown on page A-5. Specifications for the two THOR configurations and three AGENA configurations used are given on page A-1.

AGENA VEHICLE DEVELOPMENT

The AGENA vehicle was originally designed by the Air Force as the basic satellite vehicle for Advanced Military Reconnaissance Satellite Systems Programs. Basic design was based on use of the ATLAS ICBM as the first stage. ATLAS trajectory characteristics and the stringent eccentricity requirements of the advanced programs led to the selection of a guidance system suited to achieving orbital injection in a horizontal attitude. As a result, an optical inertial system was developed for vehicle guidance and a gas jet system for orbital attitude control. An urgent need for attaining higher altitude orbits resulted in development of the AGENA "B" versions. The YLR81 Ba-5 version of the LR81-Ba-3 engine (Bell Hustler engine developed for B-58 aircraft) is used on AGENA "A" vehicles. The YLR81-Ba-5 version of this engine was developed to provide increased performance through the use of unsymmetrical di-methyl hydrazine (UDMH) fuel instead of JP-4.



Early AGENA "B" vehicles will use the YLR81-Ba-7 version of this engine. The majority of AGENA "B" vehicles will use the XLR81-Ba-9 engine incorporating a nozzle expansion ratio of 45:1, and providing a further increase in performance capability including engine restart and extended burn capability.

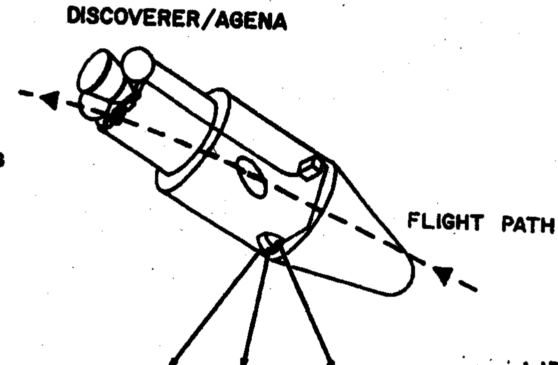


PERFORMANCE CAPABILITIES

ALTITUDE
200–20,000 MILES

ATTITUDE
ROLL – 0.1 DEGREE
PITCH – 0.1 DEGREE
YAW – 1 DEGREE

DISCOVERER/AGENA



Powered Flight Trajectory

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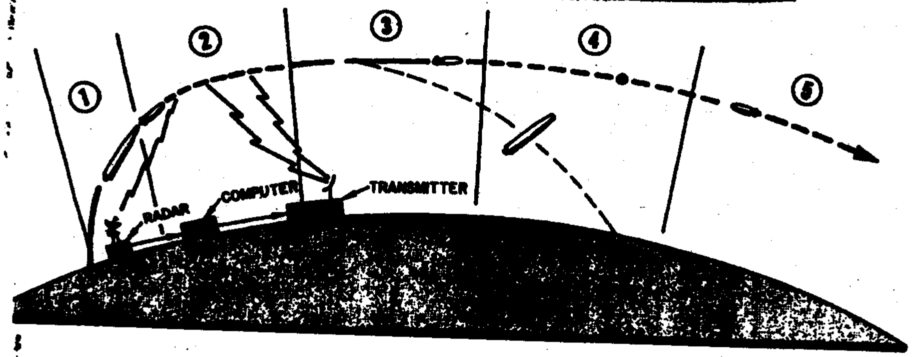
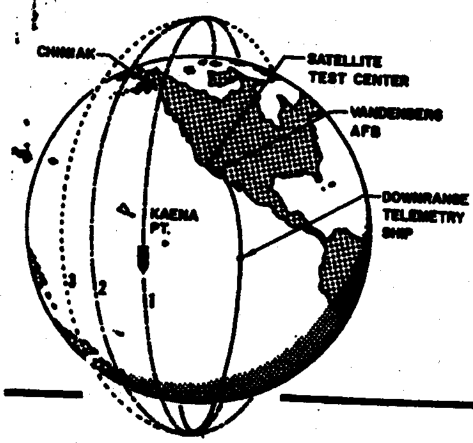
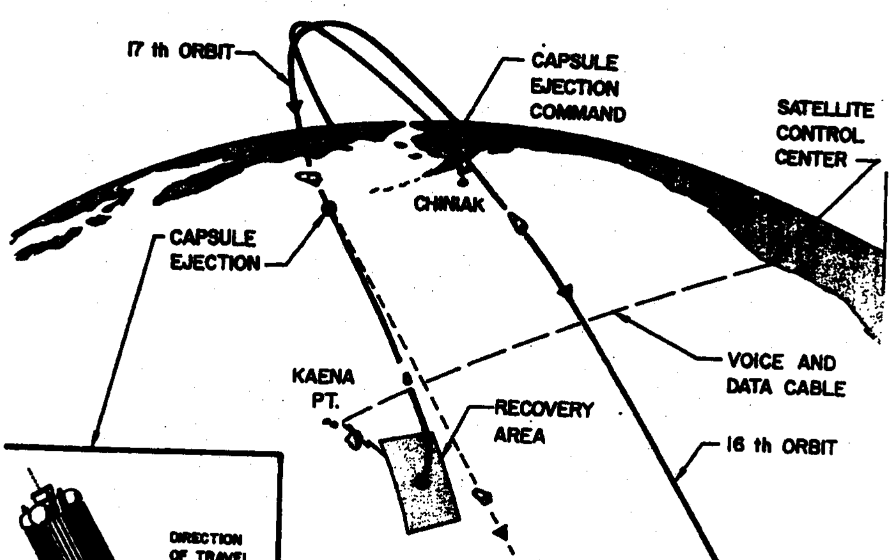


