MILITARY SATELLITE PROGRE

FOR QUARTER ENDING 30 SEPTEMBER, 1959

RCS DD-SD (M) 242



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Prepared By UNULASSIES Division

Headquarters Air Research And Development Command

UNITED STATES AIR FORCE

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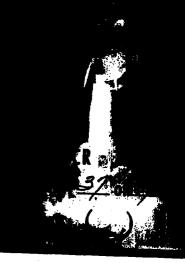
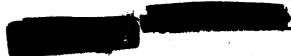




Figure 4. Mockup of panel configuration for Ferret Reconnaissance (F-2) Command Console.



AIR FORCE BALLISTIC MISSILE DIVISION
HEADQUARTERS
AIR RESEARCH AND DEVELOPMENT COMMAND

UNITED STATES AIR FORCE Air Force Unit Post Office Los Angeles 45, California

WDPCR

8 October 1959

MILITARY SATELLITE PROGRAM PROGRESS REPORT Quarter Ending 30 September 1959 RCS DD-SD (M) 242

FOREWORD

During this reporting period the Military Satellite Program passed a significant milestone in the successful flights of DISCOVERERS V and VI. All program objectives, except recovery of capsules, were achieved. Both flights provided added demonstrations of the already proven reliability of the THOR booster. Performances of the AGENA upper stage vehicle were entirely as planned, providing complete confidence in this Research and Development satellite in its application toward more sophisticated programs.

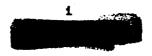
The SENTRY Program was redesignated the SAMOS Program by ARPA direction. The recovery capability was re-included as one of the Programs' major objectives.

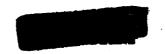
Reorientation of the MIDAS Program combined Phases I and II into a single, 10-vehicle, R&D phase.

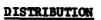
Funding problems and absence of approval of total programs including long range advanced objectives, continue to hamper orderly program accomplishment.

O. J. KITLAND
Maj. Gen., USAF
Commander

WDPCR-78

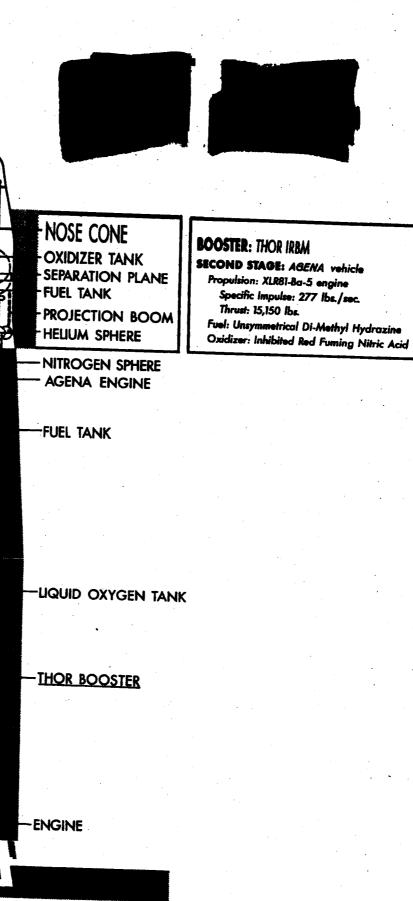






Advanced Research Projects Agency	7
Headquarters, United States Air Force	12
Air Research and Development Command	2
Strategic Air Command	· ī
Air Force Cambridge Research Center	ī
Rome Air Development Center	2
Wright Air Development Center	7
Air Force Ballistic Missile Division (ARDC)	19
Ballistic Missiles Center (AMC)	4
Assistant CINCSAC (SAC MIKE)	7
Air University Library	1

WDPCR-78



PAYLOAD OBJECTIVES

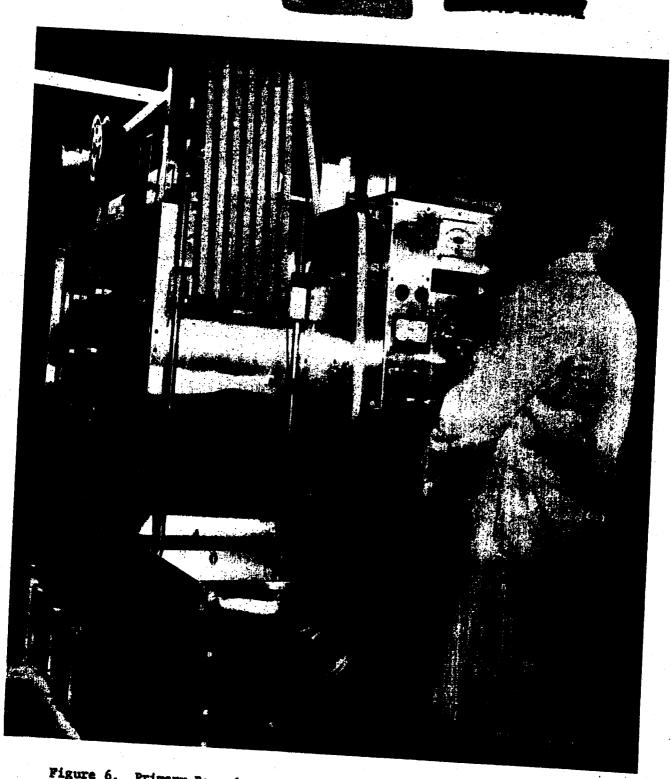


Figure 6. Primary Record Processor - a high speed, spry type 35mm film processor capable of handling 100 foot of film



I. GENERAL

Six successful launches to date

Six launches have been made in the DISCOVERER Program to date. Four of these were successful in attaining orbit following excellent booster and second stage performance. DISCOVERERS III and IV also achieved all flight parameters but did not attain orbit due to a slightly less than nominal second stage velocity.



Figure 1. DISCOVERER V prior to erection on launch pad (above) and during launch preparations (top left).

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The capsule separated, but the recovery aids failed to function due to battery failure caused by low temperatures.

DISCOVERER VI successfully launched on 19 August.

Both flights provide invaluable data for top priority space programs. Telemetry indicates that the capsule separated as planned. However, capsule temperatures were so low that the battery used to initiate the recovery sequence could not have functioned. The failure was attributed to this temperature condition.

DISCOVERER VI (Figure 2) was launched successfully from Vandenberg AFB on 19 August. All launch equipment functioned as planned. Orbital. tracking of the satellite was satisfactory. However, intermittent malfunctions of the orbital timer command control caused the expected capsule re-entry point to shift 366 nautical miles to the south. The RC-121 aircraft were able to redeploy for the expected capsule re-entry, but the C-119 aircraft and surface vessels could not redeploy in time. No positive indication of capsule reentry was obtained. The paint on the nose cone was removed to raise capsule temperature, but the temperature rise was only 10°; still below the 40° required for successful battery operation. Since the temperature sensors in the AGENA vehicle did not react to indicate retro rocket firing, it is not known if the rocket fired. The space track station at Laredo, Texas, reported skin-tracking two objects during pass 75, but the cause for failure cannot definitely be established.

