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MILITARY SATELLITE PROGRAMS PROGRESS REPORT
Month Ending 30 June 1960
DD-DR&E(M) 397

FOREWORD

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

for Harry L. Evans
O. J. RITLAND
Major General, USAF
Commander

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DISCOVERER PROGRAM

1. This report, covering progress during the month of June 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 XII Flight

DISCOVERER XII was launched at 2300, GMT, on 29 June 1960 from Pad 4 of Complex 75-3, Vandenberg Air Force Base. The countdown proceeded satisfactorily with minor technical holds for ground support equipment. The major hold was caused by weather. The launch, first stage trajectory, engine cutoff, and separation were normal. AGENA engine ignition, thrust, and engine cutoff were also normal. However, the satellite failed to achieve orbit. Telemetry data indicate that the AGENA vehicle was in a pitch down attitude during engine operation causing the vehicle to re-enter the atmosphere. Subsequent investigation has isolated the cause of the improper pitch attitude to the horizon scanner. A thorough examination of the horizon scanner operation and checkout is being conducted to determine the reason for malfunction and to correct the condition prior to the launch of DISCOVERER XIII.

b. DISCOVERER XII Diagnostic Payload

DISCOVERER XII carried a diagnostic payload in addition to the normal recovery equipment. This payload contained instrumentation to determine capsule environment and the functioning of separation and recovery sequence events. A five channel telemetry system was installed to transmit the data obtained to the ground stations. To assure receipt of all data, a tape recorder was provided to record the real time events and capsule performance during the telemetry "blackout" period which occurs when the capsule re-enters the atmosphere. After a two-minute time delay, this stored data would be transmitted to the ground stations. The high speed of re-entry induces ionization over the skin of the capsule which effectively blocks telemetry transmission. An S-band transponder was also provided to aid in tracking the capsule from ejection through recovery.

3. TECHNICAL STATUS

a. Recovery System Component Test Program

(1) Extensive examination of the results of DISCOVERER flights I-XI has indicated the possibility of tumbling and/or precession of the

capsule upon separation from the AGENA vehicle because one or more of the spin/de-spin rockets failed to fire properly. To correct this condition a "cold gas" spin/de-spin system was incorporated into the DISCOVERER XII payload. The "cold gas" system contains two separate subsystems each supplying a maximum of 195 pounds of thrust with a firing duration of 0.8 seconds. Each system contains a gas bottle (containing a nitrogen and freon gas mixture), a manifold, a squib operated valve, and exhaust jets.

(2) Drop testing of the DISCOVERER capsules continued throughout the report period at Holloman Air Force Base, New Mexico. Originally scheduled for nine drops, the test series has been extended to permit field testing of the capsule parachute system and testing of the retrofiring system. Solid propellant rocket spin/de-spin systems tests were conducted on 24 May. "Cold gas" systems tests were conducted on 25 June. The parachute system tests started prior to the solid propellant rocket test and are still in progress.

(3) For each of the drop tests, the capsule is carried to 100,000 feet altitude. On command from the ground, the capsule is released from a fairing which simulates the AGENA vehicle. During the retrofiring system drop, the ejection programmer within the capsule fires the spin system, the retro rocket, and the de-spin system in the normal ejection sequence. Parachute deployment is also controlled by the ejection programmer. These capsules are fully instrumented to monitor capsule performance and contain telemetry equipment to transmit the data obtained. In the parachute deployment tests the Mach and dynamic loading conditions experienced in actual recoveries are experienced.

b. Second Stage Vehicles

(1) One AGENA "B" vehicle (XLR-81Ba-7 engine) is in storage following Air Force acceptance. Three other vehicles with XLR-81Ba-7 engines have completed hot firing tests at Santa Cruz Test Base and have been returned to the systems test area for rework and a second system check prior to Air Force acceptance. The first two AGENA "B" vehicles using the XLR-81Ba-9 engine are ready for hot firing system testing at Santa Cruz Test Base.

(2) Evaluation and testing of nozzle coatings in an effort to reduce XLR-81Ba-9 engine throat erosion continued during the report period. The test results using a modified fuel injector have been encouraging. Tests of this injector will continue.

