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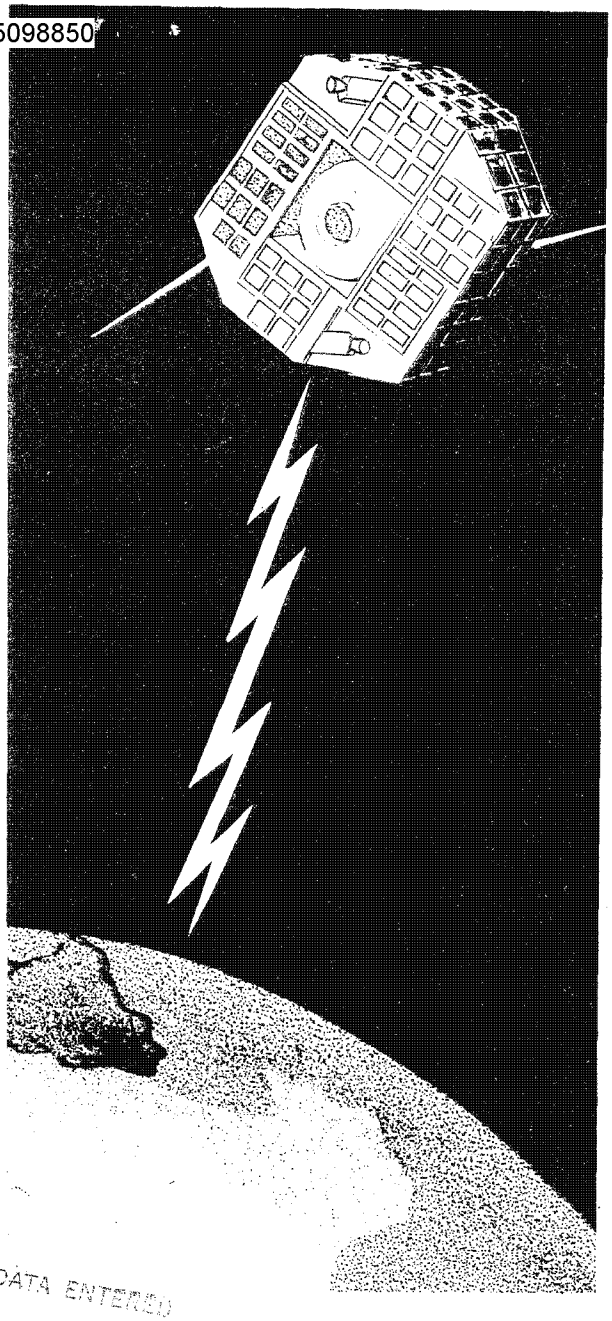

DESCRIPTION OF
SIGINT MISSION
7342

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SIGINT Mission 7342 Description

1. GENERAL INFORMATION

SIGINT Mission 7342 is a satellite ELINT intercept system which performs general search (GS) for pulsed and continuous wave (CW) emitters and electronic order of battle (EOB) for pulsed emitters in the 2 to 12 GHz frequency range. The intercept system is mounted on a spin-stabilized spacecraft placed in a 275 n. m. circular orbit. [redacted] 25X1
25X1
25X1
The system also detects CW signals and measures their frequency. A three-dimensional view of the spacecraft with all antennas deployed is presented in Figure 1.

This description discusses the following:

a. Antenna system

b. Receiver system

(1) Frequency coverage and measurement

(2) Performance characteristics

c. System output

d. New or unique items

2. ANTENNA SYSTEM

Mission 7342uses two antenna systems, one for intercept and one for command and telemetry. The antenna system configurations are shown in Figure 1.

2.1 Intercept Antenna and Geopositioning System

A total of six antennas are used for signal intercept in the 2-12 GHz range: two high-gain antennas for target sidelobe intercept and geopositioning and four omni-directional antennas that provide inhibit protection for the high-gain antennas.

