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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

REPLY TO
ATTN OF: WDLPM-4

10 March 1960

MILITARY SATELLITE PROGRAMS PROGRESS REPORT
Quarter Ending 29 February 1960
DD-DR&E (M) 397

DD-S&T(Q) 397 perhaps

FOREWORD

Attached are the initial quarterly reports for the DISCOVERER, SAMOS and MIDAS Programs as directed by Secretary of Defense memorandum to the Secretary of the Air Force, dated 27 February 1960. As stipulated in the above memorandum, this quarterly report reflects program progress during the months of January and February only.

Harry H. Arons
for O. J. RITLAND
Major General, USAF
Commander

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DISCOVERER

The DISCOVERER Program consists of 29 flights.

1. The DISCOVERER Program 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). Both the DM-21 and the AGENA "B" will be available in two or more configurations. The DM-21 Block I booster will boost the four flights scheduled in June and July 1960. This version has the MB-3 Block I engine used on the THOR missile. The DM-21 Block II booster, equipped with the more powerful MA-3 Block II propulsion system, will boost all subsequent flights. This program will provide:

a. Research and component development in support of the SAMOS, MIDAS, and certain ARPA Programs using AGENA satellite vehicles.

b. Tests of the ground communications and tracking network developed for the above programs.

c. Flight test of the AGENA vehicle and subsystems.

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

2. Prime program objectives include:

a. Flight test of the satellite vehicle airframe, propulsion, guidance, control system, auxiliary power supply,

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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 Program originated as part of Weapon System 117L at the Air Force Ballistic Missile Division. In early 1958, the program was transferred ARPA, and subsequently divided into the DISCOVERER, SAMOS, and MIDAS Programs. After frequent funding problems and re-orientations, the programs evolved into the present configurations. The DISCOVERER vehicles have been launched to date. Six achieved successful orbits, all very close to the planned orbit. This was the heaviest payload ever placed on orbit by an intermediate range missile by the free world (1,700 lbs plus). Four of these satellite vehicles achieved complete attitude stabilization on orbit. This was never accomplished previously. This is a major requirement for the success of the SAMOS, MIDAS, and ARPA Programs using this vehicle. The program has been outstandingly successful in providing flight test data for refinement of the complex systems required for advanced military satellites.

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

4. Flights - DISCOVERER IX was launched from Pad 4, Vandenberg AFB, at 1051 hours PST on 4 February 1960. Launch took place on the fourth attempt. The first attempt, on 29 January, was cancelled when the THOR engine did not ignite. The second attempt, on 31 January, was cancelled due to instrumentation difficulties. The third attempt, on 3 February, was cancelled due to adverse weather conditions. The final 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 booster thrust termination and short second stage engine operation 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 due to THOR autopilot malfunction.

DISCOVERER X was launched from Pad 5, Vandenberg AFB, at 1215 PST 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

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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 is scheduled for launch from Vandenberg AFB during mid-March. This vehicle will carry an instrumented recovery capsule, plus advanced engineering test instrumentation.

B. 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 AFB 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 - 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. 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. Subsequently, it

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was found that a much-enlarged thrust chamber would provide greater thrust at altitude, where the satellite engine is the XLR81-Ba-9. The LR81-Ba-3 and LR81-Ba-5 engines have been thoroughly tested and proven in both ground and flight tests. Tests of the single restart-extended burn XLR81-Ba-7 engine are progressing at the Santa Cruz Test Base of Lockheed Aircraft Company. During this quarter, Phase II testing was completed, with a total of three firings. The first firing, on 8 February, was a full-duration run of 244 seconds. On 9 February the engine was operated for 220 seconds, stopped for five minutes, restarted, and operated for 28 seconds. The third run, on 12 February, consisted of a 220 second firing, five minute shut down, and restart for 27 seconds of operation.

Two XLR81-Ba-7 engines completed PFRT.

b. Two XLR81-Ba-7 engines completed Preliminary Flight Rating Tests (PFRT) 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-9 engine was initiated at the Santa Cruz during February. This engine is programmed for use on the fifth and subsequent AGENA "B" vehicles replacing all previous configurations.

