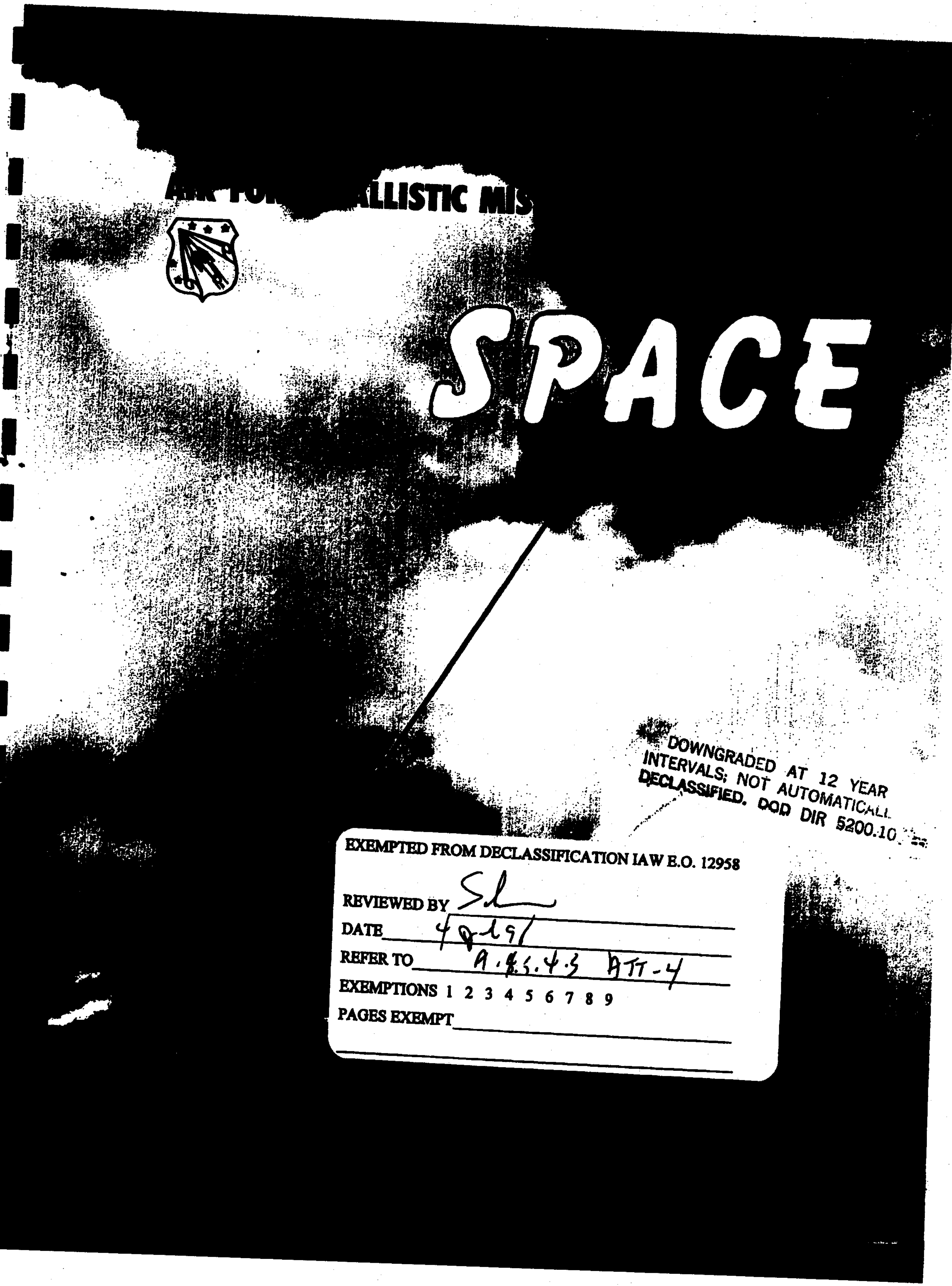

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HEADQUARTERS
AIR FORCE BALLISTIC MISSILE DIVISION (ARDC)
UNITED STATES AIR FORCE
Air Force Unit Post Office
Los Angeles 45, California

WDLPR-4

10 November 1960

Summary of
AIR FORCE BALLISTIC MISSILE DIVISION
Activities in Space

October 1960

FOREWORD

The only AFBMD space vehicle to be flown during the month was DISCOVERER XVI, launched from Vandenberg Air Force Base on 26 October. This was the first flight test of an AGENA B vehicle. Also in the DISCOVERER section, is a report of significant progress achieved during the month in the biomedical subsystem. The MIDAS section includes photographs and progress reports on the Donnelly Flats tracking station in Alaska. With the successful flight and orbital performance of COURIER 1B, all objectives of this program were fulfilled. Coverage of this program is being terminated with the program summary given in this issue.

O. J. RITLAND
Major General, USAF
Commander

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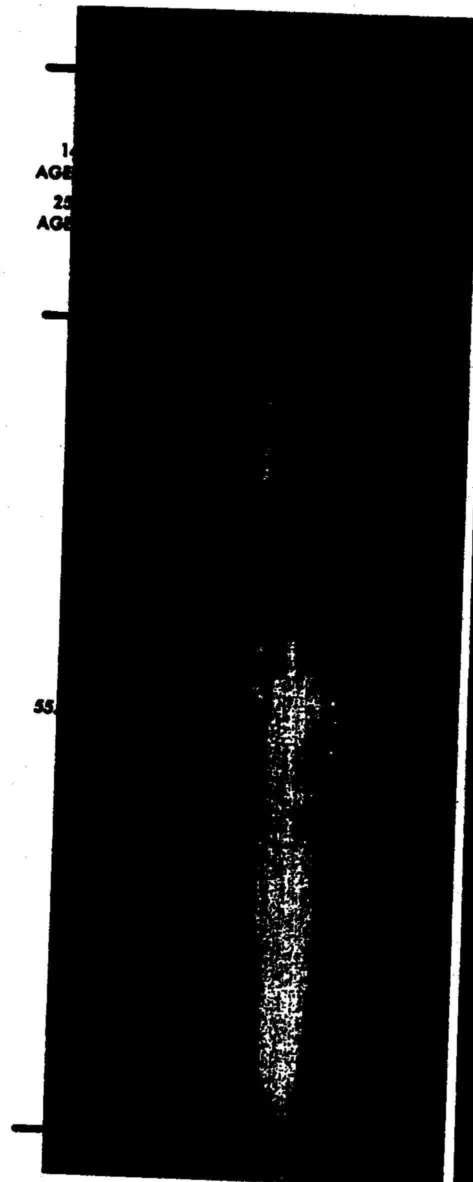
[redacted]

SATELLITE
systems

DISCOVERER
MIDAS
ADVENT

DISCOVERER

The DISCOVERER Program consists of the design, development and flight testing of 37 two-stage vehicles, using the Douglas DM-21 Space Booster as the first stage booster and the AGENA as the second stage, satellite vehicle. The program was established early in 1958 under direction of the Advanced Research 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.

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	6,500
Fuel	33,700	33,700
Oxidizer (LOX)	68,200	68,200
GROSS WEIGHT (lbs.)	108,850	108,400
Engine	MB-3 Block 1	MB-3 Block 2
Thrust, lbs. (S.L.)	152,000	169,000
Spec. Imp., sec. (S.L.)	247.8	248.3
Burn Time, sec.	163	148

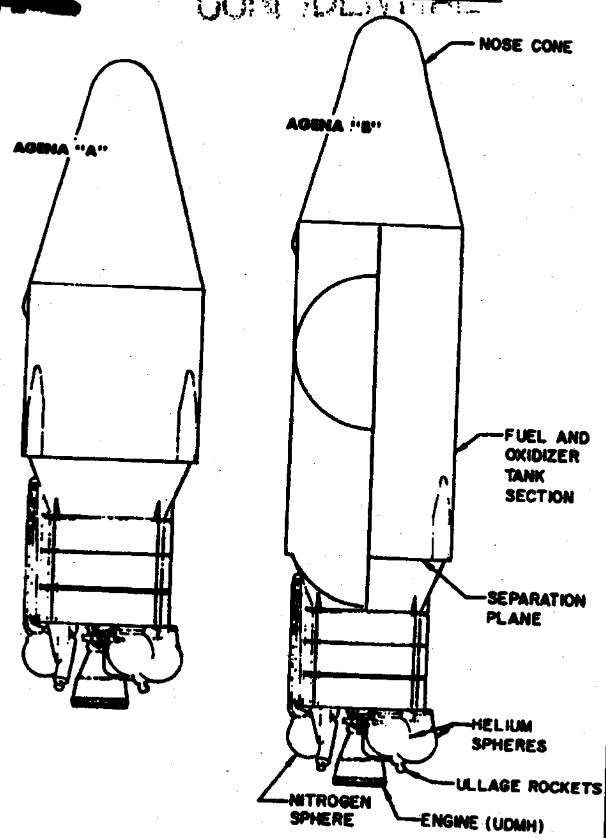
Telemetry ships are positioned as required by the specific mission of each flight. Figures 2 and 3 show a typical launch trajectory from Vandenberg Air Force Base, and figure 3 shows schematically a typical orbit. An additional objective of this program is the development of a controlled re-entry and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

