

PROGRAM

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SPECIFICATION NO. R/S -
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PRELIMINARY PERFORMANCE AND DESIGN REQUIREMENTS
FOR THE RELAY SATELLITE SYSTEM*

*This document defines a preliminary baseline system which is subject to change as a result of studies now in progress.

PERFORMANCE AND DESIGN REQUIREMENTS
FOR THE RELAY SATELLITE SYSTEM

Section I. Scope - This specification establishes the performance, design, development, and test requirements for the Relay Satellite System. All elements and contract end items of the Relay Satellite System shall conform with the requirements delineated herein.

1.1 The Relay Satellite System is an element of the Electro-Optical Imaging (EOI) System. One [] Imaging Satellites, otherwise referred to in this document as low altitude vehicles, are deployed in 280 NM circular, sun-synchronous orbits. [] vehicles transmit encrypted [] to either of two [] [] relay satellites used exclusively by the EOI System which are in view of a dedicated Receiving Facility located near [] Image data acquired when not in view of a Relay Satellite will be recorded on board the Imaging Satellite for transmission to a Relay Satellite at a later time. The data are recorded at the Receiving Facility and transmitted via microwave link to an

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Operation/Processing Facility in Washington where the image data are processed for use by photointerpreters. Elapsed time from image acquisition to hard copy output image will be less than one hour. (Z)

[REDACTED] launch, and positioning of the Relay Satellites. Once on station, the Relay Satellites will be operationally controlled and used only by the customer through his ground station which will also control and operate the EOI satellites. After the Relay Satellites are positioned, SCF support will only be required when the customer determines that an emergency exists and when tests to exercise the emergency capability are desired by the customer. (Z)

Section 2. Applicable Documents - The following documents, of the exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between documents referenced here and other detail content of Sections 3 and 4 to follow, the detail content of Sections 3 and 4 shall be considered a superseding requirement.

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Specifications

Federal

Military

Contractor

Standards

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Section 3. Requirements -

3.1 Performance - The Relay Satellite (R/S) System

consists of two relay satellites at [redacted]

Either R/S will receive data from a low altitude vehicle when the vehicle is in the satellite's field of view and relay the data to a CONUS ground receiving station (G/S)

located [redacted]

Each

R/S shall support only one low altitude vehicle at a time. (7)

The primary function of the R/S is to relay wideband [redacted] from a low altitude vehicle to the CONUS (G/S). Telemetry, tracking, and command data will also be transmitted via the R/S as described below and in Figure

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3-1 "Relay Satellite System Deployment." The entire system must have a high degree of isolation from the earth environment; therefore, the low altitude vehicle and relay satellite primary frequencies are established in the [redacted]

[redacted] The G/S to satellite link and the data down-link frequency is in the [redacted] The R/S must have SGLS compatibility to provide for initial injection and positioning operations and for back-up operation.

The two R/S will be located east and west of the ground station at locations such that the ground station antenna elevation will be between 5° and 10° above the horizon. More precise locations will be furnished in a later revision of this specification. For the purposes of this specification, the R/S over the Pacific is designated R/S No. 1 and the R/S over the Atlantic as R/S No. 2.

The following are the R/S performance requirements: (The links are identified in Figure 3-1 "Satellite System Deployment")

