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SPACE

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a foreword to...

SPACE

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

WDLPM-4

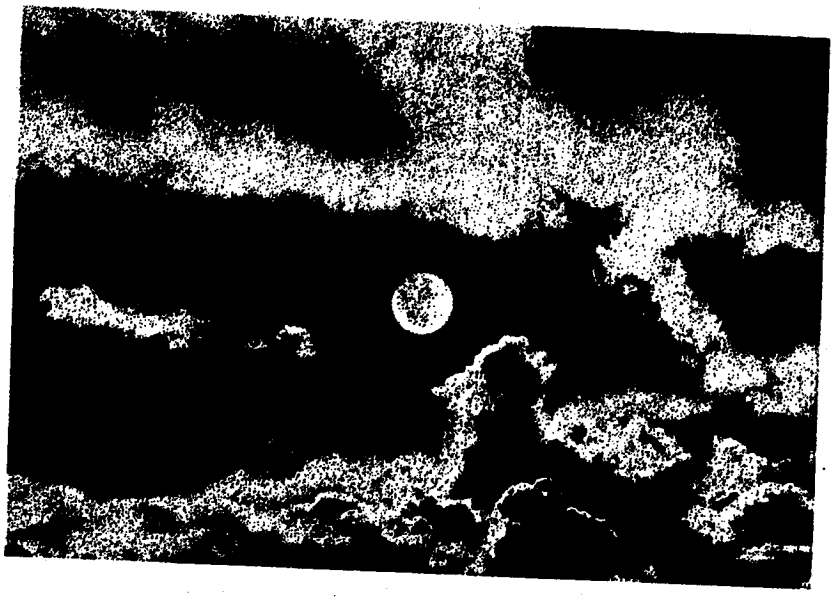
17 October 1960

FOREWORD

This report includes information on the three space vehicles launched by the Air Force in September. DISCOVERER XV was launched from Vandenberg Air Force Base on 13 September. At the Atlantic Missile Range a Project 609A Blue Scout, Jr., vehicle was flown on 21 September and the ABLE-5 Lunar Probe vehicle was launched on 25 September. In addition, preliminary flight information is given on the 4 October launch and highly successful orbital performance of COURIER 1B. The SAMOS section has been deleted as of this issue. The program has been placed directly under the Secretary of the Air Force and is no longer an official AFBMD responsibility.

O. J. RITLAND
Major General, USAF
Commander

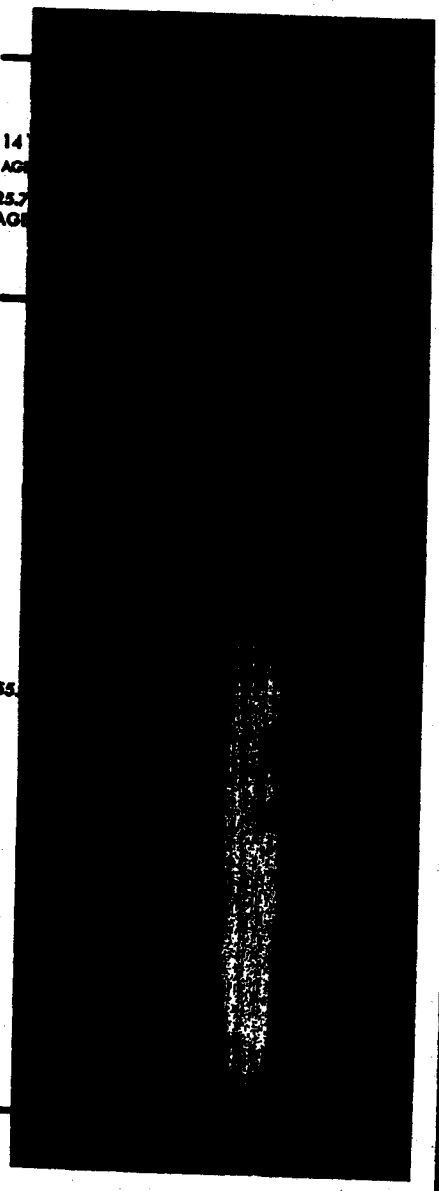
SATELLITE
systems



DISCOVERER
MIDAS
ADVENT

Discoverer

The DISCOVERER Program consists of the design, development and flight testing of 37 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.

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	167,000
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.

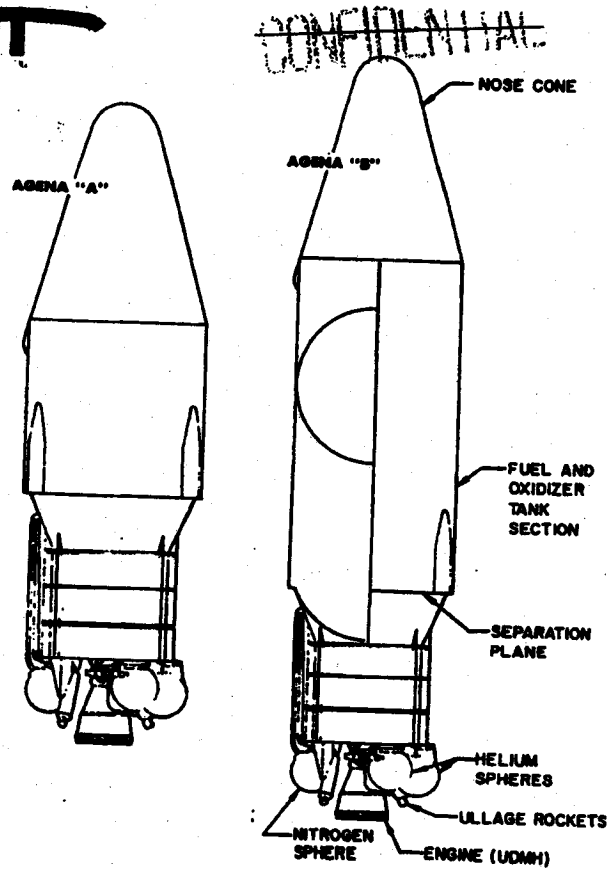
FLIGHT VEHICLE

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.

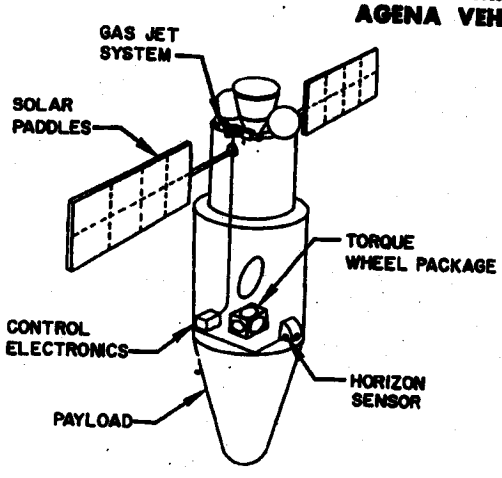
AGENA VEHICLE DEVELOPMENT

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 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.



