DISCOVERER PROJECT (Research and Development Satellites)

DISCOVERER XI was launched from Vandenberg Air Force Base on 15 April. The powered flight trajectory of the THOR-AGENA launching vehicle and orbital injection were excellent. All program objectives were attained with the exception of capsule recovery. Successful recovery was prevented by capsule ejection on a higher than nominal re-entry trajectory. Intensive testing of recovery system components has been initiated to provide maximum probability of successful recovery on future flights.

All AGENA "A" vehicles and the first AGENA "B" vehicle were delivered during March.

The construction contract for the Vandenberg Air Force Base propellant storage and disposal facility was awarded in April with completion scheduled for September. The conversion of launch pad 5 at Vandenberg Air Force Base to AGENA "B" capability has been started.

SAMOS PROJECT (Reconnaissance Satellites)

Systems checks of the second-stage AGENA vehicle for the first SAMOS flight in September are nearing completion with delivery to Santa Cruz Test Base scheduled for June. The vehicle will be the first of three to carry a dual visual-ferret payload.

Subsystem testing of the first visual (photographic) payload has been completed successfully and payload AGENA capability established. The optical glass for two of the 66-inch, f/5 lenses for the visual recovery system (E-5) payload has been delivered from West Germany.

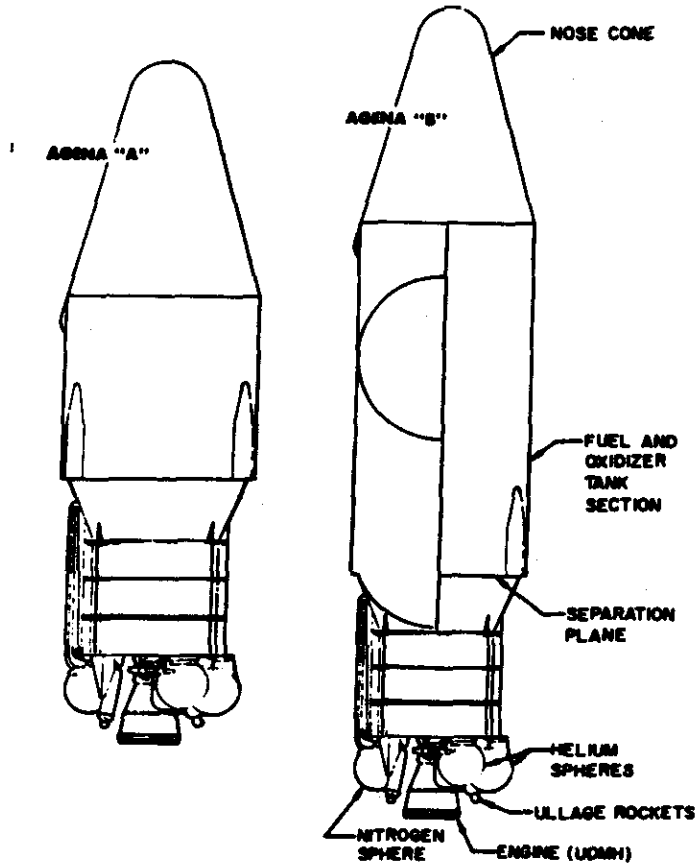
Subsystem tests of the first two ferret reconnaissance system payloads were completed in March. The first electromagnetic ferret payload was aligned with the visual component test payload and the dual package was installed in the AGENA vehicle. Systems testing of the complete installation was started in March.

The missile assembly building at Vandenberg Air Force Base was completed during March 1960. Construction was started on the technical support and laboratory buildings.

At Point Arguello, launch pad 1 was completed in March and launch pad 2 was completed in May. The construction contract for the launch technical support buildings was awarded in April.

***** NOTICE OF MISSING PAGES *****

PAGES 1 THROUGH 12 ARE MISSING IN THE ORIGINAL COPY.



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

Figure I - 8.