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The initial firing consisted of a 120 second run, shutdown for five minutes, restart, and a run of 122 seconds. Successful gimballing of the engine was achieved for the first time during this run. Six more firings are programmed for this engine test series.

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, providing hydraulic pressure. 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 AFB with the primate sealed in the capsule.

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A countdown was performed, and after 22 hours the capsule was flown to the Sunnyvale Development Center (with passenger). It was placed in the High Altitude Temperature Simulator for the simulated orbital phase, then sequenced through simulated re-entry-recovery phases. It was then placed in temperature-regulated water for five hours to simulate the final five-hour recovery phase. During these tests the primate responded to stimuli properly and was able to perform all programmed tasks. A new feeder, designed by the School of Aviation Medicine, proved excellent. Electrocardiogram readouts were excellent and all components of the air regeneration system functioned well.

DISCOVERER facilities are, for the most part, shared with the SAMOS and MIDAS Programs.

5. Facilities - DISCOVERER facilities are shared for the most part with SAMOS and MIDAS. The facilities information contained in those sections of the report is generally applicable to DISCOVERER. DISCOVERER facilities are complete and operational, and no problems exist. The following are the key facilities for the DISCOVERER Program:

a. The Lockheed Missile 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 firing of satellite vehicle propulsion systems prior to acceptance.

The above facilities are shared with SAMOS/ MIDAS.

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d. The Vandenberg AFB launch site.

e. Tracking stations at Vandenberg AFB, Point Mugu, California; Kodiak, Alaska; and Kaena Point, Hawaii.

f. The Hawaiian Recovery Control Center.

The enlarged thrust chamber presents test difficulties.

6. Problem Areas - The enlarged thrust chamber for the XLR81-Ba-9 engine was originally planned to use an extension fabricated from carbon. However, test problems have hindered verification of engine performance. Due to the design, this chamber will operate properly only at extreme altitude. Ground tests resulted in burn through of the thrust chamber. Structural problems were also encountered. The problem has been studied and it appears that a titanium thrust chamber extension may provide the answer. Further tests will be necessary to provide a complete solution.

C. FLIGHT SCHEDULES

THOR/AGENA "A"

1959											
J	F	M	A	M	J	J	A	S	O	N	D
1	1	-	1	-	2	-	2	-	-	2	-

THOR/AGENA "A" * **

1960											
J	F	M	A	M	J	J	A	S	O	N	D
-	2	2	2	2	2	2	2	2	2	2	-

* DM 21 Block I/AGENA "B" (XLR81-Ba-7 engine)

** DM21 Bloc II (MB-3 engine)/AGENA "A" (XLR81-Ba-9 engine)

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DISCOVERER PROGRAM

1. This report, covering the period that Air Research and Development Command managed this program for the Advanced Research Projects Agency, is submitted in accordance with ARPA Order No. 41-60, Amendment No. 3, dated 10 June 1960.

2. PROGRAM HISTORY

a. ARPA Orders

The original fifteen ARPA funded flights for Weapon System 117L were established under ARPA Order 17-59, dated 4 September 1958. The THOR-boosted (DISCOVERER) portion of Weapon System 117L was separated from that program by ARPA Order No. 48-59, dated 16 December 1958. The DISCOVERER Development Plan for a thirteen flight program was approved by Amendment No. 2 to ARPA Order No. 48-59, dated 24 March 1959. April Development Plan calling for a twenty-five vehicle program was authorized by Amendment No. 4 to ARPA Order No. 48-59, dated 25 May 1959. The program was expanded to include twenty-nine vehicles by Amendment No. 6 to ARPA Order No. 48-60, dated 20 July 1959. Program responsibility for DISCOVERER was transferred from ARPA to the Department of the Air Force by Amendment No. 8 to ARPA Order No. 48-60, dated 3 December 1959.

b. Contracts

(1) Work on the DISCOVERER Program was conducted at Lockheed Missile and Space Division under Letter Contract AF04(647)-181 issued on 16 January 1958. This contract was definitized by Supplemental Agreement No. 10 to AF04(647)-97 on 6 January 1959 and covered the period through 30 June 1959. Letter Contract AF04(647)-347 issued 1 July 1959 was definitized by AF04(647)-558 on 3 May 1960 and covered the period from 1 July 1959 to 31 March 1961.