Even though the capsule recovery experiment failed, these flights were of great value in testing the AGENA vehicle. This satellite vehicle will be utilized with more powerful boosters in the Advanced Military Reconnaissance Satellite programs. The AGENA performed extremely well on both flights as did the satellite propulsion system. The

oriented to a nose-backward position as programmed on both flights and stabilization was satisfactory. This lends confidence to the success of future programs which will use this satellite.

II. TECHNICAL STATUS

An intensive study has been conducted to determine the cause for failure of the capsule recevery aids (telemetry beacon and parachute) on DISCOVERER flights V and VI. The studies concluded:

guidance and stabilization system, controlled by a horizon scanner, functioned as planned. The satellite re-

- 1. Additional telemetry is required to provide positive indication of the sequential recovery occurrences.
- 2. To obtain this telemetry, the tracking and telemetry ship, Joseph E. Mann, must take station at a point at which it is able to track the vehicle during the time of capsule separation.
- 3. Temperatures in the recovery capsule must be stabilized at the desired value.

The recovery capsule of DISCOVERER VII is being equipped with heaters, to control capsule temperature, and with additional telemetry. This telemetry (Figure 5) will provide positive indication of the sequence of events during capsule separation and operation of the recovery aids. The capsule beacon will be turned on prior to separation, and will broadcast throughout the entire re-entry trajectory. The new telemetry beacon will also provide a

The DISCOVERER flight test program has been halted pending study of recovery aid failures and corrective action required.

study.

DISCOVERER VII will be

modified as indicated

by the results of the



backup capability for tracking the capsule. The two surface vessels to be on station in the recovery area are being equipped with additional antennae and receivers to provide additional tracking data.

The fuel tank capacity of the AGENA vehicles scheduled for use on flights 18 through 25 has been doubled. This, in conjunction with an engine restart capability, will provide a substantial increase in weight/altitude performance.

A reliability and analysis laboratory has been established at Lockheed Sunnyvale. This laboratory will provide a controlled environment for determining the reason for failure of parts, and a facility for environmental and shock testing of new design components.

III. WORK SCHEDULES

The last of the seventeen single-burn satellites has been released-from manufacturing. It is now in the "pipeline" between modification and checkout at Sunnyvale, Santa Crus Test Base (SCTB), and Vandenberg AFB.

In addition to DISCOVERER VII, four vehicles are presently undergoing functional tests at Vandenberg AFB. These constitute presently planned launch vehicles through DISCOVERER XI.

During the report period, pre-acceptance testing of satellite vehicles continued with hot engine firings, inspections, and functional component checks. Two vehicles are currently at SCTB. One is to be eracted for testing. The other is being evaluated for acceptance, after incorporation of outstanding Engineering Orders.

AGENA vehicle modified for optimum performence with restart engine.

A laboratory has been established for testing and evaluation of failed parts.

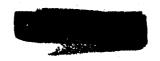
All single-burn AGENA configurations are in "pipeline".

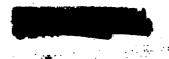
Next satellites are currently being prepared for launch at Vandenberg AFB.

The Santa Cruz Test Base is operating on a busy schedule.





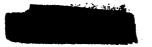


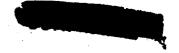


Modification and Chackout Center prepares three vehicles for test and launch. Three BLSCOVERER vehicles are currently at the Modification and Checkout Center. One is in the systems check position, about 70 percent complete. The other two have been accepted by the Air Force after hot firing at Santa Cruz Test Base and are scheduled for re-shipment to Vandenberg AFB.

IV. FACILITIES

See SAMOS and MIDAS sections.





3. Comparative data which demonstrate the difference between the two flights include: (a) main engine burning duration 158.5 and 163.4 seconds, (b) total thrust at liftoff as indicated by chamber pressures of 151,000 vs 153,000 lbs, (c) average fuel flow rate of 188 lbs/sec and 205 lbs/sec, (d) vernier thrust of 1060 lbs vs 1065 lbs, (e) propellant utilization of 99.8 percent against between 99.9 and 100 percent.



SUMMARY

- 1. During this quarter the DISCOVERER Program provided reassurance in the following three areas:
- A. PROGRAM MANAGEMENT. Maintenance of a flexible system of scheduling permits, but monitors closely, slippages, holds, or revision when necessary to achieve long term objectives on schedule. This was demonstrated by the rescheduling of DISCOVERER V and VI launch dates. When DISCOVERER flights III and IV did not attain orbit the decision was made to discontinue further flight tests for study of the problems involved. The problems were defined, necessary modifications were incorporated, and the subsequent flights have attained orbits very close to those planned.
- B. TESTING AND DATA EVALUATION. The failure of DISCOVERERS III and IV to attain orbit was attributed to slightly less than nominal first and second stage performance. Modifications were designed to upgrade performance and subsequently incorporated into the booster and satellite. Test procedures used were proven valid within close margins by the flights of DISCOVERER V and VI. A comparison of performance figures for DISCOVERERS IV and VI is given in TABLES 1 and 2.
- C. BASIC DESIGN AND FABRICATION. The validity of design, engineering, and fabrication have been proven by four successful flights out of six attempts. The two failures were not caused by malfunction of the booster or satellite subsystems. This record was established even though these satellites are by far the heaviest ever attempted in the U.S. with any type of missile.
- 2. Data evaluation from the DISCOVERER IV flight indicated that increased performance must be obtained by (a) weight reduction, (b) use of RJ-1 in lieu of RP-1 fuel as a THOR propellant, and (c) use of a launch azimuth of 170 instead of 175 degrees. The weight saving was effected by the deletion of structural and mounting components used on THOR IRBM's but not required for space missions. Weight was reduced by approximately 100 lbs. Burning time of the THOR booster was increased by the use of the more dense RJ-1 fuel. Use of a slightly more easterly launch azimuth also contributed to the attainment of increased everall flight performance.

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TABLE 2. Propulsion System Performance (DISCOVERER IV vs DISCOVERER VI)

	Nominal	Actual Values			
	Values	Based on flow rate and acceleration data	Based on recorded acceleration data		
Peak Acceleration DISCOVERER IV	8.3				
DISCOVERER VI	8.6	7.9	8.2		
Average Thrust (1bs) DISCOVERER IV DISCOVERER VI	15,000(min) 15,000(min)	15,389 15,312	15,220 15,420		
Average Propellant Flow Rate (Ibs/sec)					
DISCOVERER IV DISCOVERER VI	55.7 55.5	55.1 55.0	54.62 54.4		
Weight of Vehicle at Burnout (1bs)		•			
	1904 1827	1973 1950	2021 1 90 1		

TABLE 1. Comparison of Trajectory Data (DISCOVERER IV vs DISCOVERER VI)

