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AIR FORCE BALLISTIC MISSILE DIVISION
HEADQUARTERS
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
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MILITARY SATELLITE PROGRAMS PROGRESS REPORT
Month Ending 31 April 1960
DD-DR&E (M) 397

FOREWORD

Attached are the reports covering progress during the month of April 1960 for the DISCOVERER, SAMOS and MIDAS Programs. These reports are directed by Secretary of Defense memorandum to the Secretary of the Air Force, dated 27 February 1960.

O. J. RITLAND
Major General, USAF
Commander

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DISCOVERER PROGRAM

1. This report, covering progress during the month of April 1960, is submitted in accordance with Department of Defense memorandum to the Secretary of the Air Force, dated 27 February 1960. Table 1 shows the flight schedule, vehicle configurations, and flight history to date for the DISCOVERER Program.

2. FLIGHT TEST STATUS

a. DISCOVERER XI was launched from Pad 5, Vandenberg Air Force Base, at 1230 hours, PST, on 15 April. No technical holds were encountered during the countdown, but the launch was delayed one and one-half hours by mandatory holds while trains passed through the area. Terminal countdown time was only 12 minutes, 45 seconds. Significant events occurred as follows:

(1) Liftoff was normal and boost trajectory was nominal.

(2) Second stage separation occurred at T plus 185 seconds.

(3) Trajectory during the coast period was below normal dictating early AGENA engine ignition.

(4) AGENA performance was very close to nominal.

(5) Orbital status of the vehicle was very accurately indicated by ascent radar tracking.

b. The resulting orbit has a perigee of 109.5 statute miles, an apogee of 380 statute miles, an eccentricity of .033 and an orbital period of 92.3 minutes.

c. Acquisition was accomplished by every station on every pass. All fifteen commands were received and verified. The horizon scanner, inertial reference package, and gas jet control system functioned extremely well, resulting in excellent satellite attitude stabilization. The satellite power supply, including the two advanced design static inverters, performed efficiently. The main batteries lasted through the 26th orbit.

d. DISCOVERER XI was the first orbiting AGENA to carry the dual-frequency doppler beacon (APL) used in the TRANSIT Program. This vehicle also carried four optical tracking lights which were photographed, providing the most precise satellite tracking data ever obtained. Both frequencies of the doppler beacon operated and were tracked during all passes. Data received will enable determination of the accuracy of the TRANSIT beacon and the DISCOVERER verlort radar stations by comparison with the precise optical data.

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e. Telemetry data indicate that the recovery capsule was ejected on the 17th orbit as planned. The data did not indicate the firing of the spin rockets. Analysis of the available data indicates that capsule re-entry occurred west of the orbital plane and that impact occurred south of the recovery area.

f. Four AGENA "B" vehicles have been added to the DISCOVERER Program. These additional vehicles bring the DISCOVERER/AGENA "B" total to sixteen.

3. TECHNICAL STATUS

a. Second Stage Vehicles

(1) The AGENA "B" vehicles (XLR-81Ba-7 engine) for DISCOVERER flights XVIII and XIX underwent hot firing tests on 1 April and 19 April, respectively, at the Santa Cruz Test Base. The vehicle for flight XVIII has been returned to the System Test Area for rework and a second system check prior to Air Force acceptance. Additional hot firing tests of this vehicle will not be required.

(2) Preliminary Flight Rating Tests (PFRT) of two XLR-81Ba-7 engines were completed during the month at the manufacturer's plant. The gas generator propellant valve malfunctioned during the tests and will be redesigned and retested.

(3) Testing of nozzle extensions for the XLR-81Ba-9 engine continued at Bell Aircraft and Arnold Engineering Development Center (AEDC). All tests of the 45:1 area ratio titanium nozzles have been successful.

(4) Acceptance tests of the XLR-81Ba-9 engine at the engine contractor's facility revealed thrust chamber throat erosion. Lockheed Missile Systems Division (LMSD) propulsion system representatives and Bell Aircraft engineers initiated a program providing for tighter quality control and acceptance testing of engine components. The thrust chamber will be coated with Zirconia to reduce the amount of thrust chamber throat erosion.

(5) Type testing of the transistorized S-band beacon was successfully accomplished during the month. This qualifies these weight saving beacons for use in the AGENA "B" vehicle. One of the beacons is undergoing compatibility tests at Vandenberg Air Force Base. The first flight beacon has been delivered to LMSD for installation in the AGENA "B" vehicle.

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b. Ground Support Equipment

(1) Two new pieces of equipment for ground handling of the AGENA "B" vehicle are now in use. The first is a ground handling dolly adaptable for either AGENA "A" or "B" configurations to hold the vehicles during assembly and checkout. The other is a vehicle transporter to transport the AGENA "B" vehicle between LMSD, Santa Cruz Test Base, and Vandenberg Air Force Base.

(2) An AGENA "B" facilities checkout vehicle for use at Vandenberg Air Force Base was completed late in April. This vehicle is capable of facilities checkout for the DISCOVERER, SAMOS and MIDAS Programs.

c. Biomedical Capsules

Upon arrival at LMSD of the test capsule (USE-77), specialized biomedical environmental testing of flight components will begin. Vibration, centrifuge and impact tests designed to assure reliable flight operation will be conducted. The capsule is scheduled for delivery early in May.

