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~~1ST~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

OFFICE OF THE DIRECTOR

7 October 1970

Repro Cy #5

MEMORANDUM FOR THE SECRETARY OF THE NAVY

SUBJECT: Augmentation of POPPY Facilities for Ocean Surveillance

REFERENCE: BYE 61524/70, 11 June 1970, Use of POPPY ELINT Satellite System for Ocean Surveillance

I agree with you that the threat posed by the Soviet Navy is of such growing significance that surveillance of Soviet naval activity should be provided by available national assets where applicable. After discussion of this matter with the Deputy Secretary of Defense, I have asked our NRO Staff to program for the augmentation of POPPY ground facilities so as to provide additional ocean surveillance support to the Navy. Admiral Harlfinger, Director of Program C of the NRO, has prepared a modified augmentation plan, in coordination with NSA and my Staff, which provides an interim capability based on a shared processing concept proposed by NSA.

This interim ocean surveillance capability (TAB A) can be accomplished by augmenting [redacted] the present POPPY facilities and installing a new facility at [redacted] construction is included in the Navy FY 1970 authorization. Any other construction involved would be subject to the CCP processes with Navy funding. NSA will cooperate with the Navy in programming for any required additional CCP manpower billets. The NRO will provide funds for the necessary equipment to include O&M costs. NSA, as the agency responsible for processing and analysis of overhead ELINT data, will exercise technical direction in a coordinated NSA, NRO, NRL effort providing for equipment acquisition, readiness, and installation.

I believe the above arrangements should provide an adequate interim ocean surveillance capability which is cost effective and responsive to your needs. In addition, we are working on other systems to more effectively satisfy the problem in the future.

John L. McLucas

mayo
~~Dix~~
Hellwick
Price

Atch
TAB A, POPPY Proposal

Cy to: Deputy Secretary of Defense
DDR&E
Director, NSA
Director, Program C

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DOD DIRECTIVE 5200.10 DOES NOT APPLY

Repro

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COPY 5 OF 7 COPIES
PAGE 1 OF 1 PAGES
B-124-70

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NRL SPECIAL PROJECTS CONTROL NO. NRL E-000126-70

DATE 7 October 1970

ORIGINATOR	SERIAL NO.	ENCLOSURES
NRO	BYE-13243-70	(1) Tab A, POPPY Proposal

DATE REC'D IN NRL	COPIES REC'D	COPY NOS.	RECEIPT NUMBER
15 Oct 1970	One	#32	TR-928/70

Basic document, less Tab A previously received and controlled by NRL E-000124-70

SUBJECT

Augmentation of POPPY Facilities for Ocean Surveillance

Report by 5 of basic received previously

ROUTE TO	*	COPY NO.	WITH ENCLS.	SIGNATURE	DATE OUT	DATE RETURNED	ROUTE TO	*	COPY NO.	WITH ENCLS.	SIGNATURE	DATE OUT	DATE RETURNED
1000					Note: you have previously read								
4000					covering letter but not Tab A.								
5610				[illegible]									
5600													
5.14					Reid do we concur with [illegible] etc.								
					Are all in here incidentally [illegible]								
					[illegible] not								

RETURN THIS ROUTE SLIP TO NRL SPECIAL PROJECTS OFFICE, ROOM 222, BLDG. 43.
DO NOT ROUTE TO OTHER SECTION OR BRANCH

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* SYMBOL	ACTION TAKEN BY	DESTRUCTION REPORT NO.	FINISHED FILE
A-ACTION C-COMMENT I-INFORMATION R-RETAIN E-EVALUATE			

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NRL CONTROL RECORD NDW-NRL-5216/1005 (11-67)

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CONTROL NO. Bye 13243/70

Cy 5 B

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	SIGNATURE	DATE	TIME	DATE	TIME	NAME & OFFICE SYMBOL	DATE
NRL							

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Access to this document will be restricted to those persons cleared for the specific projects;

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NRL B-000126-70
TR-928/70

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GROUP 1
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POPPY SUPPORT TO THE OCEAN SURVEILLANCE REQUIREMENT

1. On 11 June 1970, the Secretary of the Navy forwarded to the Deputy Secretary of Defense a proposal for Ocean Surveillance Processing Centers, utilizing the POPPY Elint Satellite. The Deputy Secretary of Defense requested comments from various officials of the Department of Defense. Several of these officials, notably the Director of the National Security Agency, while endorsing the requirement, suggested alternative methods of solution. The Director, National Reconnaissance Office requested that the Director, Program C,examine alternatives to the Secretary of the Navy proposal, and forward to him a recommended alternative.

2. The Program Director's staff met with interested parties from the National Reconnaissance Office, the National Security Agency, the Defense Intelligence Agency, the Naval Security Group, and the Naval Research Laboratory. A recommended alternative to the Secretary of the Navy proposal is presented in this paper. Although each of the above listed agencies provided representation and valuable assistance in the preparation of this alternative proposal, the paper has not been formally endorsed by these agencies.

3. In Tab A, an austere augmentation of existing Navy manned overseas field activities is addressed. The recommendation for augmentation of these field activities specifies the acquisition of a new computer for [redacted] a new Perishable Data Extractor for each site; and the temporary deployment of an existing computer van to [redacted] Personnel augmentation is not required for sites other than [redacted] at this site, 15 enlisted personnel are required. Initial operational dates begin as early as 1 January 71; and the total capability will be operational by 1 July 72. Total costs, both recurring and non-recurring for FY 71 is $1,246,000. Annual recurring costs are $33,000. The increase in processing capability derived from this augmentation for national tasking is 400% at [redacted], and 80% for the other [redacted] sites. The increased capability for ocean surveillance processing is 1000% at [redacted] and 80% for the other sites. It is also recommended that consideration be given to acquiring a new generation computer for [redacted] in FY 73 and for [redacted] in FY 75. Cost of each

computer is approximately $858,000. It is also indicated that modifications to mission 7107 can greatly enhance POPPY's collection capability for ocean surveillance. Specific proposals in this regard will be forwarded within 60 days.

4. In Tab B, it is recommended that a POPPY ground facility be established at [redacted] Although it is recognized that other sensors provide coverage of the North Atlantic, it is shown that such a facility can provide significant input to the ocean surveillance requirement, and that such a facility can be obtained at minimum costs, utilizing, to a large extent, refurbished equipment from [redacted] Such a facility would serve both operational and training functions, and could be operational in October 72. Total non-recurring costs are $1,187,000 (including $815,000 Navy milcon). Total yearly recurring costs are $275,000.

5. In Annex A, four alternative augmentations are examined in detail, and rationale for the alternative selected is verified. In Annex B (to be forwarded within 60 days) specific proposals for optimizing POPPY mission 7107 against the ocean surveillance requirement is discussed. Annex C contains a comparison of available computers, including the Model 86, and a functional diagram of the Perishable Data Extractor. Annex D justified the requirement for a facility on the eastern U. S. coast, examines alternative sites, and recommends building the POPPY ground facility at [redacted]

6. Due to the uncertainty associated with establishment of an austere communications facility at [redacted] and the on-going deliberations in Congress, establishment of a POPPY ocean surveillance facility has not been addressed in this paper. Rather, it is believed that the Secretary of the Navy proposal delineates the minimum expenditure of funds necessary for the [redacted] site. It is therefore recommended that such a facility be addressed in conjunction with the on-going Congressional deliberations, and not in conjunction with this specific paper.

7. In summary, the paper presents an alternative by which both national and ocean surveillance processing capabilities of the POPPY satellite system are significantly increased at low cost. Additionally, acquisition of the new generation equipment permits extensive system growth. Minimal augmentation of existing personnel strengths are required by this proposal.

TAB A

OVERSEAS SITE AUGMENTATION

1. The recommended augmentation of the [redacted] indicates an immediate deployment of an existing SEL 810A computer van to [redacted], and the deployment of one Perishable Data Extractor (PDE) to [redacted] The additional [redacted] computer would be utilized until the acquisition of an SEL Model 86 computer, at which time the SEL 810A would be returned to CONUS for use in a CONUS facility. After on-site check out and engineering evaluation, including determination of such items as mean time between failures, the SEL 810A van could be returned to CONUS for other uses. The PDE's would become an integral part of the processing facility at each location. The recommended equipment augmentation, therefore, is:

Site	Equipment
[redacted]	Perishable Data Extractor, SEL Model 810A*, SEL Model 86
	Perishable Data Extractor
	Perishable Data Extractor

*Temporary deployment of existing equipment, pending delivery of Model 86

2. The additional maximum capability to be derived from deployment of this equipment, in terms of processing, is summarized below:

Site	National	Ocean Surv	NSA (Hdqtrs Process)
[redacted]	Increased 400%	Incr. 1000%	Reduce Cost
	Increased 80% (approx)	Incr. 80%	No change
	Increased 80% (approx)	Incr. 80%	No change

The increased capability for [redacted] is derived from increased computer capacity, coupled with digital formatting accomplished by the Perishable Data Extractor (PDE). For example, utilizing the Model 86 permits processing of X-band signals within approximately 50 minutes after intercept, with additional locations becoming available approximately at one minute intervals. This compares with the maximum current processing capability in X-band, utilizing existing equipment, of 9 hours, with additional locations at intervals of approximately 10 minutes. Increased collection capability is recommended, and can be obtained by optimizing frequency band assignment in mission 7107, by employing the fifth spacecraft of mission 7107 for providing certain operational capabilities in the ocean surveillance arena, by utilization of the third transmitter in each of the four primary spacecraft for ocean surveillance, and by including S-band coverage in the X-band pair. This combination of improvements could increase collection opportunity by 40-50 percent. Detailed proposals concerning these recommended changes to 7107 spacecraft will be forwarded to the NRO within 60 days.

