BIF003W/B-304950-88
9999
Sheet Count: 53
Unit 10
Copy No.: 1

25X1

INTERDEPARTMENTAL COMMUNICATION

TO: Distribution ORGN: 68-30 FAC: 1 DATE: 8 Dec. 1988
FROM: ORGN: 68-30 FAC: 1 EXT: 28228

SUBJECT: MEMO FOR THE RECORD - TOPHAT III CONCEPT OF OPERATION (CONOPS) DOCUMENT

Attached is the TOPHAT III Concept of Operations (CONOPS). The Short form of this document has been provided. This Short form version had all of the graphics prepared, and is considered to be the most up to date and complete version. If the TH III program were to proceed, this is the CONOPS version that should be used as the starting point. The TH III Data Analysis Operations Concept is included as a separate section at the back of the document. This includes a description of the TH III Data Base support, Signal Analysis and Reporting (OIN) and Term Analysis tasks.

Prepared by:

Senior Staff Engineer

for

Manager, Dept. 68-36

25X1

CC:

Data Center, Bldg. 104

25X1

Handle Via BYEMAN
Control System Only

****
* ~~SECRET~~ [redacted] *
****

25X1

LOCKHEED PRIVATE DATA

DRAFT

TOPHAT III

CONCEPT OF OPERATIONS

[redacted]

CDRL XXXX

2 DECEMBER 1988

Prepared by:

[redacted]
Advanced Planning

Prepared by

[redacted]
Advanced Planning

Approved by:

[redacted] Manager
Mobile Elements/Advanced Planning

[redacted] Manager
Systems Engineering

[redacted] Vice President,
Special Programs II

C. Hand
R32

Approved by

[redacted]
Program Manager

[redacted]
Program Manager

G. Geyer, [redacted]

25X1

LOCKHEED PRIVATE DATA

****
* ~~SECRET~~ [redacted] *
****

T80037
1424R

Handle Via BYEMAN
Control System Only

25X1

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

25X1
25X1

25X1

TABLE OF CONTENTS (Continued)

25X1

25X1

ACRONYMS AND ABBREVIATIONS

A/D	Analog to Digital Conversion
AARS	Advanced Analyst Remote Station
ACDS	Attitude Control and Determination Subsystem
ADPS	Analog Data Processing Subsystem
AFSCN	Air Force Satellite Control Network
AGE	Aerospace Ground Equipment
AOA	Angle of Arrival
BB	Baseband
BPSK	Binary Phase Shift Keyed
BVS	Booster Vehicle System
BW	Bandwidth
C^3	Command, Control, and Communications
CCIR	COMINT Consultation International Radio
CE	Calibration Element
CMD	Command
COMINT	Communications Intelligence
CRF	Calibration Resource Facilities
CRS	Computer Resources Subsystem
CRV	Calibration Resource Vehicles
CSTC	Consolidated Space Test Center
CW	Continuous Wave
dB	Decibel
DDPS	Digital Data Processing Subsystem
DDPPS	Digital Data Preprocessing Subsystem
DDT	Direct Data Transfer
DE	Director of Engineering
DF	Direction Finding
DH&C	Data Handler & Control Unit
DSCS	Denfense Support Communication System
DSIS	DSCS SCF Interface System

25X1

ACRONYMS AND ABBREVIATIONS (Continued)

ELINT	Electronic Intelligence
EPS	Electrical Power Subsystem
ERP	Effective Radiated Power
FDM	Frequency Division Multiplexing
FE	Front End
FM	Frequency Modulation
FSK	Frequency Shift Keyed
FTR	Fine Tuned Receiver
GCCS	Ground Communications and Control Subsystem
GHz	Gigahertz
ID	Identifier
IE	Intercept Electronics
IF	Intermediate Frequency
[redacted]	System Byeman Channel Reports Designator
I&W	Indications and Warnings
KHz	kilohertz
Kbps	kilobits per second
LHCP	Left Hand Circular Polarization
LO	Local Oscillator
LSIC	Launch Segment Integrating Contractor
LVCO	Low Voltage Cut Off
MCC	Mission Control Center
MDAS	Mission Data Analysis Subsystem
MPS	Mission Planning Subsystem
Mbps	Megabits per second
OCMC	Overhead Collection Management Center

25X1

Handle Via BYEMAN
Control System Only

25X1

****
* ~~SECRET~~ [redacted] *
****

25X1

LMSC PROPRIETARY INFORMATION

ACRONYMS AND ABBREVIATIONS (Continued)

P/L	Payload
PCM	Pulse Code Modulation
PM	Phase Modulation
PPS	Propulsion and Pyrotechnics Subsystem
PRN	Pseudorandom Noise
QPSK	Quadriphase Shift Keyed
RF	Radio Frequency
RHCP	Right Hand Circular Polarization
RT	Realtime
RTS	Remote Tracking Station
S/C	Spacecraft
SAFSP	Secretary of the Air Force Special Projects
SGLS	Space-Ground Link Subsystem
SIGINT	Signal Intelligence
[redacted]	
SOI	Signal of Interest
T/R	Tape Recorder
TBD	To Be Determined
TBR	To Be Reviewed
TBS	To Be Specified
TCS	Thermal Control Subsystem
TI	Technical Intelligence
TLM	Telemetry
TOM	Time of Measurement
TRG	Time Reference Generator
TSG	Test Signal Generator
TT&C	Tracking, Telemetry and Commanding

25X1

****
* ~~SECRET~~ [redacted] *
****

25X1

ACRONYMS AND ABBREVIATIONS (Continued)

UHF	Ultra High Frequency
VCO	Voltage Controlled Oscillator
VHF	Very High Frequency

Section 1

EXECUTIVE OVERVIEW

1.1 SYSTEM OVERVIEW

The TOPHAT III System provides for collection of electromagnetic radiation, data analysis, and reporting of Communications Intelligence (COMINT) data. The system is made up of three segments: space, ground, and launch. The space segment consists of a TOPHAT III satellite (Figure 1) in near-polar 320 nmi circular orbit. The satellite provides worldwide coverage (75° inclination) of both the northern and southern hemispheres. TOPHAT III covers the frequency range of 0.1 to 2.0 GHz. The satellite collects information for communication emitter signal characterization, signal identification, and geolocation. Figure 2 depicts the TOPHAT III satellite collecting data. The launch segment launches the satellite into orbit. The ground segment consists primarily of the Air Force Satellite Control Network (AFSCN) and the [redacted] The AFSCN provides command, control and communications (C^3) of the satellite in response to [redacted]

25X1

The remainder of this System Overview provides a comparative history of the three TOPHAT missions, more detailed descriptions of the TOPHAT III System missions, the functional organization, and an overview of the operational concept. Section 4 provides a detailed operational concept.

1.2 HISTORY

TOPHAT III is the third of a series of COMINT collection and geolocation spacecraft in support of strategic and tactical national COMINT collection objectives.

CHARACTERISTICS

- SPINNING INTERFEROMETER
- 0.1 TO 2-GHz CW COLLECTION
- PRECISION FREQUENCY MEASUREMENT (10 kHz)
- ~~275~~ 320 nmi, ~~70~~ 75 deg INCLINED ORBIT