SAMOS and MIDAS AGENA VEHICLE

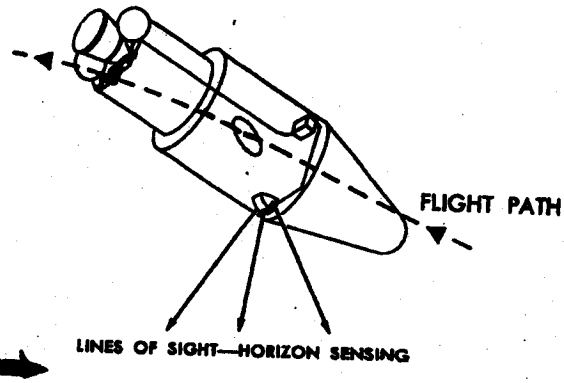


PERFORMANCE CAPABILITIES

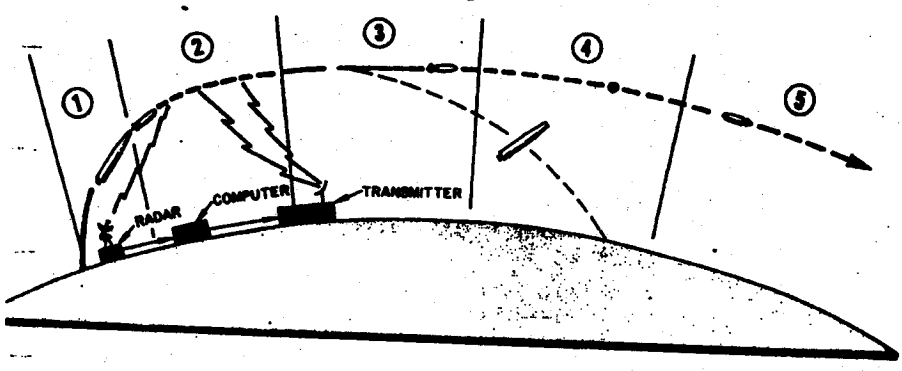
ALTITUDE
200–20,000 MILES

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

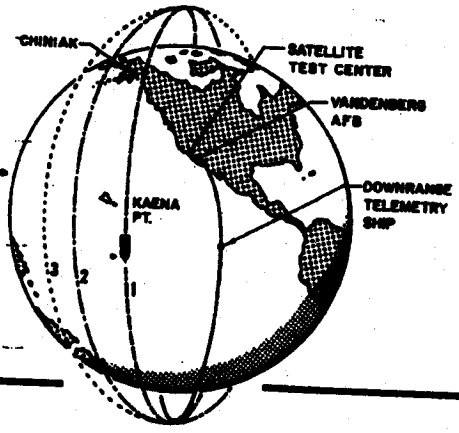
DISCOVERER/AGENA



Powered Flight Trajectory

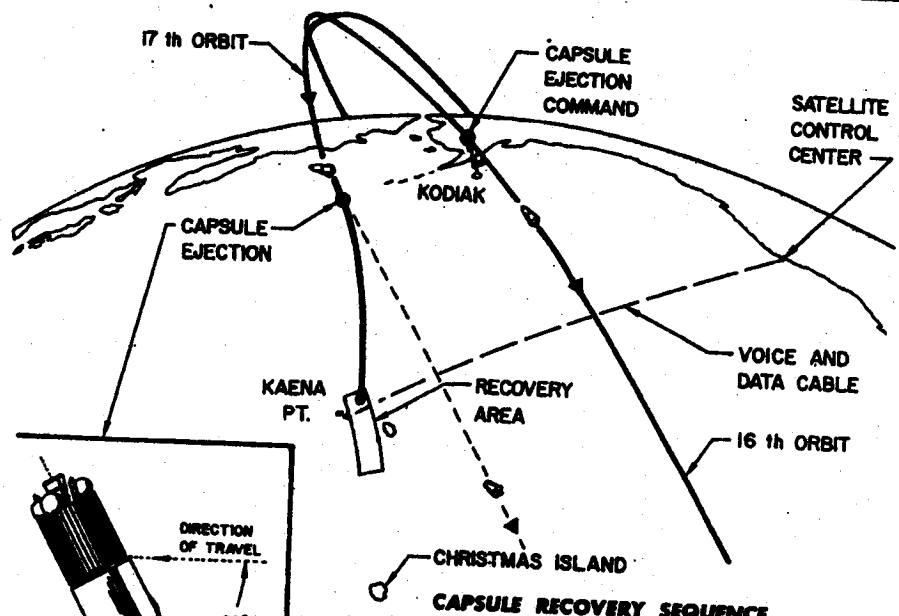


1. First Stage Powered Flight—2.5 minutes duration, 78 n.m. downrange, guided by programmed auto pilot.
2. Coast Period—2.4 minutes duration, to 380 n.m. downrange; altitude controlled by inertial reference package, horizon scanner, gas reaction jets. Receives AGENA time to fire and velocity to be gained 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

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.

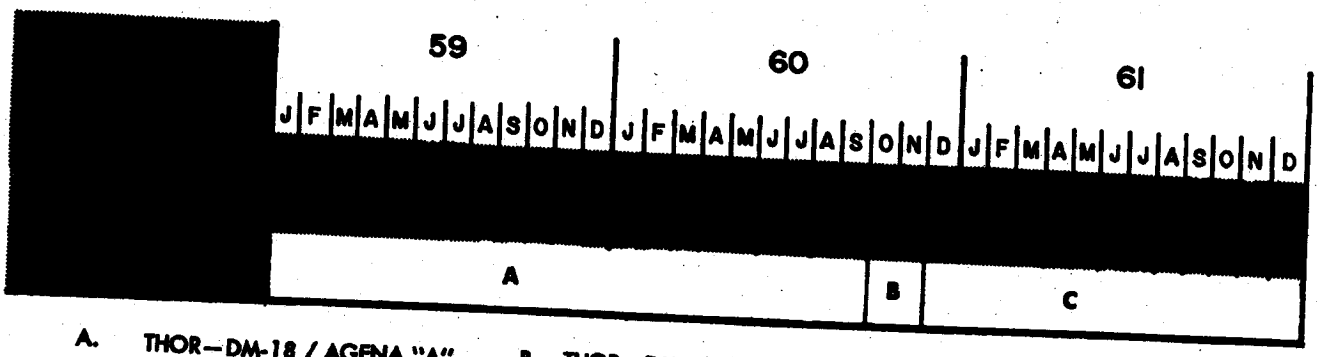
Capsule ejection command is sent to the satellite by the Chiniak, Alaska station on the 16th orbit. The vehicle reorients its position (see inset) to permit ejection to occur on a re-entry trajectory on the 17th orbit. The recovery capsule parachute is activated at about 50,000 feet, and the capsule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

GROUND SUPPORT FACILITIES

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 data.
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.
New Boston, New Hampshire (tracking station)	BDEFGHIJK	Orbital tracking and telemetry data reception.
Kodiak, 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



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

● Attained orbit successfully.

△ Failed to attain orbit.

Flight History

DISCOVERER No.	AGENA No.	THOR No.	Flight Date	Remarks
0	1017	160	21 January 1959	*AGENA destroyed by malfunction on pad. THOR refurbished for use on flight XII.*
I	1022	163	28 February	*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 1960	*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.*
XII	1053	160	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	1057	231	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	1056	237	18 August	*Attained orbit successfully. Recovery capsule ejected on the 17th orbit and was successfully recovered by the airborne force. All objectives successfully achieved.*
XV	1058	246	13 September	*Attained orbit successfully. Ejection and recovery sequence were normal. Capsule impact occurred south of the recovery forces; located but lost prior to being retrieved.*

MONTHLY PROGRESS—DISCOVERER Program
Flight Test Progress

DISCOVERER XV

- DISCOVERER XV was launched from Vandenberg Air Force Base at 1515 PDT on 13 September and was successfully injected into polar orbit. Two-thirds of the satellites launched in the DISCOVERER Program have attained orbit. THOR booster trajectory was satisfactory; AGENA performance was nominal. Propellant exhaustion caused shutdown, rather than integrator command. A comparison of programmed and actual orbital parameters is shown in Table I.

