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HEADQUARTERS

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

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WDLPM-4

9 November 1960

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

FOREWORD

Attached are the reports covering progress during the month of October 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.

*for Robert W. Hoffman*  
O. J. RITLAND  
Major General, USAF  
Commander

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

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DISCOVERER Program Progress Report

1. This report, covering progress during the month of October 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 XVI Flight

(1) DISCOVERER XVI was launched from Vandenberg Air Force Base at 1226 PDT on 26 October. DISCOVERER XVI was the first launch attempt of an AGENA "B" vehicle. Countdown was normal and DM-21 performance was satisfactory except that the vernier engines did not operate after main engine cutoff. Normally, the vernier engines burn nine seconds longer to damp out any attitude errors induced during main engine thrust decay.

(2) Following cutoff of the DM-21 main and vernier engines, the AGENA Subsystem D timer is programmed to initiate a series of events which should result in injecting the satellite into its planned orbit. These events include firing explosive separation bolts, activating satellite control and stabilization equipment, firing the retro-rockets on the adapter, firing ullage rockets, initiating AGENA engine firing and reorientation events. A failure in the timer prevented successful separation of the THOR and AGENA and the satellite plunged into the ocean 660 nautical miles downrange.

(3) Telemetry data reveal that the signal initiating separation was not sent by the sequence timer. A malfunction within the computer rendered the sequence inoperative. The computer has been modified to prevent a recurrence of this problem.

b. DISCOVERER XVII

The launch of DISCOVERER XVII is now scheduled for early November. The AGENA vehicle has been delivered to the launch pad for checkout and installation on the DM-21 booster. DISCOVERER XVII will carry an advanced engineering test payload, optical tracking lights and an Applied Physics Laboratory doppler beacon. Flight objectives are similar to previous DISCOVERER flights, except that in the event the satellite is performing satisfactorily on orbit a decision may be made to de-orbit after two days instead of one.

c. Radiometric Measurement Flights

The Radiometric Measurement flights are currently scheduled for mid-December and early February. The purpose of these flights is to gather infrared background radiation data for the MIDAS program. No attempt will be made to recover the payloads on these flights.

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3. TECHNICAL STATUS

a. Mark II Capsule Tests

(1) A completely successful orbital simulation test of the Mark II biomedical capsule with a live female Rhesus monkey passenger was conducted in October. The monkey was put in the life cell of the capsule on 21 October at Vandenberg Air Force Base during a simulated launch countdown. The sealed capsule was then flown to Sunnyvale and placed in the high altitude simulator on 22 October. It was removed from the simulator on 24 October. The primate was dependent upon the life cell for its existence throughout the 65-hour period. This is twenty percent longer than required by project specifications. The 42 hours the capsule was in the high altitude chamber is the longest time in the United States space programs history an animal has been confined under orbital conditions.

(2) The primate emerged from the life cell in an exceptionally vigorous condition. She lost about a half pound in weight, as expected, and exhibited very mild effects of exposure to carbon monoxide. The results demonstrated that the capsule can sustain a primate in satisfactory condition for a longer period than required by present DISCOVERER flight objectives.

b. Mark II Life Cell Operation

(1) The life cell uses a closed cycle ducted air regeneration system pressurized to approximately one-half atmosphere. During normal operation, the cell atmosphere contains a mixture of oxygen, carbon dioxide and water vapor. Some carbon monoxide is also present. The mixture is regenerated by the filtering action of lithium hydroxide, lithium chloride and activated charcoal. Pure oxygen is introduced into the system by a pressure regulated valve.

(2) The monkey is trained to operate a lever in response to a red light which can be turned on by the vehicle programmer or by command from the ground. The purpose of the device lever is to provide a psychomotor performance measure, in order that evaluation of space environment stresses upon high order functioning may be made. The primate must operate the lever back and forth as long as the light is on. If she holds the lever in any position longer than 2 1/2 seconds, she receives a shock. A feeder provides pieces of parafine covered apple at regular intervals throughout the test. The animal is instrumented to provide data on her condition and a camera photographs her every three seconds throughout the mission.

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c. Second Stage Vehicles

(1) Three AGENA vehicles, in addition to those scheduled for DISCOVERER XVII and XVIII, have been accepted by the Air Force. Eight other AGENA vehicles are proceeding through manufacturing and systems tests on schedules compatible with present launch requirements.

(2) The XLR-81Ba-9 engine (Serial No. 306) completed the final start-stop test in the Preliminary Flight Rating Test program satisfactorily. Upon completion of component functional checks the engine was shipped to Bell Aircraft for use in the reliability program which began on 25 October. Vibration tests, with an XLR-81Ba-9 engine installed in a mount with a higher natural frequency than previously used were conducted with satisfactory results. The engine was tested in the longitudinal and lateral planes. Testing in the vertical plane is scheduled next.