3. The cost, both one time, and recurring, of adopting this proposal is summarized below:

COSTS (IN THOUSANDS OF DOLLARS)

	FY 71	FY 72	FY 73	FY 74	FY 75	TOTAL
A. One Time Cost						
Equipment	1147		858*		858*	1147 (2823)*
B. Annual Cost (Recurring)						
Personnel	84	0**	0**	0**	0**	84
Equipment	33	33	33	33	33	165
TOTAL	1264	33	33 (891)*	33	33 (891)*	1396 (3112)*

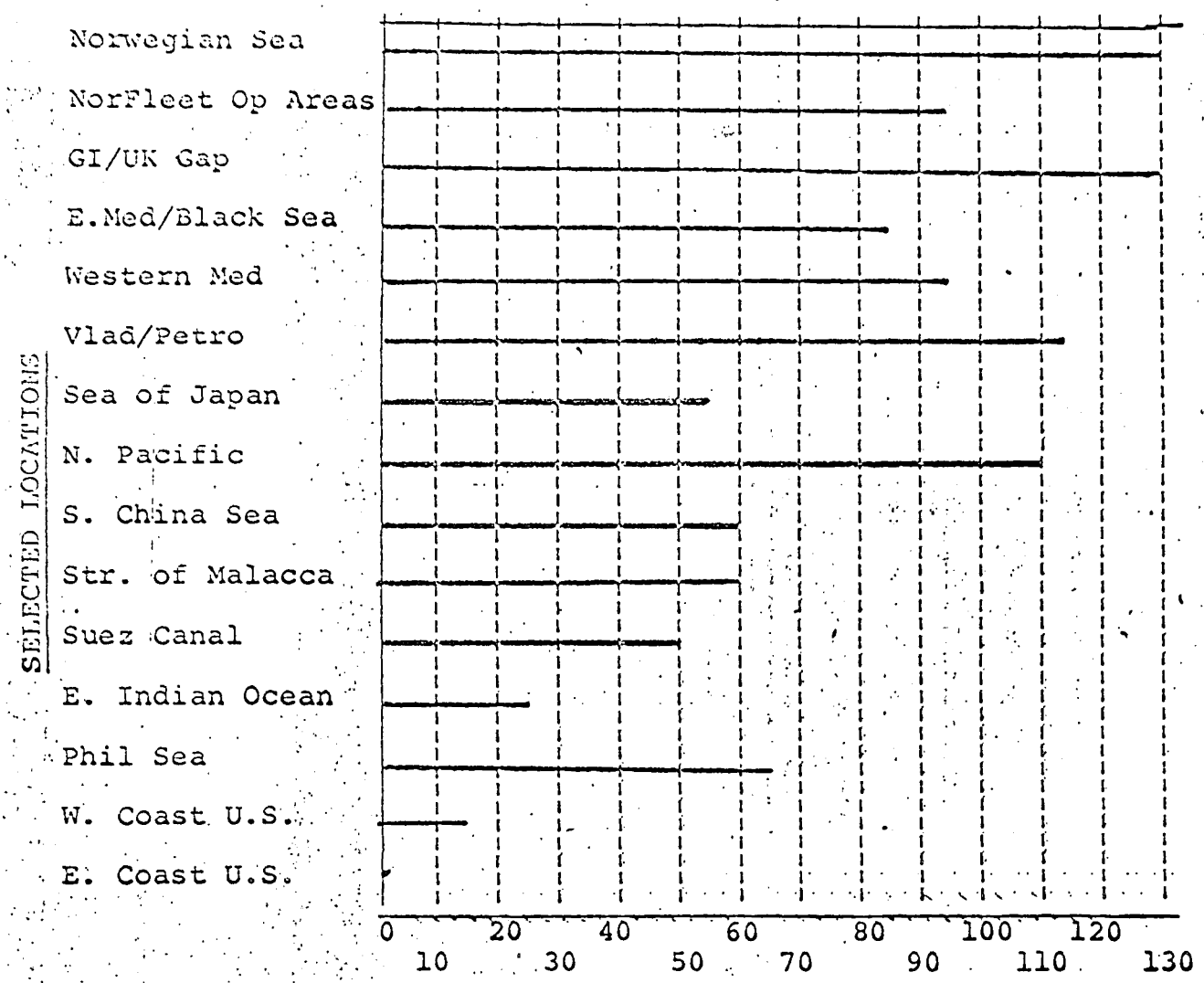
* After evaluation of SEL Model 86 at [redacted] it is recommended that consideration be given to deployment of a Model 86 at [redacted] in FY 73, and to [redacted] in FY 75.

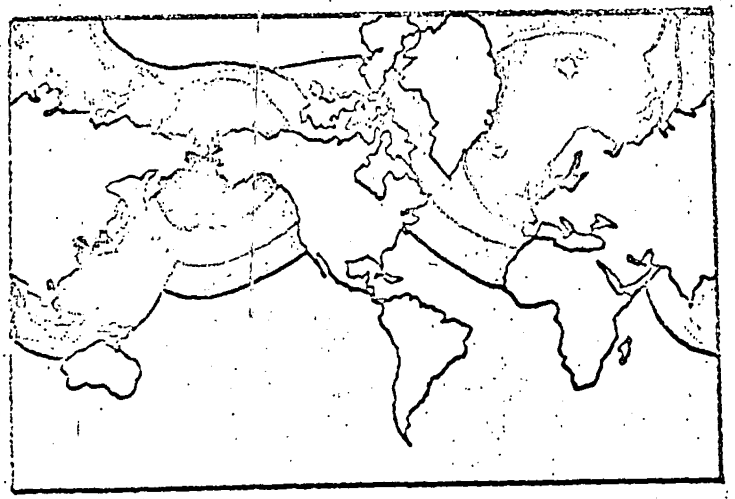
** A small increase in the personnel manning level of [redacted] may be required on a full time basis in view of the increased capabilities for processing, locating and reporting attendant with the Model 86.

Advantages of implementing this proposal, from a cost standpoint, are that initial costs are small, and additional annual recurring costs are negligible.

4. Personnel required to implement the recommended augmentation are 15 enlisted personnel at [redacted] who would be utilized to man the augmented SEL 810A. As experience is gained with the SEL 86, a slight increase in the CCP billet authorization for [redacted] is a distinct possibility. Justification for this increase will be submitted via the normal CCP channels.

SE[illegible]BILITY





RED - 60-130 Minutes

GREEN - 15-60 Minutes

BLUE - 0-15 Minutes

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SCHEDULE

	SEP70	NOV70	JAN71	MAR71	MAY71	JUL71	JAN72	JUL72	JAN74	JUL74
Facilities	A NONE REQUIRED									
Equipment										
SEL 810A	C	D	E			C[1]	C[2]			
SEL 86	B			C	D	E				
PDE	B		C	D	E					
Personnel	F		E				G[3]			
Facilities	A NONE REQUIRED									
Equipment										
PDE	B		C	D	E					
SEL 86							A	BC		
Personnel	NONE REQUIRED									
Facilities	A NONE REQUIRED									
Equipment										
PDE	B		C	D	E					
SEL 86										ABCDE
Personnel	NONE REQUIRED									

CODE: A - Decision
B - Order
C - Ship
D - Install and Check-out
E - IOC (Initial Operational Capability)
F - Identify and Order
G - Reassign Personnel

[1]To CONUS [2]Van to CONUS [3]If Required

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FUNDING (FY-71)

SITE	AMOUNT
[redacted]	
Equipment	
SEL 810A Van (Ship, Re-Ship)	24,000
SEL 86 Computer, including shipment and install	858,000
Software	115,000
PDE	50,000
Personnel*	84,000
Equipment O&M	11,000
Sub-Total	1,142,000

*Personnel required should be derived from billets currently occupied at [redacted] Recommend combination of voluntary one year extensions, and absorption from forced reduction in other assigned missions at [redacted]

[redacted]	
Equipment	
PDE	50,000
Equipment O&M	11,000
Sub-Total	61,000
[redacted]	
Equipment	
PDE	50,000
Equipment O&M	11,000
Sub-Total	61,000
TOTAL	$1,264,000

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TAB B

CONUS OCEAN SURVEILLANCE FACILITY

1. Summary. The desirability of obtaining an ocean surveillance processing and training facility on the east coast of the continental United States has been examined. The facility has been determined to represent a valid requirement, due in large measure to the lack of coverage of known ballistic missile hold areas for Soviet SSBN's, the increasing scale of Soviet surface unit deployments into this area, and the necessity for establishing a training facility to standardize operating procedures, and to relieve operational units of the necessity of conducting large scale on the job training. A careful survey of available facilities on the East Coast indicates an optimum location at [redacted] This decision was influenced by the following factors; availability of support and security facilities; availability of communications; low RFI; and maximum coverage of the major threat areas.

Total cost of this facility is $1,462,000, itemized as follows:

Non-recurring

Equipment	$372,000*
Building	$815,000

Recurring

Personnel	$250,000
Equipment O&M	$ 25,000

*Predicated on acquiring new equipment, refurbishing equipment from [redacted] and utilization of the SEL 810A currently deployed to [redacted] Command and interrogation functions will be accomplished from the [redacted] engineering facility.

Personnel necessary to provide a cadre for training, and to man the operational site, total 1 officer and 42 enlisted personnel, as itemized below:

Officer in Charge	
Material Maintenance Men	(5)
Digital Processors	(6)
Collection Operators	(16)
Collection Supervisors	(4)
Analogue Pre-processing/ And Analysis	(4)
Senior Supervisor/Analysts	(3)
Training Supervisors	(4)

2. Coverage. Unique coverage provided by a ground processing facility at [redacted] for selected geographic areas is provided below:

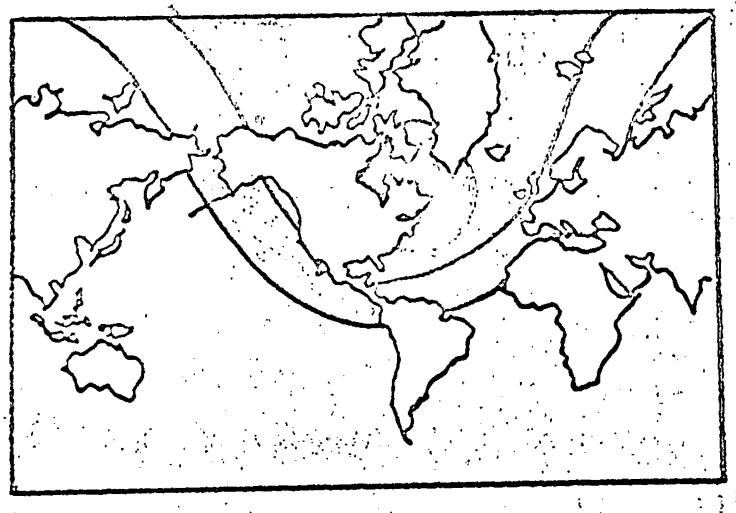
Cuba:	30-50 minutes per day
Mid-Atlantic:	50-80 minutes per day
[redacted]	50-100 minutes per day
Panama Canal:	10-30 minutes per day

Coverage obtained both from [redacted] is reinforced by [redacted] particularly in those areas of primary strategic importance; ie, [redacted] choke points, areas through which Soviet surface and sub-surface units must pass for out of area deployments, and major operating areas. Specifically, the coverage from [redacted] in minutes per day POPPY satellite series, is as shown.

RED - 100 plus minutes

GREEN - 30-100 minutes

BLUE - 0-30 minutes



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EQUIPMENT

The following primary listing of equipment would be available at [redacted] Some of the equipment, such as the 810A computer, would be acquired from [redacted] other equipment would be refurbished; still other equipment must be acquired new.