PARAMETER	NOMINAL	ACTUAL
Azimuth, degree	172.0	175.2
Perigee, statute miles	120	129
Apogee, statute miles	410	478
Injection Angle	0	−0.2
Eccentricity	0.0371	0.04
Period, minutes	93.44	94.2

TABLE I. DISCOVERER XV Programmed Orbital Parameters

- Data received on the first pass over Kodiak and Hawaii indicated that the satellite was stable and in correct attitude but that control gas consumption was excessive. The capsule was ejected on the 17th orbit but, because of a loss of control gas, the pitch-down prior to ejection was not accomplished. As a result, the capsule impacted about 1,000 miles south of the impact point predicted prior to capsule ejection. Subsequent analysis indicates that the roll rate gyro was not properly restraining the rate of satellite roll movements to the proper frequency. This caused the satellite to roll between limits faster than normal and resulted in higher than normal control gas expenditure.

- The capsule descent was tracked by the Hawaiian tracking station until re-entry; a computer run of this data resulted in a revised impact point prediction. Aircraft and the recovery ship "Dalton Victory" were dispatched to the impact area. The first aircraft to reach the area located the capsule by radio beacon at 2105 PDT and a second aircraft sighted it thirty minutes later. Marker beacons, strobe lights, smoke bombs and aluminum dye were dropped to mark the area. On the morning of the 15th, a Coast Guard amphibian arrived but did not land because of rough seas. Because of deteriorating weather and sea conditions, a plan to drop parachutists and a raft was abandoned.

- At 1115 PDT on 15 September electronic contact was lost. Fifteen minutes later, the aircraft lost sight of the capsule which was then listing and riding low in the water. The capsule was not seen again although the search continued throughout 15 and 16 September.

DISCOVERER XVI

- DISCOVERER XVI is scheduled for launch from Vandenberg Air Force Base in October. This will be the first AGENA "B" vehicle to be launched. Vehicle subsystem and system checks were completed during September and the vehicle has been installed on the launch pad. The AGENA "B" is an improved version of the AGENA "A" containing integral propellant tanks which form part of the satellite skin and having double the propellant capacity.

- The increased payload capability of the AGENA "B" will permit use of extra batteries and control gas required for two, three and four day intervals between launch and capsule recovery. The recoverable payload is similar to those flown on DISCOVERER XIV and XV. The ascent parameters for AGENA "B" DISCOVERER satellites are markedly different from previous DISCOVERER vehicles. A comparison of predicted parameters for DISCOVERER XV and DISCOVERER XVI are shown in Table II.

	DISCOVERER XV (AGENA "A")	DISCOVERER XVI (AGENA "B")
ASCENT PARAMETERS		
THOR Burnout Time, seconds from liftoff	163	163
THOR Velocity at Burnout, fps	13,660	10,610
AGENA Ignition Time, seconds from liftoff	269	237
AGENA Burn Time, seconds	117	240
Injection Velocity, fps	26,032	25,964
ORBITAL PARAMETERS		
Apogee, statute miles	410	426
Perigee, statute miles	120	130
Eccentricity	0.0371	0.035
Inclination Angle, degree	79.63	81.83
Period, minutes	93.44	93.5

TABLE II. Comparison of Ascent and Orbital Parameters for AGENA "A" and AGENA "B" Satellites

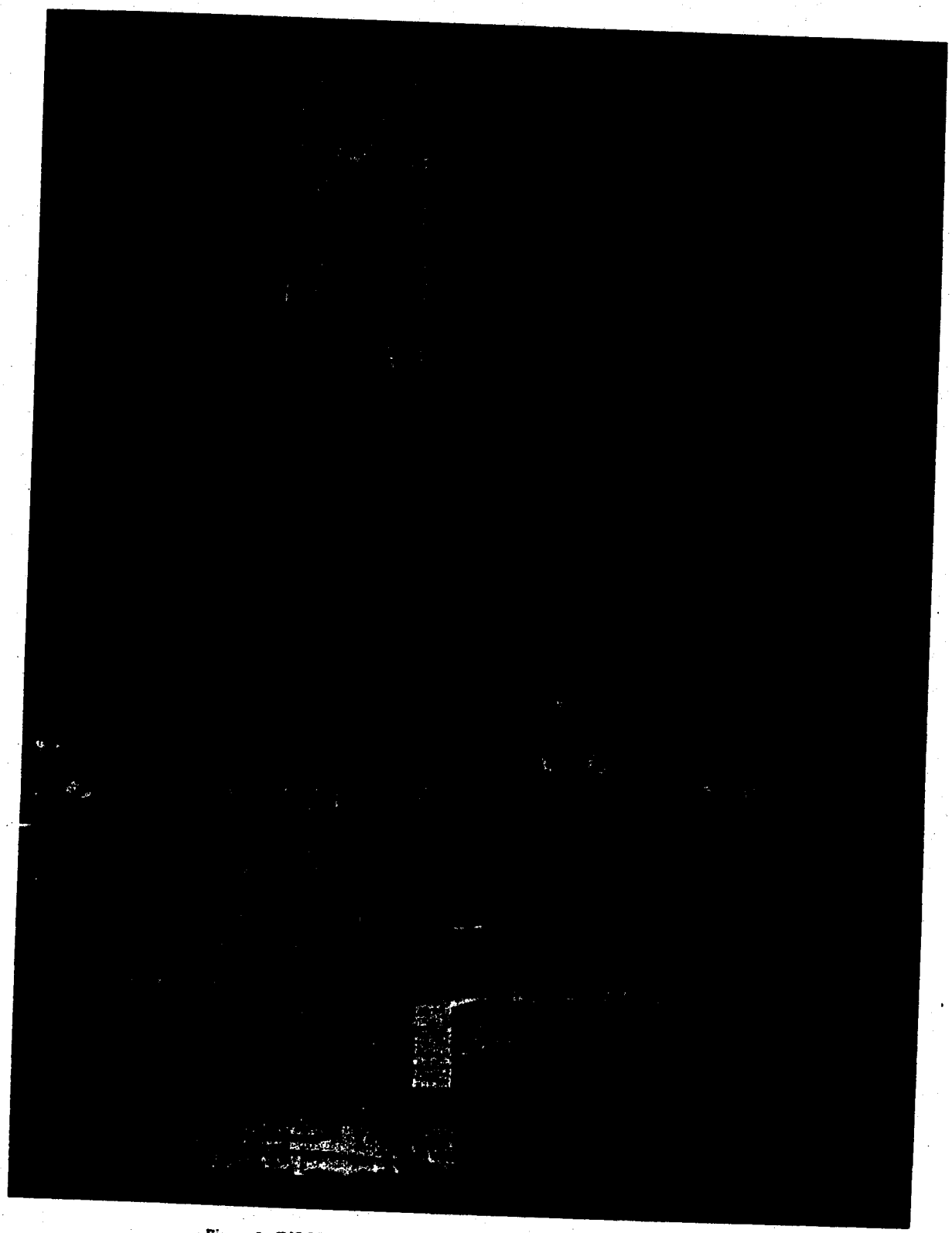


Figure 1. DISCOVERER XV prior to launch on 13 September. The transporter shown in front of the THOR booster is lowered for launch. The missile shelter is shown in the right background. The two nitrogen storage trailers and the hydro-pneumatic trailer are shown on the right.

Technical Progress

Second Stage Vehicles

- The results of an investigation into system and equipment performance on DISCOVERER XV were presented on 20 September. The presentation included analysis of the various problem areas encountered; action taken to improve test procedures, inspections and equipment specifications; and action to incorporate improvements in DISCOVERER XVI.

- The XLR-81Ba-9 engine (serial No. 307) was fitted with a new thrust chamber and subjected to a full duration calibration run. The 240 second firing was completed without appreciable nozzle throat erosion, using a titanium uncooled extension which had previously completed a five day humidity test. The nozzle extension was in excellent condition following the firing. This test completed the Preliminary Flight Rating Test for this engine which is now being prepared for re-acceptance inspection prior to shipment to Arnold Engineering Development Center for reliability testing.

