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3 AUGUST 1961
AIR FORCE MANUAL
NO. 100-30B

DEPARTMENT OF THE AIR FORCE
Washington, 3 August 1961

Communications-Electronics Activities

CLASSIFIED CHANGE

AFM 100-30, 1 January 1960, is changed as follows:

1. Insert the attached pages.

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3085-1 thru 3085-21

2. After posting the change, file this change sheet in front of the manual.

BY ORDER OF THE SECRETARY OF THE AIR FORCE:

CURTIS E. LEMAY
Chief of Staff

OFFICIAL:

R. H. KING
Colonel, USAF
Director of Administrative Services

CMS

REVIEW ON 3 Aug 1991

25 JUL 1985

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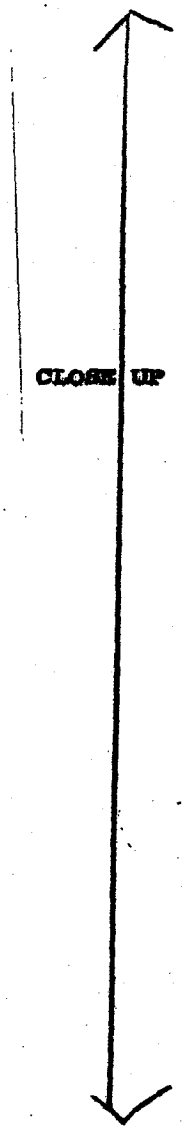
AEROSPACE COMMUNICATIONS-ELECTRONICS

(UNCLASSIFIED) EXISTING AEROSPACE C-E SYSTEMS



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SECRET
31 December 1960
August 1961

AFM 100-50B

ASTRONAUTICS COMMUNICATIONS-ELECTRONICS

CED 2500

CLASSIFIED SUPPLEMENT

CED 61-147
RSI 61-4775

10 PT FUTURA DEMIBOLD

10 PT FUTURA DEMIBOLD

14 PT SPARTAN BLACK

CONTENTS

8 PT GARAMOND BOLD ITALIC 2PT LEADED

8 PT GARAMOND BOLD ITALIC 2PT LEADED

8-PT GARAMOND BOLD 2PT LEADED

30 PICAS

TRIM SIZE 7-3/4 X 10-1/4"

10 PT FUTURA DEMIBOLD

MANUSCRIPT

MASTER LIST OF FIGURES AND INSERTION INSTRUCTIONS

CED Number	Figure Number	Title	Follows CED Paragraph
Text	5025-1 (S)	Discoverer Ground Support Facilities	5025. 1b
	5025-2 (S)	~~Discoverer Satellite Vehicle~~ AGENA "A" AND "B"	5025. 1d(1)(a)
	5025-3 (U)	Advent Space Craft	5025. 2b
	5025-4 (S)	Midas Satellite Vehicle	5025. 4c(1)
Text	5025-5 (S)	Midas System Ground Support Facilities	5025. 4e
	5025-6 (S)	BMEWS Simplified Block Diagram	5025. 5a(1)
	5025-7 (T)	~~BMEWS Forward Site Radar Subsystems~~ TYPICAL BMEWS RADAR CONFIGURATION	5025. 5a(2)
	5025-8 (U)	BMEWS Site Locations and Radar Coverage	5025. 5a(5)
Text	5025-9 (U)	Technical Characteristics of the Detection Radar Subsystem	5025. 5b(2)(b)
Text	5025-10 (U)	Technical Characteristics of the Tracking Radar Subsystem	5025. 5b(2)(c)
	5025-11 (S)	BMEWS Rearward Communications Routing ~~for Site I~~ - THULE	5025. 5g(1)(a)
	5025-12 (S)	BMEWS Rearward Communications Routing ~~for Site II~~ - ALASKA	5025. 5g(1)(a)
	5025-13 (S)	BMEWS ~~Rearward~~ TRANSATLANTIC Communications ~~Routing for Site III~~ ROUTES	5025. 5g(1)(a)

Date 3 August 1961 — Some not changed on all pages of this Copy

5025.1 (~~S~~ short) Discoverer:

a. (U) (unclassified) Program Objective:

(UNCLASSIFIED)

(1) The Discoverer program includes the design, development, and flight testing of 44 two-stage vehicles, using the Thor (IRBM) (intermediate range ballistic missile) as the first stage (booster) and the Agena as the second stage (satellite vehicle).