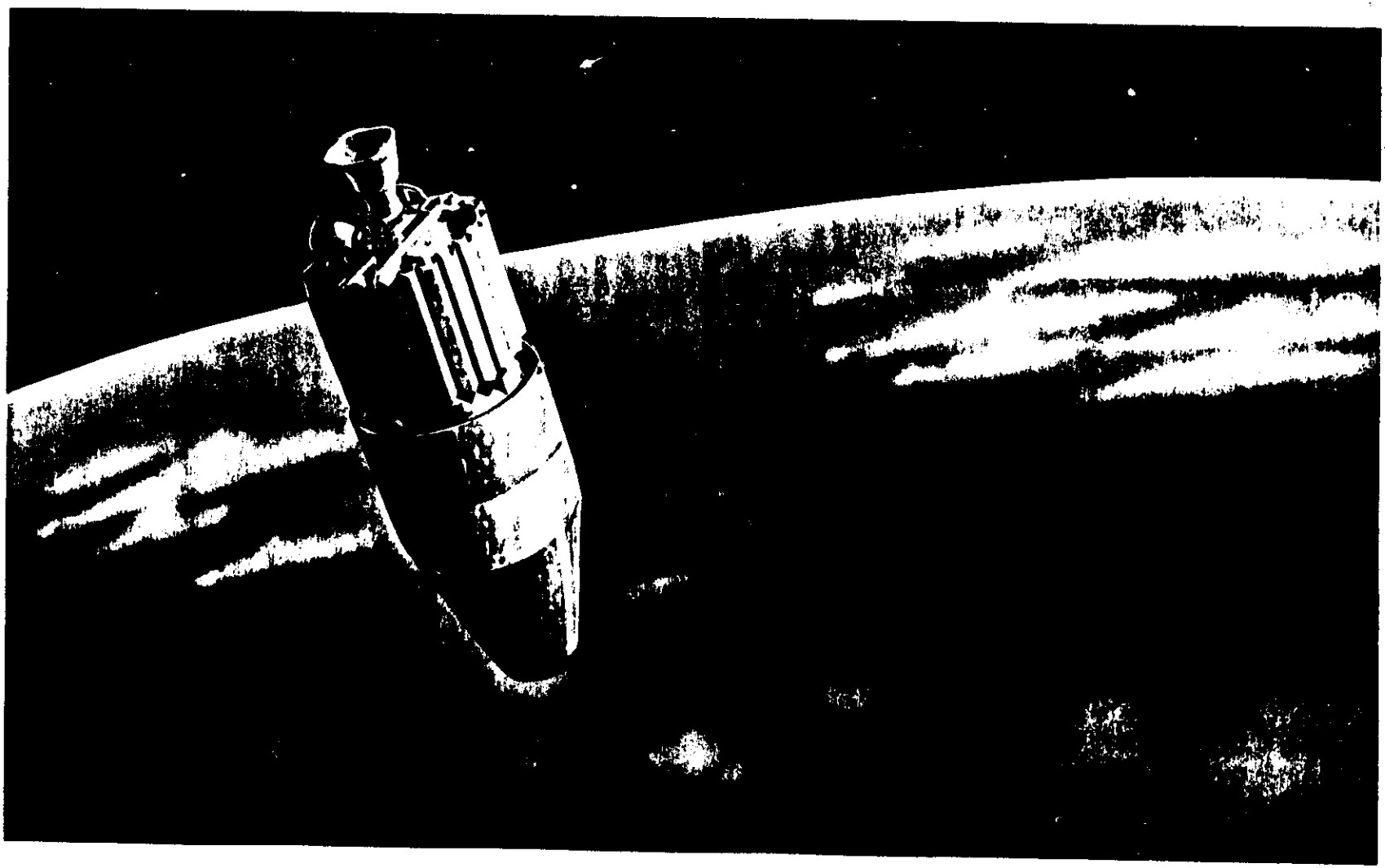


Figure I - 9. Artist's concept of the DISCOVERER satellite vehicle in orbit.

SECRET

II. SAMOS PROJECT

(RECONNAISSANCE SATELLITES)

A. Project Objective

1. General

SAMOS to provide both Visual (Photographic) and Ferret (Electromagnetic) data on enemy strength.

a. The objective of the SAMOS project is the development of a reconnaissance system utilizing polar orbiting satellites to collect and process visual (photographic) data and ferret (electromagnetic) data. The SAMOS system is expected to acquire a great amount of technical intelligence regarding enemy military and industrial strength.

2. Specific

Specific Objectives

The research and development effort is directed toward providing equipment which permits the following:

a. Coverage of world-wide areas of interest.

b. Detecting new and hitherto unknown targets.

c. Locating and verifying targets and defenses.

d. Determining characteristics of enemy electronic emissions.

e. Collecting data on technological progress.

f. Evaluating military and industrial strength.

g. Observing enemy build-up indications.

h. Evaluating attack capability.

i. Assessing damage from high-yield weapons.

j. Reconnoitering military movements.

k. Locating naval forces throughout the world.