Digital

SEL 810A computer mainframe
TM-11 Digital Tape transporters (3)
Magnetic Tape Control Unit
Moveable Head Disc
Fixed Head Disc and Controller
Anelex Line Printer
Graphics display console
High speed paper tape reader/punch
Paper tape spooler
X-Y plotter
Perishable Data Extractor
Support Spare Package

Sub-Total - $165,000

Analog

CEC GR 2800 analog tape recorder
Tektronics 565 oscilloscope (W/3 A-1 PI)
Distribution Amplifier (DA-1)
CEI speaker
ESL pulse rate synthesizer
Video disc recorder
Brush Oscillographic recorder (8 ch)
Astrodata 6200 time code translator
Electronic counter HP 5216A
Test Oscillator HP-204C
Timing Generator Tek 184
Audio signal monitor AM01
Oscillographic recording camera Polaroid manual
Support spare package
RS-1A Receiver (9)

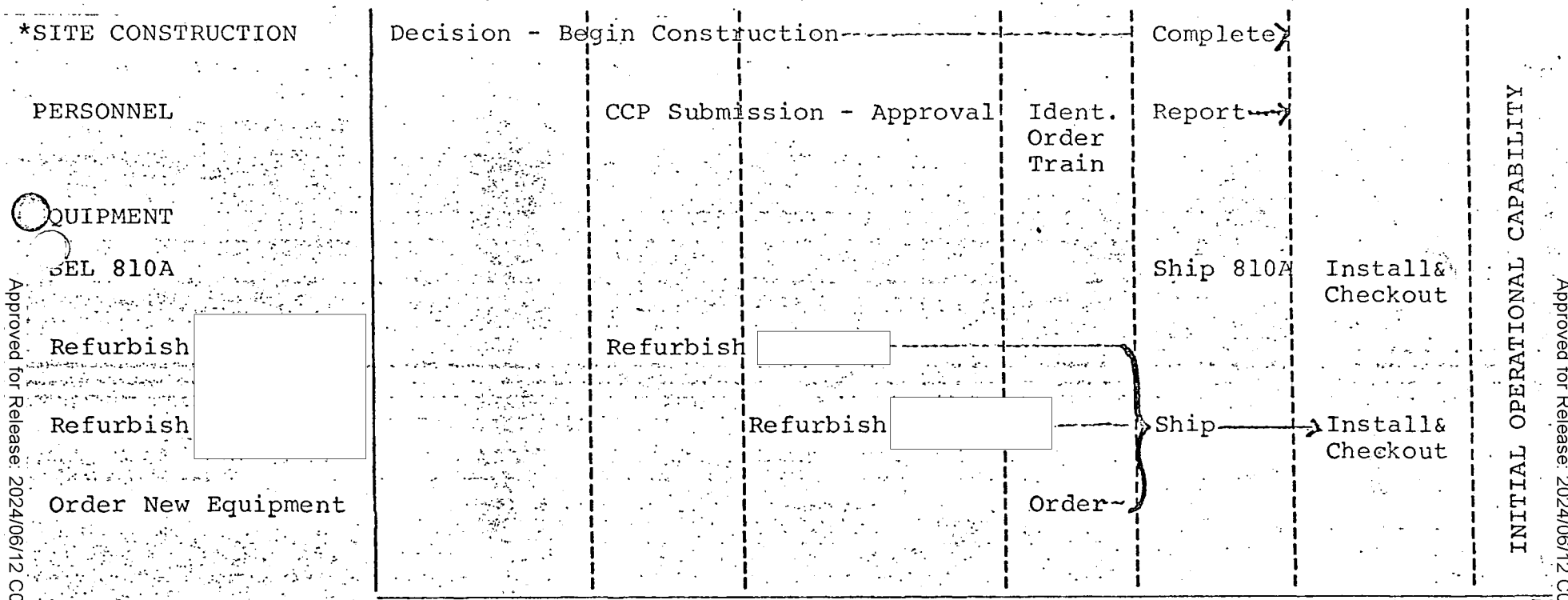
Sub-Total - $158,000

Flooring, air-conditioning, installation, and incidental costs

Sub-Total - $ 49,000

TOTAL - $372,000

SCHEDULE



*Pacing Factor

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FUNDING

1. As indicated in paragraph 1 above, non-recurring funding totals $1,187,000, while recurring funding totals $275,000.

Non-recurring	
Equipment	$372,000
Building	$815,000
Recurring	
Personnel	$250,000
Equipment O&M	$ 25,000

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~~ISI~~ NATIONAL RECONNAISSANCE OFFICE

WASHINGTON, D.C.

THE NRO STAFF

16 October 1970

MEMORANDUM FOR CHIEF OF NAVAL OPERATIONS

SUBJECT: Ocean Surveillance

The NRO has recently completed a study of the application of existing NRO ELINT assets to the ocean surveillance problem. In addition, a preliminary design of a new secondary payload for ocean surveillance was completed. The results of this work were presented to representatives of the U. S. Navy on 8 October 1970. A copy of the briefing charts is attached. It is requested that comments and recommendations be provided as soon as possible. Specifically, reaffirmation of the Navy requirement for ocean surveillance that was provided to us by the Director, Program "C," is requested.

We are initiating efforts to obtain additional ocean surveillance data from existing ELINT systems in support of your requirements based on the above study. In the near future we will probably need your assistance in the implementation of this additional effort.

E F Sweeney

EDWIN F. SWEENEY
Colonel, USAF
Director

Atch
Briefing Charts

Cy to: Director, Program C

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PAGE 1 OF 1

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PRESENTATION TO U. S. NAVY

CAPABILITIES AND LIMITATIONS OF SIGINT SATELLITE SYSTEMS

IN SUPPORT OF NAVY OCEAN SURVEILLANCE

8 OCTOBER 1970

BY

NATIONAL RECONNAISSANCE OFFICE STAFF

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THIS BRIEFING IS IN RESPONSE TO WAHOO 3194 WHICH ASKS FOR

- TRADE-OFF STUDY OF ALTERNATIVE SYSTEMS FOR ELINT SURVEILLANCE OF THE OCEANS
- CAPABILITIES OF PRESENT SYSTEMS
- NEW SYSTEM(S), I.E., ROSALI
- A LONGER RANGE SOLUTION
- PROCESSING AND REPORTING SYSTEM

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OUTLINE

- STATEMENT OF REQUIREMENTS
  - USN (ADM. HARLFINGER MEMO)
  - USIB
- CAPABILITIES OF CURRENT SYSTEMS
- ROSALI OCEAN SURVEILLANCE CONCEPT
- ROSALI VS URSALA CAPABILITY
- MISSION TRADE-OFF STUDY
  - CAPABILITY TO MEET USIB REQUIREMENTS
  - CAPABILITY TO MEET USN REQUIREMENTS
- DATA READ-OUT, PROCESSING, AND REPORTING
- CONCLUSIONS AND RECOMMENDATIONS

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OCEAN SURVEILLANCE REQUIREMENTS

ADM. HARLFINGER'S MEMO TO DNRO - WEIGHTING FACTORS

A. SHIP LOCATION RELATIVE TO OUR FORCES

DISTANCE = 0 - 200 - 500 - 1500 NM
WEIGHT = 0.4 0.3 0.2 0.1

B. WEIGHT PER GEOGRAPHIC AREA

0.3	MEDITERRANEAN, TONKIN GULF
0.2	NORTH/NORWEGIAN/BARENTS/JAPAN SEAS, GI/UK GAP
0.1	EAST ATLANTIC, NORTH PACIFIC
0.05	SOUTH PACIFIC, INDIAN OCEAN

C. POLITICAL CLIMATE = HOT WAR - LIMITED WAR - TENSION - CALM

WEIGHT = 0.3 0.2 0.1 0

D. WEIGHT PER PLATFORM (HULL TYPE)

0.5	
0.4	SSGN, CLG, DLG, SSG (MAJOR MISSILE CARRIERS)
0.3	CHG, DDG (MISSILE CARRYING CRUISERS, DESTROYERS)
0.2	PGM (MISSILE CARRYING PATROL CRAFT)
0.1	MAJOR NON MISSILE NAVAL UNITS
0.05	HIGH INTEREST AUXILIARIES

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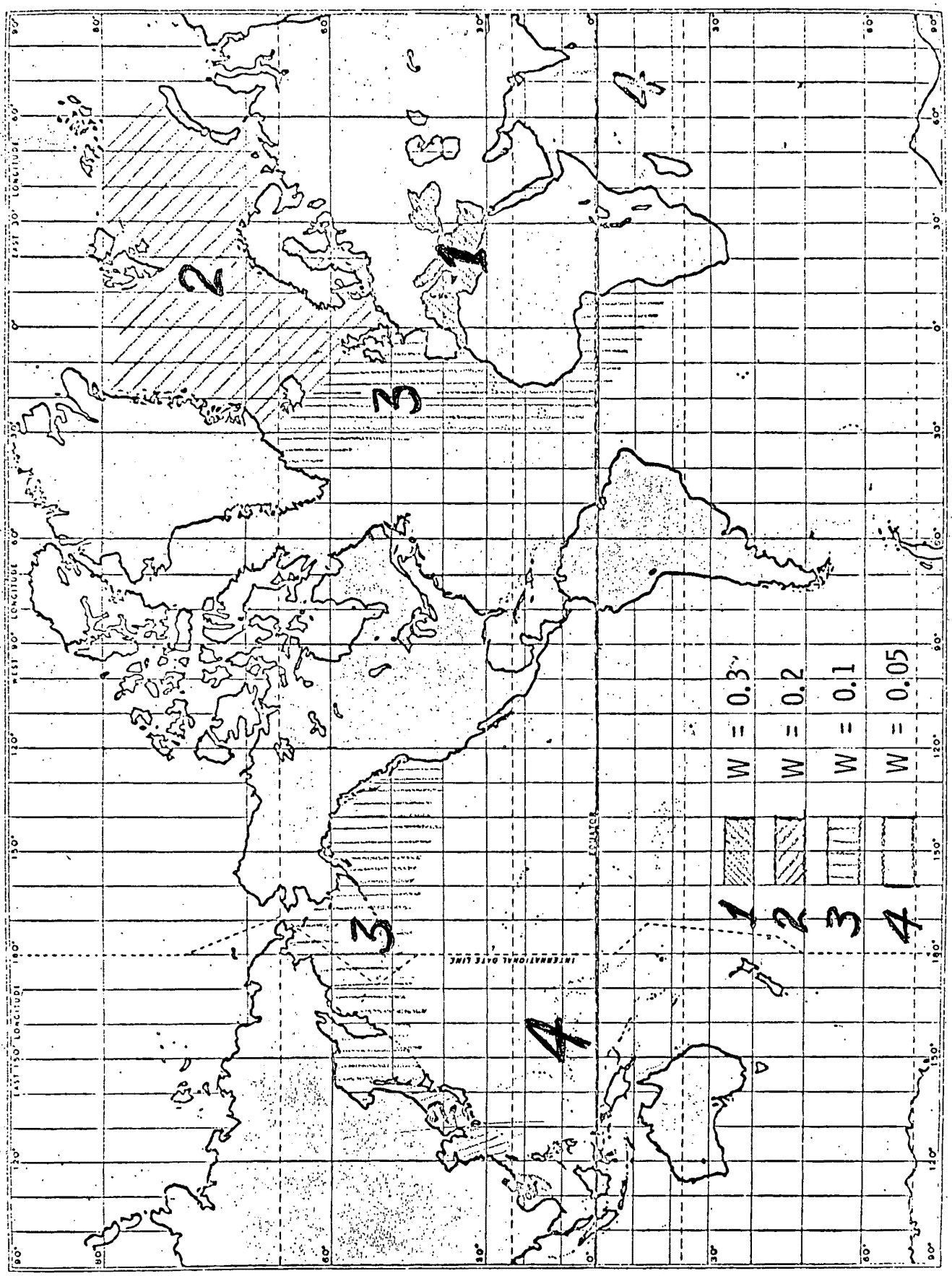

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ELINT OCEAN SURVEILLANCE

MISSION CONSIDERATIONS

- SHIP SEARCH AND NAV RADARS ARE NORMALLY ON (PARTICULARLY AT NIGHT OR IN BAD WEATHER), PENETRATE CLOUDS, AND CONSTITUTE A LOCATABLE SOURCE.
- [redacted]
- VARIATION IN EMISSIONS IS AN INDICATOR OF COMBATANT POSTURE.
- UNDER CERTAIN CONDITIONS, RADIO SILENCE IS MAINTAINED.

