SECRET [redacted]

NO. 10
N
101-11.6

UNITED STATES GOVERNMENT

Memorandum

TO : Code 5600

DATE: 9 October 1970

FROM : Code 5610

SUBJECT: ADM Eppes briefing on space projects at NRL

1. This briefing is a full all-out attempt to overcome the sell job that APL did on the Admiral after he had paid a short visit to NRL. [redacted] did the previous E.W. briefing for the Admiral but had a very short time in which to carry it out.

2. I received a call on 8 October from [redacted] giving us the first part of the program.

Date - 14 October (Wednesday)
Time - 1000
Place - Building 56
Overview by [redacted] 20 min.
E.W. by Lorenzen
5600 Codes
Trexler
Mayo (show 56 lab spaces)
Wilhelm (show lab)
[redacted] (show lab ?)
Etc.
Etc.
At least one hour will be spent with Easton

Rehearsal on Tuesday, 13 October.

3. There was a request to stress background so as to show the long experience of NRL.

James H. Trexler
Head, Space Technology Branch

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5010-108

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

Briefing for Admiral EPPS at NRL on 14 October 1970....

~~SECRET~~

Arrival at NRL Main Gate 0955

arr. Rm 200D Bld 56

Log-in & Untroduction .. . . . . 1000 until

OverView. . . . . .Until 1020

H.O. Lorenzen Indtroduction of EW Div Until 1025

J.H. Trexler RASUR. 1065 1055

R.D. Mayo Program C Progress
Requirements
Checks and balances

NRL Role in Concept formulation, Budget, Design definition
Interface with Vandenberg Launch

Achievements National and Naval

Potential for future system improvement
Until 1125

Flight Hardware display

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SUGGESTED BRIEFING MATERIAL FOR ADMIRAL EPPS VISIT OF 14 October 1970

1. It is [redacted] tention that the Admiral is in the balance of the two schools of thought which manifest (1) The IN-HOUSE Navy capability and (2) the Industrial Complex manner of placing the Navy in space.

Therefore it is imperative that we show him only those facets of our effort which contribute to the strong and consistent picture that will justify and vindicate the decision made several years ago to proceed with Program "C" Technical effort with the IN-HOUSE NRL team. The future Navy efforts to proceed in SPACE will have to be judged on the merits of each specific endeavor [redacted] as they can best be served by one proceedure or the other. It is thus in our best interest that the Admiral see the MAJOR facilities such as the Anechoic Chamber, the shock and vibrations facility and the Vacuum chambers but NOT the small crowded laboratory spaces of Code 5614...these will not enhance our creditability in the business of leading a National effort in the space arena.

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[redacted]

~~Top Secret~~ [redacted] 11 October 1970.

MEMO TO HO Lorenzen on Second Generation Computer Subject...

On 14 Sept, just two days before your departure, when you were down seeing Dr. Berman, you may recall Dix, Lee and I went to 4C1000 to listen to the arguments pro-and-con relative to the 2nd Generation Computer System for Program "C". I made a report to you verbally on the exchange in front of Mr. [redacted] with NSA being unsuccessful in their fragmentary arguments against what we were offering...a point of inflection on our growth curve where we could imagine that 40 to 50 times the capability was within Initial Operational Capability (IOC) and something approaching 400 to 500 times present capability would be achievable ultimately within 24 months. Mr. [redacted] voted very strongly for the approval of the new computer [redacted] and since he had been told to implement this Augmentation of the program it should proceed. He passed out a question sheet relating to the 17 August NavIntCom letter on augmenting the program (Revised Packard Letter). These questions had a few impacting items relative to this Fiscal Year and he wanted answers ASAP so the approval of this program could have the correct amount of $ associated in initial approval. On 22 Sept [redacted] Col Kiefer and I met with Mr. [redacted] and it was somewhat clumsey because I had just sent a rough copy of the ASAP answers to [redacted] for him to smooth up and send to Mr. [redacted] instead [redacted] made the appointment with Mr. [redacted] and I was invited without any indication that a smooth would not be prepared in the Program Office so we showed up with only my orginal of the "Rough Working Copy" and had to give him the information verbally and perhaps in the face of this budget delima at NRL it is best that it was done this way because I was completely unaware of the deficiency at all, much less the magnitude of it. I had turned in my A-1 form and it remained nearly identical to the one in March...Mr. [redacted] was told that every effort was made to keep the augmentation of the program in the "Low Cost" and fast response climate that had been indicated throughout the ~~reviewing~~ by the community.

On 24 Sept we had the TOG meeting and it was noticable only by the large number of STIC and NSA men present. However [redacted] did bring up a point of contention between NRL and NSA on the QC (Manual Analysis)Complex and the way it had been handled in the past and how it should go in the future. I Insisted that this not come up before the full TOG but be taken privately before Capt [redacted] immediately following the meeting. This was done and those present were [redacted] from NSG, [redacted] (NIC) [redacted] Abplanalp and [redacted] (NSA) with Dix and Me from NRL. It seems that the main point that NSA was making was that in spite of the NSA neglect of the past they must insist on a more active participation in the future, particularly for the Processing effort of this program including that part overseas. They have the charter and they willbecome involved in all aspects of this effort. I countered that they had consistently stood AGAINST progress in this program and mere words are not enough to get a vote or power of veto, we do not have the luxury of a Debating Society and the operational software effort was with a contractor whom they had no good words for, we could not share the technical responsibility with a team who would rather see another program get all the credit and still another program get the "Enhancement for Ocean Surveillance" [redacted] made the noises that one would expect, stating that he had heard repeatedly all the gripes against NSA and was full of them. Now we must get on with the job and work together toward the future good, in this computer evolution. -/-

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~~Top Secret~~ [redacted]

Top Secret [redacted]

Let me point out some of the salient points about NSA's positions on the matter of the "Enhancement of Program "C" for Ocean Surveillande":

1-On June the Packard Letter was sent out by NIC and NSA responded with a very Low Cost Alternative, in essence giving [redacted] what NIC's letter had asked but substituting in the two pacific sites, a QC Complex for an SEL 810 Computer at each site, thus reducing the requirement for doubling the personnel costs at each of these sites. [redacted] was also reduced in priority and [redacted] was substituted for [redacted] with very little justification and wisdom. The entire thing smelled like"just do not spend any money for Program "C" which might perpetuate it into the Ocean Surveillance World when NSA wanted their HOT IDEA= ROSALIE to get all the emphasis...this is what we heard in late July at Lockheed

The debate on this alternative was also followed by a letter to CNO from [redacted] with the Program "C" Information dated 26 July I think. But it did say that P-11 Program could possibly offer significan advantages for a future Ocean Surveillance system.... we felt that what should have been said is that"all programs should be studied with this new role in mind" and not just compare todays Program "C" with tomorrows P-11's after all this is stupid. We did not pay too much attention to the [redacted] remark to CNO because it was eclipsed by the "Revised Packard Letter of 17 August"from NIC. Keep in mind the advantage of the original letter from Sec Nav to Packard only improved the capability of Program C by a factor of TWO, by giving each digital site its own computer for Ocean Surveillance Processing. The staff work for this was done by NSG and it was briefed widely by NSG including the Herzfeld group a couple of times. Lee and I did give [redacted] a paper drawn up over one week-end indicating that an improvement by a factor of 40 to 50 was easily available if they would take advantage of the evolution that had taken place in the computer industry si ce the original SEL-810 was selected. This informal Working Paper did not leave the Lab officially and we were not even given the courtesy of reviewing the Staff work of NSG on the paper sent to SecNav and Packard...our input was not only ignored but was surpressed. It was not until 7 July in advance of the [redacted] breakfast which was being staffed by [redacted] that our thoughts of a FACTOR ot 40 to 50 instead of only TWOM (2) became an issue. I did disclose this opportunity to [redacted] at the last minute of this meeting and I suspect that it might have been instrumental in NSA getting the mandate to find a more effective or a lower cost alternative...this is just conjecture though. In any case the original Packard letter went downhill after this and another (17 August) rationale' replaced it, with NRL giving the Staff Study in support of this new computer. The basic information of this 17 August letter is from our paper to [redacted] on 14 August.

