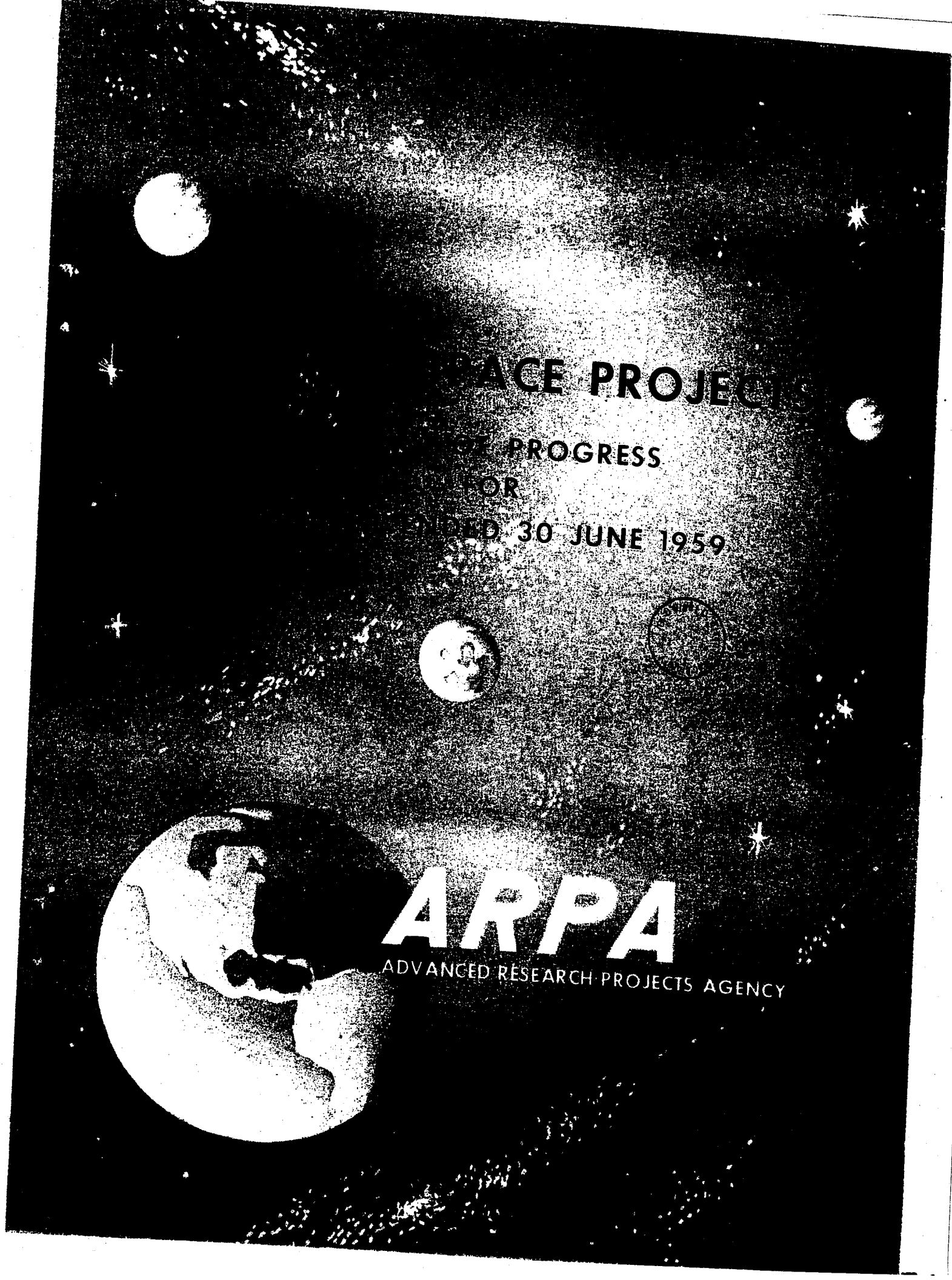
ACE PROJECT
PROGRESS
OR
D 30 JUNE 1959
ARPA
ADVANCED RESEARCH PROJECTS AGENCY

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ARPA

MILITARY SPACE PROJECTS

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

QUARTER ENDED 30 JUNE 1959

Department of Defense

Washington 25, D.C.