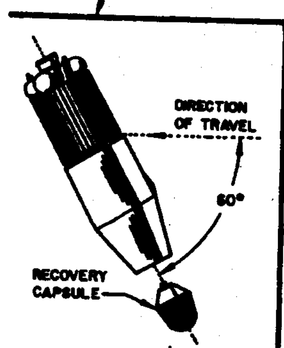
1. **First Stage Powered Flight**—2.5 minutes duration, 78 n.m. downrange, guided by programmed auto pilot.
2. **Coast Period**—2.4 minutes duration, to 380 n.m. downrange; altitude controlled by inertial reference package, horizon scanner, gas reaction jets. Receives AGENA time to fire and velocity to be gained commands.
3. **Second Stage Powered Flight**—2 minutes duration, to 770 n.m. downrange. Guided and controlled by inertial reference package, horizon scanner, gas reaction jets (roll) gimballing engine, yaw and pitch accelerometer—integrated.
4. **Vehicle Reorients to Nose Aft**—2 minutes duration, to 2,000 n.m. downrange. Guided and attitude controlled by inertial reference package, horizon scanner and gas reaction jets.
5. **In-Orbit**—Controlled (same as 4).



Orbital Trajectory

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





CAPSULE RECOVERY SEQUENCE

Capsule ejection command is sent to the satellite by the Chiniak, Alaska station on the 16th orbit. The vehicle reorients its position (see inset) to permit ejection to occur on a re-entry trajectory on the 17th orbit. The recovery capsule parachute is activated at about 50,000 feet, and the capsule beacon transmits a radio signal for tracking purposes. The recovery force is deployed in the recovery (impact) area.

RECOVERY CAPABILITY

This objective was added to the program after the first launch achieved vehicle flight and orbit objectives successfully. It includes the orientation of the satellite vehicle to permit a recoverable capsule to be ejected from the nose section of the AGENA vehicle. Ejection is programmed to occur on command on the 17th orbit, for capsule impact within the predetermined recovery area south of Hawaii. Aircraft and surface vessels are deployed within the area as a recovery force.

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Facility	Equipment	Flight Function
Satellite Test Center	A	Over-all control, convert tracking stations data to obtain a predicted orbit and generate subsequent ephemerides issue acquisition data to tracking stations for subsequent passes, predict recovery area.
Vandenberg AFB	BCDEFGHIJK	Launch, ascent and orbital tracking, telemetry reception, trajectory measurements including time to ignite second stage.
Point Mugu	BCDEFGHIJKL	Ascent tracking and telemetry data reception, transmits command to ignite and shut down AGENA (via guidance computer).
Telemetry Ship (Pvt. Joe E. Mann)	DF	Final stage ascent tracking and telemetry data reception.
Annette Island, Alaska (tracking station)		Activity at this station terminated 1 December 1959 due to fund limitations.
Cape Chiniak, Alaska (tracking station)	BDEFGHIJK	Orbital tracking and telemetry data reception, including first pass acquisition, recovery capsule ejection and impact prediction.
Kaena Point, Oahu, Hawaii (tracking station)	BCDEFGHIJK	Orbital tracking and telemetry data reception.
Hickam AFB Oahu, Hawaii		Over-all direction of capsule recovery operations.

