AFBMD Activities in Space Jun 60

SATELLITE

systems

DISCOVERER
SAMOS
MIDAS
COMMUNICATIONS SATELLITE

Discoverer

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.

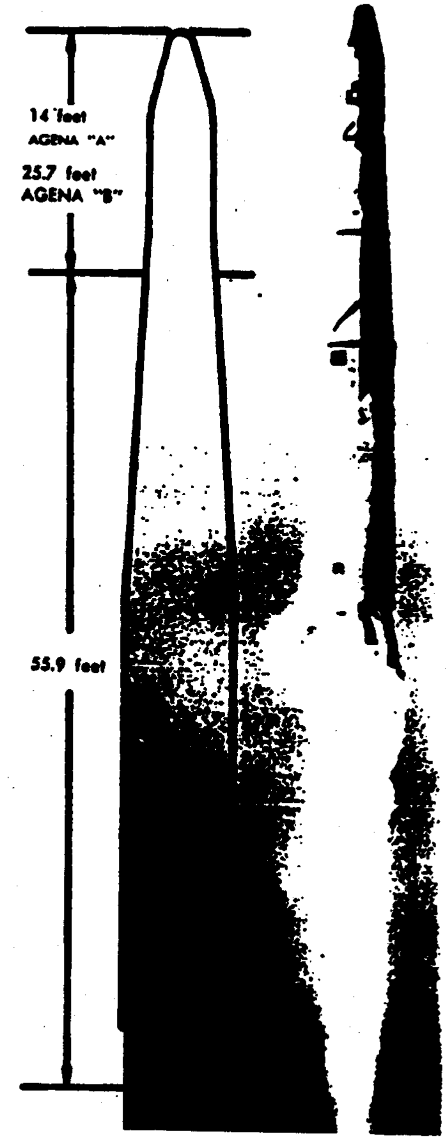
(e) Testing of ground support equipment and development of personnel proficiency.

(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, Palo Alto, 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

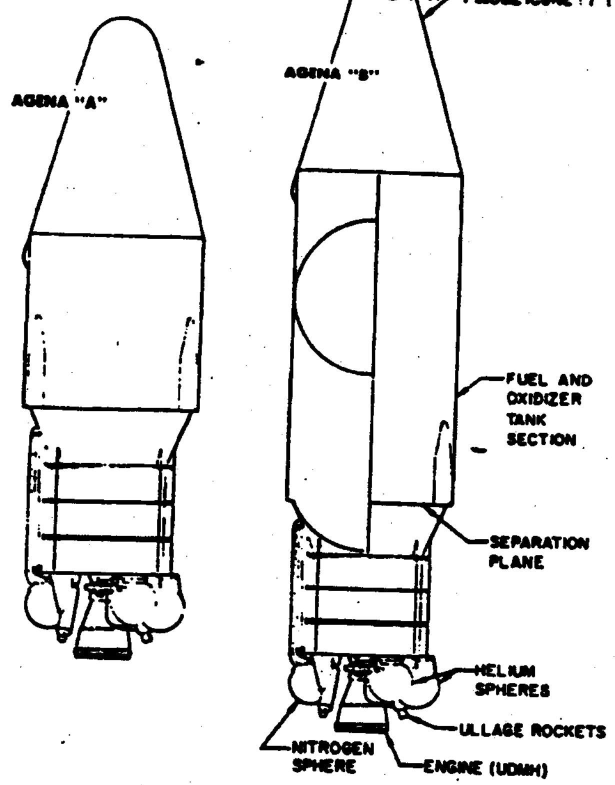
Telemetry ships are positioned as required by the specific mission of each flight. Figures 2 and 3 show a typical launch trajectory from Vandenberg Air Force Base, and figure 3 shows schematically a typical orbit. An additional objective of this program is the development of a controlled re-entry and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

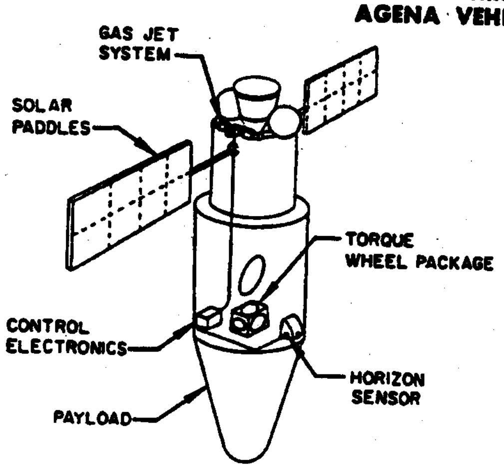
The AGENA vehicle was originally designed by the Air Force as the basic satellite vehicle for Advanced Military Reconnaissance Satellite Systems Programs. Basic design was based on use of the ATLAS ICBM as the first stage. ATLAS trajectory characteristics and the stringent eccentricity requirements of 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



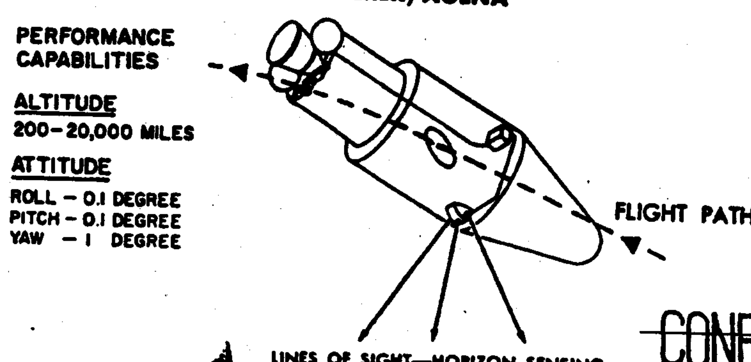
gas jet system for orbital attitude control. An urgent need for attaining higher altitude orbits resulted in development of the AGENA "B" versions. The YLR81 Ba-5 version of the LR81-Ba-3 engine (Bell Hustler engine developed for B-58 aircraft) is used on AGENA "A" vehicles. The YLR81-Ba-5 version of 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



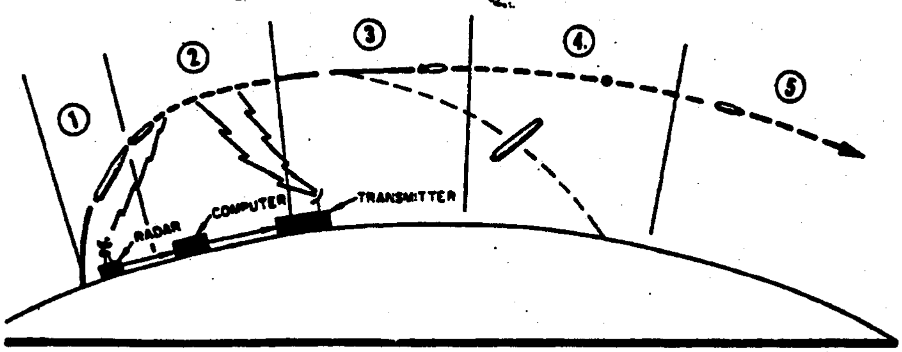
DISCOVERER/AGENA



ENTIAL
OSE CONFIDENTIAL

Powered Flight Trajectory

SECRET



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).

—FUEL AND OXIDIZER TANK SECTION

—SEPARATION PLANE

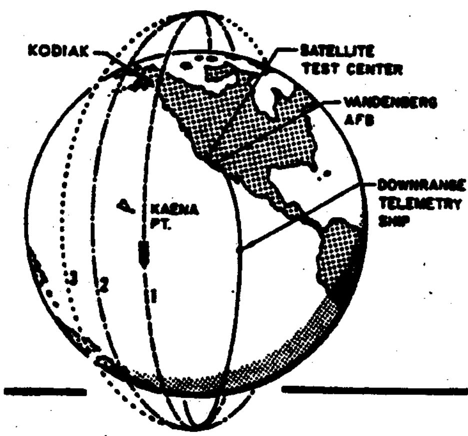
HELIUM SPHERES

LAGE ROCKETS

E (UDMH)

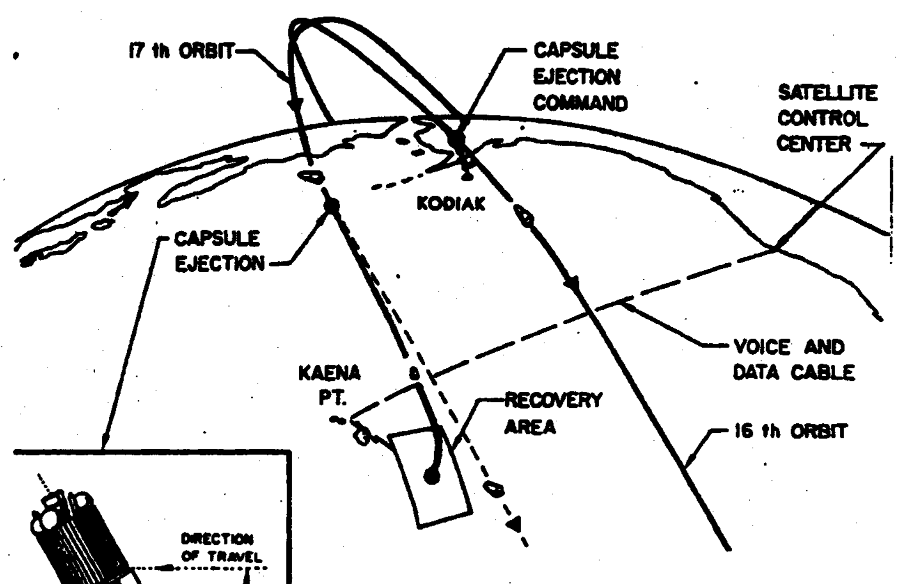
urgent
lted in
YLR81
Hustler
ed on
of this
rform-
methyl

1-Ba-7
A "B"
rating
ding a
luding



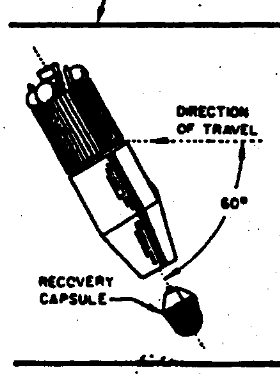
Orbital Trajectory

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 south of 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.