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2- On 22 Sept NSA/ /us/NRO/NIC/NSG all met first to discuss the payload separation problems and then after the meeting adjurned NSA came over to our building and we sat down to a session on the Quality Control Analysis comples with Abplanalp, on one side and Me, then later and Ed Dix joined because I had to go see Mr. This session was a confrontation which had been building up for a long time with NSA having some points and we others. I thought a sincere effort should be made to make the best of it until they made some sneering comment about us "Throwing it together",(meaning the QC complex) and I exploded all over them on this obvious poor choice of words. Dix was there to maintain the steadying prosepctive and carry the ball after I had to leave but the scar tissue is still pretty thick on my team. The whole thing involved here is that they volunteered to write the SOP for the unified QC Complex which was started in Jan. 70? Since this complex is the source of the SOI messages that NSA has to answer it is natural that the method of measurement be their option and we concurred to the extent that we invited them here and to to use the one and only such complex that had been assembled. It was our intent that this complex be shaken down here for a period of a month or 1½ months and then sent to for further evaluation prior to going into the full scale job of duplicating it in quanty TWO at each of the sites. The Quantity TWO is necessary to expedite the QC scanning of all the tapes before those with SOI's are selected and sent back to NSA (Analog tape that is)... In the previous cost climate we were really only adding two pieces of equipment and re-engineering its lay-out to expedite operator usage...the two pieces of equipment were recommended by NSA so I really fail to see the controversy yet. It seems that in his visits to NRL to use the equipment found several things that were a matter of adjustment or otherwise of little significance and made his report to the K-46 people at NSA that the system should be assembled there forethe Shake-down and not sent to We were told that they wanted it at NSA but that they did not yet have a place for it so went ahead and sent it to That is where it hit the fan. Their position is that has no such expertise as theirs and we exceeded our mandate to cut them out of the evaluation and re-engineering role...after all their Video-Disc expert now supposedly says that the Disc which they originally recommended is no longer any good. The company has changed a couple of times etc etc. The entire issue is trivial except that NSA has at long last awakened from hibernation where the engineering of Program "C" is concerned. Lip service is all that has thus far surfaced but it has the smell of a fight where they have the Charter and can make it stick if they want to pull rank. What I have proposed is that we will produce a program plan with anticipated schedule for the 2nd Generation Computer Selection, indicationg points in this schedule where we will send them an agenda prior to andNRL/NIC/NRO/NSA meeting on a subject of partial Design Review with minutes bei ng kept and action items followed up etc. This will give them a formal forum where they can meet and exchange ideas and offer benefitial suggestions if that really be their intent.

We have it on real good athority that the Civilian leaders of will not mouse-trap Adm Gayler again on this Program. They will not by any act or lack of action manifest any position contrary to Program "C",...if this is documented it is sufficient for dismissal of the civilians involved. Sounds a little strong but it might suggest that their past history has caught up with them at last.

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~~Top Secret~~ [redacted]

Summarizing NSA's actions:

1- Opposing Monetary enhancement of Program C . . . answering June Packard letter
2- Offering a Low cost alternative [redacted] July
3- Gayler to CNO testimony for P-11, [redacted]
4- 16 Sept Argument against SEL-86 2nd Generation computer
5- Subsequent testimony to Comptroller in support of the Money for Ocean Surveillance Modifications to Program C processing changes go through NSA so they would be in the Drivers seat, technically.
6- 22 Sept ONRL, the QC complex confrontation.
7- 24 Sept TOG Pitch to exert technical leadership in the matter of the computer and its software systems, etc.
8- 2 Oct, Rough of [redacted] McLucas to SecNav that Dix saw with [redacted] as NRO endorsement of Technical role of NSA in this augmentation of the Program.
9- The Approval granted but no letter yet????

We must "Play games with Them" since they have the charter we must pre-empt the technical program and in the face of their poor track record any arguments will be submitted to a referree, perhaps [redacted] for a ruling. They had better not play an obstructionist game with us or we are liable to fall on our face with (1) a budget problem and (2) the extensiveness of the job of getting a new computer plus (3) the hard-wired Priority Data-Extractor (PDE) developed and deployed. Superimpose these problems on top of an architecture for Branch formation, Security arraangement for [redacted] computer system and a few dozen other problems and you have an idea of the climate in Program "C". We must get our kicks out of "Choice of Crisis" because that is our routine stance.

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~~Top Secret~~ [redacted]

~~Top Secret~~ [redacted]

Budgetary Delima:

1- Several areas of our endeavor (5614) could be identified for special attention where we could justify and receive separate funding ~~with an~~ opportunity for NSA to pick-up the tab on one or two: (even give)

A- The modification to the large anechoic chamber in Bld A-59 has had a deficiency in a way that inhibits the antenna measurement & documemtation of Vince Rose's bands for ultimate use by NSA in resolving the SLX Signal Amplitude measurement data for antenna Beam Definition purposes. This is a very critical deficiency in our Chamber and we have no guarantee that the first modification tried will be successful but the Main ~~xxxxx~~ one to be proposed now will reduce the time for Plotting these multi-frequency patterns by as much as eight to one. This alone might justify the expenditure if it was not totally successful in rectifying the chamber defeciency. This effort is under Pete's program and it is just possible that NSA might lend support for this improvement in our facilities in their behalf.... $230,000.oo

2- QC Complex:

This effort has severe NSA implications where the measurements made operationally are being made for NSA and only in a small way in support of guiding the computer analysist toward the most lucrative signals. This effort has been going on since January with $_____ already spent and about $126K remaining toward having duplicate systems at each of the [redacted] sites. and [redacted] The cost for this effort is not as high as it would have been if only new equipment were used. Instead most of the older equipment from the site is being retrofitted into these complexes with some small investment for shipping and retrofit being necessary.

3- Buffered Tape System (BTS):

The BTS is a vital piece of equipment for the digital site that must store the digital data on magnetic tape for any reason, either to send it beck to NSA or to process it locally. It is a relatively small investment when compared to the back-up system, the SEL-810A computer system. For this reason and many others it has been vital that a new Dual BTS be developed at NRL for ultimate deployment to the digital sites. This instrument will allow two digital tapes to be made either in series or in paralle. $402K Total / $260K To Finish

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IBM 70S

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Agenda for
pt. L. W. Moffit briefing
October 8, 1970
Conference Room 1D43

8:30	- 8:45	Introduction
8:45	- 9:30	CDMS
9:30	- 10:15	UNREC
10:15	- 10:30	Break
10:30	- 11:00	Intelligence Data Proces
11:00	- 11:30	Image Manipulation
11:30	- 11:45	Discussion
11:45	- 12:00	Lunch
10:00	- 12:45	RSSS
12:45	- 1:30	Displays
1:30	-	Digital TV (demo)

(Note: The meeting will continue during lunch.)

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Talent-Keyhole
jointly

Briefing for ADM EBPS on 14 October 1970

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Early History

First SecDef Approval
First and Second Launch Totally Navy Effort
1962 First National Mission 7101

Requirements from USIB to SORS to NRO to Prog. "C"
We develop Concept, Detailed Design Goals, Schedule and $
and a Technical Description, Eng'g Evaluation (Initial)

Operational status of the Program now:

Sites + remain with approval for 6 working birds, 4 are over 3 years old and 2 will be one yearold in about 1½ weeks.

An assessment of the weekly results of all the programs including ours gives about ½ of the notable mentions to this program with another fairly large % where we share mention with other programs.

Our Program Emphasizes the following aspects of its operation:

1- Main Beam Intercept ...to preserve the Antenna Scan Characteristics.

2- ..to provide ability over entire spectrum.

3-Long Lifetime operationally by simplicity in bird and redundancy.

4-No mixer by-products by using Crystal video type receivers.

5- Documented collection characteristics precludes uncertainty of signal characteristics in analysis effort.

6-Total Weapon-System Intercept possible simultaneously.

7- Horizon to Horizon coverage up to 9-times per day at norther latitudes.

8-

(1) EARLY (NAVY ONLY) Dyno I (1st in USA) II dual band

(2) SPACELOG

(3) 1962 = NRO 7100 Missions

(4) 7101 & 7103 & 7104

(5) Major Step Forward A-to-D + Computer

Many existing subsystems but computer to sort out Specific signal (Selective Processing)

April 68 Adm Moorer CNO directed by ship box.

Fingerprint.

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~~TS~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

OFFICE OF THE DIRECTOR

OCT 13 1970

MEMORANDUM FOR THE DIRECTOR, PROGRAM C

SUBJECT: FY 1971 Increased Approval

Reference: BYE-13243-70 dated 7 October 1970, subject "Augmentation of POPPY Facilities for Ocean Surveillance."

The FY 1971 POPPY approvals are hereby increased as follows, for the interim Ocean Surveillance capability:

Godersdorf/Domestic:	
Equipment:	
SEL 86 (2)	$ 858,000
Software	115,000
Perishable - Data Extractor	50,000
Deployment:	
SEL 810A Van	24,000
Equipment O&M:	
[redacted]	27,000
Domestic	18,000
NRL Personnel:	
One man, 3/4ths year	22,500
Sub-total	1,114,500
[redacted]:	
Equipment:	
Perishable - Data Extractor	50,000
Equipment O&M	3,000
Sub-total	53,000
[redacted]:	
Equipment:	
Perishable - Data Extractor	50,000

POPPY

NRL B-000127-70

[redacted]

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PAGE 1 OF 2 PAGES

[redacted]

Equipment O&M	3,000
Sub-total	53,000
Total	$1,220,500

It is requested that your financial records maintain these and any later Ocean Surveillance distinctions, in order that appropriate costs may be readily-identifiable.

The Director, Program A has been instructed to furnish the fund authority immediately.

Signed

JOHN L. MCLUCAS

cc: Director, NSA

Note forward 21 Octobe 970 for JURO FY-70

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I. Background:

The budget estimates for Fy-71 provided in Ref (a) were provided by NRL without full definition of Mission 7107. However, since the major emphasis in the determination of Mission 7107 was to provide the fastest response time for replacement of the two operational spacecraft which failed prematurely in Feburary 1970, there was not thought to be the likelihood of 7107 being notable for its extensive innovation beyond that of the earlier Mission 7106. Therefore it was thought that Mission 7106 would serve as a cost basis for the FY-71 portion of Mission 7107. It is now apparent that t ese costs are quite different from those of Mission 7106 through several discrete areas, which are identified below and treated in succession in the remaining portions of this paper:

A Cost of modification of the technical goals for Mission 7107.
B " of Increased Redundency for improved spacecraft reliability.
C " of changes brought about by increased operational requirements.
D " of increased component replacement costs.
E " of Ocean Surveillance changes to the mission Spacecraft and Site systems
F " R&D spacecraft costs, technical goals and schedule implications
G " of NRL Facility improvements proposed.

