Copy No.

SPACE PROJECTS

REPORT OF PROGRESS

FOR

JANUARY - FEBRUARY 1960

OFFICE OF THE DIRECTOR
OF
DEFENSE RESEARCH AND ENGINEERING

SECRET

MILITARY SPACE PROJECTS

JANUARY AND FEBRUARY 1960

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

~~SECRET~~

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.

By J. B. Macaulay
Herbert F. York

Inclosure - 1
Military Space Projects Report

REGRADED UNCLASSIFIED
WHEN SEPARATED FROM
CLASSIFIED ATTACHMENT

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) [redacted] 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, [redacted] 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 [redacted] DISCOVERER XI and XII and the [redacted] are scheduled for this month.

[redacted]

With great respect, I am

Faithfully yours,

James H. Douglas
Deputy

Inclosure - 1
Military Space Projects Report

The President

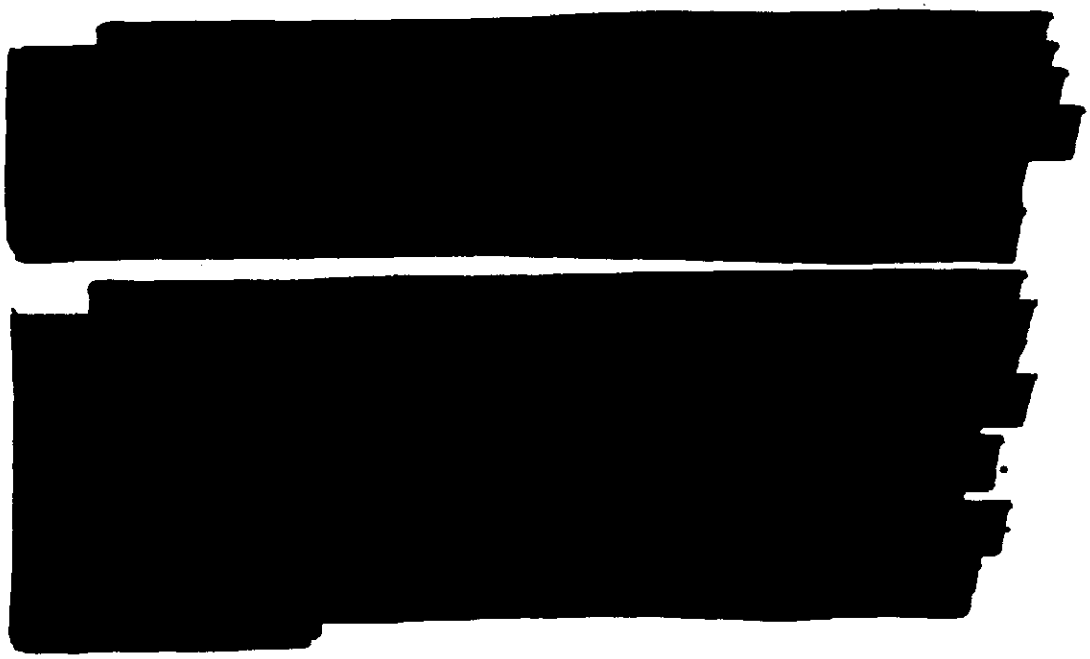
The White House

SECRET

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.

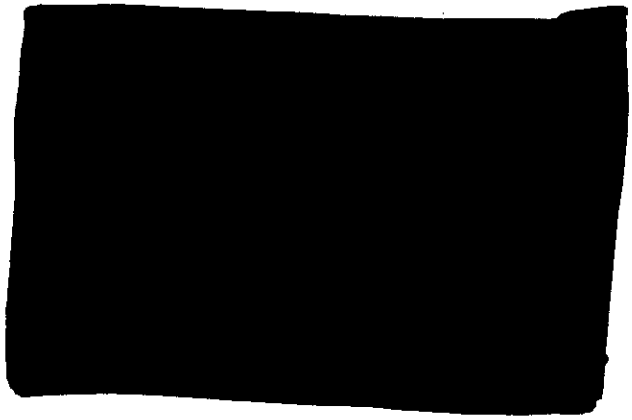


Fabrication of the second-stage vehicles for the first three SAMOS flight tests is proceeding on schedule. These vehicles will carry a combination visual/ferret payload. Visual (photographic) and ferret (electromagnetic) payloads for the first flight test have been delivered and are undergoing functional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

[redacted]

CONTENTS

ILLUSTRATIONS



TOPICAL SUMMARY

D I S C O V E R E R P R O J E C T

(RESEARCH AND DEVELOPMENT SATELLITES)

Project Objectives - Development and testing 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 equipp with a restart engine capable of longer burning duration). This program will provide:

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

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

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

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

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.