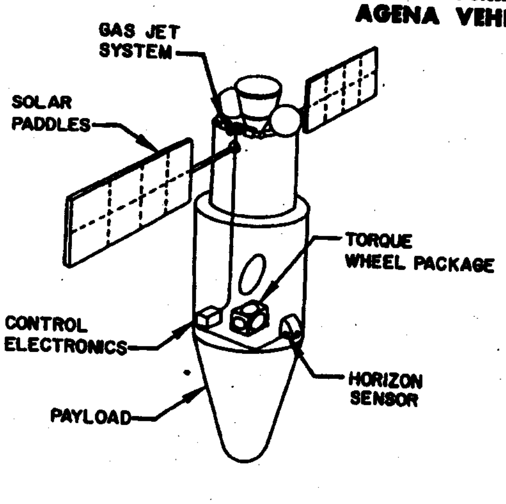
AGENA VEHICLE DEVELOPMENT

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 stabilization system suited to achieving orbital injection in a horizontal attitude. As a result, an optical inertial system was developed for vehicle stabilization 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.

SAMOS and MIDAS AGENA VEHICLE

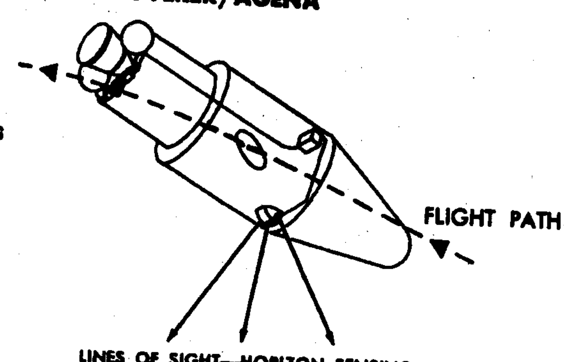


DISCOVERER/AGENA

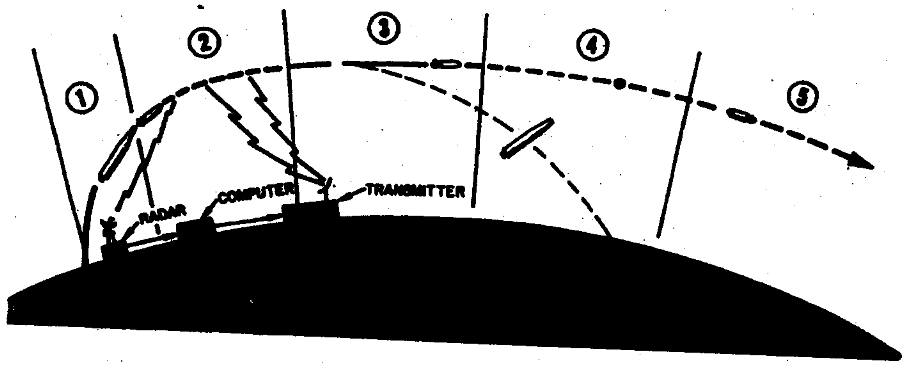
PERFORMANCE CAPABILITIES

ALTITUDE
200–20,000 MILES

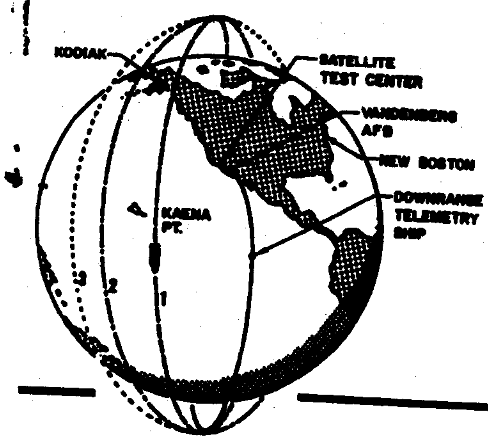
ATTITUDE
ROLL – 0.1 DEGREE
PITCH – 0.1 DEGREE
YAW – 1 DEGREE



Powered Flight Trajectory



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, attitude controlled by inertial reference package, horizon scanner, gas reaction jets. Receives AGENA time to fire and velocity to be gained commands.
3. **Second Stage Powered Flight**—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).

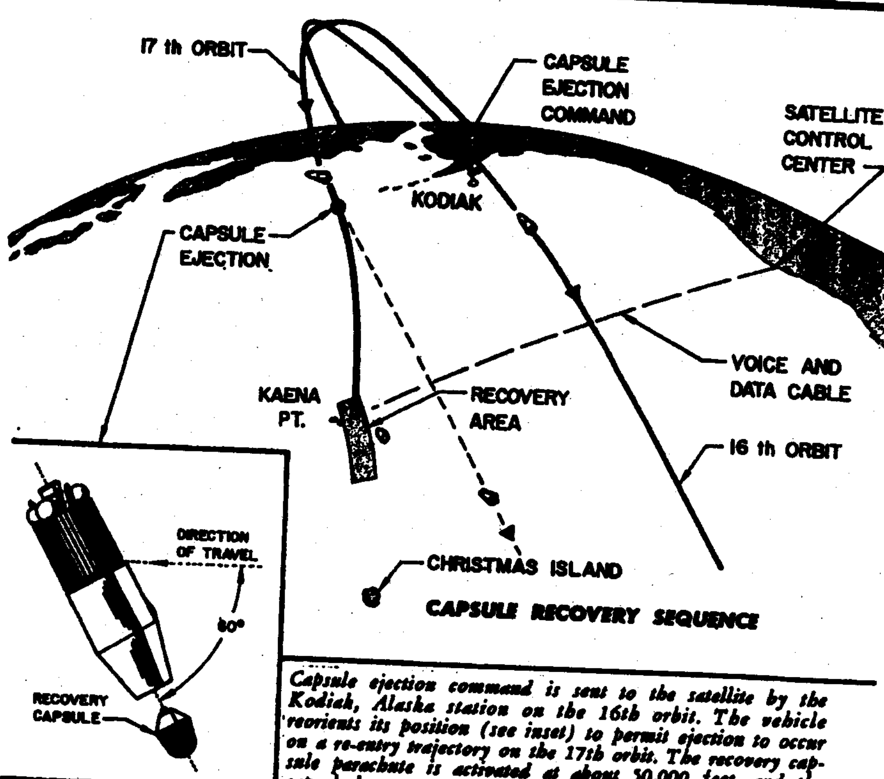


Orbital Trajectory

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.

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 near Hawaii. Aircraft and surface vessels are deployed within the area as a recovery force.



CAPSULE RECOVERY SEQUENCE

Capsule ejection command is sent to the satellite by the Kodiak, 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.

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GROUND SUPPORT FACILITIES

Facility	Equipment*	Flight Function
Satellite Test Annex	ABCD	Over-all control, orbit computations and predictions, acquisition data for tracking stations, prediction of recovery area.
Vandenberg AFB Tracking Station	BDEFGHIJ	Ascent and orbital tracking, telemetry reception, trajectory measurements, command transmission.
Mugu Tracking Station	BDEFGHI	Ascent tracking, telemetry reception, computation and transmission of ignition and shutdown corrections.
Downrange Telemetry Ship	BGIJK	Telemetry reception and tracking during ascent and early part of first orbit.
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		Over-all direction of capsule recovery operations.