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ADVANCED RESEARCH PROJECTS AGENCY
WASHINGTON 25, D. C.

July 28, 1959

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Progress Report on Military Space Projects for Quarter Ended June 30, 1959

This transmits the Military Space Projects Report for the quarter ended June 30, 1959.

Project TIROS (meteorological satellite) and Project CENTAUR (high energy upper stage) were transferred to the National Aeronautics and Space Administration on April 13, 1959, and July 1, 1959, respectively. Therefore, this is the last time progress on these projects will be included in this report. However, because of their potential military application, the Advanced Research Projects Agency will maintain close liaison with the National Aeronautics and Space Administration in order to keep abreast of progress in these two important projects.

Highlights of major events to date are briefly covered in the accompanying draft of your letter of transmittal of the report to the President.

John E. Clark
Rear Adm., USN
Acting Director

1 Incl
Report, subject
as above

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THE SECRETARY OF DEFENSE

WASHINGTON

Dear Mr. President:

July 28, 1959

I am forwarding herewith the Military Space Projects Report for the quarter ended June 30, 1959.

The DISCOVERER II satellite was successfully launched into a polar orbit on April 13, 1959, from the Pacific Missile Range. The timer command reset failed to adjust to the actual orbit period, which was less than planned; consequently, the biomedical capsule was not ejected in the planned recovery area. Search operations failed to locate the capsule, after it was reported seen in the Spitzbergen, Norway, area. DISCOVERER III, launched on June 3, 1959, and DISCOVERER IV, launched on June 25, 1959, experienced successful ascent, separation and orbit boost; however, both vehicles failed to achieve orbit. DISCOVERER V, originally scheduled for July 1, 1959, has been postponed until July 28, 1959.

Due to launch pad availability problems and difficulty with the ATLAS-D missile, the first MIDAS (very early warning satellite) launch has been delayed two months to January 1960.

Firm objectives have been established for the SAMOS (reconnaissance satellite) project with polar orbiting satellites capable of performing visual and ferret reconnaissance functions. The first flight is scheduled for April 1960.

The first two of the eight engines for the SATURN (clustered booster) project have been successfully tested at the Army Ballistic Missile Agency. Development of the navigation and communication satellites is in the hardware stage and continues on schedule.

As indicated in my letter transmitting the previous quarterly report, project TIROS (meteorological satellite) was transferred to the National Aeronautics and Space Administration effective April 13, 1959. In addition, project CENTAUR, the high energy upper stage, was transferred to the National Aeronautics and Space Administration at the close of this quarter.

With great respect, I am

Faithfully yours,

/s/ Thomas S. Gates
Deputy

1 Incl.:
Report

cc: Members of the National Aeronautics and Space Council

The President
The White House

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CONTENTS

ILLUSTRATIONS

PROGRESS HIGHLIGHTS

During the Quarter Ended June 30, 1959

(Project code names were assigned to all major ARPA projects during the quarter and are evident throughout this document.)

On April 13, 1959, DISCOVERER II was successfully launched into orbit from the Pacific Missile Range. The recoverable capsule was not ejected in the planned recovery area, however, and an intensive search was unsuccessful. Although DISCOVERER III and DISCOVERER IV, launched June 3 and June 25 respectively, experienced successful ascent, separation and orbit boost, these vehicles failed to achieve orbit.

Launch of the initial SAMOS reconnaissance satellite, formerly designated SENTRY, is scheduled for April 1960 and will contain both visual and ferret payloads.