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 [redacted] 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 stablization in orbit. This is a major requirement for the success of the SAMOS, [redacted], 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.

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

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

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

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

1. Airframe

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

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.

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

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.

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

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.

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

d. The third phase of hot firings of the XLR81-Ba- 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.

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 gimballing 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.

Biomedical recovery capsule tests were continued during the report period to check capsule design.

4. Biomedical Recovery Capsule

Tests of the biomedical capsule designed for a small primate were resumed in the Lockheed high altitude temperature simulation chamber on 8 February. The General Electric capsule tested utilized several modifications and techniques derived from thermal profile tests in November and proof tests by the School of Aviation Medicine in December. These include increased cooling capacity, refinement of sensor-to-animal attachment methods for telemetry readout, relocation of life chamber components, and reprogramming of psychomotor response stimuli. The first full-duration test of the capsule containing a live primate was completed on 12 February. This 55-hour test, simulating a complete flight, was initiated at Vandenberg Air Force Base with the primate sealed in the capsule. Test results were excellent.

DISCOVERER [redacted]

5. Facilities

[redacted]

a. The Lockheed Missiles and Space Division Plant at Sunnyvale, California, where AGENA manufacturing, modification, and checkout are performed.

b. The Satellite Test Center at Sunnyvale, operated by Lockheed and the Air Force. During orbital tests, the systems are operated from this Center.

c. Santa Cruz, California, Test Base. This base provides facilities for hot firings of satellite vehicle propulsion systems prior to acceptance.

d. The Vandenberg Air Force Base launch site.

e. Tracking stations at [redacted] and [redacted]

f. The Hawaiian Recovery Control Center.

SAMOS PROJECT

(RECONNAISSANCE SATELLITES)

SAMOS to provide both Visual (Photographic) and Ferret (Electromagnetic) data.

1. Project Objective

a. The objective of the SAMOS project is the development of a reconnaissance system utilizing polar orbiting satellites to collect and process visual (photographic) data and ferret (electromagnetic) data. The SAMOS system is expected to acquire a great amount of technical intelligence regarding enemy military and industrial strength.

Acquisition of data by capsule recovery.

b. Two approaches are being developed for acquiring intelligence data: (1) the recovery system - for visual data - in which a capsule is ejected from the satellite and recovered, and (2) the electronic data readout system - for both visual and ferret - in which data is transmitted to ground stations.

Dual payload scheduled for first 3 flights.

c. A combined visual/ferret payload will be tested on the first 3 flights. The first seven ferret payloads (F-1 and F-2) will include progressively more complete installations of receivers and antennas to provide increasingly greater electronic measurement capability. The major portion of the hardware components developed for the original program are usable in the reoriented program.

AGENA vehicles for first 3 flights progressing on schedule.

2. Technical Progress

a. Second-Stage Vehicles

Work on the second-stage (AGENA) vehicle for the first SAMOS flight is 70 percent complete in the Modification and Checkout Center. This vehicle will be the first of three to carry a combination visual and ferret (E-1 and F-1) payload. Assembly of the other two vehicles is proceeding on schedule. Inter design of the AGENA vehicles for flights 4 and subsequent is proceeding on schedule. A common airfram design from the forward equipment compartment aft is

being used for these vehicles and for MIDAS vehicles (flights 4 and subsequent). Equipment installations need not be interchangeable. Substantial progress has been made on the design of the vehicle for the E-5 payload.

b. Payloads

(1) Visual (Photographic) Reconnaissance System

Visual Reconnaissance System payloads are being developed in a minimum number of configurations to attain readout and recovery mission objectives. The designation and purpose of each configuration is as follows:

Readout:

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

Recovery:

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

Functional testing successful on first visual payload.

(a) E-1 Payloads - The first E-1 flight article payload was delivered to Lockheed Missiles and Space Division on 8 February. Functional tests were performed on all components. During a preliminary functional test, with the payload mounted in the collimator, a system resolution of greater than 94 lines per millimeter was obtained. The payload was subjected to a series of three 19-hour tests under simulated orbital conditions, with satisfactory results obtained. The second E-1 payload is undergoing quality evaluation testing at Eastman Kodak. This is a spare payload for component replacement only and will be delivered unassembled to Lockheed Missiles and Space Division before 15 March.

Environmental tests completed on E-2 thermal model payload.

(b) E-2 Payloads - Delivery of the first E-2 payload is scheduled for July. Environmental tests of the thermal model E-2 payload were completed on 28 January in the high altitude temperature simulation chamber. Test objectives were achieved. Changes in the payload housing surface and heater power requirements are being made as a result of test data.