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I- Revision of FY-71 Budget for FY-71 for Mission 7107:

The budget estimate for FY-71 provided in Reference (a) was submitted by NRL before:

A- Mission 7107 was fully (or adequately) defined.

B- Mission 7106 failure analysis with its resulting impace on Mission 7107 had been determined.

The consequence of this situation was that the assumption of similarity between Mission 7106 and 7107 were sufficiently inaccurate soas to cause a budget deficiency in the ammount of $_____ for FY-71. In addition the time involved in resolving conditions A- and B- above, have caused a delay in NRL's"testing the market place". Once the costs of these technical modifications, plus the increased costs of simple replaceme nt systems, were quoted by the manufactures and then compiled for regular in-house NRL budget review, it became apparent that the original FY-71 budget estimate was inadequate for carrying out Mission 7107 in a timely and efficient manner.

These factors are delineated in the following two tables. Table #1 lists the increased system cost and components. NRL feels the costs in Table #2 are reflections of the overhead-inflation spiral which is especially severe in the aerospace industry. It should be noted that whenever possible these costs have been arrived through competitive bidding proceedures.

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July [redacted] FY 71 NRL

Portion of Program C

Ref (a) NRL ltr 7000 Ser. Prog. C of 1 May, BYE-51904-70

(b) NIC ltr. to DNRO of 17 Aug 1970 -

(c) Working paper from Comp. NRO to Dir Prog C - 14 Sept 1970

I. Background

On ref (a) NRL provided the budget submission for FY 71. This budget submission was based on Mission 7107 being a "quick turn around" effort resulting in a launch in Nov 1971. From a technical standpoint Mission 7107 was very similar to Mission 7106 and therefore NRL based the budget on the cost experienced in 7106. It should be noted that the budget was needed before the design details had been completed.

NRL has realized that the 66 costs were not a sufficiently accurate base for 67 costs. We are finding out that the general national inflation is only a small portion of the escalation being experienced in the aerospace and electronics industry. The overhead costs in these two industries has increased tremendously in the recent past, some specific examples of this overhead inflation spiral are listed in [illegible]

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1.

Ch 1. Glomar Budget for Mission 7107

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The original FY 71 budget for Mission 7107 (ref a) was submitted before:

a. Mission 7107 was adequately defined

b. Mission 7106 failure analysis, with its resulting impact on Mission 7107, had been determined.

The consequence of this situation was that the assumptions of similarity between Missions 7106 and 7107 were sufficiently inaccurate so as to cause a similar inaccuracy in the original budget estimate. In addition, the time involved in resolving condition (a) and (b) alone caused a delay in NRL's "testing of the market place." Once the costs of these technical modifications, plus the increased costs of simple replacement systems, were quoted by the manufacturers it became apparent that the original FY 71 budget estimate was inadequate for carrying out Mission 7107 in a timely and efficient manner.

and then compiled for regular in-house NRL budget review

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These items are detailed in the following three (3) tables.

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Table 1 lists the items involved in the Mission 7106 failure analysis which had a greater diversionary effect on Mission 7107 than had been anticipated. In a general sense, the situation resulted from the fact that the Mission 7106 failure analysis proved far more difficult and time consuming than had previously been estimated (see Table 1). It involved many more man hours (much of it overtime) purchase of special test equipment, some permanent modifications to the test equipment at the ground station and other factors which are listed and described in more detail in Table 1. These funds, which total $365.5K were spent on the last 4 months of FY70, on Mission 7106 and were therefore unavailable to apply to Mission 7107.

Table 2 lists the increase costs over what had been budgeted for certain "replacement" systems and components that

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systems and components. NRL feels the cost of Table 2 are a reflection of the overhead-inflation spiral which is especially severe in the aerospace industry. It should be noted that whenever possible these costs have been arrived at thru competitive bids.

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	ORIGINAL ESTIMATE			INCREASE COST	RELIABILITY		
	LAST 4 MO FY70	12 MO FY71	TOTAL (16 MO.)	OVERHEAD INFLATION AVAILABILITY	REDUNDANCY	INCREASED OPERATIONAL REQUIREMENTS	TOTAL REVISED ESTIMATE
I. PAYLOAD (development-recurring)							
A. Electronic Equipment (Data & TM)	155.8	195.7	175.45	174.6	155.0	534.0	2618.1
B. Stabilization Systems	135.0	248.5	383.5	142.0	130.0	—	655.5
C. Powered Systems		154.8	154.8	31.9	95.0	—	281.7
D. Control Systems	172.0	138.4	310.4	61.2	71.0	45.0	487.6
E. Compatibility & environmental tests		157.0	157.0	—	—	—	157.
F. Mechanical Structures & Fabrication	9.8	273.0	282.0	9.8	—	—	282.
G. NRL Salaries & Overhead	595.7	1769.5	2385.2	—	—	89.5	2474.
H. Misc. Materials Travel & Shipping	194.2	928.8	1123.0	68.0	—	—	1191.
II. GROUND STATION (investment)	(2654.7)	(3985.7)	(6550.4)	(4[illegible])	(451.0)	(6685.)	(8147.6
A. Electronics (Rec. Record & timing)	—	621.0	621.0	31.0	—	151.0	772.
B. Antenna Systems	—	63.2	63.2	8.9	—	20.0	83.
C. NRL Salaries & Overhead	20.0	813.7	883.7	—	—	—	883.
D. Misc. Materials Travel & Shipping	206	606.8	686.8	59.2	—	—	746.
E. A&D SYSTEMS	—	—	—	—	—	—	—
III. FACILITIES (investment)	90.0	(2164.7)	(2254.2)	(62.7)	(0)	(171.0)	(2425.7)
A. Test equipment & facilities	—	(573.0)	(573.0)	—	—	—	(573.0)
V. SERVICES (operational)							
A. Operational Field assistance	—	715.0	715.0	70.0	—	—	785.0
B. Computer Services	—	259.0	259.0	—	—	—	259.0
	—	(974.0)	(974.0)	(70.0)	—	—	(1044.0)
	(2754.7)	(7597.4)	(10,352.1)	[illegible]	(451.0)	(837.5)	(12,190.7)
				1839.2			

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C05026158

~~Top Secret~~

	ORIGINAL ESTIMATE			INCREASE COST	RELIABILITY REDUNDANCY		
	LAST 4 MO. FY70	12 MO FY71	TOTAL (16 MO.)	OVERHEAD INFLATION AVAILABILITY		INCREASED OPERATIONAL REQUIREMENTS	TOTAL REVISED ESTIMATE
I. PAYLOAD (development-recurring)-							
A. Electronic Equipment (Data & TM)	1558.8	195.7	1754.5	174.6	155.0	534.0	2618.1
B. Stabilization Systems	135.0	248.5	383.5	142.0	130.0	—	655.5
C. Powered Systems		154.8	154.8	31.9	95.0	—	281.7
D. Control Systems	172.0	138.4	310.4	61.2	71.0	45.0	487.6
E. Compatibility & environmental tests		157.0	157.0	—	—	—	157.0
F. Mechanical Structures & Fabrication	9.0	273.0	282.0	9.8	—	—	282.
G. NRL Salaries & Overhead	595.7	1789.5	2385.2	—	—	89.5	2474.
H. Misc. Materials Travel & Shipping	194.2	928.8	1123.0	68.0	—	—	1191.0
II. GROUND STATION (investment)	(2664.7)	(3985.7)	(6550.4)	(487.5)	(451.0)	(668.5)	(8147.6)
A. Electronics (Rec, Record & timing)	—	621.0	621.0	-31.0	—	151.0	772.
B. Antenna Systems	—	63.2	63.2	-2.7	—	20.0	83.
C. NRL Salaries & Overhead	70.0	813.7	883.7	—	—	—	883.
D. Misc. Materials Travel & Shipping	200	666.8	686.8	-34.2	—	—	686.
E. ADD SYSTEMS	—	—	—	—	—	—	—
III. FACILITIES (investment)	90.0	(2164.7)	(2254.7)	(67.9)	(0)	(171.0)	(2425.8)
A. Test equipment & facilities	—	(573.0)	(573.0)	—	—	—	(573.0)
V. SERVICES (operational)							
A. Operational Field assistance	—	715.0	715.0	70.0	—	—	785.0
B. Computer Services	—	259.0	259.0	—	—	—	259.0
	—	(974.0)	(974.0)	(70.0)	—	—	(1044.0)
	(2754.7)	(7597.4)	(10,352.1)	(625.9)	(451.0)	(839.5)	(12,318.5)

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13.1
8.0
5.1
12

1 A B C E L
of ENCL. 1

Increased Cost Arising From Overhead-Inflation Factor

D	64.1%	1.	Command Receivers	$ 61.2
A	12.5%	2.	Ekut System	$ 150.0
B	53.8%	3.	Reaction Wheels	$ 35.0
B	53.8%	4.	Gravity Gradient Dampers	$ 35.0
B	44.6%	5.	Micro Thruster Systems	$ 52.0
C	53.3%	6.	Batteries	$ 13.9
A	60%	7.	Transmitters (Channel A)	$ 24.6
C	10%	8.	Solar Cells	$ 18.0
H	3%	9.	R.F. cable	$ 16.0
H	4%	10.	R.F. connectors	$ 6.0
H	22%	11.	MULTIPIN CONNECTORS	$ 1.0
B	33%	12.	Gravity Gradient Boom	$ 20.0
H	5%	13.	Shell Sections + mechanical components	$ 39.0
				$ 477.7
IV A		14.	Contractor O.H. Increase DENDIX HRB	10.0 60.0
				540.7