GHT PATH

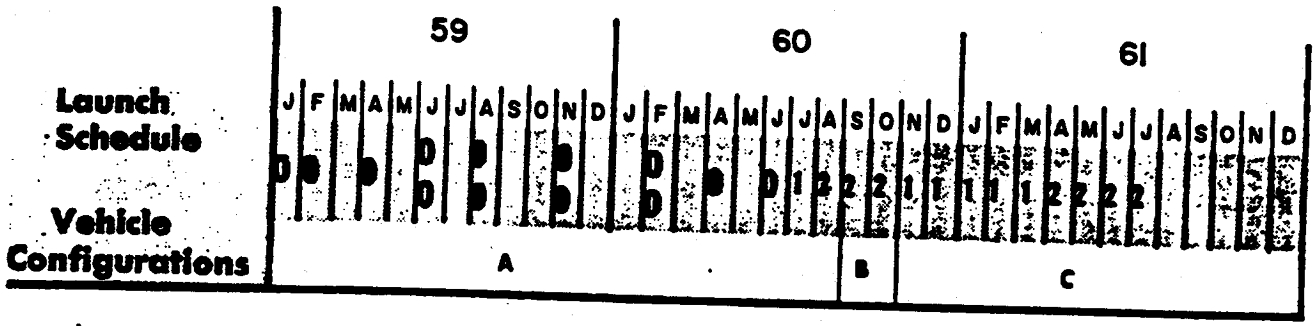
CONFIDE

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.
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

GROUND SUPPORT FACILITIES



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

0 Attained orbit successfully.

● Failed to attain orbit.

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.*
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.*

MONTHLY PROGRESS—DISCOVERER Program

Flight Test Progress

- DISCOVERER XII was launched at 2300, GMT, on 29 June from Pad 4 of Complex 75-3, Vandenberg Air Force Base. The countdown proceeded satisfactorily with minor technical holds because of ground support equipment problems. The major hold was caused by weather. The launch, first stage trajectory, engine cutoff, and separation were normal. AGENA engine ignition, thrust and engine cutoff were also normal. However, the satellite failed to achieve orbit. Teleme'ry data indicate that the AGENA vehicle was in a pitch down attitude during engine operation causing the vehicle to re-enter the atmosphere. Subsequent investigation has isolated the cause of the improper pitch attitude to the horizon scanner. A thorough examination of the horizon scanner operation and checkout is being conducted to determine the reason for malfunction and to correct the condition prior to the launch of DISCOVERER XIII.

- DISCOVERER XII carried a diagnostic payload in addition to the normal recovery equipment. The payload contained instrumentation to determine capsule environment and the functioning of separation and recovery sequence events. A five chanel telemetry system was installed to transmit the data obtained to the ground stations. To assure receipt of all data, a tape recorder was provided to record the real time events and capsule performance during the telemetry "blackout" period which occurs when the capsule re-enters the atmosphere. After a two-minute time delay, this stored data would be transmitted to the ground stations. The high speed of re-entry induces ionization over the skin of the capsule which effectively blocks telemetry transmission. An S-band transponder was also provided to aid in tracking the capsule from ejection through recovery. DISCOVERER XIII will carry an identical diagnostic capsule.

Technical Progress

Second Stage Vehicles

- One AGENA "B" vehicle (XLR-81Ba-7 engine) is in storage following Air Force acceptance. Three other vehicles with XLR-81Ba-7 engines have completed hot firing tests at Santa Cruz Test Base and have been returned to the systems test area for rework and a second system check prior to Air Force acceptance. The first two AGENA "B" vehicles using the XLR-81Ba-9 engine are ready for hot firing system testing at Santa Cruz Test Base.

- Evaluation and testing of nozzle coatings in an effort to reduce XLR-81Ba-9 engine throat erosion continued during the report period. The test results using a modified fuel injector have been encouraging. Tests of this injector will continue.

- Testing of the XLR-81Ba-9 engine (with 45:1 area ratio nozzle) continued at Arnold Engineering Development Center. An engine start and restart firing series covering a temperature range of 120 to −55 degrees F has been completed. The engine is mounted in a modified test stand which permits engine gimballing.

Recovery System Component Test Program

- Extensive examination of the results of DISCOVERER flight I through XI has indicated the possibility of tumbling and/or precession of the capsule upon separation from the AGENA vehicle because one or more of the spin/de-spin rockets failed to fire properly. To correct this condition a "cold gas" spin/despin system was incorporated into the DISCOVERER XII payload. The "cold gas" system contains two separate subsystems each supplying a maximum of 195 pounds thrust with a firing duration of 0.8 seconds. Each system contains a gas bottle (containing a nitrogen and freon gas mixture), a manifold, a squib operated valve, and exhaust jets.

Figure 1. The thrust cone for the diagnostic payload showing the "cold gas" spin/de-spin systems. The gas spheres, squib operated valves, and manifolds for each system are shown in the top of the photo. The exhaust jets are mounted on the outside of the cone. The thrust cone separates from the payload prior to parachute deployment.

- Drop testing of the DISCOVERER capsules continued throughout the report period at Holloman Air Force Base, New Mexico. Originally scheduled for nine drops, the test series has been extended to permit field testing of the capsule parachute system and testing of retrofiring system. Solid propellant rocket spin/de-spin systems tests were conducted on 24 May. "Cold gas" systems tests were conducted on 23 June. The parachute system tests started prior to the solid propellant rocket test and are still in progress.

- For each of the drop tests, the capsule is carried to 100,000 feet altitude. On command from the ground, the capsule is released from a fairing which simulates the AGENA vehicle. During the retrofiring system drop, the ejection programmer within the capsule fires the spin system, the retro rocket, and the de-spin system in the normal ejection sequence. Parachute deployment is also controlled by the ejection programmer. These capsules are fully instrumented to monitor capsule performance and contain telemetry equipment to transmit the data obtained. In the parachute deployment tests the Mach and dynamic loading conditions encountered in actual recoveries are experienced.

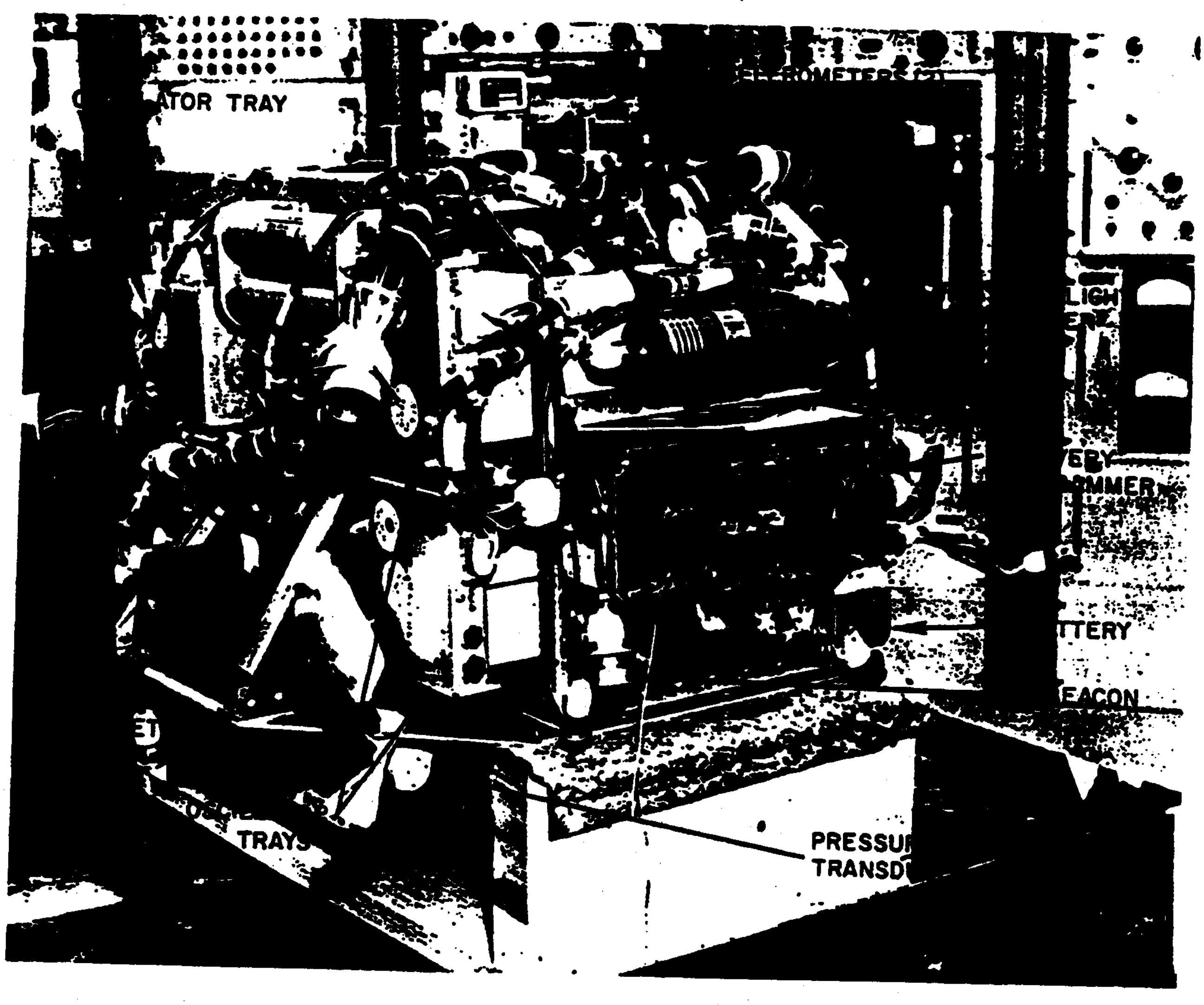


Figure 2. DISCOVERER diagnostic flight payload shown during system tests prior to shipment to Vandenberg Air Force Base. The equipment contained in this payload monitors the performance of the ejection and recovery system components and telemeters this data to the ground stations.