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

Equipment

A. General Purpose Computer(s) and Support Equipment
B. Data Conversion Equipment
C. Master Timing Equipment
D. Control and Display Equipment
E. Guidance and Command Equipment (DISCOVERER ascent only)
F. VERLORT
G. VHF FM/FM Telemetry Station
H. VHF Direction Finding Equipment
I. Doppler Equipment
J. VHF Telemetry Antenna
K. APL Doppler Equipment

LAUNCH SCHEDULE

Config.		Month	Year
A	⬮	J	1959
A	★	F	1959
A		M	1959
A	★	A	1959
A		M	1959
A	⬮ ⬮	J	1959
A		J	1959
A	★ ★	A	1959
A		S	1959
A		O	1959
A	★ ★	N	1959
A		D	1959
A		J	1960
A	⬮ ⬮	F	1960
A		M	1960
A	★	A	1960
A		M	1960
A	⬮	J	1960
A		J	1960
A	Ⓡ Ⓡ	A	1960
A	★	S	1960
B	⬮	O	1960
B	1	N	1960
B	2	D	1960
C	2	J	1961
C	1	F	1961
C	1	M	1961
C	2	A	1961
C	2	M	1961
C	2	J	1961
C	2	J	1961
C	2	A	1961
C	2	S	1961
C	1	O	1961
C		N	1961
C		D	1961

★ Attained orbit successfully.

Ⓡ Capsule recovered.

⬮ Failed to attain orbit.

FLIGHT HISTORY

DISCOVERER No.	THOR 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.*

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

Monthly Progress—DISCOVERER Program

Flight Test Status

DISCOVERER XVI Flight

• DISCOVERER XVI was launched from Vandenberg Air Force Base at 1226 PDT on 26 October. DISCOVERER XVI was the first vehicle to carry an AGENA "B" second stage. Countdown was normal and DM-21 performance was satisfactory except that the vernier engines did not operate after main engine cutoff. Normally, the vernier engines burn nine seconds longer to damp out any attitude errors induced during main engine thrust decay.

• Following cutoff of the DM-21 main and vernier engines, the AGENA Subsystem D timer is programmed to initiate a series of events which should result in injecting the satellite into its planned orbit. These events include firing explosive separation bolts, activating satellite control and stabilization equipment, firing the retro-rockets on the adapter, firing ullage rockets, initiating AGENA engine firing and reorientation events. A failure in the timer prevented successful separation of the THOR and AGENA and the satellite plunged into the ocean 660 nautical miles downrange.

• Telemetry data reveal that the signal initiating separation was not sent by the sequence timer. A malfunction within the computer rendered the sequence timer inoperative. The computer has been modified to prevent a recurrence of this problem.

DISCOVERER XVII

• The launch of DISCOVERER XVII is now scheduled for early November. The AGENA vehicle has been delivered to the launch pad for checkout and installation on the DM-21 booster. DISCOVERER XVII will carry an advanced engineering text payload, optical tracking lights and an Applied Physics Laboratory doppler beacon. Flight objectives are similar to previous DISCOVERER flights, except that in the event the satellite is performing satisfactorily on orbit a decision may be made to de-orbit after two days instead of one.

Radiometric Measurement Flights

• The Radiometric Measurement flights are currently scheduled for mid-December and early February. The purpose of these flights is to gather infrared background radiation data for the MIDAS program. No attempt will be made to recover the payloads on these flights.

Technical Status

Mark II Capsule Tests

• A completely successful orbital simulated test of the Mark II biomedical capsule with a live female Rhesus monkey passenger was conducted in October. The monkey was put in the life cell of the capsule on 21 October at Vandenberg Air Force Base during a simulated launch countdown. The sealed capsule was then flown to Sunnyvale and placed in the high altitude simulator on 22 October. It was removed from the simulator on 24 October. The primate was dependent upon the life cell for its existance throughout the 65-hour period. This is twenty percent longer than required by project specifications. The 42 hours the capsule was in the high altitude chamber is the longest time in the United States space programs history an animal has been confined under orbital conditions.

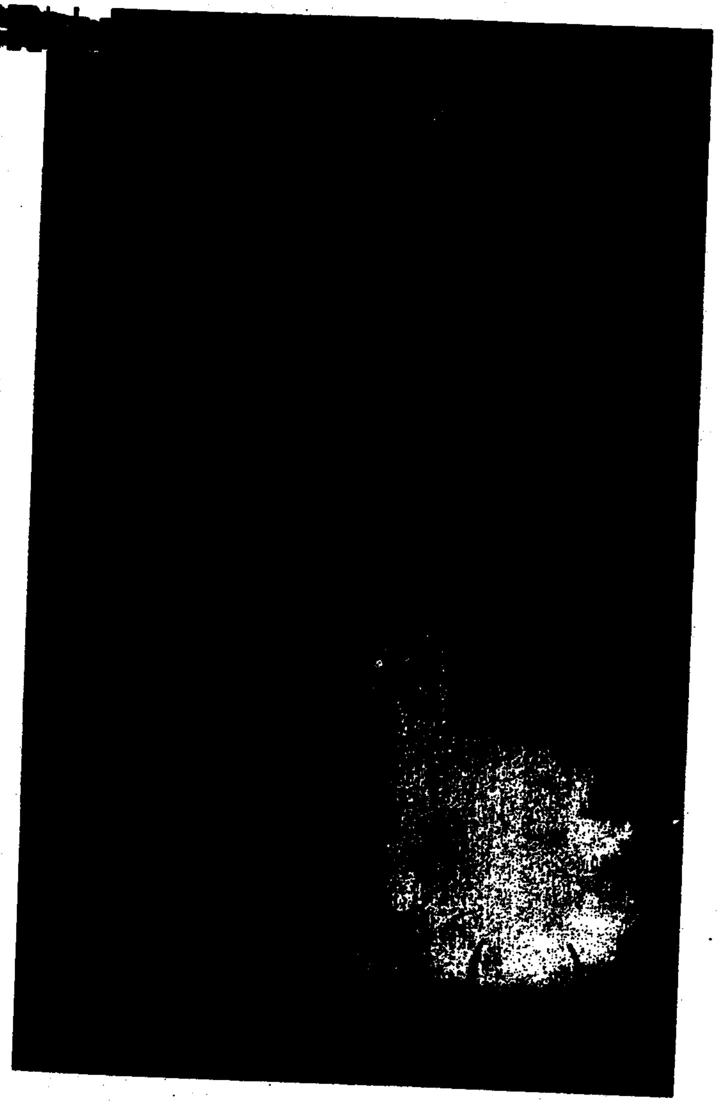
• The primate emerged from the life cell in an exceptionally vigorous condition. She lost about a half pound in weight, as expected, and exhibited very mild effects of exposure to carbon monoxide. The results demonstrated that the capsule can sustain a primate in satisfactory condition for a longer period than required by present DISCOVERER flight objectives.

