30 June 1970

SUMMARY OF [redacted]S BYE-1414-70 (SORS 16./32 of 25 June 1970
In [redacted]or meeting in Program "C" Office early 30 June 1970.

1. Cover Letter signed by [redacted] chairman of POPPY Ealuation Working Group.

2. The cover letter tabulates (1) a draft evaluation of POPPY Mission 7105 which is an amaggamation of the inputs from SORS Agencies and members of the 7105 Evaluation Workigg Group.

(2) It requests a review of attached draft for clarity and accuracy. The conclusions are of course subject to further considfeation in terms of the total NRP program.

(3) It is suggested that this draft evaluation not be lengthened so as to becomm tedious and repetitious. Commentss or sugestions by phone will be appreciated. The PEWG will meet on 7 July in foom 4E28 CIA Headquarters, at 0930 inorder to conclude this evaluationand forward it to SORS fpr consideration.

I. USIB REQUIREMENTS AGAINST WHICH POPPY, 7105 was DEFINED:

POPPY Mission 7105 designed to provide an on-orbit capability at all times, available for sampling as required to search the freq ency spectrum between ____ and _____ MHz. The specific USIB requirements (USIB D-41.14/246, 15 April 1965) stated objectives for general search SIGINT satellite collection which were to provide the identification of new and unusual signals whos accurate interpretation and analysis will provide information on new Sino-Soviet technological develdpments & by continued monitoring to detect changes in the electronic environment which could serve as indicators of unusual activity, imminence of hostilities or confirmation of information from other sources. In Nov 66, the USIV stated the Urgent need for SIGINT Satellite collection against Soviet ABM/AES systens (USIB-D-41.14/303) In response to the latter requirement, the NRO Modified Mixsion 7105 to provide dual-ball coverage of the frequency range from 150 to 3200 MHz in usuable frequency increments in order to provide data for geopositioning purposes using [redacted] The POPPY Command system was also modified to permit tasking on everyxorbit over the USSR; this increased by 3 or 4 orbits per day the collection orbits of previous POPPY systems.

II. POPPY MISSION 7105CAPABILITIES:

POPPY Mission 7105 retains the basic system design and functions of predecessor POPPY satellites. The basic design concept provides for the acquisition of gross frequency measurements, excellent PRF and scan rate measurements. DAta derived from the intercept of the same radar pulses by [redacted] can be utilized by the [redacted] technique to provide some location data. POPPY 7105 also carried experimental options to acquire some Pulse Width and Pulse Amplitude data. In Poppy 7105, the major emphasis was shifted towards optimizing the POPPY units for data collection to provide for ABM and EOB emitter location. 7105 consists of 4 independent satellites subsystems, each containin[redacted]rystal video receiving sysstems; 19 of these frequency bands[redacted]cated in more than a single subsystem. This increased the operational capability (compared to previous POPPYs) to

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provide dual [redacted] intercepts so that the difference in the time of arrival (DTO[redacted] single radar pulse into two subsatellite receiving systsms can be resolved by the use of [redacted] to produce location data. Although the versatility of command was enhanced in Mission 7105 to embrace multiple band tasking, this tasking is limited to a maximum of four bands per unit at one time in order to resolve frequency ambiguities. Poppy Mission 7105 consists of 4 separate satellite subsystems traversing the same circular earth orbit at an equatorial inclination of approximately 70° and at an altitude of approximately 500 N.M. and [redacted] These separate satellite subsystems were launched together as a

SECRET [redacted]

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Issue:

SECRET [redacted] systems" entry under "Ground Station" is recommended by NRL for $120K FY 1970 funding. It was not included in the President's Budget as an identified entry. What is it, and what is the appropriate FY 1970 initial approval?

Discussion:

NRL obligated $120K thru March 1969 for this account, and forecasts $200K additional for April thru June 1969. These amounts will cover the most of the $ for digitizing and data handling equipment for the Adak installation.

The $120K requested in FY 70 is to update the digitizing and data handling capability at [redacted] to make it identical to the three systems at the cryptologic services stations at [redacted] Because it could be deployed as an operational facility if necessary in the future, and because it is identical to the other ground stations, it is placed in the budget as a Ground Station item rather than as a test and evaluation item under Facilities. OK but better reason

Heretofore, all R&D evaluations with the on-orbit missions have been performed at the field site in [redacted] This has resulted in a burden on the site personnel and has degraded standard operational capability. NRL states that the upgrading of the [redacted] facility will provide a more readily accessible and useful facility for both payload and spacecraft support requiring R&D personnel than the [redacted] site.

Recommendation:

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~~SECRET~~ [redacted] discussion on the [redacted] requirement is necessary. ~~Reco~~ this $120K be initially-deferred.

FY 70 Financial Program Issue - NRL POPPY Test Equipment and Facilities

SECRET [redacted]

Issue:

NRL has recommended $755K funding for Test Equipment and Facilities vs. $375K in the President's Budget, and an FY 1969 total of $433K estimate ($313K obligated thru March, $120K estimated April thru June). What specific effort is intended, and what is the appropriate FY 1970 initial approval?

Discussion:

NRL made several references to an upgrading of the local ground station at [redacted] As denoted in the discussions for the issues on Computer Services and Operational Field Assistance, additional support will be required for Mission 7106 in evaluating ELINT payload performance and for orbital control. This item is in part to fund for equipment needs at [redacted] for the payload evaluation and stored command generation and transmission.

The other equipment stated needs in this item are to equip an expanded laboratory area at NRL (added 3600 sq. ft.), an RF anechoic room for payload/antenna measurements and a new vault area within the laboratory work area.

Recommendation:

More [redacted]ssions are necessary on [redacted] an expanded lab area at NRL, and [redacted] vault area. Recommend initial-approval of the $375K budgeted amount, and initial-deferral of $380K.

3 Jun 69

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Issue:

NRL has recommended $681K for Operational Field Assistance under "Services," which is lower than the President's Budget of $730K, but higher than the FY 1969 estimate of $560K. What are the reasons for the increases over FY 1969, and what is an appropriate amount for the FY 1970 initial approval?

Discussion:

In FY 1969, of the $560K, $85K was allocated to a Bendix support contract for spacecraft engineering evaluation, orbit control, and station keeping at the [redacted] The remaining $475K was allocated to an HRB support contract for design and development of ground station equipment and for two field technical representatives.

In FY 1970, NRL states the increase to $681K is due to the addition of one more technical representative at the [redacted] digitized field site and several added personnel at [redacted] for increased in-flight support. The 7106 mission will require added support because the spacecraft will be clustered in one group instead of two groups of two each which can be supported more readily due to their time phasing.

Recommendation:

More discussions are necessary on [redacted] and the proposed additional tech rep at [redacted] Recommend initial-approval of $560K (same amount as FY 1969), and initial-deferral of $121K.