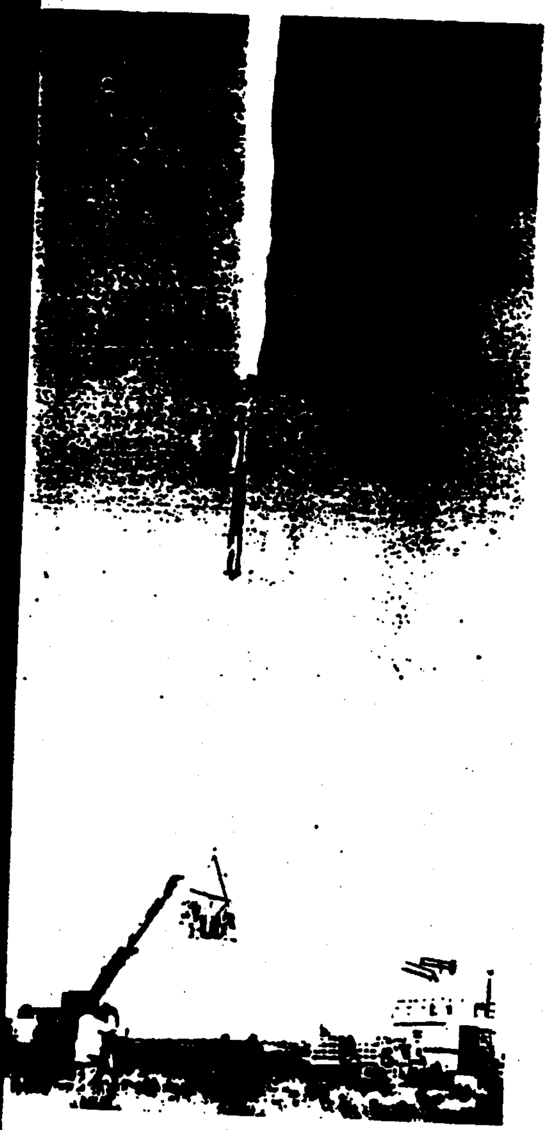
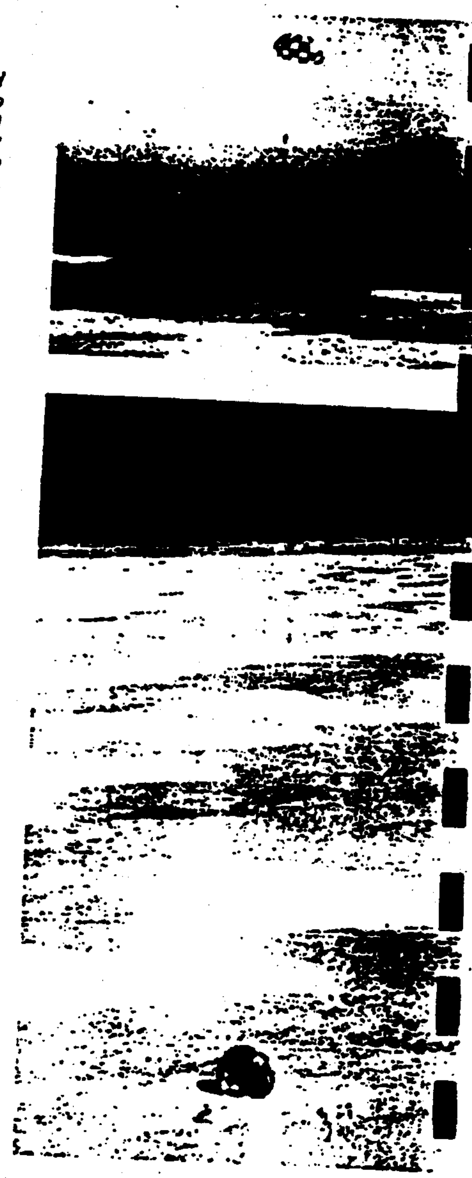
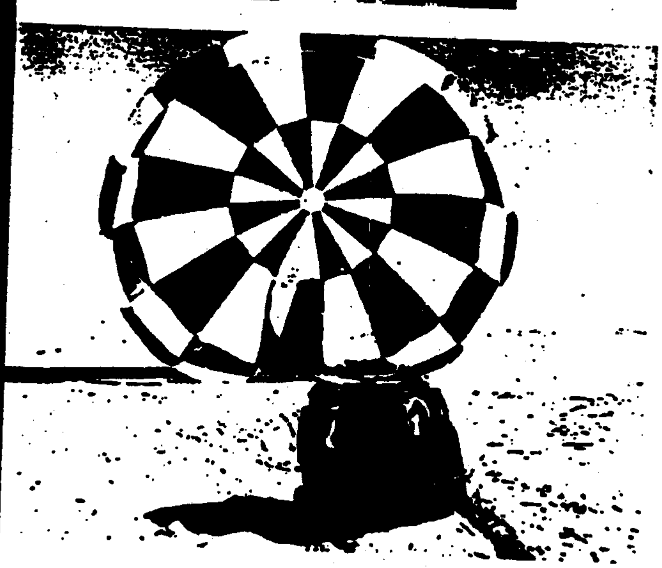


Figure 3. Test capsule (left) suspended from the balloon that will carry it to 100,000 feet altitude. Closeup (above) of test capsule and telemetry equipment which provides flight data and through which the release command is received. The ablative shield which protects the capsule from the heat generated during high speed re-entry into the atmosphere is shown. The external surface of the shield peels off under the intense heat of friction, thus dissipating the heat and protecting the capsule. The capsule and parachute are contained within this shield. Aerial view (right) of the capsule during descent over New Mexico. The parachute deployed at approximately 55,000 feet altitude. Capsule immediately after impact (lower right). Closeup of the capsule and parachute (lower left). An impact at sea would cause little damage to the capsule structure.





Biomedical Capsules

- The Advanced Biomedical Capsule Study was completed on 17 June. This study indicated the feasibility of developing a capsule capable of maintaining a chimpanzee in orbit for two days. The capsule would be integrated with the SAMOS recovery vehicle. A final report, preliminary drawings and a full-scale mockup have been prepared as part of the study.

Facilities

- A van-type telemetry readout and recording installation has been established on Christmas Island. This installation will provide monitoring and recording facilities downrange from Hawaii. The equipment at this installation will monitor all orbital passes within the range of the station, record all telemetry data from the diagnostic payload and from the AGENA vehicle. During the recovery pass, this installation will extend the telemetry reception coverage south of the equator. An additional ship and five telemetry equipped aircraft will be dispersed between Hawaii and Christmas Island to complete the telemetry coverage south of Hawaii.

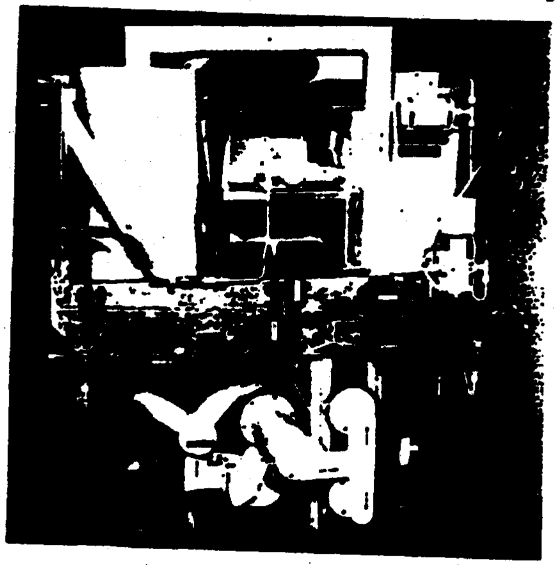
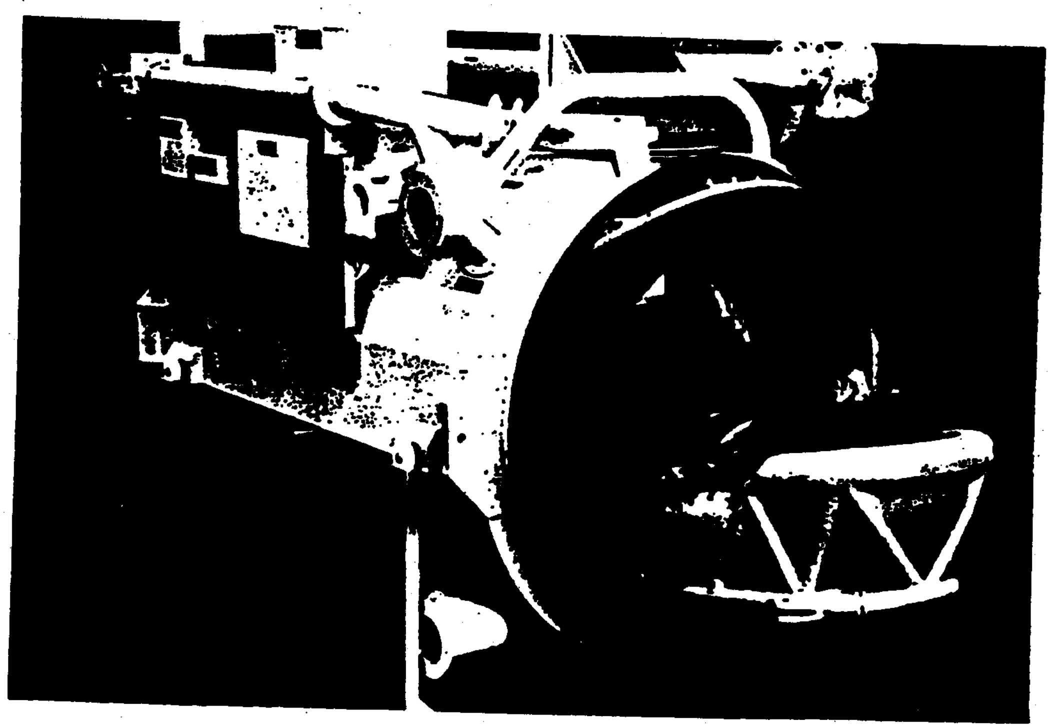