(2) Douglas Aircraft Company modified ten SM-75 missiles to WS-117L boosters under Letter Contract (designated supplemental agreement No. 15) to Contract AF04(645)-65 issued 2 April 1958. This contract was definitized by Supplemental Agreement No. 52 on 29 October 1959. Amendment No. 2 to Letter Contract AF04(645)-65 called for the modification of nine additional missiles.

(3) Rocketdyne Division of North American Aviation produced booster engines under Supplemental Agreement No. 10 to Contract AF04(645)-2 and under Letter Contract AF04(647)-167 dated 22 March 1959. Contract AF04(647)-167 was definitized in Contract AF04(647)-287 on 29 June 1959.

[redacted]

[redacted]

c. Progress

(1) Nine DISCOVERER vehicles were prepared for flight during the period of ARPA responsibility, eight of which were successfully launched. One vehicle was damaged during countdown because of premature firing of AGENA pyrotechnics. Orbital capability was satisfactorily demonstrated on six flights. THOR booster performance was excellent on all eight flights. Approximately 78 percent of the primary and all of the secondary and tertiary objectives were achieved.

(2) The recovery rehearsal conducted in conjunction with the DISCOVERER I operation satisfactorily culminated training operations. Although not required to attempt recovery on four DISCOVERER flights, the recovery force was operationally ready for the recovery operation. Recovery operations for DISCOVERER V, VI and VIII flights were conducted satisfactorily with the exception of capsule recovery. During the DISCOVERER VIII operation, capsule beacon signal contact was made by all C-119 pickup aircraft.

(3) The system of tracking and control stations, including the Palo Alto computer, Interim Development Control Center, and the communications network have demonstrated over-all satisfactory performance. Procedural changes, including more thorough R-F frequency protection, have improved the coverage and quality of tracking data as well as command reliability.

3. PROGRAM STATUS

The DISCOVERER Program under ARPA's direction went through numerous changes in program objectives and funding. During this same period a great deal of progress was made. The reliability of the DISCOVERER vehicle was established, ground support capability was developed, and other program objectives, except recovery of the capsule were met.

4. FUNDING

a. The following funds were provided by ARPA during its period of responsibility for the DISCOVERER Program:

ARPA Order	Amendment No.	Date	Cumulative Funding (Millions of Dollars)
48-59	1	16 Feb 59	[redacted]
	4	20 May 59	
	5	23 Jun 59	
	6	20 Jul 59	
	7	8 Oct 59	
	8	3 Dec 59	

* 15.25 reduction in funds

[redacted]

[redacted]

Status:	31 December 1959	31 July 1960
Program	[redacted]	[redacted]
Initiations		
Commitments		
Expenditures		

b. ARPA Order No. 60-59, dated 17 February 1959, provides $1027 [redacted] for the DISCOVERER telemetry ship.

Status:	31 December 1959	31 July 1960
Program	[redacted]	[redacted]
Initiations		
Commitments		
Obligations		
Expenditures		

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SAMOS PROGRAM

1. This report, covering the period that Air Research and Development Command managed this program for the Advanced Research Projects Agency, is submitted in accordance with ARPA Order No. 41-60, Amendment No. 3, dated 10 June 1960.