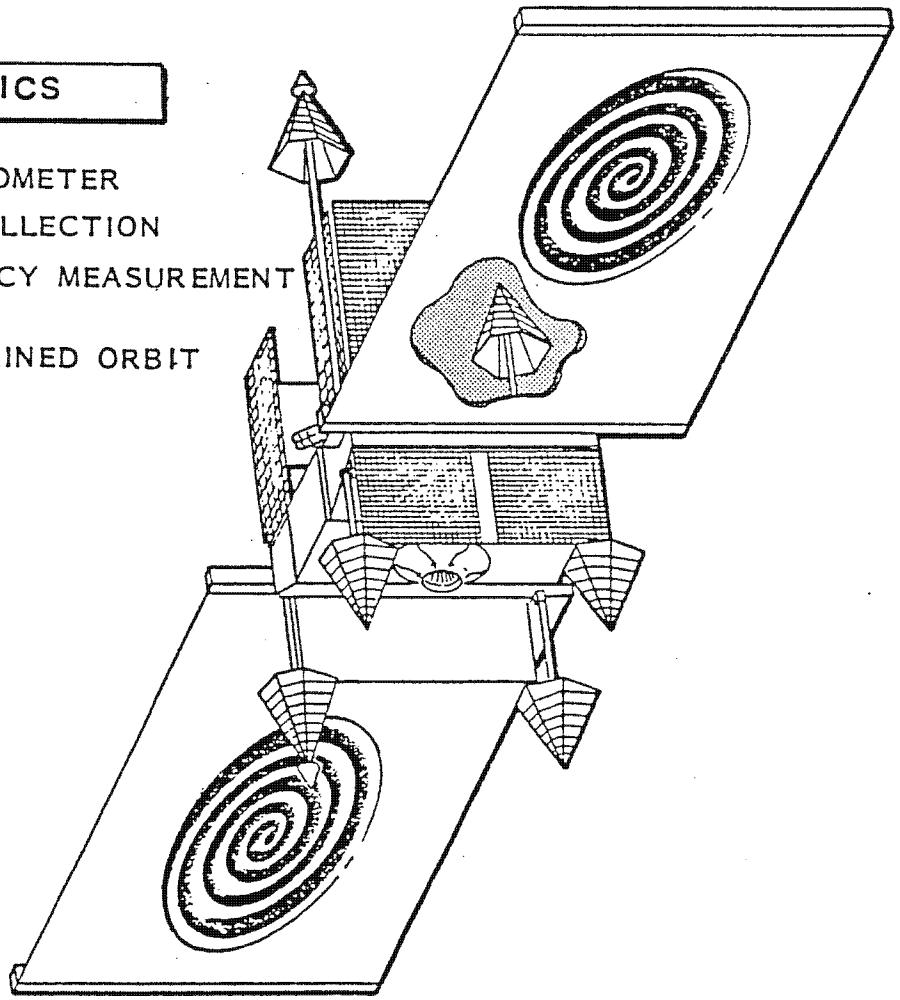


Fig. 1 TOPHAT III Satellite Configuration

****
* ~~SECRET~~ [redacted] *
****

LMSC PROPRIETARY INFORMATION

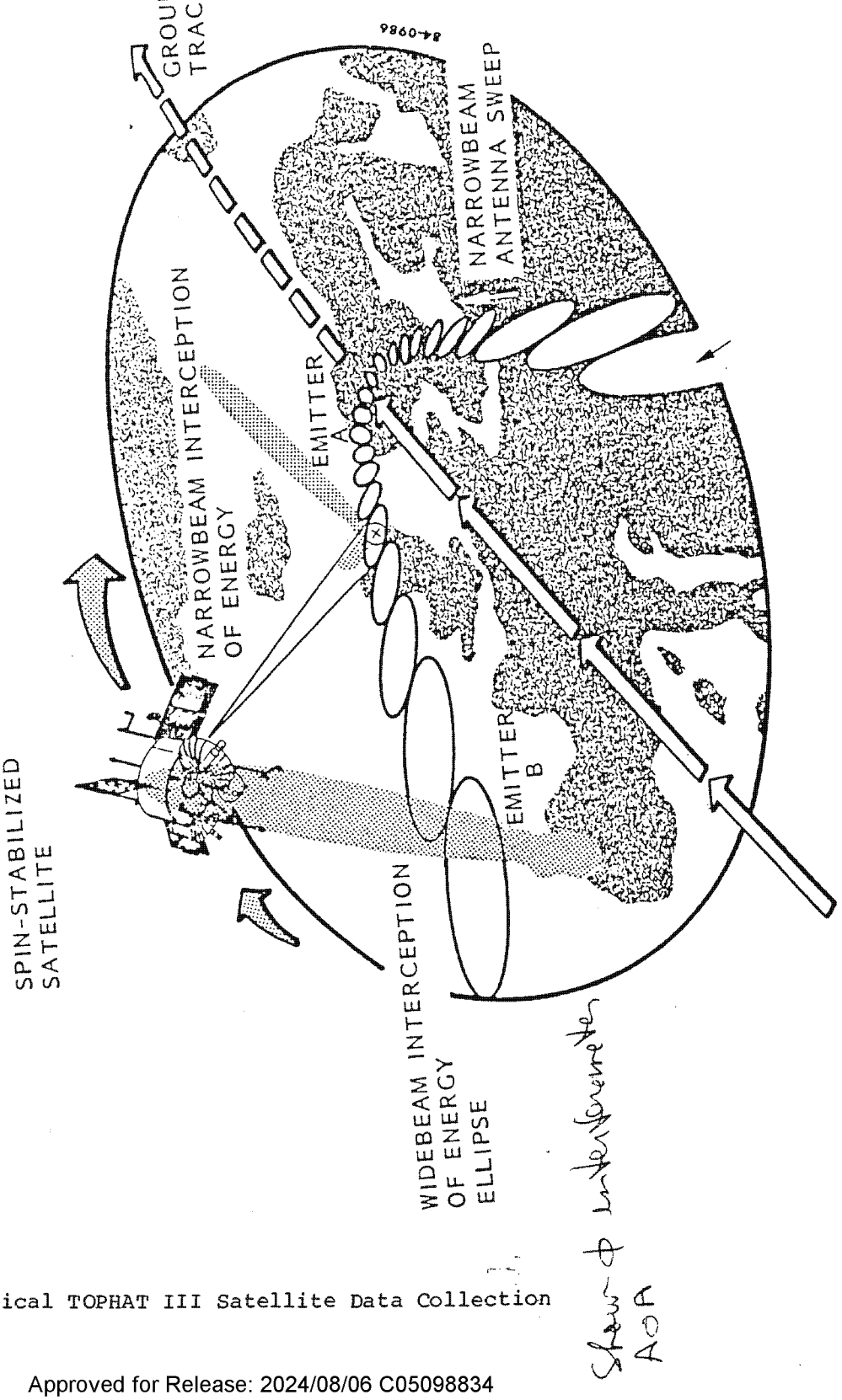


Fig. 2 Typical TOPHAT III Satellite Data Collection

1.2.1 TOPHAT I

TOPHAT I (Spacecraft 4423) was launched 18 November 1970 and had a collection lifetime of 44 months. It was designed to operate from a low-altitude, as a spin stabilized satellite, and collected in the frequency range of 0.450 to 1.0 GHz. Its primary target emitters were 3 to 5 kilowatt frequency modulated, frequency division multiplex (FM/FDM) signals in C.C.I.R. standard 12, 24, 60, or 120 channel formats. The TOPHAT I system was required to select this class of signals from a signal environment containing many interfering signals. In the worst case (daytime, Europe and Western USSR), these interfering signals were capable of generating field strengths at the TOPHAT I antennas equal to or greater than those produced by the target emitters. The results from the first TOPHAT mission were essential to determine SOI access and interference characteristics for TOPHAT II COMINT mission planning and now provide a basis for the TOPHAT III mission.

1.2.2 TOPHAT II

TOPHAT II (Spacecraft 4428) was launched 10 April 1972 and had a collection lifetime of 70 months. It also covered the frequency range of 0.45 to 1.0 GHz.

TOPHAT II also was a COMINT collection and geolocation system designed to operate from a low-altitude, spin-stabilized satellite. Like TOPHAT I, it was targeted against FM/FDM troposcatter communication links. In addition, it was designed to recognize and copy frequency-shift keyed (FSK) signals with a wide range of baud rates and deviation levels within the 450-1000 MHz spectrum. In the Fine Tuned Receiver (FTR) mode, it had increased sensitivity (13 dB greater than TOPHAT I). The system provided both Directed Search and General Search operation, by means of ground-commandable recognition criteria and limited frequency scan operation.

The primary purpose of the TOPHAT II payload was to detect and recognize signals-of-interest in the presence of interfering signals, and to dwell upon those signals-of-interest while recording a selected sample of the link

activity for FDM signals and Pre-D data for FSK signals, along with signal frequency, amplitude, modulation characteristics, target Direction Finding (DF) measurements, and payload status data. In addition, signal parameters were recorded on interfering sources to provide signal environment data.

1.2.3 TOPHAT III

TOPHAT III will collect in the VHF/lower VHF frequency range (0.1 to 2.0 GHz) and will intercept, characterize, [redacted] 25X1

[redacted] 25X1

[redacted] In addition, TOPHAT III will be capable of performing General Search in designated areas worldwide, and of supporting Tipoff/Indications and Warning (I&W) and Technical Intelligence Missions. 25X1

[redacted] 25X1

1.3 MISSIONS

The TOPHAT III system produces COMINT emitters parametric measurements and geolocation information in support of four primary mission objectives: Directed Search (for designated SOIs), General Search, Tipoff/Indications and Warning (I&W), and Technical Intelligence. Figure 3 summarizes the missions and highlights the capabilities of the new TOPHAT III system, and Figure 4 shows the system level expected geolocation accuracy.