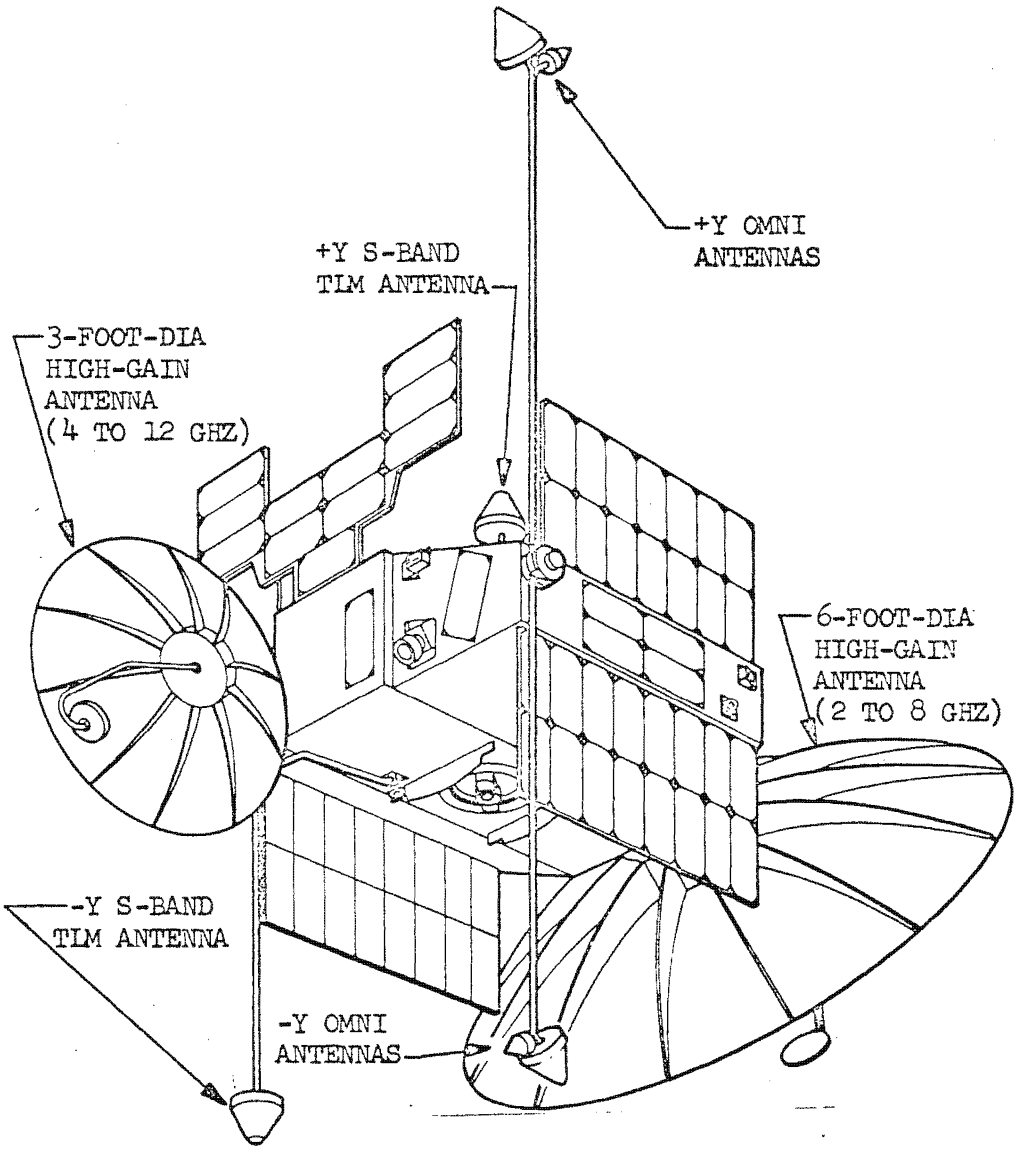

Figure 1. Spacecraft Intercept System in Orbital Configuration

The high-gain antennas are deployable 6-foot-diameter- and 3-foot-diameter-paraboloidal reflectors which use flex-rib and metalized mesh construction. The 6-foot-diameter antenna covers the 2- to 8-GHz band and the 3-foot-diameter antenna covers the 4- to 12-GHz band; thus, providing overlapping coverage of C-band (4 to 8 GHz). The feeds for the two paraboloidal reflectors are flat four-arm Archimedes spirals with microwave absorber backing. The four arms of each spiral are connected through four equal-length coaxial cables to a beam forming network (BFN) which has a sum and difference output from which emitter location is determined.