8.0
1.7
6.0

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Increased Costs Arising From Technical Modifications

RELIABILITY - REDUNDANCY

71	D	1.	Command System	(+71)	$142.0 M
~~135~~ 135	C	2.	Power Supply	(+20)	$135.0 M
95	A	3.	Clock System		$95.0 M
60	A	4.	Telemetry System	(+20)	$80.0 M
110	B	5.	Stabilization System		$110.0 M
20	D	6.	Monitor Valves	(+75)	$45.0 M
		7.	Deployable Antenna		$25.0 M
451					$632.0 M

INCREASED OPERATIONAL REQUIREMENTS

	165	1.	Parametric Measurement Versatility (VINCE)	$165.0
D	45	2.	Decoder Versatility	50.0
~~229~~		~~3.~~	~~Transmitter System Cost~~ (10 x 2.2x)	~~280.0~~
	24	4.	Telemetry System	24.0
	85	5.	Ranging System	~~196.0~~
	220	6.	Band Extention	284.0
A	40	7.	K band geoposition	60.0
	126	8.	Q.C. Cycles	126.0
~~229~~		~~9.~~	~~Telemetry System~~	~~50.0~~
	45	10.	System Calib. Unit Mods	50.0
~~839.5~~		~~11.~~	~~Contingency~~	~~Bal~~
839.5			Labor 25% x 17% x 20% =	1119.8

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From: Dir Naval Research Laboratory
TO: Director Program "C"
Subj: Supplementary Cost Information NRL effort on Program "C"
Ref. (a) NRL to Director Program "C" letter of 1 May 1970 B-51904-70
(b) Dir Prog "C" ltr to DNRO of 17 Aug.- B-66387-70
(c) Informal Questions by NRO Comptroller of 14 Sept 70.

I- BACKGROUND.

In Ref (a) NRL provided the budget submission for FY-71 without the full definition of Mission 7107. However since the major emphasisin the Mission 7107 concept was for a "Quick Turn around " following the in-flight failure of two of the spacecraft of Mission 7106, we assumed there was not likely to be a great deal of technical innovation beyond that of mission 7106. Therefore it was thought that Mission 7106 would have served as a cost basis for the Fy-71 effort toward Mission 7107. It is now apparent that 7107 costs are quite different from those of 7106 through several discrete areas. These increased cost areas, identified as

(1) Cost escallation throughout the aerospace industry as the Overhead burden increases higher and higher. Some specific examples of this overhead-inflation spiral are listed in Table #1.

(2) Technical Escalation due to changes in Operational Requirements and reliability-redundency for increased payload lifetimes. Specific examples of these costs are given in Teble #2.

individual enclosures, are:

Encl. 1. Revised Budget for Mission 7107
C. Technical Modification, Out of (TABLE 3)
1. Increased redundancy
2. Change in Operational Requirements
B. Increase in Replacement Costs (TABLE 2)
A. Impact of Mission 7106 failure on mission 7107 (TABLE 1)
Encl. 2. Ocean Surveillance Additions
Encl. 3. R&D Payload Additions
Encl. 4. Facility Improvements

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OUTLINE OF WORDS TO ACCOMPANY NRL FY-71 BUDGET AND TECHNICAL REVISION FOR MISSION 7107.....

1- Introduction and Background:

(a) Continued evolution of the technical goals for Mission 7107,

(b) Cost inflation

(c) Additional Redundancy brought about by failure in-flight of 2 of the mission 7106 spacecraft.

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1. Background: ~~Top Secret~~

xx Mission 7107 initially proposed by the Naval Research Laboratory in February 1967 has been modified many times and continues to undergo certain changes in response to changing operational requirements. The most recent approved concept proposed in Ref (a) and approved by Ref. (b) has been under active preparation for a Launch scheduled in late November 1971. This concept and its technical aspects for the four primary spacecraft were defined in Ref (a) and the cost estimates provided about six months ago, immediately following the premature failure, in-flight, of two of the spacecraft from the Mission 7106. The ELINT systems thus proposed in Ref. (a) were restrained in technical innovation to allow the maximum acceleration of the launch schedule for Mission 7107 and therefore could not include any new development work in the ELINT systems the pace-setting effort for the Mission. Now, still under the same constraint of limited technical innovation in the ELINT systems, the Naval Research Laboratory proposes certain small but none-the-less significant modifications to the ELINT collection systems which will further the optimization of Mission 7107 for its Ocean Surveillance capability without jeopardizing the normal function of the Mission:

2. Spacecraft
   (a) Modification of band-pass specs
   (b) Substitution of 4-way Collection Coverage
   (c) Comb-filter in X-band.
   (d)

3. Ground Station:
   (a) - Auto-Antenna Tracking System (AATS)
   (b) Perishable data-extractor (PDE)
   (c) Second-Generation Site Computer. System-86 class
   (d) Second Generation PDE/ADDS (Prisort)
   (e) antenna test panel - Pre Amp mode.
   (f) BTS + QC

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1- Background:

The concept advanced for Mission 7107 by Ref (a) (7107) calls for [redacted] spacecraft, with some duplication among all of the primary spacecraft and great similarity between the spacecraft [redacted]. Thus one would expect that the geopositioning capability of the Mission would be maximized, the time over target would be doubled by having [redacted] spacecraft come over the target area as times about [redacted]. By the addition of a third transmitter in each spacecraft the instantaneous gross magnitude of data capable of being collected, would not drop much below that experienced by Mission 7106 in the past, where the [redacted] The ELINT ~~Elint~~ coverage proposed in Ref (a) has been under study and certain small changes have been found necessary for engineering compatibility and will be evident in the Table I/ of proposed ELINT coverage. The following reasons are offered for these changes in the ELINT coverage: (1) Changes in the operational requirements imposed on this mission, (such as intensification of the Ocean Surveillance ~~and~~ or the solution of the SA-6 question) (2) Engineering considerations of weight, volume, ~~and~~ antenna compatibility & schedule. The latter category has been largely responsible for the changes of coverage being shifted [redacted] following in sequence of production. It is imperative that the items arriving toward the latter part of the schedule not be destined for use in the ALPHA/BRAVO spacecraft which are the first and second in production. Handle Via BYEMAN Control System only

An example of the manner in which changing operational demands may change the ELINT coverage of a Mission such as 7107 is seen in the recent verbal exchange between NRL, NRO & NSA on the subject of extending the frequency of coverage where geopositioning capability will be provided in Mission 7107. Under the restraints which have been placed on the degree of innovation (through emphasis on early launch date) we could not undertake any new development effort to extend this coverage but we could by refurbishing a spare collection-system left over from 7106, extend the K_u Band geopositioning capability upward by adding one more band to 7107 Delta. This has been undertaken at this time with the cost implication of an additional $20 K for implementation and refurbishing the old spare unit. Thus the additional band from 14.8 to 15.1 GHz has been added and the proposed geopositioning capability in this microwave portion of the spectrum now covers from 14.5 to 15.1 GHz, with a minimum impact in cost or schedule.

Another example of the operational requirements influencing the design goals for Mission 7107 is seen in the strong position by NRO staff that the coverage (single ball) be complete from 153 to 18 GHz. In the Option #2 proposal of Ref (A) this was pointed out as a strenous and time consuming and costly effort. However we have undertaken the challenge and these components are under procurement, However They must be accorded the lowest priority of all the components being purchased from this particular vender. It is still too early to predict with any confidence whether they will be ready in time or not because of the uncertainty of the ammount of re-work which might be necessary on those parts of the spectrum which hold a higher priority. We are today as in the past, trying to be responsive to the requirements as they are filterd down to us.

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Table #3 is provided to up-date the ELINT collection sub-systems now being planned for Mission 7107. The changes fall into at least two categories, (1) Operational requirement emphasis shifting since the 7107 Concept was formulated and (2) Technical consideration relative to the maximization of use of weight, volume and antenna considerations. The first category, changing operational requirements in the K_A band now indicate that geopositioning of signals thus intercepted is much higher priority than was ~~indicated~~ understood earlier this year. Therefore the duplication of the K_A bands previously flown in Mission 7106 is proposed...giving duplicate coverage and thus geopositioning capability from 14.5 to 15.1 GHz. The single-ball coverage previously offered 12½ to 14.5 and 17 to 18 GHz) is being extended by three additional single-ball collection systems, from 10½ to 12½ and from 15.1 to 16 and from 16 to 17 GHz respectively. Note that these tthree collection systems represent the only developmental area in the ELINT collection systems which has been started since April 24 when the NRO was briefed on the proposed acceleration of Mission 7107 and it was decided that only existing designs in this Pace-Setting areas of the mission would be used so that the schedule would be as short as possible.

Note that the areas where certain portions of the spectrum were proposed for four-way duplication in Mission 7107 has come under some modification so that the Ocean Surveillance collect on capability could be increased, thus taking fuller advantage of the greater time-over-target potential of Mission 7107. The addition of the third Data-link transmitter to each of the spacecraft has provided a tremendous potential for enhancement of the ocean surveillance or tactical role of this program...specifically providing for two widely separated [redacted] doubles the time over target and by increasing the down-link data magnitude by 50% (the 3rd Transmitter) the Gross Collection capability per 7107 [redacted] will be nearly that of the 7106 [redacted] (4-spacecraft).