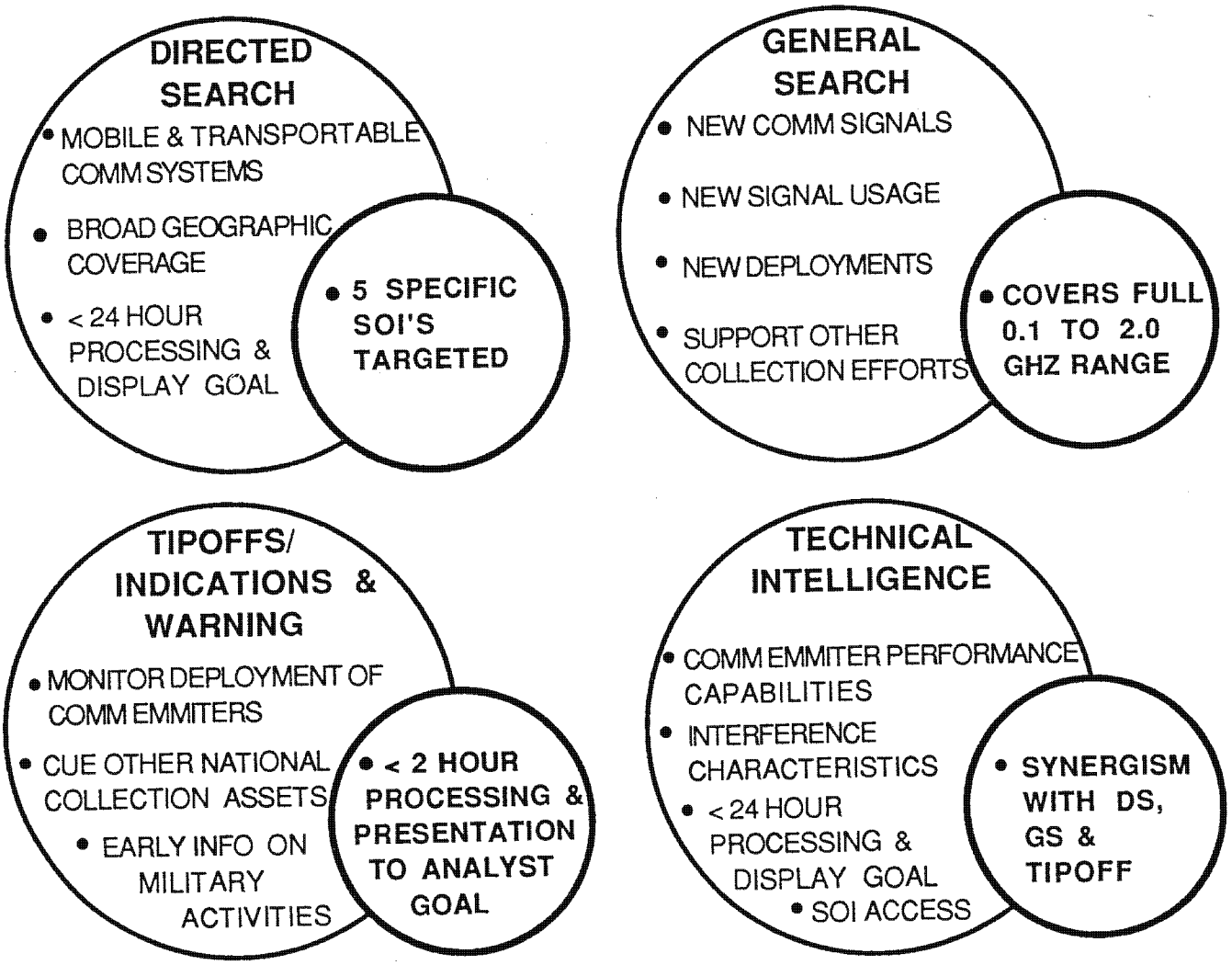


Fig. 3 TOPHAT III Mission Objectives

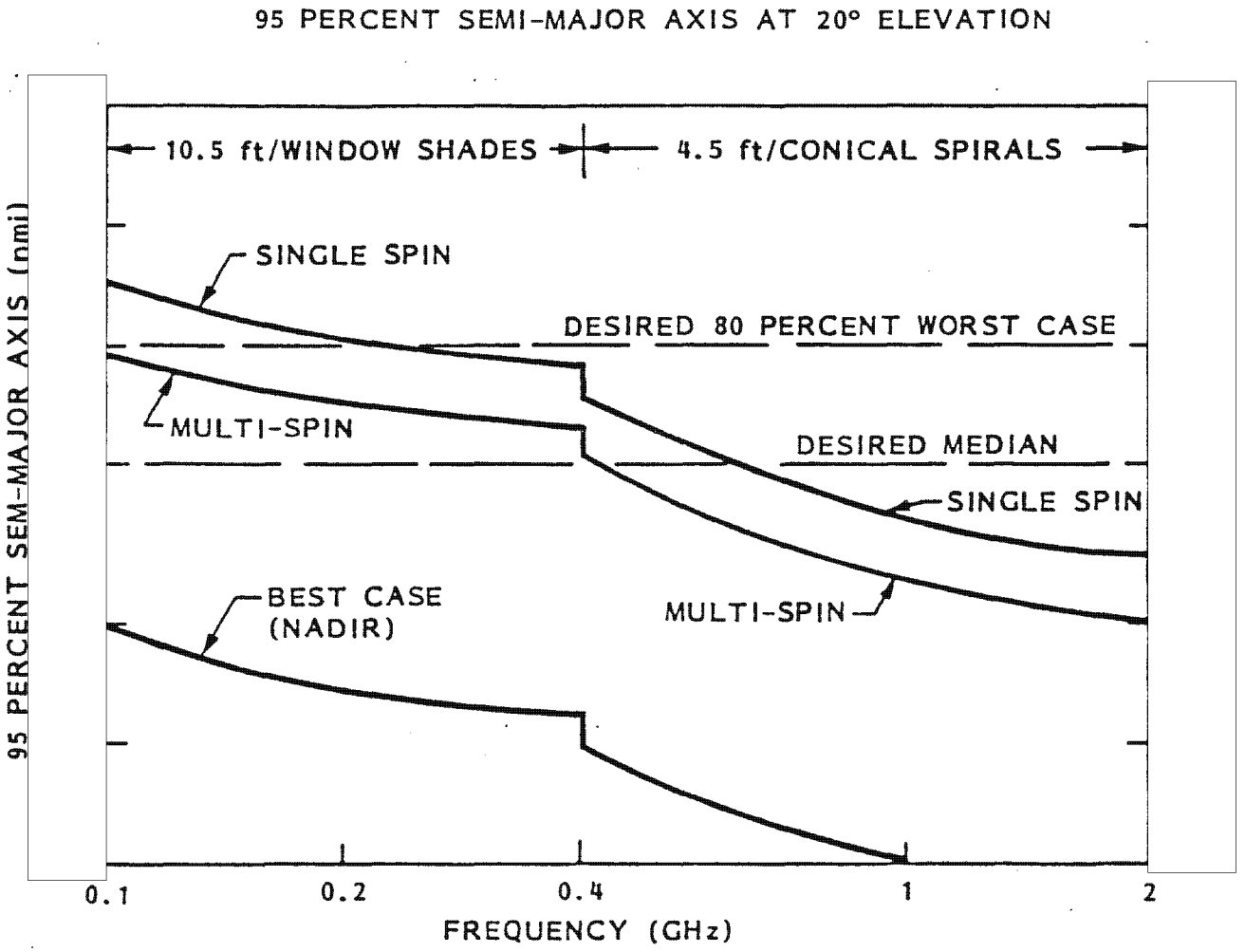


Fig. 4 System Level Expected Geolocation Accuracy

The timeliness for the different missions are given in Figure 3. The design of the TOPHAT III system allows for flexible tasking operations, i.e., geofrequency search range. Reorienting the spin axis emphasizes northern/southern hemisphere collection. Commandable RF range emphasizes general/directed search for high interest emitters.

1.3.1 Directed Search

Directed Search is the primary mission for TOPHAT III. In the Directed Search mission, TOPHAT III is tasked to monitor the operational status and deployment of the five types of mobile and transportable communications systems provided in Table 1.

Table 1

DIRECTED SEARCH SOIs

25X1

[redacted]

1.3.2 General Search

In the General Search mission, the TOPHAT III System is tasked to monitor broad geographical areas and a wide range of frequencies. The objective is to detect, identify, geolocate, and report new or unusual communications signals. Existing systems that have been upgraded or redeployed are also targets of the General Search mission.

General Search is carried out by means of tuning to selected regions of the 0.1 to 2.0 GHz range. New or changed emitter parameters or combinations of parameters are sought. Geolocation processing is used to determine new locations for known or unknown signals. The new or revised information is used to update the TOPHAT III signal database. While most search tasking uses automated processing, manual analysis of digital PCM and digitized analog data, using a high-performance digital signal processor, will be applied to the TOPHAT III data.

1.3.3 Tipoff/Indications And Warnings

In the COMINT Tipoff mission, the TOPHAT III system is tasked to monitor the deployment of designated communications system emitters and to provide timely surveillance tipoff data to cue other national collection assets. This mission is the COMINT equivalent of the EOB and I&W missions for radar signals.

COMINT tipoff involves detection of new locations and/or unusual activity by COMINT emitters, in order to cue other collection systems capable of reading COMINT internals. The tipoff mission may become high-priority and time-critical, depending on the locations and activities.

In the Indications and Warnings (I&W) mission, the TOPHAT III system is tasked to provide early information about possible military activities. The mission is carried out by monitoring the operational status and deployment of COMINT emitters associated with tactical forces which might participate in military operations in new geographic areas or might indicate increased alert levels.

1.3.4 Technical Intelligence

In the Technical Intelligence (TI) mission, the TOPHAT III System provides digitized analog information about the electronic characteristics of communications equipment.

In many cases, TI analysis requires highly detailed analog signal data in addition to the parametric measurements. TI analysis is performed by the [redacted] using TOPHAT III data, applicable [redacted] FARRAH data and data from other collection sources. 25X1

Section 2

SYSTEM ORGANIZATIONAL AND FUNCTIONAL OVERVIEW

The TOPHAT III System is organized into three segments: space, ground, and launch. Each of these segments is further divided into elements. The System structure is shown in Fig. 5.

2.1 FUNCTIONAL OVERVIEW

The TOPHAT III System is divided into five functional areas: planning, control, collection, processing/analysis, and support. The functions and their interactions are presented in Fig. 6 and described in the following paragraphs.

2.2 MISSION PLANNING

The TOPHAT III mission planning function combines tasking authority guidelines, priorities, and requirements with collection opportunities and system resource status to generate a plan and schedule which achieves mission goals. The function includes: (1) reception of the tasking requests, (2) determination of the available system resources, (3) development of system configurations and schedules to satisfy the requests, (4) preparation of command loads to configure and control the satellite, and (5) distribution of schedules and other planning products. The mission planning for TOPHAT III will be performed using the existing [redacted] FARRAH Mission Planning Subsystem with modifications/extensions as required.

2.3 CONTROL

The TOPHAT III control function executes the resource assignments and configuration commands to implement the plans at the scheduled times for the system satellite and associated ground facilities. The function includes: (1) the development of detailed operational sequences for each satellite pass