B. Project Description

Goal is timeliness of intelligence information.

1. The SAMOS Project, employing orbiting satellites composed of AGENA vehicles and reconnaissance payloads, will provide surveillance of the entire Soviet Complex, providing a variety of Sino-Soviet Bloc intelligence data. Timeliness of receipt of the intelligence information with daily reconnaissance coverage of high resolution is the ideal. The SAMOS concept utilizes satellite vehicles, modified ATLAS boosters, launch facilities, tracking facilities and a complex communications and data processing network with related facilities. The recovery system will include a re-entry capsule and a recovery force.

Acquisition of data by (1) capsule recovery and (2) electronic data readout system.

2. Two approaches are being developed for acquiring intelligence data: (a) the recovery system - for visual (photographic) data - in which a capsule is ejected from the satellite and recovered, and (b) the electronic data readout system - for both visual (photographic) and ferret (electromagnetic) - in which data are transmitted to ground stations.

Dual payload scheduled for first 3 flights.

3. A combined visual/ferret payload will be tested on the first 3 flights. The successive ferret payloads (F-1 and F-2) will include progressively more complete installations of receivers and antennas to provide increasingly greater electronic measurement capability.

C. Progress Review - March, April, May 1960

1. Component Development

a. Second Stage Vehicles

Second stage AGENA vehicles for dual payload flights proceeding on schedule.

System checks of the second stage AGENA vehicle for the first SAMOS flight are nearing completion with delivery to Santa Cruz Test Base scheduled for 2 June. This one month delay was caused by late delivery of airborne communications equipment and vehicle wiring changes. The vehicle will be the first of three to carry a dual visual (E-1) and ferret (F-1) payload. The third AGENA "A" vehicle was delivered to the system test area on schedule. Subassembly of the first AGENA "B" vehicle (flights 4 and subsequent) is proceeding on schedule. This is the first of the single-payload SAMOS vehicles which will carry either a photo readout (E-2) or a ferret reconnaissance (F-2)

payload. Design of the AGENA "B" vehicles scheduled to carry the recoverable visual (E-5) payload is proceeding on schedule. See Figure II-1.

b. Payloads

(1) Visual (Photographic) Reconnaissance System

Visual Reconnaissance System payloads are being developed.

Visual Reconnaissance System 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 Payloads (with 20-foot ground resolution)

Recovery:

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

(a) E-1 Payloads

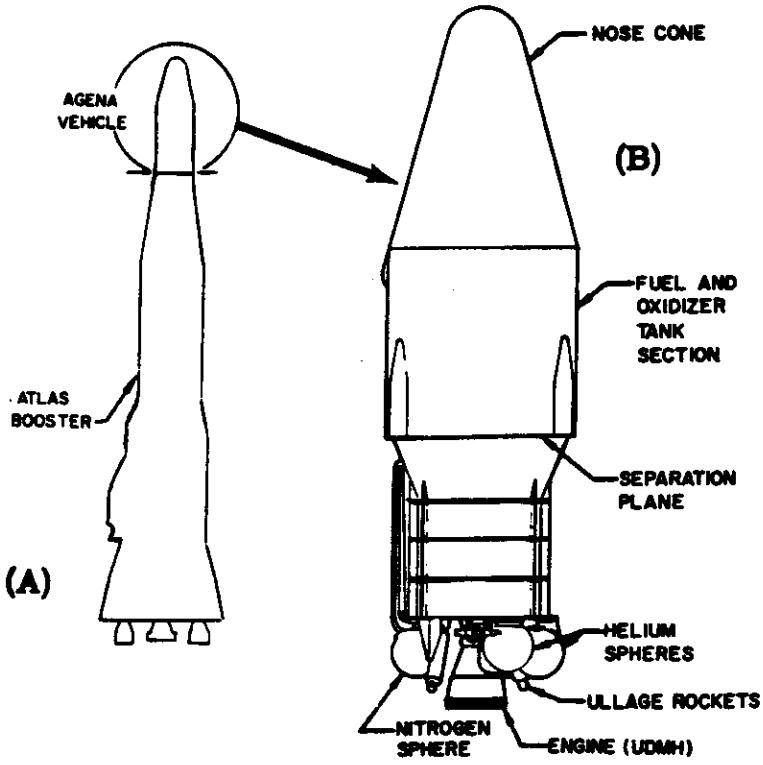
Payload compatibility with AGENA vehicle has been established.

