BIF-037A-4716/89

SECTION II

THE

[redacted] 25X1

LOW EARTH ORBIT

SIGINT SYSTEM

(MISSION 73XX)

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1. SUMMARY DESCRIPTION

The Mission 73XX system is a low earth orbit SIGINT system which collects pulsed and CW signals in the 2-18 GHz range. The satellite spins at 50 RPM and employs high-gain pencil beam antennas with monopulse feeds to detect and geolocate emitters. The satellites collect and store signal data and, when in view of a Remote Tracking Station (RTS) of the Air Force Satellite Control Network (AFSCN), downlink the data for relay to the [redacted] The Army's ELINT Processing and Dissemination System (EPDS) vans can also receive and process the 73XX downlink. Commencing with [redacted]

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Mission:	**Primary:** Performs general ELINT search for pulsed and continuous wave (CW) emitters and mainbeam technical intelligence. **Secondary:** Limited COMINT, FIS, and mapping capability.
Radio Frequency Coverage:	2-18 GHz
Number of Satellites:	One per mission (three missions currently active).
Orbit:	Near circular
Altitude:	370-485 nm
Inclination:	70-105 degrees
Orbit Period:	96 minutes
Orbits Per Day:	15 per satellite
Geolocation Accuracy:	[redacted]

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Geolocation Technique:	[redacted] 25X1
Swath Width:	1,000-1,500 nm depending on frequency
Target View Time:	About 10 minutes average in primary area.
Mode of Operations:	Transpond or store-and-dump
Revisit Capability:	2 hour gap average with 2 satellites in Northern Hemisphere where each satellite has 3-5 visits per day.
Reporting Timeliness:	3 hours "normal," 20-90 minutes "rapid" for select signals.

2. LAUNCH SCHEDULE

Vehicle ID	Mission #	Launch Vehicle	Launch Date	Mean Mission Duration/Design Life
LAURIE II				
GLORIA				

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3. ORBITAL ELEMENTS

Available data indicates each vehicle is placed in a slightly different orbit. Orbital Element ranges are:

Altitude:	370-435 nm
Inclination:	70-105 degrees
Orbit Period:	95-98 minutes

4. ORBIT DETERMINATION UNCERTAINTIES

	One-Sigma Position Uncertainty (m)	One-Sigma Velocity Uncertainty (m/min)
IN-TRACK	300	3
CROSS-TRACK	60	2
RADIAL	30	1

5. PAYLOAD SUBSYSTEM

a. Antenna System

The spacecraft antenna system consists of four separate subsystems, each of which has a separate antenna configuration with the following capabilities:

1) DF Subsystem - three high gain, narrowbeam antennas that provide high sensitivity and angle-of-arrival (AOA) measurements. These antennas are spaced at 120^{o} separation around the spacecraft which spins at 50 RPM. Thus each antenna places a pencil beam footprint on the earth during one-third of a rotation. The angle between the spacecraft spin axis (aligned with the earth's spin axis) and the high gain antenna's boresight is 100 degrees. Antenna parameters are:

Antenna	Diameter (m)	Min. Freq. (GHz)	Max. Freq. (GHz)
1	1.83	2.0	6.0
2	0.914	6.0	12.0
3	0.914	12.0	18.0

2) OMNI/C^3 Subsystem - antennas with broad angular coverage that provides access to generally main-beam power signals. The C^3 antennas provide signal reception and transmission for the C^3 SGLS system.

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4) Guard Antenna - a guard antenna is mounted on each DF antenna to provide gain in excess of the first sidelobe of their respective DF antennas to inhibit processing of signals intercepted by the near-in sidelobes of the DF antennas.

b. Receiver System

The receiver system consists of:

- a DF pulse receiver
- a DF CW receiver
- an OMNI pulse receiver
- an OMNI CW receiver
- a polarization analysis receiver (PAR)
- a technical intelligence receiver (TI)

Each receiver provides coverage over the entire 2 to 18 GHz frequency range. The instantaneous frequency bandwidth is 2 GHz for the DF and OMNI receivers. The DF pulse/CW receivers and the OMNI pulse/CW receivers will cover the same 2 GHz band. The OMNI bands selected are independent of those selected for the DF receivers. The PAR simultaneously processes intercepted pulse or CW signals from the right hand circular polarized (RHCP) and left hand circular polarized (LHCP) channels. Activation of the PAR in the pulse and CW modes is by frequency handover from the OMNI pulse and OMNI CW receivers, respectively, or via a fixed-

frequency assignment mode. In the handover mode, a signal meeting certain criteria from either the pulse or CW search receivers is handed over to the TI receiver. The fixed frequency assignment mode is independent of the pulse and CW search receivers. The outputs from the individual receivers are digitized for incorporation into a PCM wavetrain. In addition, the TI receiver can output data in analog form. The PCM wavetrains and analog data may be transmitted directly to a tracking station or recorded on vehicle tape recorders for later transmission. Channel G/T employing the high gain antennas is shown in the Table below for FARRAH II:

