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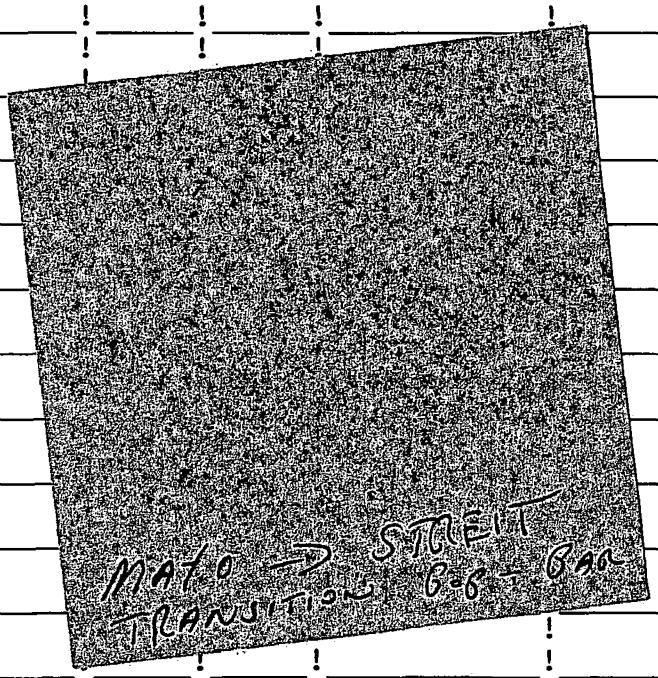

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MEMORANDUM TO FILE 29 March 72.

To: PM-16 [redacted]

From NRL Code 7920
R.D. Mayo

Subj: Summary of design effort todate on Joint Ocean Surveillance System;

1.Background:

In the seven separate Missions of POPPY under the NRO, NRL has exercised a role as the Technical Arm of the community to design and build the spacecraft and to participate as the major element in the evolution of the special purpose data collection systems for the overseas sites; in fact the design and installation and logistic support was entirely the responsibility of the NRL team. Since the period in late 1965 when the NRO funded and authorized the first computer system for installation in [redacted] NRL has exercised (by default) a design responsibility for a "Selective" Processing system at certain of the sites. The Ocean Surveillance capability that has been demonstrated in the program has been possible mainly because NRL was intent on exploitation of the program capabilities and because it was recognized very early that the A-to-D data conversion and computer System provided a latent Potential for on-site processing of Time-critical data.

2. Now in the climate of a redirection of the old POPPY Program it is clearly apparent that the experience of the past five or six years in POPPY must be utilized to the fullest in the orchestration of the "New O/S" System, in order to optimize the [redacted] system for this singular Ocean Surveillance role. It seems that NRL with its historic design role, must once again assume a position of technical leadership and not only evolve a workable system but surface it and defend it and be prepared to support the other elements of the community who must by Charter, process the data and diseminate the information to the users. In other words the design must not be a "Take it or Leave it" issue but must be available for assessment against a series of alternatives raised by these other facets of the community...NSA and NSG. It is therefore imperative that NRL expose the design concept as it is unfolding and give some of the logic which has cause the design to take the shape that it has. This is the precise reason for this memorandum.

[redacted]

[redacted] VIA
[redacted] CONTROL SYSTEM ONLY

3. The design of the Ocean Surveillance system offer many new and greater challenges to the technical POPPY design team. As one looks at a map of the Northern Hemisphere of the world where the water areas are all shaded blue it is very evident that the Sino Soviet Bloc land mass is a very small portion of this overall area and that the present orientation of the ground collection sites is not well arranged for surveillance of the entire water area of the northern Hemisphere...in fact certain new and different sites must be configured to expand the coverage of the POPPY-Family sites. It is these new sites that I am going to address in this portion of the paper. How are they different in philosophy and in design.

A- The New site is for the first time in POPPY going to be capable of accepting a data stream of sufficient dimension that it embraces the entire spectrum of ocean surveillance ELINT. That is, the Data Link system will be capable of transfering the [redacted] information from all of the ocean surveillance collection subsystems of a spacecraft constellation as it passes from horizon to horizon over the collection site. Note for example, the POPPY site and D/L system could only handle a portion of the collection coverage available in the spacecraft so that the philosophy of "Selective" use has evolved. Now with the Ocean Surveillance Tactical role it is imperative that the spacecraft capability for this job be at least a minimum requirement on the capacity of the data link system. Thus the ocean surveillance role has caused a change in the philosophy to one of Full-Time use of the O/S collection capability, and a much better agreement will be attained between the Bird and the ground collection site.