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NMMNWK011
PP RUKQAAJ
DE RUKQAA 263 1450930
ZNY XXXXX VVV
P R 230930Z
ST
XXXXX

5/28/70

TOP SECRET

Handle via BYEMAN Control System

P R 282032Z
FM COMNAVSECGRU
INFO CNO
COMNAVINTCOM
CINCUSNAVEUR
COMSIXTHFLT
CINCLANTFLT
USCOMEASTLANT
DIRNSA
YSNKQAC/SAFSS(SOC)
ZEM
T O P S E C R E T BBBBB EARPUP BYEMAN CHANNELS
CNO HOLD AND PASS TO NRL
DIRNSA FOR K4
SAFSS(SOC) FOR
SPECIAL REPORTING REQUIREMENT
A. CINCLANTFLT 251851Z MAY 70 NOTAL
1. POPPY COVERAGE SVERDLOV CLG 846 AND KILDIN DDGs 971, REQUESTED REF A, APPROVED USIB(SORS) COMMENCING IMMED AND TERMINATING 070001Z JUN 70. UPON RECEIPT IMPLEMENT FOL PROCEDURES:
A. PROCESS EMITTERS IN SECOND PRIORITY AFTER UNIDENT AND REPORT AT IMMEDIATE PRECEDENCE TO CINCLANTFLT, COMSIXTHFLT AND CINCUSNAVEUR, INFO/PRIORITY TO CNO, COMNAVINTCOM, COMNAVSECGRU, NFOIO AND INCLUDE PASSING INSTRUCTIONS "CINCUSNAVEUR HOLD AND PASS TO USCOMEASTLANT" AND PASS TO FOSIF ROTA".
B. REPORT IN FOL FORMAT:
SPECIAL SHIPBORNE LOCATION (SERIAL NR)
1. INTERCEPT TIME AND UNIT
2. EMITTER NAME
3. LOCATION AND LOCATION QUALITY RATING
CONTINUE TO REPORT ALL SHIPBORNE LOCATIONS USING EXISTING FORMAT IN THE SUPPLEMENTARY LOCATION REPORT.
2. AUTH GRANTED UTILIZE UNTASKED ORBITS BETWEEN 150-170 DEGREES EQX FOR SUPPORT ABOVE REQUIREMENT USING 7105/7106 TASK GRPS 33/34 AND R02 RESPECTIVELY.
3. MOST RECENT NFOIO ANALYSIS INDICATES SVERDLOV 846 AND KILDIN 971 TRANSITED STRAITS GIB EVENING 27 MAY INTO MED. BOTH UNITS DECLARED FOR TRANSIT BOSPORUS 4 JUN.
300

TOR 1030
6-1-70
5614
5170

TOP SECRET

Handle via BYEMAN Control System

TWX076
PP RUXCAAJ
DE RUXQAA 403 1541755
ZNY XXXXX VVV
P 031750Z
BT
XXXXX
[redacted]

~~TOP SECRET~~ [redacted]

Handle via BYEMAN Control System

Ship Tasking

TOR 1330 6-3-70 5614

5/70

P 021859Z
FM CNO
TO OPCEN
INFO SSO DIA
DIRNSA
AFSSO USAF
STATE RCI
SSO ACSI DA, WASH D. C.
COMNAVSECGRU
ZEN/NRL
ZEN/KOMNAINTCOM
ZEN
~~T O P S E C R E T~~ BBBBB EARPOP BYEMAN CHANNELS
SSO DIA KEEP AND PASS SAFSS [redacted]
OPCEN FOR DR. C. COOK. [redacted]
SAFSS FOR [redacted]
DIRNSA FOR MR. JOHN LIBBERT
[redacted]
TASKING REQUIREMENT
1. ORIG HAS RECEIVED HIGH PRIORITY REQUIREMENT FROM NAVAL COMMANDERS IN EUROPE FOR POPPY LOCATION, AND TACTICAL REPORTING, ON MAJOR SOVFLT SURFACE UNITS DEPLOYED IN MEDITERRANEAN SEA. REQUIREMENT IS FOR REPORTING TO COMMENCE ASAP AND CONTINUE FOR INDEFINITE PERIOD.
2. SUPPORTING RATIONALE FOR THIS REQUIREMENT FOLLOWS:
A. ANTICIPATED INCREASED TEMPO OF SOVIET NAVAL OPERATIONS BASED ON POSSIBLE ENTRY OF KHA/CLG GROUPS FROM ATLANTIC AND PRESENT MONTREAUX CONVENTION DECLARATIONS FROM BLACK SEA FLEET.
B. GEO LOCATIONAL INACCURACY OF MED/NORM DF REPORTS DUE TO TEMPORARY LOSS OF SELECTED SITES BEARING SUPPORT.
C. UNACCEPTABLE TIME LAPSES BETWEEN DF GEOLOCATIONAL REPORTS ON SOVIET NAVAL UNITS CAUSED BY INCREASED USE OF EMCON AND MORE SOPHISTICATED COMMS. TIME LAPSES IN EXCESS OF SIX HOURS CONSIDERED UNACCEPTABLE FOR MAINTAINING A TACTICAL OPERATIONAL PLOT IN MED ENVIRONMENT. LOCATIONAL INFO ON MED DEPLOYED SOVIET NAVAL UNITS IS BASED PRIMARILY ON DF (NORMALLY IN EXCESS OF 90 PER CENT AND FREQUENTLY 100 PER CENT) WITH TIME LAPSES IN EXCESS OF TWELVE HOURS BEING A NORM.
D. LIMITED AIR AND SURFACE SURVEILLANCE RESOURCES.
E. SIXTHFLT INVOLVEMENT IN MAJOR NATO EXERCISE PERIOD 3 TO 15 JUN.
F. INCREASED TENSIONS IN MID-EAST, WITH LATENT POSSIBILITY OF SOVFLT INVOLVEMENT IN HOSTILE ACTION IN THAT AREA.
3. ACCORDINGLY, IT IS REQUESTED THAT THE FOLLOWING REQUIREMENT FOR POPPY BE APPROVED.
A. TASKING - AUTHORITY FOR SAFSS TO CONTINUE OPTIMIZED TASKING OF ROUTINELY UNTASKED ORBITS (APPROX 2 PER DAY PER SERIES) IN AREA OF WESTERN MED AND EASTERN ATLANTIC.
B. FIELD PROCESSING - AUTHORITY FOR [redacted] TO FIELD PROCESS [redacted] NET EMITTERS ASSOCIATED WITH SOVFLT UNITS DEPLOYED IN MED.
4. IF APPROVED, ORIG WILL INFORM SORS IMMEDIATELY WHEN REQUIREMENT HAS BEEN FULFILLED.
520