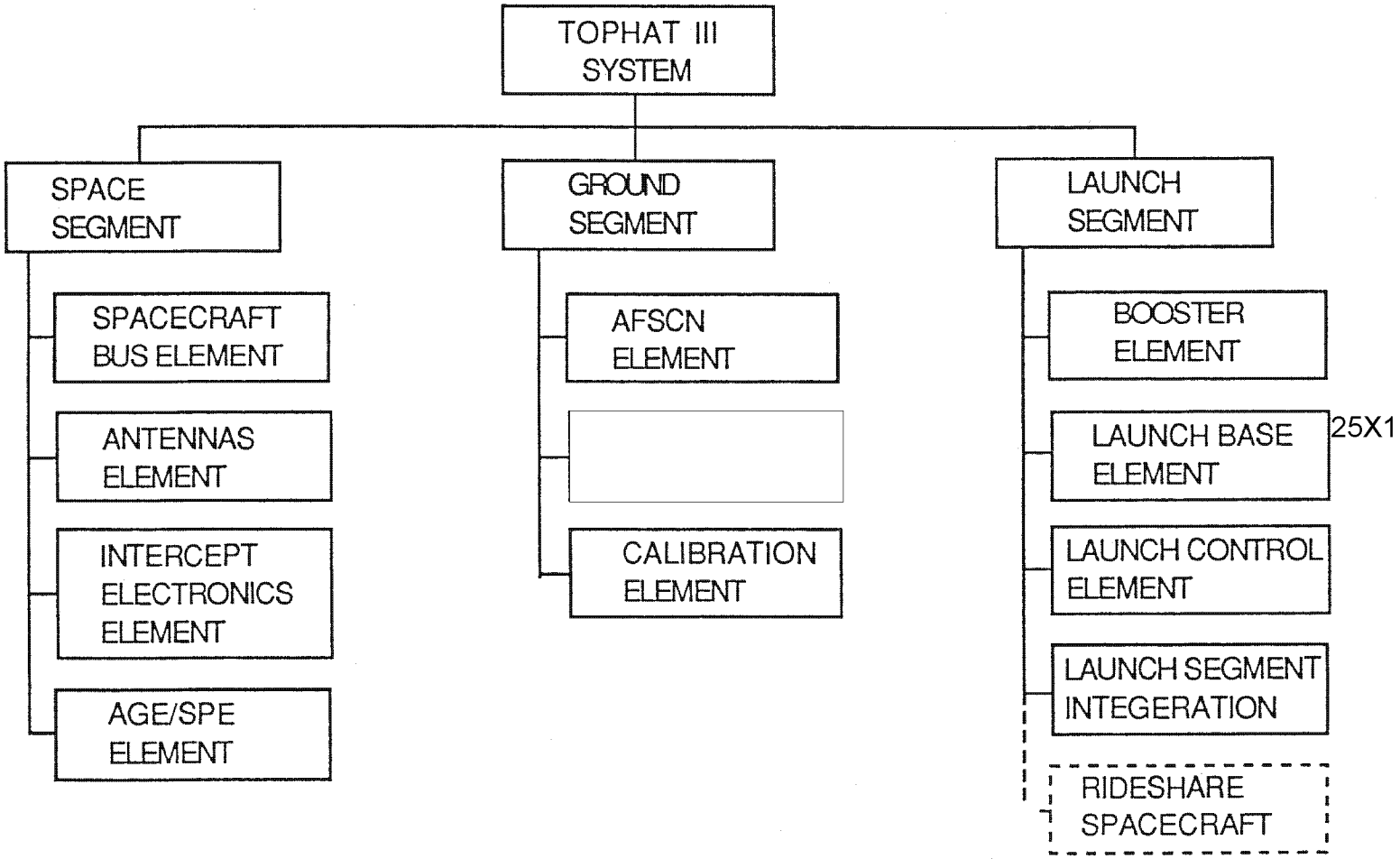


Fig. 5 TOPHAT III System Structure

****

* SECRET [redacted] *

****

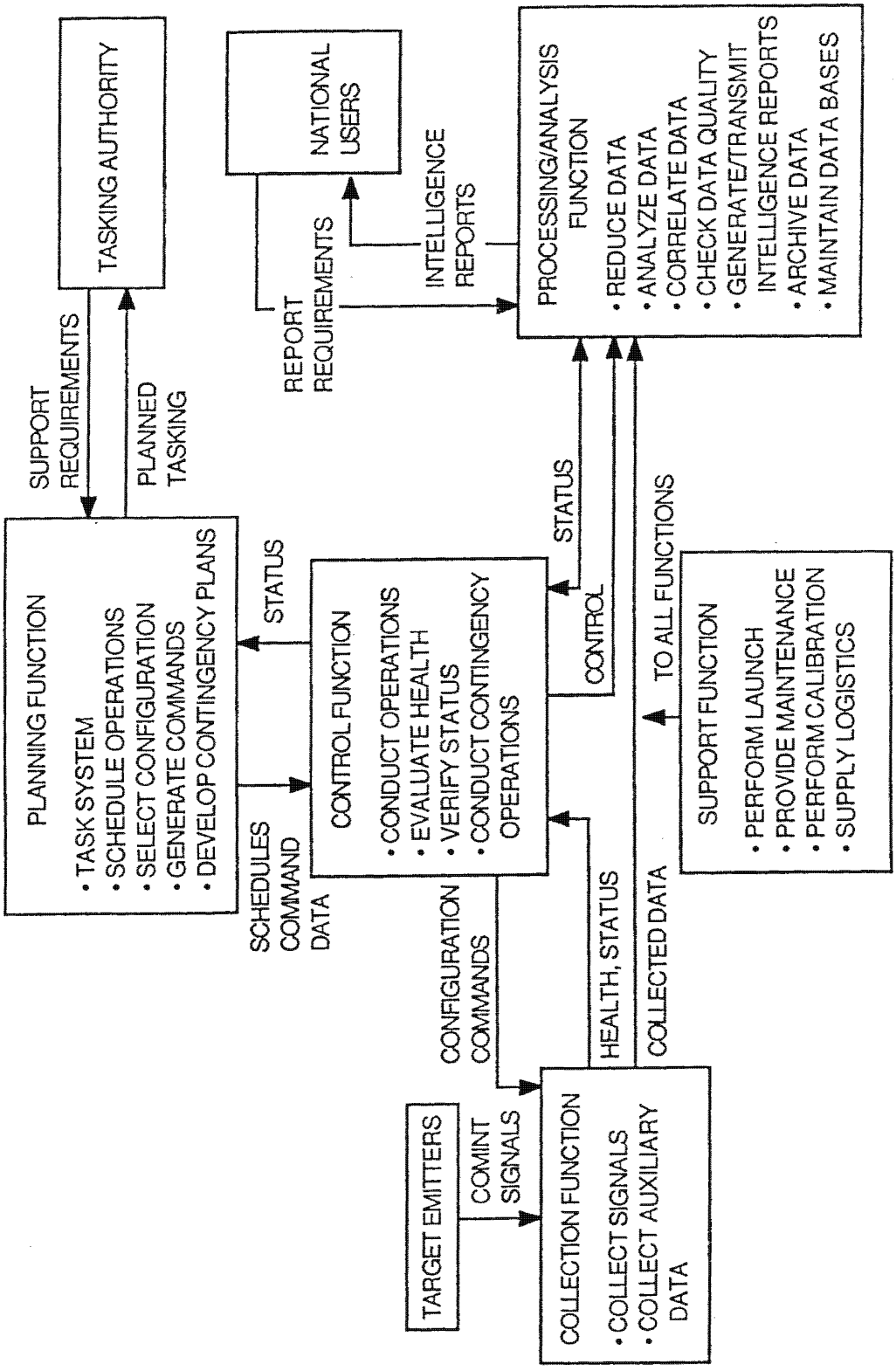


Fig. 6 TOPHAT III System Functional Diagram

over a remote tracking station; (2) the performance of the pass operations (in both nominal and contingency conditions), of commanding, data reception, and quick evaluation of health and status; (3) the forwarding of received data to other functions; and (4) provision of a detailed verification of satellite health and status.

2.4 COLLECTION

The TOPHAT III collection function accomplishes emitter signal interception and measurement according to the commanded configurations. The function provides mission (signal parameters) data and the auxiliary data (such as attitude data) for the TOPHAT III System. [redacted] 25X1

[redacted] 25X1

2.5 PROCESSING/ANALYSIS

The processing/analysis function computes relevant information from collected data and analyzes the results to produce intelligence reports for the user community. The function provides for transmission of these reports to the users. The function provides both short- and long-term storage of collected raw and processed data.

2.6 SUPPORT

The support function provides resources to support the other four functions. For the satellites, the support functions include power, thermal control, structural alignment and launch. For the ground elements, the support functions include software and data bases, computer resources, communications links, calibration equipment, and facilities.

25X1

Section 3

SYSTEM OPERATIONAL OVERVIEW

This section presents the operations of the TOPHAT III System and its external interactions. The operational flow and the assignment of system elements to functions is illustrated in Fig. 7. Operations are a cyclic, repetitive process. Operations are planned in overlapping 3-day cycles; thus, operations that are planned on Day 1 are developed in detail on Day 2 and are executed on Day 3.

3.1 TASKING AUTHORITY

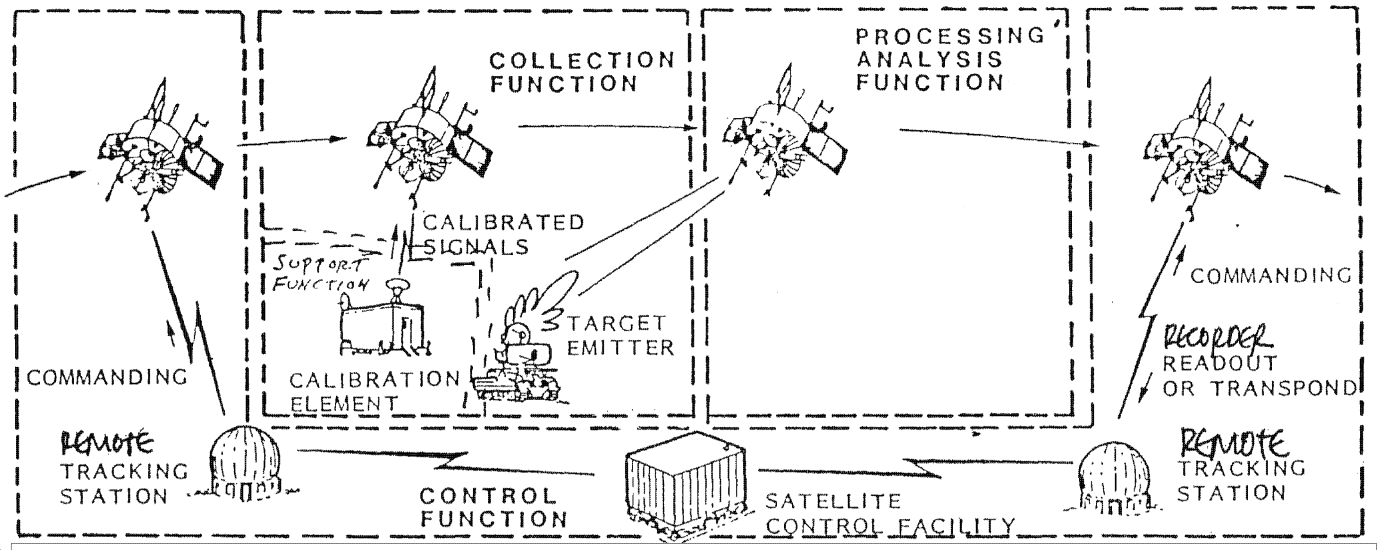
The tasking authority is the Overhead Collection Management Center (OCMC). It receives requests from both tactical and national users for SIGINT information and support. The OCMC assigns collection resources and priorities which meet the user's needs. The OCMC sends the tasking requirements and priorities in guidance messages to the TOPHAT III System planning function. These requirements range from one-time collection of a specific emitter to repeated surveillance of large areas.

3.2 PLANNING OPERATIONS

25X1

25X1

THIS FIGURE MUST BE RECREATED FOR TOP HAT III



7 FORMAT III

Fig. 3.1 Operations Concepts

[redacted]

[redacted]

[redacted] This schedule is then processed by the Consolidated Space Test Center (CSTC) to determine Remote Tracking Station (RTS) availability for TOPHAT III support. Since there are other programs which use RTS resources, some of the proposed RTS contact opportunities may not be available. The [redacted] CSTC scheduling process is iterated until a satisfactory support schedule is achieved. 25X1

Satellite commands are then generated to carry out the scheduled tasks. The commands include realtime commands to activate the satellite at an RTS and stored commands to operate and configure the satellite for remote collection and readout. The command sequence is verified and checked that no constraints are violated.

3.3 GROUND CONTROL OPERATIONS (COMMANDING)

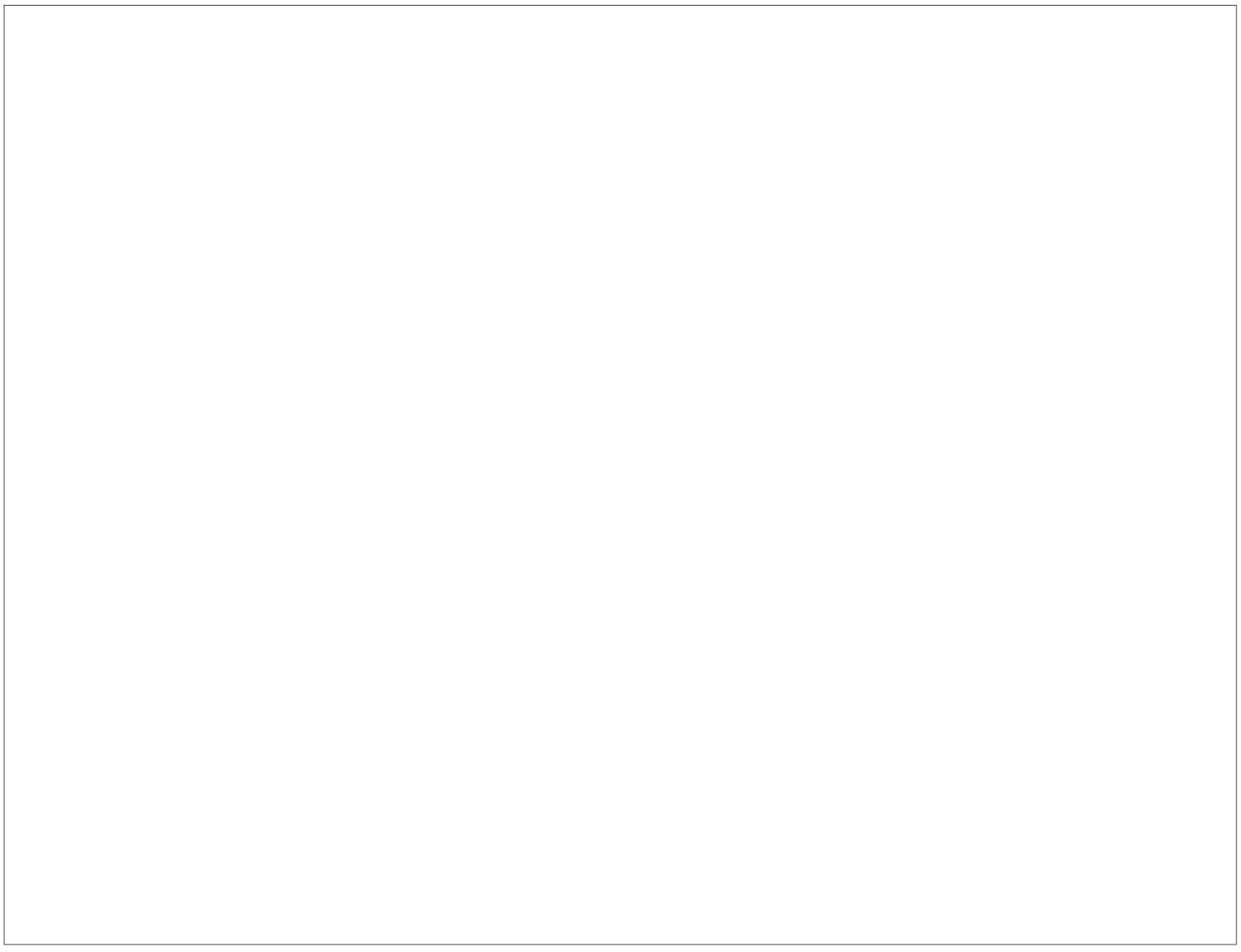
The CSTC controls the TOPHAT III satellite through the RTSs. The CSTC converts the schedules and the command sequences into detailed operational sequences for prepass, pass, and postpass operations. As a satellite rises over an RTS horizon, commands are sent to activate readout of mission, health, and status data. Additional commands are sent to be stored onboard for execution at specified later times. The CSTC monitors the commanding process to verify that all commands are correctly received. As necessary, commands may be retransmitted until proper verification is received.

3.4 SATELLITE CONTROL OPERATIONS (COMMANDING)

Satellite operations are controlled by commands from the RTSs. There are two types of commands. Realtime commands are received and executed immediately by the satellite. Stored commands have a time tag and are stored by the satellite. When the satellite clock time equals the command time tag, the command is executed. Both types of commands are used to configure and operate the satellite to collect and produce the desired data.

3.5 SATELLITE COLLECTION OPERATIONS

25X1



The digital PCM and the digitized analog data are sent to the processing/analysis function for processing, storage, or transmission.