2. PROGRAM HISTORY

a. ARPA Orders

ARPA Order No. 9-58, dated 30 June 1958, announced that direction of the Weapon System 117L Program had been assigned to ARPA. ARPA Order No. 38-59, dated 5 November 1958, separated the Infrared Reconnaissance Development (MIDAS) from the basic program. On 1 December 1958, ARPA proposed a reorientation of the Weapon System 117L Program as a result of the ARPA being provided with the consolidated SENTRY intelligence requirements by the Air Force. Amendment No. 11 to ARPA Order No. 9-58, dated 14 April 1959, gave qualified approval of the 30 January SENTRY Development Plan. In June, under ARPA direction, the development of mapping and charting capabilities was deleted from the SENTRY Program. Work on the SENTRY recovery program was deferred because of funding limitations. On 7 August instructions were received from ARPA to change the program name from SENTRY to SAMOS. Program responsibility for SAMOS was transferred from ARPA to the Department of the Air Force on 17 November 1959.

b. Contracts

(1) Lockheed Missile and Space Division has performed work under Contract AF04(647)-97, dated 22 January 1958 (complete as of 1 July 1959); Contract AF04(647)-347, dated 1 March 1959; and Amendment No. 1 to that contract dated 1 July 1959.

(2) Ramo-Wooldridge is working on portions of the Data Processing Subsystem under Contract AF30(602)-1814.

(3) Massachusetts Institute of Technology has completed development work on the guidance system under Contract AF04(647)-103.

c. Progress

Final assembly of the AGENA "B" vehicle for the first SAMOS flight was started during the period of ARPA's direction. Assembly of the first E-1 payload was completed and the first and second F-1 prototype payloads were in modification and checkout during this period. Development of more advanced payloads, production of ground support equipment and construction of facilities was progressing satisfactorily.

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3. PROGRAM STATUS

The SAMOS Program under ARPA's direction went through several reorientations. Limitations of funding also hampered the program. However, development of the payloads, design and assembly of ground support equipment, and construction of facilities continued.

4. FUNDING

a. The following funds were provided by ARPA for the R&D SAMOS Program during its period of responsibility:

ARPA Order	Amendment No.	DATE	Cumulative Funding (Millions of Dollars)
9-58		30 Jun 58	22.7
	1	17 Jul 58	30.7
	2	4 Aug 58	50.7
	3	25 Aug 58	70.7
	4	25 Sep 58	136.2
	7	19 Jan 59	148.2
	8	16 Feb 59	96.6*
	12	1 Jul 59	118.2
	13	30 Jul 59	135.6
	14	27 Aug 59	147.6
	15	8 Oct 59	167.6
	16	3 Dec 59	96.6**

* 51.6 reduction in funds
** 71.0 reduction in funds

Status:	31 December 1959	31 July 1960
Program	96,600,000	[redacted]
Initiations	95,841,662	
Commitments	95,841,662	
Obligations	92,819,804	
Expenditures	90,482,426	

b. The following funds were provided by ARPA for SAMOS facility construction:

ARPA Order	Amendment No.	Date	Cumulative Funding (Millions of Dollars)
41-59		17 Nov 58	6.659
	1	19 Dec 58	9.827
	2	13 Feb 58	9.0*

* 827,000 reduction in funds

[redacted]

[redacted]

Status:	31 December 1959	31 July 1960
Program	9,000,000	[redacted]
Initiations	9,000,000	
Commitments	9,000,000	
Obligations	8,800,900	
Expenditures	2,666,748	

[redacted]

[redacted]

MIDAS PROGRAM

1. This report, covering the period that Air Research and Development Command managed this program for the Advanced Research Projects Agency, is submitted in accordance with ARPA Order No. 41-60, Amendment No. 3, dated 10 June 1960.

2. PROGRAM HISTORY

a. ARPA Orders

AFBMD on 17 September 1958 recommended that Subsystem G of Weapon System 117L be accelerated and published an Attack Alarm Development Plan. ARPA Order No. 38-59 dated 5 November 1958 directed that the study and development being conducted as Subsystem G of Weapon System 117L be established as a separate development program and identified as the Missile Defense Alarm Satellite (MIDAS). In response to ARPA Order No. 38-59, a Missile Defense Alarm Development Plan was presented by AFBMD in January 1959. Amendment No. 7 dated 26 August 1959 to ARPA Order No. 38-59 directed reprogramming to accommodate launches 3 and 4 from Vandenberg Air Force Base beginning July 1960. Program responsibility for MIDAS was transferred from ARPA to the Department of the Air Force on 17 November 1959, by memorandum from the Secretary of Defense.

b. Contracts

(1) Lockheed Missiles and Space Division has performed work under Contract AF04(647)-97, dated 22 January 1958; Letter Contract AF04(647)-347, dated 1 July 1959; Contract AF04(647)-564, dated 5 May 1960 which definitized the MIDAS portion of the -347 contract; and Contract AF04(647)-595, dated 1 August 1960 covering the communications and control portion of the -347 contract.