Subsystem testing of the first E-1 payload has been completed successfully and payload compatibility with the AGENA vehicle has been established. Operational tests of the second E-1 payload have been completed and the payload is being prepared for subsystem testing and installation in the vehicle. The third E-1 payload was received from Eastman Kodak in mid-May.

(b) E-2 Payloads

Functional evaluation and environmental testing of E-2 payloads has started.

Testing and assembly of E-2 payload components is continuing at the contractor's facility. Functional evaluation and environmental testing of service test models has started. Tests of the E-2 thermal model in the high altitude temperature simulator indicated that a change was required in the upper pressure shell conductance level. The lower pressure shell tests results were satisfactory.



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 II - 1. The SAMOS Flight Vehicles:
(A) Line drawing of the launching vehicle.
(B) Detail drawing of the AGENA second stage.
(C) Artist's concept of the SAMOS satellite.

(c) E-5 Payloads

Design and testing of E-5 system proceeds on schedule.

Design is continuing on the high acuity panoramic camera to combine all camera components as an integrated unit. The optical glass for two of the 66-inch, f/5 lenses has been delivered from West Germany. The release of engineering drawings for the payload thermal model and fabrication of the first recovery equipment test unit has been accomplished. Ballistic range tests of the recovery capsule configuration indicate satisfactory capsule stability. Wind tunnel tests of the recovery capsule configuration are being continued.

(d) Ground Support Equipment

Ground reconstruction electronics equipment checkout nearing completion.

During a subsystem test conducted in March with the E-1 payload mounted on the 40-inch collimator, all payload support equipment functioned successfully. Installation and alignment of the E-1 collimator and checkout of the E-1/E-2 ground reconstruction electronics equipment at the missile assembly building are nearing completion. Delivery of the E-1/E-2 ground reconstruction electronics equipment, primary record cameras, and operating consoles for the Vandenberg tracking and acquisition station has been delayed until June. Compatibility test and incorporation of design changes at Eastman Kodak caused this one month delivery slippage. Installation of the vacuum test chamber (for leak testing E-1 and E-2 payloads prior to launch) in the missile assembly building at Vandenberg Air Force Base is complete except for the electronic portion of the chamber. Delivery of the electronic portion is scheduled for June.

(2) Ferret (Electromagnetic) Reconnaissance System

Ferret Reconnaissance System payloads are being developed.

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

[redacted]

(a) F-1 Payloads

First two F-1 payloads complete subsystem tests.

Subsystem tests of the first two F-1 payloads were completed in March. The first F-1 payload was aligned with the E-1 payload and the dual package was installed in the AGENA vehicle. Systems testing of the complete installation was started late in March. Significant refinements were made in the F-1 payload during April. Circuitry improvements being tested indicate a potential increase of approximately 5 db pulse width measurement sensitivity. The third payload was received from [redacted] on 27 May.

(b) F-2 [redacted]

Testing and assembly of F-2 payload components continues with delivery scheduled for October

Design and modification of the reoriented F-2 [redacted] was started in March. Testing and assembly of F-2 payload components is continuing at the contractor's facility with delivery of the first F-2 payload scheduled for October. Results of the F-2 thermal model environmental test conducted in April indicated satisfactory thermal control for all orbital conditions. Functional evaluation of service test models is in progress.

(c) [redacted]

[redacted]

(d) Ground Support Equipment

Installation and testing of F-1 data conversion equipment completed.

Mechanical inspection by the Air Force of the F-1 data conversion equipment was completed on 22 March. This equipment converts the F-1 payload digital data for data processing. Installation and preliminary functional testing of the data conversion equipment in the interim area of the Satellite Test Center were completed during May. The checkout equipment for subsystem testing of F-1 payloads was shipped to Lockheed Missiles and Space Division on 25 March. This equipment will be installed in the missile assembly building at Vandenberg Air Force Base.

c. Communications and Control Equipment

UHF ground system dismantled and shipped to Vandenberg AFB.

(1) During March, the UHF (Ultra High Frequency) ground system was dismantled by the contractor for shipment to Vandenberg Air Force Base. Included in the system are the angle tracker, command transmitter, command tracker, and the tracking and acquisition system. Seventy per cent of the system was delivered to Vandenberg and installation was started in April.

Magnetron tube shortage results in substitution.