~~TOP SECRET~~ [redacted]

Handle via BYEMAN Control System

NNNNTWX130
PP RUXQAAJ
DE RUXQAA 519 1570105
ZNY XXXXX VVV
P 060105Z
BT
XXXXX

[redacted]

S. Tasking

~~TOP SECRET~~ [redacted]

Handle via BYEMAN Control System

440

for 6-8-70

5644

P R 051712Z
FM COMNAVSECGRU
[redacted]
INFO CNO
COMNAVINTCOM
CINCUSNAVEUR
COMSIXTHFLT
CINCLANTFLT
USCOMEASTLANT
DIRNSA
YSNKQAC/SAFSS (SOC)
ZEM
~~T O P S E C R E T~~ BBBBB ~~EARPOP~~ BYEMAN CHANNELS
CNO HOLD AND PASS TO NRL
CINCUSNAVEUR HOLD AND PASS TO USCOMEASTLANT
SPECIAL REPORTING REQUIREMENT
A. MY 282032Z MAY 70
1. SPECIAL REPORTING REQUIREMENT REF A HEREBY TERMINATED.
2. UPON RECEIPT IMPLEMENT SPECIAL REPORTING/PROCESSING PROCEDURES AS FOL:
A. GEOLOCATION PROCESS ALL [redacted] AND [redacted] EMITTER INTERCEPTS IN EQUAL PRIORITY IMMED FOL PROCESSING UNIDENT [redacted] INTERCEPTS. REMAINDER PRIORITY PROCESSING UNCHANGED.
B. REPORT IMPACTS CORRELATED TO CHG, CLGM, CL/CLG, DDGS, DLG, AND DDG PLATFORMS IN MEDITERRANEAN, BLACK SEA, AND ATLANTIC APPROACHES TO MEDITERRANEAN AT IMMED PRECEDENCE TO COMSIXTHFLT, CINCUSNAVEUR, AND [redacted], INFO/PRIORITY TO CNO, COMNAVINTCOM, COMNAVSECGRU, NFOIO, AND CINCLANTFLT. INCLUDE PASSING INSTR "CINCUSNAVEUR HOLD AND PASS TO USCOMEASTLANT" AND [redacted] PASS TO FOSIF ROTA". IN ADDITION, REPORT IMPACTS WHICH CANNOT BE EQUATED TO SPECIFIC UNIT OR UNIT TYPE AS "UNEQUATED".
C. REPORT GEOLOCATION IMPACTS CORRELATED TO KRESTA II CLGM PN 585 AND PEYTA PCE PN 636 AT IMMED PRECEDENCE TO CINCLANTFLT AND CINCUSNAVEUR, INFO/PRIORITY TO CNO, COMNAVINTCOM, COMNAVSECGRU, COMSIXTHFLT AND NFOIO. INCLUDE PASSING INSTR "CINCUSNAVEUR HOLD AND PASS TO USCOMEASTLANT".
D. REPORT IN TANGO/KILO CHANNELS USING FOL FORMAT:
SPECIAL SHIPBORNE LOCATION REPORT (SERIAL NR)
1. INTERCEPT TIME AND UNIT (IF CORRELATED)
2. EMITTER NAME
3. LOCATION FIX AND QUAL RATING
CONTINUE REPORT ALL SHIPBORNE LOCATIONS IN EXISTING SUPPLEMENTARY LOCATION REPORT.
3. AUTH GRANTED UTILIZE UNTASKED ORBITS BETWEEN 150-170 DEGREES EQX FOR SUPPORT ABOVE REQUIREMENT USING 7105/7106 TASK GRPS 33/34 AND R02 RESPECTIVELY.
4. ANTICIPATE REQUIREMENT PARA 2B ABOVE MAY BE RENEWED IN 30 DAY INCREMENTS PRIOR EXPIRATION CURRENT AUTHORITY FOR SPECIAL SUPPORT TO FLEET COMMANDERS.
440

~~TOP SECRET~~ [redacted]

Handle via BYEMAN Control System

NNNNTWX174
RR RUXQAAJ
DE RUXQAA 576 1600920
ZNY XXXXX VVV
R 090920Z
BT
XXXXX

TOR
0910
6-19-70

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Handle via BYEMAN Control System

5614

P. Tashing
Rptg

P R 082028Z
FM COMNAVSECGRU

INFO CNO
COMNAVINTCOM
CINCUSNAVEUR
COMSIXTHFLT
CINCLANTFLT
USCOMEASTLANT
DIRNSA
YSNKQAC/SAFSS (SOC)
ZEM
~~T O P S E C R E T~~ BBBBB ~~EARPOP~~ BYEMAN CHANNELS
CNO HOLD AND PASS TO NRL
CINCUSNAVEUR HOLD AND PASS TO USCOMEASTLANT
DIRNSA FOR K4
SAFSS (SOC) FOR
SPECIAL REPORTING REQUIREMENT
A. MY 051712Z JUN 70
1. KRESTA CLGM 550 AND KOTLIN DD 304 SIGHTED LEAVING NORTHERN FLEET WATERS WITH NAVAL OILER IN COMPANY. FOUR CONVENTIONALLY POWERED SUBMARINES PROB ALSO IN COMPANY. ANTICIPATE THESE UNITS, AND POSS OTHERS, CURRENTLY TRANSITING TO MEDITERRANEAN.
2. COMMENCING UPON RECEIPT, INCLUDE KRESTA 550 AND KOTLIN 304 REPORTING CRITERIA ESTAB REF A PARA 2C. UPON ENTRY MEDITERRANEAN REPORT IAW CRITERIA REF A PARA 2B.
190

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NAVAL RESEARCH LABORATORY
WASHINGTON, D.C. 20390

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CONTROL SYSTEMS JOINTLY

BYE-51906-70
18 June 1970

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From: Director, Naval Research Laboratory
To: Commander, Naval Intelligence Command, [illegible]
(ATTN: [redacted])

Subj: POPPY Collection System Correlation with [illegible] and forwarding of

Encl: (1) Two copies of subject report

1. Enclosure (1) is forwarded herewith.

[redacted]

By direction

PAGE 1 OF 1 PAGE
COPY 3 OF 4 COPIES

~~TOP SECRET~~ [redacted]

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CONTROL SYSTEM ONLY

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POPPY COLLECTION SYSTEM CORRELATION WITH USIB GUIDANCE

17 June 1970

Prepared by
L. Hammarstrom

Reviewed by
R. D. Mayo

Electronic Warfare Division
Naval Research Laboratory
Washington, D.C. 20390

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Encl (1) to NRL ltr
5614-230:LMH:mab

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CONTROL SYSTEMS JOINTLY

OUTLINE

I. General Philosophy

A. Collection Technique

B. Frequency Coverage

C. Geographic Coverage

D. Examples of Weapons Systems Collected

II. Matching of USIB Requirements

A. General Statement

B. Matching Mission with General Requirements

C. Specific Comparisons of USIB Annex

III. Summary

Annex I - Example of a Weapon System Search

Annex II - USIB Annex as Met by POPPY 7106-07

ABSTRACT

The mission philosophy and the specific mission designs of Missions 7106 and 7107 are compared to the basic USIB objectives and to the detailed USIB requirements. Specific examples are included to illustrate the success of the match.