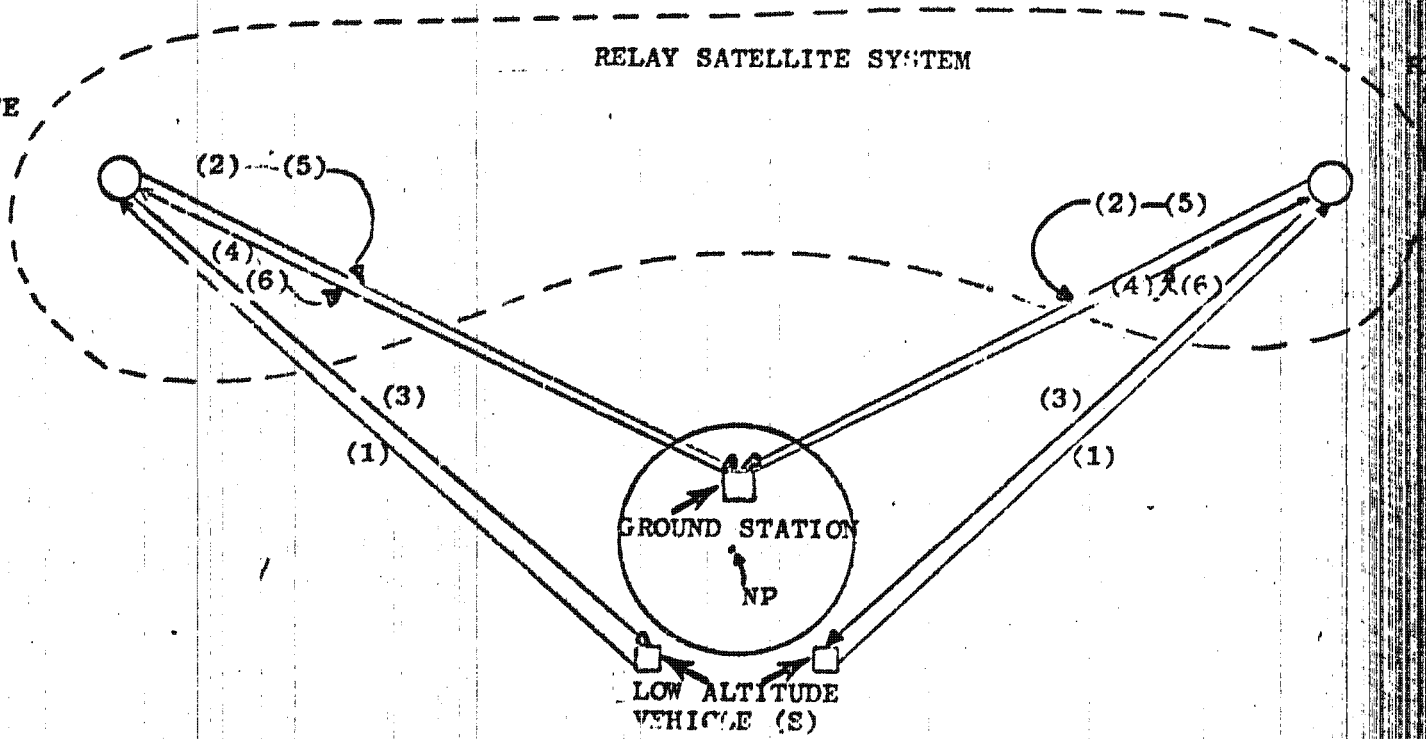
- a. Provide for [redacted] data reception at a

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#2

RELAY SATELLITE SYSTEM



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COMMUNICATION LINK IDENTIFICATION

- (1)
- (2)
- (3) Low Altitude Vehicle Command and Tracking
- (4) Autotrack Beacon
- (5)
- (6)

Figure 3-1 Relay Satellite System Deployment

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frequency of [] from a low altitude vehicle, (Link 1), and transmission to the ground at a frequency of [] (Link 2).

b. Provide for transmission of commands and ranging data at a frequency of [] to a low altitude vehicle (Link 3).

c. Provide for reception of a coded beacon signal from the ground to be used for autotrack at a frequency of [] (Link 4). Upon acquisition all tracking shall be automatic.

d. Provide for acquisition and tracking using Link 1. Upon acquisition, all tracking shall be automatic.

e. Provide for a SGLS telemetry link (Link 5). This down link from the R/S to the G/S is for transmission of R/S telemetry and ranging signals and does not include data from the low altitude vehicle.