(2) Some phases (communications and control) of Contract AF04(647)-347 are being performed by Philco Corporation under Letter Contract AF04(647)-532, dated 8 January 1960.

c. Progress

The MIDAS Development Plan outlined a program which would have resulted in the completion of the MIDAS R&D Program in May 1961 and provided an operational capability by December 1961. The launch schedule associated with the program was divided into three phases. Phase I provided for four R&D launches from November 1959 through May 1960. Phase II provided for six R&D launches from Vandenberg Air Force Base from June 1960 through May 1961. Phase III called for an operational network of twenty satellites during the period of July through December 1961. The MIDAS Development Plan was approved by ARPA in March 1959;

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but efforts were limited by ARPA to the support of Phase I launches only. Lack of full approval and firm financial status resulted in inability of AFBMD to maintain the schedule presented in the Development Plan.

3. PROGRAM STATUS

The NASA/ARPA agreement on the use of AMR stand 14 for Project MERCURY launches resulted in revised scheduling for MIDAS Phase I launches 3 and 4. Insufficient funding and consequent program stretch-out, resulted in rescheduling MIDAS launches 3 and 4 to October 1960 and February 1961, respectively. At the time of transfer the program was proceeding on a limited basis with the first launch scheduled in January 1960.

4. FUNDING

The following funds were provided by ARPA during its period of responsibility for the MIDAS Program:

ARPA Order	Amendment No.	Date	Cumulative Funding (Millions of Dollars)
38-59		5 Nov 58	.750
	1	2 Mar 59	8.0
	3	16 Apr 59	10.80
	4	20 May 59	22.80
	5	1 Jul 59	27.05
	6	30 Jul 59	31.05
	7	26 Aug 59	35.05
	8	8 Oct 59	42.55
	9	20 Oct 59	40.80*
	10	3 Dec 59	22.80**

* 1.75 reduction in funds
**18.00 reduction in funds

Of the above funding, expenditures were limited by ARPA to efforts supporting Phase I R&D, except for $2,600,000 which was authorized for urgent lead time procurement of boosters, vehicles, and engines under Phase II of the R&D program.

Status	31 December 1959	31 July 1960
Program	22,800,000	[redacted]
Initiations	22,719,265	
Commitments	22,719,265	
Obligations	22,700,957	
Expenditures	19,822,904	

WDLPM-4-230

[redacted]

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DISTRIBUTION

ARPA	6
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6555 Test Wing (Development)	2
6594 Test Wing (Satellite)	5
San Bernardino Air Materiel Area	1
Air Force Command & Control Development Division	1
Air Force Ballistic Missile Division	12

[redacted]

[redacted]

SAMOS PROGRAM

A. BRIEF OF PROGRESS

A revised flight test plan and new configurations arrangement was made during February for the ferret reconnaissance system payloads. This is part of the program reorientation made necessary by restricted funding levels announced during December 1959.

Progress on the second stage vehicles for the first three SAMOS flight tests is proceeding on schedule. These flights will carry a combination visual/ferret payload. Visual and ferret payloads for the first flight test have been delivered to Lockheed Missile and Space Division (LMSD) are are undergoing functional tests and preparations for installation in the second stage AGENA vehicles.

The complete visual system ground support equipment complex was operated with a visual payload during February with satisfactory results.

Design of the high acuity panoramic camera system for the visual recovery system (E-5) payload is proceeding on schedule. The recovery capsule development plan has been published and wind tunnel and aerodynamic studies are being made of various capsule configurations.