HANDLE VIA BYEMAN-TALENT-KEYHOLE CONTROL SYSTEMS JOINTLY

I. POPPY is unique among the satellite systems in that it is designed against a basic philosophy as compared to most other systems which are designed against a specific requirement, i.e., SA-5 recognition, EOB collection, time coverage of SARY SHAGAN, etc. The basic philosophy of POPPY is weapon system collection. Toward meeting this primary USIB objective, the following are the guidelines used in the Mission definition.

A. Collection Technique

The collection should be done so that the maximum intelligence is obtained on the emitter system. The order of parameter importance for isolating and identifying new weapons systems through to providing a detailed assessment of the performance capabilities and limitations of a weapons systems is as follows. The primary parameters for isolating new weapons systems are antenna scan and PRF information from which the basic function of the radar is determined [redacted] etc.). The next level of parameter determination is for assessing the emitter performance capabilities and limitations. These are the measurement of power, pulse width, frequency, as well as chirp, pulse coding, phase reversals, etc. The first three parameters of this level are general and as such are necessary in the primary collection system. The latter ones are more specific and are instrumented and used on a case by case basis. The design of POPPY basically follows this priority order and the following considerations.

The collection system should be simple to minimize the influence of the collection technique on the wide range of characteristics of the radar weapon system and to enhance the spacecraft life-time characteristics.

The final characteristic is that the collection technique should have a frequency independent location (geopositioning) capability simultaneously available on all elements of a weapons system. Thus by frequency independance geopositioning all elements of the weapons systems are equally weighed in their interrelationships and usage patterns and the second priority of Electronic Order of Battle and Surveillance can be met over the entire weapons system. The specific collection technique which covers the full frequency range of the weapon systems and best matches the above philosophy is that of a broad band crystal-video system. The frequency coverage of these crystal video systems giving 100% intercept probabilities is basically designed around specific "Magnetron Families" based on this and other intelligence on Soviet and other reactive weapons, and the sensitivities and bandwidths are established to optimize (1) full main-beam collection on all weapon systems, (2) realizable processing data densities, and (3) the avoidance of interference to ELINT collection such as T.V., FM and communication systems, etc.

B. Frequency Coverage

The Mission should operate over the entire frequency range of all weapon system radars from the ionospheric to the atmospheric ga limitations. This range, basically is from 150 MHz to 18 GHz and is

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defined by the USIB requirements as the highest priority range for ELINT collection.

The complete R.F. range of weapon systems operation should be simultaneously collected to provide the total picture of all the elements of the weapon system. To provide this full capability is a quite difficult engineering task. Mission 7106, however, as launched had an instantaneous frequency coverage from 153 MHz to 9340 MHz. This allowed observation of almost all the deployed threat radar for establishing activity levels, usage patterns, and recognition of frequency-agile or frequency-diverse radars which might escape detection by any sampling of the same frequency range using a narrow-band collection system.

C. Geographic Coverage

Weapons systems may spread over thousands of miles and be capable of directing their elements from the horizon through zenith or they may be restricted to some azimuth or elevation range. In order to provide maximum intelligence collection against these wide ranges of conditions of weapon system operation, the collection mission should have omnidirectional horizon-to-horizon coverage over the entire frequency range. Thus it can provide much greater geographic coverage as opposed to operating directly below the spacecraft on a restricted geographic area. This coverage to the horizon is very important for obtaining the scan characteristics and operational modes of many of the weapon systems radars. The altitude of the space-craft should be high enough to maximize the geographic coverage

without being so high as to reduce the signal to noise ratio or to not be able to observe the full operation of the radars (i.e., satellites which are too high do not have enough motion relative to the ground targets to observe the total weapons system scan and sector coverage patterns). While any choice is a compromise, for POPPY the specific orbit chosen is 70° inclination and a 500 N. mile altitude.

POPPY's final mission design constitutes an integration of the above guidelines with cost, engineering considerations and the basic technical requirements consistent with the overall philosophy of weapons systems collection.

D. Examples

Examples of some specific weapons systems' radars which POPPY provides the intelligence community with data are listed on the following four pages. An example of an active data collection and isolation of a specific weapon system radar is covered in ANNEX 1.

An example of a collection pass over the Eastern Atlantic on page 9 illustrates the horizon coverage capability as well as the relative motion with respect to the ground which provides sector and scan dimension definition. An example which is used to illustrate the ranking of parameter importance as discussed under collection technique is shown on page 9a. Page 9b is a discussion of the POPPY demonstrated capabilities against frequency agile radars.

SOVIET ABM RADARS

Radar Name	Code
DOG HOUSE	(B389Z)

The following are exerpts of a series of messages in the hunt for the [redacted]

1. NSA 6 March 1970 - "All available highly accurate satellite data reviewed for ELINT from [redacted] (Missions 7228, 7229, 7230, 7232, 7326, 7327, 7325, 7233, 7234, and 7165). A candidate for a component of [redacted]

2. NSA 23 March 1970 - "Subject: [redacted] candidate isolated in [redacted]' 'Increased probability that [redacted] has been isolated.'"

3. NSA 2 April 1970 - Missions 7104-05-06 searched. "Search is incomplete, but one intercept located at [redacted] with a 1 x 4 N.M. Cep."

[redacted]

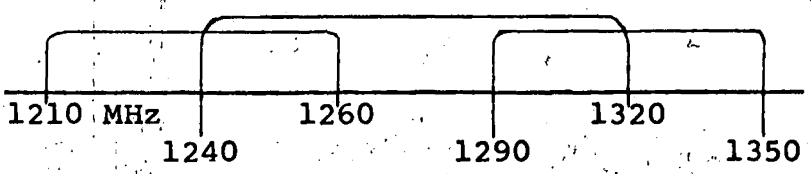
In summary, all other satellite collection systems were helpless without scan to assess the role of this radar. The conclusion from this classic case is verification of POPPY's basic concept of weapons system parameter priority weighting of scan and PRF.

There have been two different techniques used for collection against frequency agility radars.

1. Mission 7103 (Jan 1964)

   Technique - Multiple R.F. Bands

   Frequency -



   Accuracy < 3%

   Radar - [redacted]

2. Mission 7106 (Oct 1969)

   Technique - Broad Band Discriminator

   Accuracy ≃ 1%

Both of these techniques can be built to cover any of the frequency ranges of POPPY. The basic POPPY missions of continuous frequency coverage does provide full collection of frequency agile radars. The frequency agility range and accuracy can be determined to the resolution of Table 1.

