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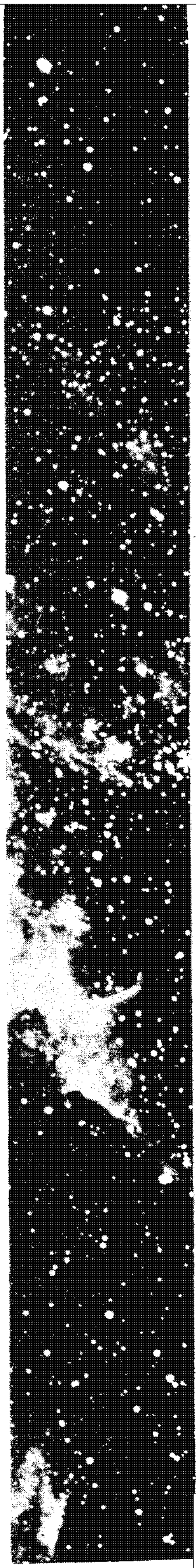

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This Document Contains
190 pages
Copy No. 1 of 1

ELECTRO OPTICAL IMAGERY SYSTEM

SYSTEM STUDIES

VOLUME 1

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TABLE OF CONTENTS

SECTION

2.2.3 Relay System

The baseline relay network consists of [redacted] orbits with apogees in the Northern Hemisphere. The relay satellite has a [redacted] diameter parabolic antenna for communications at [redacted] with the collection vehicle and a [redacted] antenna for the space to ground link. The relay spacecraft configuration could typically be a dual body spinner with body mounted solar cells. The non-deployable gimballed antennas with all of the communications electronics would be mounted on the de-spun section. Spacecraft weight is expected to be in the 1200 to 1500 lb range which is easily within the capability of the Titan III B-Agena launch vehicle.

The [redacted] baseline approach provides continual coverage of all land mass areas except for Antarctica and those parts of Argentina and Chile south of 42 degrees. Future studies will consider the effects on coverage of placing the apogee of two of the relay satellites at the Equator. This should improve southern hemisphere coverage at the expense of double coverage in the northern hemisphere. If one of the relay satellites should fail the system may lose some southern hemisphere coverage depending on the orientation of the orbit plane with respect to the sun. (The coverage provided by any one of the relays varies with time of year due to nodal regression.) [redacted] the baseline relay concept will provide 100% coverage of the Sino Soviet land mass.

The cost of developing and operating the relay system for a [redacted] period is estimated at [redacted] This figure is comprised o[redacted] for design and development, [redacted] for booster procurement and [redacted] for satellite prominent. Management costs, operational costs, etc., are included in the procurement costs.

In addition to the baseline approach, three alternative relay concepts will be examined. Table 1 compares the characteristics of these alternatives with the baseline system. The two satellite [redacted] concept is the only truely global system but suffers from the standpoint of degraded mode operations. Failure of either satellite will essentially put the entire system out of operation. The cost advantage resulting from use of only two satellites is largely off-set by the high booster costs required for [redacted] altitude. The long (44,000 nm) relay to relay results in ERP plus receives antenna gain requirement of [redacted] which involves high risk antenna/TWT developments.

The hybrid system consisting of [redacted] relays provides good coverage and degraded mode capability but the cost is expected to be significantly higher than the baseline. Reasons for the higher costs include two booster interfaces to be established, two sets of launch site AGE, and additional spacecraft development costs associated with operating in the two orbits.

The [redacted] low altitude system provides good coverage and degraded mode capability and is cost competitive with the baseline. It also has the significant advantage of shorter transmission distance (about a 10 db advantage over the baseline). The smaller antenna size and lower TWT power levels would require lower risk developments. The major disadvantage of the low altitude approach is the complex communications electronics required. Each satellite must be capable of reviewing from either a collection vehicle or another relay and retransmitting to either the ground or another relay. [redacted] will be required to prevent interference and since there is a limited amount of space in the high absorption bands, some degree of security is sacrificed with a multiple hop approach. For example, an airborne jammer will prefer to jam a double hop system over a single hop system by a factor of about 13 db.

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