****
* ~~SECRET~~ [redacted] *
****

25X1

LMSC PROPRIETARY INFORMATION

3.6 GROUND CONTROL OPERATIONS (DATA RECEPTION)

All satellite data are downlinked to RTSs. The digital PCM data and the digitized analog data are both relayed through the AFSCN communications system to the CSTC [redacted] Satellite health and status telemetry is embedded in the digital PCM stream.

The CSTC processes the satellite telemetry to verify the proper status of all the satellite subsystems and that the current configuration is as planned and commanded. Realtime telemetry information is used to verify commanding and configuration. If necessary, contingency plans are implemented to correct anomalies. Information on health and status is forwarded to [redacted] Health and status data are also analyzed and stored at [redacted]

25X1

3.7 GROUND PROCESSING/ANALYSIS OPERATIONS

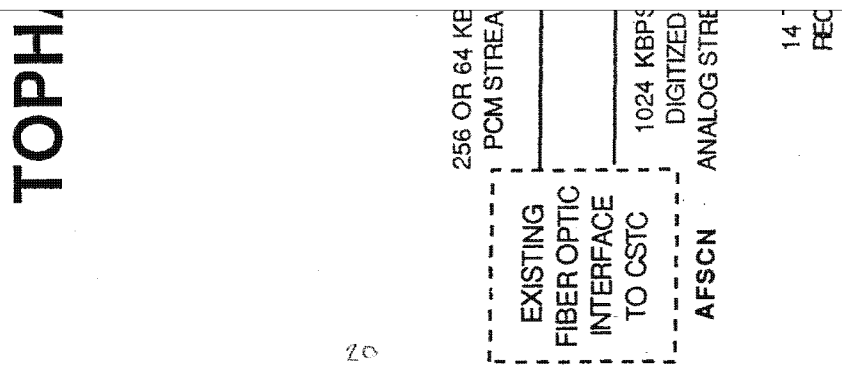
[redacted]

LMSC PROPRIETARY INFORMATION

****
* ~~SECRET~~ [redacted] * Handle Via BYEMAN
****

25X1

Control System Only

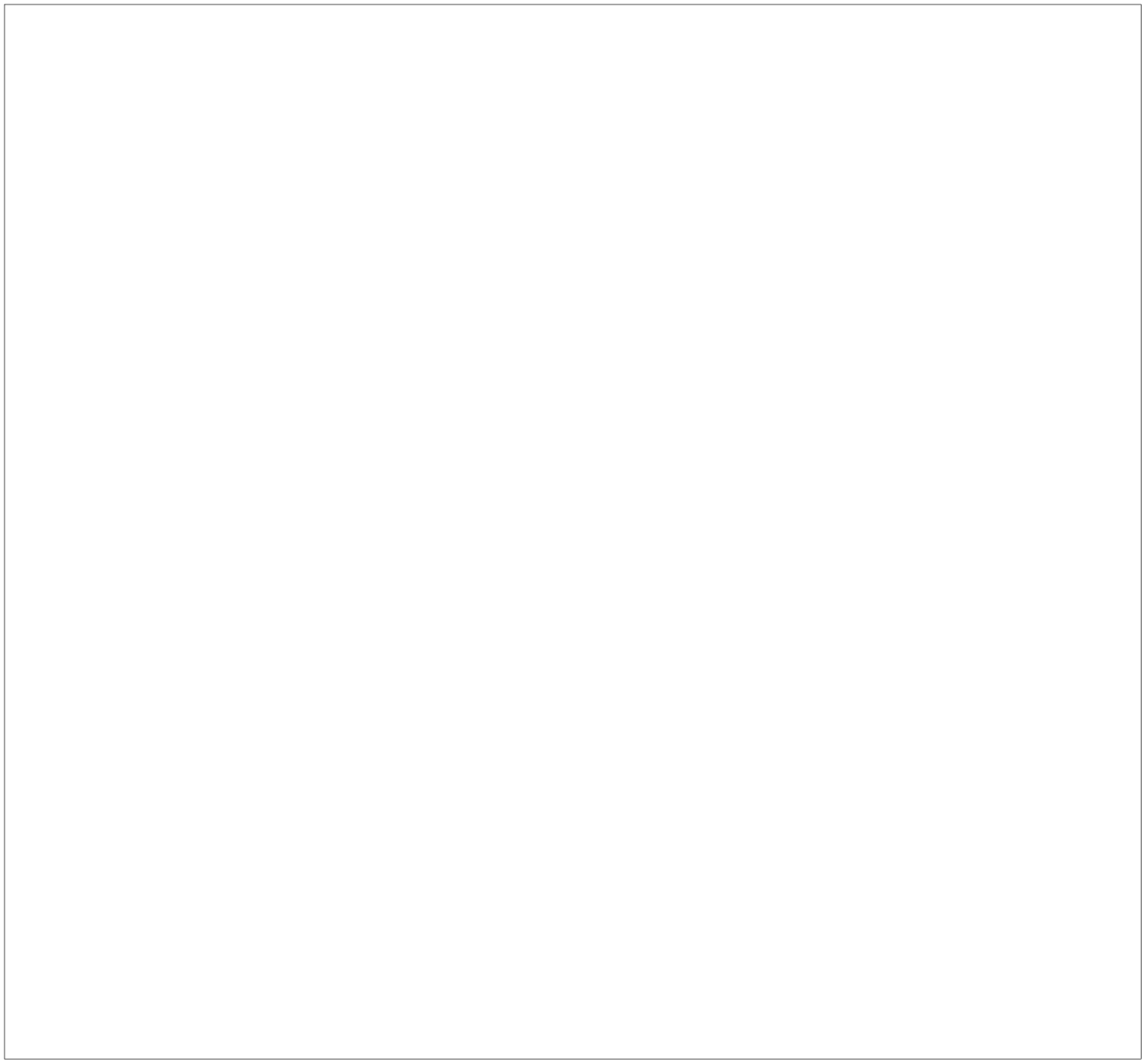


20

****

* SECRET/JUPITER-[redacted] * Handle Via BYEMAN

25X1



3.8 SUPPORT FUNCTIONS

Support functions provide essential services to the other functions, enabling them to carry out the TOPHAT III system missions.

3.8.1 Satellite Support. There are several satellite functions which support the major functions of control, collection, and processing/analysis. These supporting functions are:

a. Attitude control and determination
b. Electrical power
c. Structure (support and alignment)
d. Propulsion and pyrotechnics.

3.8.2 Calibration Support. Calibration support is provided by fixed and mobile facilities. These facilities provide signals with precisely controlled characteristics from known locations for the TOPHAT III satellite to collect. processing of the results is used to evaluate satellite performance and to update satellite calibration tables.

3.8.3 Communications Support. The communications support provides voice, message, and data communications between and the users within the TOPHAT III System. The communications links are standard Government and commercial systems. 25X1

The AFSCN RTSs provide the SGLS communications links with the TOPHAT III satellite. In addition, the AFSCN provides its own DSIS-based internal communications links between the CSTC and the RTSs.

3.9 LAUNCH

The Launch Segment provides prelaunch and launch support to the TOPHAT III System. The launch vehicle places the TOPHAT III satellite into an elliptical parking orbit at the desired inclination and apogee altitude. The satellite provides the onboard capability to circularize at the final mission orbit altitude, to set the attitude, and to spin up to the operational spin rate. The TOPHAT III vehicle may share the booster with a (TBD) spacecraft.

Section 4

CONCEPT OF OPERATIONS

This section presents a detailed concept of operations for the TOPHAT III System. It provides a description of the flow of operational control and of data through the system. Physical and functional limitations are covered. The major emphasis of this section is on the routine operations. After discussing these routine operations in detail, material is provided for the special cases of launch, crises operations, and satellite degradation. The TOPHAT III System consists of three segments: space, ground, and launch. The three segments and their subordinate elements are illustrated in Fig. 5.

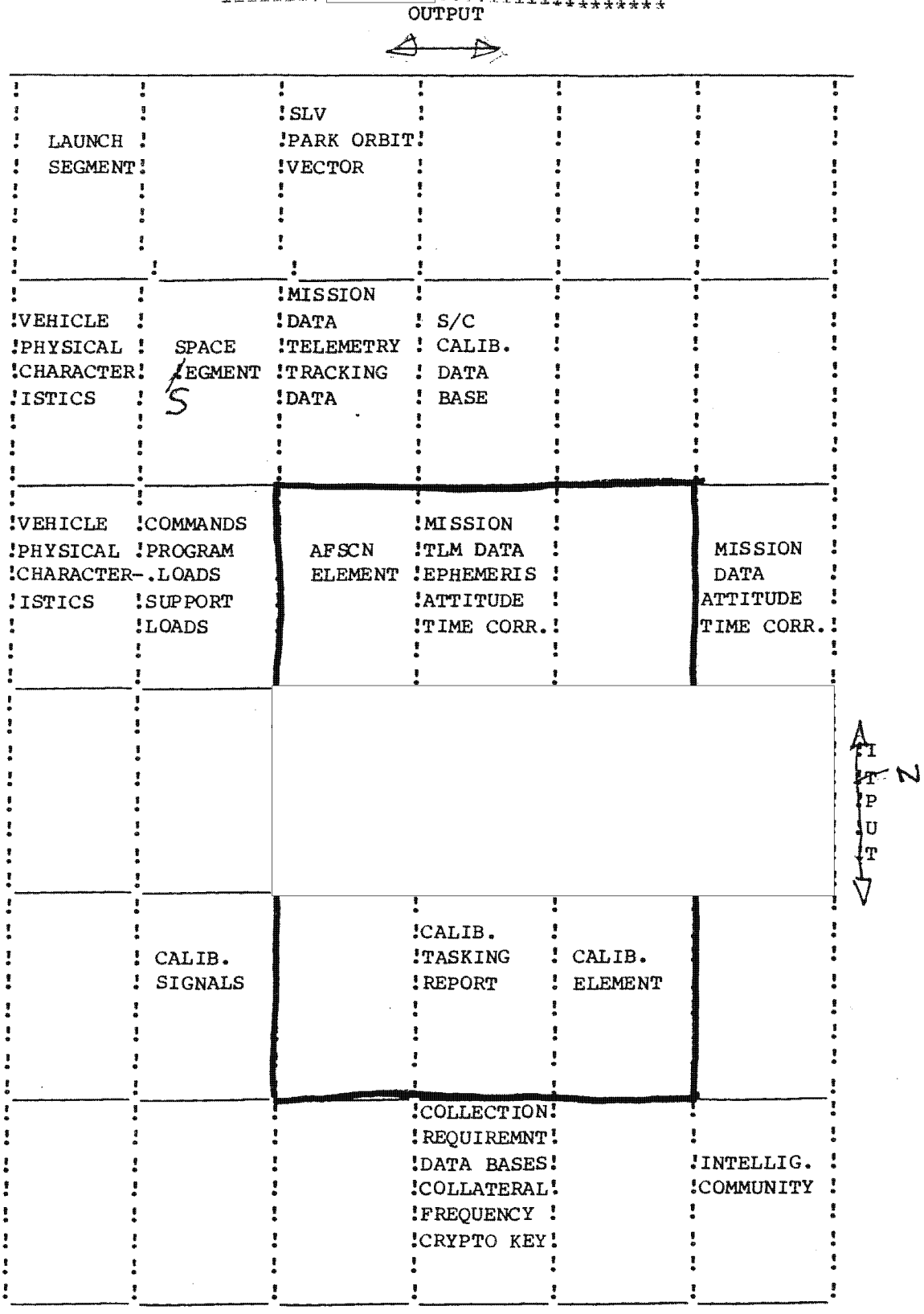
4.1 SPACE SEGMENT

The Space Segment is composed of the TOPHAT III satellite, which is illustrated in Fig. 1. The relationships among the functional elements of the Space Segment, Ground Segment and the other elements of the TOPHAT III system are illustrated in the N-squared diagram of Figure 9; the breakdown into subsystems is provided in Fig. 10. The TOPHAT III satellite consists of the spacecraft bus, antennas, and Intercept Electronics (IE) elements. The following material provides a brief description of each element and its subsystems.