The electrical phase difference between the sum and difference outputs is a linear function of target azimuth angle B (see Figure 2). It should be noted that the sum and difference patterns are rotationally near symmetrical about the boresight axis. The axes of both antennas are at an angle of approximately 55 degrees with respect to the spacecraft spin (Y-Y) axis.

The omni-inhibit antennas are two-arm, conical spirals. The 2 to 8 GHz omni-inhibit antennas are 60-degree cones having 2-inch diameter at the base. The omni-inhibit antennas are located on two booms; each boom contains one 2- to 8-GHz and one 4- to 12-GHz antenna. The -Y boom directs the inhibit antennas in the same direction as the paraboloidal reflector, while the +Y boom directs the inhibit antennas toward the paraboloidal back lobes. The patterns of the inhibit antennas have a 3-db beamwidth of approximately 80 degrees with an axial ratio of less than 4 db over most of the area of interest. Some poke-through will occur at the crossover points of the dual inhibit system.

2.2 Command and Telemetry Antennas

Two S-band telemetry antennas and one command antenna provide communications with the spacecraft control network.

3. RECEIVER SYSTEM

3.1 Frequency Coverage and Measurement

Mission 7342provides selectable frequency coverage over the RF band from 2 to 12 GHz using the five contiguous bands defined

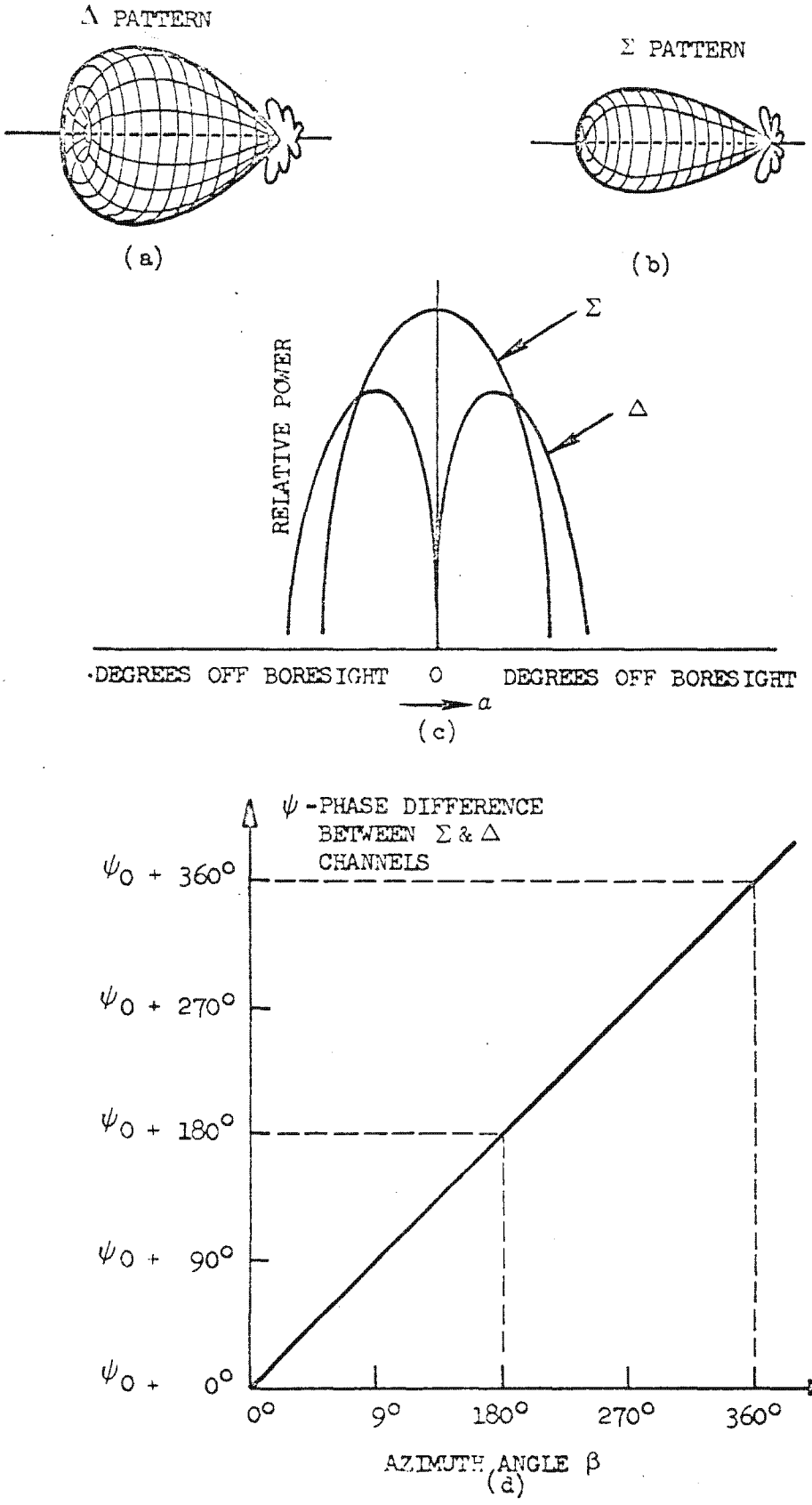

Figure 2. Idealized Sum and Diffence Patterns

in Table 1. The 4- to 6- and 6- to 8-GHz bands are intercepted by either parabolic antenna. The total 2-GHz frequency range of a selected band is detected simultaneously. The receiver system can be tuned to one frequency band or over a 2 1/2-second period can be stepped through any combination of the five bands.

