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5400-73:HOL:pk
28 October 1963

Code 5400

Code 5430

Comment on Proposed Satellite Localizer System

Ref: (a) Code 5100 memo 5100-42:CEC:wdw of 30 Sep 1963

Encl: (1) Sec Memo 5400-73A:MJS:RDM:BW:pk of 28 Oct 1963

1. Reference (a) was forwarded to 5430 for comments. Clarification of certain details was the result of a meeting of Countermeasures Branch and Space Surveillance Branch personnel held 24 October.

2. Enclosure (1) contains the technical comments of 5438 and 5432.

3. In general, questions of feasibility as an ECM System are contingent upon:

(a) Probability of Intercept based on narrow frequency search, only 5 mc at a time, in S-Band.

(b) Need for calibration of the system during each orbit.

(c) Question of saturation lock-out because of high density of signals known to exist.

(d) Need for at least four channels of telemetering data.

(e) Lack of identification of signal parameters in the data as now conceived.

(f) Considerably more complex data reduction effort than is presently available.

4. I do not think it is advisable to attempt to prejudge the applicability of the system to the general problem. However, since NRO has a considerable effort underway, most of which we are not a party to the details, I would recommend the Director arrange for an unofficial review by CDR Sperberg. This should serve as a guide to the Navy in its official presentation and thus avoid possible embarrassing conflicts.

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H. O. LORENZEN
Head, Countermeasures Branch

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COMMENTS ON PROPOSAL FOR RECONNAISSANCE SATELLITE

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The system proposed reveals much ingenuity, but appears to be best suited for cooperative systems, i.e. those where the transmitted signal has been designed to be intercepted by the satellite. Indeed, if the transmitted signal were omnidirectional and continuous, the system would be a "Minitrack in reverse", with accuracy limited by the smaller array size.

For the non-cooperative case, however, several difficulties appear. It must be remembered that the signals to be intercepted are pulses, and are emitted by directional rotating antennas which concentrate energy at low angles. Provided that the satellite had sufficient gain in the maximum gain direction to look straight down and "see" the top of a radar transmitter, then it is quite likely that it would see a radar pencil beam pointed at it even if this signal arrived in a non-maximum direction for the satellite. Stated another way, since the side lobe suppression of the fan beam of the satellite array must be comparable in magnitude to the side lobe suppression of the radar, the satellite will respond simultaneously when its fan is pointing straight down to the top of a radar below it and to a radar near its horizon pointing at it.

It might be hoped that the satellite array minor lobe response could be identified as such as the satellite rotates, but it must be remembered that the radars are rotating and do not provide continuous illumination of the satellite.

The other implication of any proposed countermeasures use of this system is that the interference measurement of angle of arrival must be done on a very short pulse, not on the cw signals that are used in a tracking system. While it is undoubtedly possible to build

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such circuitry, the difficulties of so doing must not be underestimated. The output of such circuitry would be a measurement for each pulse, and the satellite-borne computational facility for reducing the bandwidth of this data to something that fits into present operational schemes is frightening to consider. Essentially an "Audico / burst-sort 704" would have to be flown. If, on the other hand, angle of arrival measurements of each received pulse are to be telemetered to the ground, the communications link would have to handle ten to twenty pulses for each received radar pulse. This would require completely new and different ground stations, and would make the satellites mission obvious. Concept

From the fix location standpoint, considering the intermittent nature of illumination and the extremely high density of output, obtaining fixes would be at least as difficult as the in the present system. This assumes that calibration transmitters at known locations with unusual, easily recognizable characteristics are distributed around the world and are continuously operating, as the proposed system requires these calibration signals to work at all. On the other hand, NSA assures us that if such calibration signals could be supplied to the present system, many of its fix location problems would disappear.

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