The first flyable infra-red scanner for Phase I of the MIDAS infra-red reconnaissance satellite program was delivered in June, and the first satellite launch is scheduled for January 1960. Delay of approximately two months is due to conflict in pad schedules and to difficulty in the ATLAS-D program.

Transfer to NASA of the meteorological satellite project (TIROS) was made in April 1959.

Launching of the first navigation satellite (TRANSIT I) is now scheduled for mid-September. The satellite equipment is in final assembly and test.

Communications satellite project (NOTUS) calls for development of a delayed repeater satellite system (COURIER) and an instantaneous repeater satellite system comprised of three sub-projects, STEER, TACKLE and DECREE. The first COURIER satellite is scheduled in February 1960. Launchings of instantaneous repeater satellites are scheduled to begin in late 1960.

The combined MINITRACK-DOPLOC fence, a portion of Project SHEPHERD, continues to successfully track satellites in space.

Under TRIBE, the project for development of a continuing family of military space vehicles, the first two engines of the 1.5 million pound thrust cluster engine SATURN were successfully fired at ABMA.

Fabrication of a full scale mockup of a SATURN booster tail section is complete and all major structural drawings for the SATURN test vehicle were released.

The Bell-Hustler upper stage vehicle (code name AGENA) is being modified to provide a greatly improved high altitude capability.

The CENTAUR project (high energy upper stage) will be transferred to NASA on July 1, 1959. Assembly of the engine is near completion and the first run date is scheduled for July 1959.

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TOPICAL SUMMARY

DISCOVERER PROJECT

(COMPONENT TESTING SATELLITE)

INTRODUCTION

Project Objectives-Development and Testing of Components for Military Space Technology Program.

The objectives of the Discoverer Satellite Project are to conduct research and development on components, equipment, instrumentation, propulsion, data processing, communications and operating techniques. Development testing will be conducted in a secure military manner and at an early date relative to over-all system development schedules. Developments accomplished under this project are expected to make major contributions to many advanced military space systems. For example, MIDAS, SENTRY and the SAC Recall Communications Satellite will all use the basic satellite vehicle, and to varying degrees, components, communications, tracking equipment, and operating techniques developed and tested in this program.

The Discoverer project is characterized by an open-ended series of space flights which will be utilized for testing classified equipments within the space environment. The program permits varied test conditions which will duplicate the actual operating conditions of the space equipment being tested. All of the earlier flights planned for this project will utilize the THOR IRBM booster and the AGENA second stage.

Flight Schedule

The current schedule for the Discoverer project calls for a total of 29 firings through fiscal year 1961; the majority of which will be in fiscal year 1960.

DISCOVERER FLIGHTS

DISCOVERER II

DISCOVERER II successfully achieved polar orbit.

On April 13, 1959, DISCOVERER II was successfully injected into orbit approximately six minutes after being launched from Vandenberg Air Force Base. The 1,858 lb. DISCOVERER II vehicle, containing 6,352 lbs. of propellants, separated from the THOR booster and coasted to near-apogee altitude where rocket engine ignition occurred and required orbital velocity was attained. The satellite required 90.43 minutes to complete an almost circular orbit of the earth with an apogee of 215.7 and a perigee of 157.6 statute miles.

Orbit, ejection, and re-entry aspects successful.

During the seventeenth orbit the satellite nose was tilted 60 degrees downward to permit ejection to cause re-entry of the 197 lb. recoverable capsule payload. Telemetered data show that control and ejection equipment operated as planned.

Capsule did not impact in recovery area; search unsuccessful.

A reset error introduced into the satellite timer by ground command on the second pass, however, made it impossible to adjust capsule ejection to permit impact within the planned recovery area, and the automatic ejection program took effect. Based on the known orbit characteristics and the predicted time of automatic ejection occurrence, it was calculated that the capsule would impact near the Arctic Circle. A "space watch" was alerted and, at the predicted time and in the predicted area, observers on the Norwegian islands of Spitzbergen saw a "starburst," probably foil chaff, and a descending parachute. Search activities conducted by the Norwegian government and the U. S. Air Force throughout the extremely rugged, snow-covered, Spitzbergen area were unsuccessful.