4.1.1 Spacecraft Bus Element. The Spacecraft Bus Element consists of six subsystems which provide essential supporting services to the other elements.

4.1.2 Antennas Element. The Antennas Element provides antennas for reception and transmission.

The antennas consist of two (2) flat spiral antennas and six (6) conical spiral antennas. The flat spirals cover the frequency range of 0.1 to 0.4 GHz and form a spinning interferometer. The conical spirals cover the frequency range from 0.4 to 2.0 GHz and are also configured in pairs to form a spinning interferometer, with two pairs LHCP and one pair RHCP.



25X1

Fig. 9 TOPHAT III N-Squared Functional Diagram

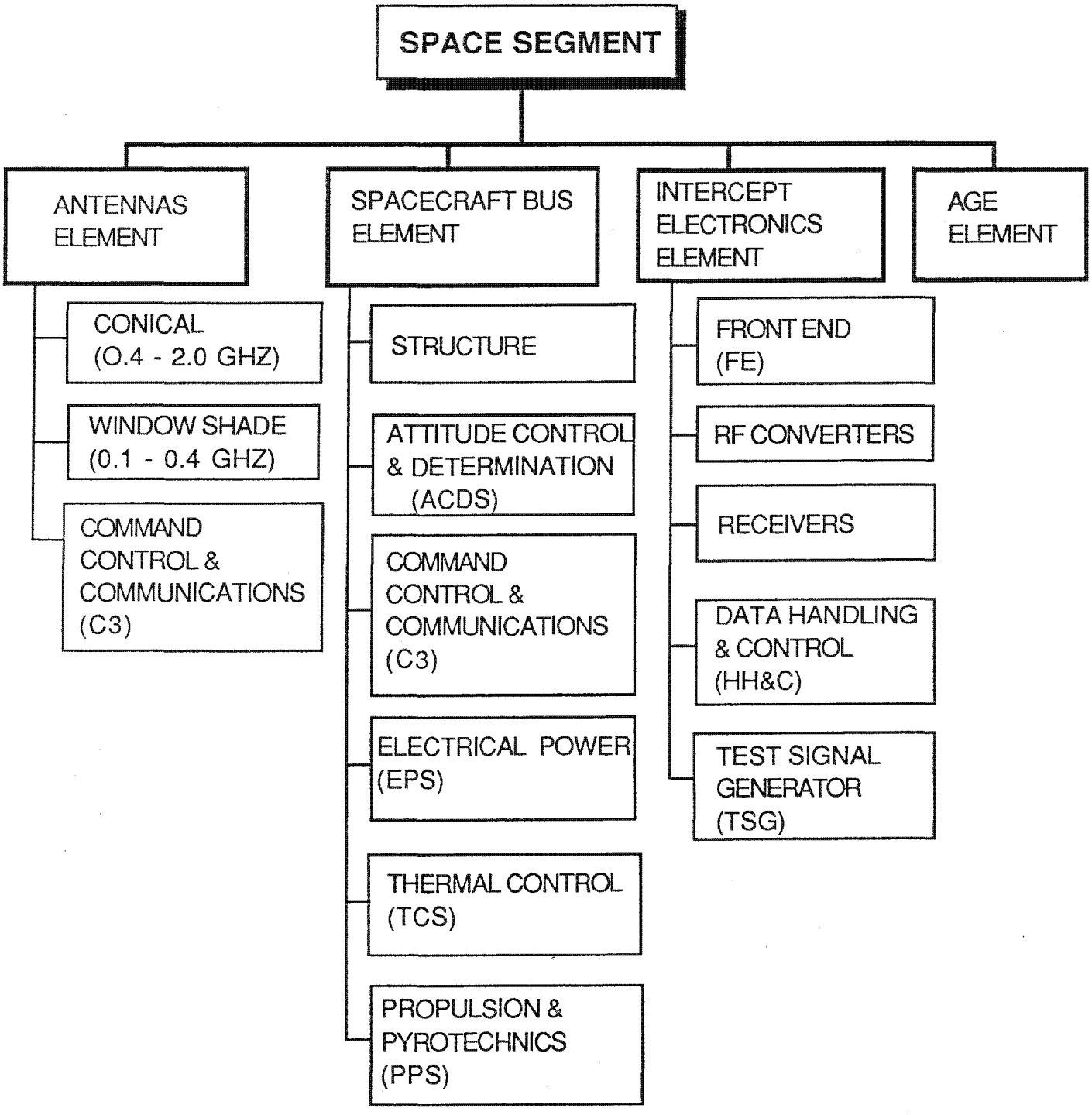


Fig. 10 TOPHAT III Satellite Element and Subsystem Hierarchy

The two C^3 antennas provide hemispherical coverage for the reception of commands and ranging signals from the Ground Segment and for the transmission of mission and telemetry data to the Ground Segment.

4.1.3 Intercept Electronics Element. The IE provides the data collection function for the TOPHAT III System. The IE processes the signals collected by the antennas element to produce the mission data output of the satellite. The IE element consists of the subsystems shown in Figure 10.

4.1.4 Aerospace Ground Equipment (AGE) Element. The AGE consists of three major classes of equipment:

a. Test and checkout hardware and software
b. Handling and test fixtures
c. Containers for storage and shipping.

4.2 GROUND SEGMENT

The three Ground Segment elements for TOPHAT III are the AFSCN Element, the [redacted] and the Calibration Element (CE). Figure 11 is a data flow diagram of the Ground Segment. The AFSCN Element provides satellite control and Mission data return from the TOPHAT III satellite. [redacted] The Calibration Element (CE) provides signals of known characteristics from known locations for system calibration purposes. 25X1

4.2.1 Air Force Satellite Control Network Element. The AFSCN Element is responsible for supporting the operations of the TOPHAT III System satellites. The TOPHAT III System uses the AFSCN worldwide satellite control and RTS network to provide tracking, telemetry and commanding and mission data return, under the control of Mission Control Complex III (MCC-III) within the CSTC.

T80037

LMSC PROPRIETARY INFORMATION

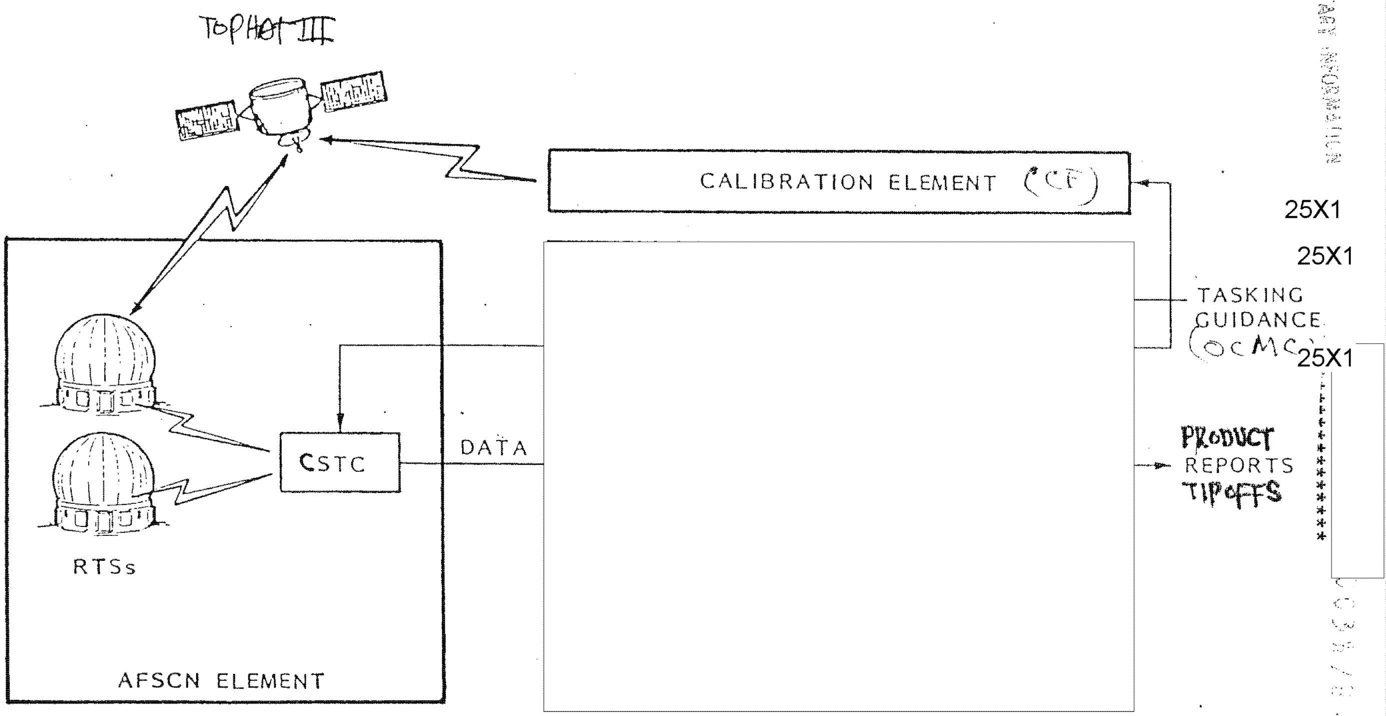


Fig. 11 Ground Segment Data Flow Diagram

25X1

25X1

25X1

27

* SECRET [redacted] *

Handle Via BYEMAN
Control System Only

LMSC PROPRIETARY INFORMATION

950-88

[redacted]

4.2.3 Calibration Element. The CE is responsible for providing signals for use in the on-orbit performance verification of the TOPHAT III satellite. The CE provides signals of known characteristics from known locations. [redacted] 25X1

[redacted]

The CE consists of Calibration Resource Vehicles (CRV) and Calibration Resource Facilities (CRF). The CRVs are mobile and are used at different locations. The CRFs are at fixed sites.

4.3 LAUNCH SEGMENT

The Launch Segment provides the booster vehicle to place the satellites into parking orbit. The launch base is the Western Test Range. The segment consists of the following elements:

- The Booster Vehicle System (BVS) element is a (TBD) launch vehicle and a shroud for the satellite.

25X1

- The launch control element provides for the launch and ascent control of the BVS.

- The launch base element provides facilities for the prelaunch checkout and launch support.

- The Launch Segment Integrating Contractor (LSIC) provides interface definitions for the BVS and the Space and Ground Segments. The LSIC provides the services of ascent trajectory requirements definition, planning for satellite deployment from the launch vehicle, and launch vehicle/satellite interface management. The LSIC integration efforts ensure that the satellite, BVS, and launch facilities function together to provide a satisfactory launch and ascent.