(3) Two XLR-81Ba-9 thrust chambers developed blisters in the hardkote coating of the barrel section during hot firing acceptance tests conducted at the Bell facility. These chambers were coated using the new cleaning and handling procedures which were expected to eliminate this problem. The cause of the blistering is being analyzed.

d. Balloon Drop Tests

A two-stage parachute development program is currently being conducted. This program includes high altitude balloon drop tests to evaluate system operation and select a radar reflective parachute pattern compatible with the APS-95 radar.

e. Capsule Ablative Shell

The capsule ablativ shell used on DISCOVERER XVI was constructed of phenolic nylon. Since this material exhibits certain advantages over the previous shell, it will be used on subsequent flights. During the qualification tests, under low pressure and high temperature conditions, this material was found to crack circumferentially on the ojive and conical skirt section. The development program initiated to correct this condition resulted in the machining of stress relieving grooves in the ojive of the shell. This configuration has successfully passed qualification tests in the high altitude test chamber with only minor cracks occurring. Extensive tests have indicated that minor cracks, as experienced in the stress relieved shells, does not materially degrade the structural and ablativ integrity of the shell. Other manufacturing techniques are being studied in an effort to eliminate this minor cracking.

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f. Facilities

An additional capsule tracking facility is being installed on Tern Island, northwest of Hawaii. This station will be operative by 15 December and will provide additional capsule position data during re-entry to increase the possibility of recovery.

  
MIDAS Program Progress Report

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

2. PROGRAM ADMINISTRATION

a. The MIDAS Development Plan was completed on 24 October and was presented to Headquarters, ARDC, Headquarters USAF and AFBMC during the week of 31 October. The new plan stresses complete system development, increases the number of development test launches and provides back-up development efforts to provide a higher confidence of success.

b. Representatives of AFEMD visited the Lincoln Laboratory to review progress on MIDAS System Analysis effort. Encouraging progress is being made in system data analyses; in efforts to tape and then perform computer studies of data from the impending MIDAS 3, 4 and 5 launches; special studies on remote station data system configurations; and data display systems. A series of reports, beginning in November, will detail the results of the Lincoln efforts and give their recommended courses of action.

3. FLIGHT TEST STATUS

The vehicle for the third MIDAS flight is expected to complete the systems test phase on 9 December. A reworked horizon scanner was received from General Electric on 15 October, as scheduled. Since bench tests indicated that the scanner is sensitive to RF interference, it was decided to eliminate the RF transient noise with the unit installed in the satellite vehicle. The scheduled launch date for this flight is still 28 February 1961.

4. TECHNICAL PROGRESS

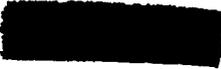
a. Second Stage Vehicles

(1) The fourth MIDAS satellite is in the final assembly phase of manufacturing. Completion is being delayed because of electronic equipment shortage and intensive schedule recovery effort has been initiated. Based on current delivery schedules for delinquent items, the vehicle is expected to complete final assembly on 10 November.

(2) The fifth MIDAS satellite is currently on schedule in final assembly. However, critical equipment shortages, similar to those which occurred with the fourth vehicle, could occur. A major effort is being made to avoid this situation.

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b. Infrared Scanners

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

(1) The first Baird-Atomic, Inc., flight article payload is currently being optically checked in the Lockheed collimator. Air Force acceptance of this unit is expected shortly. This payload will be carried in the third MIDAS satellite in a 2,000 nautical mile orbit.

(2) An engineering model of the Aerojet-General advanced scanner will be delivered in January.

c. Radiometric Measurement Flights

(1) The background radiometer which will be carried on the RM-1 flight is currently undergoing test in the Lockheed high altitude temperature simulation chamber. When this series of tests is completed the unit will be shipped to Vandenberg Air Force Base for compatibility checks and assembly with the satellite vehicle. The purpose of this flight is to gather infrared background radiation data. This flight is currently scheduled for December.

(2) The second background radiometer, for the RM-2 flight, is currently under construction. It is anticipated that this unit will be shipped to Vandenberg Air Force Base late in December.

d. Van Allen Belt Radiation Measurement Flights

Instrumentation will be carried on the MIDAS 3 and 4 flights to measure nuclear radiation in the Van Allen belt. Since the lower Van Allen region extends from 1200 to 2400 nautical miles above the surface of the earth; the MIDAS satellites, orbiting at 2000 nautical miles, will be functioning in the belt. This instrumentation will have its own telemetry and will be concerned primarily with radiation above the 100 mev range. The instrumentation will include means of measuring the proton radiation flux. It will also include photovoltaic cells, similar to those used in the solar auxiliary power array, which will be exposed to Van Allen belt radiation to determine the decrease in short circuit current as effected by radiation damage.

e. Solar Auxiliary Power Array

Component compatibility tests have been conducted with the full-scale model of the solar auxiliary power array. The full array,

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including stepping motors, was operated by exposure to sunlight and refrigerated batteries were used to simulate orbital temperature conditions. The performance of the array was entirely satisfactory and the current generated exceeded expectations.

f. Ground Support Equipment

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(2) On 19 October, an agreement was reached on the technical approach to be used in modifying the Vandenberg Air Force Base 60-foot antenna. These modifications will comply with the requirements of SAMOS, MIDAS, and ADVENT programs.

(3) The provisioning of data handling equipment (PICE peripheral equipment) for the New Boston station is currently a problem. Solutions are under investigation which, if successful, will permit support of MIDAS operations on schedule.

g. Facilities

(1) The heated vehicle storage building at Fort Greely was completed on 31 October. Completion of the combined dormitory and dining hall facility is scheduled for completion on 30 December. 1012  
Construction of the Donnelly Dome microwave relay station is proceeding on schedule toward a 15 December completion date.

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(4) Construction of support facilities at the New Boston station is on schedule.

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