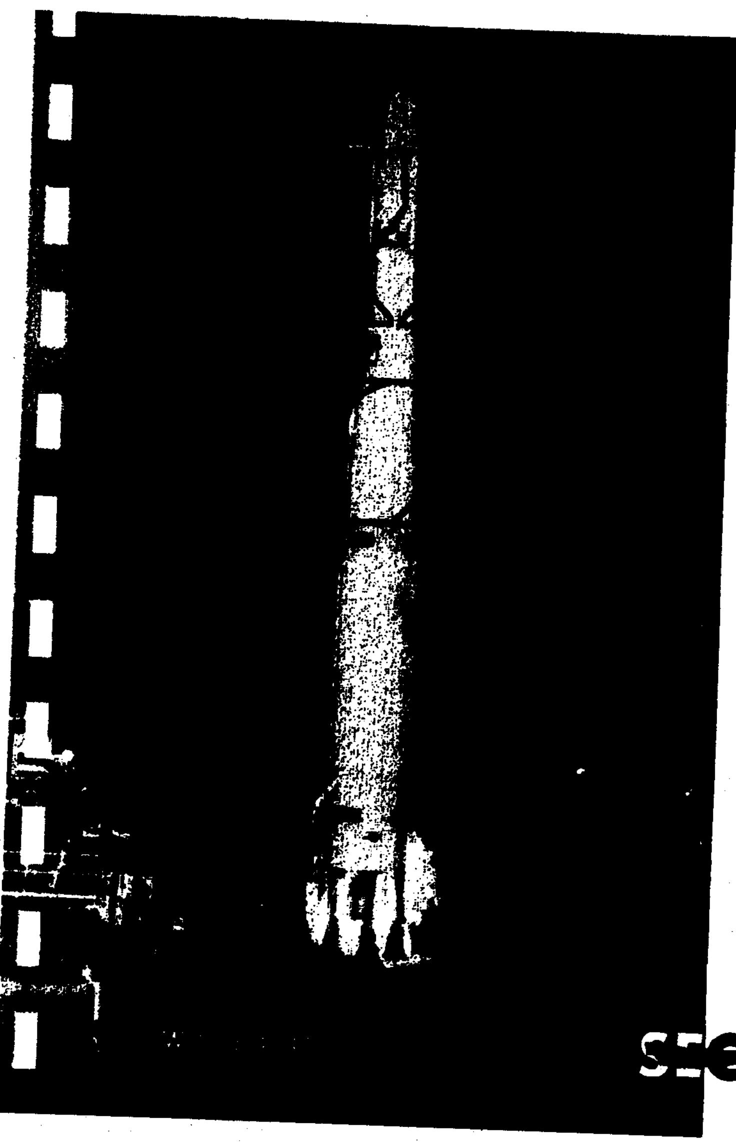
Mark II Life Cell Operation

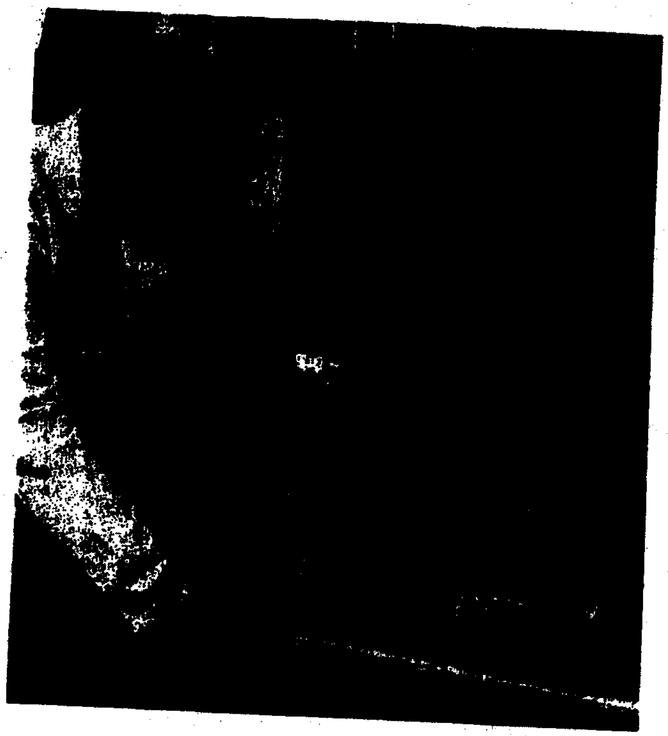
• The life cell uses a closed cycle ducted air regeneration system pressurized to approximately one-half atmosphere. During normal operation, the cell atmosphere contains a mixture of oxygen, carbon dioxide and water vapor. Some carbon monoxide is also present. The mixture is regenerated by the filtering action of lithium hydroxide, lithium chloride and activated charcoal. Pure oxygen is introduced into the system by a pressure regulated valve.

• The monkey is trained to operate a lever in response to a red light which can be turned on by the vehicle programmer or by command from the ground. The purpose of the lever device is to provide a psychomotor performance measure, in order that evaluation of space environment stresses upon higher order functioning may be made. The primate must operate the lever back and forth as long as the light is on. If she holds the lever in any position longer than 2½ seconds, she receives a shock. A feeder provides pieces of parafine covered apple at regular intervals throughout the test. The animal is instrumented to provide data on her condition and

Figure 1. Checkout of the first AGENA "B" vehicle (lower right) at Vandenberg Air Force Base. Some of the many pieces of test equipment required are visible in the right foreground. The duct which brings air to cool the precision electronic equipment is visible in the upper left. DISCOVERER XVI during liftoff (below) on 26 October. The ground support equipment, erector, and shelter are visible. Seconds later the stand is hidden by flame and smoke as the air conditioning cover is pulled free and the missile is on its way.







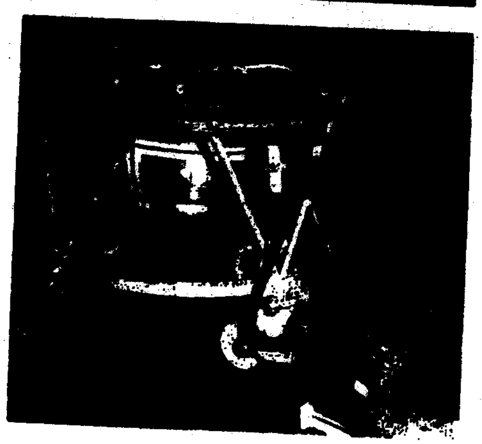
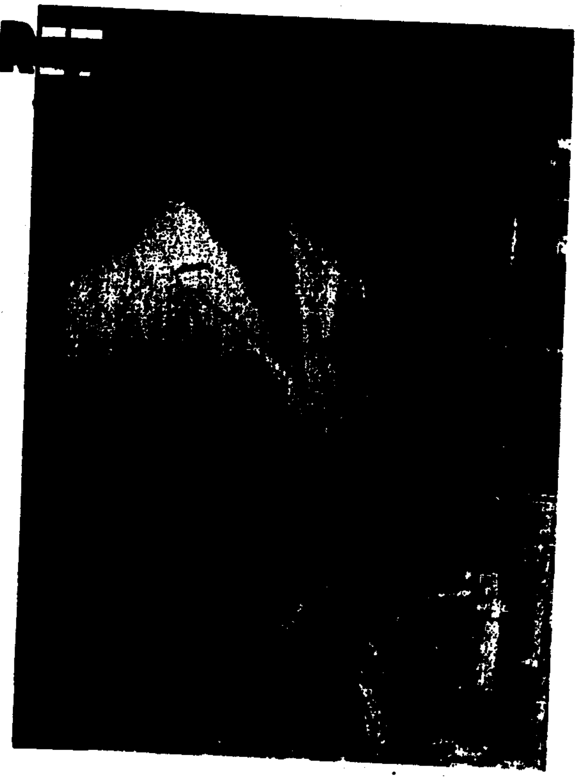


Figure 2. Device (left) used in training monkeys for space flights. When the red light on top of the trainer flashes, the monkey pulls the lever. The primate is conditioned to respond to the light signal in order to avoid a mild shock. Performance of this psychomotor task provides scientists with information as to how well man will be able to perform his duties as pilot of a spacecraft. Center photograph shows the biomedical capsule after its arrival from Vandenberg Air Force Base during the simulated orbital test. The equipment in the right foreground cools the interior of the capsule. Bottom view shows the capsule, encased in its ablative shell, prior to insertion into the high altitude simulation chamber. The consoles in the background record pressures and temperatures inside the chamber.

A scientist (opposite page) checking the readings of the air within the capsule. All impurities (carbon dioxide, water vapor, etc.), are removed by the self-contained air filtering system. Lower photo shows the removal of the sealing cover from the life cell. The feet of the monkey are visible (arrow). "54 Easy" following her removal from the life cell. During this test she spent 65 hours in the cell, 42 of them under orbital conditions. Rhesus monkeys are used in these tests because of the enormous amounts of information available from previous experimentation with this species.