(2) The shortage of acceptable magnetron tubes for the narrow band transmitters may result in the substitution of a transmitter manufactured by General Electronics Laboratories on early SAMOS flights.

First AN/GPS/TLA calibration van delivered.

(3) The first of three AN/GPS-TLA calibration vans was received at Lockheed Missiles and Space Division on 8 April. These vans will be used to transmit calibrated signals to F-1 and initial F-2 payloads in orbit. These vans will be placed at 400-mile intervals along U.S. Highway 30.

Model 1604 computer accepted.

(4) Installation of the first Model 1604 computer and most of its support equipment in the Satellite Test Center was accomplished in April. Acceptance tests were completed late in April.

2. Facilities

a. Vandenberg Air Force Base

Missile assembly building completed.

The missile assembly building was completed during March 1960. Construction was started on the technical support and laboratory buildings. Completion of the laboratory building and the technical support building is scheduled for July and October respectively.

b. Point Arguello

Point Arguello launch pads completed.

Launch pad 1 was completed in March and pad 2 was completed in May. The construction contract for the launch technical support building was awarded in April with beneficial occupancy scheduled for August.

c. Offutt Air Force Base

Construction of interim data processing facility deferred.

A construction contract had been awarded for the interim data processing facility, but notice to proceed has been deferred by request of the Under Secretary of the Air Force. Requirements for data processing facilities are being reviewed at the present time.

d. [redacted] Tracking and Data Acquisition Station

Construction of technical facilities is complete.

Construction of the technical facilities for this station is complete except for radomes required for winter operation. These are now being added to the contract. Design of support facilities for this station was completed during May and the project is being advertised for bid. Completion of these facilities is scheduled for December. Rehabilitation of support facilities at Grenier Field is under way with completion scheduled for October.

D. Project History

History.

The SAMOS Project 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 [redacted] 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.

E. Project Features

1. Launching Vehicle

Launching vehicle.

ATLAS Series D missiles launched from Vandenberg Air Force Base will boost the AGENA vehicle into polar orbits. See Figure II-1.

2. Powered Flight Trajectory

SAMOS trajectory - launch to orbit.

Injection of the satellite into near-circular polar orbits will be accomplished by the AGENA vehicle rocket engine. See Figure II-2. The satellite payload is housed in the AGENA vehicle. A self-contained guidance system using a horizon reference scanner will provide attitude stabilization.

3. Orbital Pattern

Single satellite vehicle can observe the entire earth.

The satellite will orbit the earth in approximately 94-minute intervals. Because the orbit is essentially fixed in space, while the earth rotates inside it, successive passes over the earth's surface will be displaced laterally approximately 23½ degrees at the equator. See Figure II-3. This offsetting will permit a single satellite 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.

4. Visual Reconnaissance

The visual reconnaissance system.

Payload camera, film processor and electronics readout equipment are being developed by Eastman Kodak Co. Cameras having a 36-inch focal length are being used. The payload equipment includes automatic film processing, film transport and take-up, electronic readout and temperature controls. The recoverable system will return both the exposed film and the 66-inch local length camera. See Figure II-4.

5. Ferret Reconnaissance

The ferret reconnaissance system.

Ferret payloads are being developed on a progressively more advanced basis from R&D (F-1) [redacted]. The F-2 all-digital, general coverage payload will use super-heterodyne 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. [redacted]

6. Launch Schedule

The R&D launch schedule.

The tentative 18-shot R&D launch schedule is currently being reviewed to determine the desirability of adding additional shots. The launch schedule is shown in Figure II-6.