Freq. (GHz)	G (dB)	NF (dB)	G/T (dB)
2	20.2	4.6	-0.9
4	27.4	4.6	-1.8
4	27.4	6.4	-3.6
6	29.5	6.4	-1.5
6	24.2	5.4	-5.8
8	26.6	5.4	-3.4
10	27.8	5.7	-2.5
12	27.0	6.2	-3.8
12	34.9	6.2	+4.1
14	36.2	7.0	+4.2
16	36.6	8.0	+4.0
18	36.8	7.6	+4.6

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6. OPERATIONAL MODES

Two basic modes of operation are available, record and transpond. In the record mode, intercept payload data (mission data) is stored on tape recorders on board the satellite for subsequent play-back and transmission to the ground. The transpond mode provides an avenue for the transmission of mission data to the ground in real time at the same time that it is being recorded on board the satellite. The mission data and status telemetry data, in encrypted form, is transmitted to an RTS and/or to EPDS vans using the standard SGLS system and on-board transmitters.

7. GEOLOCATION TECHNIQUE

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8. DOWNLINK PARAMETERS

In the satellite baseband assembly, the PCM telemetry bit stream bi-phase modulates a 1.024 MHz subcarrier. The 1.024 MHz subcarrier and the pseudo random noise (PRN) ranging signals are summed into a composite output for modulating the downlink transmitter. Three data downlinks are available, the STATUS/TLM link and two wideband links. There are four downlink transmitters on the satellite. The carrier/(2 watt) transmitter is normally used to transmit PRN and real-time status and health information. Carrier 4, 5, and 6 transmitters (each 10 watts) are used for transmitting real time and recorded mission (payload) data. These transmitters provide both frequency modulation (FM) and phase modulation (PM) capability. The carrier 6 transmitter can be commanded to the PM mode when selected to substitute for the carrier/transmitter. The following downlink frequencies are assigned to Mission 7300:

SGLS Channel No.	Frequency MHz	Carrier
1		1
7		6
12		4
17		5

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The Mission 7300 spacecraft is equipped with COMSEC equipment to prevent unauthorized commanding and use of the spacecraft and for encrypting all the digital PCM data downlinked from the spacecraft (including TLM status data).

9. GEOLOCATION ERROR BUDGET

For FARRAH II

Residual [redacted] error at SNR = 0.1 deg. 25X1

Angular mean error at 0 db SNR = 0.2 deg.

Residual time error at SNR = 1 E-3 sec.

1 time resolution error at 0 db SNR = 1 E-3 sec.

10. COST MODEL PARAMETERS

Not Available

11. MGS LOCATIONS

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The [redacted] satellites communicate with the AFSCN Remote Tracking Stations (RTS) which then relay the mission data through the Satellite Control Facility (SCF) [redacted] The locations of the seven RTS are:

LAT	LONG
34.7	239.4
21.56	201.76
42.95	288.37
13.62	144.86
-4.67	55.48
76.52	291.4
51.11	359.1

12. [redacted] PROCESSING CAPABILITIES 25X1

The Ground Segment processing/analysis function processes and analyzes data to produce reports. The function involves the use of data from the space segment, ground segment collection function, and additional information, such as signal characteristics lists and signal histories, to produce reports. There are three primary processing subsystems.

a. Digital Data Processing Subsystem (DDPS)

The DDPS simultaneously accepts up to six PCM data streams via the fiber-optic interface with the STC and provides automatic and interactive computational capabilities for simultaneously processing four of the six formatted streams and storing the remaining two for subsequent processing. This processing involves interactive analytic processes by which the analyst can manipulate signal files, blip files, and reference files to aid his reporting.

b. Analog Data Processing Subsystem (ADPS)

The ADPS provides the capability to perform signal simulation, digital ground station equipment calibration, digital ground station fault isolation, and software program development.

c. Mission Data Analysis Subsystem (MDAS)

The MDAS is an integrated collection of autonomous analyst interactive processing stations that have as inputs the blip and signal files created by the DDPS and support files. The outputs of the MDAS are product intelligence reports and include either operational SIGINT or technical intelligence. The MDAS contains three major components each having multiple analyst interactive stations allowing the satisfaction of the three general analytical functions: search, operational SIGINT, and technical intelligence culminating in the issuance of intelligence reports.

13. [redacted] FACILITY LAYOUT DIAGRAM

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Not Available

14. FUTURE SYSTEM CAPABILITIES

General

It is anticipated that the current, basic configuration of the Mission 7300 system will remain relatively constant through the [redacted] era. With the advent of [redacted] a complete block change is anticipated. Since the configurations of the future systems are evolutionary in nature, only those improvements that are currently considered as "base-line" will be addressed in this section.

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Gloria

Gloria is a Gas Deployable Spacecraft System (GDSS) built by Ball Brothers and designed to survey signals in the 30 to 38 GHz frequency range. The payload is built by E-Systems. It satisfies quick response, low cost, and limited time mission objectives. Frequency measurement accuracy is ±150 MHz. Minimum required ERP is 70-100 dBm and geolocation accuracy is estimated to be [redacted] EEP. 25X1