Table 1

FREQUENCY COVERAGE BANDS

Band	Frequency Coverage (GHz)	Antenna
1	2-4	6-ft. Parabolic
2	4-6	3- and 6-ft. Parabolic
3	6-8	3- and 6-ft. Parabolic
4	8-10	3-ft. Parabolic
5	10-12	3-ft. Parabolic

The frequency of pulsed emitters is measured on a single-pulse basis to an accuracy of $\pm$18.6 MHz with a resolution of 31.25 MHz anywhere in the 2-GHz instantaneous band being used. Frequency measurement is possible wherever the received peak pulse power is above the sum channel threshold. Up to three frequencies from a multiple-frequency emitter are recorded provided that they are separated by a minimum of 64 MHz and that all are no more than 10 db below the total received peak pulse power. Except for the above limitations, the frequency distribution is arbitrary. The frequency accuracy applies to each of the three simultaneous frequencies. The system also indicates which frequency of a multiple-frequency emitter produces the largest received power and, also, whether the two largest signals have power levels which are within 4 db of one another.

3.2 Performance Characteristics

Figure 3 is a simplified block diagram of Mission 7342 showing the relationship of the subsystems to one another.

3.2.1 Pulsewidth and Sensitivity

The system measures pulsewidth to an accuracy of 0.1 usec or 10 percent of the pulsewidth, whichever is greater for pulsewidths from 0.1 to 100 usec. Pulsewidth measurements are performed on the sum channel, and have a sensitivity of -69 dbm in Band 1 and -73 dbm in Bands 2 through 5.

3.2.2 Dynamic Range

All system requirements are met over an input range from the sum threshold to -33 dbm total received peak power when measured at the input to the sum channel. System requirements include data accuracy, all inhibit functions, and spurious responses.