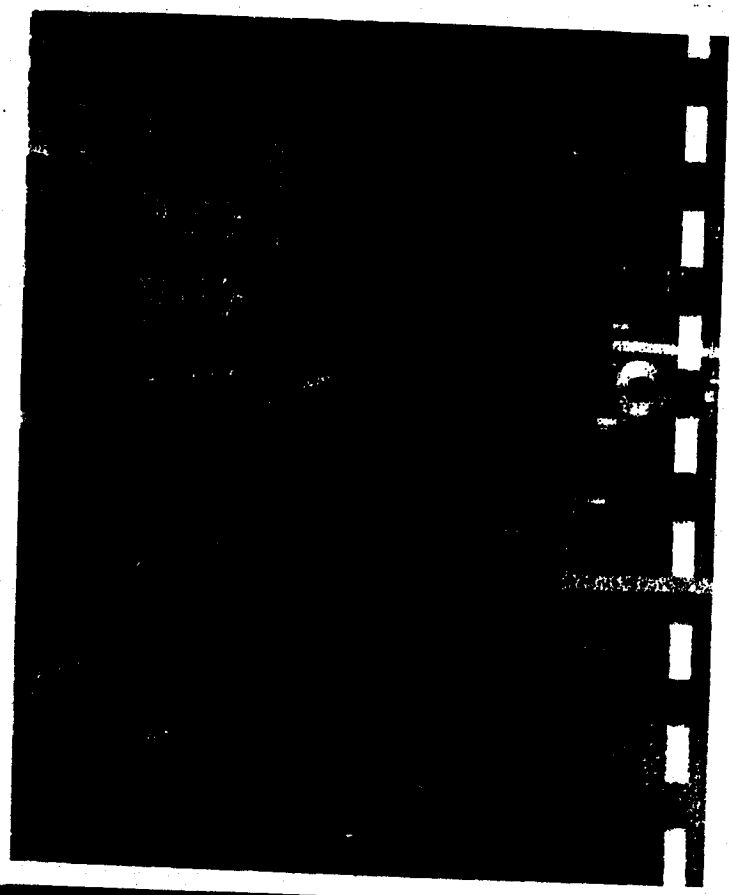
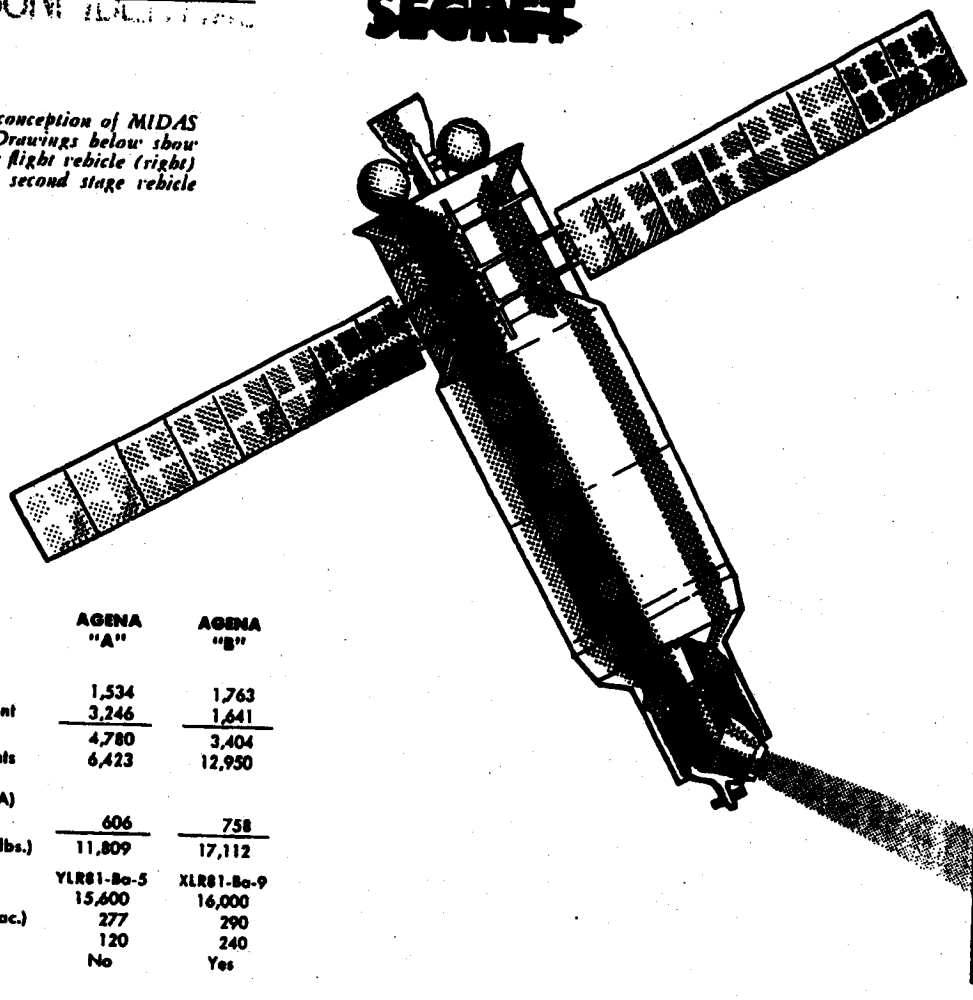


Figure 2. Air Force technicians adjusting electronic checkout equipment during flight control checkout of an AGENA vehicle. This activity is taking place in the Vandenberg Air Force Base missile assembly building.

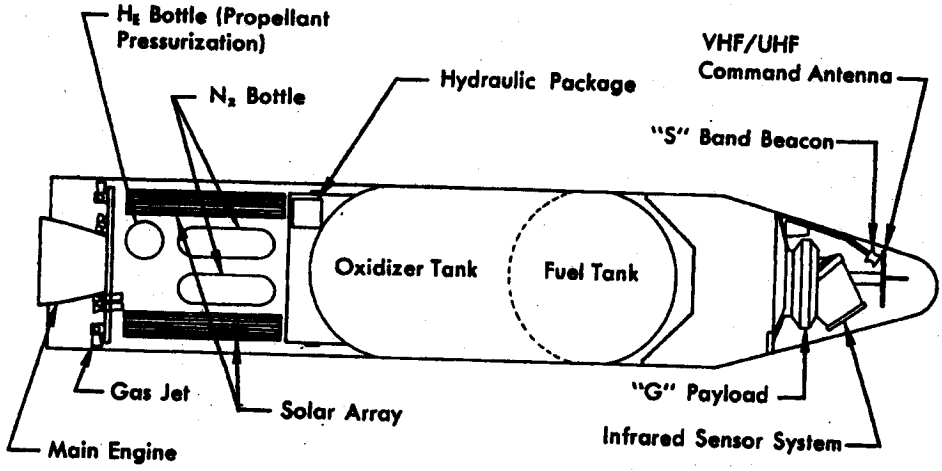
Figure 3. Change-over from AGENA "A" to AGENA "B" in the missile assembly building at Vandenberg Air Force Base. The AGENA "A" on the right, is DISCOVERER XV which was launched on 13 September. One more AGENA "A" remains to be flown. On the left is the AGENA "B" vehicle scheduled for launch in October as DISCOVERER XVI.

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).