Figure 4. The Advanced Biomedical Capsule mockup (below) with a model of the 30-pound chimpanzee and the seat partially installed. Specimen-recording and telemetry equipment are mounted on the top of the capsule. Forward end of the mockup (left) showing oxygen spheres, blowers, and coolant equipment. This mockup was constructed as part of the Advanced Biomedical Capsule Study.

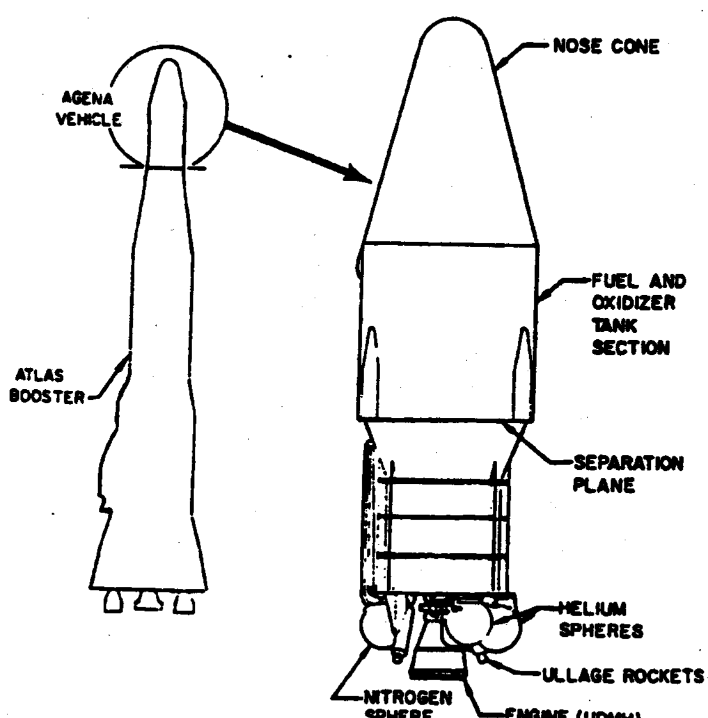


BOOSTER—ATLAS ICBM	
Weight—Wet	15,100
Fuel, RP-1	74,900
Oxidizer (LOX)	172,300
GROSS WEIGHT (lbs.)	262,300
Engine—MA-2	
Thrust (lbs. vac.) Boost	356,000
Sustainer	82,100
Spec. Imp. (sec. vac.) Boost	286
Sustainer	310

SECOND STAGE	AGENA "A"	AGENA "B"
Weight—		
Inert	1,508	1,695
Payload equipment	2,605	3,058
Orbital	4,113	4,753
Impulse Propellants	6,492	12,950
Fuel (UDMH)		
Oxidizer (IRFNA)		
Other	606	718
GROSS WEIGHT (lbs.)	11,211	18,421
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

Figure 1.

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



PROGRAM HISTORY

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

PROGRAM MISSION

The primary mission of the SAMOS advanced reconnaissance system is to provide visual and electronic coverage of the USSR and its allied nations. Efforts include development of hardware to permit:

a. Determination of characteristics of enemy electronic emissions.

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

c. Location and evaluation of defenses.

d. Evaluation of military and industrial strength.

e. Assessment of high-yield weapons damage.

f. Reconnoitering of troop movements.

g. Location of naval forces throughout the world.

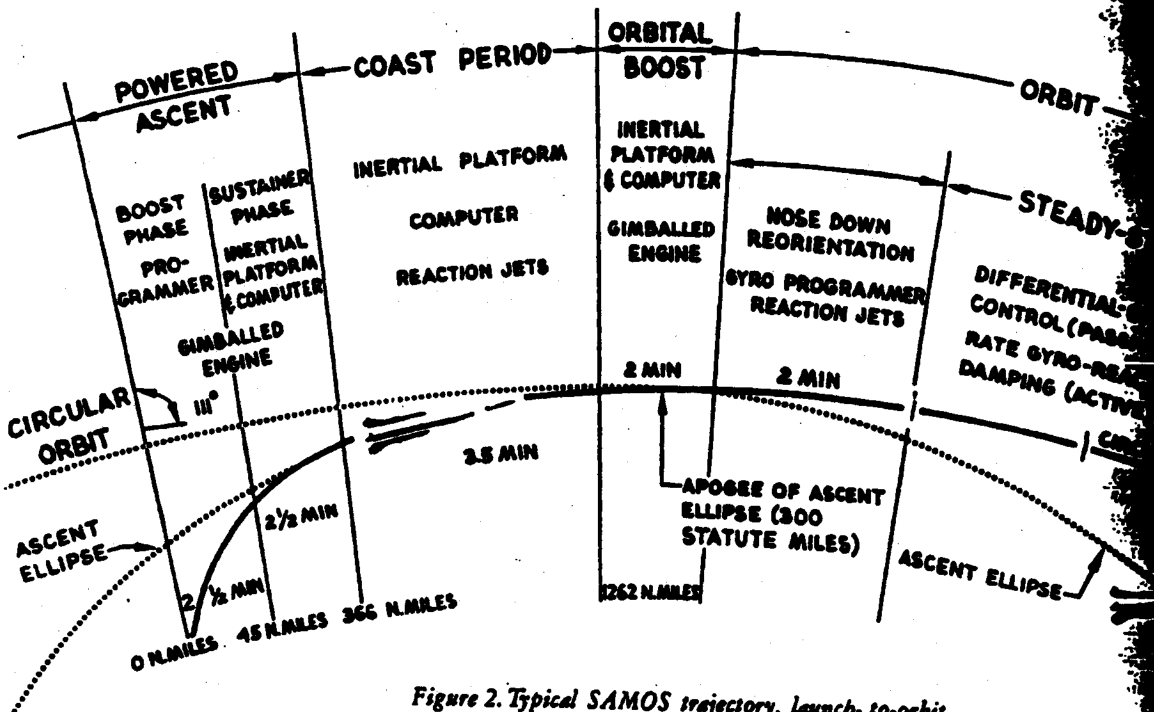


Figure 2. Typical SAMOS trajectory, launch- to-orbit.

Ferret Reconnaissance . . .

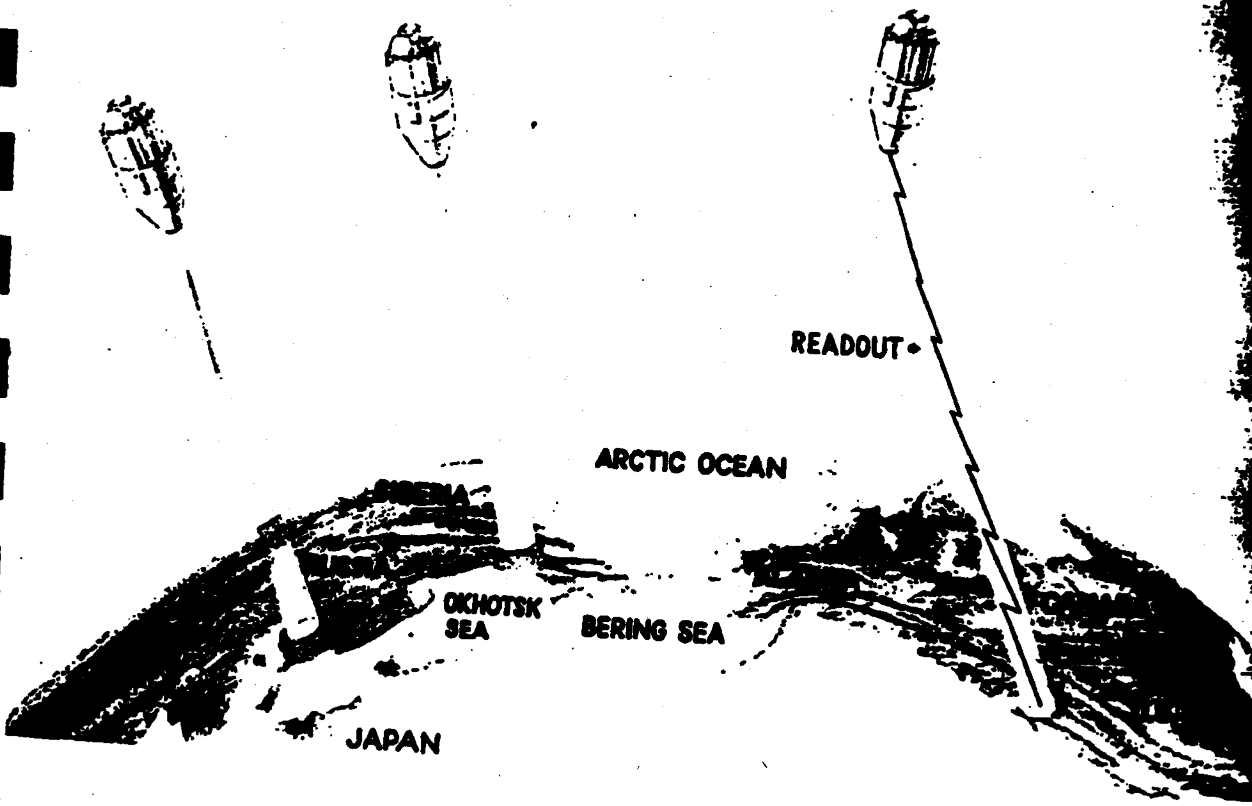


Figure 4. The Ferret reconnaissance system will gather data from electronic emissions over areas of interest.

