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

IN REPLY REFER TO
NAVINTCOM-2Q1
8 July 1970

~~TOP SECRET~~ ~~EARPOP~~
HANDLE VIA BYEMAN-TALENT-KEYHOLE-COMINT
CHANNELS JOINTLY

MEMORANDUM FOR THE CHAIRMAN, SIGINT OVERHEAD
RECONNAISSANCE SUBCOMMITTEE

Subject: OCEAN SURVEILLANCE SUPPORT

1. On 2 June 1970 the Chief of Naval Operations forwarded a requirement for POPPY support to Navy tactical commanders in the Mediterranean and Eastern Atlantic to the SIGINT Overhead Reconnaissance Subcommittee. At the SORS meeting on 3 June, approval was granted to augment tasking of POPPY missions 7105/7106, and to revise the field processing priority listing for [redacted] in support of this requirement. Although the CNO requirement was for an indefinite period, SORS approved support for 30 days, with advice that extensions of this support should be submitted as required. On 1 July 1970, in response to a request for a 30 day extension of POPPY support, SORS authorized continuation of the augmented tasking and revised field processing priorities. This support is now authorized through 040001Z August 1970.

2. The purpose of this memorandum report is to advise the SORS of the degree of which POPPY has contributed to Navy operational commanders' missions, to provide a status report of the support received to date, and to advise the Committee of the continuing nature of the requirement. Since inception of the support on 6 June 1970, [redacted] has issued a total of 39 spot reports. These reports have contained information on 53 Soviet surface combatants. A breakdown of the units reported shows that [redacted] provided the Fleet Commander with timely, accurate and, in most instances, unique reports concerning CHG MOSKVA, 7 DDGs, 2 CLGMs, and 10-12 unidentified units. Highlights have concerned movement of major surface units from the North Sea through the Mediterranean into the Black Sea, and return of units from the Black Sea to the Northern Fleet. Initial indications have been received that CHG MOSKVA has begun a southerly transit through the Black Sea;

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if MOSKVA exits into the Mediterranean, POPPY will have provided the first indication of this deployment. Reports of these major units in the Mediterranean have been a most significant source of intelligence for maintaining a tactical operational plot of SOVMEDRON movements. The level of support provided by [redacted] has not approached that provided during Operation OKEAN. Reasons for this are under investigation; however, it appears that lower activity levels, coupled with minor difficulties in the satellite [redacted] are prime reasons for the diminution of support.

3. Despite the reduction in support now being rendered, Navy operational commanders have recently (30 June 1970) reaffirmed the requirement, and have commented again on the unique, timely and accurate nature of these reports. The reasons for the valuable contribution of this system in support of these Navy-sponsored requirements are well documented at SORS, as is rationale supporting the continuing nature of the requirement, and complete justification for continuation of the support. These comments, and this rationale and justification, is, at a minimum, as valid today as they were when they were submitted. In addition to the justification, which included increased tempo of operations, geolocational inaccuracies of HFDF nets, unacceptable time lapses between these DF intercepts and their receipt by operational commander, and limited air and surface surveillance resources, it is significant that the Oceans and Seas for which this support is required is the environment in which Soviet and United States nuclear capable forces are in daily contact, and, at times, confrontation. In a time period during which the highest levels of the U. S. Government have indicated that the major danger to world peace is in the Middle East, it seems prudent to task SIGINT Satellite Systems against those requirements for which these systems have a proven, demonstrated capability of support.

4. It is respectfully requested that this memorandum report be incorporated in the minutes of the SORS meeting of 8 July 1970.

[redacted]

Copy to: Members, SORS

(27)

REVIEW OF THE OCEAN SURVEILLANCE BRIEFING OF Cod 5620 by 5614 13 July 70.

Pg. #1--"Need" = Item #3...Exploitation need not be by Navy as much as for Navy.

Item # 4..."This should be replaced..." What should be replaced. Isn't Enhanced a better word?

Pg#2--"Tasks in development..."

Item #1--Why tactical?

#2 Present and Future capability...

#3 and #4 should be exchanged??

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Pg#3--"Define Operational Requirements for O/S system"

How about a "Productivity" figure of merit

Pg#3A...Particularily into the denied areas of the Oceans this is important.

Pg#4--"Evaluate Prog "C" for O/S function"

Item A= Optimization is from the ground site & Orbit not the Spectral use since the magnitron families for ships are very similar to those for use on land.

