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MILITARY SATELLITE PROGRAMS PROGRESS REPORT
Month Ending 31 December 1960
DD-DR&E(M) 397

FOREWORD

Attached are the reports covering progress during the month of December 1960 for the DISCOVERER 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

2 Atchs
1. ~~(S)~~ DISCOVERER Program
2. ~~(S)~~ MIDAS Program

DOWNGRADED AT 12 YEAR
INTERVALS; NOT AUTOMATICALLY
DECLASSIFIED. DOD DIR 5200.10

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DISCOVERER PROGRAM

1. This report, covering progress during the month of December 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. DISCOVERER XVIII Flight

(1) DISCOVERER XVIII was launched from Vandenberg Air Force Base at 1221 PST on 7 December. This vehicle was the first combination of the infrared DISCOVERER configuration. The booster was the DM-21 with the MB-3, Block 2 engine, and the second stage was an AGENA "B" with the Bell XLR81-Ba-9 engine which includes a 45:1 area ratio nozzle.

(2) Liftoff and booster operation were normal. THOR main engine cutoff occurred as planned at an altitude of approximately 46.4 nautical miles and a velocity of 11,080 feet per second. The AGENA "B" engine ignited as programmed and operated for 234.7 seconds, providing an injection velocity of 25,900 feet per second. The resulting orbit has a 380 nautical mile apogee, a 133 nautical mile perigee and a period of 93.67 minutes.

(3) All systems operated satisfactorily, remaining within prescribed limits. Attitude stability was maintained and ground-to-space communications were normal. On the 48th orbit, after three days exposure to the space environment, a successful capsule ejection was accomplished.

(4) All elements of the recovery force were on station at the time of parachute deployment. C-119J number 3 obtained a bearing on the descending capsule with its FLR-2 direction finder equipment. The descending capsule and parachute were sighted at 1531 PST at a distance of five nautical miles and an altitude of approximately 40,000 feet. Three other C-119J aircraft reached the area in time to observe the descending capsule. At 1542 PST aircraft number 3, flying at 10,200 feet altitude at an IAS of 122 knots, snagged the parachute on its first attempt. The capsule, in good condition, was reeled aboard the aircraft at 1558 PST. The DISCOVERER XVIII capsule was the fourth to be recovered from orbit and the first to be recovered after more than three days in orbit. Subsequent to capsule ejection, the AGENA vehicle was reoriented to a normal ejection attitude. A stable attitude-on-orbit was recorded through the 89th orbit. After this orbit, sufficient electrical energy was not available to maintain a prescribed attitude.

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(5) Biomedical experiments similar to those carried in DISCOVERER XVIII were carried as part of a continuing effort to gain more knowledge about the space environment. Only preliminary results are available, but indications are that all experiments were successful.

b. DISCOVERER XIX Flight

(1) DISCOVERER XIX was launched from Vandenberg Air Force Base at 1237 PST on 20 December carrying a non-recoverable radiometric payload furnished by the MIDAS Program. Booster and second stage performance were near nominal. A comparison of programmed and actual orbital parameters is shown in the following table:

PARAMETER	PROGRAMMED	ACTUAL
Apogee, nautical miles	343	348
Perigee, nautical miles	113	104
Inclination Angle, degrees	81.82	83.48
Eccentricity	0.0313	0.0326
Period, minutes	92.97	92.86

DISCOVERER XIX Programmed and Actual Orbital Parameters

(2) Telemetry data obtained during the period of reorientation to a nose-aft horizontal attitude indicated a very rapid loss of control gas pressure. This nitrogen-freon mixture is exhausted through reaction jets in response to guidance system signals and provides the motive force to maintain satellite stability on orbit. When the satellite was acquired by Kodiak on its first pass, the gas supply was completely exhausted and the satellite was unstable. The reasons for the control gas loss have not yet been been determined. The most probable cause from analysis to date indicates an electronic equipment malfunction occurred.

(3) The oscillations of the satellite throughout its active lifetime resulted in communications difficulties caused by mis-orientation of vehicle antennas. This affected radar tracking, command reception by the satellite, and ground data reception. The communications operations were accomplished; however, and substantial amounts of useable data were obtained about satellite and payload operation. The payload gathered background infrared radiation data for use in the MIDAS Program.

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c. Balloon Drop Tests

(1) During the week of 12 December, two high altitude balloon drops were conducted on the backup, two stage DISCOVERER Mark 4/5 vehicle recovery parachute. On the first test all systems performed within specifications. During the second test the balloon ruptured prior to reaching the drop altitude. This test has been rescheduled for 4 January.

(2) Four drop tests were conducted at Vandenberg Air Force Base on 19 December to determine the radar reflectivity of the Mark 4/5 vehicle parachute. These tests established the compatibility of the proposed parachute metalized configuration with the APS-95 radar now installed in the RC-121 aircraft.

d. Biomedical Test Program

(1) The capsule recovered from DISCOVERER XVII in November and DISCOVERER XVIII in December each contained a Biopack and an Emulsion Block as part of a special BIOASTRONAUTICS research project. Results of the DISCOVERER XVII experiments are nearly complete and are included. Preliminary results of the DISCOVERER XVIII experiments will be available in January. The results of these experiments cannot be considered conclusive, however, until further experimentation is conducted in these areas to provide confirming evidence.