B- The new collection site will be designed and dedicated to the collection and processing and dissemanation of the ocean surveillande information. In order to achieve this goal one must recognize a basic difference between existing and future requirements on the sites...The new role presents the sites with little or no requirement to look for an Unknown signal but instead are destined to collect and process signals that are well understood and known in advance. Thus the need for manned intervention is greatly reduced,(hopefully eliminated). The instrumentation at these new sites will be aimed at being computer controlled so that the operation is almost entirely automated. The message traffic into the site may shift priorites or emphasis to reflect changing political or "Hot Spot" areas and provide the bounds for these. The maintenance man will before each collection operation, establish the readiness of the instrumentation complex, and make the instrumental-error correction measurement.

As the spacecraft cluster passes into the collection horizon of this site the computer controlled system will tract the spacecraft, collect the data and make it available in real time for the processing system.

C-The manner which the existing sites handle the operation will be somewhat different in that they have a capability to do more than just ocean surveillance and here is the opportunity to exploit the additional capability of the collection system. For example/~~xxx evolving xx~~ surveillance of the ocean threat can be supported at these sites where the opportunity to monitor the interior ship missle ranges now exist and where the analysis in depth may proceed with guidance by the NSA team. Technical Intelligence production can be exploited at these sites by having them develop the new Ocean Surveillance capability of the New sites and still progress in a role similar to that of the existing sites for POPPY.

4. Design evolution on the Spacecraft is dubdivided into many Functional subsystems like the Command System, the Data Link, the ELINT and attitude subsystem. Each of theseand many more have all been under study and certain of them may now be discussed along with some of the explanatory reasoning.

A- Command System:

The simplest command system that can do the job reliably is the one that must be used...which brings us to "What is the Job for the Command System?" In its least demanding form it is just to turn the Bird "ON" after launch and then with a "Bolt Cutter" turn it "OFF" band at a time as they fail to be usable. It is anticipated that the spacecraft may possible have some contingency Bands, that embrace ± 10% wider frequency response than those now recognized for the particular threat signals in each band. This is proposed to provide two distinct advantages for the Program; (1) additional redundancy in the ELINT area and (2) a Hedge against Technologic surprise if the Soviets should possess a Battle Mode for their emitters this tolerance in RF change is reasonable/~~xx~~ from the hardware design standpoint. The command system must be able to exchange the Standard bands for the contingency bands upon recognition of an operational need. The command function must be considered as mainly being carried out at the NRL ground site in [redacted] and thus reducing to an absolute minimum the requirement for operational commands to be sent by the operational sites. The function of setting the operational Gain control for the Elint Bands will be re-established once each Quarter for each operational area and not changed very often

It is operationally important that the collection sites be used insofar as possible to Collect and Process the data and not waste valuable collection time to set up the spacecraft. The command and control should be carried out in the relatively unperturbed climate of a Continental site in the USA, remote from the open dangers of disclosures of the command system.

B- ELINT Subsystem: The official emitter list is well known at this time with relatively little of controversy except how does one satisfactorily collect two signals in the same frequency band when their effective radiated power differ by 21 db [redacted]. For this reason Bands #2 and #3 must be resolved. perhaps by dropping Band #2. Band #4 is aimed at [redacted] and [redacted] but embraces many other high power emitters that are not of interest to the ocean surveillance job so that this band also probably should be considered very carefully, since it represents an increase in sensitivity beyond that now being used in 7107 of between 12 and 19 db...enough to pick up side lobes from many emitters now being acceptable intercepted by 7107.

C- Data-Link: The historic transmitter channels have always been analog in nature but for the future it is highly possible that they may be digitized in the spacecraft, particularily if there is a firm requirement to make a parametric measurement in the spacecraft of some type or another. The frequency of the down link will have to change in order to improve the measurement of [redacted] that is required to support the location accuracy requirements against brief signals. The search for a new frequency has been undertaken with Official approval being sought for the range above 1000 MHz. At this time it appears that the requirement for wider information bandwidths and elevation of frequency itself have together made it imperative that the number of transmitters be reduced and that the number of pulse width codes be increased commensurately. At this time it is proposed that the spacecraft use a single transmitter channel to pass all the ELINT data to the ground station, using between 10 and 15 discrete pulse-widths to code the band-of-origin of the data.