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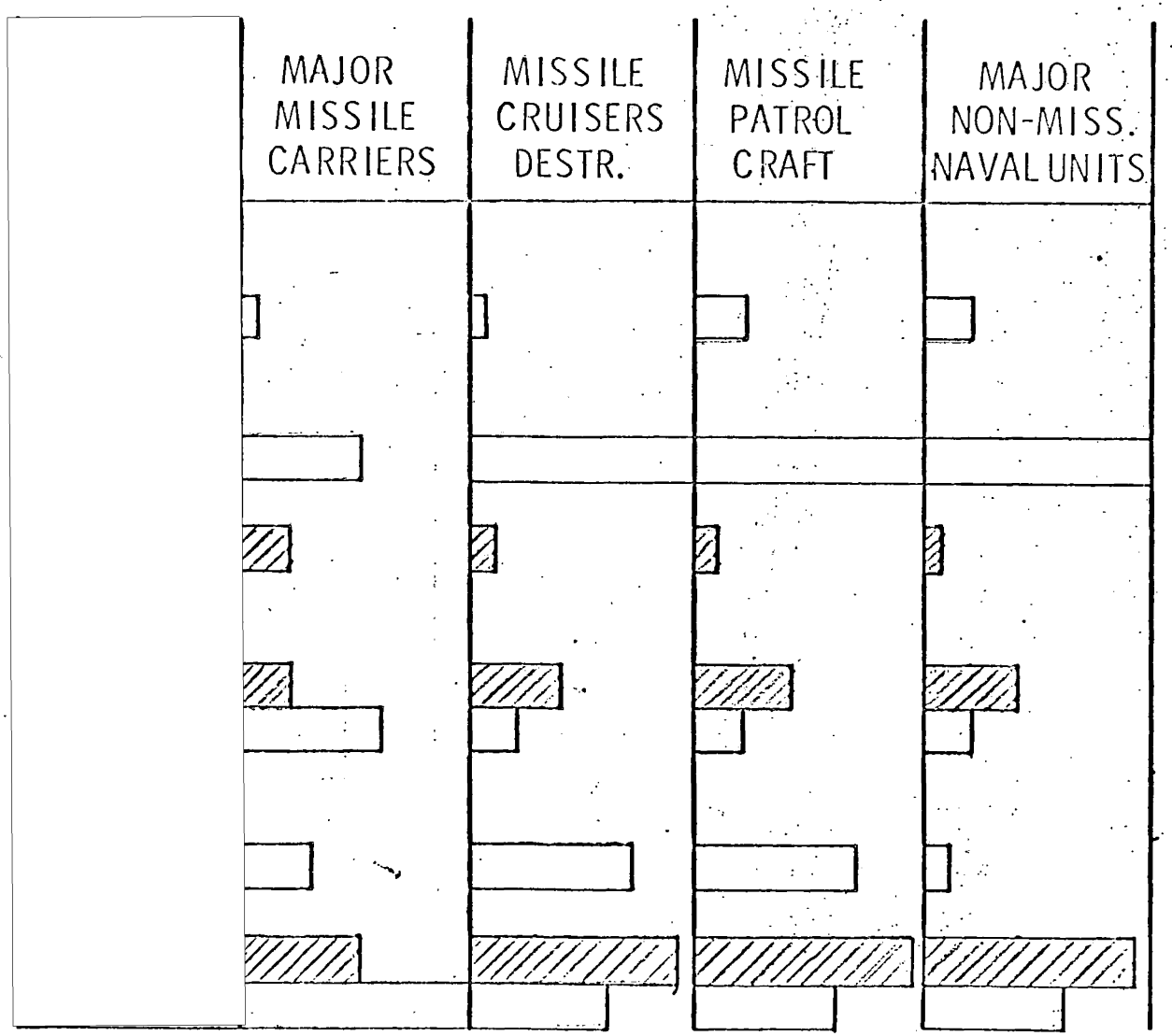
USSR FLEET RADAR USAGE PER RF BAND



A = USUALLY ON =
B = USUALLY OFF =

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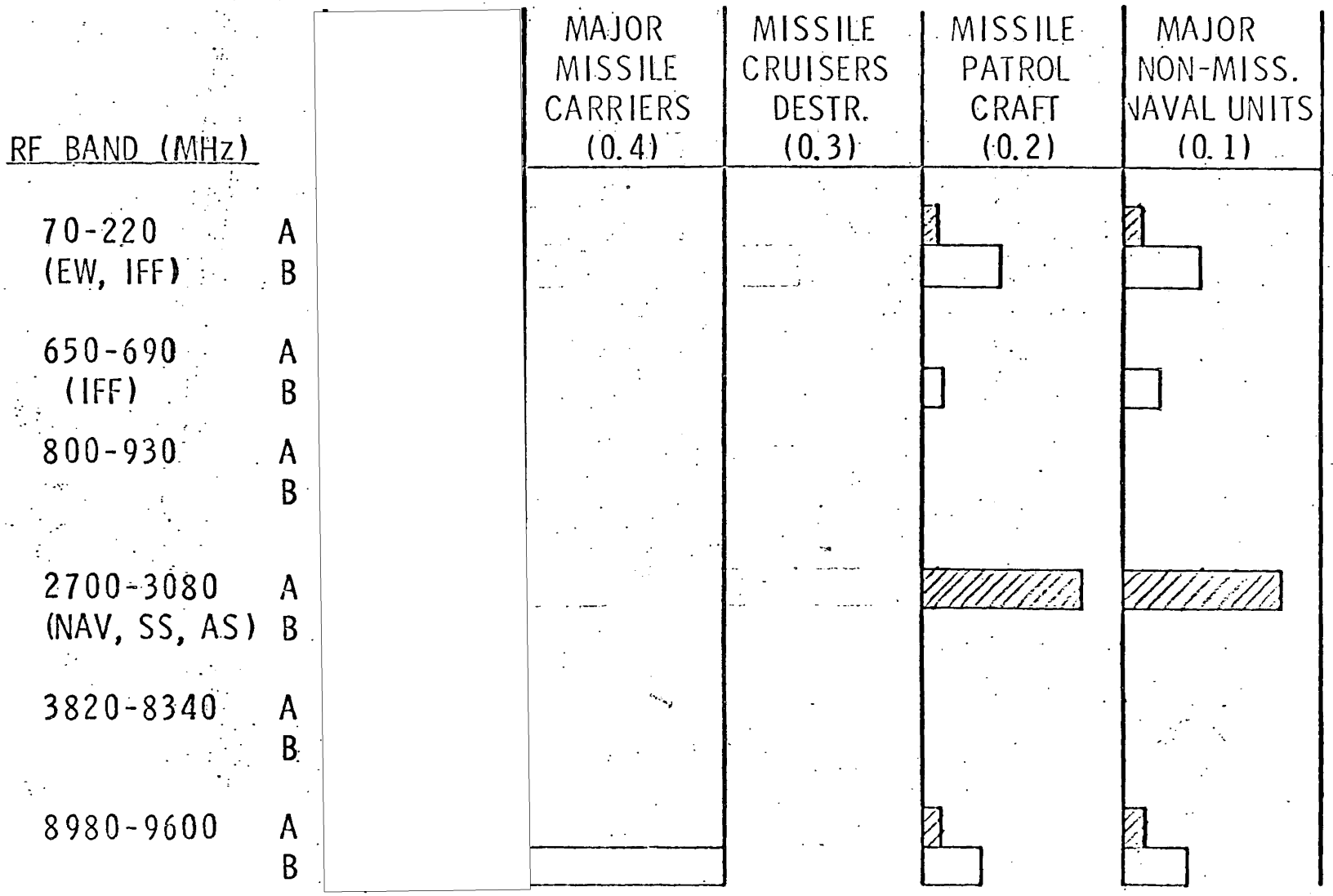
CHICOM FLEET RADAR USAGE PER RF BAND



A = USUALLY ON =

B = USUALLY OFF =

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CONCLUSIONS FROM RF USAGE EVALUATION

- THE MOST IMPORTANT RF BANDS FOR OCEAN SURVEILLANCE ARE THE 8980-9600 MHz PORTION OF X-BAND AND THE 2700-3100 MHz PORTION OF S-BAND.
- 
- THE HIGH INTEREST MISSILE AND FIRE CONTROL RADARS ARE IN THE 3820-9600 MHz RANGE BUT ARE RARELY ACTIVE.

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PROBABILITY OF INTERCEPT WHEN RADIATING

ADMIRAL HARLFINGER'S STATED REQUIREMENT FOR SIGNAL INTERCEPT

PROBABILITY	CONDITION
0.997 (3σ)	MISSILE EQUIPPED SHIP WITHIN STRIKE RANGE OF USN
0.954 (2σ)	MAJOR COMBATANT WITHIN 500 NM OF USN
0.683 (1σ)	ALL OTHER RADIATIONS

IMPLICATION OF REQUIREMENT

CONTINUOUS SURVEILLANCE OF PRIORITY OCEAN AREAS AT ALL COMBATANT RF FREQUENCIES IS IMPLIED BY THIS REQUIREMENT.

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OUTLINE

- STATEMENT OF REQUIREMENTS
  - USN (ADM. HARLFINGER MEMO)
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- DATA READ-OUT, PROCESSING, AND REPORTING
- CONCLUSIONS AND RECOMMENDATIONS

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CAPABILITIES OF CURRENT SYSTEMS

PARAMETER	STRAWMAN REAPER/THRESHER	P-989 TRIPOS/SOUSEA	[redacted] POPPY
RF RANGE (GHz)	1.8-3.3/0.125-2.1	4-8/8-12	0.153-10.5
GEOGRAPHIC COVERAGE	76°S TO 76°N	20°S TO N. POLE	R/O SITE LIMITED
ACCURACY RANGE (NM)	[redacted]		
CONTACT FREQUENCY	3-6 DAYS	≥TWICE DAILY	≥4 TIMES DAILY
QRC REPORTING DELAY	3-8 HOURS	22-24 HOURS	0.5-2 HOURS
TRAFFIC HANDLING	GOOD	FAIR	POOR

Punch punch
Card

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CAPABILITIES OF PROJECTED SYSTEMS

PARAMETER	P-989 URSALA	[redacted] POPPY
RF RANGE (GHz)	2-12	0.153-18
GEOGRAPHIC COVERAGE	20°S TO N. POLE	R/O SITE LIMITED
ACCURACY RANGE (NM)	[redacted]	
CONTACT FREQUENCY	≥ TWICE DAILY	≥ 4 TIMES DAILY
QRC REPORTING DELAY	2-6 HOURS	0.3-2 HOURS
TRAFFIC HANDLING	GOOD	POOR

[redacted]

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MAIN BEAM VS SIDELOBE EOB

MAIN BEAM SYSTEM (POPPY)