II. Matching of Requirements of USIB

A. General. This section compares the basic requirements (Items 1-38) to the POPPY Missions 7106 and 7107. The general overall response to these requirements has been to indicate where POPPY can make significant contributions. These areas are noted in the tabulations by a yes, indicating that POPPY, through Missions 7106-7107, can make significant contributions. The detailed explanations of each Annex Line Number will put a perspective as to whether POPPY meets a part of the requirements of the systems or whether POPPY exceeds them for all of the systems.

B. Matching Missions with General Requirements.

Annex Line No.

1. Value of frequency used. The philosophy on R.F. determination is that the complete tuning range of a "magnetron AND OTHER RADAR FREQUENCY-SENSITIVE DEVICES IN RADAR TRANSMITTERS family" be covered by a receiving band. The intent is to be able to intercept all the emitters of a family regardless of where an individual radar may be tuned to observe all the modes of operation of the family. Providing continuous overlapping coverage makes certain that the system is not out-flanked by a shift in frequency and by attempting to match a "magnetron family", frequency outside the expected range are quickly and easily recognized. This philosophy's success has been illustrated many times. Two recent examples

were POPPY's recognition of a new higher [redacted] frequency and of the extension of the [redacted] CE above and below its old magnetron limits of 4910-5220. In summary, POPPY's basic philosophy is that in most radars they do not have an exact frequency and that the use of the radar over the entire magnetron tuning range as is limited in its basic design is done routinely and as a matter of necessity in many cases to avoid mutual interference between radars. The basic POPPY approach is to detect changes in the basic design which gives more capability and flexibility to the radar. It is by following this philosophy that the basic aims of the USIB guidance are met, i.e., identification and initial estimates, and technical assessment of capabilities. See Table 1 for overall percentage accuracy as a function of frequency.

For specific radars where R.F. frequency is important to the radar itself, such as the frequency steered antennas or frequency agility, POPPY has a capability of broad band R.F. measurement which is accurate to about 1% currently in Mission 7106 on payload 176 covering the 360 to 440 MHz range and the 830 to 935 MHz band. This system may be extended in frequency range in the fifth operational spacecraft of Mission 7107 to provide coverage of other frequency dependent radars.

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TABLE 1

COMBINED 7106/7107 FREQUENCY RESOLUTION

RF Coverage	Resolution (%)	RF Coverage	Resolution (%)
154-165	± 3.5	5250-5260	± 0.1
165-200	± 9.6	5260-5820	± 5.1
200-240	± 9.1	5820-5850	± 0.3
240-350	±19.1	5850-5875	± 0.2
350-450	±12.5*	5875-6690	± 6.5
450-550	±10.0	6690-6700	± 0.1
550-650	± 8.4	6700-6725	± 0.2
650-815	±11.3	6725-6790	± 0.5
815-822	± 0.5	6790-7300	± 3.6
822-836	± 0.9	7300-7350	± 0.4
836-923	± 5.0*	7350-7860	± 3.4
923-970	± 2.5	7860-7900	± 0.3
970-1080	± 5.4	7900-7915	± 0.1
1080-1092	± 0.6	7915-8580	± 4.1
1092-1200	± 4.7	8580-8600	± 0.1
1200-1800	±20.0	8600-9100	± 2.9
1800-2085	± 7.4	9100-9315	± 1.2
2085-2100	± 0.4	9315-9340	± 0.2
2100-2580	±10.3	9340-9360	± 0.1
2580-2593	± 0.3	9360-9400	± 0.2
2593-2680	± 1.7	9400-9450	± 0.3
2680-2692	± 0.3	9450-9570	± 0.7
2692-2800	± 2.0	9570-9600	± 0.2
2800-2920	± 2.1	9600-10,040	± 2.3
2920-2930	± 0.2	10,040-10,500	± 2.3
2930-3105	± 2.9	12,500-14,600	± 7.8
3105-3120	± 0.3	14,600-14,800	± 1.4
3120-3125	± 0.1	14,800-14,900	± 0.7
3125-3275	± 2.4	14,900-15,100	± 1.3
3275-3300	± 0.4	17,000-18,000	± 5.7
3300-3315	± 0.3	34,500-34,900	± 1.2
3315-3600	± 4.1		
3600-3615	± 0.2		
3615-4010	± 5.2		
4010-4050	± 0.5		
4050-4830	± 8.8		
4830-4850	± 0.2		
4850-4880	± 0.3		
4880-5220	±		
5220-5250	±		

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(Note the higher tolerances often found where little Soviet activity has been found to exist, or at lower frequencies where ~~of~~ the difficulty of building broad-band exponents is lesser than at higher f's.

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*Note: 176 has 1% capability.

2. Number of frequencies used. This varies according to the spread of the frequencies consistent with Table 1. Examples of specific multiple frequency radars which POPPY has been instrumental in determining the number of frequencies are C327 and T-8833/34.

3. Short term stability. No capability.

4. Long term stability. No capability.

5. Pulse to pulse coherence. No capability.

6. Operating frequency limits. Capability as described in #1.

7. Agility band limits. Capability as described in #1.

8. Basic Pulse Repetition Intervals (PRI). The most accurately measured parameter of the POPPY system. Short term accuracies (30-50 msec) of 1 to 2 μsec (0.1% on a 500 pps signal). Long term accuracies (30-50 seconds) of 1 to 3 Nsec (10^{-6} on a 500 pps signal).

9. PRI Stability. Available either as above or over months or years of multiple intercept. This is the parameter on which the fingerprinting of ships as well as other radars, such as [redacted] depends and on which POPPY has had outstanding success.

10. Pulse Group Pattern. The group patterns are available for almost all radars to the accuracies stated above in 8 or 9. A specific example of this is the [redacted] group pattern. [redacted]

11. Pulse Interval within Group. Available if the interval exceeds the transponded pulse width of from 80 to 200 μsec. Accuracy is as in 8 and 9. Specific example would be separation.

12. PRI Modulation Type, limits and rate. Fully available on all types of PRI modulation. Specific examples run from the pseudo-random to the more conventional two or three element stagger of radars like

13. Relationship of PRI to other parameters. In addition to broad weapon system correlations, an example of the POPPY system correlations of PRI to scan is readily available as, for example, direct correlation of scan to one tenth the PRF of the Correlations with power and pulse width can be made as well as to elevation.

14. Time Relationship of PRI Multiple Pulse Trains. The VHF to K-band coverage allows time relationships between multiple pulse trains either on one R.F. or over a wide range to the basic accuracies of item 7 and 8. A specific example is in R.F. transmission.