4.4 EXTERNAL PARTICIPANTS AND ORGANIZATIONS

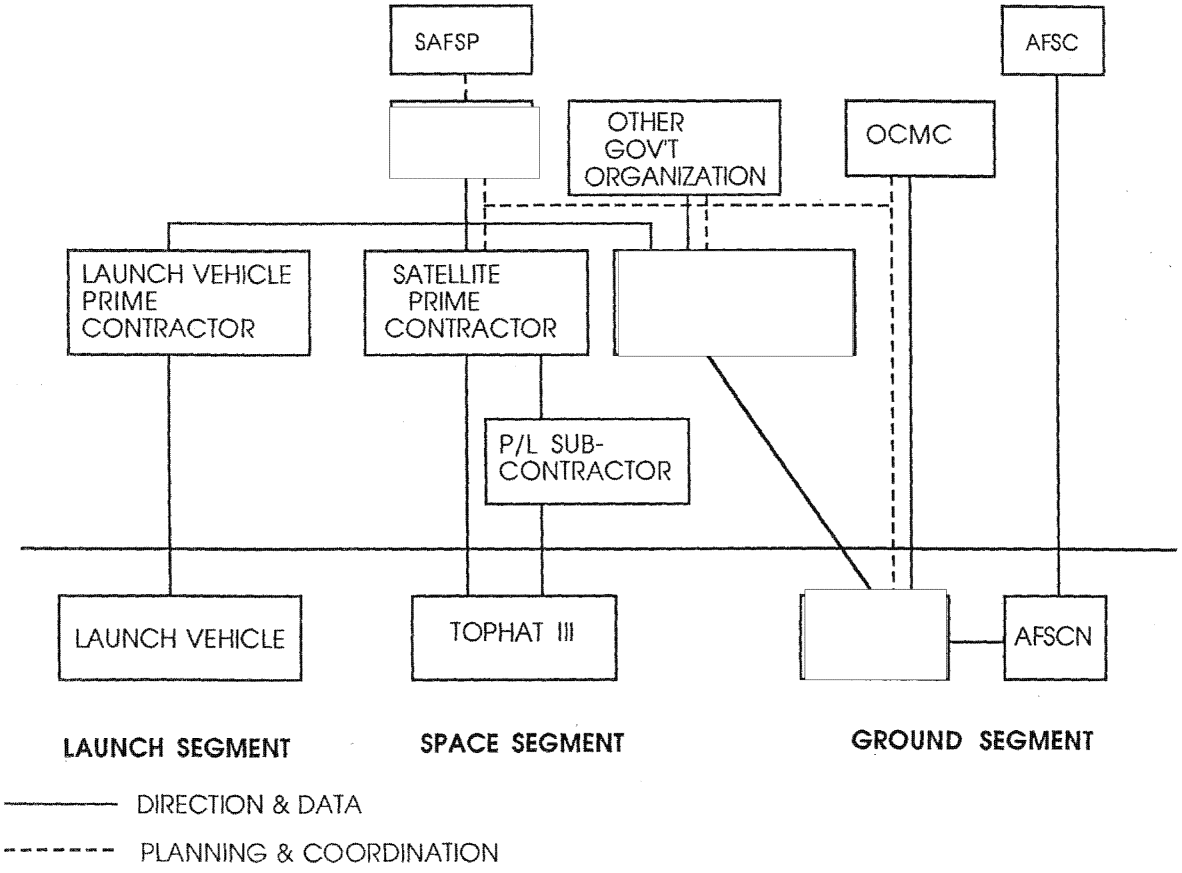
The TOPHAT III System interacts with a number of external agencies in various ways. The functions of the external organizations and of the components of the TOPHAT III System are summarized in the following sections and the interfaces with external organizations are shown in Fig. 12.

[redacted]

25X1

25X1

FIG. 12 EXTERNAL PARTICIPANTS & ORGANIZATIONS



4.4.2 Other Government Organizations. Another Government organization is responsible for TOPHAT III digital processor, analog processor and analysis workstation. This includes the associated system engineering, software development, software and hardware integration, validation and verification for operations with actual intercept data. This hardware and software are shown as the dedicated TOPHAT III processor group (B side in Figure 8).

4.4.3 Tasking Authority. The Overhead Collection Management Center (OCMC) is responsible for consolidated prioritization and tasking of the total TOPHAT III System. The OCMC receives collection requirements from users and develops collection strategies which maximize results for available overhead collection systems. The OCMC forwards overall TOPHAT III requirements for collection, in the form of tasking guidelines, to the TOPHAT III Ground Segment for implementation.

4.4.4 Satellite Prime Contractor. The satellite prime contractor, under [redacted] direction, is responsible for the overall management, design, development, integration, test, and delivery of the TOPHAT III satellite. The prime contractor is responsible for design and development of hardware elements and supporting subsystems and for the integration of these items into the TOPHAT III satellite. The prime contractor directs the TOPHAT III subcontractors who provide design and development for selected satellite payload elements and subsystems. 25X1

4.4.5 Satellite Payload Subcontractors. One subcontractor is responsible for the design, development, test, and delivery to the prime contractor of the IE element. This subcontractor provides algorithms and calibration data for processing the output of the IE. The subcontractor also provides the necessary test equipment for testing the IE. Some of the subsystems in other satellite elements are provided by subcontractors.

4.4.6 Launch Vehicle Prime Contractor. The launch vehicle contractor provides the booster vehicle and supporting equipment and services for launching the TOPHAT III satellite into parking orbits.

25X1

25X1

LMSC PROPRIETARY INFORMATION

25X1

****
* ~~SECRET~~ [redacted] * Handle Via BYEMAN
**** Control System Only

Section 5

ROUTINE OPERATIONS DESCRIPTIONS

Routine operations cover the ordinary, day-to-day operations of the system. Routine operations are based on a repetitive, 3-day cycle of planning and implementation with a new cycle starting every day.

5.1 PLANNING INPUTS

The OCMC is the major source of tasking inputs for the TOPHAT III System. OCMC provides general guidance for the conduct of operations ([redacted] 97 messages) and specific support guidance ([redacted] 62 messages). The specific guidance includes a brief description of the objectives, the target, the target location, the times for target surveillance, the priority, and the reporting goals for each task. The definition of a target ranges from a specific emitter to all emitters in a military exercise over a large area.

[redacted]

25X1

5.2 TASKING DEFINITION DEVELOPMENT

The first step in the planning process is the analysis of the tasking request input and the selection or development of a configuration for the TOPHAT III satellite which meets the tasking requirements. The configuration considers the current satellite equipment availability and limitations, the desired frequency bands, signal filtering, target characteristics, requested collection and processing, and other pertinent factors. The result, called a subpayload configuration, defines the satellite configuration required for supporting the task. The subpayload configuration and the target information

(locations, signal characteristics, collection times, reporting requirements) form the tasking definition. [redacted] 25X1

[redacted]

5.3 PERFORMANCE ASSESSMENT

Performance assessment occurs after the final schedule is developed. The process reviews the scheduled tasks against the requested tasks. Those tasks which have had their requirements satisfied have their priority lowered, while unsatisfied tasks receive increased priority. These revised priorities are fed back to event prediction and task scheduling for use in the next planning cycle. Performance assessment reports of planned and achieved tasking are provided to the OCMC.

5.4 CONTROL FUNCTION

The control function directs, controls, and evaluates system functioning as events occur.

The TOPHAT III payload is task dependent and depends on control information received from the spacecraft bus command equipment. Different control information to select collection and processing functions is required for each task.

5.5 SATELLITE COLLECTION

Two major factors influencing the collection capabilities are the satellite orbit and the intercept antenna design.

5.5.1 Orbits. The TOPHAT III satellite orbit is circular with parameters as follows:

a. Altitude - 320 nautical miles
b. Inclination - 75 degrees
c. Spin axis alignment - parallel with Earth's axis, (8 degrees out of orbit plane)
d. Spin rate - 60 (TBD) revolutions per minute

The TOPHAT III orbit is designed to provide antenna coverage of the earth from TBD degrees south latitude to TBD degrees north latitude. It is possible to provide coverage down to TBD degrees south latitude or up to TBD degrees north latitude by varying the spin axis tilt. Every location within this range is visited at least once a day. Figure 13 illustrates the coverage available and the overlap for two consecutive passes of the TOPHAT III satellite.

Increased coverage of southern latitudes may be obtained by realignment of the spin axis. However, there is correspondingly reduced coverage of northern latitudes.

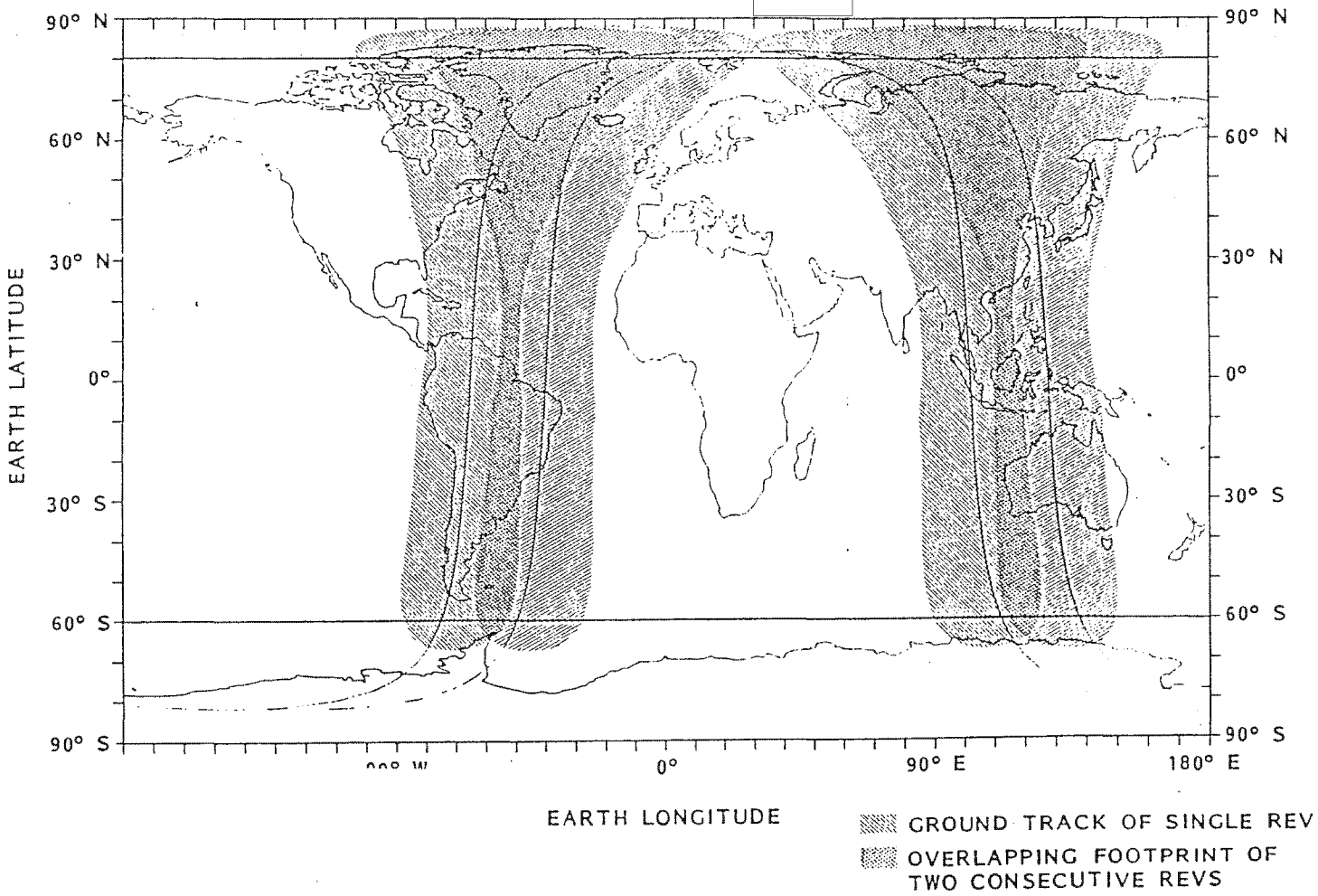
5.5.2 Antennas. The TOPHAT III Antenna Element provides antennas for collection, command reception and data transmission.