(UNCLASSIFIED)

(2) The objectives of the Discoverer program are as follows:

(UNCLASSIFIED)

(a) Flight testing of the satellite vehicle airframe; propulsion, guidance, and control systems; auxiliary power supply; and telemetry, tracking, and command equipment.

(UNCLASSIFIED)

(b) Attaining satellite stabilization in orbit.

(UNCLASSIFIED)

(c) Obtaining satellite internal thermal environmental data.

(UNCLASSIFIED)

(d) Testing of techniques for the recovery of a capsule ejected from the orbiting satellite.

(UNCLASSIFIED)

(e) Testing of ground support equipment and developing personnel proficiency.

(UNCLASSIFIED)

(f) Conducting biomedical experiments with mice and small primates, including ejection into orbit, reentry, and recovery.

(UNCLASSIFIED)

(3) The Discoverer program is providing a broad experimental base for future space programs. The experience,

Wrong Spacing

techniques, procedures, facilities, the Agena vehicle and vehicle subsystems, and items of hardware are applicable directly in whole or in part to the space weapons systems such as MIDAS.

(UNCLASSIFIED)

b. (U) Tracking and Command Functions. Discoverer vehicles are launched from Vandenberg AFB, California, with overall operational control exercised by the Satellite Test Center, Sunnyvale, California. The functions and equipment used by each station facility are listed in figure 5025-1.

(UNCLASSIFIED)

c. (U) Overall Flight Characteristics:

(UNCLASSIFIED)

(1) Launch Phase:

(UNCLASSIFIED)

(a) The first stage of powered flight by the Thor booster is 2.5 minutes long, carrying the vehicle 78 nautical miles downrange from Vandenberg AFB. Guidance is provided by a programmed autopilot. After Thor burnout, the Agena and Thor sections separate. As the booster falls away, the satellite vehicle continues in a self-stabilized, predetermined coast for 2.4 minutes to a point 380 nautical miles downrange.

(UNCLASSIFIED)

(b) At the end of the coast phase, the Agena power plant activates for 2 minutes to a point 770 nautical miles downrange, and this supplies the orbital velocity increment necessary to establish a substantially circular orbit. The internal controls then reorient the vehicle to the proper attitude (nose aft) within 2 minutes, enabling the satellite to achieve an in-orbit condition 2000 nautical miles downrange. The most common orbits pass within a few degrees of the poles.

Block

MANUSCRIPT

Facility	Equipment[1]	Flight Function
Satellite Test Center, California	A	Overall control; conversion of data from tracking stations to predict orbits and generate acquisition data to tracking stations for subsequent passes; prediction of recovery data.
Vandenberg AFB, California	BCDEFGHIJK	Launch, ascent, and orbital tracking; telemetry reception; trajectory measurements, including time to ignite second stage.
Point Mugu, California	BCDEFGHIJKL	Ascent tracking and telemetry data reception; transmission of command to ignite and shut down Agena (via guidance computer).
Telemetry Ship (950 n.m. downrange)	DF	Final stage ascent tracking and telemetry data reception.
New Boston, New Hampshire (tracking station)	BDEFGHIJK	Orbital tracking and telemetry data reception.
Kodiak, Alaska	BDEFGHIJK	Orbital tracking and telemetry data reception, including first pass acquisition; recovery capsule ejection and impact prediction.

(SECRET)

Figure 5025-1. Discoverer Ground Support Facilities.

MANUSCRIPT

Facility	Equipment[1]	Flight Function
Kaena Point, Oahu, Hawaii (tracking station)	BCDEFGHIJK	Orbital tracking and telemetry data reception.
Hickam AFB Oahu, Hawaii		Overall direction of capsule recovery operations.

