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MILITARY SPACE PROJECTS

REPORT OF PROGRESS
FOR
JANUARY - FEBRUARY 1960



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MILITARY SPACE PROJECTS

JANUARY AND FEBRUARY 1960

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OFFICE OF THE DIRECTOR
OF
DEFENSE RESEARCH AND ENGINEERING
Department of Defense
Washington 25, D.C.



Approved

J. B. Macaulay
for Herbert F. York
Director

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DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING
WASHINGTON 25, D. C.

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Progress Report on Military Space Projects for January
and February 1960

Progress on the major Department of Defense Space Projects during January and February 1960 is presented in the attached Military Space Projects Report.

In association with the preparation of these reports by my office, the reporting period has been adjusted one month. Future Military Space Project Reports will cover a full three month period.

Highlights of the report have been included in your letter of transmittal to the President, which I recommend that you sign.

H. B. Macaulay
for Herbert F. York

Inclosure - 1
Military Space Projects Report



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THE SECRETARY OF DEFENSE
WASHINGTON

April 11, 1960

Dear Mr. President:

I am forwarding herewith the Military Space Projects Report for the period of January and February 1960.

One (1) MIDAS and two (2) DISCOVERER launchings were made during February 1960. Unfortunately, due to malfunctions during the boost phase, none were successful in placing a vehicle in orbit. Continuing effort and renewed emphasis is being placed on improving the reliability of components and system testing. Several DISCOVERER, MIDAS and SAMOS vehicles and payloads are nearing completion and it is hopefully expected that a number of successful launchings will be achieved during the current quarter. Tentatively, launching of the second MIDAS, DISCOVERER XI and XII and the second TRANSIT are scheduled for this month.

Project NOTUS (Communication Satellites) is being redirected with increased emphasis placed on an ultimate 24-hour global satellite communication system. The former medium orbit SAC POLAR satellite systems (STEER and TACKLE) and the former 24-hour global system (DECREE) are being reoriented to provide a revised 24-hour global system (ADVENT). The interim communication satellite system (COURIER) is proceeding as previously scheduled with the first launching scheduled for July 1960.

There is included herein a report of progress on the SATURN Project. However, inasmuch as the transfer of the SATURN Project to NASA was officially completed in March, no further progress reports will be made thereon. However, this vehicle has potential military application and the Department of Defense will continue to follow the project with considerable interest and assist in the development thereof insofar as practicable.

With great respect, I am

Faithfully yours,

James H. Douglas
Deputy



Inclosure - 1
Military Space Projects Report

The President

The White House

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PROJECT HIGHLIGHTS

During January and February 1960

On 4 February 1960, DISCOVERER IX was launched from the Pacific Missile Range. The final count-down and lift-off were normal. Instrumentation indicated early termination of booster thrust and short operation of the second-stage engine. Orbital velocity was not obtained. The AGENA vehicle impacted in the ocean about 400 miles south of the launch site. DISCOVERER X was launched on 19 February 1960. Immediately after lift-off, the THOR booster started pitch oscillations and the command destruct signal was sent at T-plus 56.4 seconds.

The first MIDAS flight test vehicle was launched from the Atlantic Missile Range on 26 February 1960. A satellite orbit was not obtained because of a malfunction or failure, which occurred during the boost phase. Preliminary indications are that a malfunction occurred during the firing of the retro-rockets to provide separation of the booster from the AGENA vehicle. The second MIDAS launching has been scheduled for April 1960.

NOTUS Project (Communication Satellites) is being redirected with an increased emphasis towards an ultimate 24-hour global satellite communication system. Former medium-orbit SAC POLAR satellite systems (STEER and TACKLE) and the former 24-hour global communication system (DECREE) are being re-oriented to provide a revised 24-hour global system (ADVENT). In the case of the interim communication satellite system (COURIER), the program is currently limited to two (2) satellite launchings, as previously scheduled, with the first launching scheduled for July 1960 and the second launching for September 1960.