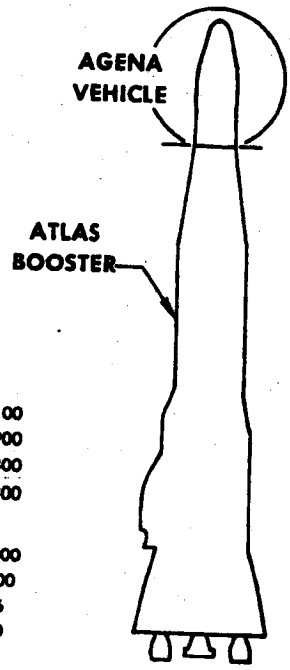


Midas

SECOND STAGE	AGENA "A"	AGENA "B"
Weight—		
Inert	1,534	1,763
Payload equipment	3,246	1,641
Orbital	4,780	3,404
Impulse Propellants	6,423	12,950
*Fuel (UDMH)		
Oxidizer (IRFNA)		
Other	606	758
GROSS WEIGHT (lbs.)	11,809	17,112
Engine	YLR81-Ba-5	XLR81-Ba-9
Thrust, lbs. (vac.)	15,600	16,000
Spec. Imp., sec. (vac.)	277	290
Burn Time, sec.	120	240
Restart Provisions	No	Yes



MIDAS, Configuration II, AGENA "B" Satellite



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

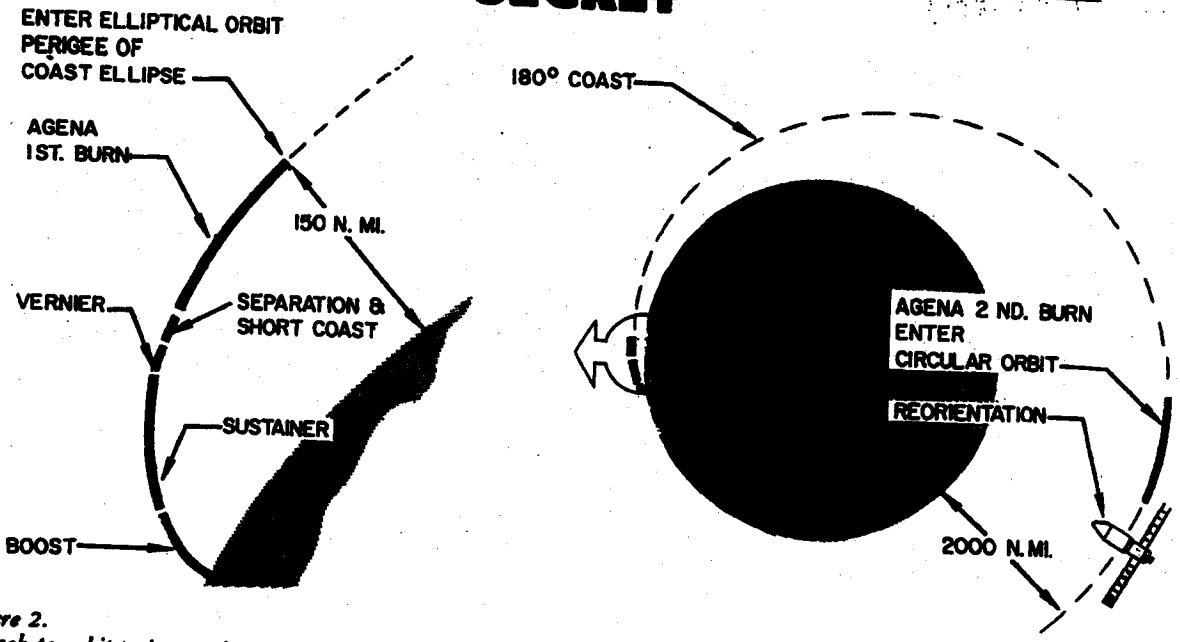


Figure 2.
Launch-to-orbit trajectory for flights 3 and subsequent. From boost through separation guidance and control is provided by the ATLAS radio inertial system. The AGENA inertial guidance system, with horizon scanner, provides attitude, velocity and directional control to establish the orbit and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

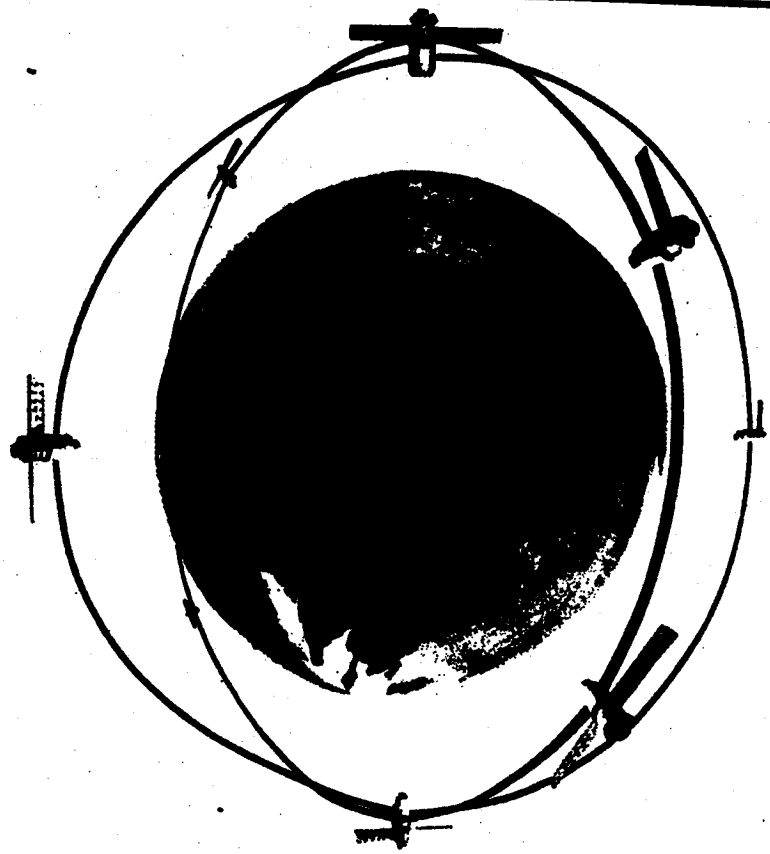


Figure 3.
Proposed MIDAS system. Four satellites spaced equidistant in each of two orthogonal planes at 2,000 n.m. altitude. Provides maximum coverage of USSR with minimum number of satellites.

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 reconnaissance 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.