Radar and telemetry contact excellent.

Telemetry, radar beacon and continuous-wave beacon operation was excellent thoughout the lifetime of the batteries. Telemetry and radar beacon were operative until after the 25th pass (about one and one-half days), confirming predicted battery life. The continuous-wave beacon, which operates from its own battern, was heard for the last time on April 19, almost a week after launch. The satellite, visible only in the Antarctic region because of its orbital plane in relation to the sun, was sighted repeatedly in that area. It was last seen at the South Pole on April 25 and is believed to have re-entered the atmosphere the next day.

Changes made to prevent recurrence of error.

Steps have been taken to prevent recurrence of the error which caused loss of ejection timer control. The interim timer installed in the vehicle has been replaced by the more sophisticated Fairchild timer, previously planned for installation in DISCOVERER IV.

DISCOVERER III

DISCOVERER III failed to achieve orbit.

DISCOVERER III was launched from the Pacific Missile Range on June 3 after three unsuccessful attempts during the previous two weeks. Inclement weather and minor technical difficulties with the lift-off staging caused the postponements. Launch, ascent, separation, coast, and orbital boost were accomplished as planned. Premature satellite engine shut-down resulted in failure to achieve required orbital velocity, and impact occurred approximately 30 degrees south of the equator. Indications are that fuel exhaustion was the cause of premature shut-down, since fuel for additional burning should have been present in the tanks at the time of shut-down.

DISCOVERER IV

DISCOVERER IV failed to achieve orbit.

DISCOVERER IV was launched on June 25 from Pacific Missile Range (See Figure 1). Launch, ascent, separation coast, and orbit bboost were

successfully accomplished. However, the vehicle failed to achieve orbit. A detailed review of DISCOVERER III and IV flight records is being made since neither vehicle achieved orbit, in spite of successful systems and component operation. Several modifications are planned to increase the probability of achieving orbit, such as a change in fuel and a reduction of weight in orbit. Launch of DISCOVERER V on July 1 has been postponed until this review has been completed.

FUTURE FLIGHTS

Vehicles on hand at Vandenberg, Santa Cruz and Palo Alto.

DISCOVERER V is installed on a Vandenberg Air Force Base launch pad. Two additional satellites are at Vandenberg undergoing pre-mating checks At Santa Cruz Test Base (SCTB), two vehicles are installed in test stands awaiting acceptance testing. A third vehicle is ready for installation when a stand becomes available. Four vehicles are at the Modification and Checkout Center at Palo Alto.

BIOMEDICAL RECOVERY PROGRAM

Successful data obtained from "Mechanical Mice" on DISCOVERER II flight.

Extensive testing of the Biomedical Recovery Capsules is being conducted. "Mechanical Mice" (multi-vibrators emitting a pulse similar to the heartbeat of live mice) were carried in the DISCOVERER II recovery capsule instead of a live payload. Telemetered data showed visibility on all channels during the flight.

Live mice data successful on DISCOVERER III flight.

Live mice, contained in the life-cell of DISCOVERER III, were in a satisfactory condition throughout the period of telemetry reception and their behavior was as predicted. The animals sustained 11 G acceleration during THOR boost and about eight minutes of weightlessness between the start of coast and re-entry. Photographs of a biomedical package may be seen in Figure 2

TELEMETRY AND TRACKING

Down-range radar station needed for additional DISCOVERER Flight Data.

Flights of the first three DISCOVERER vehicles revealed that additional radar data is required immediately after orbital injection to obtain precise calculation of orbital trajectory. During the critical two minutes after satellite engine burn-out, the vehicle passes beyond range of the existing radar. Surveys have indicated the desirability of locating an additional station on the southern tip of Baja, California. This possibility is being actively explored.

Modification of two tracking and recovery vessels essentially complete.