- GEOPOSITION BY EITHER [redacted] OR PRF DOPPLER
- GIVEN LONG INTERCEPT ARCS, GOOD GEOPOSITION ACCURACY IS OBTAINABLE OVER WIDE SWATHS
- DATA SORTING ABILITY SATURATES RAPIDLY IN HEAVY TRAFFIC
- STABLE PRF GREATLY FACILITATES BOTH SORTING AND GEOPOSITION
- POOR CAPABILITY AGAINST SHORT ON TIME SIGNALS
- LOW ALTITUDE OMNIDIRECTIONAL SYSTEM WHICH TRANSPONDS DATA IS IMPLIED

SIDELOBE SYSTEMS

- LOW ALTITUDE SYSTEM CAN PROVIDE PULSE-BY-PULSE D/F
- DEMONSTRATED TRAFFIC HANDLING WITH MONOPULSE GEOPOSITION IS OVERWHELMINGLY SUPERIOR TO MAIN BEAM
- THE [redacted] TECHNIQUE CAN BE USED FOR SIDELOBE LOCATION FROM HIGH ALTITUDE

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TACTICS TO IMPROVE CURRENT SYSTEM TYPES

- o TASK CURRENT SYSTEMS OVER PRIORITY OCEAN AREAS
- o INCREASE PRIORITY AND RESOURCES FOR QRC REPORTING
- o PROVIDE FUTURE STRAWMAN OPTION FOR INCREASED SWATH
- o ADD FIXED AND ADAPTIVE PRF SORTING CIRCUITS AT POPPY STATIONS
- o USE EXPANDED SOLAR ARRAY SYSTEM ON URSALA
- o ADD X-BAND COVERAGE TO STRAWMAN
- o CONSIDER NEW READ-OUT LINKS FOR RAPID DATA RETURN

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ROSALI OPERATIONAL FEATURES

NEAR TOTAL GLOBAL COVERAGE MINIMUM OF TWICE/DAY.

READOUT STORED OR REALTIME DATA TO SCF, POPPY SITES OR APPROPRIATELY EQUIPPED SHIPS.

SCF REALTIME MODE AT NEW HAMPSHIRE, VANDENBERG, AND HAWAII STATIONS PROVIDES U.S. COASTAL COVERAGE.

READOUT PROGRAMMED BY SCF OR COMMANDED AT READOUT LOCATION

DATA FORMAT INCLUDES ALL NECESSARY INFORMATION FOR SIMPLIFIED D/F DETERMINATION.

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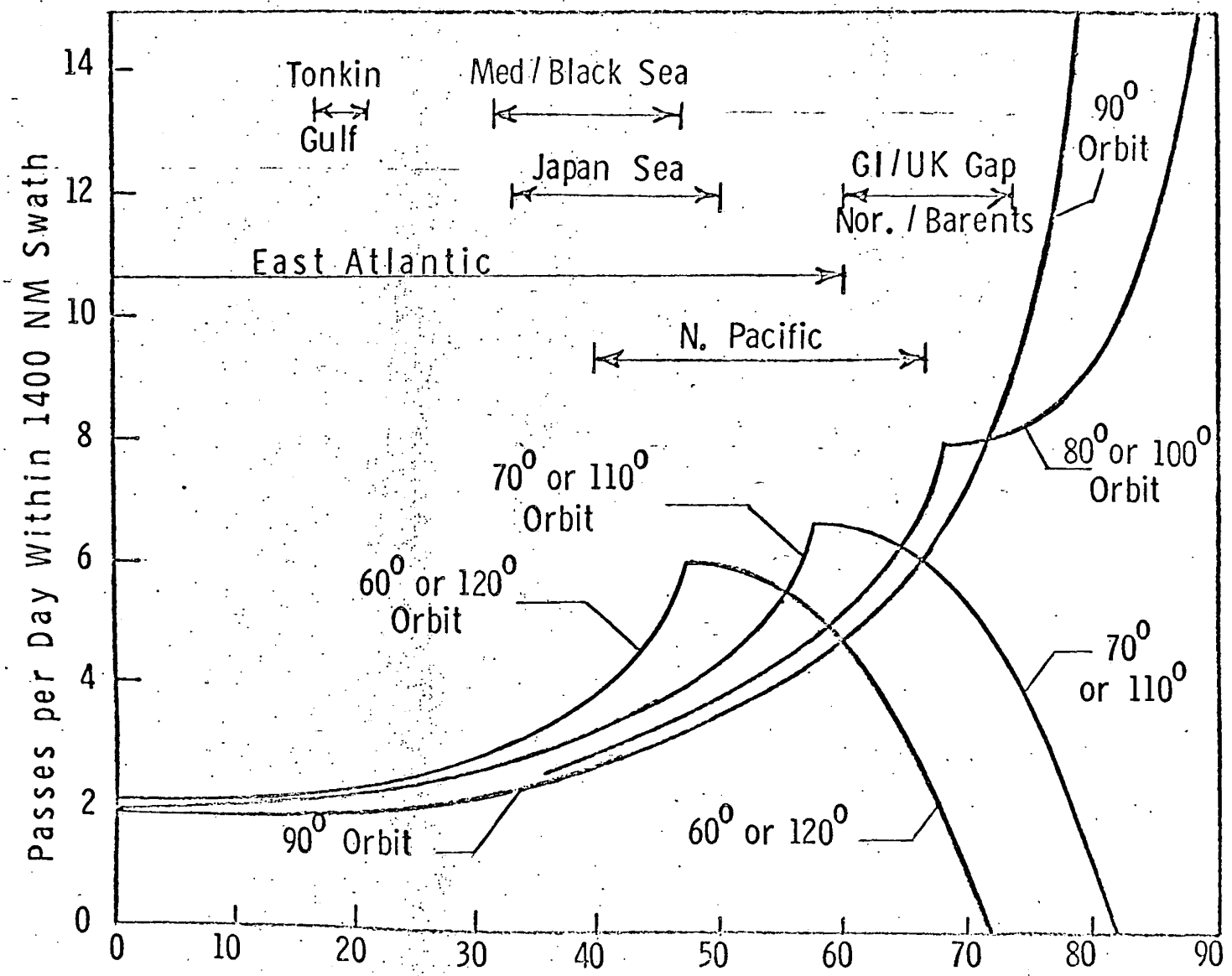
Frequency of Coverage with 275 NM Sidelobe Mapper



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SPECIFIC ROSALI PAYLOAD CAPABILITIES

- RF BANDS: 780-925MHz, 2.7-3.1 and 8.9-9.6GHz
  UNIQUE CLASS IDENTIFICATION POSSIBLE
- TOTAL 2σ MONOPULSE D/F ERROR: 0.7^{0}. YIELDS SEMI-MAJOR AXIS OF 3.5NM NADIR; 42NM AT 720NM OFF-TRACK
- SYSTEM SENSITIVITY: DETECT L-BAND 100KW, S & X-BAND 6KW
- PULSE TRAIN DEINTERLEAVING. ACCOMPLISHED BY SMALL INSTANTANEOUS FIELD-OF-VIEW, FREQUENCY, AND PRI SORTING. ALLOWS MAJOR ON-BOARD DATA COMPRESSION.
- SOLID-STATE MEMORY

Duplicate

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ROSALI DATA OUTPUT

° EPHEMERIS, SPIN AXIS ORIENTATION, BIAS CORRECTION	1/MIN
° TIME, EARTH AND SUN SENSOR TRANSITIONS	60/MIN
° 1st PULSE TOA, Δ TIME LAST PULSE TOA ON MAX AMPLITUDE PULSE: RF, PW, PA, PRI MONOPULSE D/F RATIO & TOA: 1 or 4 PULSES	EACH DEINTERLEAVED PULSE TRAIN

° ANTICIPATED REALTIME DATA RATE WELL WITHIN POPPY TELEMETRY SYSTEM BANDWIDTH

° SOLID STATE STORAGE CAN PROVIDE BUFFERING

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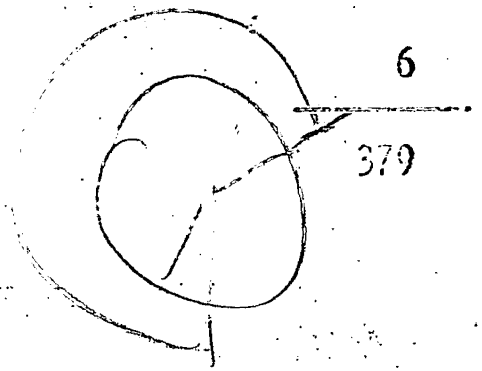
DAILY POWER REQUIREMENTS

SUBSYSTEM	FULL COVERAGE ABOVE 60 SOUTH LAT (WATT-HRS/DAY)	SELECTED OCEAN AREA COVERAGE (WATT-HRS/DAY)
CMD RCVR, TIMER	100	100
RADIOMETER	50	3
SCF CONTACTS (5 PER DAY)	40	40
P/L ON FULL POWER (WATER)	1050	225
P/L ON 60% POWER (LAND)	270	0
VHF XMTR ON	28	6
TOTAL	1538	379



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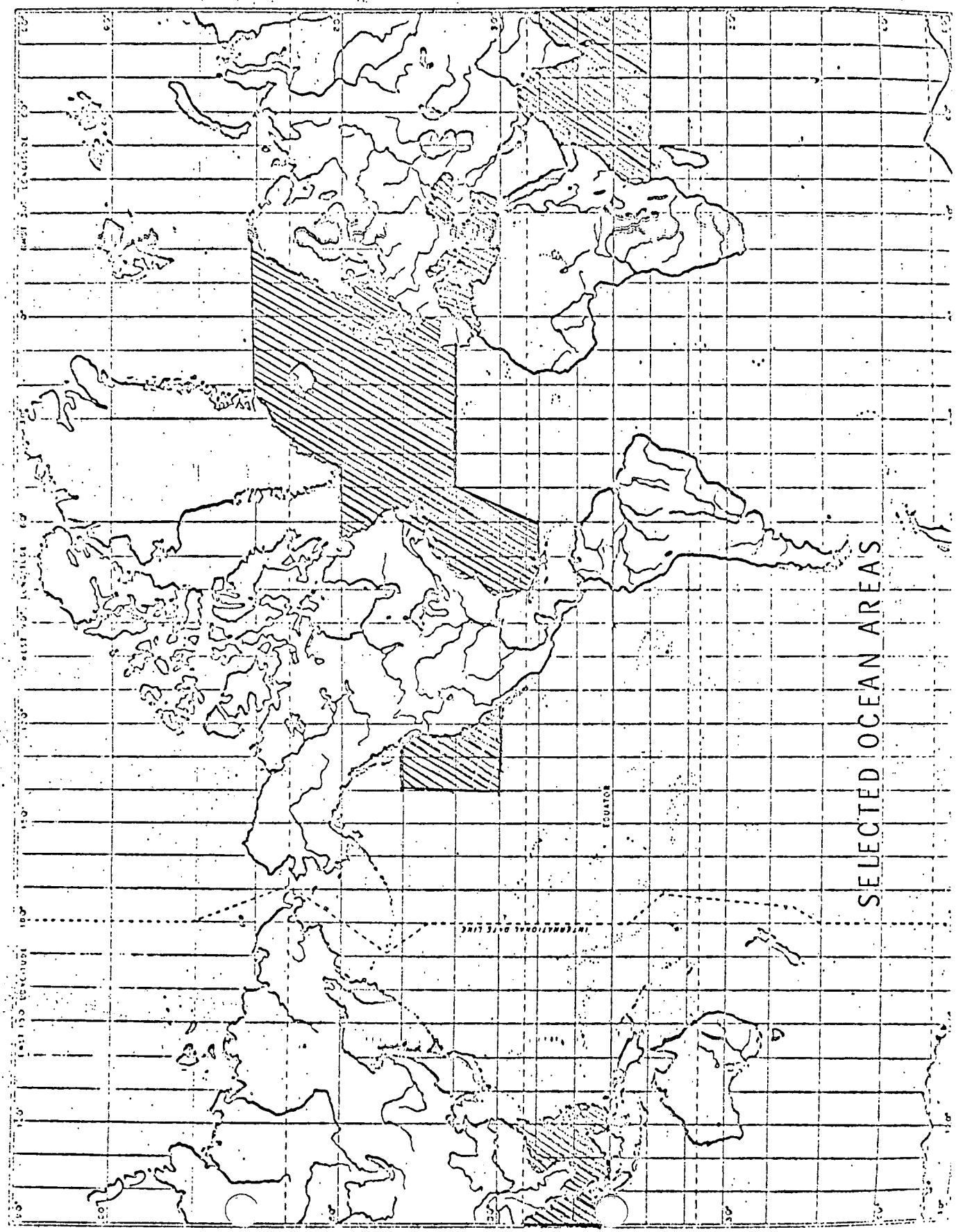