Fabrication of the second-stage vehicles for the first three SAMOS flight tests is proceeding on schedule. These vehicles will carry a combination visual/ferret payload. Visual (photographic) and ferret (electromagnetic) payloads for the first flight test have been delivered and are undergoing functional tests and preparations for installation in the AGENA vehicle. The first launching of a SAMOS vehicle is scheduled for September 1960.

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The over-all program planning and objectives of the SHEPHERD Project (tracking network) are being carefully re-evaluated. The re-evaluation is for the purpose of re-assessing the present and long-range requirements for (1) a SPASUR (dark satellite fence) system, (2) the requirements for additional sensor elements for the detection system, and (3) the national requirements for a Space Surveillance Control Center, which will receive data from any and all sensor systems, compute space vehicle orbits and provide satellite position predictions. This re-assessment of the SHEPHERD Project will include an over-all evaluation of world-wide tracking and sensor requirements in cooperation with the National Aeronautics and Space Administration.

The second attempt to launch a TRANSIT vehicle (navigation satellite) is scheduled for April 1960. This vehicle will be similar to the first TRANSIT vehicle, will transmit on four frequencies: 54, 162, 216 and 324 megacycles, and will include new type nickel-cadmium batteries with increased storage capacity.



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TOPICAL SUMMARY

DISCOVERER PROJECT

(RESEARCH AND DEVELOPMENT SATELLITES)

Project Objectives -
Development and test-
ing of components for
Military Space
Technology Program.

1. Project Objectives

a. The objectives of the DISCOVERER Satellite Program are to conduct research and development on components, equipment, instrumentation, propulsion, data processing, communications, capsule recovery and operating techniques all dealing with military space technology.

b. The DISCOVERER Project consists of design, development, and launch of 29 two-stage satellite vehicles. The first stage is the THOR IRBM, the second stage the AGENA satellite vehicle. Of the AGENA vehicles, 17 are the "A" configuration, 12 the "B" configuration. Later vehicles will use the DM-21 first stage (A THOR IRBM specially designed for space booster duties by removal of all components not necessary for booster missions) and the AGENA "B" second stage (An AGENA vehicle modified to carry double propellant load, and equipped with a restart engine capable of longer burning duration). This program will provide:

(1) Research and component development in support of the SAMOS, MIDAS, and certain other programs using AGENA satellite vehicles.

(2) Tests of the ground communications and tracking network developed for the above programs.

(3) Flight test of the AGENA vehicle and subsystems.

2. Prime Program Objectives

a. Flight test of the satellite vehicle airframe, propulsion, guidance, control system, auxiliary power supply, and telemetry, tracking and command equipment.

Program objectives include development of reliable systems for Military satellite programs.



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- b. Attaining satellite stabilization on orbit.
- c. Obtaining satellite internal thermal environment data.
- d. Test the techniques for recovery of a capsule ejected from an orbiting satellite.
- e. Test of ground support equipment and development of personnel proficiency.
- f. Conducting bio-medical experiments involving the orbiting and recovery of mice and small primates.

This program evolved from Weapon System 117L, Advanced Reconnaissance Satellite.

3. History

The DISCOVERER Project originated as part of Weapon System 117L at the Air Force Ballistic Missile Division. In early 1958, the program management was transferred to ARPA, and subsequently divided into the DISCOVERER, SAMOS, and MIDAS Projects. After several reorientations, the programs evolved into the present configurations. Ten (10) DISCOVERER vehicles have been launched. Six (6) achieved successful orbits, all very close to the planned orbit. These are the heaviest satellites to be placed in orbit by an intermediate range missile by the free world (1,700 lbs plus). Four of these six satellite vehicles achieved complete attitude stabilization in orbit. This is a major requirement for the success of the SAMOS, MIDAS, and other programs using this vehicle. The program has been quite successful in providing flight test data for refinement of the complex systems required for advanced military satellites.

4. Flight Test Progress

DISCOVERER IX was launched from Vandenberg Air Force Base on 4 February 1960. The countdown was smooth and liftoff occurred with all ground and vehicle equipment operating properly. No unusual phenomena were observed during the initial ascent portion of the flight, but instrumentation indicated early termination of booster thrust and short operation of second-stage engine during the latter

DISCOVERER IX was launched on 4 February. It failed to attain orbit due to insufficient velocity.