Time from 1	ift-off(sec)	Range (ft)		Altitude (ft)	
Nominal	Actual	Nominal	Actual	Nominal	Actual
150 //	150 50	406.606			
					235,49
103.8	163.35	517,270	509,610	256,950	270,500
167.71	167.62	613.941	614 916	280 526	267,530
173.07	172.55	637,306			310,744
			·		0.001,1.1
	173.55		796,000		277,000
	178.6		776,000		328,000
					•
261.5	241.08	1.819.447	1 341 000	470 069	403,300
273.7					627,500
375	356.70		3.584.000	323.246	247,700
387.4	391.1	3,925,300	3,921,000	633,600	738,400
<u>Veloci</u>	ty (vt)	Flight 1	Path Elevat	ion Angle	
Nomina1	Actual				
13 403	12 250	17.05		•	,
				_	
13,720	13,790	10.0	17.8	·	
					• .
12,993	12.826		3 5		
13,340	13,060	7.024			
		- TO			
25,590	25,420	-9.62	-8.8		
		77404	-0.0		
	158.46 163.8 167.71 173.07. 261.5 273.7 375 387.4 Veloci Nominal 13,493 13,720	158.46 163.8 167.71 167.62 173.07 173.55 178.6 261.5 241.08 273.7 375 356.70 387.4 Velocity (vt) Nominal Actual 13,493 13,720 13,790 12,993 12,826 13,340 13,060	Nominal Actual Nominal 158.46	Nominal Actual Nominal Actual	Nominal Actual Nominal Actual Nominal

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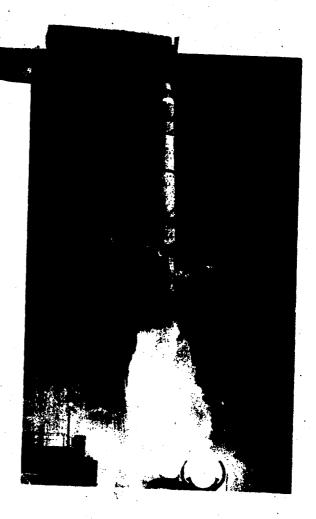
DISCOVERER V was successfull launched on 13 August 1959.

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After six aborts, DISCOVERER V was successfully launched from Vandenberg Pad IV on 13 August 1959. Four aborts were caused by weather, one by technical difficulties, and one by a hurricane in the Hawaiian recovery area. The scheduled noon launch was achieved with liftoff at 1200:08, PDT. Launch, booster performance, and orbital injection were normal. A departure azimuth approximately one degree east of the 170 degree nominal azimuth was obtained. The only malfunction was failure of the Vandenberg Mod II radar to maintain satisfactory lock-on.

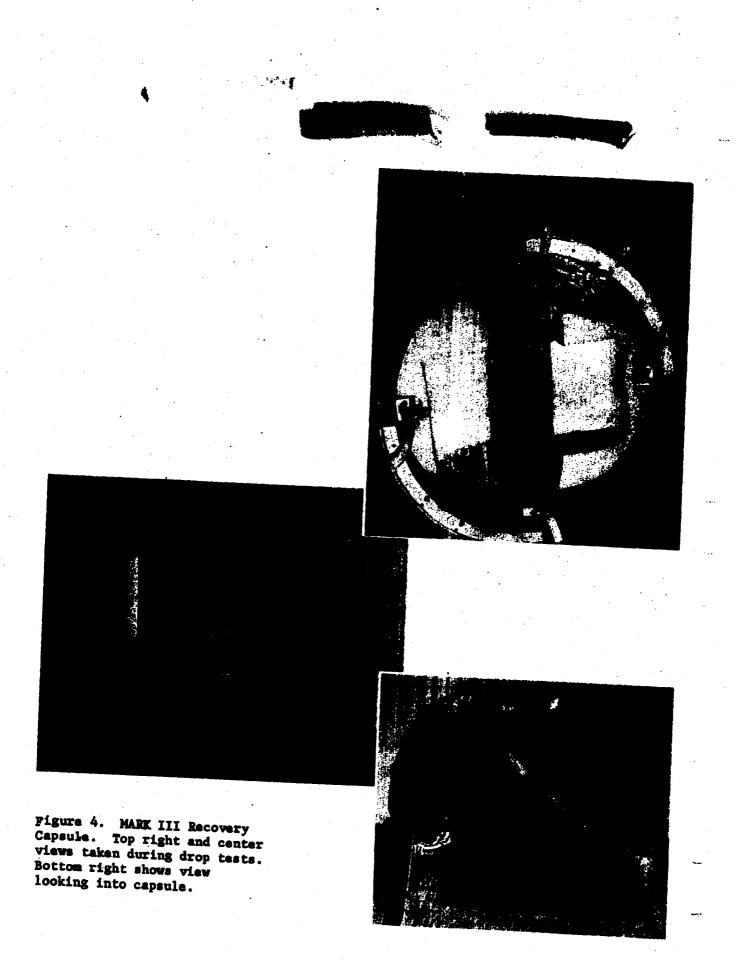
Figure 2. DISCOVERER V (right) at liftoff from Vandenberg Air Force Base launch pad. DISCOVERER VI (below) during launch (note that white paint has been removed from nose cone).

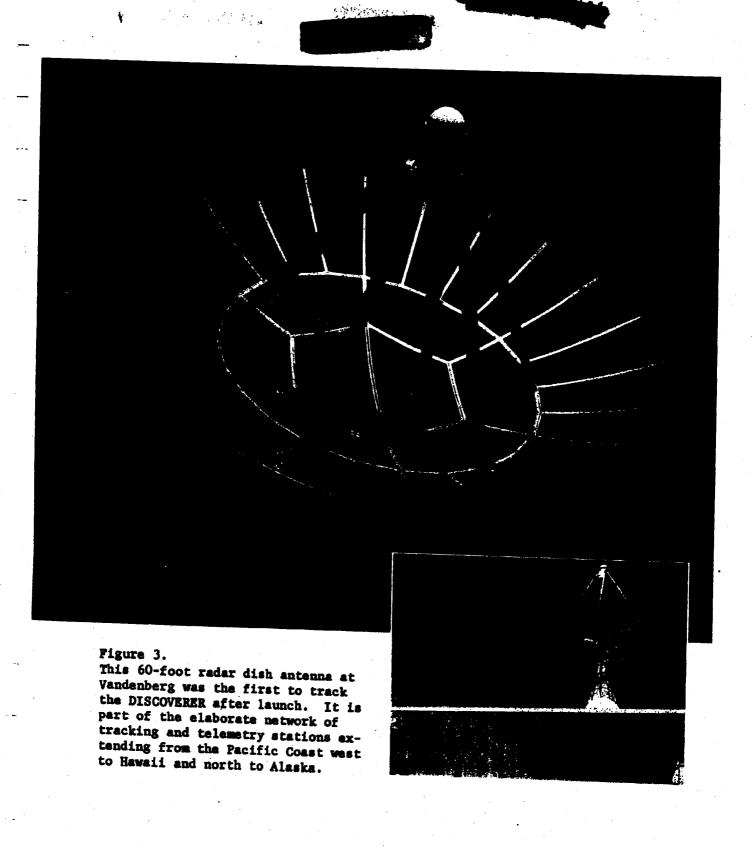




AGENA vehicle and subsystems, except recovery aids, performed as planned.

Telemetry indicated that satellite propulsion, guidance and stabilization, and auxiliary power subsystems performed as expected during the orbital period before capsule separation. Command of the orbital timer was maintained throughout the flight. The expected capsule re-entry point was shifted 88 miles northward during the last 85 minutes before separation. Only the aircraft were able to redeploy in time for capsule descent. The recovery forces failed to locate the capsule.