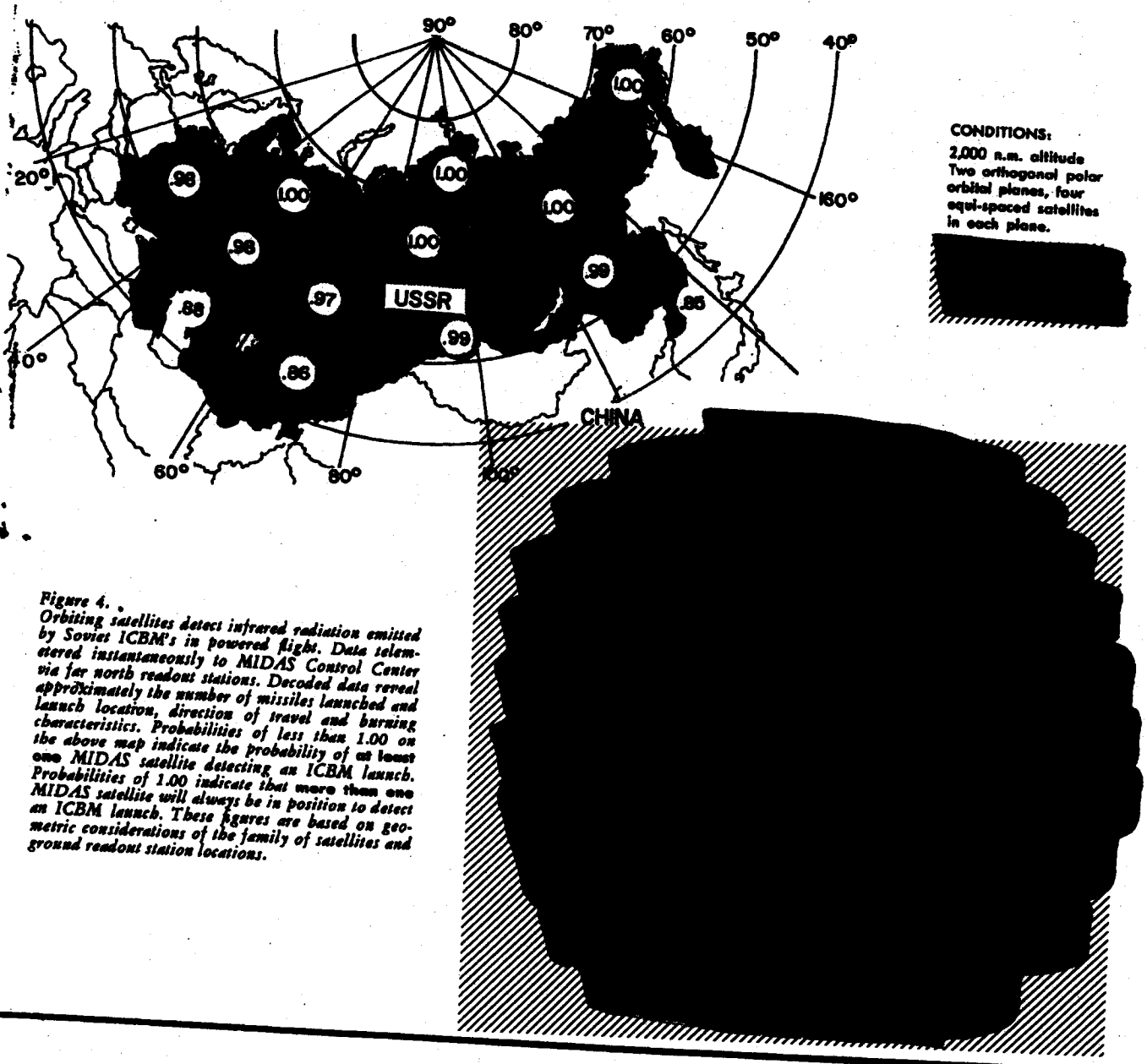


Figure 4.
Orbiting satellites detect infrared radiation emitted by Soviet ICBM's in powered flight. Data telemetered instantaneously to MIDAS Control Center via far north readout stations. Decoded data reveal approximately the number of missiles launched and launch location, direction of travel and burning 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 reconnaissance 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.

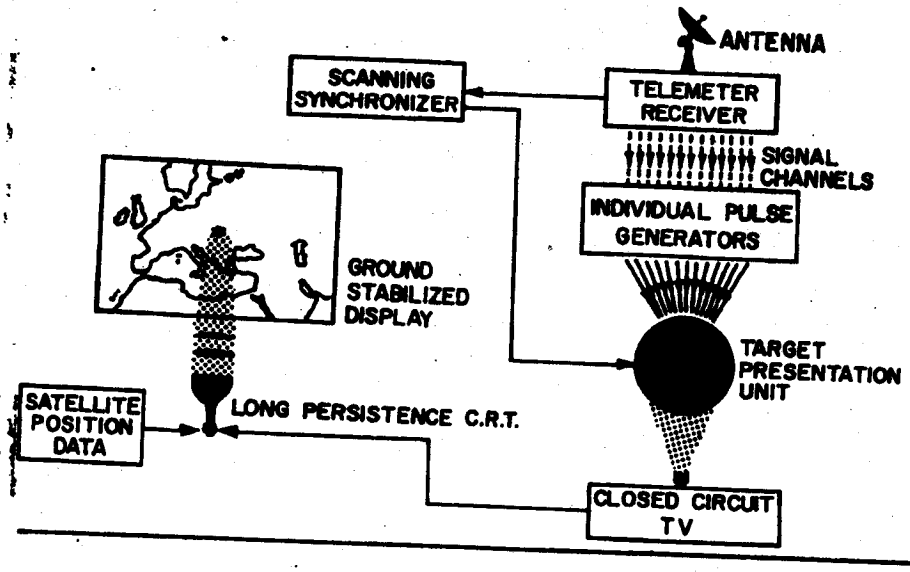
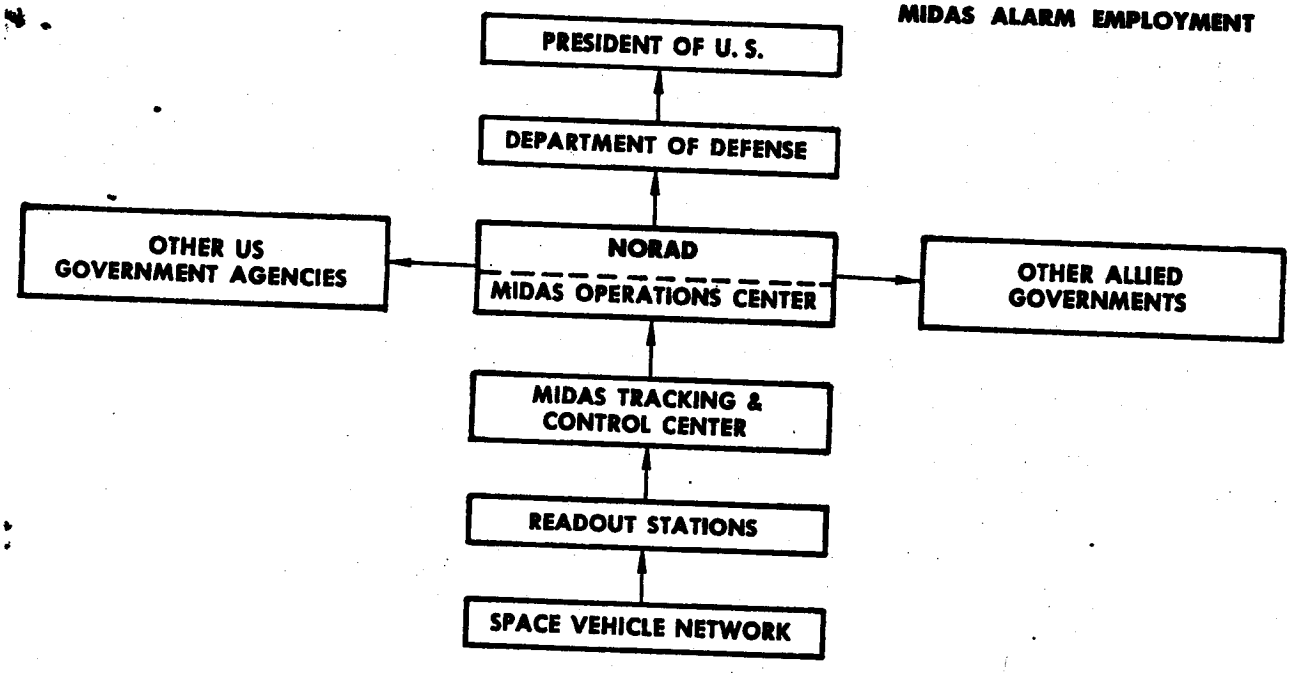