SECRET

CONFIDENTIAL

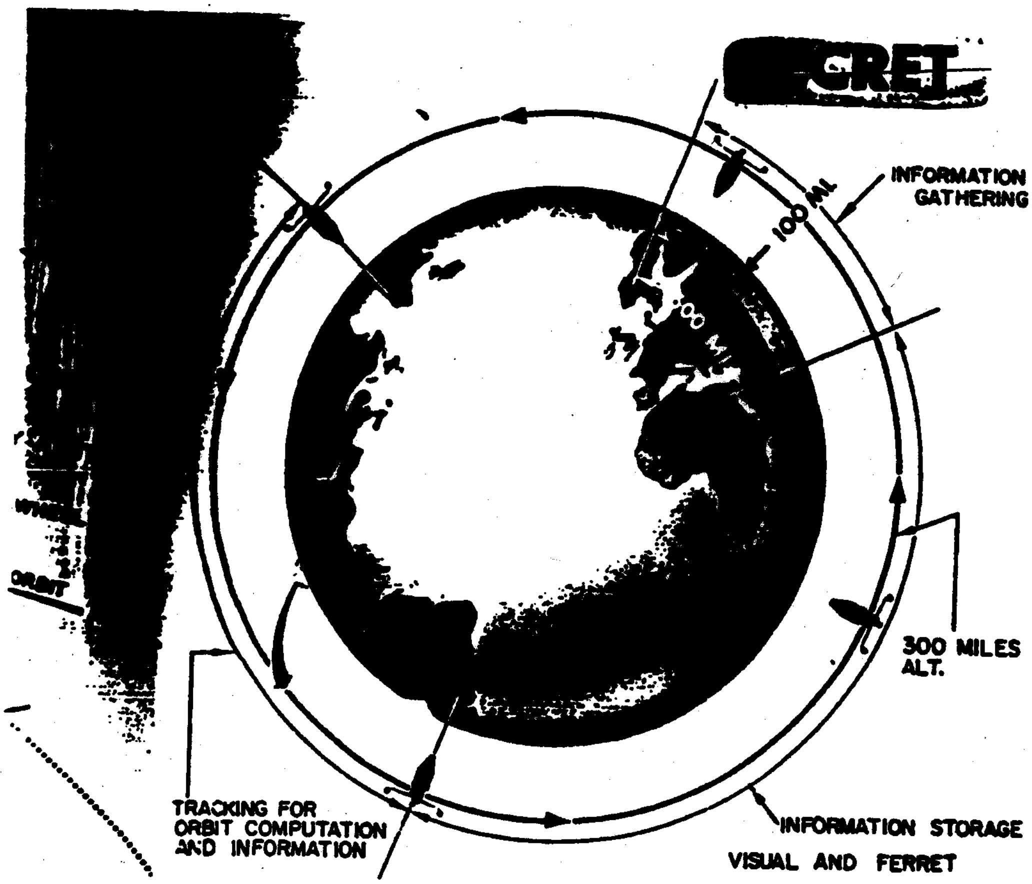


Figure 3.
Schematic of SAMOS system in operational orbit. When the satellite is over the area of interest the sensing equipment is turned on (Information gathering). When it leaves the area of interest the sensing equipment is turned off and the sensing data is processed (Information storage). When the vehicle comes within range of a ground receiving station, the data will be read-out upon command for processing and transmitted to using agencies. This process is continuously repeated during the useful lifetime of the vehicle.

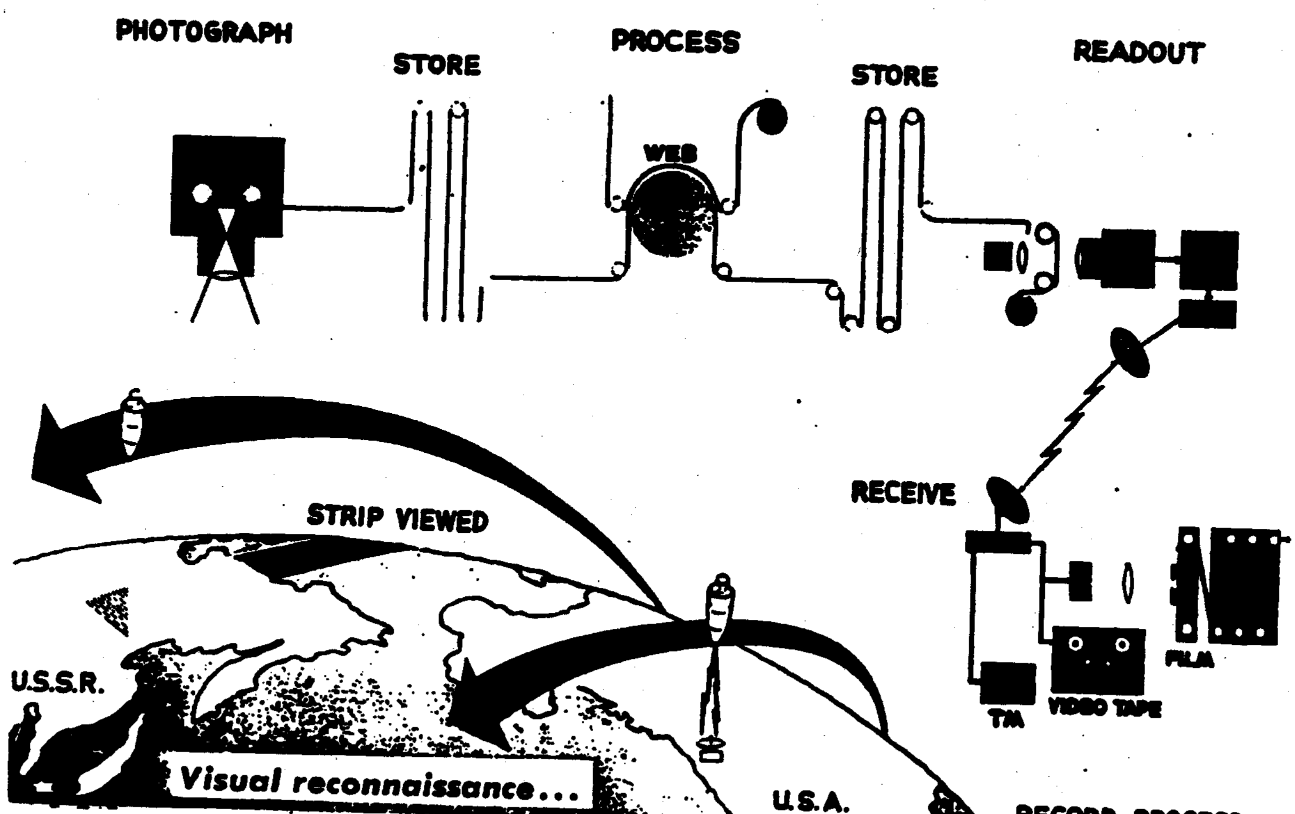


Figure 5.
The initial visual reconnaissance program will use conventional photo techniques with automatic film processing and TV-type electronic image readout to ground stations thru a data link. Ground electronics will reconvert the signal into photo image form, with a capability of resolving objects 20 feet in length.

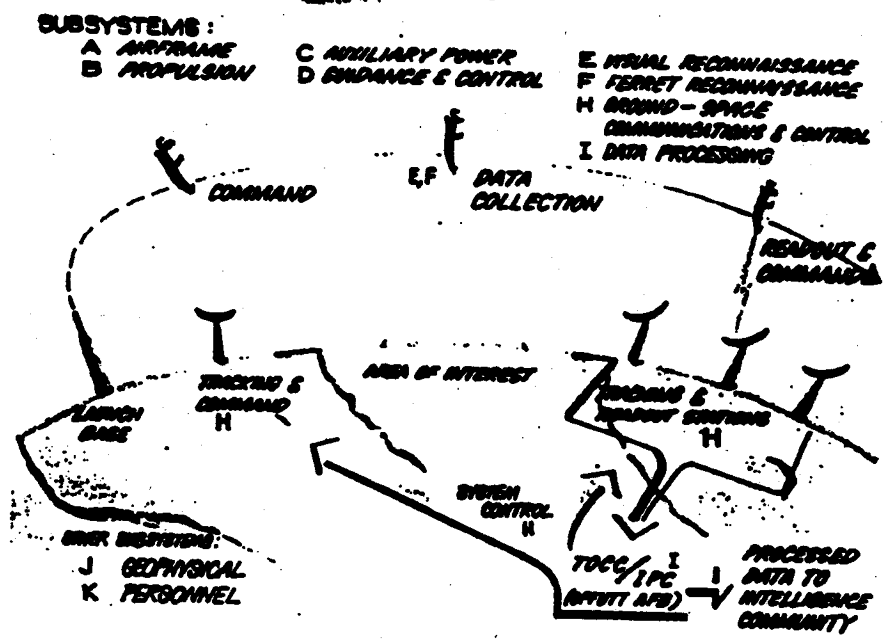


Figure 6. SAMOS concept, showing reception of commands and transmission of data between satellite and ground station; and subsystem functions (schematic).