Equipment

a. 2 UNIVAC 1103-A digital computers
b. VERLORT (Modified Mod II) radar
c. TLM-18 self-tracking telemetering antenna
d. Tri-helix antenna
e. Doppler range detection equipment
f. Telemetry tape recording equipment
g. Telemetry decommutators for real time data presentation
h. Plot boards for radar and TLM-18 tracking data
i. Conversion equipment for teletype transmission of radar, TLM-18 and doppler tracking data in binary format
j. Acquisition programmer for pre-acquisition direction of antennas
k. Ground command to satellite transmission equipment
l. Guidance computer

GROUND SUPPORT FACILITIES

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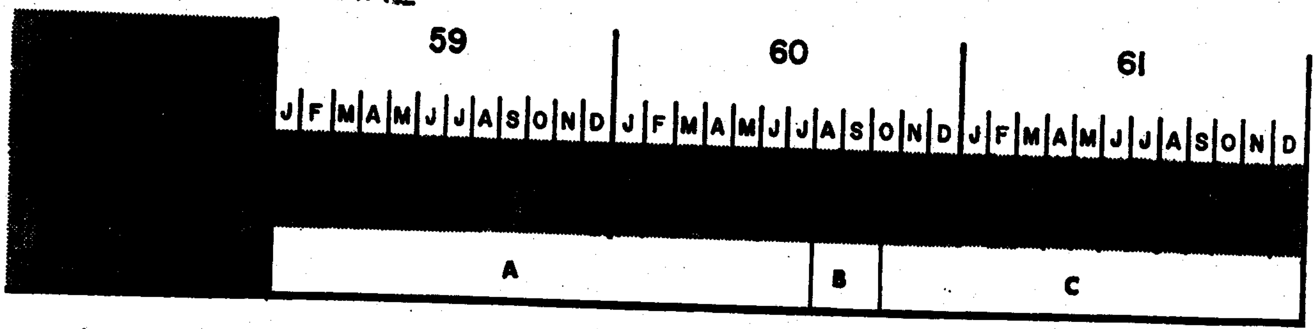

A. THOR—DM-18 / AGENA "A"

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.*
XI	1055	234	15 April	*Attained orbit successfully. Recovery capsule ejected on 17th orbit was not recovered. All objectives except recovery successfully achieved.*

Monthly Progress—DISCOVERER Program

Flight Test Progress

DISCOVERER XI

- The high re-entry trajectory of the recovery capsule following the very successful launch and orbiting of DISCOVERER XI on 15 April has resulted in an intensive recovery system component test program. This program is designed to gather information from which correctives will be made to assure maximum probability of recovery on subsequent DISCOVERER flights.

- Telemetry data on the DISCOVERER XI flight indicate that the recovery capsule was ejected on the 17th orbit as planned. A good track of the capsule telemetry transmitter was obtained by the Kaena Point station which showed that the predicted re-entry trajectory did not occur. Capsule separation and retro-rocket firing were verified. However, spin rocket firing was not verified. Data evaluation indicated that resultant velocity magnitude and direction were incorrect and, as a result, recovery was not effected.

- As part of the diagnostic program a more complete "blossom" telemetry package is being installed to monitor the DISCOVERER XII payload recovery sequence. This package will provide information on all phases of capsule ejection including retro, spin, and de-spin rocket separation and parachute deployment.

- An intensive recovery system test program is being conducted at two sites:

  1. Santa Cruz Test Base—Spin rocket firings have been checked in a series of capsule drop tests. While the test capsule was in free fall from a tower, various firing combinations of spin rockets were attempted and the effects on the capsule recorded.
  2. Holloman Air Force Base—Functional phases of the recovery system (including rocket firings and parachute deployment) are being tested in a series of balloon drop tests.