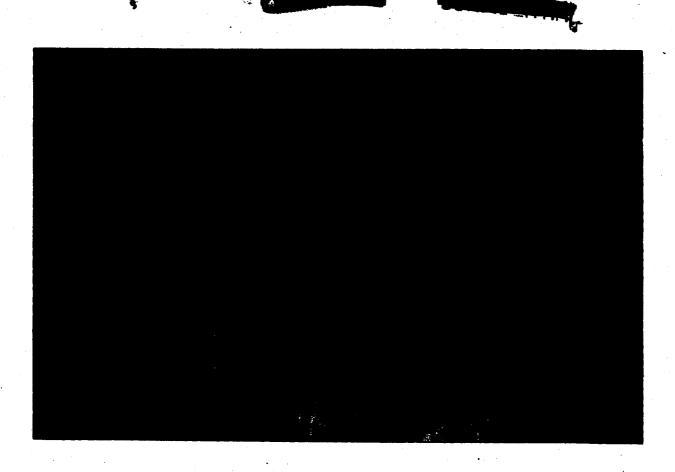


Figure 6. Aerial view of test stand area at Santa Cruz Test Base.

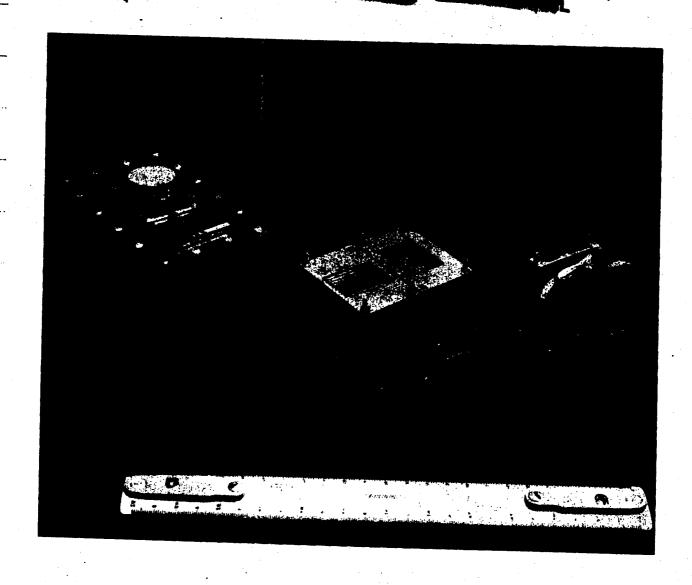
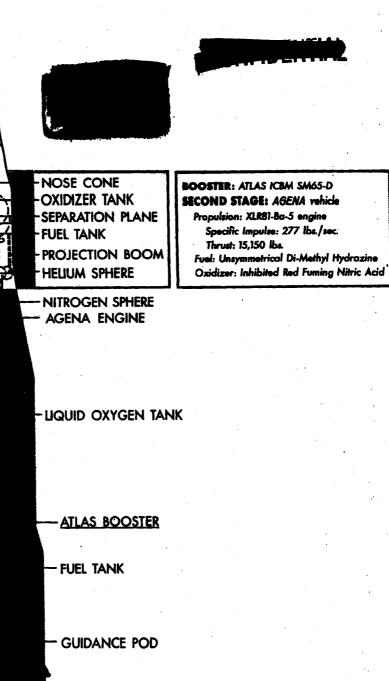


Figure 5. This small telemetering unit will be installed in the capsule of DISCOVERER VII, and will transmit data on the sequence of recovery system operations following capsule ejection. The telemetry ship, Private Joe E. Mann, will cruise in the area in which ejection is expected to occur and will record telemetry signals received.



PAYLOAD OBJECTIVES

SUSTAINER ENGINE **BOOSTER ENGINE**

VISUAL (Photographic Reconnaissance) -airborne equipment to collect, proc-

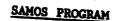


sion to ground. Ground anniament to

data from 30 to 300,000 mc/sec electromagnetic spectrum region; store, filter







GENERAL

- A. ARPA has renamed the SENTRY Program the SAMOS Program.
- B. By secret letter DEF 965117, dated 10 September, ARPA directed that the recovery capability be reincluded in the program and that the readout portion be reoriented to accommodate this effort.
- C. An analysis of satellite operational coverage considerations was completed. The results indicate (1) the frequency of coverage of a target at any latitude by a single satellite for various orbit inclinations and altitudes, and (2) the number of satellites required for 100% coverage of the earths' surface by polar orbiting vehicles as a function of altitude.
- D. Design studies are continuing of a system capable of controlling and distributing data received from varioussimultaneously orbiting satellites, with particular application being made to the SAMOS and MIDAS programs.

TECHNICAL STATUS AND WORK SCHEDULES

- A. Visual Reconnaissance System Visual system payloads are designated by the letter E. E-1 payloads are designed to use prototype components for early availability and are tor the purpose of testing the validity of component design in actual space environment. E-2 and subsequent payloads are based on progressively more sophisticated designs.
- 1. Acceptance testing of the first flyable prototype (E-1) payload (Figure 1) is 50% complete, with delivery to

WDPCR-78

Program renamed.

Recovery capability reincluded.

Satellite coverage considerations analyzed.

System design studies continue.

Acceptance test of first flyable E-1 payload 50% complete.

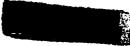
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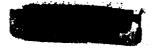
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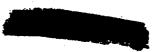












Fabrication of E-2 payloads progressing satisfactorily.

E-1 Thermal Model in temperature testing.

Visual reconnaissance system checkout equipment installed. LMSD scheduled for 23 November. Subsystem checkout of the Service Test Model E-1 payload was completed with no equipment malfunctions.

- 2. Fabrication of the first flyable E-2 prototype steerable payload, with the 36-inch focal length lens is approximately 60% complete. Component subassembly was started on schedule. The Engineering model of the E-2 payload is in final stages of development test and modification. Completion of this nonflyable, functional test model is expected by mid-October. The 36-inch lens and camera assembly has been completed. and tests show compatibility with design requirements. The payload readout equipment (including the line-scan tube, photomultiplier, and scanning system) was assembled, tested and operated as a complete system. This system was connected to the ground reconstruction electronics (GRE) via the data link simulator and a final reassembled film record was obtained.
- payload in the LMSD high altitude temperature simulator indicated close adherance to required temperature tolerances. The payload-vehicle attachments will be insulated further to reduce heat loss. A retest is scheduled for October. The Thermal Mockup of the E-2 payload was completed and will be subjected to environmental testing by LMSD on 12 October.
- 4. Installation of test and operation equipment in the visual reconnaissance (Subsystem E) checkout area at LMSD Sunnyvale has begun. The first primary record film processor, chemical process tanks, E-1 payload collimator, and payload handling equipment have been



Specifications and Analysis Report completed.

Final acceptance of first F-1 payload near.

F-1 ground equipment checked out.

delivered. E-1/E-2 ground reconstruction electronics and associated equipment was completed and delivered to IMSD.