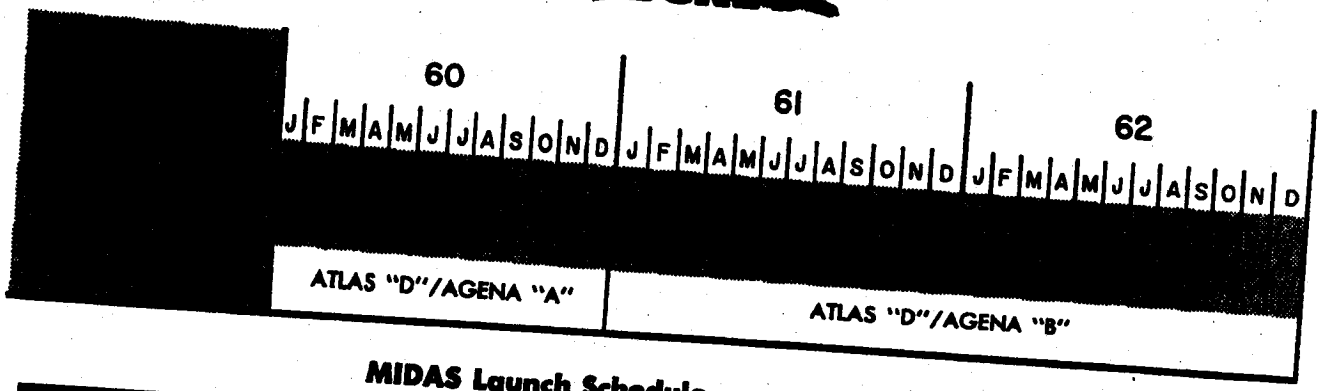
Figure 5.
Simplified version of ground presentation system (left) for display of infrared reconnaissance data. The data is displayed on a TV monitor with a map overlay. The chart below shows data flow from the readout stations to decision-making agencies. The MIDAS Control Center, or other using agencies 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 reconnaissance 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.



MIDAS Launch Schedule

Facility	Equipment*	Flight Function
Satellite Test Center	ABC	Operations control center of the system during the R&D program. Directs tracking station operations, controls satellite programming and communication system utilization. Receives and stores key vehicle and station data, determines vehicles ephemerides and generates acquisition and tracking data to tracking stations. Analyzes systems operation and telemetry and payload data.
Vandenberg Air Force Base (tracking and data acquisition station)	ABCEFGHIJKLMPTU	Provides launch and ascent tracking, receives and records telemetry data and trajectory measurements. Gathers payload data, telemetry and tracking data and transmits this data to the Satellite Test Center.
Telemetry ships	IKMS	Ascent tracking and telemetry data reception through AGENA first burn period.
Vandenberg AFB	NO	Provides ground radio guidance system for booster guidance during the launch phase.
Northeast Station (New Boston, New Hampshire)	CDEFHMPQR	Provides orbital tracking. Gathers payload data, telemetry and tracking data and transmits this data to the Satellite Test Center.
Southeast Africa Station	JKM	To receive and record telemetry data and provide limited tracking during the AGENA second burn period.
Kaena Point, Oahu, Hawaii	HIKLMTU	Gathers supplemental Verlort tracking data during orbital passes.
Kodiak, Alaska	HIKLMTU	Gathers supplemental Verlort tracking data during orbital passes.
Point Mugu	HI	Ascent tracking for range safety; backup function.
Point Arguello	V	Mates vehicles, performs final system checkout, prepares vehicle for launch and launches vehicle.

*Equipment

A. Model 1604 Computer
B. Ground Presentation Equipment
C. Data Distribution Equipment (PICE)
D. Data Conversion Equipment
E. UHF Tracking Equipment
F. UHF Telemetry and Data Acquisition Equipment
G. UHF Command Antenna
H. VERLORT (Mod II) Radar
I. Tri-helix Antenna
J. TLM-18 Telemetry Antenna
K. Telemetry Receiving and Recording Equipment
L. Plot Boards for Radar and TLM-18 Tracking Data
M. Doppler Data Gathering Equipment
N. AN/GQR-2 (XXA-2) Tracking and Monopulse Radar
O. AN/GRS-2 (XAA-2) Rate Measuring System
P. Timing (WWV) Equipment
Q. VHF FM/FM Data Acquisition Equipment
R. VHF PAM/FM Data Acquisition Equipment
S. High Frequency Radio Communications and Teletype Circuits
T. Acquisition Programmer for pre-acquisition Direction of Antennas
U. Conversion Equipment for Teletype Transmission of Radar, TLM-18 and Doppler Tracking Data in Binary Format
V. Complete Launch Facilities

GROUND SUPPORT FACILITIES

MONTHLY PROGRESS — MIDAS Program

Program Administration

- As a result of recent investigations by Space Technology Laboratories on the significance of the high energy tail of Van Allen protons, and their potential effect on long-life satellites, Lockheed has been requested to develop special instrumentation to be carried on MIDAS flights. Contrary to the present theory that the damage cross section is inversely proportional to energy, evidence has been found that solar photovoltaic cells may be degraded at a much higher rate by high energy protons, e.g., 700 MEV. A comprehensive program has been initiated to determine the sensitivity of selected components to high energy proton radiation and to determine the quantitative and qualitative characteristics of the Van Allen radiation at MIDAS flight altitudes.

Flight Test Progress

- The vehicle for the third MIDAS flight is currently in the systems test phase of checkout. This is the first MIDAS vehicle to have restart capability. Because of problems which developed in the horizon sensor and related checkout equipment, this vehicle is behind schedule. Based on delivery of a reworked horizon sensor on 15 October, it is scheduled to complete the systems test phase on 12 December. The scheduled launch date for this flight remains 28 February 1961.

Technical Progress

Second Stage Vehicles

- Assembly of the AGENA "B" vehicles for the fourth and fifth MIDAS flights is proceeding on schedule. The vehicle scheduled for the fourth MIDAS flight is now in final assembly.

Infrared Scanner Units

Infrared scanner units for flights 3, 4 and 5 are being manufactured by Baird-Atomic, Inc., and for flights 6, 7 and 8 by Aerojet-General Corporation.

- The infrared detector payload scheduled to be carried on the third MIDAS flight has been delivered. Acceptance testing of this payload will be completed in early October. The second flight payload is scheduled for delivery on 15 October. Two more payloads, one for backup purposes, remain to be delivered.

- Temperature profile tests of the engineering test model of the Baird-Atomic configuration are in progress in the High Altitude Temperature Simulation Chamber.

Ground Support Equipment

- Delivery of the initial Baird-Atomic ground infrared data display equipment is scheduled for 15

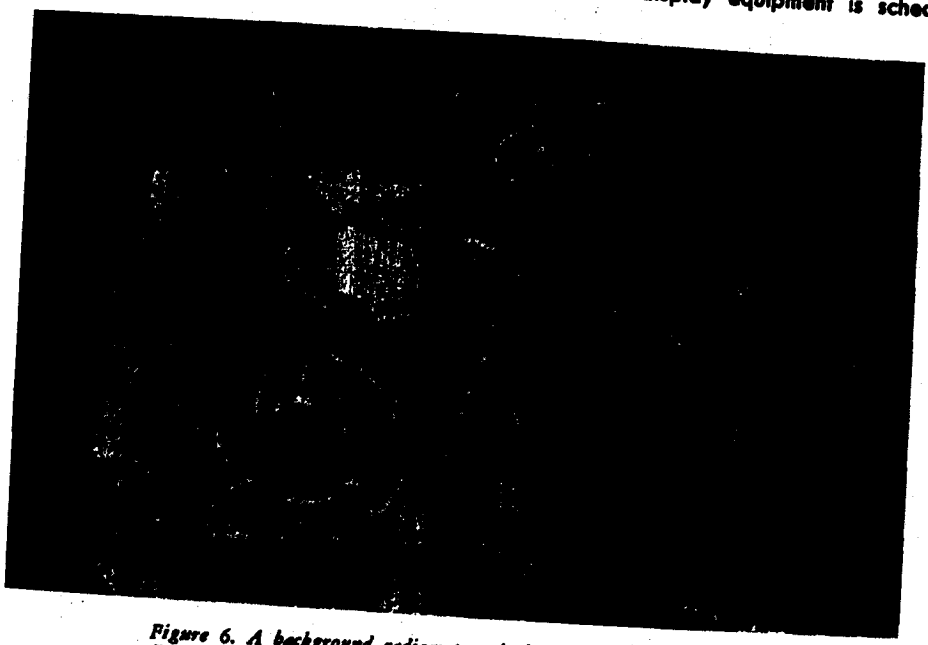


Figure 6. A background radiometer of the type to be carried on DISCOVERER flights RM-1 and RM-2. The primary function of these flights will be to provide background radiation data for use in future MIDAS flights. The nitrogen spheres are part of the nitrogen-gas cooling system which cools the sensitive element of the radiometer.