Design progress of E-5 system on schedule.

(c) E-5 Payloads - Design of the high acuity panoramic camera system is proceeding satisfactorily. The special optical glass for the lens elements, which has been ordered from West Germany, will be delivered to the Itek Corporation in mid-April. The Development Test Plan for the recovery capsule has been published, including payload test requirements from checkout through post-launch operations. Avco Corporation is conducting wind tunnel tests on various recovery capsule configurations as a parallel effort with Lockheed Missiles and Space Division aerodynamics studies.

Ground support complex operated successfully.

(d) Ground Support Equipment - The complete visual reconnaissance system ground support equipment complex was operated with the E-1 payload during February. All equipment operated satisfactorily

(2) Ferret (Electromagnetic) Reconnaissance System

Ferret Reconnaissance System payloads are being developed in a minimum number of configuratio The designation and purpose of each configuration is as follows:

F-1--R&D Test Payloads

F-2--Digital General Coverage Payloads

[redacted]

First two F-1 payloads being prepared for installation in AGENA vehicles.

(a) F-1 Payloads - The first two F-1 payloads are being prepared for installation in their respective AGENA vehicles at the Modification and Checkout Center. During payload evaluation tests conducted in January, a discrepancy was indicated in the pulse width measurement circuit. The circuit design is being studied in an effort to solve this problem. Efforts to solve the intermittent time counter errors encountered during systems testing of the third F-1 payload are progressing satisfactorily. Desensitizing the counter stages appears to be the most feasible solution. A breadboard of the desensitized time counte has been installed in an F-1 service test model payload and has been operated satisfactorily for 48 cycles of life testing (equal to approximately three days of orbital operation). The use of line filters is being

studied as an additional effort. Separation tests of the vehicle nose cone were completed satisfactorily during January. Separation tests simulating vehicle-payload attachments were completed satisfactorily during February.

Concepts and characteristics of new F-2 [redacted] defined.

(b) F-2 [redacted] - [redacted] the concepts and basic characteristics for the new F-2 [redacted] payloads have been defined. Work statements in accordance with the new requirements are being prepared for Airborne Instruments Laboratory. Design and modification of some of the payload components affected by the change (i.e. payload structure and antenna assemblies) have been initiated.

F-1 data conversion equipment set for 25 March delivery.

(c) Ground Support Equipment - Delivery of the F-1 data conversion equipment to the Satellite Test Center, Sunnyvale, California, is scheduled for 25 March. Negotiations are underway for the changes to the F-2 and [redacted]

Improved design for VHF antenna tested successfully.

c. Communications and Control Equipment

(1) Design of the exit VHF (Very High Frequency antenna for the satellite vehicle has been refined, using a honeycomb dielectric to support the cavity. A weight reduction of 60 percent was realized and laboratory tests indicate satisfactory performance.

March delivery scheduled for UHF equipment.

(2) Systems and acceptance tests are being conducted on the UHF (Ultra High Frequency) ground equipment for the Vandenberg Air Force Base tracking and data acquisition station.

Equipment delivered for launch pad #1

d. Ground Support Equipment

(1) Ground Handling and Service Equipment - Equipment for Point Arguello launch pad #1 has been delivered and is scheduled to be completely installed and checked out by mid-May.

Propulsion system checkout units delivered to Vandenberg Air Force Base.

(2) Checkout Equipment - AGENA propulsion system checkout equipment was delivered to Vandenberg Air Force Base during February. Integration and acceptance testing of systems checkout complex 1A are in progress at the Modification and Checkout Center,

Sunnyvale, California. Complex 1A is a modification of the DISCOVERER vehicle checkout complex and will be used for both SAMOS and MIDAS vehicles.

Control equipment for launch pad #1 delivered in February.

(3) Launch Control Equipment - Manufacturing of launch control systems equipment for Point Arguello launch pad #2 is 80 percent complete. The equipment for launch pad #1 was shipped to Vandenberg Air Force Base on 18 February.

***** NOTICE OF REMOVED PAGES *****

Pages___11____through___15_____ of CORONA, ARGON, LANYARD programmatic information are not provided because their full text remains classified.

***** NOTICE OF REMOVED PAGES *****

Pages 16 through 23 and Figures 1 through 4 of CORONA, ARGON, LANYARD programmatic information are not provided because their full text remains classified.

***** NOTICE OF REMOVED PAGES *****

Pages 24 through 25 of CORONA, ARGON, LANYARD programmatic information are not provided because their full text remains classified.