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AIR FORCE BALLISTIC MISSILE DIVISION
HEADQUARTERS
AIR RESEARCH AND DEVELOPMENT COMMAND
UNITED STATES AIR FORCE
Air Force Unit Post Office
Los Angeles 45, California

Assistant for Programming
WDPCR

8 May 1959

SUBJECT: DISCOVERER Monthly Program Progress Report

TO: Director
Advanced Research Projects Agency
Washington 25, D C.

1. This report covers progress during the month of April 1959 in the DISCOVERER Program, directed by ARPA Order 48-59, prime contractor Lockheed Missile Systems Division. The DISCOVERER Program is funded in the amount of $104.3 millions in Fiscal Year 1959, in accordance with the 30 January 1959 Development Plan. A summary list of contracts is contained in Tab 3 of Section 1 of the Development Plan.

2. TECHNICAL STATUS

a. DISCOVERER II-1018-170 was launched from launch pad #4, Vandenberg Air Force Base, at 1318 hours, PST, on 13 April. THOR main and vernier engine performance were normal, and programmed roll and pitch were smooth and accurate. Retro-rocket ignition and vehicle separation occurred as planned. The only deviation from the programmed boost was a slightly higher separation velocity, and separation altitude, than expected. The second stage engine operated normally for 112.3 seconds. Radar track was maintained through orbital injection and telemetry coverage through orbital reorientation. Due to minor trajectory deviations the orbit was nearly circular, with an initial period of 90.5 minutes. The predicted eccentricity was 0.04 and initial period 94.5 minutes. Figure 1 illustrates the countdown sequence for this launch, and Figure 2 the basic orbital parameters.

b. All DISCOVERER subsystems operated essentially as planned. The 180° yaw turn immediately after satellite engine burnout, in preparation for the subsequent 60° tiltdown for capsule dump, was successfully completed. Subsequent data revealed that capsule dump occurred. The dump did not occur in the planned area due to inadvertent overriding of

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the vehicle timer by a ground command. Because of the shorter than programmed orbital period the radar beacon and telemetry were turned on late by the orbital timer, which was adjusted for the expected orbital period of 94.5 minutes. Both the Hawaiian and Kodiak stations acquired the radar or command beacon, but Kodiak was unable to lock on before losing contact. Figure 3 shows station acquisition times. An attempt was made to adjust the orbital timer to compensate for the actual orbital period, by ground command from Hawaii. An excessive adjustment was inadvertently transmitted. The cumulative effect of the timer error rendered subsequent correction by ground command impossible. Analysis indicated that the capsule would probably be dumped, automatically, in the Spitzbergen, Norway, area. A space watch was alerted, and several sightings were reported in the area at the time capsule descent was expected. The State Department obtained permission for a search of the area, but the search was unsuccessfully terminated on 22 April.

c. All available information indicates that DISCOVERER II entered the atmosphere between revolutions 204 and 205 on 26 April between 1330 and 1640 hours Z. Figure 4 summarizes the performance of DISCOVERER II.

d. A new ground-space communications timer will be used in future flights. This timer will offer additional flexibility in accomplishing in-flight timer reset, necessary to adjust timer cycle to the actual orbital period. The new timer has a longer timer cycle and smaller adjustment steps (ten seconds versus fifteen seconds on the previous timer.) The new timer will also provide the capability for "up and down" adjustment. Telemetry will permit the ground operator to read the timer setting at all times.

e. Flight test vehicle 1020 will test a solar reset device designed to trigger reset of the orbital timer each time the satellite passes from darkness to light. This device will eliminate cumulative effects preventing communication with the vehicle if the timer becomes excessively out of phase with the orbital period. Reset will occur on each pass and can be overridden from the ground. The test installation in flight test vehicle 1020 will not be employed to reset the timer, but will be flown open-loop to provide telemetered data on its performance.

3. PROBLEMS ENCOUNTERED

No problems of significance, other than those reported herein, have been encountered during this reporting period.

4. WORK SCHEDULES

a. DISCOVERER flight test vehicle 1020 (programmed as DISCOVERER III-1020-174) successfully passed Air Force acceptance testing on 7 April. This vehicle was shipped to Vandenberg Air Force Base on 11 April, and 85 percent of the component bench checks have been completed. Mating with THOR 174 is scheduled for 18 May 1959 and launch on 21 May. Current plans call for live mice aboard this flight.

b. A scheduled hot firing of flight test vehicle 1023 was postponed from 29 April to approximately 1 May for replacement of malfunctioning inertial reference and computer packages.

c. Flight test vehicle 1029 has been installed in test stand #2 at the Santa Cruz Test Base. Propellant tank calibration, engine checks and servicing, mechanical preparations, and auxiliary instrumentation are essentially complete. A hot firing will take place during the month of May.

d. Flight test vehicle 1025 arrived at Santa Cruz Test Base on 24 April, and preparations for hot firing will take place in May. Six DISCOVERER vehicles are undergoing modification and checkout at the Palo Alto facility prior to hot firing at Santa Cruz. Additional DISCOVERER vehicles are being fabricated at Palo Alto on a schedule consistent with the current launch schedules.

e. Douglas Aircraft Company will reduce the weight of the THOR boosters by ten pounds, effective with the fifth or sixth flight, allowing extra payload aboard the satellite. Effective with flight 8 or 9, booster weight will be reduced by 27 pounds, providing an equivalent increase in DISCOVERER payload weight capability.