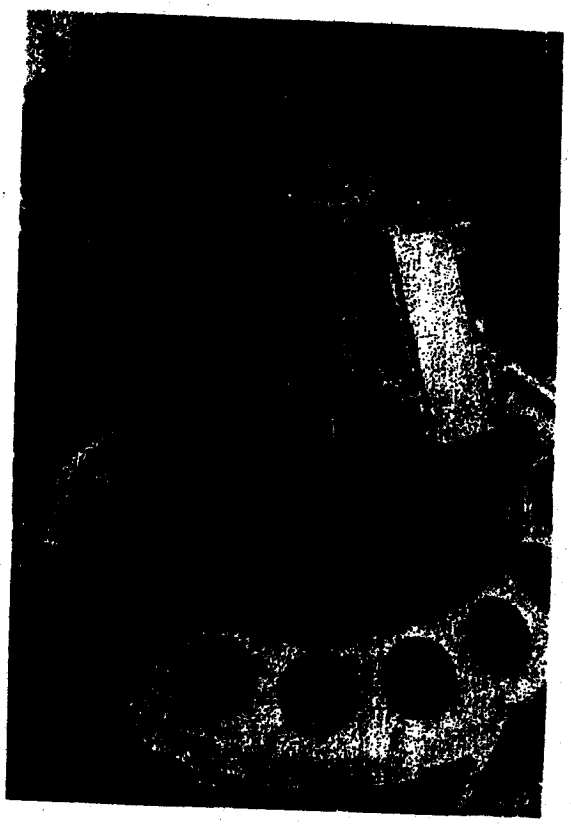
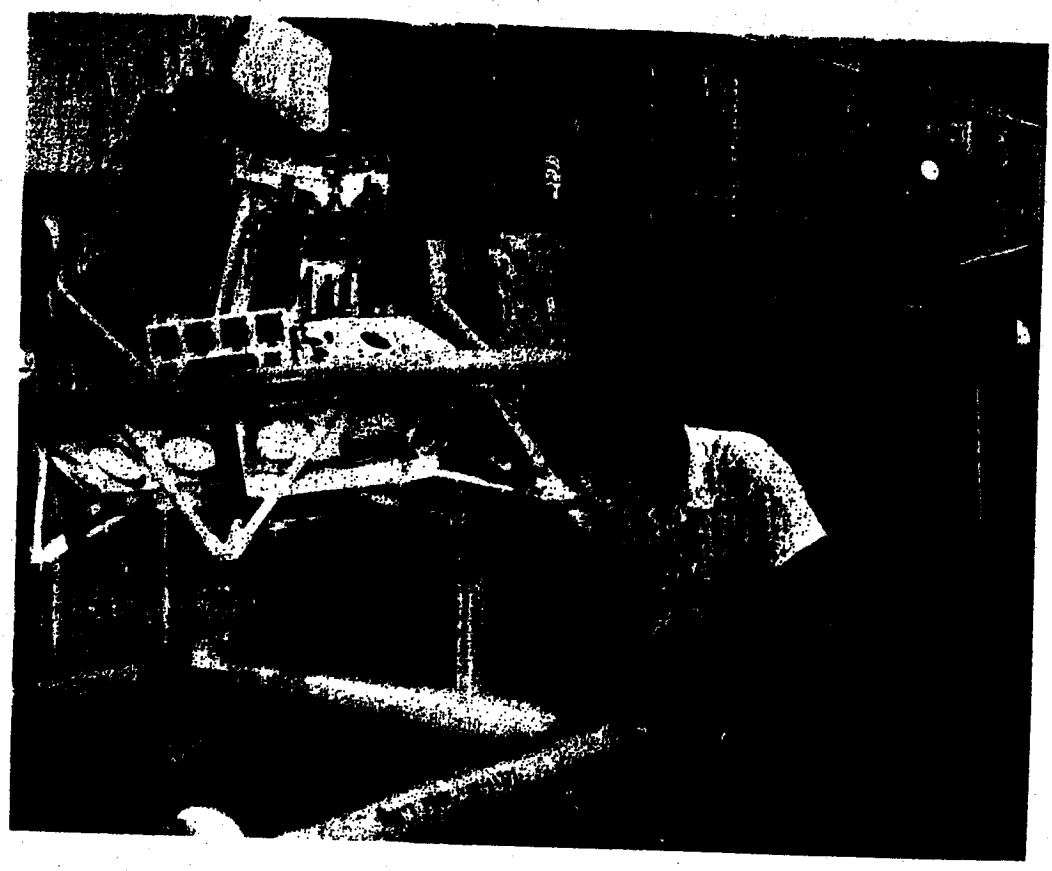


Figure 7. The Baird Atomic, Inc., infrared detector payload during checkout at the Lockheed Sunnyvale facility. This payload will be carried on the third MIDAS flight which is currently scheduled for February 1961. The payload checkout equipment is contained in the equipment racks shown on the background.



October. This equipment will be installed in the Satellite Test Center; a second unit will be installed in the Vandenberg Air Force Base Tracking station. The late delivery of the equipment for the Satellite Test Center will not affect the scheduled activation date. Some revision of the integration activity will be required; however, this will not affect the MIDAS launch schedule. Delays in delivering the second unit of ground station equipment, however, will cause some slippage in the Vandenberg Air Force Base tracking station activation date for support of MIDAS flights.

Facilities

- A detailed evaluation of launch pad requirements for the MIDAS operational phase has been accomplished. This study indicates the need for a three-pad launch complex during the establishment of the operational network, and a requirement for from two-to-three pads for maintaining the MIDAS satellite network once the buildup phase has been completed.

- Final acceptance of North Pacific station technical facilities at Donnelly Flats, Alaska, was accomplished on 29 September. The heated vehicle storage building at Fort Greely is scheduled for completion on 31 October. Completion of the combined dormitory and dining hall facility, except for exterior area grading, will be completed on 30 December. The Donnelly Dome microwave relay station is scheduled for completion on 15 December. Beneficial occupancy of the remaining North Pacific communications stations is programmed for 1 January 1961.

- All New Boston station support facilities located on Grenier Field, New Hampshire, were completed and accepted during the report period. Support facilities on the New Boston station are on schedule. Design of the data acquisition and processing building modification has been completed and a construction contract is presently being negotiated. Completion is scheduled on an incremental basis with final completion scheduled for 1 January 1961.

Figure 8. Over-all view of the MIDAS ground equipment currently installed in the Satellite Test Center. The drawer pulled out houses the oscillograph equipment. The equipment racks in the rear house the tape recorder installation.