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ADJUSTMENTS TO THE ARCHITECTURE OF MISSION 7107 TO FURTHER THE CAPABILITY AGAINST THE OCEAN SURVEILLANCE....

1- Improvements in Time Over Target (TOT)

A- Increase the ammount of 4-way duplication in Ship-radar spectrum.

(1) Expedite Interrogation Operations so greater portion of observation period is devoted to collection of data.

(2) Use Older components remaining as spares from prior missions.

2- Spectrum coverage adjustment:

A- 4- way spectrum coverage so each [redacted] birds can cover any or of the ship spectrum.

B- Adjust the [redacted] so that all these highly important emitters fall well within a single collection band rather than be split into two different bands as [redacted] in Ref (a)

C- Offer the Option of a Comb-Filter in 9200 to 9600 MHz X-Band so that this very dense spectrum can be divided into a series of 20 MHz sections... useing only those which contain the signals of interest.

D- Assign the [redacted] and Transmitter Channel Identifications so that the Majority of the Ocean Surveillance capability is available for simultaneous use without ambiguity. ~~mination of band of origin by two signals having the same~~ [redacted]

(1) The assignment of these identifications (Channel [redacted]) are ~~is~~ ususally delayed until later and does not emphasize O/S. It should enhance the "Total Weapon System Intercept" Philosophy. advanced by USIB.

3- Have the Command routines for the Ocean Surveillance-Bands in a group so that they can be called-up or Tasked with minimum interference with the other tasking.

These changes can all be added to the 4 Primary spacecraft with little additional cost including the comb-filter for X-Band. In addition they are not Schedule impacting changes. However the R&D spacecraft could

[redacted]

Keep In mind the restraints on the design and development concepts for Mission 7107...NO NEW DESIGNs in the ELINT ARena, only those items where the design is underway or already finished or previously flown will be considered. Also remember that the Pace-Setting Vender can not be further burdened with production without a compensating relief or else the schedule will suffer. Therefore the major arena in which enhancement of Ocean Surveillance has been sought has been through the use of previously procured Spare Components which can now be re-furbished and calibrated and Flight Certified for a role in Mission 7107. There are certainly some units from Mission 7106 and a few from 7105 which can be readied with a minimum of funding and effort adjustments. In General the the 7107 [redacted] have no S-Band capability as defined and they should have if this can be attained with out significant schedule impact. Mission 7106 S-Band components have been operationally acceptable but one portion of the spectrum has embraced too many emitter families and for 7107 the spectrum coverage has been slightly altered. 7106 had 2690 to 2930 while the approved Mission 7107 has 2680 to 2800 and from 2800 to 2930 in two bands. This in itself is not fortunate for Ocean Surveillance because the Primary contender in this range of frequencies is the [redacted] and it has a spread of Frequency up to 2830 MHz thus providing the contingency of appearing in two collection systems instead of only a single one. The [redacted] was selected to avoide the [redacted] emmisions which are _____MHZ. This is an acceptable condition only if Ocean Targets are not going to have any priority... a condition which is certainly not any longer valid.

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Duplicate

~~Top Secret~~ [redacted]

From: DNRL
TO: Dir Prog C

[redacted]

Subj: Modifications to Mission 7107, proposed
~~Exxxx~~

Ref. (a) our outgoiing 1 May 70
(b) its approvala of 10 June 70
(c) Augmentation of the program of 17 August 70
(d) Questions generated by above, on 14 Sept 70
(e) Approval of augmentation 7 Oct 70

~~Technical and~~ ~~FY-71~~ modifications proposed for 7107

Encl: (1) ~~Budgetary Revision of NRL Financial Program for Mission 7107~~
(2) R&D spacecraft proposal for Mission 7107.

1. Background:
Basis for Ref (a) costs and Technical concepts and the changes to Ref (a)
(a) Improved Time over target Technical Improvements
(b) Custom tailored band-pass for [redacted] emitter
(c) Comb-filter for X-band frequency discrimination use.

[redacted]

2. Technical Description justification of the changes proposed in Mission 7107
Spacecraft — Extension of Geopositioning ability
ground stations — Gap Filler coverage in 10½ to 18GHz range.
receiving systems
analysis "
Data Processing Systems.

3. Ocean Surveillance improvements identified.
Time over target
4-way coverage aimed more squarely at ship emitters.
X-Band Improvements as applied to Ocean Surveillance.
Comb Filter not greatly different from normal use of adjacent filters in our ~~xxxxxx~~ bands in a single bird...just narrower (20 Mhz).
L-, S- C- and X-Band 4-way coverage propsoed.
In ground stations:

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~~Top Secret~~ [redacted]

Enclosure 2

Top Secret [redacted]

Subj: Modifications to Mission 7107, proposed 26 October 1970.

Ref.(a) NRL Ltr to Dir. Program C of 1 May 1970, BYE-51904-70.
(b) Dir Program C ltr to DNRO of 17 August 70,BYE-66387-70.
(c) Informal Questions by Comptroller to Dir Program C of 14 Sept 70.
(d) NRO Memo to SECNAV of 7 Oct 70, BYE-13243-70.

relative to Ref. (a)

PROGRAM "C" CHANGES/PROPOSED

1- Background:

a Ref (a)
b Restraints imposed by demand for maximum schedule acceleration.
1-Failure of two of Mission 7106
c Operational capability of Mission 7105
1-7105A power radiated is marginal thus spurring improvements in receiving system sensitivity.

2- Changes in Spacecraft from proposed in Ref (a):
a- Those for improved Time Over Target (4-Way common coverage)
b- Extended Geopositioning coverage in K_U band
c- Target isolation by Frequency discrimination in X-Band (comb Filter)
d- Gap-filler K_U coverage added, but low priority
e- Total Weapon-System Intercept and analysis emphasis
f- Band-Pass adjustment to more squarely embrace [redacted]

3- Changes in the Collection-Site systems and Techniques:
a Receiver Systems Improvements
b Buffered Digital Tape Systems (evolution of)
c Quality Control Assessment systems evolution
d Perishable Data Extractor
e Second Generation Computer system
(Enhancement of [redacted] capability with another SEL-810A
f Automatic Antenna Tracking system

4-

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1. BACKGROUND:

The present proposal for modification of the designs for Mission 7107 is based on a number of influences, some are technical engineering reasons, others are of a schedule origin and some are result from a determined effort to make Mission 7107 as responsive to the operational requirements as can be done within the constraints of the schedule [redacted]. These modifications to Mission 7107 retain the basic concepts of the mission as ~~xxxxxx~~ submitted in Ref.(a); for a [redacted] schedule of maximum acceleration ready for launch in Late November 1971, with four primary spacecraft intended to fly in [redacted] transmitter channel. These modifications in the mission are proposed for both the spacecraft and the operational collection sites.

The basic reasoning behind the acceleration of the schedule remains essentially the same as in effect for Ref (a) except that the older Mission 7105 is now 3½ years old and the data from 7105ALPHA is signi-facantly weaker than its cooperative mate, 7105BRAVO thus influencing some of the changes in the ground station receiving systems for improvements in sensitivity. No change in the Mission 7106 malfunctioning spacecraft.

The operational requirements now imposed on the program are being interpreted for higher emphasis on the mobile target intercept and geopositioning, including those afloat. However this does not mean that compromises are being proposed to the detriment of the intercept and analysis of those weapon systems of the higher priority. The augmentation of the program proposed in Ref (b), the questions it generated are Ref (c) and the approval of Ref (d) all provide the basis for this interpretation. It is difficult to specify improvements that are specifically directed toward enhancement of the ocean surveillance capability of the program without noting that the program will benefit across-the-board from these improvements proposed for exploitation of the ocean surveillance.

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2. Improvements in the spacecraft design for Mission 7107:

a- Changes to the ELINT system to enhance the time over target through optimization of coverage capability from all four primary spacecraft have as noted in Table #1 provided 4-way coverage for L-Band, S-Band and X-Band. The 4-way coverage that was dropped from Ref(a) was the 1800 to 2100, the 4850 to 5250 and the 5850 to 6400 MHz. These portions of the spectrum will still be covered in [redacted] the change just makes it impossible to [redacted] thus reducing the time over target potential for these three parts of the frequency spectrum.

b- This proposal offers [redacted] with [redacted]. Particularily in the case of the "Brief Signal" or the one that does not scan wide parts of the azimuth or elevation; this proposal improves our probabilit of intercept and potential for emitter location. The improvement in X-band is more significant than merely adding it to the other two spacecraft... it provides for the first time the ability in this program to use a comb-filter with many narrow segments to discriminate on the basis of Radio Frequency, against unwanted signals in the X-Band where the signal density is extremely high for a Main Beam intercept collection system.

c- The proposed S-band addition to the [redacted] spacecraft is made possible by utilizing some of the spare components left over from the previous missions ~~such as 7106 or 7105~~ and merely having them re-certified for use. The frequency of crossover between Band number 8 and number 9 of the [redacted] see Table #1 has been raised 40 MHz so that the [redacted] emitters would fall more squarely into a single collection band instead of being spread over two adjacent bands as was the case for Ref (a), thus this slight alteration of collection frequency.

d- The provision of L-Band, S-Band, C-Band and X-Band 4-way collection coverage does to a large measure improve our capability for Total weapon-system intercept and analysis as dictated by the USIB guidance for overhead. Thus this program will be better equipped to intercept the total system components even though they may be employ significant frequency diversity and not be limited to the collection of a single component of a system at one time for analysis.