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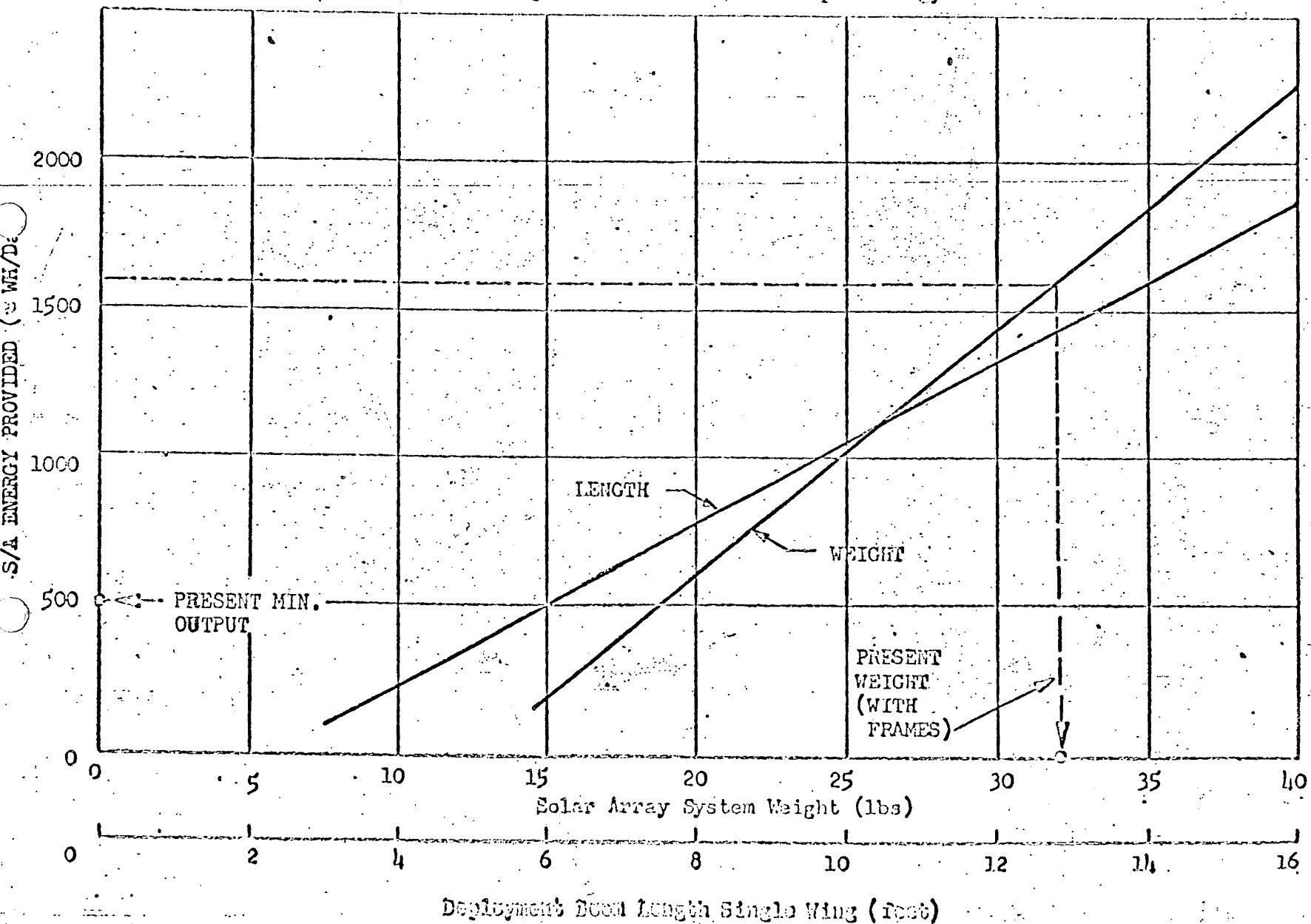
Solar Array System Weight and Deployment
Boom Length as a Function of Output Energy



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RADIOMETER CAPABILITY

RESOLUTION SET BY ANTENNA BEAMWIDTH

RESOLUTION RANGE USING 6 FOOT ANTENNA

FREQ (GHZ)	BEAMWIDTH (DEGREES)	SPOT DIAMETER AT NADIR (N. M.)
10	1.2	5.3
2	5.8	14.4

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  - CAPABILITY TO MEET USN REQUIREMENTS
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CAPABILITIES OF ROSALI VS URSALA

PARAMETER	ROSALI	URSALA
RF RANGE (GHz)	.78-.93/2.7-3.1/8.9-9.6	2-12
GEOGRAPHIC COVERAGE	60^0 S TO N-POLE	20^0 S TO N-POLE
ACCURACY RANGE (NM)	3.5-42	3.5-42
CONTACT FREQUENCY	≥TWICE DAILY	≥TWICE DAILY
ACCURACY WITH DAILY COVERAGE	10 NM	10 NM
QRC REPORTING DELAY	0.3-2 HOURS	2-6 HOURS
READ-OUT DATA RATE	< 25 KBPS	1000 KBPS
COLLECTION TIME PER DAY	12 HOURS	3 HOURS
SWATH EDGE ERP CAP.		
S-BAND	6 KW	~~40~~ 17 KW
X-BAND	6 KW	70 KW

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QRC CAPABILITY

- ROSALI WILL READ-OUT COMPRESSED INTERCEPT DATA AT < 25 KBPS TO EITHER SCF OR POPPY STATIONS

- URSALA WILL READ-OUT INDIVIDUAL PULSE PARAMETERS AT 1 MBPS TO SCF STATIONS

- ROSALI DATA COMPRESSION WILL FACILITATE
  - QRC DATA RETURN FROM SCF STATIONS TO LMSC
  - QRC DATA PROCESSING ON COMPUTERS AT POPPY STATIONS

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EMITTERS AVAILABLE TO ROSALI VS URSALA

- o ADDITION OF L-BAND (0.78-0.93 GHz) TO ROSALI
  - INCREASES AVAILABLE HIGH DUTY CYCLE EMITTERS BY ~10%
  - [redacted]
- o POOR SENSITIVITY OF URSALA IN X-BAND (8.9-9.6 GHz)
  - PREVENTS LOCATION OF NAV AND MANY SEARCH RADARS [redacted]
  - REDUCES COVERAGE OF HIGH DUTY CYCLE EMITTERS BY 50%
- o URSALA PROVIDES C-BAND COVERAGE

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COLLECTION LIMITATIONS

- EXPANDED SOLAR ARRAY SUBSYSTEM MUST BE DEVELOPED TO SUPPORT MORE THAN 4 HOURS PER DAY COLLECTION BY EITHER ROSALI OR URSALA.

- URSALA 1 MHz TAPE RECORDERS
  - HAVE WEAR-OUT PROBLEM
  - LIMIT COLLECTION TIME PER SCF READ-OUT TO 44 MINUTES.

- ROSALI SOLID STATE STORAGE HAS POTENTIAL OVERFLOW PROBLEM. (ALLEVIATED BY LINE-OF-SIGHT READOUT AND BY RADIOMETER TO PREVENT NON-OCEAN COVERAGE)

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URSALA IMPROVEMENTS FOR OCEAN SURVEILLANCE

- CHANGE ANTENNA MOUNTING ANGLE TO INCREASE LOW LATITUDE COVERAGE.
- FEED SIX FOOT DISH AT X-BAND TO IMPROVE ERP CAPABILITY.
- HAVE RECORDER BYPASS MODE FOR LINE-OF-SIGHT READ-OUT TO SCF STATIONS.
- REDUCE PCM DATA RATE AND/OR ADD RECORDER SPEED MODES TO INCREASE QRC DATA RETURN CAPABILITY.
- USE EXPANDED SOLAR ARRAY SYSTEM FOR INCREASED TASKING.

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URSALA PLUS OCEAN SURVEILLANCE

- o URSALA I MISSION IS SINO-SOVIET ELINT SEARCH/EOB
  - LAUNCH IS SCHEDULED FOR SEPTEMBER 1971
  - POWER SYSTEM WILL PERMIT SOME HIGH PRIORITY OCEAN COVERAGE
- o URSALA II COULD BE LAUNCHED BY JAN 1972 AND DEDICATED TO OCEAN SURVEILLANCE
  - WITHOUT MODIFICATION, URSALA CAN MEET USIB OCEAN SURVEILLANCE REQUIREMENT FOR PRIORITY AREAS
  - WITH TWO URSALAS ON ORBIT, EITHER CAN CONTINUE HIGH PRIORITY LAND AND SEA COVERAGE IF OTHER FAILS
  - TWO P-989 SYSTEMS PROVIDE 4 TIMES PER DAY COVERAGE OF PRIORITY AREAS IN NORTHERN HEMISPHERE
- o EARLIEST LAUNCH FOR ROSALI IS JUNE 1972
  - ROSALI PROVIDES BETTER OCEAN SURVEILLANCE THAN URSALA
  - ROSALI IS VERY POOR BACK-UP TO URSALA FOR SINO-SOVIET EOB

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PRF ACCURACY

NAVY INPUT

PRF KNOWLEDGE TO $1/10^5$ ON CERTAIN RADARS PROVIDES UNIQUE

SINGLE SCAN PRF ACCURACY

APPROXIMATELY $1/10^3$ FOR CURRENT LOW ALTITUDE SYSTEMS

P-989 AVERAGING TECHNIQUE

WALK OUT MISSING PULSES BETWEEN SPINS (1 SECOND SPACING)