Item B= Primary difference is Mobility/Perishability

Frequency coverage os ocean emitters not different than land emitters.

Item C = How well has it in the past and the potential in the future?

Pg#4a-- "Evaluate the capability of Prog C for O/S function"
Second line... "limited capability..." is what is being evaluated. Shouldn't you specify a Demonstrated capability now exists which is to be evaluated against the requirements??? While this system was not designed against these requirements specifically

Pg#5-- Need Communications System
Forward Area vs CONUS processing system tradeoff.

Pg#6--Item A deals with more than just spacecraft

Pg#7-- RF Spectrum coverage for Model #B is given an N for New to Space?
Program C covers 100 to 18,000Mhz can you mean below 100? or above 18 GHz?

Pg#8-- In title use of (FY-74) notation after Near Term would make it clear.

Bye 059311 -94

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HANDLE VIA BYEMAN CONTROL SYSTEM ONLY

NEED FOR NEAR-TERM OCEAN SURVEILLANCE (O/S) SYSTEM

1. The Navy needs a tactical O/S system

2. A significant input to this system can come from spaceborne tactical intercept of shipborne emitters

3. Program "C" and its planned exploitation by the Navy will be the sole spaceborne O/S capability until FY 74

4. This should be replaced by a spaceborne, passive, near-term Navy O/S system in the FY 74-75 timeframe

5. It is highly desirable to have a joint active/passive spaceborne O/S system as soon as possible (FY 77)

TASKS IN THE DEVELOPMENT OF A NEAR-TERM O/S SYSTEM

1. Define the operational requirements for a tactical spaceborne O/S system

2. Evaluate the capability of Program "C" for the O/S function

3. Model systems to achieve the operational requirements in the near-term

4. Define the near-term system

5. Implement the near-term system

6. Define the long-term system (active/passive, FY 77)

1. DEFINE THE OPERATIONAL REQUIREMENTS FOR A TACTICAL SPACEBORNE O/S SYSTEM

a. Area of Coverage - Geographic areas to be covered.

b. Fraction of Coverage - Fraction of contacts needed to deduce meaningful results.

c. Data Accuracy - Uncertainty in fix position.

d. Degree of Categorization - Number of levels of categorization and degree of certainty of each category.

e. Data Timeliness - Variation of data validity with time.

f. Extent of Data Distribution - Paths of data flow including endpoints, volume and security.

TASK 1 - DEFINE THE OPERATIONAL REQUIREMENTS FOR A TACTICAL SPACEBORNE O/S SYSTEM

The operational requirement for ocean surveillance stated in GOR-35 includes acquisition, processing and dissemination of ocean surveillance information. It includes the requirements of position locating, tracking and identifying all surface [redacted] naval units. The ocean surveillance sensors currently available cannot meet this goal. A study is required to establish the current (or near term) capability of all ocean surveillance systems and, in particular, establish how a satellite sensor system can supplement this capability to more nearly meet the stated operational requirement.

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2. EVALUATE THE CAPABILITY OF PROGRAM "C" FOR THE O/S FUNCTION

a. Program "C" is optimized to intercept Russian landbased radars

b. The requirements for the interception of ocean emitters differ in:

RF frequency coverage
Geographic area coverage
Track update interval
Timeliness
Taskers and users
Platform identification
Capacity

c. How well does Program "C" meet the O/S requirements?

TASK 2 - EVALUATE THE CAPABILITY OF PROGRAM "C" FOR THE O/S FUNCTION

There currently exists a spaceborne sensor system with limited capability in the O/S area. A study is needed to evaluate the techniques used in this system, their overall value in solving the O/S problem and the fundamental limitations of these techniques. If a specific existing technique or component is needed in the O/S system, those developed in Program "C" must be considered for the near-term system to reduce development cost, shorten delivery time and provide proven spaceborne reliability. On the other hand, from the existence of the following tasks, it is assumed that Program "C" equipments cannot meet all the operational requirements for the near-term system.

In short, the objective of this task is to examine whether expansion of Program "C" without fundamental changes to the basic configuration of the system can provide the minimum necessary O/S capability.

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3. MODEL SYSTEMS TO ACHIEVE THE OPERATIONAL REQUIREMENTS IN THE NEAR-TERM.