Modifications to two VC-2 vessels for use in tracking and recovery operations were completed during the latter part of June with the exception of installation and testing of certain direction finding equipment. Both ships departed for San Francisco on June 28, 1959, and were scheduled to arrive at Pearl Harbor on July 3, 1959. They will be under operational control of the Commander, Pacific Missile Range. While these ships are designated for tracking and recovery operations for several satellite projects, their initial use will be associated with the DISCOVERER Program.

CAPSULE RECOVERY TRAINING

Operationally-ready recovery forces continuing training programs.

The recovery forces, although operationally-ready, are being given full-scale training exercises involving location and recovery of capsules dropped by parachute from B-47 aircraft. Progressive improvement has been demonstrated in both air and sea recovery training missions. About 90 percent of air pickup attempts were successful this quarter, as compared with less than 50 percent during the first month of training.

SAMOS PROJECT

(FORMERLY SENTRY)

INTRODUCTION

Project Renamed

This project was formerly known as the WS-117L or SENTRY Program prior to the establishment of DISCOVERER and MIDAS as separate projects. It was recently named SAMOS to remove the earlier all-inclusive connotation associated with the SENTRY title.

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

The objective of the SAMOS project is the development of a reconnaissance system utilizing polar orbiting satellites to collect and process visual or photographic data and ferret or electromagnetic data. Specifically, the SAMOS system is expected to acquire a great amount of technical intelligence, resulting in a more precise knowledge and evaluation of enemy military and industrial strength and their deployment. The data obtained should enable the United States to do a better target analysis job and to detect and identify unknown targets. Information obtained will provide evidence of build-up and consequently relatively long-lead warning of attack.

Ground acquisition of data by capsule recovery and by readout.

Two approaches are being developed for acquisition of intelligence data: (1) the recovery system in which a data capsule is ejected from the satellite upon command and physically recovered, and (2) the electronic data readout system in which all data is transmitted upon command to ground stations. The recovery system is used for photography and the data readout system for both photography and ferret. The recovery system will be used when rapid time response is not necessary, thus permitting collection of data over a large geographic area at a rate which would exceed the limits of a readout link capability. The