3.2.3 Peak Power Measurement

Received peak pulse power in the sum channel is measured to an accuracy of 3 db with 95 percent confidence over the specified receiver dynamic range. On multiple frequency signals, the peak power measurement is measured on the total received power and not on the individual frequencies.

25X1

3.2.5 Pulse Rate Handling Capability

The system can meet all specifications on any pulse provided that the minimum interval between pulses is 3.3 usec. In this context, the minimum interval between pulses is defined as the time between the trailing edge of one pulse and the leading edge of the following pulse.

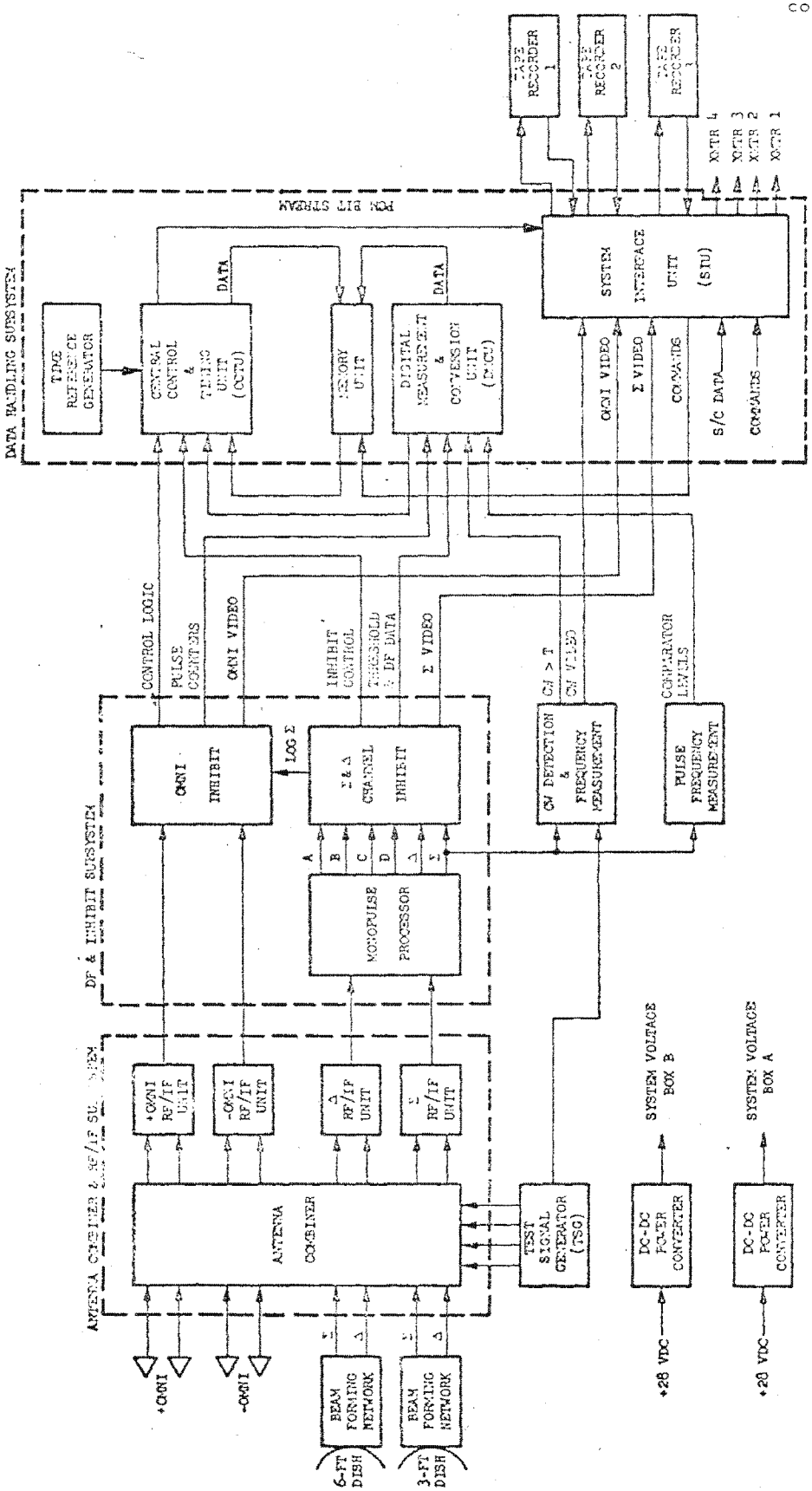

Figure 3. System, Block Diagram

3.2.6 Geopositioning Accuracy

Geopositioning accuracy varies as a function of intercepted signal frequency and location of the emitter from the satellite subvehicle point. Nominal values vary from approximately [redacted] at nadir to approximately [redacted] at an off-track distance of 450 n. m. 50X1

3.2.7 CW Signal Characteristics

Characteristics of the CW signal intercept function are as follows:

a. CW Frequency Coverage. The system provides coverage of the entire RF band from 2 to 12 GHz. Each frequency within the instantaneous 2-GHz band used for pulse intercept is searched once every 3.33 msec.

b. CW Frequency Measurement. The system provides frequency measurement of CW emitters over the instantaneous 2-GHz band selected. The frequency measurement subsystem has an accuracy of ± 15 MHz anywhere within a 2-GHz band.

c. CW Dynamic Range. The requirements of the CW frequency measurement are met over an input range of from -92 to -33 dbm total received peak power when measured at the input to the sum channel. Frequency measurement requirements include data accuracy and pulsed signal rejection.

d. CW Channel Sensitivity. The CW channel has a sensitivity of -85 dbm at the sum channel system input for any frequency within the specified frequency range. With this input power, the probability of detection is 0.5, and the false alarm rate is less than one per second.

e. Pulsed Signal Rejection. The CW system rejects any single pulse which has a pulsewidth of 100 usec or less.

3.2.8 Video Output

Mission 7342 provides three 10-KHz bandwidth analog data outputs: sum channel video, CW video, and omni video. Each video output level is proportional to the total received power. The sum channel video signal is recorded if the intercept is valid; the CW