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- f. Provide for a SGLS command and ranging link (Link 6). This up-link carries command and ranging data addressed to either the R/S or low altitude vehicle. Data addressed to the low altitude vehicle is retransmitted over Link 3. Protection against jamming is not necessary but coding is required so as to prevent accidental or deliberate command of the R/S by other than the user.
- g. Any R/S shall not be allowed to drift more than $\pm 2^\circ$ in longitude over its useful life.
- h. All relay satellites shall be of identical design and performance.
- i. The satellite antenna for Links 5 and 6 shall provide for hemispherical coverage.
- j. Either R/S #1 or #2 shall be capable of being moved to the position of the other satellite twice during its useful life. The total time to reposition the satellite shall not exceed five days.

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3.1.1 Performance Characteristics

3.1.1.1 Operational - The following are the
the operational requirements of the R/S system:

- a. Both R/S shall be capable of providing continuous support for Link 4, i.e., they shall be capable of autotracking the G/S on a continuous basis.
- b. Both R/S shall be capable of providing support for Link 1 for for autotrack or data transmission.
- c. Both R/S shall be capable of providing support for Links 2 and 3 for per day.
- d. Both R/S shall be capable of providing support for Links 5 and 6 for normal operational support of the R/S plus per day support for commanding the low altitude vehicle via Link 3.

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3.1.1.1.1 Employment - This system shall interface with a low altitude vehicle segment, a ground station segment, and the USAF Satellite Control Facility (SCF).

The system shall be designed to satisfy the following requirements:

a. Link 1 - Reception from Low Altitude Vehicle

R. F. Frequency - TBF (in the band)

Receive Signal Power - (receive signal power is defined so that when multiplied by antenna gain, it yields the signal power at the antenna feed output waveguide)

Dynamic Range - 10 db

Receive Antenna Subsystem Characteristics -

axial ratio \geq 2.5 db

tracking accuracy \geq 0.5 db loss

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antenna temperature = earth in view

b. Link 2 - Relay #1 or #2 to Ground

R. F. Frequency = TBF (in the
band)

Baseband Characteristics = TBF

Modulator Characteristics = TBF

Transmitter Characteristics

Phase Linearity = TBF

Amplitude Linearity = TBF

AM to PM Conversation = TBF

Spurious and Harmonic Signals = TBF

Out-of-Band Noise - TBF

Relay Antenna Subsystem Characteristics

Effective Radiated Power =

Axial ratio \geq 2.5 db

Tracking accuracy \leq 0.5 db loss

c. Link 3 - Relay #1 or #2 to Low Altitude Vehicle

R. F. Frequency = TBF (in the
band)

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GROUP 1
Excluded from automatic
downgrading and
declassification

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[] to either of two []

[] relay satellites used exclusively by the EOI

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Operation/Processing Facility [redacted] where the
image data are processed for use by photointerpreters.
Elapsed time from image acquisition to hard copy output
image will be [redacted] (Z)

[redacted] launch,
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R/S shall support only one low altitude vehicle [redacted] (Z)

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The following are the R/S performance requirements:

(The links are identified in Figure 3-1 "Satellite System Deployment")

a. Provide for [redacted] reception at a

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frequency of [] from a low altitude vehicle,

(Link 1), and transmission to the ground at a
frequency of [] (Link 2);

b. Provide for transmission of commands
and ranging data at a frequency of [] to a low
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c. Provide for reception of a coded beacon
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5). This down link from the R/S to the G/S is for
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and does not include data from the low altitude
vehicle.

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f. Provide for a SGLS command and ranging link (Link 6). This up-link carries command and ranging data addressed to either the R/S or low altitude vehicle. Data addressed to the low altitude vehicle is retransmitted over Link 3. Protection against jamming is not necessary but coding is required so as to prevent accidental or deliberate command of the R/S by other than the user.

g. Any R/S shall not be allowed to drift more than $\pm 2^\circ$ in longitude over its useful life.

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