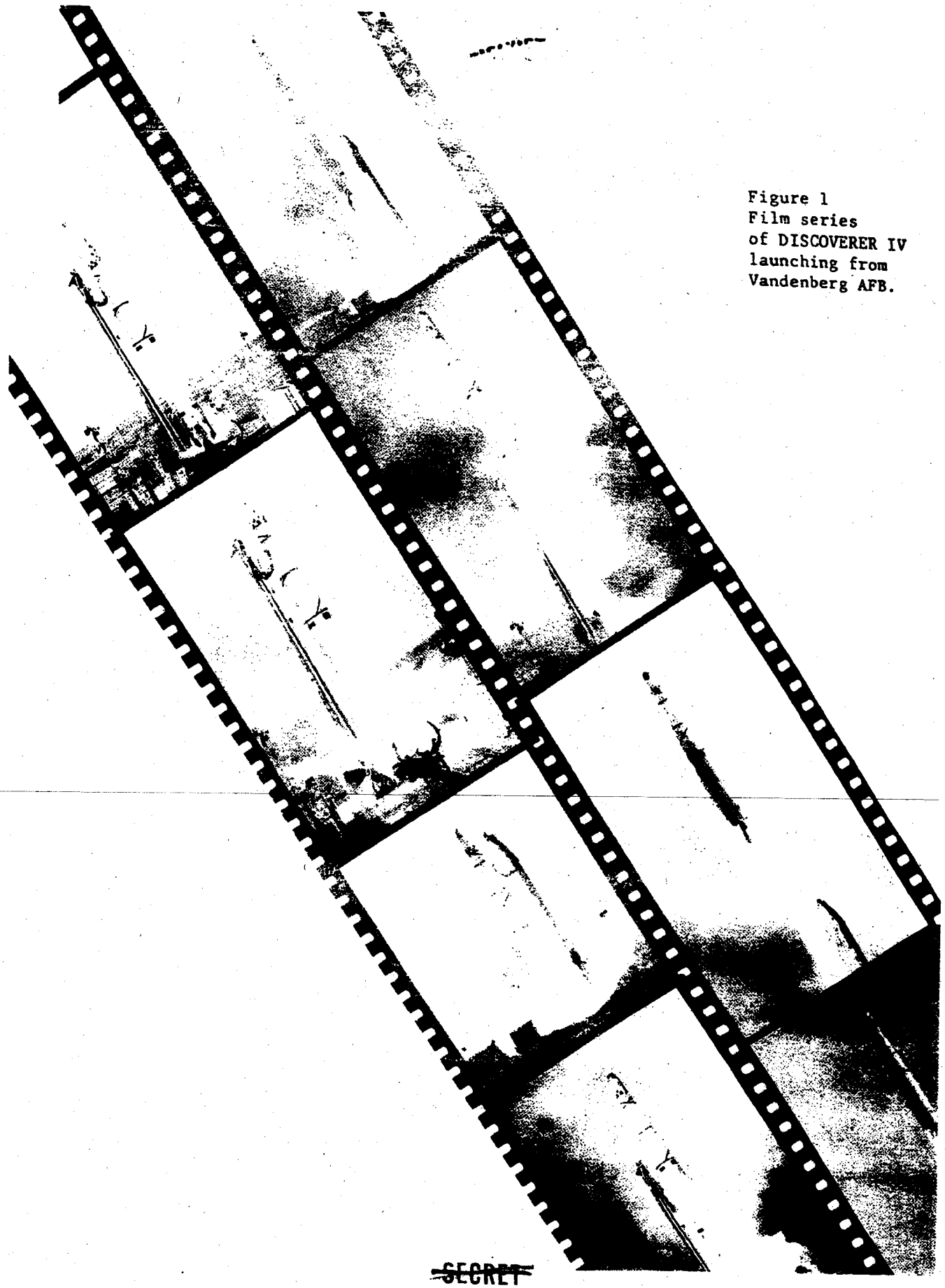

Figure 1
Film series
of DISCOVERER IV
launching from
Vandenberg AFB.

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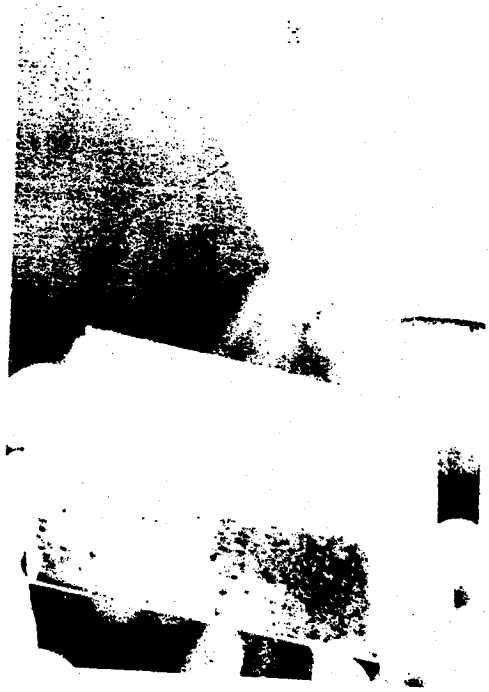
BIOMEDICAL PACKAGE

Veterinary Surgeons implanting viability transmitter electrodes into subject.



Examination of food pack prior to installation in viability capsule. Numbers identify wave lengths assigned to different subjects.

Installation of electrical connections between life cell and chassis.

Life cell placed in altitude chamber prior to test.

FIGURE 2

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photographic readout system will be used for surveillance of specific targets when time response is an important factor.

Flight Program

The program initially included 22 launchings. Current program reviews of payloads planned may reduce this to 18 launchings. The first launching is scheduled for April, 1960.