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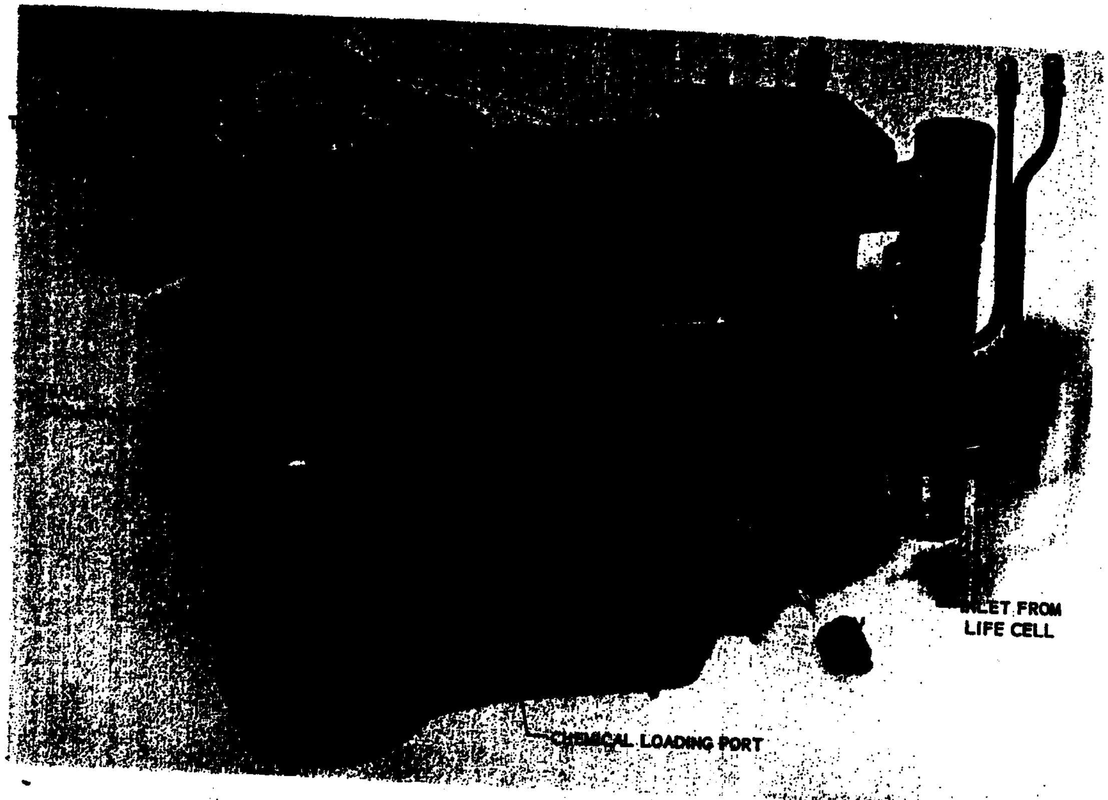
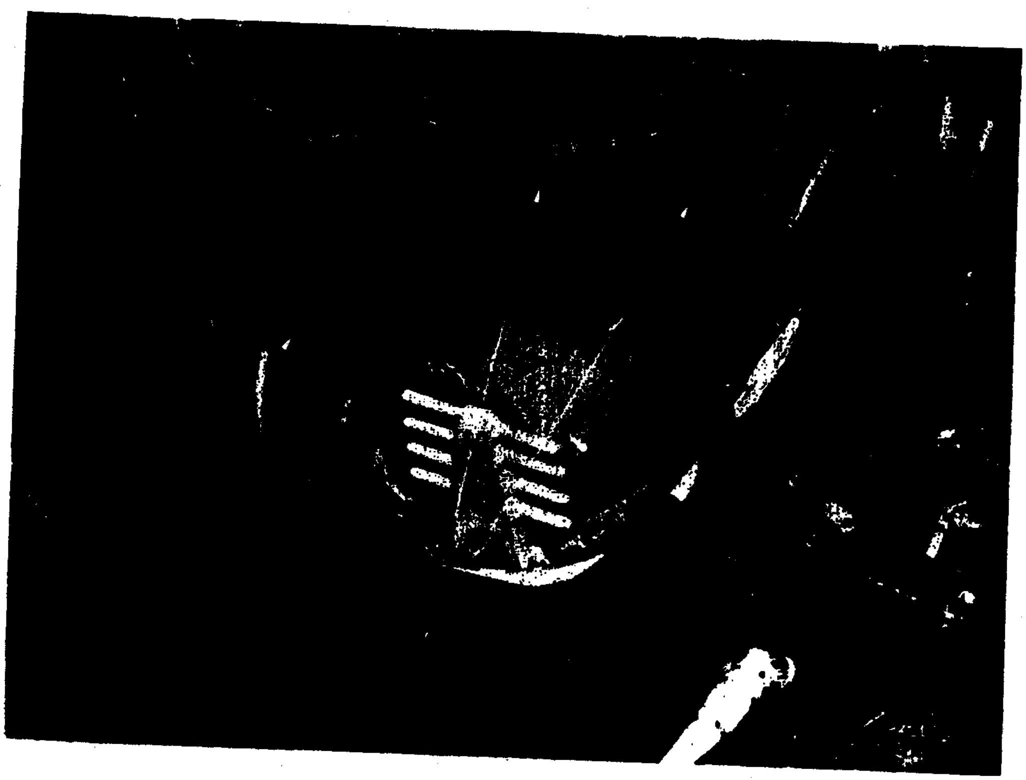


Figure 3. Upper photo shows the air conditioner assembly with major parts labeled. The air returns from the life cell, passes through a chemical filter, over a coil in the heat exchanger and returns to the cell. Lower photo of the life cell shows the pallet on which the monkey rests, the fan which circulates the air and the feeder from which the primate receives pieces of paraffin-covered apple.



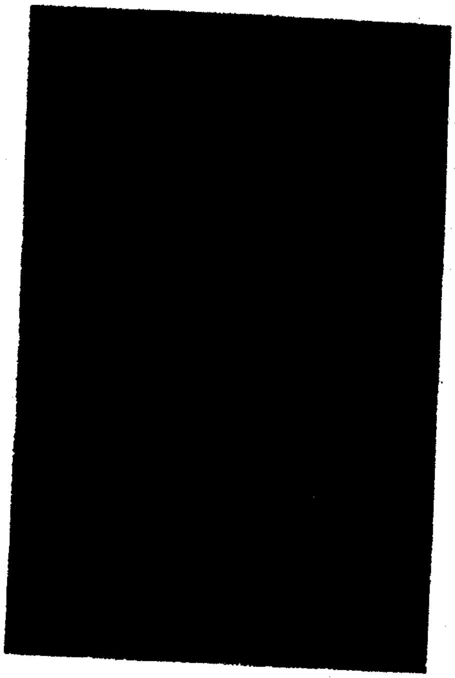


Figure 4. Recovery operations which will permit picking DISCOVERER capsules from the water if they should impact some distance from the recovery force. Frogman with life raft (left) during descent from C-54 aircraft. Frogman in large raft with capsule in net behind one-man raft. Erecting the mast which will allow a C-119 recovery aircraft to snatch the capsule from the sea. Frogmen are shown with smoke bombs which show wind direction and position of capsule. C-119 as its lines catch the mast to initiate capsule recovery. Shot of the raft showing the mast and capsule during pickup attempt.

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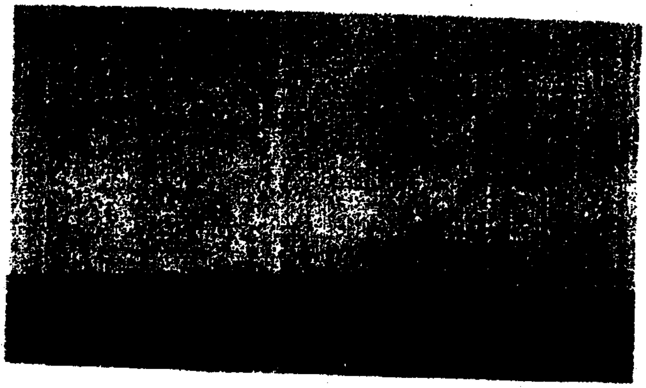

