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SATELLITE AND SPACE SYSTEMS HISTORY (U)

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Addendum Pages

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REPORT CHANGE RECORD
FOR
SATELLITE SYSTEMS HISTORY, VOL. I

The following additions, revisions, or errata corrections, should be incorporated into the document identified above. This Report Change Record page should be inserted as the first page of the affected report preceding the title page. If a page in the original document is eliminated and/or replaced by the instructions which follow, the page must be destroyed according to the Air Force directive governing such destruction.

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ADDENDUM PAGE	REVISION		ERRATA		REVISION OR ERRATA CORRECTION (CORRECT IN INK)	CORRECTION MADE	
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SUBSYSTEM G

INFRARED RECONNAISSANCE

Along with visual and electronic techniques, infrared reconnaissance was considered as a means of gathering intelligence about the activities of the USSR and was developed by Lockheed as a valuable tool for strategic early warning of enemy attack. In 1955 the idea was not considered really feasible even though the Sniperscope and the Sidewinder air-to-air missile had been developed for short range defense purposes. The main interest in infrared seemed to be centered in developing a better oven for cooking pre-frozen dinners. The vast scope of the concept, involving as it did large numbers of satellites carrying heavy payloads at a 1000 mile altitude, provoked scepticism in those knowledgeable of the then current state of the art . . . the developments required in the fields of propulsion, satellite stability, and reliability on orbit seemed almost impossible of attainment in this period two years before Sputnik and three years before our own Explorer I. However, in spite of this scepticism and with very little encouragement, Lockheed continued to work on this phase of the reconnaissance mission.

> *Two possible infrared detection and tracking systems for air defense have been studied. One of these configurations is applicable to the manned bombers and air breathing missiles, while the other configuration applies to ICBM's. As a result of this work, it is believed that the infrared technique continues to appear attractive for application to the air defense mission.*[1]

The Subsystem is described in Volume II, Sub-System Plan, G. Infrared Reconnaissance, of the Pied Piper Development Plan.[2] It would be designed to provide early warning, observation of military aircraft patterns, and ground detection of targets. No comparable system was currently available or under development as all previous infrared systems had been developed for manned aircraft and the resolution, sensitivity, scanning, and data

[1] *Progress Report for December*, LMSD 1941 (0304), 1 January 1956, p. M2.

[2] *Pied Piper Development Plan*, LMSD 1536 (0369), 1 March 1956.

processing requirements were of different magnitudes for satellite application because of the altitude and environment encountered by the vehicle.

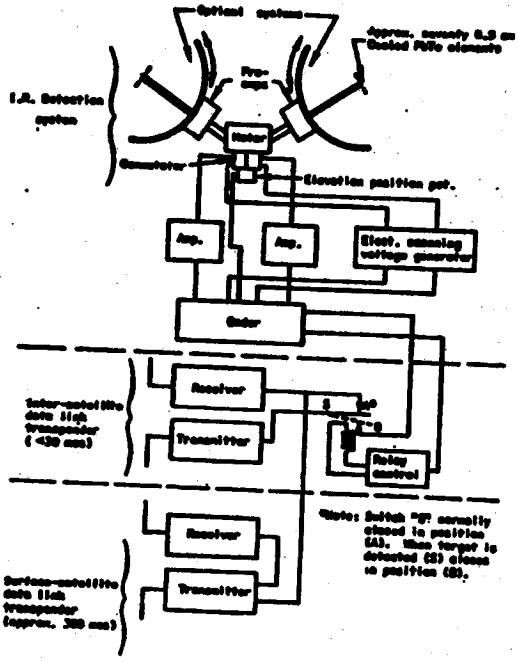

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FIG. 1 SATELLITE INFRARED DETECTION SYSTEM FOR USE AGAINST ICBMS

Two similar models of infrared equipment employing detectors of the PbTe (lead-telluride) type were considered, the major differences being the type of scan and the method of transmitting the data to the ground. For ICBM detection/tracking the information would be relayed to the ground via an intersatellite radio network and a satellite-to-ground link. In the case of the manned bomber detection system, the information would be recorded before transmission to the ground. The type and quantity of information transferred would permit the use of a very narrow bandwidth.