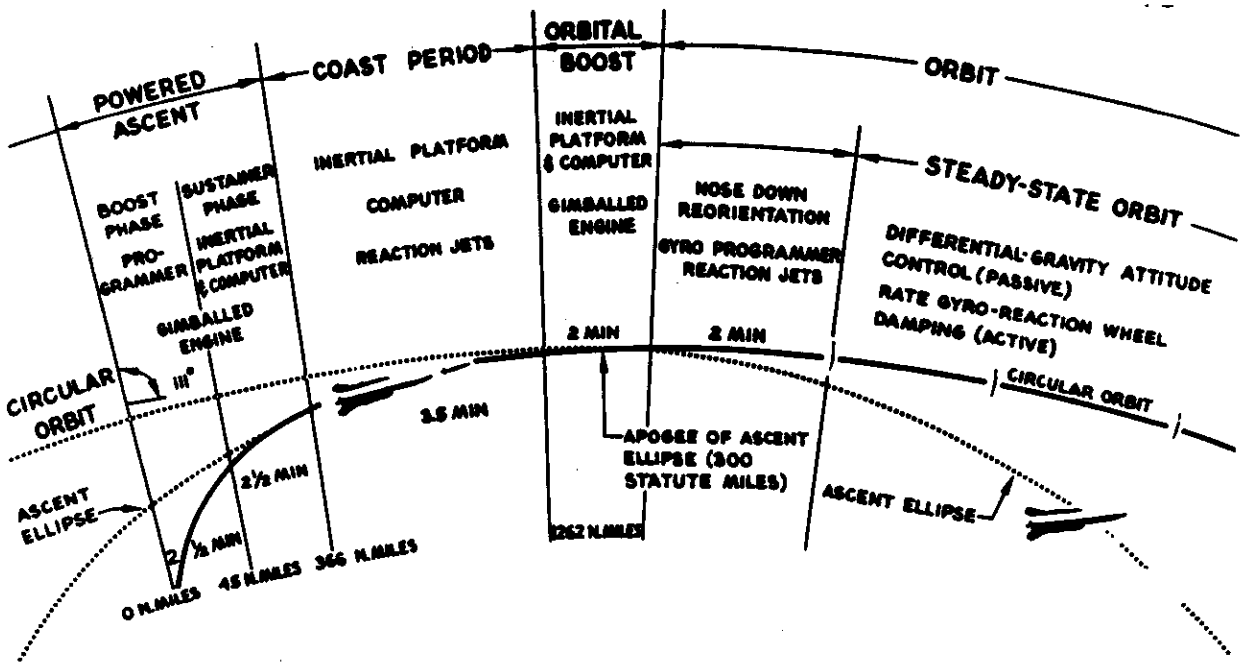
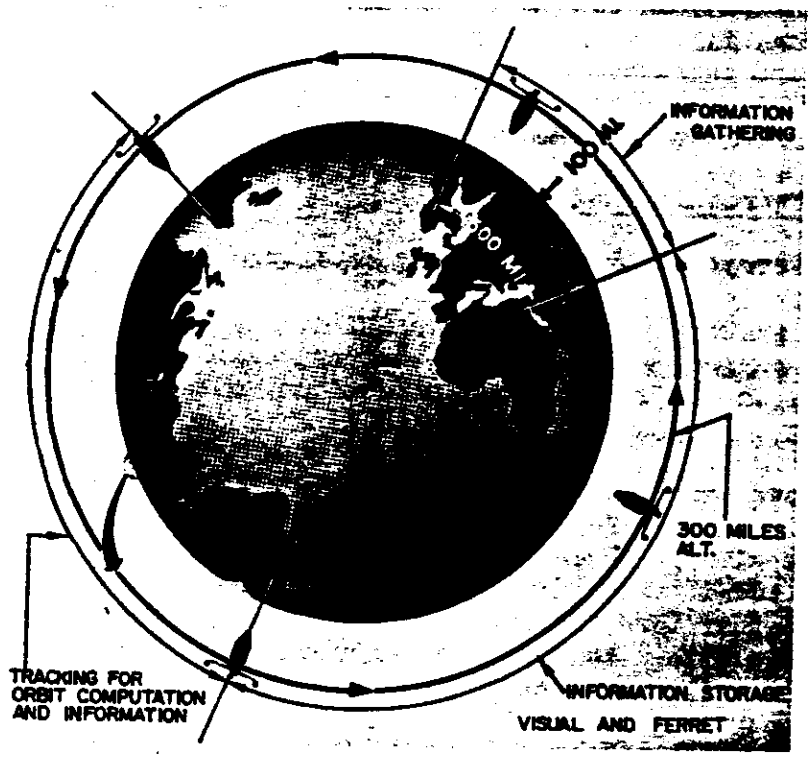