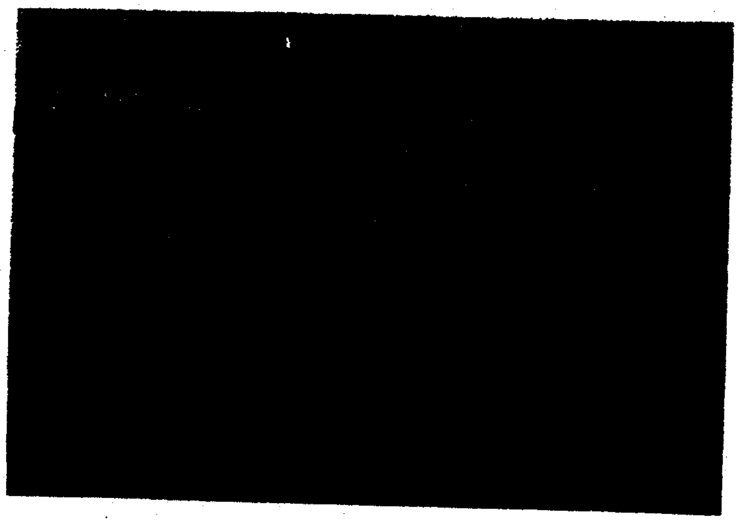

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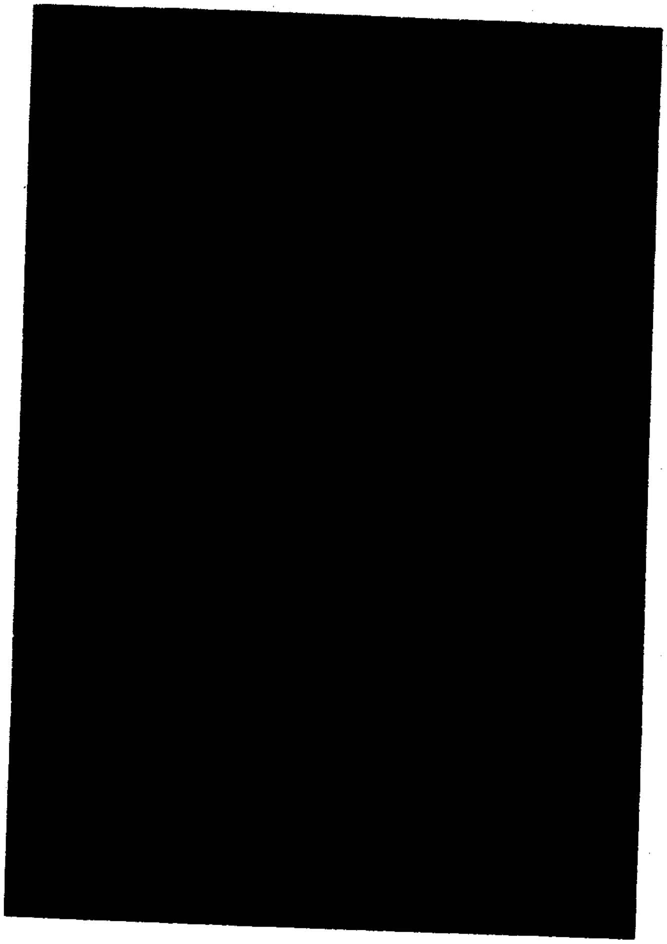


Figure 5. Photo showing smoke bomb in the distance, capsule at the end of the rope, and the snag hook midway between the capsule and the aircraft. Lower photo shows the capsule being pulled aboard the C-119 recovery aircraft.

a camera photographs her every three seconds throughout the mission.

Second Stage Vehicles

• Three AGENA vehicles, in addition to those scheduled for DISCOVERER XVII and XVIII, have been accepted by the Air Force. Eight other AGENA vehicles are proceeding through manufacturing and systems tests on schedules compatible with present launch requirements.

• The XLR-81Ba-9 engine (Serial No. 306) completed the final start-stop test in the Preliminary Flight Rating Test program satisfactorily. Upon completion of component functional checks the engine was shipped to Bell Aircraft for use in the reliability program which began on 25 October. Vibration tests, with an XLR-81Ba-9 engine installed in a mount with a higher natural frequency than previously used were conducted with satisfactory results. The engine was tested in the longitudinal and lateral planes. Testing in the vertical plane is scheduled next.

• Two XLR-81Ba-9 thrust chambers developed blisters in the hardkote coating of the barrel section during hot firing acceptance tests conducted at the Bell facility. These chambers were coated using the new cleaning and handling procedures which were expected to eliminate this problem. The cause of the blistering is being analyzed.

Balloon Drop Tests

• A two-stage parachute development program is currently being conducted. This program includes high altitude balloon drop tests to evaluate system operation and select a radar reflective parachute pattern compatible with the APS-95 radar.

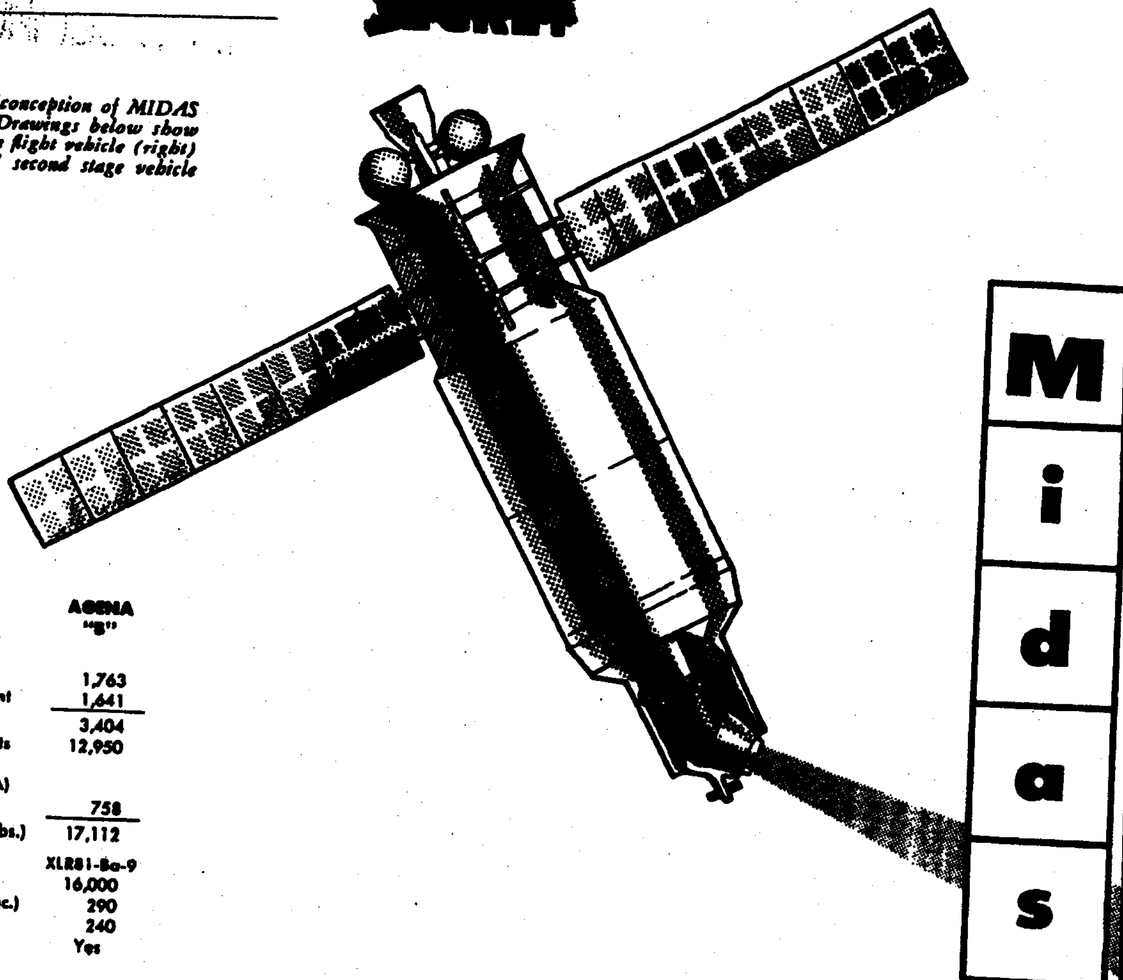
Capsule Ablative Shell

• The capsule ablative shell used on DISCOVERER XVI was constructed of pheolic nylon. Since this material exhibits certain advantages over the previous shell, it will be used on subsequent flights. During the qualification tests, under low pressure and high temperature conditions, this material was found to crack circumferentially on the ojive and conical skirt section. The development program initiated to correct this condition, resulted in the machining of stress relieving grooves in the ojive of the shell. This configuration has successfully passed qualification tests in the high altitude test chamber with only minor cracks occurring. Extensive tests have indicated that minor cracks, as experienced in the stress relieved shells, does not materially degrade the structural and ablative integrity of the shell. Other manufacturing techniques are being studied in an effort to eliminate this minor cracking.