5. Final subsystem specifications for the E-1 and E-2 airborne and ground equipment were completed. The Visual Reconnaissance Readout Subsystem Engineering Analysis Report was revised during September.

B. Ferret Reconnaissance System

Ferret system payloads are designated by the letter F. F-1 payloads are designed to use prototype components for early availabiltiy and are for the purpose of testing the validity of component design in actual space environment. F-2 and subsequent payloads are based on progressively more sophisticated designs.

- 1. The first prototype F-1 vehicle equipment (to be flown with the E-1 payload) is nearing completion of final acceptance tests with the ground checkout equipment at Airborne Instruments Laboratory (AIL). Inhibit action tests were continued on the first service test model F-1 payload (see Figure 3). Both frequency bands have been tested and the results are being evaluated. The second service test model (Figure 2) was given environmental tests. Results will determine the most desirable skin coating characteristics for maintaining optimum equipment temperature in orbit. A retest for verification of the thermal design is being made. Other environmental tests for this model are nearing completion.
- 2. Checkout was completed of the first deliverable ground data handling equipment, including the signal reconstructor, digital test work generator,



power supplies and tape transports. Also completed was testing of the band 1 and band 2 antennas for use with the calibration vans. These vans will be used in early flight testing to transmit known signals from the Southwestern U. S: to the payload in orbit. The second subsystem checkout console was delivered to LMSD; the first console was accepted by LMSD but retained by AIL for checkout of prototype F-1 payloads.

F-2A payload components, near completion.

subassemblies of the first deliverable F-2A payload is complete except for the band 1 and band 2 receivers and the power and control unit. Testing of completed subassemblies has been started. Environmental tests of the F-2A thermal mockup payload are underway.

3. Fabrication of the assemblies and

F-2A checkout console 80% fabricated.

4. Component fabrication of prototype models 1 and 2 of the F-2A checkout console is 80% complete and assembly of components is 40% complete. Systems testing of the F-2A service test model console is 50% complete.

F-2B payload design on schedule.

5. Design of the F-2B payload is nearing completion and fabrication of the first prototype article is approximately 50% complete. Testing of the various subassemblies is underway. A mockup of the evaluation and command console (Figure 4) for the F-2 payloads was completed and fabrication of components started.

F-3 payload design nears completion.

6. Design of the F-3 payload is nearly complete. Procurement, fabrication and assembly have begun on various components of the first prototype.



7. Greater definition of the F-4 development program was achieved and a

F-4 payload defined.

Data handling procedures being prepared.

Photo data processing equipment on schedule.

Data reduction design criteria started.

Interpretation console engineering models nearly complete.

Data Processing Central modules 70% complete.

Display system equipment progress on schedule.

subcontract negotiated with AIL.

C. Data Handling Equipment (Subsystem I)

(See Figures 5 through 7)

- 1. Satisfactory progress was made in the preparation of standard procedures for Subsystem I photo data reduction. Computer programs were written for the AN/FSQ-27 Data Processing.
- 2. Development of photo data processing equipment for interim use in the System Test and Evaluation Program progressed on schedule. Design and fabrication of several photo processing components was nearly completed. Initial models of Center Format equipment will be delivered during the next quarter.
- 3. Work was started on system and equipment design criteria for the Analog Ferret Data Reduction Subsystem.
- 4. Final assembly and test of the first three engineering models of the Elint Interpretation Console were essentially completed. Work continued on programs for automatic ferret data reduction operations and console routines.
- 5. Fabrication of the initial modules, for the Data Processing Central, was 70% complete and an initial test cell 80% complete. The test cell will be delivered by 1 December for use in the System Test and Evaluation Program.
- 6. Equipment design for the Subsystem I Display System neared completion, with fabrication progressing



System Test and Evaluation program underway.

USAF directive causes Subsystem I acceleration.

Facilities work at Offutt AFB placed on accelerated schedule.

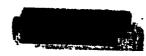
on schedule. Cabinet control drawings were completed for the Display Projector and assembly wiring was started for both the Display Projector and the Display Generator. Delivery of these items is scheduled before the end of 1959.

- 7. System Test and Evaluation Program facilities neared completion, with Subsystem I equipment being installed and early test and evaluation of components underway. Planning was started for the initial orientation and training for operation and maintenance of Subsystem I. A Proposed Manning Table for October, November, December and January has been coordinated at AFEMO and ATC. Subsystem I requirements for manuals, logistics, maintenance specifications, and exhibits were reviewed and preliminary phasing charts prepared.
- 8. Due to USAF direction requiring all SAMOS Program intelligence data processing to be performed by military personnel at an Air Force base, the Subsystem I construction and activation schedules have been accelerated. Non-automated Subsystem I equipment will be installed in Building D, Offutt AFB, to support the first three SAMOS flights. Installation of automated equipment in the Intelligence Processing Center (also Building D) will support subsequent SAMOS flights.

D. Facilities

1. Offutt AFB - All SAMOS work at this base has been placed on an accelerated schedule. Equipment will be installed in Building D to provide a small interim data processing capability for the first three SAMOS flights. The main

WDPCR-78



Intelligence Processing Center will be activated on an incremental basis to permit support of all subsequent SAMOS flights. Design of the Technical Operations Control Center (to be located adjacent to the Intelligence Processing Center) will be initiated in October and completed in January. Full Operational capability will be attained by October 1961.

- 2. Development Control Center Completion of Increment 1 construction is scheduled for December. Design of Increment 2 was complete, and in the hands of the construction agency for advertising for construction bids on 10 August; however, advertising has been delayed pending release of funds. The scheduled beneficial occupancy date of March 1960 cannot now be met. A revised date will be established upon receipt of funds.
- 3. Foint Arguello Launch Complexes 1 and 2 Beneficial occupancy of Launch Complex 1 blockhouse began in August, with beneficial occupancy of the launch pad scheduled for January 1960. Joint occupancy for the installation of equipment began in August. Beneficial occupancy of launch pad 2 is scheduled for February 1960.
- 4. Vandenberg AFB Tracking and Data Acquisition Station construction is scheduled for completion on an incremental basis from October through January 1960. Completion of the various facilities of the New Boston Station is scheduled on an incremental basis from February to September 1960. Plans and Specifications for the technical facilities at the Ottumwa Station are complete

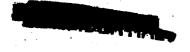
Fund availability may delay construction.

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Launch complex occupancy initiated.

Tracking station construction continues on schedule.





and ready for contract advertising. Design of support facilities is currently being initiated. Construction of the Ottumea technical facilities is scheduled to begin in December, with completion scheduled for February 1961.

III. PROBLEMS ENCOUNTERED

A. The delay in receipt of funds is causing slippage in completion of the second increment of the Development Control Center.

B. The slippage of beneficial occupancy of the Arguello launch pad mentioned above will result in a substantial slippage of the first SAMOS launch. This launch was originally scheduled for April 1960. It now appears that installation and checkout of equipment which follows beneficial occupancy will dictate a first launch date near the end of June 1960. All possible action to compress the installation and checkout schedule is being taken.