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~~ELINT CHANGES TO MISSION 7107~~ proposed ELINT Coverage.

e- One of the major modifications to the ~~R~~ ELINT Coverage of Ref (a) what is now ~~p~~ proposed is for a duplication of both K$_u$ bands 14.5 to 14.8 and 14.8 to 15.1 GHz so that geopositioning can be done in both of these ~~microwave~~ parts of the spectrum. Note that previous missions have had some deliberate overlap in coverage but this has never resulted in a signal being geopositioned from POPPY in this part of the spectrum. ~~Perhaps this has not been attempted sufficiently to~~ ~~instead of indicating~~ that the signals ~~did not illuminate both space-craft in the overlap frequency bands~~. This revision of the bands available for geopositioning analysis has been made as a direct result of discussion with both NSA and NRO staff in answer to an operational requirement.

f- The other parts of the 10½ to 18 GHz spectrum are offered as given in option 2 of Ref (a) except that the gaps in this previous proposal are now being offered tentatively, depending upon the availability from the vender. Therefore the bands from 10½ to 12½, from 15.0 to 16 and from 16 to 17 GHz are only offered if hardware (which has the lowest priority of all the ELINT material being prepared for Mission 7107) becomes available. ~~The procurement for these three collection bands has been placed and represents an expenditure of approximately $2~~84,000.00 beyond the costs for ELINT components anticipated in the cost estimates of Reference (a). The cost for the additional K$_u$ band to provide duplicative coverage throughout the 14.5 to 15.1 GHz bands, ammounts to approximately $ 20,000 since this particular hardware was a spare unit remaining from an earlier Mission which required only minor refurbishing and recertification.

Ref (a) FY-70

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The collection antenna systems provided for these bands above 10½GHz are not omnidirectional in azimuth but have sectoral horn type antennas with a maximum beam width of about 60° by about 150 degrees aimed at a point slightly below the horizon. Note that the wto bands that are duplicated in the [redacted] spacecraft have antennas looking forward, t e lower band out to the right hand side of the spacecraft and the higher frequency band looking our the left side of the " with collection antenna beam width being about 60° X 150°. Understand that this imposes a requirement upon the attitude control of both spacecraft to be looking the same direction before the signals will be seen in the data from both spacecraft to support geopositioning. We would like to provide greater azimuthal coverage but the limitation on hardware availability within the schedule time frame makes this impossible. We feel that the attitude requirements thus imposed on the spacecraft are reasonable and can be met operationally so that signals will be seen in common the locations will result.

developed for the enhancement or augmentation of the program for Ocean Surveillance, is essential even if there is another more sophisticated PDE under design and development, they will be designed to compliment each other and to work compatibly and not obsoltete one another.

2- [redacted] needs an ADDS which has not been budgeted for in the cost summaries of Ref (b). The going cost is $120K. There is a certain amount of risk in the estimate of costs for refurbishing the electronic systems and the computer system for the [redacted] site. This presupposes that the equipment from [redacted] will arrive in usable or recoverable condition and that the computer system (SEL-810) from [redacted] will be available for use at [redacted] The entire subject of the/use of the SEL-810 computer at the operational sites even in the presence of the Second-generation processing system has not been adequately costed out nor have all the technical aspects of this been identified. For example about 15% of the present computer system Time is devoted to the QC assessment ~~of~~ and Editing of the digital tape going back to NSA. There is an increasing requirement for a computer data base at the site to relate all the history of the program as well as the Soviet/Navy data base to assist the operators in making the most effective use of the near-real-time computer processing system. There is the continued need for improvements in ephemeral computation and refinement. There is a new Antenna Tracking System which requires a punched paper tape to run the antenna training mechanism instead of the operators, thus insuring a far more consistent data characteristic than has been attainable with the antennas trained manually.

continued

The Schedule for deployement of the Second and Third SEL "System-86 (second generation)computer systems to [redacted] in FY-73 and FY-75 have no reason to be stretched out to this extent. In fact to wait two years between deployment will almost assure that the systems will ecllipsed by design improvements before the third operational system would be deployed. Therefore it is suggested that the [redacted] systems/both be pursued in FY-73, to follow the first deployment by a period of about two years, thus taking advantage of the opportunity for operationally optimizing the hardware and software design aspects. The costs for this acceleration would be largely in experiencing the O&M costs for these operational systems at an earlier date than one would expect from Reference (b)....

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Background:

1. Mission 7107, initially proposed by the Naval Research Laboratory in February 1967 and that concept was modified [redacted] Ref (a) which was proposed in late April 1970 following the in-flight failure of two of the Mission 7106 spacecraft. The concept of this proposal has been under active implementation at the NRL for the past six months leading toward a launch scheduled for late November 1971. The major emphasis of the proposal of Ref (a) was for the maximum acceleration of the launch schedule, which would thus precluding much of the technical innovation requiring development time. Particularily the ELINT collection systems are subject to this constraint since they have become the pace-setting effort, ~~with vender delivery in the frequency spectrum above 3600 MHZ being the most critical~~. Now, still under the same constraints of schedule emphasis, the concepts for the ELINT portion of the mission continue to be adjusted for both engineering reasons as well as in a direction to better meet the changes in the operational requirements. The ELINT collection coverage now proposed is given in the Table #1 of this Enclosure. For clarity we shall group the various changes (relative to Ref (a)) into their areas of common explanation:

a. Four-(4) Way ELINT duplication of coverage for maximization of Time-Over-Target:

(1) Ref (a) proposed 4-way coverage the following parts of the spectru

815 to 970 Mh[redacted]
1800 to 2100=
2100 to 2580=
4850 to 5250=
5850 to 6725=

Note that this coverage emphasizes the parts of the Soviet radar spectrum which have manifested use of multiple frequency in their emitter systems and in addition the [redacted] emitters. The frequency diversity use in the [redacted] now-explained as the SA-6 Weapon System was the main reason for the 4-way coverage in the two higher frequencies proposed in Ref (a). Now that this particular puzzle has been explained by the SA-6, certain adjustment in the 4-way coverage for Mission 7107 is in order.

Modified ELINT now proposed in Table #1 has following 4-Way Coverage

(2) Table #1 of this enclosure proposes 4-way coverage as follows:

815 to 970 MHz = same
2100 to 2580 = same
2680 to 2840 to 2930 or(2680 to 2930) [redacted]
6400 to 6725 Same
9200 to 9340 to 9400 to 9600 or (9200 to 9600) Many Targets.

Why 4-way what good is it. brief emission ets

Need Major Headings:
1. Background
2. Spacecraft 4 way, K-Band
3. Sites
4. Systems PDE Computer BTS QC
5. New Site
6. Personnel
7. O&M

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[redacted]

um.

B. Several areas of improvement are proposed within the area of the [redacted] electronic systems at the collection sites: (a) the addition of an Automatic Antenna-Tracking System which had been under development for the past 10 months in response to the request to provide [redacted] with a semi-unattended system which will bridge the periods of peak personnel activity so that the POPPY mission may continue with reduced or no attention. The purpose here is to attempt to exchange personnel attending during the passage of the satellites for personnel monitoring the tapes after the pass for the generation of electrical messages of pressence of Signals Of Interest (SOI) so that prioritization of the processing can take place on these tapes. Thus the most important observations from this site will begin to be forwarded. In the past no scanning of tape has been made at this site due to limitations on [redacted] personnel. The automatic antenna tracking system uses a simple punched-paper tape to up-date the tracking of the antennas in both azimuth and elevation at regular [redacted] 30 second intervals. This instrument will be added to others in the past which have aimed at removing from our data various causes of amplitude fluctuations, a disturbance which degrades the time domaine measurements in our data. For instance if the two receiver channels through which the [redacted] measurements are to be made, are not coming through the same site-antenna system, there is a disparity in the signal amplitudes on these two channels [redacted] thus the delay for the smaller signal is different than the delay for the large signal. So another attempt is being made to reduce the variations in signal amplitude in our data and reduce the standard deviation measurement of our data still farther.

Add. (3) Receivers & Systems Calibrations Test Complete

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(b) The Perishable (or Priority) Data-Extractor (PDE) was first discussed in the letter of Ref.(b) as a Hardware device to assist in getting the data into the on-site computer in usable format and reduced extraneous background data quantity. This PDE as proposed is a Quick Response device aximed more specifically at the re-formatting job than that of data selection. The easiest parts of data selection are not the most impacting or important but the parts that are intended for this early PDE are just selection of the approriate Spacecract Transmitter channel and Spacecraft Sreceiver band by selecting only the vital Pulse-width format. However there are usually many radar families all mixed together within the bandwidth of each of the spacecraft ELINT collection bands. For Example in Band #4 of Table #1 covering from 815 to 97o MHz there are at least _____radar famalies of radar that will all come through the system with the same Transmitter channel/data Pulse-width format. Thus there is a significant need for the evolution of this instrument to proceed toward the Ultimate PDE or Second Generation PDE which will be able by virtue of the difference in the pulse-repetition-interval be able to differentiate between the many radar famalies within each collection band. This instrument is so closely associated with the analog-to-digital data conversion processes that it propably should be a combination of both functions into a single new development.