15.

16. [redacted]

17. [redacted]

18. Modulation type. Observable, (but no capability to do detailed analysis) For example, the initial recognition of the [redacted] normally

19.-26. Intrapulse and nonpulsed characteristics. No capability at present time, some preliminary R&D will be done in the fifth 7107 payload. CW capability optn was available

27. Type of Scan. POPPY's basic main-beam concept combined with the omnidirectional antenna patterns makes scan types easily recognizable and has been a major asset in achieving the wide range of firsts on Soviet unknowns from ABM to SAMs. The simultaneous coverage of an R.F. range by two satellites and the power measurement capability provide the measurements necessary for definition of complex or exotic scan types. It is NRL's contention that scan rate and pattern is a most important parameter in analyzing a new system, as well as recognizing purposes and modes of known systems.

28. Scan modes. As in 27 a strong point.

29. Scan Rate. Easily measurable to high accuracy for the reasons listed above. The best example of the high accuracy is in establishing the exact synchronism of [redacted] rate to the [redacted] rate to an accuracy of parts in 10^{-6}.

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30. Scan Dimensions. As in 27 the dimensions are easily ascertained to high accuracy, for example, POPPY's definition of the sector coverage on all the ABM radars.

31. Orientation. As in 30 very accurately defined.

32. Beam Width. The above mentioned capabilities combined with a signal level capability on all bands gives a complete beam width capability.

33. Polarization. The capability exists in a number of R.F. ranges in 7106 and will be available in 7107 over most of the bands where requirements exist.

34. Side Lobes/Grating Lobes, amplitudes and location. Available on most bands, with some having selectable sensitivity to allow deep definition of lower lobes. Examples of grating lobe definition have been on ABM radars while on a complex beam radar such as [redacted] side lobes have been located and measured.

35. Number of beams and relative position. As 27-34 have described, the system provides full description of beams and position.

36. Radiated Power. Available on all bands to an accuracy of 3 db without calibration and to a higher accuracy with calibration (see Table 3). For a specific example of power and beam measurements see NSA ELT 39-70 R051900Z June.BYEMAN

Sub-reference noted in

TABLE 3

MISSION 7106 SIGNAL LEVEL MEASUREMENT

Readout Format Binary Count	Signal Level DB Above Threshold(Pr)
1	Solid
2	+ 1.5
3	+ 3.0
4	+ 4.5
5	+ 5
6	+ 6
7	+ 6.5
8	+ 7.5
9	+ 8.5
10	+10.5
11	+12.5
12	+14.5
13	+17.5
14	+22
15	+25.5

37. Location Accuracy. Location accuracies have been steadily improving from the 1967 accuracies of 25 to 50 N miles to 1970 accuracies of less than 10 N miles routinely with specific locations being less than 1-2 N miles. Improvements in basic ephemeris, which are now being tested, show over a factor of 3 further improvement and other improvements are planned.

plural

e

NOT IN LOCATION

38. Periodicity. POPPY has a demonstrated capability to respond over any sampling period from hours to years. The best tactical example was during the Russian Okean exercise of April and May 1970. POPPY provided locations within slightly more than four hours of intercept on almost the entire Soviet Navy with a periodicity such that almost all the Soviet ships were tracked. Needless to say, slow strategic sampling is not a problem (see Table 4). Two examples of the ship tracking capability are shown on Tables 5 & 6. This same EOB capability is available on any radar listed on Table 4, as is demonstrated on page 23 by the plot of the [redacted] radars located largely over an eight week period by [redacted]. All of the data presented does not represent evaluated intelligence. It is presented to demonstrate or highlight POPPY Weapon Systems collection capability.

TOC should be qualified for emitter type and ship type i.e. standoff/cruisers as well as fleet

confirmed by NSA

TABLE 5

INTER-OCEAN TRANSFER
KRESTA
CLCM 532
QA: POPPY FIXES

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RUSSIAN NAVAL EXERCISE
April-May 1970

A few of the Soviet vessels tracked

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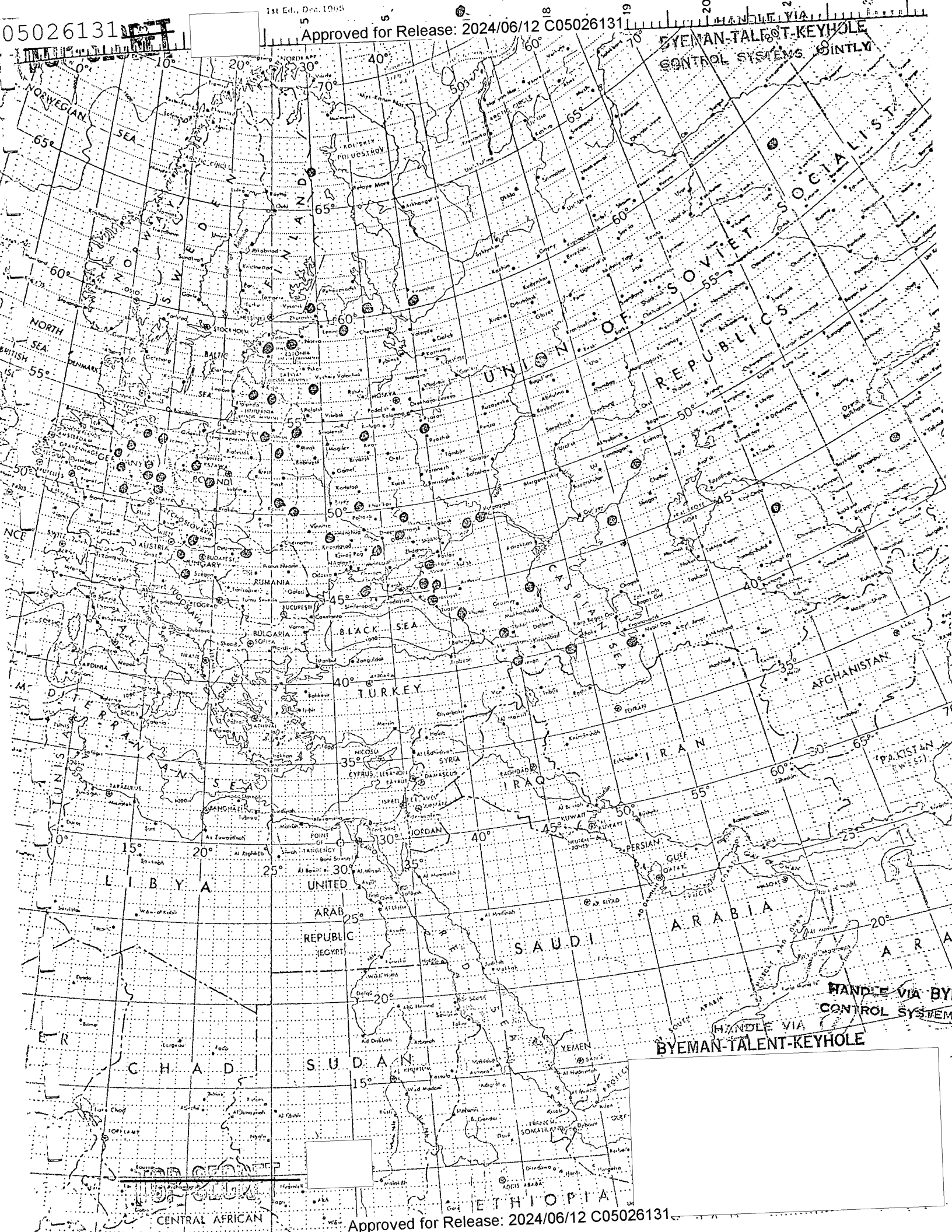
1st Ed., Dec. 1965