C. The FY 60 SAMOS program is based on a \$168.5 million budget request. ARPA has approved \$148 million, directed that the recovery pertion of the program be pursued, and that the readout portion be recriented to accommodate the recovery effort within this amount. Such a reorientation will impose grave effects on the program. Hq USAF has been queried for guidance on reorientation in light of SAMOS requirements and priority.

IV. ARPA ACTION REQUIRED

Action is required to release the funds for construction of the second increment of the Development Control Center.

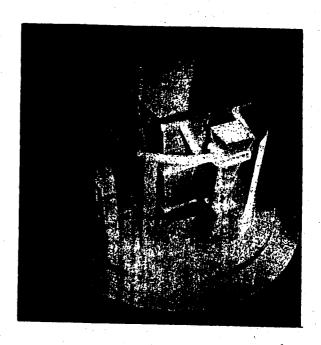




Figure 1. Visual Reconnaissancy System E-1 payload mounted on 40-inch collimator. The optical collimator will be used to align the camera axis with the payload axis during the subsystem test procedure.



Figure 3. Three-quarter view (right) of the S and X band receiving antenna for the F-1 payload, giving a clear view of the X-band antenna and X-band inhibit antenna. Front view (below) showing S-band signal antenna (band 1) and SS/E (subsystem E) "look-thru" area (in center). In upper right is the X-band (band 2) antenna. At bottom right is shown the S-band inhibit antenna, and at bottom left, the S-band inhibit antenna.





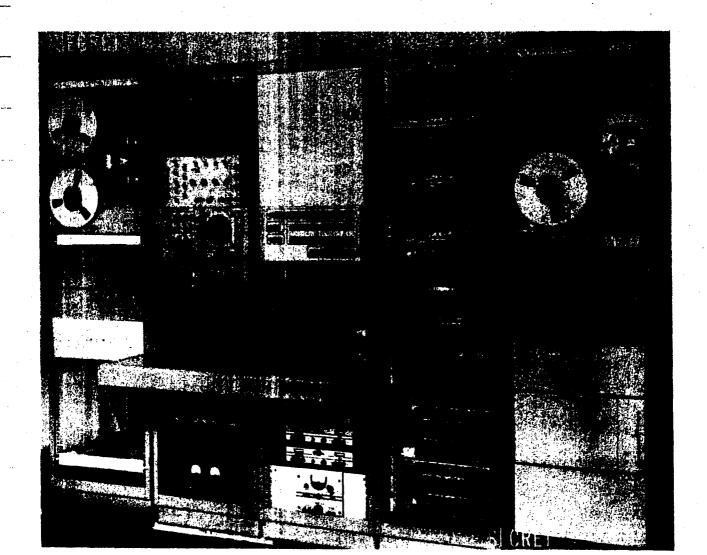


Figure 5. Ground Reconstruction Electronics - This GRE unit receives the video signal from the airborne payload and duplicates it on two repeater kinescopes. These two images are photographed by the primary record cameras, shown mounted at each end of the GRE unit, on continuously moving 35mm film.

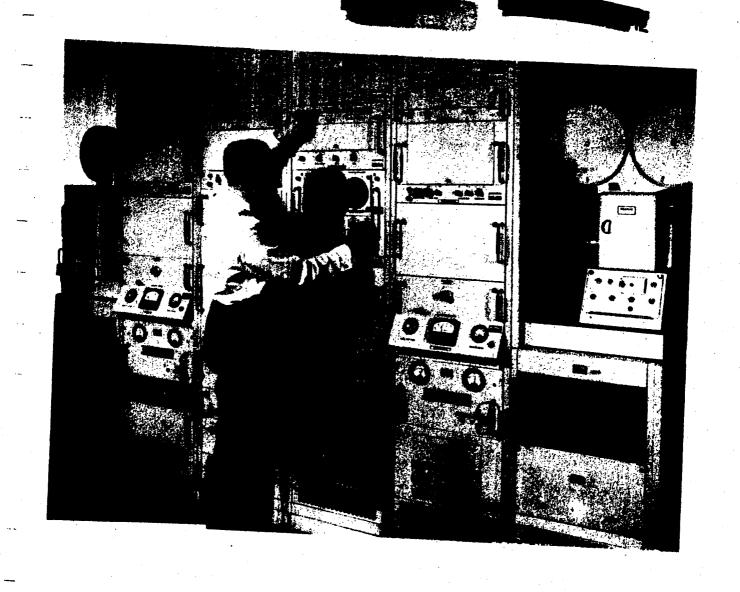


Figure 7. Ferret Reconnaissance System ground data handling equipment.

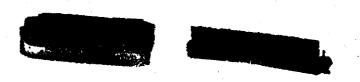






Figure 2. Ferret Reconnaissance System F-1 payload (service test model) prior to environmental testing in the high altitude temperature simulator (HATS). The coupler for checking out the antenna is shown mounted on the antenna structure.







NOSE CONE OXIDIZER TANK SEPARATION PLANE FUEL TANK

PROJECTION BOOM HELIUM SPHERE

BOOSTER: ATLAS ICBM SM65-D SECOND STAGE: AGENA vehicle

Propulsion: XLR81-Ba-5 engine Specific Impulse: 277 lbs./sec. Thrust: 15,150 lbs.

Fuel: Unsymmetrical Di-Methyl Hydrazine Oxidizer: Inhibited Red Fuming Nitric Acid

NITROGEN SPHERE AGENA ENGINE

LIQUID OXYGEN TANK

ATLAS BOOSTER

FUEL TANK

GUIDANCE POD

SUSTAINER ENGINE BOOSTER ENGINE

PHASE I - Four flights, starting December 1959, from Atlantic Missile Range. Nominal launch azimuth of 108° with mean orbital altitude of 250-350 stat-

PAYLOAD OBJECTIVES
ng Decem- hicle subsystems and communications, and ground tracking and command

evaluation of infrared reconnaissance

MIDAS PROGRAM

I. GENERAL

In accordance with Amendment No. 7, dated 29 August 1959, to ARPA Order No. 38, the MIDAS Program has been reoriented to include Phases 1 and 2 into a single R&D phase. Fiscal year 1960 funding of \$46.9 millions was provided. The reoriented MIDAS development program contains 10 R&D flights, the first two from the Atlantic Mistile Range (AMR) and the remaining eight from the Pacific Missile Range (PMR). Program redirection was made to achieve higher altitudes in earlier flight tests. Near equatorial orbits of 261 nautical miles altitude are planned for flights 1 and 2. Polar orbits are planned for flights 3 and subsequent. Flight 3 will use the basic AGENA vehicle with a dual burn capability. The modified AGENA (dual burn and double capacity propellant tanks) will be used on flights 4 and subsequent. Orbital altitude will be increased to 2,000 nautical miles as early in the flight test program as possible. Present indications are that this objective may be achieved by flight 4. Flight 1 is scheduled for January 1960.

B. Coverage of the ascent trajectory on initial launches will require only those tracking and data acquisition stations now included in the AMR downrange network. Ascent through orbital injection will be covered by the Puerto Rico.

Program recrientation defines 10-vehicle R&D phase.