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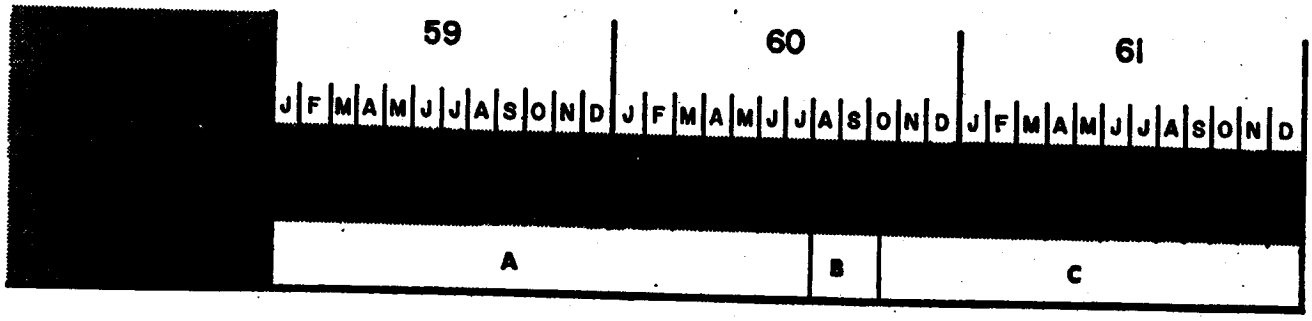

A. THOR—SM-75 / AGENA "A"

B. THOR—DM-21 / AGENA "B"
MB-3 Block 1 / XLR81-Ba-7

C. THOR—DM-21 / AGENA "B"
MB-3 Block 2 / XLR81-Ba-9

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 36 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.*

TABLE 1.

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SAMOS PROGRAM

1. This report, covering progress during the month of April 1960, is submitted in accordance with Department of Defense memorandum to the Secretary of the Air Force, dated 27 February 1960. The first three SAMOS flights are programmed to carry a dual payload including both visual and ferret reconnaissance system packages. Future flights will carry single-system payloads. Payloads are being developed to attain progressively higher levels of performance, as follows:

a. Visual Reconnaissance Systems

Readout:

E-1 - Component Test Payloads.
E-2 - Steerable Reconnaissance Payloads (with 20-foot ground resolution).

Recoverable:

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

b. Ferret Reconnaissance System

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).

2. TECHNICAL STATUS

a. Second Stage Vehicles

(1) The AGENA vehicle for the first SAMOS flight is undergoing system checks in the System Test Area. Late delivery of airborne communications equipment, vehicle wiring changes and problems encountered in completion of the systems checkout complex has caused a one-month delay. The UHF narrow band transmitter was delivered on 14 April, the wiring changes were completed on 6 April. The Systems Checkout Complex is complete except for equipment to check out the UHF wide band transmitter. Completion of systems tests and shipment to Santa Cruz Test Base for hot firings is scheduled for mid-May.

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(2) The second AGENA flight vehicle was delivered to the System Test Area on 11 April.

(3) Final assembly of the third and last AGENA "A" vehicle is in progress. This vehicle will be delivered to the Systems Check Area on schedule.

(4) Design efforts for the first of seven AGENA "B" vehicles scheduled to carry the recoverable payload (E-5) are proceeding on schedule.

b. Visual Reconnaissance Systems

(1) Readout:

(a) The second E-1 payload has successfully completed 19-hour and 48-hour operational tests and was accepted at Eastman Kodak on 14 April. The payload is being prepared for subsystem testing and installation in the vehicle.

(b) A thermal model of the E-1 payload also was delivered during the month. This model will be used for additional environmental testing.

(c) Modification and checkout of the third E-1 payload is continuing.

(2) Recoverable:

The basic design approach was established and preliminary interface problems involving the E-5 recovery payload were resolved during this report period.

c. Ferret Reconnaissance Systems

(1) Significant refinements were made in F-1 payload design during the report period. Circuitry improvements being tested on an F-1 service test model at Airborne Instruments Laboratory indicate a [redacted]

(2) Environmental tests of the F-2 thermal mockup were conducted in the high altitude temperature simulator early in April. Preliminary analysis of the test results indicate that the use of surface coatings will provide the required thermal control for all orbital conditions.

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(3) Installation of the F-1 data conversion equipment at the Satellite Test Center was completed ahead of schedule. This equipment converts the F-1 payload digital data for data processing. Checkout and preliminary system testing will start soon.

d. Communications and Control

(1) 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. Because of the tight delivery schedule, installation of the transmitter will be accomplished at Vandenberg Air Force Base on early SAMOS vehicles.

(2) Seventy percent of the UHF ground system equipment has been delivered to Vandenberg Air Force Base and installation has been started. The majority of angle tracker ranging system and data receiving equipment components (including the 60-foot tracking and acquisition antenna) are on the site. The command transmitter antenna also has arrived at Vandenberg Air Force Base.