[1]Equipment

A. 2 UNIVAC 1103-A digital computers
B. VERLORT (Modified Mod 11) radar
C. TLM-18 self-tracking telemetering antenna
D. Tri-helix antenna
E. Doppler range detection equipment
F. Telemetry tape recording equipment
G. Telemetry decommutators for real-time data presentation
H. Plot boards for radar and TLM 18 tracking data
I. Conversion equipment for teletype transmission of radar, TLM-18, and doppler tracking data in binary format
J. Acquisition programmer for preacquisition direction of antennas
K. Ground command to satellite transmission equipment
L. Guidance computer

(SECRET)

Figure 5025-1. Discoverer Ground Support Facilities (Continued)

(UNCLASSIFIED)
(2) Orbital Phase:

(UNCLASSIFIED)
(a) The orbital phase is the period after the vehicle is in orbit and stabilized in attitude and before the capsule is ejected. The Discoverer orbits earth in approximately 90 minutes. Because the polar orbit essentially is fixed in space and the Earth rotates inside it, each successive pass over the Earth's surface by the satellite is displaced approximately 22.5° at the equator.

(UNCLASSIFIED)
(b) As the vehicle orbits the Earth and passes within range of the ground tracking stations, telemetry signals are received from the orbiting vehicle and command signals are sent from the ground station to command and control the Discoverer. Control of the vehicle in orbit is limited to the following commands:

(UNCLASSIFIED)
1. Reset of the orbit timer
(UNCLASSIFIED)
2. Adjustment of the orbit timer
(UNCLASSIFIED)
3. Control of orbit attitude and period
(UNCLASSIFIED)
4. Initiation of the recovery sequence.

(UNCLASSIFIED)
(3) Recovery Phase:

(UNCLASSIFIED)
(a) The decision to initiate recovery of the Agena capsule is made by the STC (sensitivity time control), and the command is issued to the vehicle by one of the tracking stations. Ejection is programmed to occur on command on the first, second, third, or fourth day after launch for capsule impact within the predetermined recovery area south of Hawaii. The recovery forces, consisting of

C-119 and C-130 aircraft and surface vessels, is deployed in the predicted impact area to intercept the capsule.

(UNCLASSIFIED)

(b) The capsule-ejection command is sent to the satellite by the Kodiak, Alaska station on the orbit preceding recovery. The vehicle reorients its position to permit capsule ejection on a reentry trajectory on the 17th orbit. The recovery parachute is ejected at about 50,000 feet, and the capsule beacon transmits a radio signal for tracking purposes. Midair recovery is attempted by the aircraft and, if unsuccessful, surface vessels and aircraft coordinate efforts to retrieve the capsule from the surface of the sea.

d. (S) Description of Discoverer Spacecraft:

(UNCLASSIFIED)

(1) (U) General:

(UNCLASSIFIED)

(a) The spacecraft portion of the Agena vehicle is a 60-inch diameter, load-carrying cylinder about 14 feet long. The Agena engine and pressurized gas storage is carried at the rear of the vehicle, resulting in an overall length of about 18 feet for the Agena "A" and about 26.5 feet for the Agena "B." Refer to figure 5025-2.

INSERT
Fig 5025-2
CED
Size:

(UNCLASSIFIED)

(b) The Agena satellite vehicle is being developed over a period of years and will include a variety of configurations, capabilities, and useful satellite life spans. Development of the system is proceeding from a simple design of limited capability to a more refined version capable of greater scientific investigation.

(2) (U) Guidance and Control. The guidance and control subsystem senses and directs the vehicle attitude and velocity so as to establish a satisfactory orbit. In addition, this subsystem provides (a) a self-contained means for the initial alignment and maintenance of the desired vehicle attitude during orbital operations, and (b) an indication of attitude and rate of change of attitude to other subsystems in the vehicle as necessary.

(3) (U) Communications. The communications subsystem provides the following facilities:

(a) S-Band Transponder. The vehicle S-band transponder supplies response pulses to the VERLORT radar coded interrogations, which are used at the interrogating radar as a means of determining vehicle position. The transponder also receives, decodes, and delivers ground-to-air real-time commands for operation of vehicle functions. The S-band transponder equipment includes a decoder and an antenna.

(b) Acquisition Beacon. The acquisition beacon provides a means for acquisition and tracking. This unit operates continuously, providing an acquisition signal for "back-up" if other acquisition methods prove unsuccessful. The transmitter is a low-power, crystal-controlled, (VHF) (237.8 (mc)), (CW) transmitter, the output of which is duplexed into a common antenna with the VHF telemetry transmitter. The acquisition beacon is isolated from the telemetry transmitter by means of a two-channel diplexer.