OBTAIN 0.2 μSEC ACCURACY OF PRI DIGITIZATION

POPPY AVERAGING TECHNIQUE

WALK OUT MISSING PULSES

PRESENT PRI ACCURACY AFTER DIGITIZATION IS ~2 μSEC

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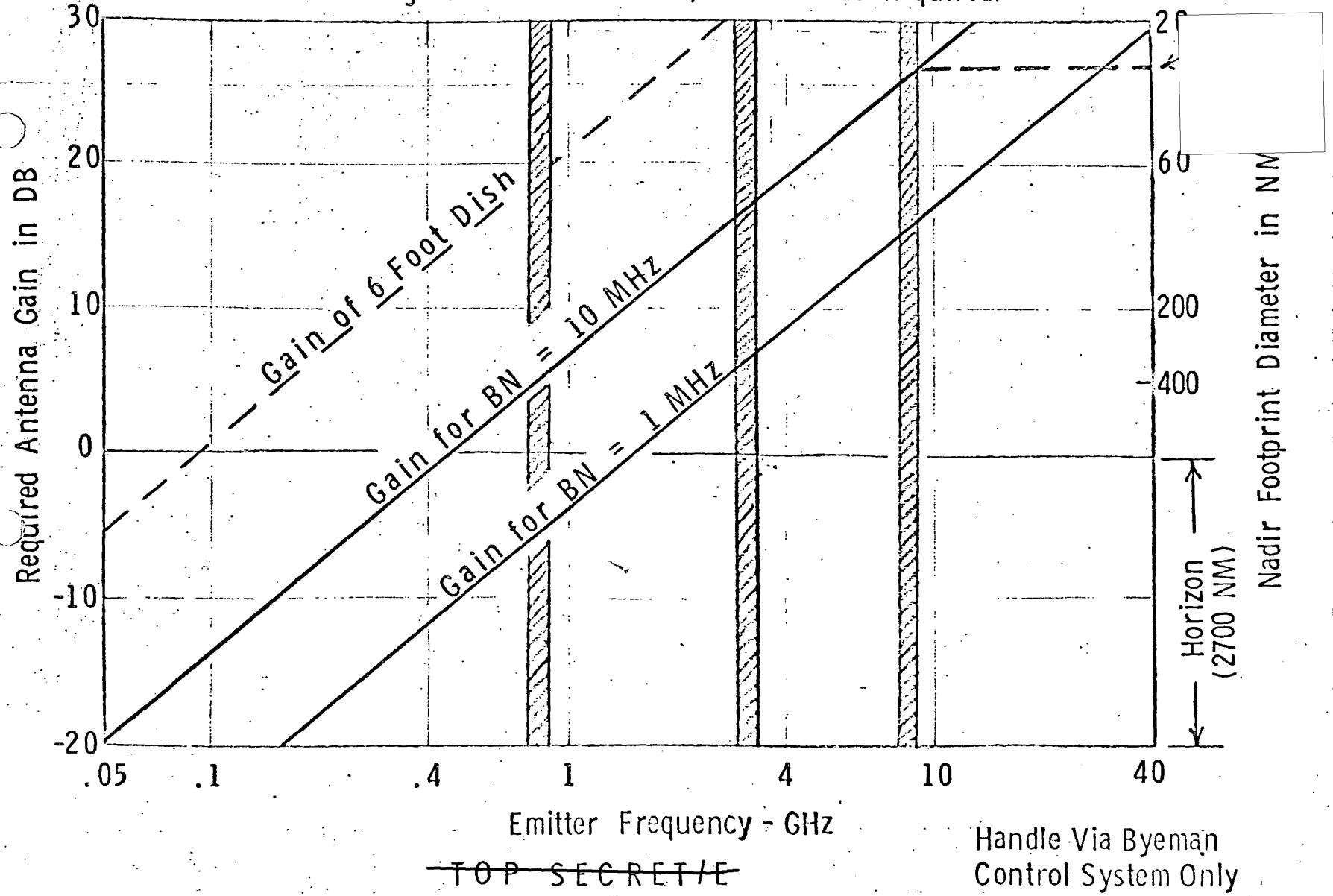
Antenna Gain Required to Intercept 1 KW ERP From 275 NM
(Assuming Receiver NF = 9 dB, 15 dB S/N Required)



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POPPY CAPABILITY AGAINST SHORT ON-TIME SIGNALS

[redacted] SYSTEM CANNOT LOCATE SHORT ON-TIME SIGNALS

SYSTEM CAN PROVIDE ROUGH LOCATIONS-

ON-SITE CAPABILITY IS SEVERELY LIMITED IF

- EMITTER DOES NOT SCAN OR
- PRF IS NOT CRYSTAL CONTROLLED OR
- TRAFFIC IS HEAVY

INTERCEPT OPPORTUNITY IS LIMITED BY R/O STATION VISIBILITY

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CONCLUSIONS ON SYSTEM TYPE FOR LOCATING HIGH DUTY CYCLE EMITTERS

- BEST SYSTEM TYPE IS LOW ALTITUDE SIDELOBE COLLECTION SYSTEM WITH MONOPULSE D/F.
- WINNING GEOMETRY IS NADIR ORIENTED WITH MULTIPLE BEAMS (OR INTERFEROMETER SETS) FOR HIGH SENSITIVITY WIDE SWATH COVERAGE.
- SPINNING PENCIL BEAM SYSTEM IS AT LEAST HALF AS GOOD AS NADIR ORIENTED SYSTEM AND CONSIDERABLY SIMPLER.
- PRIORITY FREQUENCY BANDS FOR OCEAN EOB ARE 8980-9600 MHz, 2700-3080 MHz, AND 800-930 MHz.
- THE SYSTEM MUST ACHIEVE A RAPID RESPONSE FROM INTERCEPT TO REPORTED LOCATIONS.

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INTERCEPT IMPLICATIONS OF SHORT ON-TIME SIGNALS

INTERCEPT PROBABILITY IS VANISHINGLY SMALL UNLESS ELINT SYSTEM CAN RAPIDLY SEARCH LARGE AREA.

SIDELOBE INTERCEPT AND LOCATION APPEAR TO BE NECESSARY - HENCE, A HIGH GAIN SYSTEM IS REQUIRED.

FOR TRAFFIC HANDLING, THE SYSTEM SHOULD LOCATE EACH PULSE - THIS IMPLIES D/F BY ANGLE OF ARRIVAL MEASUREMENT FOR GENERAL OCEAN COVERAGE.

THE GEOGRAPHY AVAILABLE INCREASES FOR HIGHER ALTITUDE ORBITS BUT REQUIRED ANTENNA GAIN AND ANGULAR ACCURACY ALSO INCREASES.

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POPPY DATA PROCESSING AT READ-OUT STATION

DEDICATED COMPUTER (SEL-86)

AIDS FOR QUICK SELECTION OF CANDIDATE SIGNALS

FREQUENT TRANSMISSION OF SPACETRACK EPHEMERIDES BY TWX

VEHICLE ATTITUDE AND TIME NOT NEEDED

MINIMAL AMOUNT OF POSTPASS PROCESSING

VERY LIMITED MULTIPLE TARGET CAPABILITY

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DISCUSSIONS OF CANDIDATE CONCEPT

SYSTEM OF TYPE DESCRIBED CAN

- LOCATE TO [redacted]
- PROVIDE STEADY SURVEILLANCE OF SEGMENTS OF USSR FLEET FOR AT LEAST 20 MINUTES PER OVERPASS
- LOCATE SHORT ON-TIME SIGNALS WITHIN D/F CIRCLE

SYSTEM STATUS

- THE BASIC CONCEPT IMPLIES A LARGE, EXPENSIVE SYSTEM
- NO SUCH SYSTEM IS CURRENTLY PLANNED
- IF INTEREST IS SUFFICIENT, THEN A DETAILED TRADE-OFF STUDY SHOULD BE PERFORMED TO OPTIMIZE SYSTEM PARAMETERS AND ESTABLISH FEASIBILITY, COST, AND SCHEDULE

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CONCEPTUAL SYSTEM CAPABILITIES

PARAMETER		275 NMI ROSALI
RF RANGE (GHz)		TAILORED TO OS
GEOGRAPHIC COVERAGE		60 S TO N-POLE
ACCURACY RANGE (NM)		
CONTACT FREQUENCY		≥ TWICE DAILY
QRC REPORTING DELAY		0.3-2 HOURS
TRAFFIC HANDLING		GOOD

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DATA READ-OUT OPTIONS

- READ-OUT DATA TO POPPY STATIONS
  - THIS PROVIDES LINE-OF-SIGHT COVERAGE OF HIGHER PRIORITY AREAS
  - STORE AND PLAYBACK TO COVER OTHER AREAS
- STORE AND PLAY BACK TO SCF IN QRC MODE
- READ-OUT TO LEAD SHIPS IN US FLEET
- READ-OUT THROUGH COMSAT LINK
- READ-OUT TO BOTH POPPY STATIONS AND CONUS STATION(S)

P-989 READ-OUT TO POPPY STATIONS

USE SOLID STATE DATA STORAGE / LOW-RATE ENCRYPTED PCM PLAY-BACK

NEED 136 MHZ PCM TRANSMITTER, GROUND RCVR / DECOMM / DECRYPT / COMPUTER GEAR

SCF COMMAND, CONTROL, AND EPHEMERIDES

LMSC [redacted] SYSTEM ANALYSIS, BIAS CORRECTION, SPIN AXIS DETERMINATION, CLOCK CORRELATION

STORE AND PLAY-BACK EPHEMERIDES, SPIN AXIS, CLOCK CORRELATION

DIRECT READ-OUT OR STORE AND PLAY-BACK COMPRESSED INTERCEPT DATA

SUFFICIENT ON BOARD COMPRESSION TO PERMIT NEAR-REAL-TIME PROCESSING

ALTERNATE READ-OUT TO SCF AT 2232MHZ WITH QRC PROCESSING BY LMSC

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CONFIGURE SATELLITE FOR ON-BOARD DATA COMPRESSION, POSSIBLY INCLUDING ON-BOARD GEOPOSITION

FOR P-989, LMSC WILL GENERATE SOFTWARE PACKAGE

MONOPULSE D/F PARAMETERS WILL FACILITATE QRC DATA PROCESSING OF LARGE NUMBERS OF LOCATIONS

QRC DATA REPORTING

TIME FROM INTERCEPT TO PLAYBACK USUALLY LESS THAN ONE SECOND WITH ON-BOARD PCM BUFFERING

TIME TO PROCESS AND LIST WITH POPPY COMPUTER CAN BE HELD TO SEVERAL MINUTES

COMM LINKS EXIST FROM POPPY STATIONS TO NOSIC TO DISTRIBUTION

COMPRESSED PCM FORMAT FROM SATELLITE WILL ALLOW QRC DATA RETURN TO SCF FROM REMOTE STATIONS

COMM LINKS TO NOSIC CAN BE MADE AVAILABLE FROM ALTERNATE DATA READ-OUT SITES

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* OPTION I

4426 - URSALA II

[redacted]

4429 - URSALA III

* OPTION II

[redacted]

4428 - ROSALI

4429 - URSALA III

* OPTION III

4426 - URSALA II

4428 - ROSALI

[redacted]