Flight and orbital tracking functions defined.

orbital calculations will be based on tracking data obtained by the Kaena Point (Hawaii) and Vandenberg AFB stations. Data readout from the orbiting payload will be accomplished by the Hawaii, Vandenberg and AMR stations, using the TLM-18 antennas which are already in operation.

G. Ground communications within the tracking network will be aided by those facilities now in use for DISCOVERER flights, except for the Alaskan stations. Hot lines will link all stations to the Development Control Center, Sunnyvale, California, which will coordinate the activities of the AMR network with the activities of the other stations. Effectively, the Center will be tying together two existing ground networks to cover the AMR launches.

II. TECHNICAL STATUS AND WORK SCHEDULES

A. Modification and checkout of the first flight vehicle (1008) has been completed (Figure 1). The vehicle was delivered to the Santa Cruz Test Base (SCTB) on 22 September and is being prepared for hot firing and acceptance test. Modification and checkout of the second flight vehicle (1007) was started on 23 September.

B. Following the incorporation of improved azimuth drive gears, the first infrared scanner unit (Aerojet-General) was tested successfully and mated with vehicle 1008. (Figures 2 through 5).

C. The first ground presentation unit (Aerojet-General) (Figures 6 through 10) was tested successfully for compatibility with the airborne scanner and with a

Two network tracking capability planned.

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First flight vehicle nears acceptance test.

First infrared scanner tested and mated successfully.

Tests of first ground presentation unit successful.

Thermal tests set for October

Modifications provide increased altitude, radiometric background measure.

Infrared scanner situation display consoles defined.

Facilities checkout vehicle now in use.

complete electrical mockup of the vehicle ground communications system. The equipment accepted and responded to beacon real time and programmed commands, and transmitted payload information via the RF data link to the ground display equipment.

- D. Assembly of the thermomechanical equivalent model (Baird Atomic, Inc.) has been completed and thermal tests are scheduled for late October.
- B. Modification of the scanner (Baird Atomic, Inc.) is planned to increase the operational altitude of the first unit. The Baird detection system is also being modified to include a radiometric background measurement capability. Measurements above and below the herizon, and at four sampling points within the field of view, are planned tentatively for flights 3, 4 and 5.
- F. Subcontractor bids are being received for an infrared scanner situation display console which will make it possible for the entire system to be driven digitally. This will meet the requirements of the later developmental and early operational programs. Six units of the following two types are required: (a) Data Display Consoles which will monitor incoming data, and (b) Summary Display Consoles which will have the additional capability of evaluating and summarizing the incoming data for display.
- G. The facilities checkout vehicle has been delivered to AMR. Used initially for the DISCOVERER Program facilities checkout and rehearsal function, this vehicle has been modified to conform to



Checkout equipment program continues on schedule.

Salahan a M

Reliability study pinpoints requirements.

Extension planned for background measurement program.

Pacilities construction continues on schedule except at Point Arguello.

the MIDAS configuration. It will be used to familiarize personnel with vehicle handling techniques and payload mating practices.

- H. Development, fabrication, and delivery of checkout equipment continued essentially on schedule. The first infrared payload checkout complex, propulsion checkout console, and two selar auxiliary power unit telemtry checkout consoles were delivered. The infrared scanner power console and recorder console were completed. (See Figures 11 through 14.)
- I. A preliminary reliability analysis of the long-life capability of the MIDAS system was completed. This analysis established that in many areas the use of redundancy will substantially increase the reliability factors. Electronic and mechanical equipment which require simplification to achieve desired reliability were pinpointed.
- J. An extension is planned of the MIDAS background measurements program in which background radiation would be measured from an aircraft at very high altitudes. It has been recommended that this effort begin by 1 October to permit the use of data gathered in determining the design requirements of the advanced scanner units.
- K. Construction of facilities is progressing as follows:
- 1. Design of the launch complex at Vandenberg-Point Arguello continues to be deferred pending resolution of siting problems.

- 2. Design of the MIDAS addition to the Vandenberg Tracking and Data Acquisition Station is complete. Construction, to begin in October, is scheduled for completion in April 1960.
- 3. Construction of the North Pacific Station is underway on both the technical facilities at Donnelly Flats, Alaska, and the support facilities at Fort Greely, Alaska. Completion is scheduled on an incremental basis between June and October 1960.



6. Facility modifications at AMR continue to be on schedule.

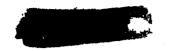
III. PROBLEMS ENCOUNTERED

A. An examination of the redefined MIDAS Program objectives, together with currently authorized funding limitations, has resulted in a preliminary determination that the two factors are incompatible. This situation is being studied intensively, with a view to developing a new program proposal geared to achieve the greatest R&D return per dollar expended. The current program will be continued as recently reoriented pending the completion of this study and subject to further ARPA guidance or approval.

Redefined program-

current funding,

incompatible.





B. Siting difficulties at Point Arguello are seriously jeopardising the design and construction schedules.

IV. ARPA ACTION REQUIRED

ARPA assistance is required in resolving the Point Arguello launch complex siting problems.



Figure 1. First Flight Test Vehicle - 80 percent complete.

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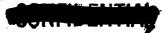
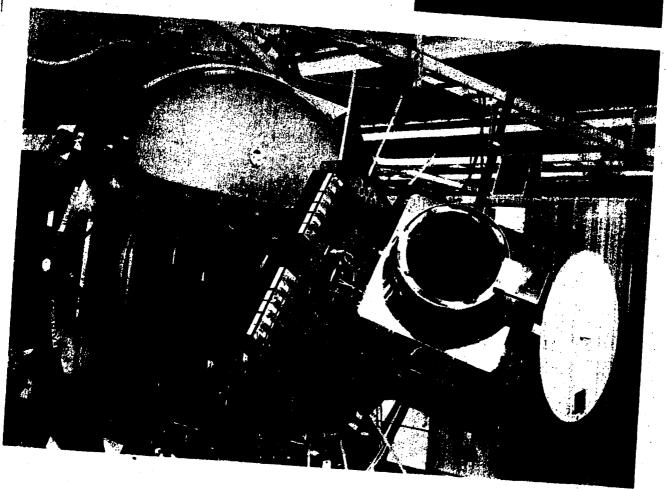
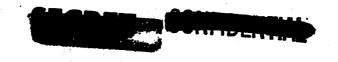


Figure 2. (right) Frontal view of first Infrared Scanner Unit (Aerojet-General) shown mounted on collimator test fixture.



Figure 3. (below) Infrared Scanner Unit installed in first flight test vehicle. Thermal shields removed.





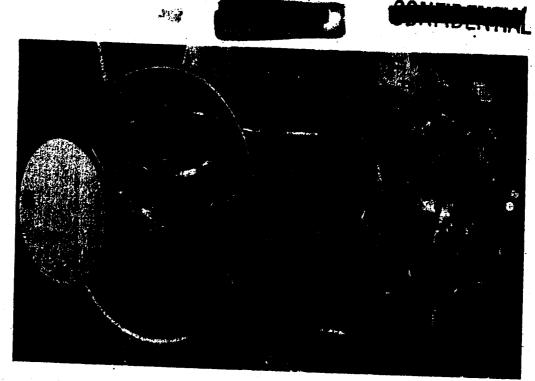


Figure 4. Infrared Scanner Unit installed on first flight test vehicle. Thermal Shield in place.