For economical testing of components a dual-capability visual and ferret payload will be used during the early development phase. On later flights only a visual or ferret system payload will be carried. These payloads will be housed in the AGENA vehicle (Figure 1).

Data collected by the visual payloads will be electronically transmitted in the readout system and retrieved in the recovery system. Ferret data will be transmitted electronically. These systems are composed of the AGENA vehicle, ATLAS booster, launch facilities, tracking facilities, and a communications and data processing network. The recovery system will also include a re-entry capsule and a recovery force.

CONCEPT

ATLAS Series D missiles launched from VAFB will boost the AGENA vehicle into polar orbits. Injection into near-circular orbits (Figure 2) will be accomplished by the AGENA vehicle rocket engine. A self-contained guidance system using a horizon reference scanner will provide altitude stabilization. As the satellite travels in an orbit essentially fixed in space the earth rotates inside the orbit (Figure 3). Each successive orbit is displaced laterally approximately 23½ degrees at the equator, permitting one vehicle to observe the entire earth in a time period dependent upon the width of the area under surveillance. Early versions will have a useful life of approximately ten days. The readout systems will have a useful life of four months with a design objective in certain configurations of one year; recovery systems will have a useful life of fifteen to thirty days.

TECHNICAL DESCRIPTION

Visual Program—Three versions (E-1, E-2, and E-5) of visual payloads are being developed. The E-1 payload is a photo component test payload which is combined with the F-1 ferret payload. The E-2 photographic payload, under development by Eastman Kodak Company, includes a camera, film processor, and electronic readout equipment. The E-5 recoverable system designed by Lockheed will retain the exposed film and the 66-inch focal length camera developed by Itek Corporation.

Ferret Program—Ferret payloads are being developed on a progressively more advanced basis from R&D (F-1) to advanced systems (F-4). The F-2 all-digital, general coverage payload will use superheterodyne scanning receivers in conjunction with directional antennas, an analog to digital converter and tape recorders (for storage). A programmer will be used to control read-in over areas of interest and readout over tracking stations. The F-3 payload will use similar receivers with stop-scan capability and controllable antennas added. Recording of the actual signal intercepted (rather than the digital representation) will be possible with a bandwidth up to 6mc. A complex programmer will permit satellite search of a given area or frequency range.

	J	F	M	A	M	J	J	A	S	O	N	D
60									1		1	
61	1			1		1		1	1	1	1	2
62		1		2		1	2	2	1	1	2	2
VEHICLE CONFIGURATIONS	ATLAS "D"/AGENA "A" (60 – J 61)	ATLAS "D"/AGENA "B" (F 61 – 62)										

SAMOS Launch Schedule

MONTHLY PROGRESS—SAMOS Program

Technical Progress

Second Stage Vehicles

- System checks of the AGENA vehicle and the dual payload for the first SAMOS flight were completed satisfactorily on 1 June. The quality assurance inspection and weighting operations were completed prior to shipping the AGENA vehicle to Santa Cruz Test Base for captive hot firing tests. The vehicle was installed in the test stand, the payloads were delivered, and the systems tests which precede hot firings were accomplished. Captive hot firing tests were conducted on 30 June.

- Modification providing improvement in payload auxiliary real time command capability (through increased backup to the airborne communications equipment sequence programmer) are essentially complete for the second AGENA "A" vehicle. Lack of a UHF narrow band transmitter continued to hamper checkout. Subsystem testing is being accomplished with a prototype narrow band transmitter.

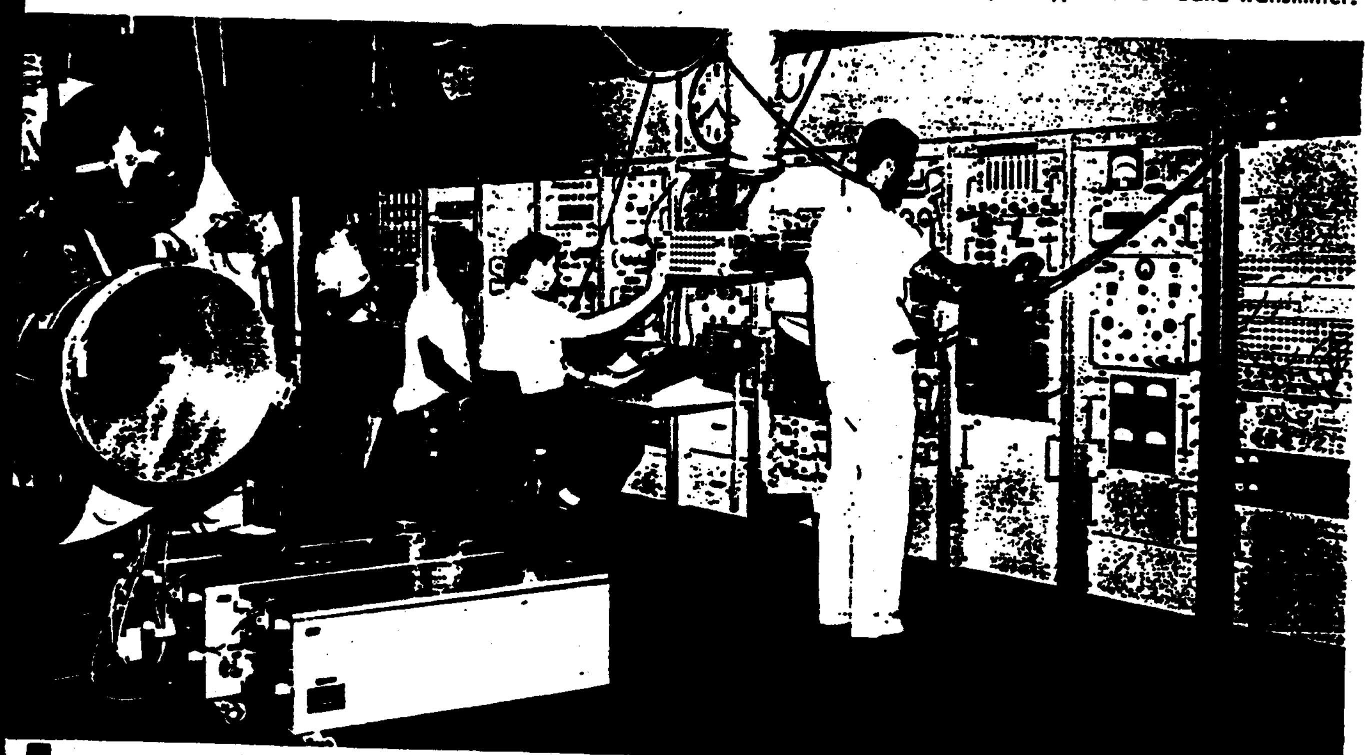


Figure 7. First SAMOS AGENA "A" vehicle during systems testing. Technician at far right is adjusting the UHF ground transmitter to simulate frequencies of the vehicle in orbit. Commands are being sent to the vehicle by the technician on his left. These tests were completed on 1 June.

● Deliveries of flight hardware for the third AGENA "A" vehicle will be completed in July. Late availability of components and the recent strike will require intensive efforts to recover current schedules for this vehicle.

● The first two AGENA "B" vehicles are in the component and subassembly stages of manufacture, with the first scheduled for completion in mid-September. This vehicle is scheduled for launch in April 1961 carrying an E-2 payload.

● Because of the attitude control problem experienced on the second MIDAS flight, the first three SAMOS satellites will maintain a horizontal, nose forward position throughout most of the first orbit. Reorientation to the nose-down position will be initiated by stored commands as the satellite comes within range of the tracking station at Kodiak, Alaska, on its first orbital pass. This change assures completion of tank pressurization venting prior to shutting off the flight control system pneumatics. The forces created by the continuation of venting after switching from the flight control to the attitude damping system are believed to be a major factor in the loss of attitude control. Modifications to the AGENA wiring and airborne components for the first flight article are scheduled to be accomplished during the Vandenberg Air Force Base modification and checkout operation. Modifications for the second and third vehicle will be accomplished at the systems test facility. The AGENA "B" vehicles will incorporate a full-time attitude control system and will not require modification.

Visual Reconnaissance Systems

● *Visual Reconnaissance Systems payloads are being developed in a minimum number of configurations to attain readout and recovery mission objectives. The design and purpose of each configuration is as follows:*

Readout:

E-1—Component Test Payloads

E-2—Steerable Reconnaissance Payload (with 20-foot ground resolution)

Recovery:

E-5—High Resolution, Steerable, Recoverable Payload (with 5-foot ground resolution)

Payloads

● **E-2 Payloads**—Assembly of E-2 payloads continues on schedule at Eastman Kodak. The film drive system and the film processor for the first E-2 payload have completed functional and operational tests successfully. The completed 36-inch focal length camera and lens assembly are undergoing vibration and operational tests at the contractor's facility.

● **E-5 Payloads**—The first test of an E-5 recovery test unit (RETU) is scheduled for July at Edwards Air Force Base. The RETU simulates the E-5 recovery capsule in size, weight and aerodynamic configuration. This test series will determine capsule drag and oscillation characteristics during recovery by a C-130A aircraft. Data from these tests will be used to establish design criteria for the E-5 recovery equipment. Additional RETU tests, including the complete recovery sequence, will be conducted later this year. A mid-February 1961 date has been established for delivery of the first E-5 flight payload.