* OPTION I - WITHIN CURRENT BUDGET

* OPTIONS II AND III REQUIRE AN ADDITIONAL
$2 M IN FY-71 AND $1 M IN FY-72 (FOR ROSALI)

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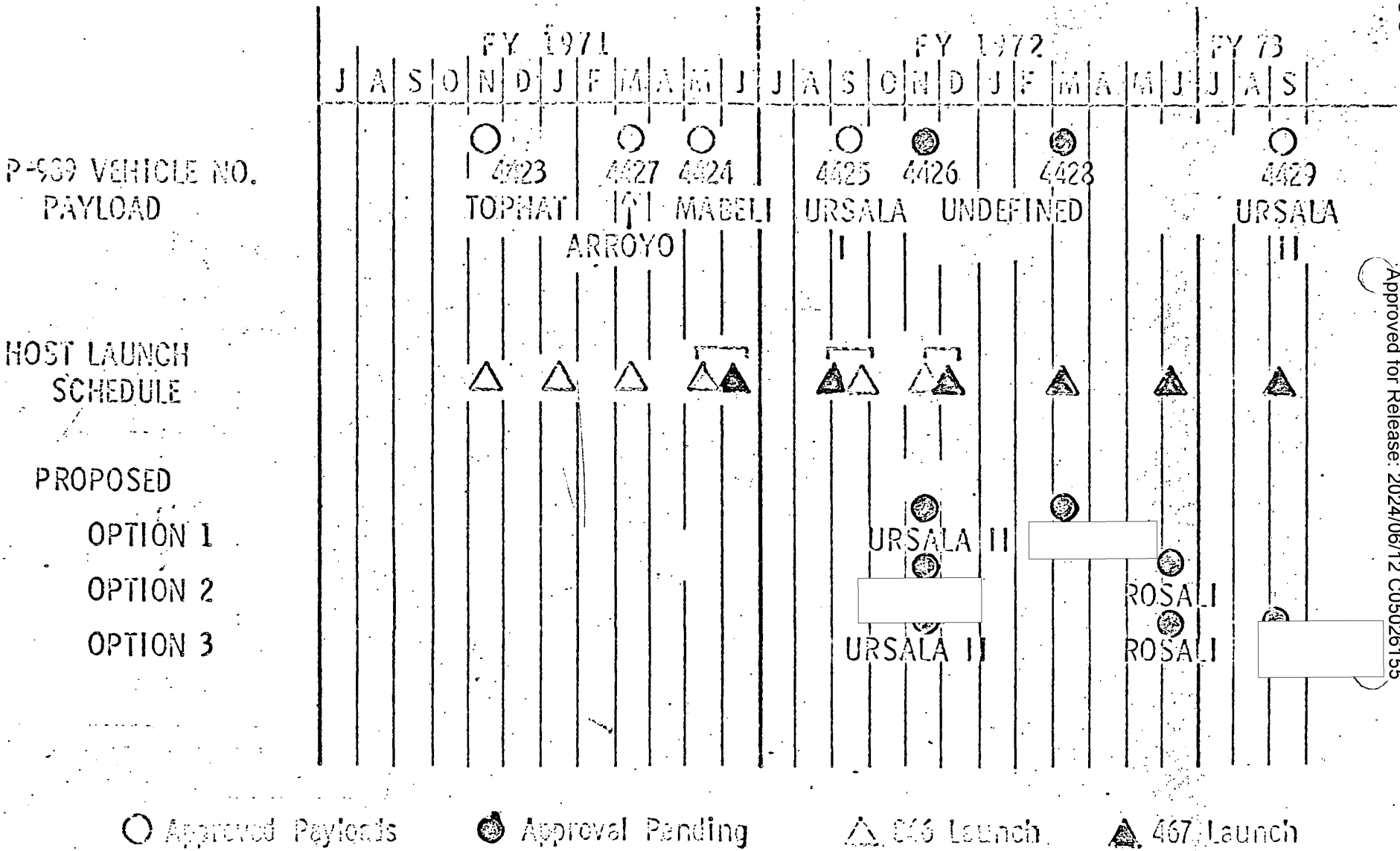

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CONCLUSIONS

- CURRENT ELINT SYSTEMS CAN CONTRIBUTE SIGNIFICANTLY TO OCEAN SURVEILLANCE MISSION IF SO TASKED.
- ADDITION OF SECOND URSALA SYSTEM TO CURRENT NRO PROGRAM WILL PERMIT DAILY LOCATION OF SURFACE SHIPS TO 10 NM ACCURACY PER USIB REQUIREMENT WITH LESS THAN SIX-HOUR REPORTING DELAY.
- ADDITION OF ROSALI SYSTEM WILL ALSO MEET USIB REQUIREMENT WITH LESS THAN TWO-HOUR REPORTING DELAY.
- FURTHER STUDY IS NEEDED TO MEET STRINGENT COVERAGE REQUIREMENTS ESTABLISHED BY USN.

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RECOMMENDATIONS

- TASK CURRENT SYSTEMS FOR OCEAN SURVEILLANCE AND PROCESS DATA IN QRC MODE.

- APPROVE SECOND URSALA OR ROSALI (DEPENDING ON CRITICALITY OF RESPONSE TIME) TO PROVIDE CAPABILITY FOR MEETING USIB OCEAN SURVEILLANCE REQUIREMENT.

- PERFORM DETAILED TRADE-OFF STUDY OF NEW OCEAN SURVEILLANCE SYSTEM CONCEPT FOR LONG TERM SOLUTION.

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DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
WASHINGTON, D.C. 20350

VIA BYEMAN CONTROL SYSTEM ONLY

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BYE 66442/70

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27 OCT 1970

MEMORANDUM FOR THE DIRECTOR NATIONAL RECONNAISSANCE OFFICE

Subj: POPPY for Ocean Surveillance

Ref: (a) NRO uncontrolled memorandum on 14 Sep 70, subject as above.

1. In accordance with the request contained in reference (a), the following response to the questions enumerated is provided.

a. Existing Stations.

(1) [redacted] The equipment list provided in the Director Program C proposal of 17 August 70 is appropriate. The O&M equipment costs for [redacted] were in error. Costs should be $27,000, which includes start up costs, and expenditures for one time low risk type spare parts. The break down of equipment, deployment, equipment O&M and NRL personnel provided in NRO BYE serial 13117-70 of 13 October 1970 for [redacted] reflects proper magnitude and distribution of FY 71 funds.

(2) [redacted] The equipment O&M costs for [redacted] were in error. Corrected O&M costs are reflected in NRO BYE serial 13117-70 of 13 October. FY 73 and 75 funding required for the purchase of Model 86 computers was in error. Costs associated with purchase of these computers should read $429,000 each. It is recommended that these computers be purchased in FY 73, and deployed at six month intervals to assure earliest possible operational date and system uniformity. With deployment of each of these computers, equipment O&M funds required for [redacted] will increase to equal those associated with [redacted] (ie., $27,000 per station). Computer deployment costs for [redacted] are $15,000; for [redacted] $20,000. Software costs associated with these deployments are supported in the contractor services (computer) portion of the budget, and should not increase as a result of these deployments.

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(3). By NRO BYE serial 13117-70, of 13 October, 1970, funds were provided for one additional NRL site coordinator for the [redacted] site. It is proposed that each site be provided with a site coordinator, required at the time of computer procurement. If approved, the FY 73 and 75 (or FY 73) budget, as appropriate, should reflect this increased personnel support. Funds required for acquiring a site coordinator are $30,000 per man year.

(4). On 26 October 1970, the Program C office presented a briefing to the NRO, covering proposed improvements to 7107 primary spacecraft, and a proposed R&D spacecraft, which would result in quantum improvements in spacecraft capabilities for ocean surveillance as well as for other missions. The arenas of improved capability are extension of frequency coverage; 4 way duplication of selected bands (time over target and total weapon system intercept); customizing of frequency bands pairs to embrace [redacted] family; X-band de-cluttering by contiguous filtering; and mono-pulse DFing in conjunction with long base line [redacted] The briefing is being reduced to writing, and will be forwarded in the near future. In the interim, the following FY 71 budget impact as it pertains to ocean surveillance is provided:

7107 Primary Spacecraft

1). 4-way coverage of shipborne spectrum. a. improves time over target b. allows intercept of total weapon sys.	-	No additional cost
2). Band #8 revision to 2680-2840	-	No cost
3). Comb-filter in X band.	-	$ 50,000
Sub-total		$ 50,000

Ground Station

1). [redacted]	FY 72 -	$140,600
2). Advanced PDE Development	-	$185,000
Sub-total		$ 325,600

[redacted]

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Computer Services

1). Ephemeris (NWL) $ 65,000

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Sub-total - $ 65,000

Total - $440,000

7106 R&D Spacecraft Total - $2,062,000

1). A detailed description of the R&D payload, ground station investments, facilities investment, and services requirements was presented at the 26 October briefing of the NRO. This entire package is dedicated primarily to enhancement of ocean surveillance. All costs associated with this package should be identified with ocean surveillance. A detailed description of this package is being prepared, and will be forwarded to the NRO in the near future.

b. [redacted]

(1) Construction request has been approved in Navy FY 70 Milcon, and funds have been allocated to the Navy for construction of this building. Site selection is currently underway, as is planning for building modification. The schedule depicted in the Director Program C proposal is being adhered to, and no unprogrammed costs are envisaged.

(2) Order date for equipment is correct. Funding should be programmed in the FY 72 budget in the amount of $372,000. In addition, it has been determined that a blue complex is an operational necessity in order to derive full benefit from the coverage afforded by [redacted] geographic location. This increased capability represents a departure from the approved proposal submitted by the Director of Program C. In summary, FY 72 funds required for [redacted] now total $447,000. The increase is directly attributable to the necessity for having a blue complex. (Equipment O&M costs of approximately $10,000 is included in this total). In response to the specific question regarding equipment O&M costs for [redacted] costs for FY 72 are $10,000. Costs for subsequent FYs are $35,000 per year.

(3) Yes. No FY 72 funds are required; however, starting with FY 73, increased budget support in the amount of $40,000 is required to support a technical representative and to

absorb increased contractor support costs.

(4) With the approval of the acquisition of a blue complex for [redacted] no increased costs are envisaged for [redacted] In the absence of such approval, the following additional funda are required:

a. Increased personnel to support operational mission, including around the clock, seven day per week operation. - 2 man - $70,000

b. Communications circuits linking [redacted] with NSG and [redacted] - Undetermine*

*As this requirement for communications becomes firm, we will identify funds required. No FY 72 funding is anticipated; funds required in FY 73 and ongoing would approximate $70,000 plus one time installation costs (comms links).

c. [redacted]

(1) The status of [redacted] is unchanged; ie, the Congressional deliberations with regard to this station are on-going. As the determination is made to establish the facility at [redacted] equipment, equipment O&M, personnel, and personnel O&M resources required are those listed in the appropriate sections of the Secretary of the Navy proposal (BYE 61524/70 of 11 Jun 70). Funding requests will be submitted by the Navy to the NRO and to NSA, as appropriate, in sufficient time to be included in the regular budget deliberations for the appropriate fiscal year.

[redacted]
By direction