Too Secret [redacted]

(c) Other changes in the architecture of Mission 7107 ELINT coverage in addition to those which may enhance the Ocean Surveillance are seen particularly in the frequency range above 10,500 MHz. Note in Table #1 that there is proposed coverage of the complete spectrum up to 18 GHz with geopositioning capability up to 10½ GHz and from 14.5 to 15.1 GHz. This represents a substantial change in the proposal of Ref (a) for maximum acceleration. In fact it represents the majority of the difference between Option #1 and Option #2 of Ref. (a) and equated to a cost differential of $226.2K for the continuous coverage along and another $40 K for the additional segment of dual coverage from 14.8 to 15.1 ghz which is being added at the verbal request of the NSA and NRO staff. This modification is in direct response to the requirements against [redacted] which was first intercepted by this program on Mission 7105 but no geopositioning capability was available until Mission 7106 when a 100 MHz overlap portion of the spectrum was provided. No occasion has been found where the data was seen in both satellites in this overlap frequency range. Therefore the entire range from 14.5 to 15.1 GHz is proposed now for Mission 7107. The antenna coverage will be re-designed from that formerly used in this band... Sectoral Horn antennas covering 60° X 15° are now proposed, looking [redacted] front of the bird.

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(c) The ground site collection system is at the present time only able to calibrate the time-delays of the various receive channels from the input to the Pre-Amplifier at the base of the antenna tower, back into and through the rest of the collection system. This has two significant disadvantages; (1) the time delay "Calibration Data" which is recorded on each track of the analog tape and also on the digital tape is often biased by the differences in the noise which that particular antenna is coupling into the system thus giving a variation in time delay bias that are a function of the environment and the azimuth and elevation of the antenna heading...(2) the antenna and its coaxial phaseing network is subjected to the severe outside range of environmental demands and feeding the test signal into the system after the antenna does not check for trouble in the antenna. Therefore it is prpposed that a complete System Test modification be deployed to each of the sites so that a target transmitting antenna can be mounted up for radiating this test signal through the collection antenna as well as the rest of the system to assure that the collection antenna is symetrical and in good working order. In addition it is proposed that a facility be provided to record the Test system Calibration signal with the antenna automatically disconnected from the receiving system so as to isolate the noise environment from the system time delay bias measurements.

The antenna Pre-amplifiers which were specially designed for this program at NRL have been extremely reliable but due to the advancements in the state of the art it is now recommended that these amplifiers be retro-fitted with a lower noise circuit now available. This effort will be take several months since the first site will be given the replacement units and their old ones will be returned to NRL for re-work and then sent on to the next site. The improvement in sensitivity which will be possible will reduce the diaparity between the data seen from 7105ALPHA as compared to that seen through 7105BRAVO as an example. This problem has led to some severe measures being taken such as reduced receiver band-width for this particular spacecraft reception so that the data from these two spacecraft will be nearly equal in data density, and allow [redacted] geopositinn analysis.

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QC Analysis Complete

(d) The on-site scanning of the analog magnetic tape serves two functions (1) the Quality Control Assessment of the receiving, Recording and timeing systems and (2) the development of a method of prioritizing the processing of data, bu having the site report by electrical message those observations of Singals of Interest (SOI) so they can receive appropriate attention when the particular tape is received back at the processing center at NSA. With the launch of Mission 7106 the four spacecraft all passing the collecting sites in one group has caused the complication of requiring the site to make two recordings at the same time; part of the data being recorded on one and the rest of the data being on the second recording. Obviously the data on these two recordings can not be reassembled adequately to support [redacted] but it is only in the analog medium that this is being done. The digital recording does place all the data from all four spacecraft on a single digital tape. The problem area is that of requiring the tape be first scanned at the site and then forwarded to NSA if it contains signals of interest and this causes a delay of varying length that often results in a poor balance between doing the job thoroughly and doing the the job in a timely fashion. It is for this reason that back in January NSA. NSG and NRL met to develop a unified electronic complex and operating proceedure in this area. The first system of this unified complex is on its way to [redacted] for an operational shakedown. NSA will get the next system for the development of the Standard Operating Proceedure (SOP). The majority of the instrumentation p esently used for this purpose at the site is being retro-fitted and two significant additions are being made; (1) the Video Disc Recorder so that the operator will have instant play-back with dual channel capabilit to ascertain that a SOI is available in the data from both Spacecraft thus indicating that it is a potential for geopositionning analysis. The occasion immediately after launch when the new mission undergoes a thorough engineering analysis requires the dual-channel playback mode for assessment of the special regeneration measurement of the spacecraft ELINT systems. (2) the addition of a Rulse-Repetition-Frequency (PRF) Synthesizer has been made to enable all sites to make the measurement of this vital parameter to a tolerance that is determined by their master timeing oscillator and consequently be of vastly more authoritive identification of the particular SOI. All sites will then make the measurements alike and to nearly the same tolerance thus making the SOI messages far more valuable

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(S) BTS Development:

(S) the production of the digital tape recording is made on a Buffered (Digital)Tape System(BTS) which has been under development at NRL for the last year. The particular design requirement [redacted] presently unfulfilled is that the on-site computer system must act as an inefficient back-up for this function on the occasions when the present BTM-9 fails. Thus the new design does provide for two tape recorders operable from a single operator console...so that if one tape should run to the end the other recorder could be started up automatically without loss of data. This eventuality is remote, not having been experienced to date, so that the most reasonable attribute is that the Dual recorder feature does provide additional redundancy of a system element which has had a high degree of [redacted] maintenance required. The continuation of this development is imperative, through the deployment of operational systems at the sites overseas.

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~~Top Secret~~ [redacted]

Enclosure #2:

Architecture changes in design goals for Mission 7107 proposed to ~~better serve~~ enhance the Ocean Surveillance ~~role~~ capability of this mission.

[redacted] spacecraft of

1. ELINT coverage proposed for Mission 7107 has been altered slightly for one or more of the following reasons; (1) engineering compatibility within the spacecraft, (2) schedule impacting due to critical availability in Vender delivery may dictate that some capability which was proposed in Ref (a) for the [redacted] is now shifted to the [redacted] the ~~xxxxxxxxxxxxxx~~ order of spacecraft production ~~is increasing~~ alphabetically, (3) Volume and (4) power requirements have also dictated to some degree the distribution of the various collection systems within The Primary Spacecraft.

While this proposed listing of Elint Coverage is offered here it in no way suggests that it is final because any one of these areas of concern above may become critical in the later stages of production. It is open to negotiation by the community also if there are good reasons why the distribution is operationally not ~~the best~~ optimum.

2. The ELINT collection coverage proposed for the total mission is almost the same as given in Reference (a) with the exception that certain of the discrete frequency coverages now proposed have been changed slightly to place one emitter family more squarely within the band-pass of a single collection system rather than be shared by two adjacent collection systems. This is particularily true for the 2630 to 2800 MHz band of Ref (a) which has now been extended upward to 2840 so that all the [redacted] signals would be found in a single collection system.

3. Four-Satellite coverage of the same frequency band has been altered from that proposed in Ref (a) by shifting the emphasis from those bands which had demonstrated a high degree of frequency diversity or in other words, emitters which have used more than one frequency with nearly identical characteristics, to the coverage which will support both National USIB goals as well as ocean surveillance. For instance, the X-Band spectrum which has always been very dense in data, is now being offered in the A/B payloads to have a Comb-Filter with 20 MHz bandwidth slices over the range from 9200 to 9600 MHz so that ~~xxxxxx~~ operationally, the portions of this spectrum which are desired may be tasked alone, and those which are not wanted may be left OFF for obvious advantages in improvements in utilization of this important spectrum by this program. The determinati[redacted]cise RF Frequency is not the operational goal in this case, b[redacted]stribution of emitters within the various bands is.

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3. 4-way coverage ~~offered on the~~ proposed ELINT coverage differs from that offered in Reference (a) because of the shift in emphasis from (1) 4-way collection capability to enhance the collection against those emitters which use more than one part of the frequency spectrum for frequency diversity to (2) 4-way coverage which will better suit both National and Navy Ocean Surveillance collection from two widely separated pairs of spacecraft. In order for these [redacted] spacecraft to maximize the Time Over Target (TOT) they must be similarily equipped in those parts of the spectrum where such maximization is desirable. If [redacted] birds flys over the target area and looks at a particular emitter family then for the [redacted] to improve on this collection coverage time against this emitter family, is for the [redacted] birds to be capable of being tasked against the same emitter family or have 4-way commonality of coverage.

Note that in this proposal the parts of the spectrum which embrace the major emitter families of the Soviet/Navy's major combatants are equipped in all four spacecraft...L-Band, S-Band and X-Band, with certain parts of C-Band also similarily duplicated. While this does specifically cover the Ship emitter families it also does a pretty good job against a large part of the major weapons systems for the land targets too. The Soviet use of spectrum has many examples of common use of hardware afloat and on land, so that 4-way commonality against L-Band, S-Band & X-Band ship emitters does not necessarily discriminate against the land-based emitter families, the differences are far more significant in the manner in which the system will be tasked operationally.