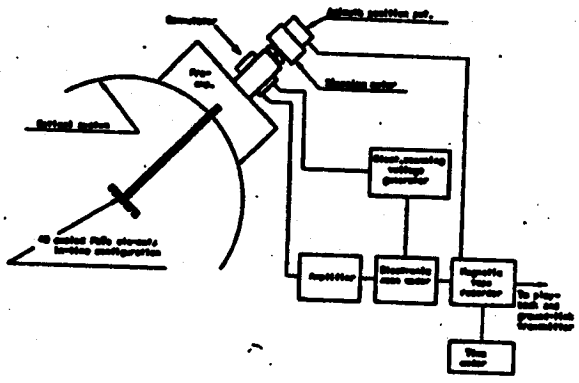

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FIG. 2 ONE POSSIBLE SATELLITE INFRARED DETECTION SYSTEM

The development plan outlined the Subsystems Tasks as follows:[3]

IR Scanner for Bomber Tracking (Eastman Kodak Co. and LMSD)

The optical system for the manned bomber and the air-breathing missile will be designed in accordance with conventional infrared collector systems. The reflector will be capable of scanning around a vertical axis covering a solid angle of 90 degrees, making it possible to determine orientation of the target with respect to the satellite. The subsystem will be capable of detecting the exhaust fumes

[3] Further detail can be found in *Development Plan*, LMSD 1536, Vol. II, G; Tab 1 (0369).

of manned aircraft as well as air-breathing missiles in the radiation region of 4.2 microns. The range of detection of a high-altitude intercontinental bomber or missile will be in the order of 420 nm.

IR Scanner for ICBM Tracking (Eastman Kodak Co. and LMSD).

The optical system to be utilized for the ICBM detection will be similar in general features to those used for bomber detection. However, due to the nature of the detection problem (high trajectory ballistic missiles) it will be necessary to provide two reflectors mounted back-to-back creating two essentially horizontal fan beams which scan up and down in a nodding motion. The detection range of the system will be a minimum of 3000 nm against ICBM's. The altitude of operation of the satellites is in the order of 1000 nm.

Airborne Data Processing (CBS and LMSD).

The detected electronic information as received by the scanner which was described for bomber tracking is appropriately processed by means of a data processing coder in a form suitable for recording. This data processing equipment will be very similar to that being developed for the Electronic Reconnaissance subsystem.

Data Recording (CBS and LMSD).

The data as received from the airborne data processing is stored on a suitable narrow band magnetic tape recorder. The recording equipment will be quite similar to that being developed for the Electronic Reconnaissance subsystem.

Data Transmission (CBS and LMSD).

The data as recorded for subsequent transmission provides the input to the data transmission equipment. This equipment consists of a transmitter and associated equipment and will be similar to equipment being developed for the Electronic Reconnaissance subsystem.

Data Link Network for ICBM Tracking (CBS and LMSD).

To provide for immediate transmission of ICBM track data, an inter-satellite network is required. This network is composed of an omnidirectional transmitter and receiver in each satellite. This equipment will not impose a serious weight problem. As targets are detected, the inter-satellite network is activated and all pertinent information is instantaneously put into the network. The number of satellites in this system is chosen such that detection requirements as well as inter-satellite network requirements are met.

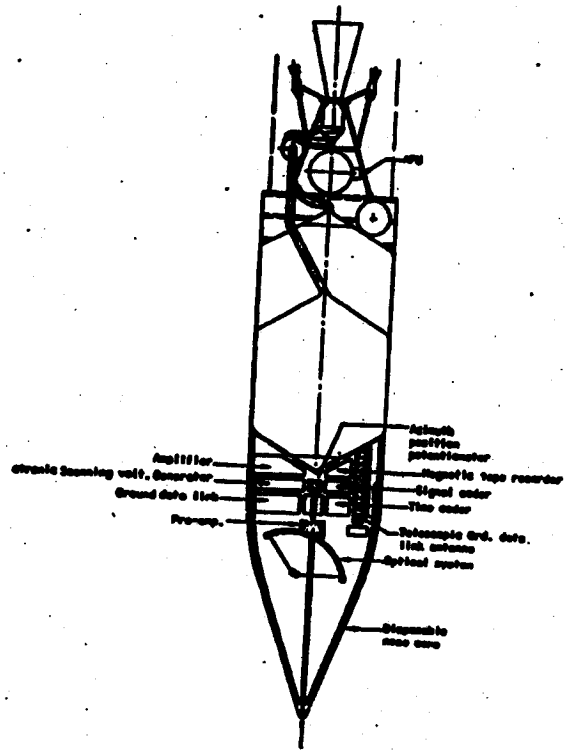

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FIG. 3. SATELLITE INFRARED DETECTION AND SURVEILLANCE SYSTEM INSTALLATION

When the WS 117L Advanced Reconnaissance System Development Plan[4] was written, some changes were made to make it conform to the version issued earlier by WDD. The Subsystem Tasks were now listed as follows:

IR Scanner for Bomber Tracking and ICBM Attack Warning (LMSD, Aerojet, Raytheon, Baird Atomics, Servo Corp.) Scanning angle changed from 90 degrees to 80 degrees.

Airborne Data Processing (LMSD).

Data Recording (LMSD).

Satellite-Ground Data Transmission (LMSD and Philco).

[4] *WS 117L Advanced Reconnaissance System Development Plan.* LMSD 2011 (0453), 1 Nov 1956.