TASK 3 - MODELING

There are four separate models to be developed under Task 3. They are modeling: the environment (Task 3.1), the satellite system (Task 3.2), the ground station (Task 3.3) and the overall systems effectiveness (Task 3.4). Before system models can be evaluated, there must be common agreement as to the electromagnetic environment in the vicinity of the satellites. Task 3.1 will define such a common Electronic Order of Battle, including generating a catalog of all known ship and tactical shore based emitters, establishing an approximation of the various nations' NWP and their day-to-day applications, and verifying these concepts using Program C tapes where possible. There are a number of system transfer functions possible for the satellites and the ground stations, and for each transfer function the possibility of many different implementations. The purpose of these last three modeling efforts is to determine the most effective achievable method of implementation. Thus, these three efforts will proceed in parallel, using existing modeling techniques where possible. At the outset, relatively crude system models will be derived to get rough estimates of system effectiveness. Only the most promising models will be refined before more detailed versions of these models are developed. These three efforts are closely linked and several iterations through the modeling cycle will be required before a comprehensive systems design is detailed.

The purpose of the satellite modeling (Task 3.2) is ultimately to determine, for each transfer function, the best implementation of the antennas, receivers, processors and communications equipment in terms of cost, size, weight, power and reliability. Task 3.3 does a similar analysis for the ground stations to measure the timeliness and accuracies of the fix reports in its data output. Task 3.4 assumes the environment generated in Task 3.1, the satellite capabilities developed in Task 3.2 and the ground station capabilities of Task 3.3 in determining the effectiveness of the system in solving the O/S problem.

MODELS OF SATELLITES DEDICATED TO NAVY O/S WILL INCLUDE:

A. Program "C" units "as is" with augmentation in the number of satellites and in the number and processing capability of the ground stations.

B. A microwave intercept system using the basic principle of Program "C" with no constraints on the processing and communications.

C. A system constrained only to be passive.

D. A system integrating both radar and passive EW sensors.

SUMMARY OF SATELLITE CONFIGURATIONS

MODELS	A	B	C	D
AREAS				
RF Spectrum coverage	PC	N	N	N
DF	-	-	N	N
Communications	PC	SP	N	N
On-Board storage	-	SP	N	N
On-Board processing	PC	SP	N	N
Passive sensors	PC	N	N	N
Active subsystem	-	-	-	N
Other systems (Timation)	-	-	N	N

SP = Space Proven
PC = Program C Components
N = New to Space

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4. DEFINE THE NEAR TERM SYSTEM

State basic assumptions

4.1 Communications subsystem

4.2 Satellite intercept subsystem

4.3 Satellite processing subsystem

4.4 Satellite active subsystem

4.5 Ground processing subsystem

4.6 Interaction with external systems

4.7 Discuss design criteria

4.8 Prepare detailed procurement specification

TASK 4A: DEFINE SYSTEM USING PROGRAM "C" COMPONENTS

Assumptions: Task 4A is the definition of the near-term system assuming the Model A conditions: the satellites are virtually identical with the Program C satellites in construction, although their numbers and orbits as well as the location and processing capabilities of the ground stations are completely arbitrary.

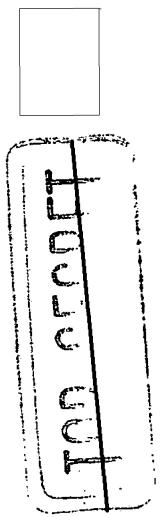
1. Communications: Task 4A.1 will determine the method of communications between the satellite and the ground as well as the optimum locations of the ground stations. These ground stations will include currently operational Program C stations, new landbased stations and possible surface vessel stations, all with the same equipment complement.

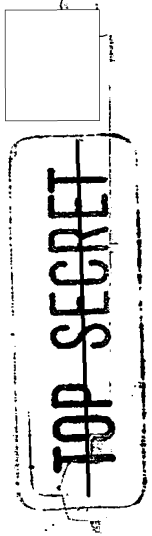
2. Satellite Intercept: Task 4A.2 is already complete by definition; the intercept subsystem will be identical with Program C.

3. Satellite Processing: Task 4A.3 is complete.

4. Satellite Active System: Task 4A.4 is complete; there will be no active capability in this satellite.

5. Ground Processing: Task 4A.5 will define the required ground station processing capability. It is already known that the Program C ground stations cannot meet the requirements for the O/S functions with the limitations imposed by present tasking and existing personnel and equipment. This subtask includes the development of a preprocessor to group the incoming pulses into blocks belonging to individual emitters and eliminating stray pulses prior to putting the data into an on-line general purpose computer. The task also includes the development of algorithms for the general purpose computer for fixing, control of the preprocessor and communications with external systems.