(3) Testing the of XLR-81Ba-9 engine (with 45:1 area ratio nozzle) continued at Arnold Engineering Development Center. An engine start and restart firing series covering a temperature range of +120 to -55 degrees F has been completed. The engine is mounted in a modified test stand which permits engine gimballing.

c. Biomedical Capsules

The Advanced Biomedical Capsule Study was completed on 17 June. This study indicated the feasibility of developing a capsule capable of maintaining a chimpanzee in orbit for two days. The capsule would be integrated with the SAMOS recovery vehicle. A final report, preliminary drawings and a full-scale mockup have been prepared as part of the study.

d. Facilities

A van-type telemetry readout and recording installation has been established on Christmas Island. This installation will provide monitoring and recording facilities downrange from Hawaii. The equipment at this installation will monitor all orbital passes within the range of the station, record all telemetry data from the diagnostic payload and from the AGENA vehicle. During the recovery pass, this installation will extend the telemetry reception coverage south of the equator. An additional ship and five telemetry equipped aircraft will be dispersed between Hawaii and Christmas Island to complete the telemetry coverage south of Hawaii.

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SAMOS PROGRAM

1. This report, covering progress during the month of June 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 dual Research and Development payloads 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. [redacted]

(2) Modifications providing improvement in payload auxiliary real time command capability (through increased backup to the airborne communications equipment sequence programmer) are essentially complete for the second AGENA vehicle. Lack of a UHF narrow band transmitter continues to hamper checkout. Subsystem testing is being accomplished with a prototype narrow band transmitter manufactured by Philco.

(3) Deliveries of flight hardware for the third AGENA "A" vehicle will be completed in July. Late availability of components and the recent strike will require intensive efforts to recover current schedules for this vehicle.

(4) The first two AGENA "B" vehicles are in the component and subassembly stages of manufacture, with completion of the first scheduled for mid-September. Assembly continues on schedule.

(5) Because of the attitude control problem experienced on the second MIDAS flight, the first three SAMOS satellites will maintain a horizontal, nose forward position throughout most of the first orbit. Reorientation to the nose-down position will be initiated by stored commands as the satellite comes within range of the tracking acquisition station at Kodiak, Alaska, on its first orbital pass. This change assures completion of tank pressurization venting prior to shutting off the flight control system pneumatics. The forces created by the continuation of venting after switching from the flight control to the attitude damping system are believed to be a major factor in the loss of attitude control. Modifications to the AGENA wiring and airborne components for the first flight article are scheduled to be accomplished during the Vandenberg Air Force Base modification and checkout operation. Modifications for the second and third vehicle will be accomplished at the systems test facility. The AGENA "B" vehicles will incorporate a full time attitude control system and will not require modification.

b. Visual Reconnaissance Systems

(1) Readout

Assembly of K-2 payloads continues on schedule at Eastman Kodak. The film [illegible] system and the [illegible] processor for the first K-2 payload have [illegible] and operational tests successfully. The [illegible] and the assembly are undergoing [illegible] at the contractor's facility.

(2) Recoverable

(a) The first test of an E-5 Recovery Equipment Test Unit (RETU) is scheduled for July at Edwards Air Force Base. The RETU simulates the E-5 recovery capsule in size, weight and aerodynamic configuration. This test series will determine capsule drag and oscillation characteristics during recovery by a C-130A aircraft. Data from these tests will be used to establish design criteria for the E-5 recovery equipment. Additional RETU tests, including the complete recovery sequence, will be conducted later this year.

(b) A mid-February 1961 date has been established for delivery of the first E-5 flight payload.

c. Ferret Reconnaissance Systems

Testing and assembly of componets for the initial F-2 payloads continues on schedule.

d. Ground Support Equipment

(1) Functional tests of the electronics portion of the vacuum test chamber (used for leak testing E-1 and E-2 payloads) were completed by the contractor and the chamber was delivered to Vandenberg Air Force Base. This completes the delivery of major items of the E-1 and F-1 payload ground support equipment for the Vandenberg Air Force Base missile assembly building.