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B. TOPICAL SUMMARY

1. Program Administration

Reoriented test plan for ferret payloads defined.

a. As a result of program reorientation, announced during December 1959 and made necessary by restricted funding levels, the flight test plan for ferret payloads has been revised as follows:

Ferret Payload	Number of Flights Old Schedule	New Schedule
F-1	2	3
F-2	2 (1--F-2A) (1--F-2B)	4
F-3	4 (2--F-3A) (2--F-3B)	1

Dual payload scheduled for first 3 flights.

b. 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 useable in the reoriented program.

2. Technical Progress

a. Second Stage Vehicles

AGENA vehicles for first 3 flights progressing on schedule.

Work on the second stage (AGENA) vehicle for the first SAMOS flight is 70 percent complete in the Modification and

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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. Interior design of the AGENA vehicles for flights 4 and subsequent is proceeding on schedule. A common airframe 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 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 LMSD on 8 February. Functional tests

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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 LMSD before 15 March.

Environmental tests completed on E-2. thermal model payload.

(b) <u>E-2 Payloads</u> - 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) <u>E-5 Payloads</u> - 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 check-out through post-launch operations. Avco Corporation is conducting wind tunnel tests on various recovery capsule configurations as a parallel effort with LMSD aerodynamics studies.

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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 System

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

F-1--R&D Test Payloads

F-2--Digital General Coverage Payloads

F-3--Specific Mission Payloads

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 counter has been installed in an F-1 servide test model payload and has been operated satisfactorily for 48 cycles of life testing (equal to

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[redacted]

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 and F-3 payloads defined.

(b) F-2 and F-3 Payloads - In accordance with the program reorientation reported in paragraph B.1, the concepts and basic characteristics for the new F-2 and F-3 payloads were defined in an LMSD Technical Letter Report for January. 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 is scheduled for 25 March. Negotiations are underway for the changes to the F-2 and F-3 ground data handling equipment resulting from program reorientation.

c. Communications and Control Equipment.

Improved design for VHF antenna tested successfully.

(1) Design of the exit VHF 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.

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March delivery scheduled for UHF equipment.

(2) Systems and acceptance tests are being conducted on the UHF ground equipment for the Vandenberg AFB tracking and data acquisition station.

d. Ground Support Equipment.

Equipment delivered for launch pad #1.

(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 AFB.

(2) Checkout Equipment - AGENA propulsion system checkout equipment was delivered to Vandenberg AFB 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 AFB on 18 February.

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MIDAS PROGRAM

A. BRIEF OF PROGRESS

The first MIDAS flight test vehicle was launched from the Atlantic Missile Range on 26 February. Satellite orbit was not attained. Significant information relating to the launch and flight was not available at the time of the report deadline. A detailed analysis will be included in next month's report.

All pre-launch tests and preparations were conducted satisfactorily and essentially on schedule. All ground stations were fully ready to perform tracking and payload readout functions and prelaunch checkout of equipment verified satisfactory systems operation.

The second stage AGENA vehicle for the second MIDAS flight test is undergoing pre-mating preparations at the Atlantic Missile Range. The infrared scanner unit for this flight was shipped to AMR during February.

The complete infrared payload system, including satellite and ground station data link equipment was tested successfully by tracking the flights of an ATLAS missile and DISCOVERER vehicle from Vandenberg AFB. Analysis of the tape recorded target information obtained was highly satisfactory.

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B. TOPICAL SUMMARY

1. Flight Test Progress

First flight test vehicle launched on 26 February.

a. The first MIDAS flight test vehicle was launched from Atlantic Missile Range launch pad 14 on 26 February. Satellite orbit was not attained. A detailed analysis of the flight and discussion of the problems encountered will be included in the March report.

Flight parameters for first flight.

b. The first MIDAS flight was planned to place the satellite vehicle into a 261 nautical mile circular orbit, with a maximum eccentricity of 0.007 and an inclination angle (to the equator) of 32.5 degrees. Useful orbital lifetime was expected to be 29 days. A launch azimuth of 107 degrees was used, with orbital injection programmed for T plus 655 seconds at a velocity of 25,024 feet per second.