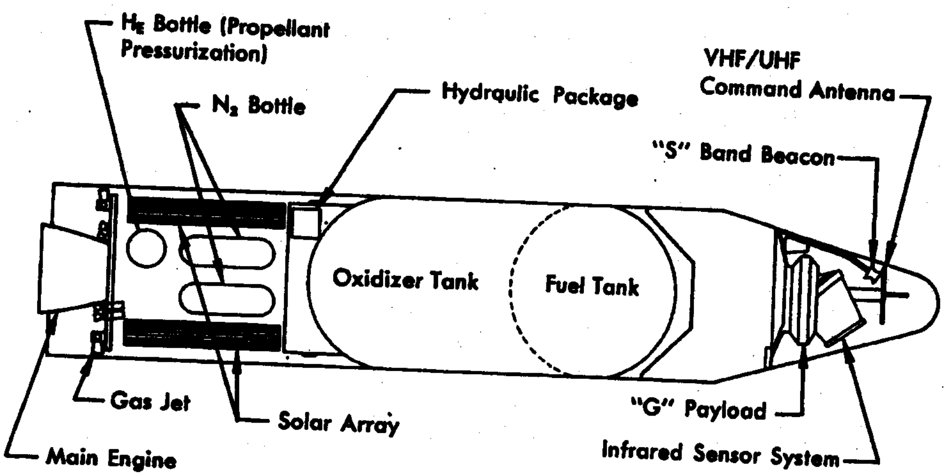
Facilities

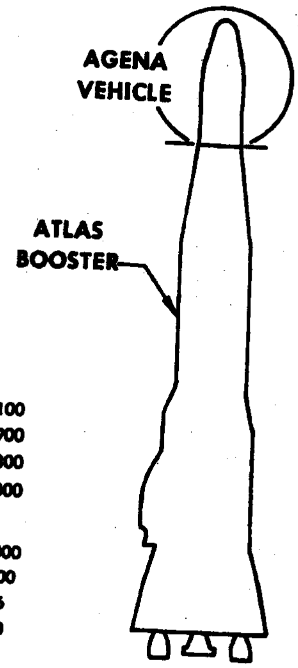
• An additional capsule tracking facility is being installed on Tern Island, northwest of Hawaii. This station will be operative by 15 December and will provide additional capsule position data during re-entry to increase the possibility of recovery.

Figure 1. Artist's conception of MIDAS satellite (right). Drawings below show complete two-stage flight vehicle (right) and AGENA "B" second stage vehicle (left).



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





MIDAS, Configuration II, AGENA "B" Satellite

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

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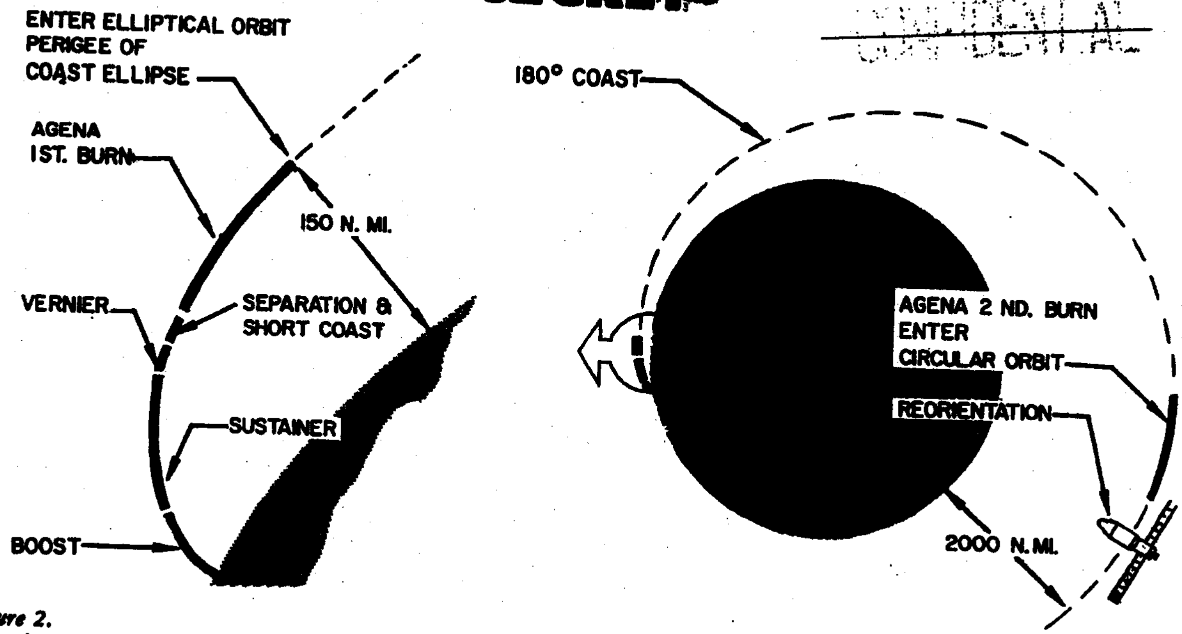


Figure 2.
Launch-to-orbit trajectory for flights 3 and subsequent. From boost through separation guidance and control is provided by the ATLAS radio inertial system. The AGENA inertial guidance system, with horizon scanner, provides attitude, velocity and directional control to establish the orbit and vehicle orientation.

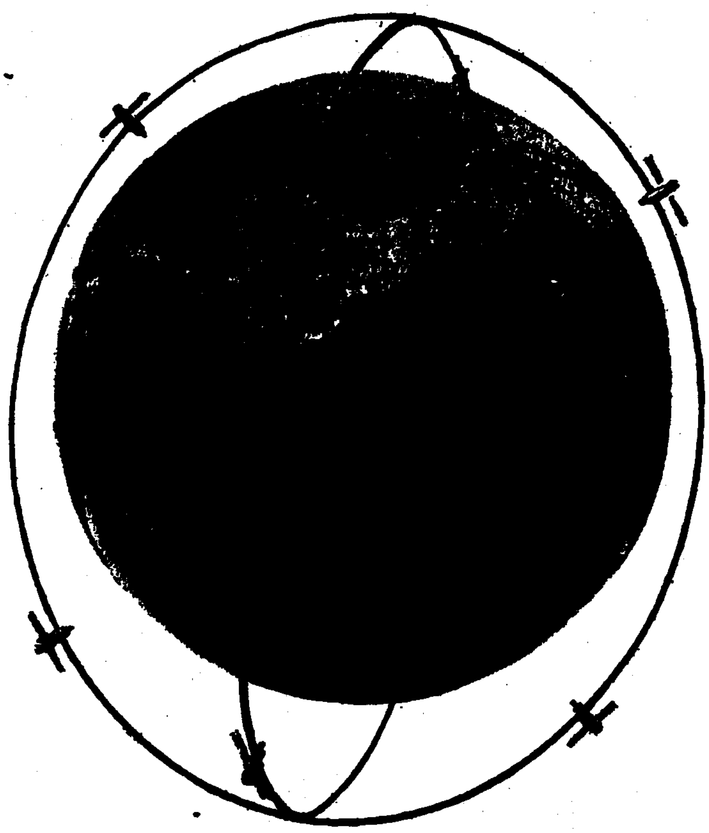
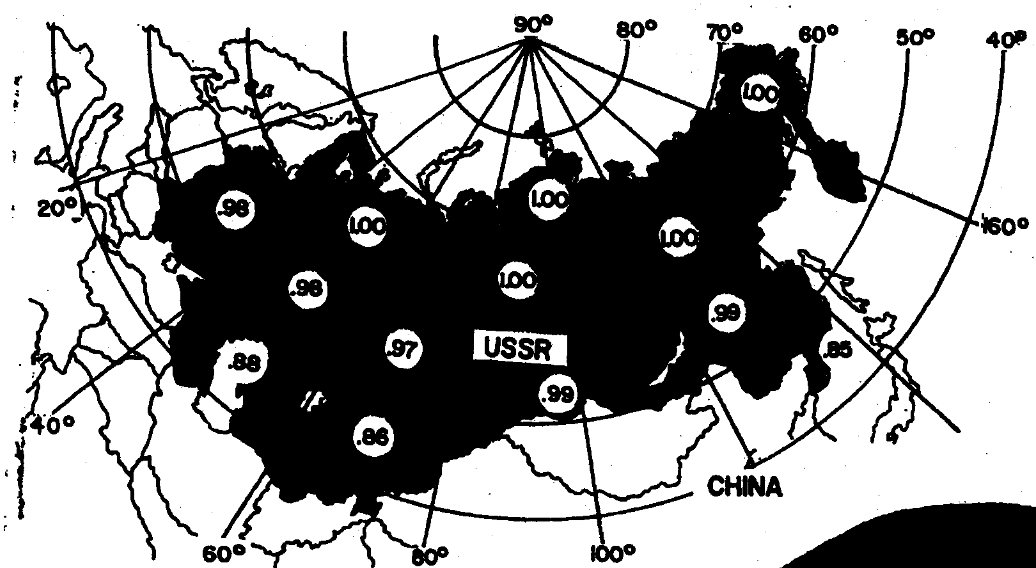


Figure 3.
Proposed MIDAS system. Four satellites spaced equidistant in each of two orthogonal planes at 2,000 n.m. altitude. Provides maximum coverage of USSR with minimum number of satellites.