SAMOS PAYLOADS

GENERAL

Initial flights to have both visual and ferret capabilities.

A dual payload, consisting of components of both visual and ferret systems, will be used on the initial development flights to test equipment. When in orbit, both the visual and ferret equipment will be checked out for satisfactory operation, prior to jettisoning of the ferret payload. The visual payload will then be permitted to operate without interference and will have a useful life of 10 to 15 days, depending upon the power supply used. Later satellites will carry only the visual or the ferret payload.

Visual payload to utilize wideband data link.

A wideband data link will be used for the visual payload ground-space communications. This link includes a payload camera, using strip film which is automatically developed while in orbit. On ground station command, readout of the developed negative is accomplished by electronic scanning (in the satellite) and conversion of the image to a video signal for transmission to a ground station over the wide-band link. The video signal is then converted into modulated lines and displayed on a kinescope. The kinescope lines are photographed by a 35 mm continuous-strip camera which records the images as a series of positive frames.

Recovery Payload

Bids for development of recovery payloads have been received and are being evaluated. The design objective for the recovery camera is to

obtain resolution sufficient to identify objects on the ground as small as five feet on a side.

VISUAL

Flights of first visual payloads (E-1) to be used for component testing.

Photo payloads, employing the readout technique, to be used in the initial vehicles, have been designated "E-1" and include some components of a more advanced design payload, designated "E-2." The E-1 payload will test in orbit the film storage transport unit, experiemental control devices, command control system and the E-2 payload processor and readout system.

E-1 dummy payload complete; ground equipment progress is substantial.

The E-1 dummy payload is available and will be used to provide mechanical fit and electrical harness compatibility with the satellite vehicle. Fabrication and assembly of the E-1 ground handling equipment is complete.

Assembly of E-1 package is underway.

The first flyable visual reconnaissance (E-1) package, now being assembled, contains component refinements, particularly in readout, instrumentation and control.

E-2 payload goal is to achieve 20-foot ground resolution.

The design objective of the E-2 version is to achieve ground resolution of 20 feet. This payload will be controllable to permit photographing of ground objects 150 miles on either side of the flight path and 17 degrees fore or aft along the flight path. Control for a given mission will be entered into a vehicle programmer by ground station command.

E-2 payload in advanced design stage; some fabrication started.

All detail and assembly drawings for the E-2 payload camera are finished. Hardware packaging of the optical system for the 36-inch focal-length lens was accomplished and collimator testing indicates performance exceeds design specifications. (See Figure 3)

FERRET

Ferret payload provides for three progressively more sophisticated versions.

NRO-25x1

The reoriented ferret reconnaissance program provides for the development of three payloads attaining progressively advanced design consistent with maintenance of program scheduling. These payloads are designated F-1, F-2, [redacted] and will be used to intercept electronic emissions, measure and store the signal parameters, and transmit the data to ground receiving stations on command. NRO-25x

Ferret payload work proceeding on schedule.

All ferret payload work is proceeding on schedule. The second article of the F-1 prototype vehicle equipment was checked out completely. Qualification testing of the F-1 payload will be conducted in July. Two antenna assemblies have been completed for the F-2 payload. Assembly drawings for the F-2 payload data handling unit and ground data handling equipment have been released for fabrication.

FACILITIES AND SITES

TRACKING

Program requires extensive ground data handling network.

The SAMOS Program requires an extensive ground data handling network, including several tracking and acquisition stations and a central data processing and control facility to be located at Sunnyvale, California. Tracking stations are planned for the eastern, western, and central regions of the United States. In addition, use will be made of DISCOVERER facilities as applicable.

Control equipment being developed for tracking stations.

A study of the requirements for data obtained and required by tracking stations has resulted in the start of development of the Programmable Integrated Control Equipment (PICE) system. This equipment, installed at tracking stations, will accept and store all incoming data and make portions of the data available instantaneously. Specifications for this equipment are complete.