(3) The first of the three AN/GPS-T1A calibration vans was received at LMSD on 8 April. These vans will be used to transmit calibrated signals to F-1 and initial F-2 payloads in orbit. The first van will be used for crew training and will then be transported to its assigned station along US Highway 30. Vans 2 and 3 will be placed at 400 mile intervals along this highway. These vans are scheduled to be delivered during May.

(4) Installation of the first Model 1604 computer and most of its support equipment in the Satellite Test Center was accomplished on time. Acceptance tests, which include 72 hours of computer operation using programs and operations with known results, were completed late in April.

e. Ground Support Equipment

(1) The vacuum test chamber (for use in leak testing E-1 and E-2 payloads prior to launch) and the E-1 test console were shipped to the Missile Assembly Building at Vandenberg Air Force Base during the first week in April.

(2) 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.

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(3) Delivery of the operating console and the ground reconstruction electronics equipment with repeater kinescope for the Vandenberg tracking and acquisition station is scheduled during May.

(4) Systems Checkout Complex 1A is now in use testing the first SAMOS vehicle at LMSD. The last two consoles for checkout complex 2A in the Vandenberg Missile Assembly Building were delivered on 26 April.

(5) Acceptance testing of the launch monitoring control equipment for Point Arguello Pad 2 was completed on 25 April at LMSD. Installation of the launch control equipment for Pad 1 is nearing completion. All ground handling and service equipment for both pads has been delivered to the launch site and installation of the equipment at Pad 1 is essentially complete.

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MIDAS PROGRAM

1. This report, covering progress during the month of April 1960, is submitted in accordance with Department of Defense memorandum to the Secretary of the Air Force, dated 27 February 1960.

2. FLIGHT TEST STATUS

a. Preparations for the second MIDAS flight continued during the month. This flight has been rescheduled from late March to 12 May to correct minor technical problems. The diodes in the AGENA flight control package have been replaced and a special wiring inspection and servicing was accomplished to improve reliability. Pre-launch preparations are currently being conducted to meet the 12 May launch date.

b. AFBMD has authorized preliminary planning and design work for two additional MIDAS flights using THOR/AGENA vehicles from the DISCOVERER Program. These flights, scheduled for late this year, are contingent upon the results of the second MIDAS flight. These THOR boosted flights would be launched into polar orbits from Vandenberg Air Force Base. To eliminate the necessity of rotating the pad installations, which are oriented for near westerly flights, the THOR booster would have a roll programmed after liftoff. The payloads would be the "B" prototype Baird-Atomic scanner, modified for flight purposes, and the Aerojet-General scanner No. 3. Ground support equipment used for flights one and two would be transferred from the Atlantic Missile Range (AMR) to Vandenberg Air Force Base to support these additional flights. Specific objectives of the proposed interim flights will be:

(1) Test and evaluation of payload and ground equipment compatibility during all phases of operation.

(2) Obtain basic payload data for evaluation and analysis.

c. An investigation is being made of the feasibility of extending MIDAS operational system capability to provide worldwide coverage, including detection of IRBM and Fleet Ballistic missile launches. The study will consider the number of additional satellites and ground stations required to support this expanded program. The final report on this study is due in June.

3. TECHNICAL PROGRESS

a. Second Stage Vehicles

(1) Design and fabrication of the AGENA "B" vehicle for the third MIDAS flight is proceeding on schedule with completion programmed

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for 11 July. Because of longer prelaunch pad time than originally scheduled, the launch date will probably be delayed from December 1960 to early 1961.

(2) A program has been developed to test the structural design of the solar auxiliary power array. Two types of tests have been proposed: static - to subject the array to torsion and compression loads; and dynamic, to subject the orbital conditions which will be experienced by the solar array.

b. Infrared Scanners

The following infrared scanner unit designs are included in the current MIDAS Program:

Flights 1 and 2 - Aerojet-General Corporation.
Flights 3, 4, and 5 - Baird-Atomic, Inc.

(1) Acceptance of the first Baird-Atomic scanner has been delayed until 22 May. Binding of the turret bearing during low temperature tests in the high altitude test chamber resulted in schedule slippage for redesign of this bearing. A new bearing has been delivered to Baird-Atomic for installation in the scanner.

(2) The development of the two Baird-Atomic display consoles is proceeding on schedule. The first console is scheduled for delivery on 15 June; the second will arrive approximately one month later.

c. Facilities

(1) The Air Force site survey team has completed its investigation of possible tracking station sites in Southern Rhodesia. This station will provide AGENA restart data on MIDAS flight 3 and subsequent. Of the fifteen potential sites visited, four were selected as acceptable. Two sites are in the vicinity of Salisbury and two are near Bulawayo. The United States Consul General in Rhodesia has entered into negotiations with Rhodesian officials for a site allocation.

(2) Surveys are being continued to locate a suitable site for the North Atlantic station.

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(4) Construction of North Pacific station technical facilities at Donnelly Flats, Alaska, and support facilities at Fort Greely, Alaska, was resumed on 1 April. Facilities are scheduled for completion on an incremental basis from July through October 1960.

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