PROGRAM HISTORY

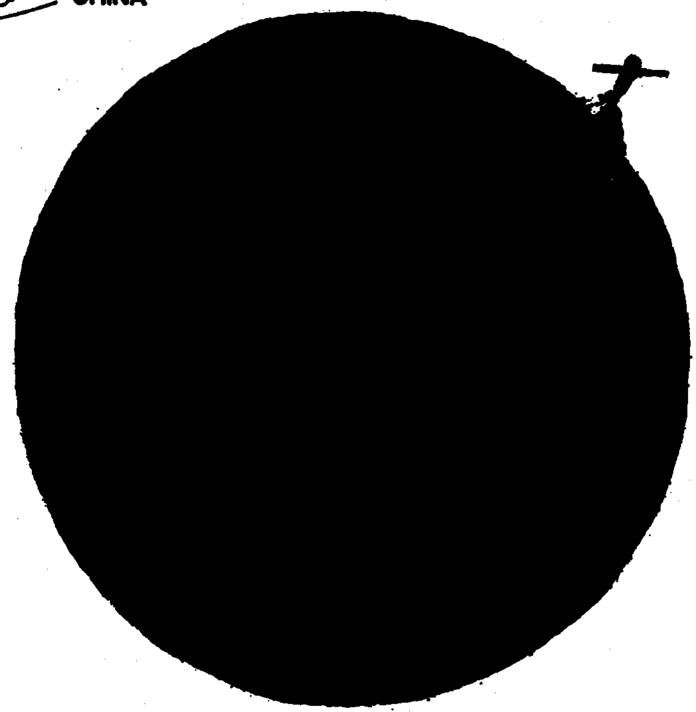
The MIDAS Program was included in Weapon System 117L when WS 117L was transferred to the Advanced Research Projects Agency. ARPA subsequently separated WS 117L into the DISCOVERER, SAMOS and MIDAS Programs, with the MIDAS objectives based on an infrared early warning system. The MIDAS (Missile Defense Alarm System) Program was directed by ARPA Order No. 38, dated 5 November 1958 until transferred to the Air Force on 17 November 1959. A ten launch development plan for MIDAS (WS-239A) has been approved. Additional authorization has been obtained to utilize two DISCOVERER flights (designated RM-1 and RM-2) to carry background radiometers in support of MIDAS.



CONDITIONS:
2,000 n.m. altitude
Two orthogonal polar orbital planes, four equi-spaced satellites in each plane.

[redacted]

Figure 4.
Orbiting satellites detect infrared radiation emitted by Soviet ICBM's in powered flight. Data 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. Probabilities of less than 1.00 on the above 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.



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 (Figure 1). The final configuration payload weight will be approximately 1,000 pounds.

The first two of the ten 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.

MIDAS I, launched in February 1960, did not attain orbit because of a failure during ATLAS/AGENA separation.

MIDAS II, launched in May 1960, was highly successful. Performance with respect to programmed orbital parameters was outstanding. Useful infrared data were observed and recorded.

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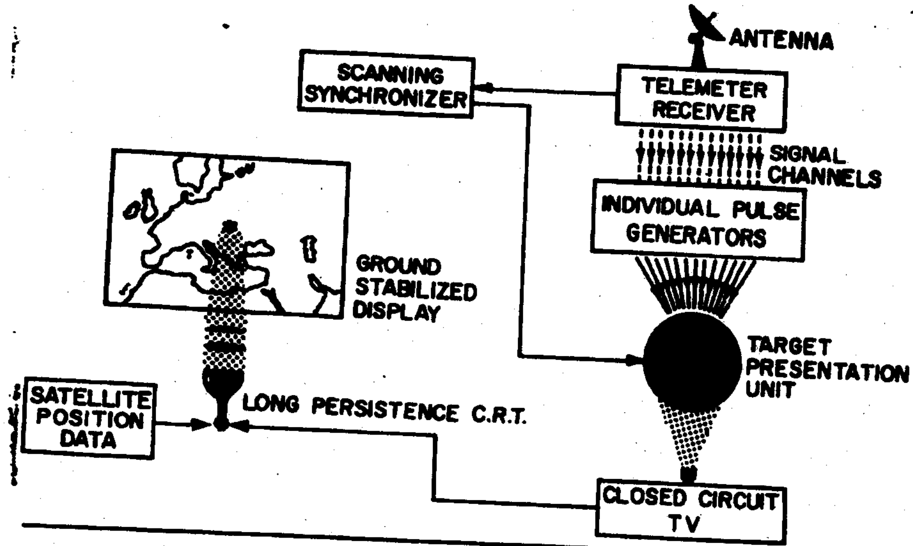
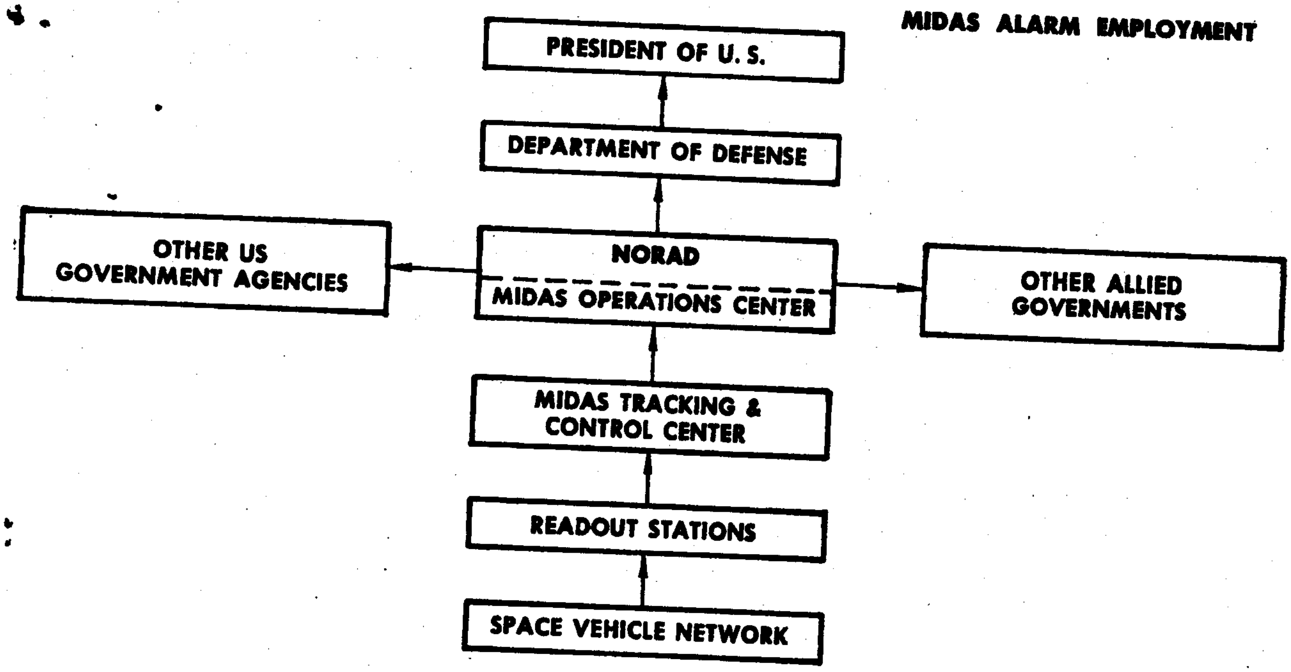


Figure 5.
Simplified version of ground presentation system (left) for display of infrared reconnaissance data. The data is displayed on a TV monitor with a map overlay. The chart below shows data flow from the readout stations to decision-making agencies. The MIDAS Control Center, or other using agencies having a correlated ground stabilized display, can determine when an actual attack has been launched.

MIDAS ALARM EMPLOYMENT



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 (Figure 3). The area under surveillance must be in line-of-sight view of the scanning satellite. Mission capabilities are shown in Figure 4. 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 (Figure 5). 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.

[redacted]

	60	61	62
	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 J A S O N D
[redacted]	[redacted]	[redacted]	[redacted]
	ATLAS "D"/AGENA "A"	ATLAS "D"/AGENA "B"	

MIDAS Launch Schedule

MIDAS GROUND SUPPORT FACILITIES

Facility	*Equipment**	*Flight Function*
Satellite Test Annex	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