

~~ZAMAN/TOP SECRET~~ATTACHMENT 2EOI SYSTEMOPERATIONAL CONCEPT AND DESCRIPTION

## 1.0 INTRODUCTION

The purpose of this document is to provide a description of the EOI System and the intended operational concept for use as guidance in conducting Phase I System Definition studies.

## 2.0 SYSTEM CONCEPT

The basic concept underlying the use and operation of the EOI System is the continuous capability to provide photographic imagery of any geographic spot on the earth within  of scene detection for use in identification of significant intelligence content. The ability to monitor world-wide activity in this manner is fundamental to a broad range of strategic intelligence problems including warnings/indication, crisis situations, activity monitoring and analysis, arms control monitoring and current intelligence.

An equally important aspect of the EOI System concept is the capability to provide an orderly return of basic target surveillance and technical intelligence imagery

Bye-108048-70

Page 12

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on a continuous basis. This capability benefits the entire intelligence process by acquiring the imagery in a timely manner that allows for an orderly exploitation of the imagery that is not currently possible. Most of the primary areas of interest are accessed during nighttime hours in Washington, D. C. Imagery of this area can be acquired, processed, initially interpreted for significant intelligence content and distributed to the user for detailed interpretation and exploitation during normal working hours.

### 3.0 SYSTEM DESCRIPTION

The EOI System provides the capability to image selected ground scenes from a satellite platform, convert the images into a stream of digital data by means of a photo-sensitive solid state transducer and integrated electronics, encode and transmit this data  via a relay satellite network to a dedicated ground station, process the data in near-real-time, reconstruct a hardcopy of the imaged scene and display it in such a manner as to be usable by a photointerpreter for the extraction of intelligence information. Control of the total EOI System is provided at a single ground location utilizing the same communications network as the image data.

Bye-108048-70

Page 13

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Figure 1 displays the EOI System in diagram form. It is composed of five system segments, namely the Imaging Satellite (I/S) segment, the Relay Satellite (R/S) segment, the Receiving Facility (R/F) segment, the Processing Facility (P/F) segment, and the Operations Facility (O/F) segment. The intelligence community provides overall guidance for operation of the system plus all target coverage requirements, and is the sole recipient of all system products.

### 3.1 IMAGING SATELLITE SEGMENT

The Imaging Satellite (I/S) segment consists of [ ] [ ] electro-optical imaging satellites deployed in low-altitude orbits. [ ] satellite is equipped with an electro-optical sensing capability consisting of large diameter reflective optics, a transducer composed of one or more arrays containing a large number of solid-state photosensitive detectors, and the subsystems necessary to support the acquisition, transformation, and transmission of the image and telemetry data.

The photosensitive detectors are electronically scanned as the arrays move over the target area and their outputs are sampled and processed for direct transmission to the Relay Satellite segment of the system.

Bye-108048-70  
Page 14

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~~ZAMAN/TOP SECRET~~

Elapsed time to acquire a complete frame of image data is several seconds.  imaging satellite may also contain a digital recorder to allow for delayed transmission of image data to a Relay Satellite or directly to the Receiving Facility in the event of failures to ensure a continuous capability to return image data.

Imaging Satellite provides the capability to access targets anywhere within a several hundred mile ground radius centered at the nadir. This maneuvering capability or agility is utilized to acquire images at various locations within the access swath, multiple images within dense target concentrations, stereo image pairs, and imagery of contiguous area considerably larger than an individual frame size. The capability to obtain multiple images of some targets on the same day provides the necessary support for use in crisis situations. Use of the Relay Satellite segment for tasking allows a near-real-time imaging satellite commanding capability for use primarily in crisis, rapidly developing, or tip-off situations.

### 3.2 RELAY SATELLITE SEGMENT

The Relay Satellite (R/S) segment consists of a network of relay satellites deployed in high altitude orbits such as to be in constant view of both the R/F and an

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Page 15

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Imaging Satellite when the latter is actively acquiring imagery. The R/S segment thus provides the space-borne communications link between the I/S and the R/F that allows for the  return of image data. It also provides for the transmission of all tracking, telemetry and command data.

During periods of I/S imaging activity, the R/S provides one-or-two-hop  transmission of data to the R/F as required. In one-hop operation, a single Relay Satellite remains locked-on to both the I/S and the R/F during these periods. In the case of two-hop transmission, one Relay Satellite remains locked-on to the I/S, a second Relay Satellite remains locked-on to the R/F and the two are additionally locked-on to each other. In the event of a Relay Satellite failure, the other(s) would be repositioned such as to minimize the degradation in the EOI System capability until a replacement becomes operational.