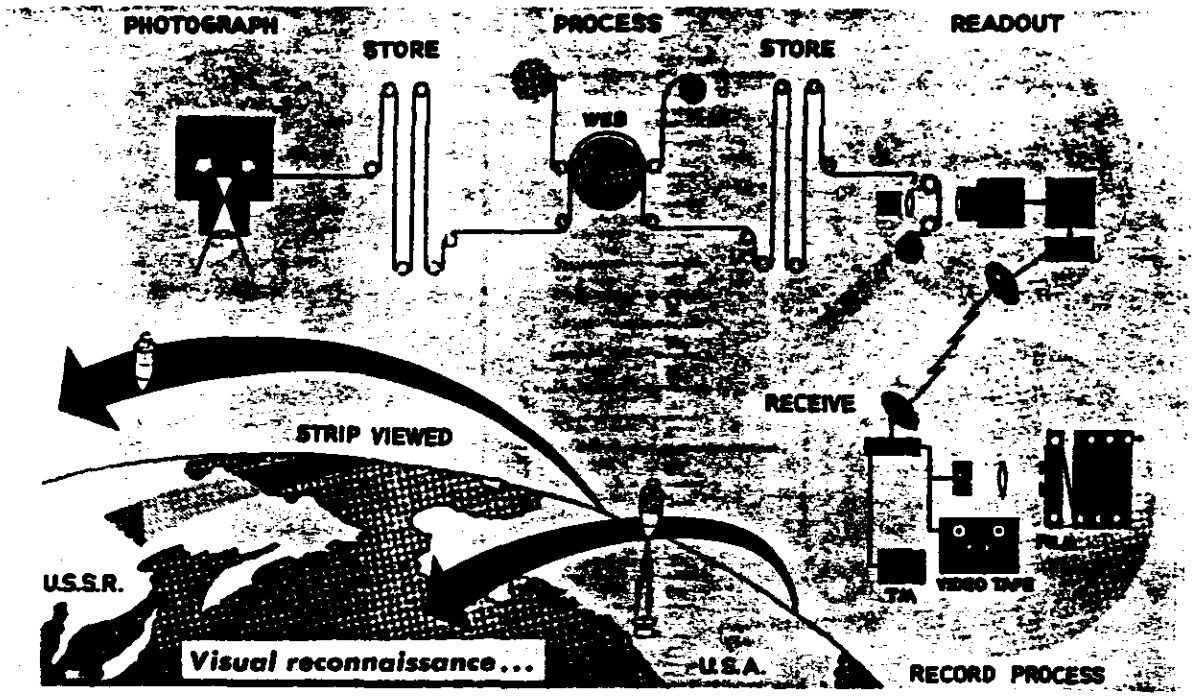
Figure II - 2. Typical SAMOS trajectory, launch - to - orbit.



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 II - 3. Schematic of SAMOS system in operational orbit.

SECRET



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 II - 4. The visual reconnaisaance system.