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portion of the trajectory. Subsequent data analysis indicated the following sequence of events as the probable cause for the malfunction:

a. The THOR booster engine shut down about 19 seconds early, resulting in a booster velocity 4,000 feet per second less than nominal.

b. The helium quick-disconnect malfunctioned at liftoff, causing loss of AGENA vehicle propellant tank pressurization. This resulted in premature shutdown of the AGENA propulsion system. Either of the above events would have prevented the attainment of orbital velocity. The AGENA impacted in the ocean about 400 miles south of the launch site.

DISCOVERER X, launched on 19 February, was destroyed by Range Safety because of THOR autopilot malfunction.

DISCOVERER X was launched from Vandenberg Air Force Base on 19 February 1960. The countdown was smooth, and launch occurred on the first attempt. Immediately after liftoff, THOR booster pitch oscillations began and a command destruct signal was sent at T plus 56.4 seconds. Many major vehicle components were recovered for examination. Preliminary analysis indicated that the malfunction was in the THOR autopilot. Extensive studies are underway to ascertain and correct the conditions leading to early termination of both of the flights.

DISCOVERER XI scheduled for launch in mid-March.

5. Future Flights

DISCOVERER XI was scheduled for launch from Vandenberg Air Force Base during mid-March. This vehicle will carry an instrumented recovery capsule, plus advanced engineering test instrumentation.

TECHNICAL STATUS

1. Airframe

All AGENA "A" vehicles are complete. The first AGENA "B" is complete and at Santa Cruz Test Base.

All of the AGENA "A" vehicles are at Vandenberg Air Force Base in various stages of preparation for launch. Three of the first four AGENA "B" (double propellant capacity, extended burn engine) vehicles are in the Lockheed Modification and Checkout Center, Sunnyvale, California, in various stages of completion. The first AGENA "B" scheduled for flight is complete and is at the Santa Cruz Test Base. This vehicle is planned for use on the 17th flight with

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the first THOR DM-21 Block I booster. No problems with the airframe are known or expected.

The single-burn engine is fully developed. A single-restart long-burn engine is under development.

2. Propulsion

a. The initial AGENA vehicles were delivered with the Bell Aircraft LR81-Ba-3 rocket engine originally developed for the B-58 aircraft. The engine was subsequently modified to burn Unsymmetrical Di-methyl Hydrazine fuel (instead of JP-4) for additional performance, becoming the LR81-Ba-5 engine. In late 1959, a program was initiated to develop an engine of still greater performance. The XLR81-Ba-7 is being developed to provide a single restart and extended burn-time capability.

b. Two XLR81-Ba-7 engines completed Preliminary Flight Rating Tests at Bell Aircraft Company during the quarter. The data will now be reviewed and the engines disassembled and inspected. The XLR81-Ba-7 will power the first four AGENA "B" vehicles.

c. A program to develop an extended nozzle for the restart engine is underway at Bell Aircraft Company. This configuration will be designated the XLR91-Ba-9. The extended nozzle will provide increased performance at altitude. A titanium nozzle has been successfully tested, and this material will probably be adopted for the nozzle.

d. The third phase of hot firings of the XLR81-Ba-9 engine was initiated at the Santa Cruz Test Base during February. This engine is programmed for use on the fifth and subsequent AGENA "B" vehicles replacing all previous configurations.

Two XLR81-Ba-7 engines completed Preliminary Flight Rating Tests.

An extended nozzle is being developed for the restart engine to increase performance.

Enlarged thrust chamber version of the restart engine is being tested.

A light weight hydraulic pump is being developed.

3. Guidance and Control

A fuel-powered hydraulic control system is being developed to save both weight and electrical power. This system, now powered by an electric motor, provides power for satellite engine gimbaling to provide directional control. The fuel-powered unit is driven by fuel diverted from the fuel pump through a hydraulic motor. This, in turn, drives a hydraulic pump. The unit is planned for incorporation into the first AGENA "B" extended chamber configuration vehicle, about the 22nd flight.

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