2. Pre-launch Plans and Preparations

Launch pad preparations.

a. Electrical rewiring of launch pad 14 and pad umbilical drop tests were completed on schedule. Additional redundant electrical circuits were installed in the mast to provide increased reliability.

Ground support equipment tested satisfactorily.

b. Systems checkout of the ground support equipment were conducted successfully with no problems becoming apparent. Checkout of the ATLAS booster was conducted with completely satisfactory results.

Payload readout plan defined.

c. AMR, Kaena Point (Hawaii) and Vandenberg AFB were scheduled to perform payload-to-ground data link readout. All

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three stations were to have tape recorded the satellite system-time data for processing, analysis and presentation on the command console of the ground presentation unit at the Satellite Test Center. In addition, real-time readout was to have been performed on the ground presentation unit at Vandenberg AFB. Motion pictures of the real-time ground presentation were to have been made, with system-time indicated on each frame.

Simulators permit pre-launch training.

d. Second stage vehicle simulators were delivered to AMR, Kaena Point and Vandenberg AFB early in February. These units were used for training and familiarization in vehicle handling, checkout, tracking and readout; and for electrical checkout of associated ground equipment. Each unit, consisting of two equipment racks, is capable of receiving and transmitting commands and simulating the characteristics of the infrared payload and communications subsystem of an orbiting MIDAS satellite.

Infrared targets planned for orbital readout testing.

e. A series of targets had been planned to test the infrared readout capability of the orbiting MIDAS satellite. Included were ATLAS and TITAN missile launches from AMR and ATLAS launch from Vandenberg AFB, timed to coordinate with MIDAS passes. In addition, ten pyrotechnic targets were to have been ignited during night-time passes over Vandenberg AFB and Edwards AFB.

3. Technical Progress

a. Second Stage Vehicles

AGENA vehicle at AMR for second flight.

(1) Preparation of AGENA vehicle 1007 for installation on the second MIDAS

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flight vehicle is proceeding on schedule in AMR Hangar E. X-ray examination of the thrust chamber revealed the presence of a foreign particle in the oxidizer inlet manifold. A new thrust chamber was installed on 8 February.

Design of third satellite vehicle on schedule.

(2) Design of the AGENA vehicle for the third MIDAS flight test is proceeding on schedule. Structures are being fabricated and release of equipment and installation brackatry designs to manufacturing is anticipated early in April.

Infrared scanner units shipped to AMR.

b. Infrared Scanner Units - Three of the flights 1 and 2 units were shipped to AMR during February and the fourth is in the Modification and Checkout Center. One of the units at AMR is the flight article for second MIDAS flight.

Infrared system tested on missile flights.

c. Infrared Payload Tracking Tests - The complete MIDAS system, including the infrared scanner unit, satellite-borne data link, ground data link, and operating personnel successfully tracked an ATLAS missile launched from Vandenberg AFB on 29 January. The payload and satellite data link were set up outside the telemetry building to track the missile ascent. Data was transmitted to the tracking station via the data link system and tape recorded. On 4 February, the DISCOVERER IX launch was similarly tracked for 110 seconds. Analysis of the tapes on which the tracking information was recorded revealed that the target information obtained was highly satisfactory. The capability of the space and ground presentation equipment as installed at Vandenberg AFB was established.

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Contract negotiations near completion.

d. Advanced Presentation Unit - Negotiations between LMSD and General Electric Co. on the contract for this unit are essentially complete.

Fabrication of panels started.

e. Solar Auxiliary Power - Fabrication of the solar array panels was started on 8 February. The mockup of the entire array is nearly complete. A functioning 1/10 scale model of the array mechanism was completed during February.

AGENA reliability program defined.

f. Reliability Negotiations - LMSD and Bell Aircraft have completed a work statement for an AGENA engine reliability program.

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DISTRIBUTION

Hq United States Air Force	20
Air Research and Development Command	5
Strategic Air Command	1
Air Force Ballistic Missile Division	22

[redacted]