4- Improvements in X-Band are noted by the proposed additon of a Comb-Filter covering from 9200 to 9600 MHz with 20 slices each about 20 MHz wide. This method of depopulation of this very dense band will offer potential tremendous possibilities for both determination of operational distribution of emitters within a family and and perhaps aid in fingerprinting or distinguishing emitters whose characteristics look the same except for RF Frequency. The use of a comb filter is not new new to Program C because in a sense that is just what a series of adjacent band-pass filters really is. The unique part of this proposal is the narrowness of the particular band-pass slices. Having such a wide selection of slices in the [redacted] spacecraft does impose a heavier burden on the command and control systems of these two birds, and this will [redacted] difficulty on the use of these spacecraft until a history study is made on the best way to use these narrow slices of X-Band by using/flight data analysis of

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3. continued.... 4-way coverage proposed....

In order for the addition of certain of these 4-way coverage to keep from impacting on the schedule of other critical component deliveries, we propose to use insofar as is possible the spare components from the previous launches and just refurbish it slightly so that the reliability factor is brought up-to-date with the other systems being designed for this Mission. The costs for these systems will be somewhat less than comparable costs for the new hardware being purchased for this mission. The cost aspects of these spacecraft modifications to the proposal of Ref (a) are given in Enclosure #1.

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xx

3 ~~The~~ Ground system modification proposed for enhancement of the Ocean Surveillance capability of Mission 7107:

Reference (b) lists the aspects of the augmentation of the program for Ocean Surveillance but there are at least two areas where the evolution of the ground data systems was not adequately treated:

1- the Priority (or Perishable) Data-Extractor hardware system that was proposed in Ref(b) is a simple system that would select only certain pulse width outputs from certain of the data link receivers at the site so that the output from only spedific spacecraft collection bands would be (1) Reformatted and (2) be delivered in real time to the input of (a) the System 86 computer (Second Generation Program C processing System) and at the same time (b) to a digital magnetic-tape recording system for storage and potential ~~use at a later time~~ storage for later processing. From the initial concept, the PDE has been a compromise between being available at an early time and being the most capable unit possible. The compromise was heavily influenced by cost as well. The evolution of this particular unit must be continued even to the point of providing Pulse repetition Interval (PRI) selection so that within a given collection band of the operational [redacted] systems only those emitters which display certain ranges of PRF or PRI will be allowed to go to the Near Real-Time computer system for analysis. In order to provide this capability it is estimated that a large share of the input circuitry of the Analog to Digital Data System (ADDS) would have to be re-engineered, requiring a rotation of the operational ADDS back to the contractor plant for up-dating. Therefore it is imperative that the developmental evolution on both the PDE and another ADDS system be undertaken at the earliest possible time. The ADDS mod [redacted] $120K and [redacted] Second-Generation PDE with PRI sort would cost about $220K a[redacted] at least one year for deployment. The PDE now

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6 NOV 1970

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MILITARY INTERDEPARTMENTAL PURCHASE REQUEST

PAGE 1 OF 1 PAGES

2. FSC	3. CONTROL SYMBOL NO.	4. DATE PREPARED	5. MIPR NUMBER	6. AMEND. NO.
		700CT14		1

7. TO: Commander
Naval Air Systems Command
Attn: Astronautics Division
(Mr. R. F. Speaker)
Washington, D. C. 20360

8. FROM: (Agency, Name, Telephone Number of Originator)
HQ Space & Missile Systems Organization
Air Force Unit Post Office
Los Angeles, California 90045

9. ITEMS ☐ ARE ☒ ARE NOT INCLUDED IN THE INTERSERVICE SUPPLY SUPPORT PROGRAM AND REQUIRED INTERSERVICE SCREENING ☐ HAS ☒ HAS NOT BEEN ACCOMPLISHED

ITEM NO. a	DESCRIPTION (Federal Stock Number, Nomenclature, Specification and/or Drawing No., etc.) b	QTY c	UNIT d	ESTIMATED UNIT PRICE e	ESTIMATED TOTAL PRICE f
1	To procure equipment for Secretary of the Air Force Special Projects Project Officer at SAMSO: Maj J. D. Hill Cy to: Maj J. D. Hill Mr. Peter G. Wilhelm 5170 NRL 4555 Overlook Drive Washington, D. C. 20390 The terms of this order are acceptable: Authorized Representative, Cognizant Division 56R06-29 copy CHARLES C. MC BRIDE, Colonel, USAF Deputy Director for Programming Adjusted total funds committed in this MIPR including all amendments are $8,873,100.00 The purchasing activity will not authorize any deviation from the specifications or other provisions cited in this MIPR without first obtaining the approval of the requiring activity. Such deviations will be confirmed in writing.				$1,220,500.00

SOURCE OF FUNDS, NRL

	Budget Office	Accounting Office
Date		
Processed by		
Source Code		

10. SEE ATTACHED PAGES FOR DELIVERY SCHEDULES, PRESERVATION AND PACKAGING INSTRUCTIONS, SHIPPING INSTRUCTIONS AND INSTRUCTIONS FOR DISTRIBUTION OF CONTRACTS AND RELATED DOCUMENTS

11. GRAND TOTAL $1,220,500.00

12. TRANSPORTATION ALLOTMENT (Used if FOB Contractor's Plant)
See paragraph 4 of attached AFLC/AFSC Form 37

13. MAIL INVOICES TO (Payment will be made by)
HQ Space & Missile Systems Organization
ATTN: Accounting & Finance Office (SMCA)
AF Unit Post Office, Los Angeles, Calif.
See P 5 of attached AFLC/AFSC Form 37

14. FUNDS FOR PROCUREMENT ARE PROPERLY CHARGEABLE TO THE ALLOTMENTS SET FORTH BELOW, THE AVAILABLE BALANCES OF WHICH ARE SUFFICIENT TO COVER THE ESTIMATED TOTAL PRICE

AB 57 X3020 141 4730 299998 Ø3414Ø ØØØØØ ØØØØØØ 594200 E94200 SSP

[redacted] Finance Officer 10/16/70

for [redacted] (Name and Title)
Chief, Proc Mgt Division

17. DATE 16 OCT 1970

DD FORM 1 OCT 69 448 PREVIOUS EDITION OF THIS FORM IS OBSOLETE.

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TS HVBCS Working Papers...

From: Director, Naval Research Laboratory, Washington DC 20390
To: Director Program "C"
Subj: Text of Briefing given 26 October to NRO Staff by Program C.

Ref (a) NIC-2Q Memo to DIRNRO of 27 Oct 70- BYE66442/70
(b) Program C Briefing of 26 Oct Given to NRO
(c) NRO Memo to DIR Prog C of 13 Oct- BYE-13117-70
(d) DIR Program C Proposel to NRO on 17 August 70, BYE-
(e) NRL to DIR Program C ltr of 1 May 70, BYE-51904-70

Encl (1) R&D Spacecraft for Mission 7107, Details, Costs and Schedule for
(2)
(3)

1- Background:

The major emphasis of the Briefing given to the NRO Staff by NRL Program C briefing team on 26 October were (1) the Technical Aspects of the proposed R&D Spacecraft, its costs and the calendar impact if were to be included as an extension of Mission 7107 for purposes of enhancing the Ocean Surveillance Capability and preparing the advanced systems and techniques for flight certification in preparation for (2) The changes in the architecture of Mission 7107 and in particular those which would enhance the capability of 7107 against the Ocean Surveillance requirements. (3) the general cost revisions for FY-71 NRL budgetary estimates provided in May 1970 for Mission 7107. The paper of Ref (a) was staffed through Director Program C in answer to the informal questions of the NRO Comptroller dated 14 Sept and do impact in certain minor ways on the material given in the Briefing one day earlier. This paper will attempt to identify these differences and resolve them into a unified position, relative to the FY-71 NRL financial program.

In order that each of the major parts of the Briefing of Ref (b) may receive adequate supporting documentation they each will be provided ad Enclosures to this basic letter. This Briefing was given to focus on the most pressing mission-impacting items evident to the Program C team at this critical point in the mission execution.

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continued....

2./At the request of the NRO staff this summary of Ref (b) is being prepared to assist in the further discussions and an ultimate decision relative to the Mission 7107 technical plan, and the fiscal support. The estimate that Mission 7107 can be completed for a late November 1971 Launch date has an element of risk in the technical arena but this risk is a good deal higher because of the deficit in financial support which is itemized in the data of Enclosure # (2).

[redacted] R&D Spacecraft for Mission 7107 is not funded or approved. In addition the operational capability for Mission 7107 in the support of the ocean surveillance requirements will be greatly reduced. Several vital areas of collection-site systems will not be pursued at this time if the R&D Spacecraft is not approved, particularily in the areas of the Soted Command system and the instrumentation for monitoring in the data stream the manifestation of the changes in the spacecraft command according to the program storred in the spacecraft twice a day as it passes the local interrogation site at [redacted]

3- Summary:

The R&D Spacecraft will perform a vital function for both Mission 7107 [redacted] by advancing several techniques which appear to have significant merit for employment in the future of this program. While it does require a schedule delay in Mission 7107 it provides several areas of technical extension of the Program C art at a time when by virtues of the maximum acceleration of the Mission 7107 very little improvement in the Program C growth is otherwise available.

Costs for Mission 7107 have increased markedly beyond those estimated 6 months ago as have the technical goals for the Mission. These two reasons for increased costs along with the heavier burden imposed by the failure analysis of Mission 7106 have led to a severe budgetary deficit at NRL for the remainder of FY-71.

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