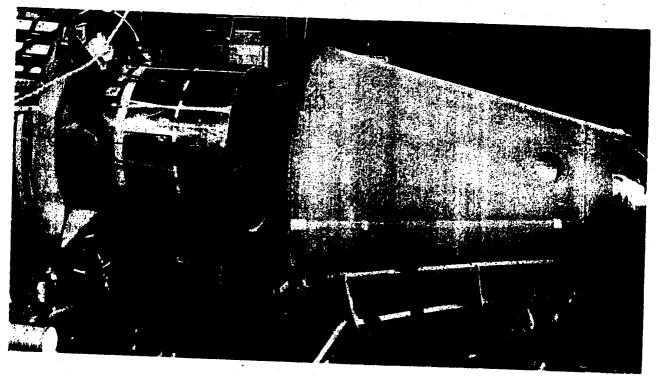


Figure 5. Infrared Scanner Unit installed on first flight test vehicle. Nose section in position for mating with vehicle.



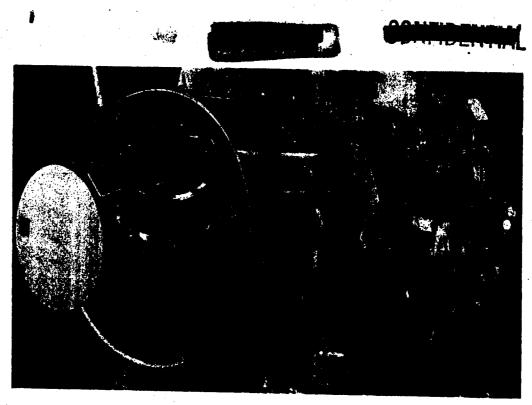


Figure 4. Infrared Scanner Unit installed on first flight test vehicle. Thermal Shield in place.

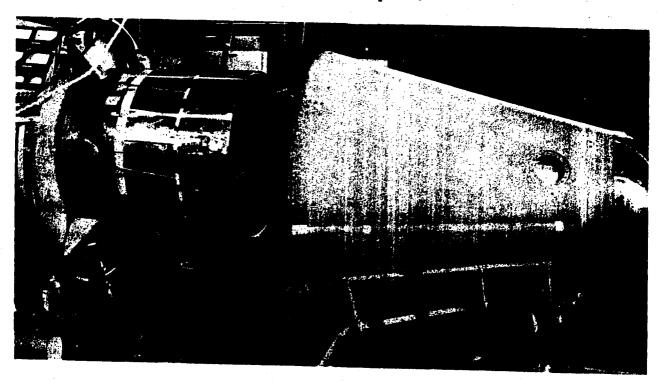


Figure 5. Infrared Scanner Unit installed on first flight test vehicle.





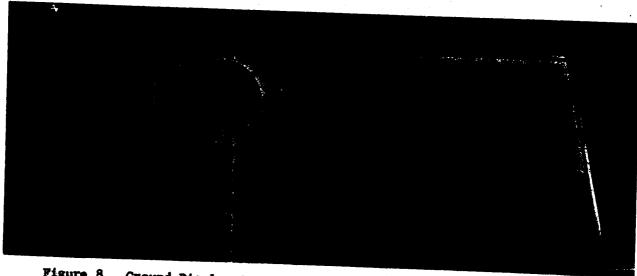
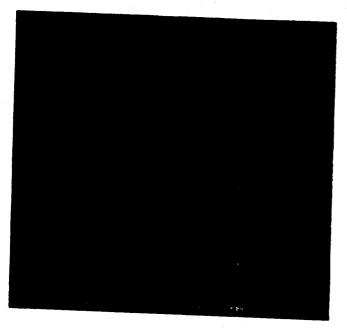
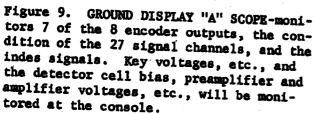


Figure 8. Ground Display Console, with television monitor on left and "A"





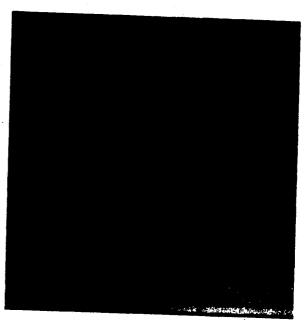
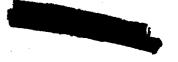


Figure 10. TELEVISION MONITORING CONSOLE which includes the monitoring screen, TV adjustments, command control activating switches and presentation time adjustment. The TV image consists of moving "asterisk of light. Scaled maps placed over the screen are used to determine the position and movement of satellite detected target







Pigure 11. Infrared payload checkout equipment: power supply (left), command console (center) and recorder (right).

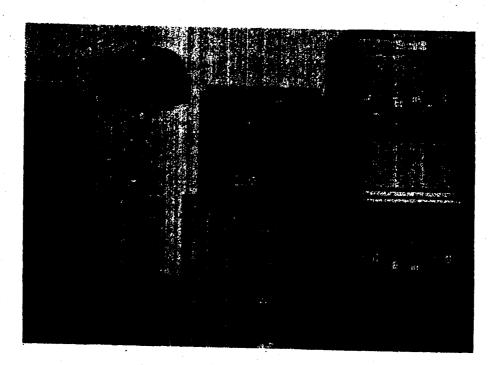


Figure 12. Infrared payload checkout equipment: radiometer (left), control panel (center) and Sanborn recorder (right).

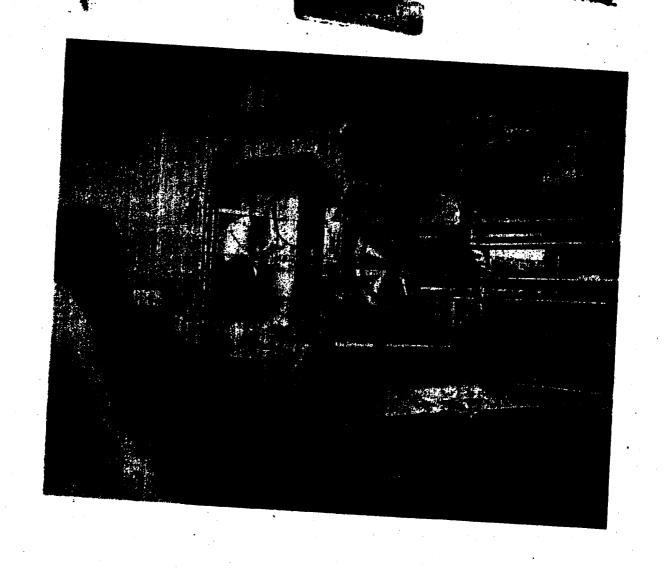


Figure 13. Functional mock-up of solar collector assembly for MIDAS flights 3 and 4, showing solar array extension and orientation systems.



Figure 14. Solar collector portable checkout unit. Exterior view shown above and interior view below.