f. The recent test of the primate recovery capsule in the high altitude simulator at Sunnyvale resulted in the death of the primate subjected to the test. The clinical cause of death was hyperthermia (excessive heat) but intensive study revealed psychological as well as physiological stresses. The specimen had been trained to lay on its back, but was confined upon its stomach for fifty hours. Also, the psychomotor shock harness electrode was placed beneath the skin, causing an excessively high current to pass through the specimen. General Electric is proceeding on a crash basis to improve the primate life-cell hardware. Future tests will utilize a button type electrode. The next experiment with a live primate is planned for the week of 10 May, at

Holloman Air Development Center. This test will simulate the entire fifty-hour biomedical mission. Another test, utilizing a live, untrained primate may take place in the Sunnyvale chamber at about the same time.

g. Capsule recovery training exercises were conducted 100 miles off Oahu on 10 April by a force of six aircraft and three surface vessels. Nine drops were made, all were air or surface recovered except the first capsule which failed to separate from the "bomb" container. Extensive training of ship and aircraft crews in the operation of special DISCOVERER direction finding equipment is being conducted. A beacon transmitter was installed in the Hickam Air Force Base control tower for use by the crews during training flights. Additional training in detection and air recovery of the biomedical capsules is underway.

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Figures 1 through 4

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R J Curtin for

O. J. RITLAND
Brig. Gen., USAF
Commander

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TABLE I

DISCOVERER II COUNTDOWN

EVENT	NOMINAL T-TIME	PACIFIC STANDARD TIME TARGET	ACTUAL	REMARKS
COUNTDOWN INITIATION	450 MIN	02:30	02:40	
BRC MATING COMPL., VEH. ERECT'N	340 "	04:20	04:29	
DESTRUCT TESTS COMPLETED	270 "	05:30	06:17	
PLANNED COUNTDOWN EVALUATION	190 TO 150 "	06:50-07:20	07:52-07:55	
DISCOVERER PROPELLANT LOADING COMPL.	130 "	07:50	08:32	HOLD FOR FUEL FILL INDICATION MALFUNCTION
PAD AREA CLEARED FOR LAUNCH	80 "	08:40	09:36	
DISCOVERER GUID. CHECKS, PRESS. COMPL.	30 "	09:30	11:33	HOLD FOR GYRO HEATER WARM UP
PLANNED COUNTDOWN EVAL. COMPL.	30 TO 12 "	09:30-09:48	11:42	
LAUNCH SEQUENCE STARTED	11.5 "	09:48 :30	13:07:09	HOLD FOR WEATHER CLEARANCE
1ST STAGE ELECTRONICS CHECKS COMPL.	10.5 "	09:49 :30	13:08:09	
" " PROPELLANT LOADING COMPL.	2.5 "	09:57 :30	13:16 :09	
ARM DESTRUCT SYSTEM	2. "	09:58	13:16:39	
1ST STAGE IGNITION	3 SECS	09:59:57	13:18:36	
LIFT OFF	0 "	10:00 :00	13:18:39	

Figure 1
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TABLE II

DISCOVERER II ORBIT PARAMETERS

Parameters	Units	Predicted	Actual, After One Day (Pass No. 18)	Actual, After Capsule Ejection (Pass No. 63)
Insertion Velocity	ft/sec	26,000	25,530	-
Insertion Angle	deg	0	0	-
Inclination Angle	deg	90	89.99	90
Perigee	n mi	140	156	153
Apogee	n mi	480	225	196
Eccentricity	-	0.0399	0.008	0.005
Period	minutes	94.54	90.4	89.9
Lifetime	days	62	11	8

Figure 2
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TABLE III

STATION ACQUISITION TIMES, DISCOVERER II

PASSES	STATION COVERAGE PREDICTED	STATION COVERAGE ACTUAL	ACQUISITION TIME* PREDICTED	ACQUISITION TIME* ACTUAL	ACTUAL DURATION OF CONTACT
1 S	KODI/ANNE/HAWA	KODI/ANNE/VAFB/HAWA △□□ △□□ △□□ △□□	89.6/90.4/101.1	91.7/85.9/95.3/93.4	8.7/7.5/7.8/6.7
2 S	KODI/HAWA	KODI/HAWA ○□ △□□	183.4/193.6	176.5/184.5	7.7/9.6
8 N	VAFB/ANNE/KODI	VAFB/ANNE □ □	722.5/731.0/737.1	696.0/701.0	10.9/7.4
9 N	HAWA/KODI/ANNE	KODI/ANNE/VAFB □ □ □	820.0/823.0/828.0	793.0/791.0/774.5	8.5/8.9/8.8
10 N	HAWA/KODI	HAWA/KODI □ □	913.6/923.6	873.0/882.0	9.8/9.2
15 S	ANNE/VAFB		1443.5/1508.0		
16 S	KODI/ANNE	KODI/ANNE/VAFB/HAWA □ □ □ □	1507.4/1503.0	1443/1441/1443/1450	3.2/7.3/7.8/8.5
17 S	KODI/HAWA	KODI/ANNE □ □	1601.8/1611.3	1531.0/1549	8.8/7.0
18 S		KODI/HAWA □ □		1622/1631	8.7/9.7
24 N		VAFB △○□		2140	8.9
25 N		VAFB/ANNE/KODI △○□ □ △○□		2250/2254/2258	8.0/8.4/8.6

▲ RADAR
○ TELEMETER
□ ACQUISITION BEACON

* MINUTES AFTER LAUNCH

Figure 3
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