The R/S segment is operationally controlled exclusively by the Operations Facility, with the ETR providing control during launch and initial orbital placement. An alternate command capability is provided as back-up in the event of failures.

Bye-108048-70

Page 16

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### 3.3 RECEIVING FACILITY SEGMENT

The Receiving Facility (R/F) segment consists of a receiver/transmitter site located in a low-interference area

a ground transmission link, and a terminal at the collocated Operations and Processing Facilities. The receiver/transmitter site provides the single ground receiving/transmission terminal for communication between the spaceborne and ground-based items. The ground transmission link and terminal provides for the communication of all data between the receiver/transmitter site and the O/F and P/F segments.

The R/F receives all I/S imagery and telemetry data via the R/S, all R/S telemetry data, and transmits all tracking and command data for both the I/S and the R/S. It also provides the capability to communicate directly with the I/S when in view for image, tracking, telemetry and command data. Tracking of the I/S and R/S for use in determining each satellite ephemeris is also accomplished utilizing the R/F.

### 3.4 PROCESSING FACILITY SEGMENT

The Processing Facility (P/F) segment consists of a facility that provides the capability in the

Bye-108048-70  
Page 17

~~TOP SECRET~~

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[redacted] to perform the functions required to process and reconstruct digital image data into interpretable hard-copy pictures, and to allow for the reporting on significant scene content to the intelligence community in as near-real-time as possible. These capabilities provide for a near-continuous flow of processed pictures during periods of high imaging activity, and the ability to respond with quick-look read-out to allow efficient utilization of the target access capability of the EOI System during crisis situations. It also provides the capabilities to perform other functions of a non-time-critical nature, including the reconstruction and distribution of duplicate copies of the acquired images, archival storage of digital image data acquired and additional digital processing for image quality improvement of selected scenes or portions thereof.

Digital image data is received in near-real-time during periods of image acquisition by an I/S. This data is either stored or reconstructed into hard-copy pictures in such a manner that the P/F has the capability to receive image data at any time. The data processing capability consists of the necessary demultiplexing, decoding, reformatting, calibration, and compensation for various system degradations.

Bye-108048-70

Page 18  
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The image is reconstructed into latent image form, all necessary frame identification data is incorporated, and is processed into an interpretable positive or negative transparency. Performance of these functions is monitored during the processing.

Experienced photointerpreters analyze the product image and prepare brief reports on significant content, with a quick-look read-out also provided for purposes of subsequent I/S tasking. Duplicates of the hard-copy pictures and the initial interpretation reports are distributed to the intelligence community for further detailed exploitation and analysis.

The non-time-critical P/F functions are performed during periods when the I/S activity is at a low level. Reconstruction of previously acquired images, additional processing to improve the quality of selected scenes or partial scenes, and archival file maintenance are accomplished during this period.

### 3.5 OPERATIONS FACILITY SEGMENT

The Operations Facility (O/F) segment consists of a facility in  that provides the central integrated control of all aspects of the EOI System operation. This capability is

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Bye-108048-70  
Page 19  
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essential to the effective utilization of the total EOI System capability, and includes the necessary control of the collocated P/F operation during periods of imaging activity.

All functions pertinent to the operation and control of the I/S and R/S are performed by the O/F, including the selection of targets to be imaged, the assembly and generation of all commands for all satellites, the reduction and analysis of all telemetry, the generation of all satellite ephemerides, the preparation of all required correlation data pertaining to the images acquired and the assessment of the overall EOI System performance.

### 3.6 INTELLIGENCE COMMUNITY

The intelligence community is the sole user of the EOI System products and also provides the guidance required to operate the system. The prime EOI System output provided to the intelligence community consists of the positive and/or negatives of the reconstructed imagery, and initial brief photointerpretation reports on the significant content contained in the imagery as required. These outputs are distributed from the P/F in a time-responsive manner to the various intelligence watch-offices, intelligence

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Page 20

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organizations, and individuals as specified.

The appropriate intelligence community organization composed of representatives from all users provide the necessary guidance for operation of the EOI System.

This includes both overall policy guidance in the EOI System operation and day-to-day target coverage requirements to be satisfied.

#### 4.0 SYSTEM DEPLOYMENT

The EOI System contains several satellites to be launched from two separate launch facilities. It is therefore necessary to achieve full system capability over a period of time during which a lesser capability is available.

Operational deployment of the EOI System to achieve full system capability involves the orderly progression of system segment operational verification prior to actual deployment of a succeeding capability. The operational verification of the ground Receiving Facility and Operations Facility segments must initially be established. Following the launch of a Relay Satellite(s), which is the first of the EOI System satellites to be launched, the O/F and R/F are utilized in the on-orbit verification of the R/S operational readiness.