C. Specific comparisions of USIB ANNEX with POPPY capabilities.

The individual USIB requirements are compared to the POPPY capabilities in ANNEX 2. Excerpts of an "End Product" report to which POPPY's weapon system collection met the many USIB collection requirements are on the following page.

III. Summary

Even though the system is not designed against specific unmet needs, as listed in the Annex of the USIB guidance, POPPY does contribute to a significant number of these. Table #5 is a tabulation of these contributions.

Final proof of the success of the POPPY philosophy is given by the wide range of highly important firsts, ranging from being the Free World's first successful ELINT satellite to being the major contributor to defining the nation's highest priority Russian ABM intelligence gaps. POPPY's success is continuing in new areas by being the U.S.'s first tactical ELINT collection and processing system as has been so successfully demonstrated against the largest Soviet Naval exercise in history.

TABLE 5

SUMMARY OF POPPY CONTRIBUTIONS TO USIB REQUIREMENTS

Measurement Accuracy Required

USIB Priority	No. of USIB Requirements	No. of POPPY Contributions	% of POPPY Contributions to Total USIB Requirements
		CATEGORY A	
1	258	192	74.4
2	118	97	82.2
3	6	6	100.0
Not Listed	12	12	100.0
		CATEGORY B	
1	233	162	69.5
2	188	116	61.7
3	84	42	50.0
Not Listed	30	30	100.0
		CATEGORY C	
Not Listed	257	140	54.5
		EOB	
Not Listed	24	24	100.0

ANNEX I

EXAMPLE OF A WEAPONS SYSTEM SEARCH

As a specific example of the preliminary aspects of isolating an element of a weapons system element the following example is presented to give a deeper meaning to the previous philosophical discussion. This is raw field data which is not in any way ~~authorized~~ cert: f.k.d by NSA for its intelligence accuracy. This example is used because it gives a good representation of a wide number of the philosophical aspects discussed and it shows the kind of data which is given to the intelligence analyst for detailed study. The signal has had a long history of intercept, but an initial assessment of its characteristics had given it a friendly classification. Higher processing priorities and limited processing capability prevented any work until late in the summer of 1969. The signal was given the temporary notation of [redacted] and [redacted] this Spring (April 2) and has had the following parameters:

[redacted]

Examples of the field analysis plots give more perspective into isolating the signal. The first plot is a raster scan plot which has a raster rate of 3.8 seconds and is run on data in the 5820-6720 MHz band. Initial review of the scan data (Plot 1) reveals a constant

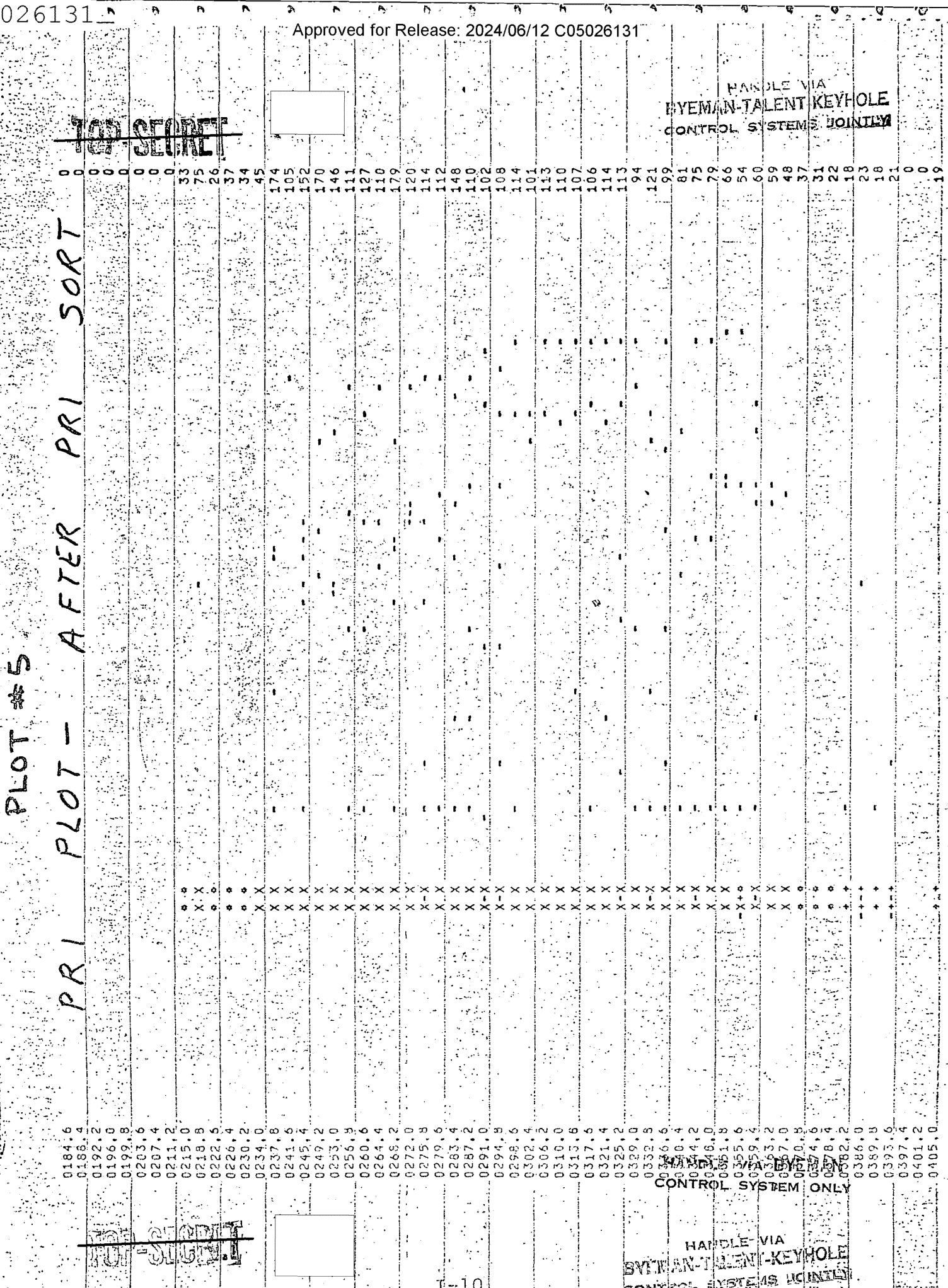
scan for [redacted] with the only unique aspect being a rather "fat" beam for a "C" band radar. The scan plot of the isolated emitter appears next (Plot 2) and shows no further information beyond the "fat" beam. The third plot, however, is an expanded scan plot which reveals, rather than a single beam, a multiple beam pattern or side lobes. An initial look by the field station revealed that for at least one observation the power level of these beams was within three db of the main beam. Several other plots from other intercepts have shown different patterns which increase the possibility of multiple beam pattern. In addition, under standard sensitivity collection of the main beam system as all of this has been, side lobes rarely appear. The judgment of whether this is long range track while scan function or merely extremely high level side lobes must await the intelligence analyst's detailed study of the signal level data.