- DISCOVERER XI was the first orbiting AGENA to carry the dual-frequency doppler beacon (APL) and four optical tracking lights. Satisfactory tracking of both systems was achieved at stations in the United States and abroad. Sufficient data were received to

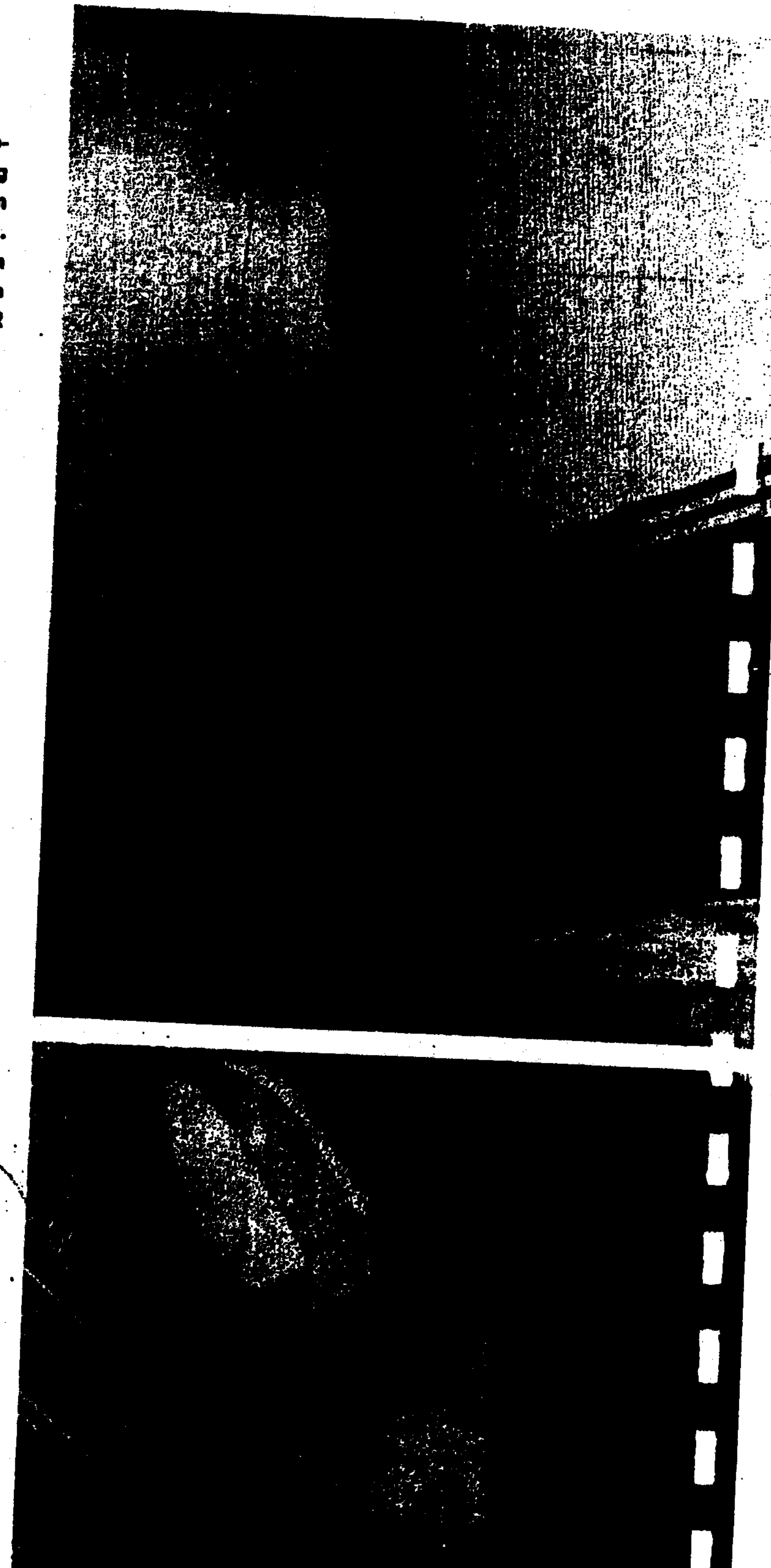

Figure 1. Spin rocket firings at Santa Cruz Test Base. Capsule is dropped from tower (upper photo), various combinations of spin rockets are fired, and the results are recorded. Capsule is caught in the net on the lower left. Spin rockets being replaced (lower) after capsule drop test.