Initial system operational capability is established upon

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Page 21

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~~ZAMAN/TOP SECRET~~

satisfactory on-orbit operation of an imaging satellite. The system operates with this system capability that is restricted only by the coverage capabilities of the single I/S

Relay Satellites are launched from the ETR and inserted into orbital position under control of the ETR and the O/F. After orbital insertion verification, total control is handed over to the O/F, which maintains control through the R/F. An imaging satellite is not launched until operational demonstration of the R/S and O/F has been verified. Imaging satellites are launched and inserted in orbit under control of the WTR with appropriate support from the O/F. Full control is handed over to the O/F upon successful orbit insertion.

Bye-108048-70  
Page 22

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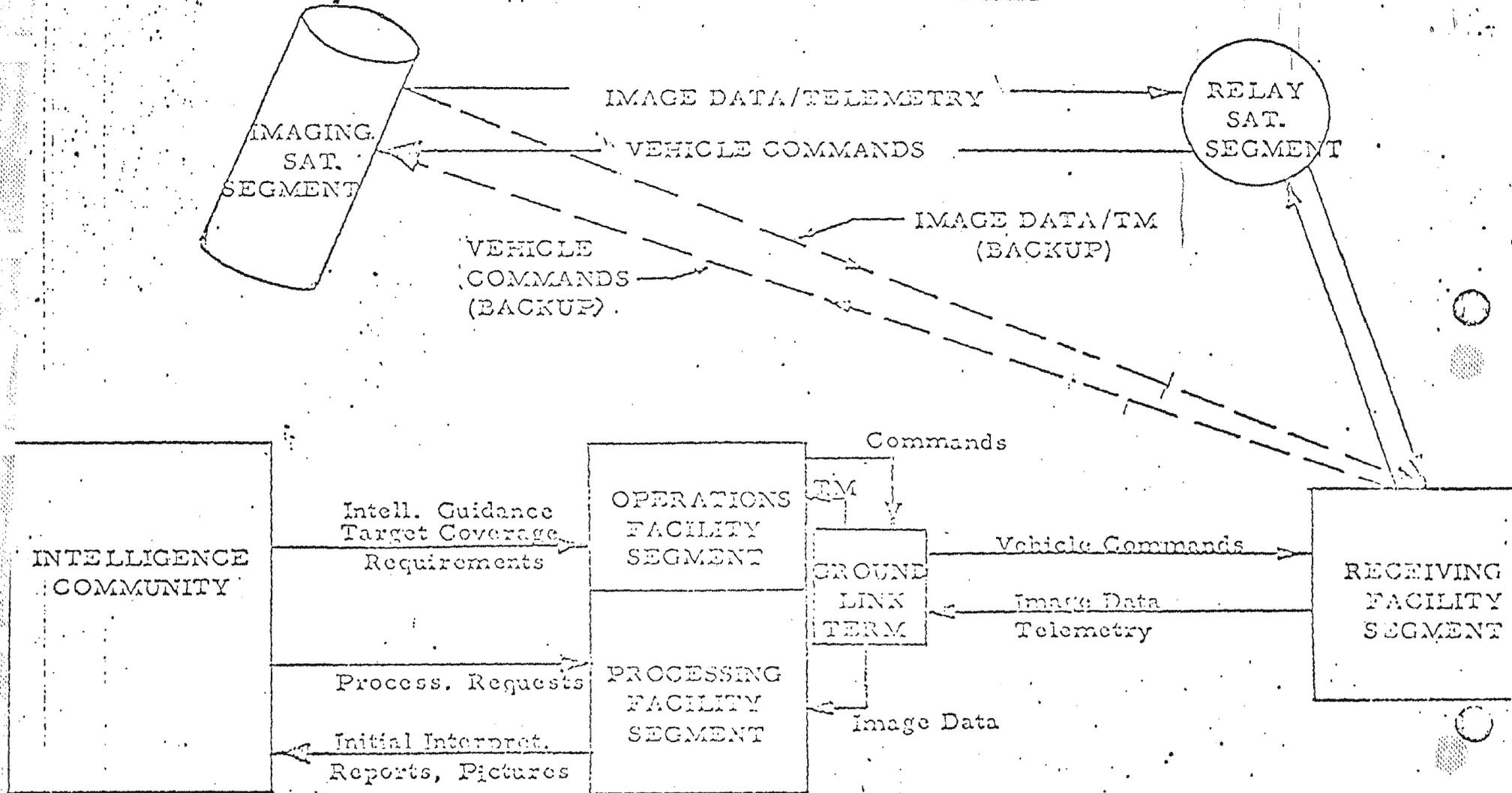


FIGURE 1

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Page 23