The next aspect for examination is that of PRI. Plot #4 shows the raw PRI plot which shows that the 1875 pps range does have a signal present. Plot #5, which has been PRI sorted, reveals a rather unusual presentation. Most signals have a constant PRF and these plots show a constant vertical straight line of one character width, but this appears distributed over a range of values. Plot #6 reveals the reason, the signal is pulse frequency modulated with a triangular modulation at 55 cps rate. This is also roughly a single beam duration time (20 msec) as seen on the expanded [redacted] plot (Plot #3). Further analysis has shown

that two frequency ranges are locked in pulse synchronism and appear simultaneously in quite a few intercepts. POPPY has also intercepted the [redacted] operating simultaneously in these two frequency ranges with high element pulse modulation. Two other bands have had similar intercepts but to date correlations have not been made. There have also been what appear to be dual beam modes covering the 4.8-5.2 and 6.4-6.7 GHz bands.

Correlation of this unknown with a weapons systems' role have come from locations of the radar. [redacted] reported some of the prime intercepts on September 26, 1969, when four separate radars were observed operating from the [redacted] SAM training site each with a different pulse modulation format. These ranged from a simple two position stagger to a complex 18 element modulation. Further correlation with weapons system activity was also reported by three [redacted] radars all located at [redacted] operating simultaneously with the [redacted] and also displaying pulse modulations of 2 and 4 elements. Overall more than one hundred of these radars have been located and from at least 25 distinct radars. There have been no correlations with known radar hardware or known SA-5 sites and a large amount of activity has been received from Emba, but the long history of observation (first heard about the launch of 7104 in March 1965 as reported by field analysts) also throws doubt on SA-6 association. At this point the intelligence analysis must take over

PLOT #5
PRI PLOT - AFTER PRI SORT



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PLOT #6
PRI PLOT - SHOWING INTERVAL MODULATION
EXPANDED

NOTE: VERTICAL TIME SCALE IS GREATLY EXPANDED

0027.702700
0027.703300
0027.703900
0027.704500
0027.705100
0027.705700
0027.706300
0027.706900
0027.707500
0027.708100
0027.708700
0027.709300
0027.709900
0027.710500
0027.711100
0027.711700
0027.712300
0027.712900
0027.713500
0027.714100
0027.714700
0027.715300
0027.715900
0027.716500
0027.717100
0027.717700
0027.718300
0027.718900
0027.719500
0027.720100
0027.720700
0027.721300
0027.721900
0027.722500
0027.723100
0027.723700
0027.724300
0027.724900
0027.725500
0027.726100
0027.726700
0027.727300
0027.727900
0027.728500
0027.729100
0027.729700
0027.730300
0027.730900
0027.731500
0027.732100
0027.732700
0027.733300
0027.733900
0027.734500
0027.735100
0027.735700
0027.736300
0027.736900
0027.737500
0027.738100
0027.738700

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PLOT # 6 (CONTINUED)

0027.739300
0027.739900
0027.740500
0027.741100
0027.741700
0027.742300
0027.742900
0027.743500
0027.744100
0027.744700
0027.745300
0027.745900
0027.746500
0027.747100
0027.747700
0027.748300
0027.748900
0027.749500
0027.750100
0027.750700
0027.751300
0027.751900
0027.752500
0027.753100
0027.753700
0027.754300
0027.754900
0027.755500
0027.756100
0027.756700
0027.757300
0027.757900
0027.758500
0027.759100
0027.759700
0027.760300
0027.760900
0027.761500
0027.762100
0027.762700
0027.763300
0027.763900
0027.764500
0027.765100
0027.765700
0027.766300
0027.766900
0027.767500
0027.768100
0027.768700
0027.769300
0027.769900
0027.770500
0027.771100
0027.771700
0027.772300
0027.772900
0027.773500
0027.774100

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CONTROL SYSTEMS JOINTLY

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and study all of the data which POPPY has collected and determine the mission of this radar. In the meantime, it has proved a good example of how the POPPY weapons system philosophy has allowed the collection of a wide range of data for the intelligence analysts to work with in determining the weapons system significance of a radar.

DOG HOUSE	A	B	C	EOB	
1. Value(s) of frequencies used	Yes	Yes			
2. Number of frequencies used					
3. Short term stability					
4. Long term stability					
5. Pulse to pulse coherence					
6. Operating frequency limits					
7. Agility band limits					
8. Basic pulse rep. int. (PRI)					
9. PRI stability					
10. Pulse group pattern					
11. Pulse interval within group					
12. PRI mod. type, limits & rate					
13. Relation of PRI to other parameters					
14. Time relation of mult. pulse trains					
15.					
16.					
17. Pulse rise and fall times					
18. Modulation type					
19. Deviation					
20. Modulation function					
21. Modulation frequency	Yes	Yes			
22. Tuning rate					
23. Step size					
24. Bit length					
25. Code length and pattern					
26. Spectral band width					
27. Type of scan	Yes	Yes			
28. Scan Modes		Yes	Yes		
29. Scan rate	Yes	Yes	Yes		
30. Scan Dimensions	Yes	Yes	Yes		
31. Orientation (Fixed Installations)	Yes	Yes	Yes		
32. Beam width	Yes	Yes	Yes		
33. Polarization					
34. Side Lobes/Grating Lobes, amp. & loc.		Yes	Yes		
35. Number of beams & relative position	Yes	Yes	Yes		
36. Effective Radiated Power	Yes	Yes			
37. Accuracy	Yes				
38. Periodicity	Yes	Yes			