(2) The first set of E-1/E-2 Ground Reconstruction Electronics (GRE) equipment, primary record camera, and repeater kinescope has been delivered to the Vandenberg Air Force Base tracking and acquisition station. The second set of GRE equipment (backup for the first set) was used for compatibility tests with the operating console. At the conclusion of these tests the operating console and the GRE equipment will be shipped to the Vandenberg Air Force Base tracking and acquisition station.

(3) The 144-inch collimator, to be used for the E-2 payload alignment and checkout, has been completed and will be delivered in July.

(4) The first F-2 checkout console has been completed and compatibility tests, using a service test model F-2 payload, are being conducted.

(5) The logic design for the F-2 data conversion and evaluation equipment has been completed. This equipment will be installed in the Satellite Test Center.

(6) The major portion of the telemetry data monitoring equipment was delivered to Airborne Instruments Laboratory on 15 June. This equipment will be incorporated into the F-2 evaluation and command complex for the Vandenberg Air Force Base and New Boston tracking and acquisition stations.

e. Facilities

(1) Installation of all launch operations equipment, propellant loading systems, and high pressure and liquid gas systems has been completed at Point Arguello Pad 1. Subsystem testing of the equipment was completed. Systems test of the facility is in progress using ATLAS 57D and the AGENA facilities checkout vehicle. Construction of Pad 2 is complete, and formal acceptance took place on 8 June.

(2) Modifications to accommodate the Model 1604 computer in the Vandenberg Air Force Base data acquisition and processing building have been completed.

(3) Construction of increment 2 to the Satellite Test Center was completed on schedule. Beneficial occupancy began on 16 June and installation of equipment is in progress.

MIDAS PROGRAM

1. This report, covering progress during the month of June 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. MIDAS 2 was launched from Pad 14, Atlantic Missile Range (AMR), on 24 May. Booster performance was highly satisfactory, with booster, sustainer, and vernier engine cutoffs occurring as programmed. Ascent trajectory was near nominal. The separation sequence was satisfactorily accomplished. Satellite engine ignition occurred within one second of nominal and engine shutdown was initiated at the proper velocity. The resulting orbit was the most perfect circular orbit achieved by the United States, with an apogee of 280 nautical miles and a perigee of 253 nautical miles. The orbital life is expected to be 40 months. Approximately 75 percent of test objectives were attained. Major problem areas during the test were in-orbit stabilization and communications.

b. Although payload and vehicle transmission ceased after the thirteenth pass, some telemetry from the Solar Auxiliary Power Unit Test System (SAPUT) has continued. The purpose of the SAPUT system is to evaluate three types of solar cell coating materials. Because of a failure in the telemetry switching system, only one channel of SAPUT information was received subsequent to orbit pass number one. Transmission characteristics of the SAPUT telemetry provided useful indications of the in-orbit motions of the satellite.

3. TECHNICAL PROGRESS

a. Second Stage Vehicles

(1) Fabrication of the AGENA "B" vehicle for the third MIDAS flight was proceeding on schedule; however, indications are that a schedule slippage will be incurred if the prepent strike at LMSD is not ended quickly. Installation of the engine has been started and assembly of the wiring harness is nearing completion.

(2) The electromechanical equipment that provides directional positioning of the solar auxiliary power array has successfully completed approximately 1000 hours of continuous cycling.

b. Infrared Scanners

Infrared scanner units for flights 3, 4, and 5 are being manufactured by Baird Atomic, Inc.

(1) Manufacture of the first Baird-Atomic, Inc. infrared payload is behind schedule and slippages have occurred in delivery dates for the first three units. This slippage can be partially attributed to deficiencies in the turret bearing and drive motor which were identified during acceptance testing of the thermomechanical equivalent of the Baird payload.

(2) Negotiations have been completed with Aerojet-General Corporation for the development of a service test model of an advanced infrared scanner planned for later MIDAS flights. This model will contain special instrumentation for engineering and life testing and will not be a flight article.

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