(2) The purpose of the Emulsion Block was to detect and measure cosmic radiation in the space environment. The Emulsion Block carried on DISCOVERER XVII was overexposed because an intense solar flare occurred during the fifty-hour flight. As yet no significant information is available.

(3) The purpose of the Biopack was to determine the effect of cosmic radiation on biological samples and to correlate biological effects with types and intensities of the measured radiation. The Biopack (an aluminum can of approximately three inches in diameter and seven inches long) contained human gamona globulin, rabbit antiserum, lead-shielded nuclear track plates, dosimeters, neutron-sensitive film, cultures of algae cells and bacterial spores, ylterium foil, albumin, analine and Rose-chamber cultures of living human cells.

(4) Despite the exposure to the intense solar flare the radiation dose received inside the Biopack was found to be about 30 rad. This is considered to be a tolerable level for human exposure. Preliminary analysis of the DISCOVERER XVIII Biopack, which was not exposed to a solar flare, shows a dosage of 100 millirad. This radiation level is lower than the limits prescribed for people working in Atomic Energy

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Commission facilities. Although the satellite passes through the outer Van Allen radiation belt four times on each orbit, no electrons entered the can. This effect requires further study. Dosimeters wrapped in lead showed a higher exposure to dangerous radiation than those protected by aluminum. The experiment suggests that heavy shielding may be dangerous during solar flares.

(5) Exhaustion of the nutrient media caused early degeneration of the human cells. Although some cells revived in new media, there is no evidence that the cells were affected by radiation. The cells are being kept alive to determine if any mutations occur in succeeding generations. Algae cells are under consideration as a means of providing oxygen, protein fat, and removal of wastes during human space travel. The algae were virtually unaffected during the flight and did not undergo mutation. Bacterial spares were not harmed by space radiation, but were capable of surviving a postflight treatment which killed unexposed spores. This effect is being investigated as a possible basis for a spore system of radiation measurement.

e. Facilities

(1) Construction has started on modifications to Complex 75-1, Pad 1, at Vandenberg Air Force Base. The pad is being activated to support the DISCOVERER Program. The first DISCOVERER flight from this pad is scheduled for May.

(2) The scheduled conversion of Complex 75-3, Pads 4 and 5 (the only two currently active DISCOVERER pads) to new propellant loading and pressurization equipment, and launch monitor and control equipment will start early in 1961.

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MIDAS PROGRAM

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

2. PROGRAM ADMINISTRATION

Revisions to the 24 October proposed MIDAS Development Plan have been completed. The document to be printed in early January reflects the guidance received during the 4 November briefing to the Air Force Ballistic Missile Committee.

3. FLIGHT TEST STATUS

a. Radiometeric Measurement Flight (RM-1)

(1) The RM-1 flight, DISCOVERER XIX, was launched from Vandenberg Air Force Base at 1237 on 20 December. This non-recoverable vehicle carried a MIDAS radiometer designed to gather and telemeter to ground stations background infrared radiation information. The satellite provided data for approximately four and one-half days, as planned. The radiometer functioned well and valuable data has been acquired; however, because of a tumbling satellite, data analysis has been made more difficult. Reduction and analysis of this data is now in progress.

(2) The radiometer telemetry consisted of four temperature channels, taking readings from various points on the radiometer; three data channels in the 2.7-micron region and three in the 4.3-micron region; and two reference channels, one for each of the two radiation regions being measured. These reference channels provided a means of calibrating out any variations in the sensitivity of the radiometer detectors which might have resulted from such factors as temperature variation. All channels, with the possible exception of the 4.3-micron reference channel, functioned properly; some early data on that channel appear to be erratic.

(3) Background data were obtained from all three channels in both the 2.7- and 4.3-micron regions. The horizon crossing can be identified from these readings, and this will assist in more accurately determining the attitude of the satellite in orbit. The tumbling of the satellite makes the data handling and reduction problem somewhat more difficult, but the background radiation data received will prove very useful. A preliminary evaluation indicates that the brightness of the background radiation in the 2.7- micron region is approximately as anticipated, and somewhat higher in the 4.3- micron region.

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(4) The nitrogen-gas cooling system for the 4.3- micron channel functioned perfectly during the flight. Termination of transmission resulted from battery degeneration; no component problems were encountered.

(5) In addition to the normal tracking stations, Atlantic Missile Range Stations 1 and 12, [redacted] and Woomera, Australia, were utilized for payload telemetry readout.

b. Future Flights

(1) A second flight, designated RM-2, is scheduled for 24 January. An identical radiometer will be carried.