video signal is recorded if the criteria for a CW signal are satisfied, and the omni video signal is recorded continuously for each read-in period. The selection of omni video or CW video for recording is by ground command.

3.3 Calibration Subsystem

The system includes an on-board test signal generator (TSG) that generates and inserts pulsed calibration test signals into the sum and difference channels at the system input. The calibration test signal generator provides the following capabilities:

a. Allows determination of DF system amplitude and phase imbalances.

b. Verifies operation of the pulsed signal frequency measurement subsystem.

c. Verifies operation of the pulsewidth measurement subsystem.

d. Verifies operation of the sum channel video subsystem (analog and digital).

e. Verifies the amplitude inhibit operation of the omni channel.

f. Verifies the amplitude inhibit operation of the difference channel.

g. Verifies the operation of the CW frequency measurement subsystem.

4. SYSTEM OUTPUT

PCM information in digital format on signal frequency, intercept time, emitter location, pulsewidth and pulse amplitude as well as analog video data are recorded on a 1-MHz tape recorder. The data are subsequently readout at a 4:1 ratio by remote tracking stations in the Spacecraft Control Network. The system contains a total of three recorders, one of which is usually in back up status. Each recorder can record a total of 24 minutes of intercept data prior to readout.

The system can be tasked for a maximum of twelve revs per day and a maximum on the order of 100 minutes of intercept per day. The former constraint is due to tracking station locations and the latter to spacecraft power.

5. NEW OR UNIQUE ITEMS

5.1 Spin Axis Control System

The spin axis control system permits periodic optimization of the antenna system to latitudes of interest.

5.2 Spin Control System

The spin control system permits a very precise control of the spin rate of the spacecraft resulting in improved geopositioning accuracy.

5.3 Monopulse Location Capability

The monopulse feature permits geopositioning each pulse of an emitter which enhances location capability through appropriate ground processing.

5.4 Digital Data Format

All data required to process intercept for geopositioning purposes are digitized enhancing expedited transmission, processing and reporting.