5.5.3 Data Readout Modes. Tape recorders are used to store digital PCM and digitized analog mission data. The digital PCM data can be readout from the tape recorders or transponded is realtime during collection. Bit rates and transmitter allocations are (TBD). The digitized analog data cannot be Transponded.

5.6 AFSCN PROCESSING/ANALYSIS

The AFSCN processing/analysis function is performed by MCC-III personnel using CSTC resources.

25X1



[EXAMPLE ONLY REDO FOR TOPHAT]

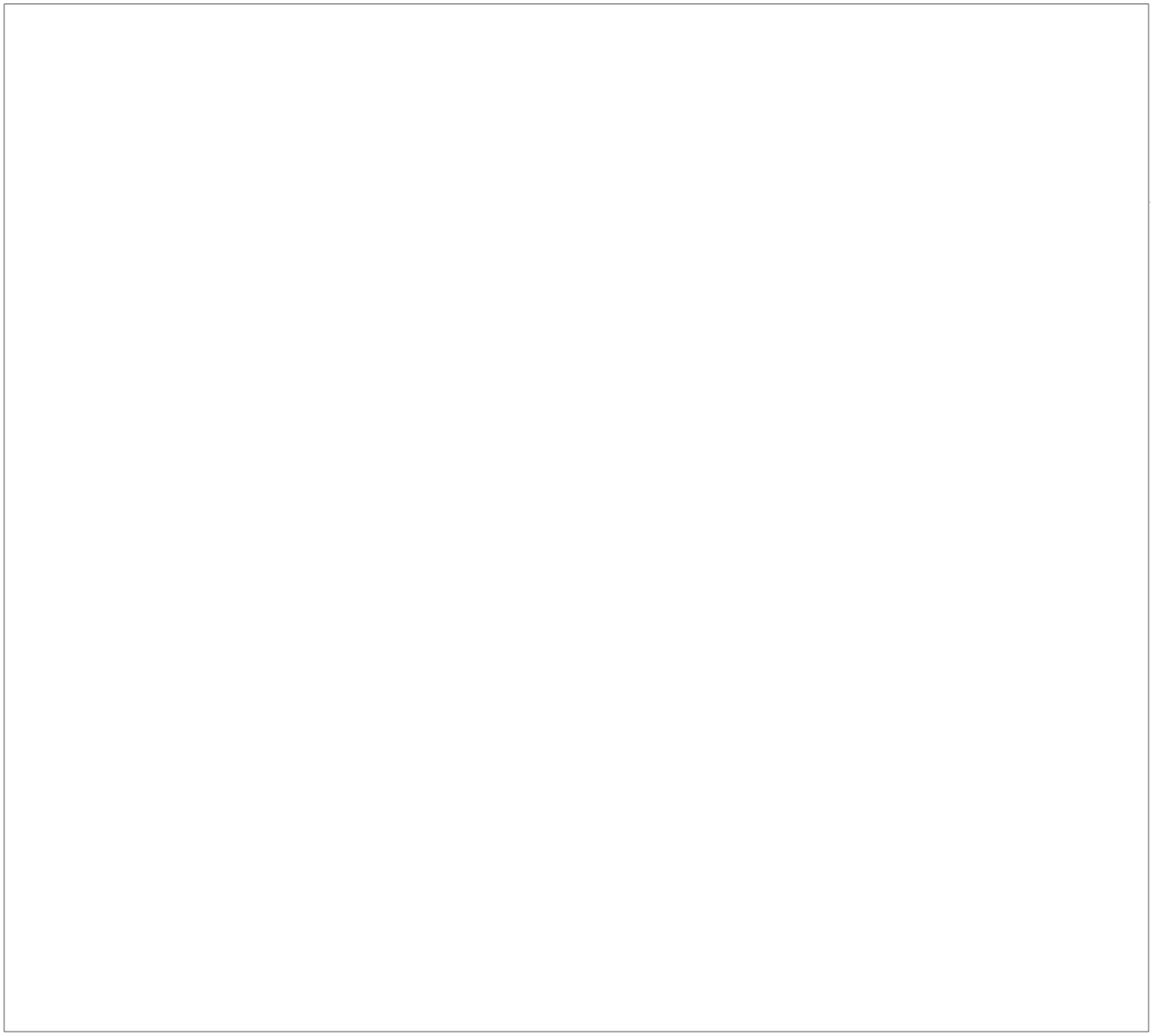
FIG. 13 ORBITAL COVERAGE

5.6.1 Telemetry Processing/Analysis. The 8-kbps PCM telemetry data stream is received from the satellite and relayed to the CSTC. The PCM stream is decommutated. Selected points are processed during the RTS pass and compared to limits. Alarms are given for out-of-limits conditions so that corrective actions may be implemented. The CSTC also processes the mission digital data streams to extract health and status data for evaluation. This extracted health and status data and the 8 kbps telemetry data stream are sent to the [redacted] 25X1

5.6.2 Ephemeris Determination. The CSTC uses RTS tracking and ranging data to determine and update the ephemeris for the TOPHAT III satellite. The ephemeris is provided to the [redacted]

5.6.3 Attitude Determination. The horizon sensor and solar aspect sensor data are extracted from the digital data streams (mission or TLM) and used to determine satellite attitude and spin rate.

[redacted] 25X1



03W/B-304950-88

25X1

~~SECRET~~ [redacted]

[redacted]

LMSC PROPRIETARY INFORMATION

INTERDEPARTMENTAL COMMUNICATION

TO: D. Bobp DATE: 23 November 1988

FROM: R. Burke Date Analyst

SUBJECT: Top Hat III Operations Concept

Reference IDC from Sue Dragich to Marlin Harvey, Subject: TOPHAT 3 Developments, dated November 1 1988.

The attached Operation Concept for TOPHAT 3 is provided as per paragraph 8 of referenced IDC.

Rex W. Burke

Rex W. Burke
Product Support, Grp. Ldr.

TOPHAT 3 OPS CONCEPT

LMSC PROPRIETARY INFORMATION

Data Base Support:

a. The Identing Reference Data Base (IDB) will be maintained to include Farrah and TOPHAT 3 signal parametric values and locations based on information provided by signal analysis of TOPHAT 3 data or from other collectors. This file or a subset thereof will be used for the identing process.

b. The Farrah Routing Tables (BLDROUTE) will be used for signal routing and to provide quality limits for signals formed in the Auto-Processing module. These tables will set appropriate bits in the TOPHAT 3 series record for this routing purpose.

c. The Roster 167 Emitter File which is used in conjunction with signal identification and correlation information will be maintained to provide information necessary to create a R-167 Report for transmission.

d. A history file of all signals formed by the Digital Processing System will be maintained on a permenant file or tape so that Off-Line Analysis can be performed for detecting new signals or for determining new deployments or new sites for the IDB.

e. Provide the capability to automaticallly update the IDB and R-167 files based on signal analysis.

Signal Analysis and Reporting (OIN)

a. A list of tasked Readins will be provided the OIN Analyst for use in determining the time of Readin and expected time for [redacted] 25X1 processing. This information will be available for display on the OIN TOPHAT 3 Analysis Display and should include but not be limited to the following: Readin Number, Readout Rev and Station, tasking on and off times and Lat/Longs, Search Mode- Direct or General Search etc.

b. The OIN Analyst shall be able to display on his screen any of the Phase folding Patterns of Target Signals for overlaying or comparison

with a wave form which has been isolated from the Residue Signal File.

c. The isolated phase pattern shall be reprocessable for signal identification and/or geolocation and subsequent comparison with the Identing Data Bases.

d. After isolation and identification, the capability shall be provided to allow transmission of the reformed signal by R-203, R-200 or R-167. The newly formed signal shall be entered into the TOPHAT 3 Signmal History with a flag set to indicate that the signal was formed by isolation and was transmitted to one or more of the reports.

e. The capability shall be provided to display the Pre-D data or Analog data associated with the Digitized signal or signals, either as formed by the Auto Processor or from the isolation of the Phase Form.

f. Signals which were formed by the Auto Processor and correctly formed should be available for transmission by R-203, R-200, and R-167 Reports. The components that formed the signal should be available for display if signal validity is necessary.

g. The capability should be provided to display time tagged measurements associated with the formed signal.

h. Provide sthe capability for the Rapid Spectral Search (RSS).

Term Analysis:

a. Signals which were not formed by the Auto Processor will be available for display on a signal-by-signal basis along with the associated data used in forming the signal.

b. If during the analysis of poorly formed signals it is determined that potential interferrence is the cause, or other problems are precluding correct signal formation, a means should be made available for reporting these problems.

c. Based on signal analysis, coordination should be accomplished with the Tasking Organization if a problem may exist in tasking.

d. A method shall be proivided to report new or unusual waveforms to appropriate agencies via R-178 or Roster X, etc.

TOP HAT III
G. Parrish Input

ANALYSIS DEPARTMENT CONCEPT

1. The Analysis Support Functions for the Analysis, and Reporting of TOP HAT III processed output is provided by:

a. Current Analysis

b. Product Support

Term Analysis

2. CURRENT ANALYSIS:

a. Analysis and certification of processed DF and selected Omni signals. Analysis will be performed on all TOP HAT III signals to determine validity and to certify and transmit Roster 203 SOI signals. Roster 174 and Roster 155 SOI's will be certified and transmitted periodically as cumulatitive reports. Timelines for the reports is to be established (TBE). Priority will be given first to Directed Search, then to General Search signals.

Selected SOI from data search.

2. PRODUCT SUPPORT:

a. Identing Data Bases will be created and maintained to include TOP HAT III SOI identity and Specific Signal parameters. The Roster 167 Data Base will be modified to include TOP HAT IIII idented signals.

b. All TOP HAT III digital signals processed through the dedicated Operational Intelligence (OI) Station, including Roster 203 signals that are qualified for Electrical Transmission, will be collected and available for a daily cumulative Roster 167 and Roster 200 Report. The Roster 167 and R-200 Reports will include all Mission 7300 and TOP HAT III digital CW signals that have been certified by analysis and edited for electrical transmission.

c. The NSA provided Daily Strum (Standard Technical Report Using Module) will be used as the basis for updating te case notations applicable to Roster 167 and Roster 203 Data Bases.

d. The Bldroute Program will be used to qualify and Route for possible shipment va Roster 203 those signals designated as SOI's. Additionally, critical signals and /or geographical areas will be designated and maintained in the appropriate control data bases to insure a timely Analysis and Reporting capability. These reports will include the Roster 155, Roster 174, and Roster 203.

e. Coordination will be maintained with Satellite Operations in order to provide current SOI Unique Idents and Parameters for the payload Commanded Stored Data Base.

f. Digitized Analog Data will be used to support the determination of internal Signal Modulation and Ident. Data Bases will be updated and reflect known values and characteristics and will include new or changed characteristics determined by analysis.

3. TERM ANALYSIS:

a. Roster 178 Reports will be prepared and generated for new signals and changed parameters of known signals. Event Associated intercepts will be reported as appropriate.

b. Analog Signal Analysis
(To Be Determined)