(2) The third MIDAS satellite vehicle, which has encountered considerable delays in manufacturing, is scheduled to complete the systems test phase on 14 January. Radiation interference with the horizon sensor remains a problem with this vehicle. General Electric has sent two engineers to Lockheed Missiles and Space Division to assist in resolving this difficulty. ATLAS booster 97D was erected on Point Arguello stand number 2 on 9 December. All other elements required for MIDAS III (launch pad and tracking stations) are being held to schedules developed to support the original 28 February launch date. The MIDAS III launch has now been rescheduled for 21 March 1961.

4. TECHNICAL PROGRESS

a. Second Stage Vehicles

(1) MIDAS IV is scheduled for launch in early May. The AGENA vehicle is in the Systems Test Facility and is on schedule. The ATLAS booster for this flight is on schedule.

(2) The AGENA vehicle for MIDAS V has completed final assembly.

(3) All testing of the MIDAS heat shield has been completed at Arnold Engineering Development Center. Evaluation of data indicate that the temperature within the aft equipment rack will be well within the established specifications. An eight pound weight reduction was accomplished in the development of the shield.

b. Infrared Scanners

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

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(1) Preliminary acceptance of the infrared detector payload for MIDAS IV has been completed. A series of additional tests are currently being performed to provide further information on the precision and accuracy of the payload's detection measurements. Delivery is anticipated in early January.

(2) Aerojet-General has initiated the reliability testing program being performed in connection with the development of the advanced payload to be used on flights 6, 7 and 8. The program consists of accelerated life testing and stress testing of payload parts and will continue for an extended period.

(3) The Aerojet-General proposal for the Series IV infrared detection payload has been received. The Series IV payload will be carried on flights 9 and subsequent. The Baird-Atomic proposal is due on 7 January.

c. Ground Support Equipment

(1) Installation and checkout of the initial Baird-Atomic ground presentation equipment in the Satellite Test Center has been completed. This equipment consists of a ground stabilization unit and a command and monitor console. In addition to providing a ground-stabilized presentation of the payload readout, the equipment permits direct visual observation of the non-stabilized image transmitted by the scanner. A second set of equipment will be installed at Vandenberg Air Force Base.

(2) The MIDAS Missile Assembly Building at Vandenberg Air Force Base has virtually all equipment installed. Completion of checkout is anticipated for 31 January. Complete installation of the launch control system at Vandenberg Air Force Base is expected on 4 January, with checkout accomplished by the end of the month.

(3) Orbital tracking, telemetry, and control station equipment will be ready at the Vandenberg Tracking Station, the Northeast Station, and the Hawaiian Station to support MIDAS III. The mobile tracking van, which will receive telemetered data on engine restart performance will be ready in March. Full readiness at the Satellite Test Center is not expected prior to 10 April; however, this facility can support the currently scheduled flights with partial capability. No problem exists relative to MIDAS III.

d. Facilities

(1) Preliminary action has been initiated to select the architect-engineer for design of the TCC. The Lockheed Missiles and Space Division is preparing the design criteria.

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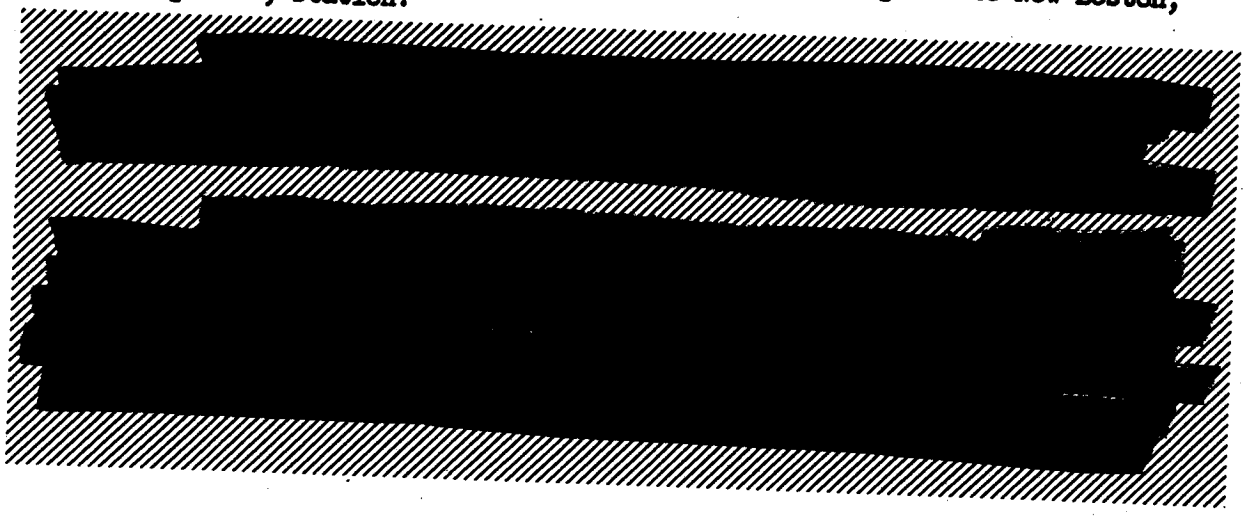
(2) Progress is being made in the selection of an architect-engineer for the design of a Technical Support Building at the New Boston, New Hampshire, station.



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