Ground Support Equipment

● Functional tests of the electronics portion of the vacuum test chamber (used for leak testing E-1 and E-2 payloads) were completed by the contractor and the chamber was delivered to Vandenberg Air Force Base. This completes the delivery of major items of the E-1 payload ground support equipment for the Vandenberg Air Force Base missile assembly building.

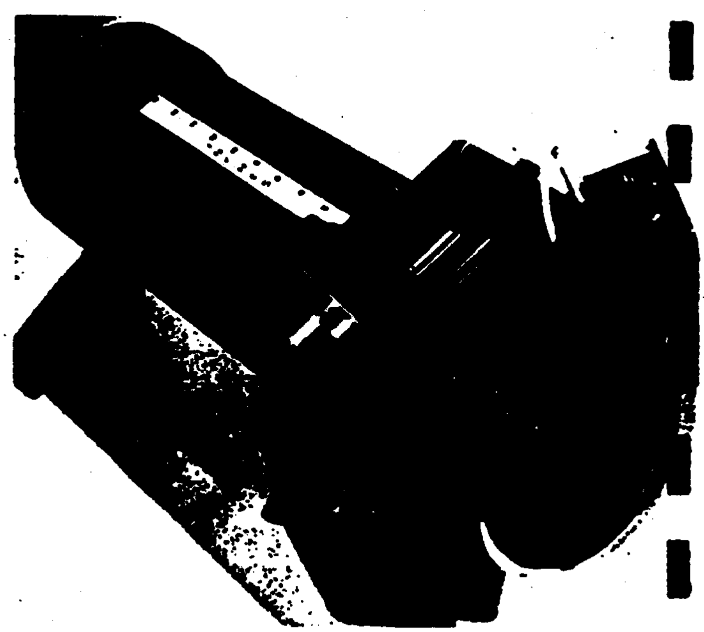


Figure 8. Thirty-six inch focal length camera and lens assembly for E-2 payload. Payload delivery is scheduled for August.

- The first set of E-1/E-2 ground reconstruction electronics (GRE) equipment, primary record camera, and repeater kinescope has been delivered to the Vandenberg Air Force Base missile assembly building. The second set of GRE equipment (backup for the first set) was used for compatibility test with the operating console. At the conclusion of these tests the operating console and the GRE equipment will be shipped to the Vandenberg tracking and acquisition station.

- The 144-inch collimator, to be used for the E-2 payload alignment and checkout, has been completed and will be delivered in July.

Ferret Reconnaissance Systems

- Ferret reconnaissance system payloads are being developed in a minimum number of configurations. The designation and purpose of each configuration is as follows:

F-1—R&D Test Payloads
F-2—Digital General Coverage Payloads
F-3—Specific Mission Payloads—Analog Presentation
F-4—Technical Analysis (study stage only)

Payloads

- **F-2 Payloads**—The testing and assembly of components for the initial F-2 payloads continues on schedule.

Ground Support Equipment

- The first F-2 checkout console has been completed and compatibility tests, using a service test model F-2 payload, are being conducted.

- The logic design for the F-2 data conversion and evaluation equipment has been completed. This equipment will be installed in the Satellite Test Center.

- The major portion of the telemetry data monitoring equipment was delivered to Airborne Instruments Laboratory on 15 June. This equipment will be incorporated into the F-2 evaluation and command complex for the Vandenberg Air Force Base and New Boston tracking and acquisition stations.

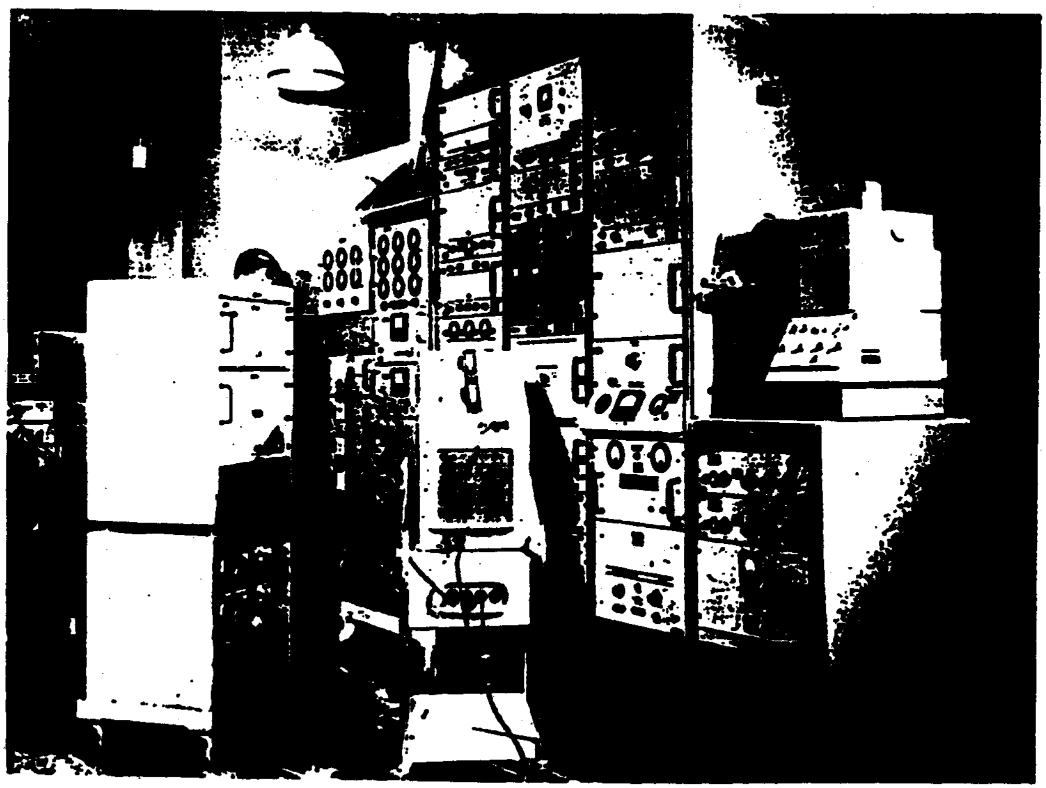


Figure 9. The first set of E-1/E-2 ground reconstruction electronics (GRE) equipment installed in the Vandenberg Air Force Base missile assembly building.

Facilities

- **Vandenberg Air Force Base**—Modifications to accommodate the Model 1604 computer in the Vandenberg Air Force Base data acquisition and processing building have been completed.

- **Satellite Test Center**—Construction of increment 2 to the Satellite Test Center was completed on schedule. Beneficial occupancy began on 16 June and installation of equipment is in progress.

- **Point Arguello**—Installation of all launch operations equipment, propellant loading systems, and high pressure and liquid gas systems has been completed at launch stand 1. System tests of the facility are in progress using ATLAS 57D and the AGENA facilities checkout vehicle. Construction of launch stand 2 is complete, except for the umbilical mast. The mast is scheduled for completion on 6 July.

- **New Boston, New Hampshire, Station**—A change in concepts of computer type and configuration has necessitated the design of a modification to the Data Acquisition and Processing Building. This modification is scheduled for completion in time to support the SAMOS launches.

- **Offutt Air Force Base**—The construction contract for the interim data processing facility was ordered cancelled by the Office of Secretary of Defense. Pending re-direction of the program, no further action will be taken on either the interim or the final facility.