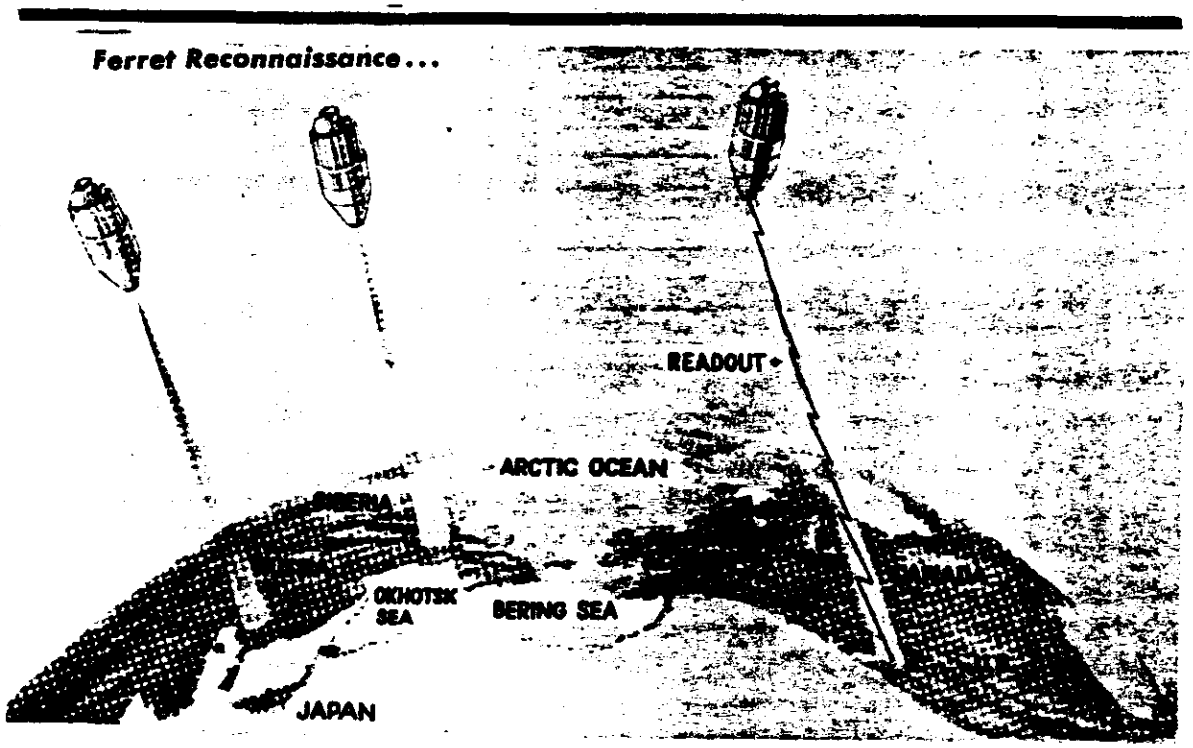


Figure II - 5. The ferret reconnaissance system.

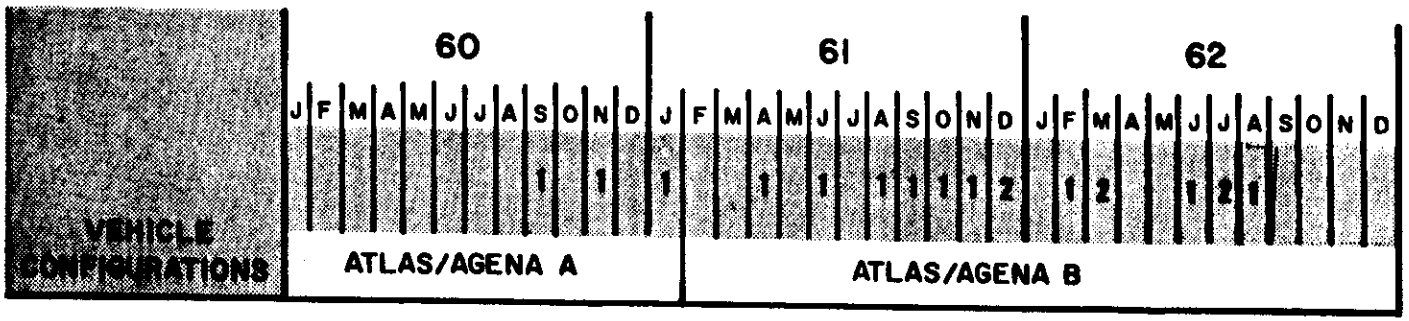


Figure II - 6. SAMOS Launch Schedule.

SECRET

***** NOTICE OF MISSING PAGES *****

PAGES 27 THROUGH 82 ARE MISSING IN THE ORIGINAL COPY.

VII. STATUS OF FUNDS BY PROJECTS

(In Millions)

31 May 1960

Project	Funding FY 1959 and Prior Years	Amounts Programmed FY 1960	Cumulative Obligations	Cumulative Expenditures
DISCOVERER 1/ (R&D Satellites)	$ [redacted]	$ [redacted]	$ [redacted]	$ [redacted]
SAMOS 1/ (Reconnaissance Satellites)	105.6	164.5	247.2	187.8
[redacted]				

1/ Excludes [redacted] programmed during FY 1958 and prior years for WS 117L program. DISCOVERER, SAMOS and [redacted] projects are outgrowths of WS 117L.

SECRET

SECRET

SPACE VEHICLE LAUNCH SCHEDULE

As of 1 August 1960

Department of Defense Schedule with the National Aeronautics and Space Administration Schedule added for information.

		PROGRAM	VEHICLE	RANGE	1960 A	S	O	N	D	1961 J	F	M	A	M	J	J	A	S	O	N	D	1962 J	F	M	A	M	J	J	A	S	O	N	D	1963 J	F	M	A	M	J	J	A	S	O	N	D
DOD	1	DISCOVERER	THOR-AGENA	PMR V	2	2	2	2	1	1	1	1	2	2	2	2																													
	2	SAMOS (R&D)	ATLAS-AGENA	PMR Arg		1		1		1			1		1		1	1	1	1	2		1	2			1	2	1	(End of Forward Program)															
	3	[redacted]																																											
	4																																												
	5																																												
	6																																												
	7																																												
NASA	8																																												
	9																																												
	10																																												
	11																																												
	12																																												
	13																																												
	14																																												
	15																																												
	16																																												
	17																																												
	18																																												

SECRET