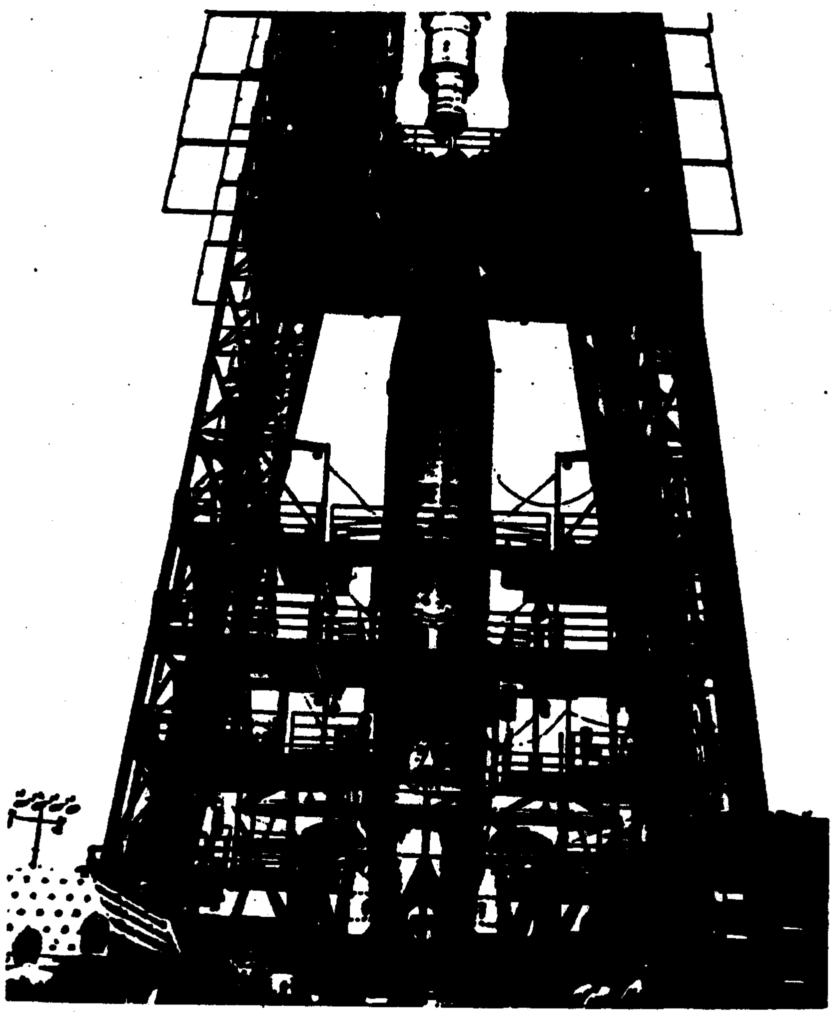
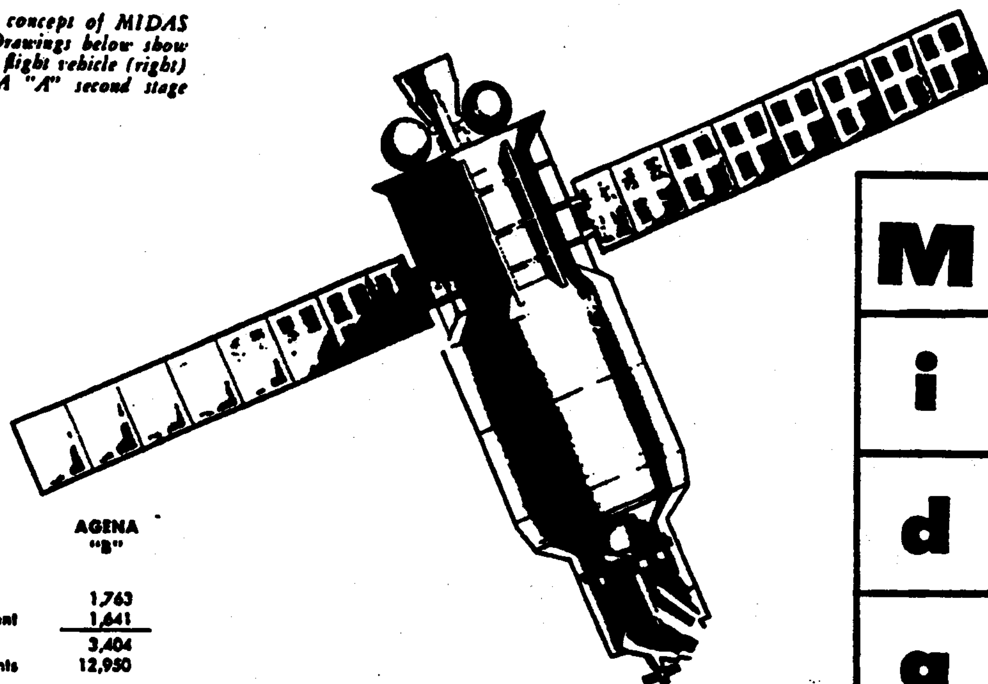


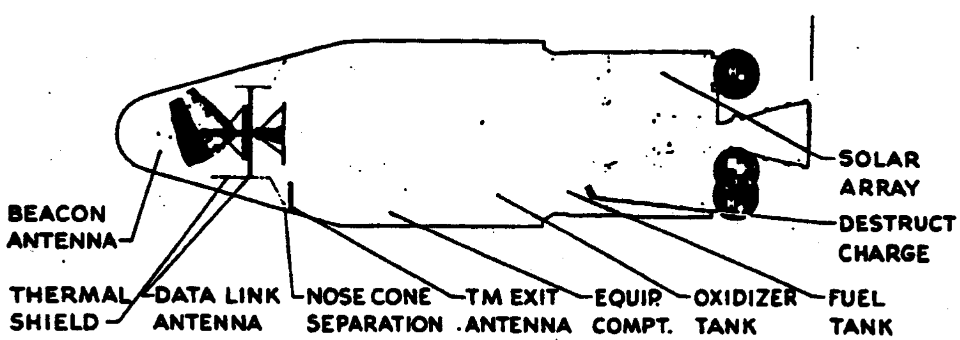
Figure 10. Installing the Agena facilities checkout vehicle on the ATLAS 57D booster prior to systems tests at Point Arguello launch stand 1.

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



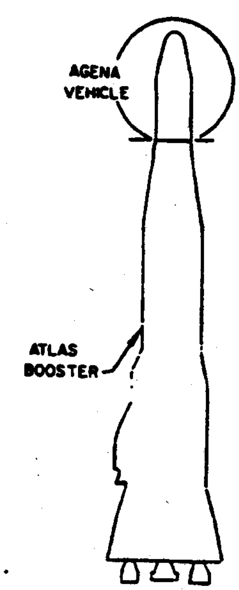
Midas

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



NOTE: AGENA "A" configuration except for solar paddles (AGENA "B" only).

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



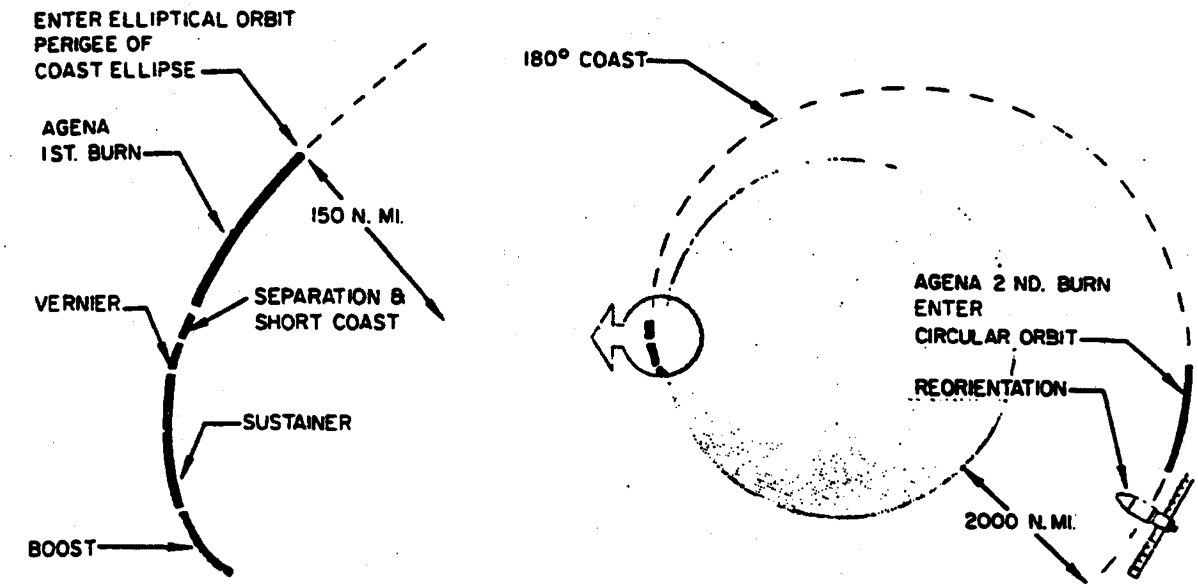


Figure 2.
Launch-to-orbit trajectory for flights 3 and subsequent. Optimum ATLAS boost, guided by radio-inertial system. AGENA ascent (coast, burn, coast, second burn) provides attitude reference. Also governs velocity magnitude and direction by inertial guidance system monitored by horizon scanner. Orbital attitude maintained by reaction wheel and gas jets.

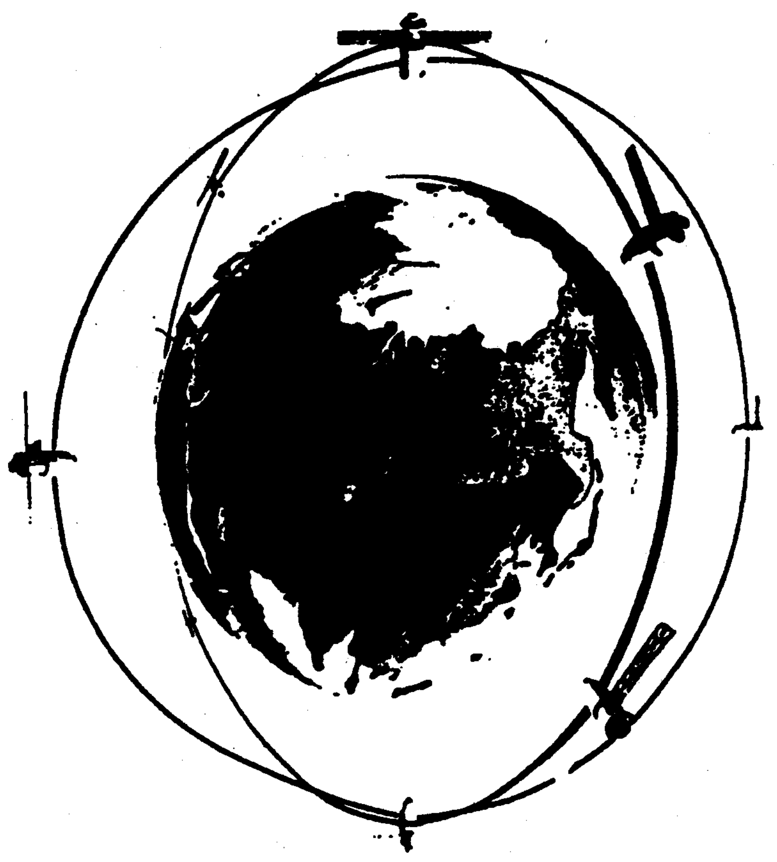


Figure 3.
Proposed MIDAS system. Four satellites spaced equidistant in each of two orthogonal planes at 2,000 n.m. altitude. Provides maximum coverage of USSR with minimum number of satell

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. This R&D Program should make possible the achievement of an operational system by 1963.

CON