6. Interaction: Task 4A.6 will establish the interaction with external systems, primarily consisting of reporting position, characteristics, and possible identification to the centralized Navy O/S system and the receipt of feedback messages.

7. Design Criteria: Task 4A.7 will present, from a systems point of view, the design criteria, tradeoffs, technical risk areas, costs, time schedules, size, weight and power constraints which led to the system definition.

8. Procurement Specification: Task 4A.8 will conclude with a report including a detailed procurement specification for all the hardware and software elements of the system.

TASK 4B: DEFINE SYSTEM USING PROGRAM "C" PRINCIPLE WITH AUGMENTED COMMUNICATIONS AND PROCESSING

Assumptions: Task 4B is the definition of the near-term system assuming the Model B conditions: the intercept subsystem in the satellite is constrained only to time of arrival of microwave signals following the principle of Program C.

1. Communications: Task 4B.1 will determine the method of communications between the satellite and the ground, as well as the optimum location of the ground stations. This includes communications to existing ground stations, new land-based stations, surface vesselsas well as communication satellites or some combination of the above.

2. Satellite Intercept: Task 4B.2 will investigate the feasibility of total coverage of the microwave spectrum (0.4-40 GHz) for both narrow-band pulsed and spread spectrum signals.

3. Satellite Processing: Task 4B.3 will define a relatively sophisticated satellite processing subsystem which will be required to reduce the data bandwidth to that which can be handled by the communication subsystem.

4. Satellite Active System: Task 4B.4 is complete; there will be no active capability in this satellite.

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5. Ground Processing: Task 4B.5 will define the required ground station processing capability. This will include a higher speed processor than required for Task 4A.6 because of the greater number of detected signals and the special circuitry required to process the spread spectrum signals.

6. Interaction: Task 4B.6 will establish the interaction with external systems, primarily consisting of reporting position, characteristics and possible identification to the centralized Navy O/S system and the receipt of feedback messages.

7. Design Criteria: Task 4B.7 will present, from a systems point of view, the design criteria, tradeoffs, technical risk areas, cost, time schedules, size, weight and power constraints which led to the system definition.

8. Procurement Specification: Task 4B.8 will conclude with a report including a detailed procurement specification for all the hardware and software elements of the system.

TASK 4C: DEFINE NEW PASSIVE SYSTEM

Assumptions: Task 4C is the definition of the near-term system where the onboard sensors are constrained only to be passive.

1. Communications: Task 4C.1 will determine the method of communications between the satellite and the ground and the optimum locations of the ground and/or relay stations. The communications subsystem may be radically different than that required for Models A and B in that it may well require much wider bandwidth in order to relay entire frequency bands to the ground stations as well as an increased amount of digital data from the other bands.

2. Satellite Intercept: Task 4C.2 will consider, over and above the microwave region of the spectrum, HF, VHF and UHF frequencies. This would allow intercept of tactical communications signals.

3. Satellite Processing: Task 4C.3 will define an on-board processing capability significantly different than that required in tasks 4A.3 and 4B.3. The increased intercept bandwidth makes it unlikely that the satellites can process all the current data without support from the ground (see 4C.6). This support from the ground will require a general purpose computer in the satellite.

4. Satellite Active System: Task 4C.4 is complete; there will be no active capability in this satellite.

5. Ground Processing: Task 4C.5 will define the required ground station processing capability. It will be more complicated than the previous models because it must include receiver/processors for the added frequency bands. The task will include the development of a high-speed preprocessor and the fixing, control of the preprocessor and communications with external systems.

6. Interaction: Task 4C.6 will establish the interaction with external systems. One of the areas under this subtask will be to investigate the feasibility of having U.S. Navy ships report evaluated position/ID data to the centralized O/S data base, to permit deletion of raw data from these targets in the satellite-to-ground link.

7. Design Criteria: Task 4C.7 will present, from a systems point of view, the design criteria, tradeoffs, technical risk areas, cost, time schedules, size, weight and power constraints which led to the system definition.

8. Procurement Specification: Task 4C.8 will conclude with a report including a detailed procurement specification for all the hardware and software elements of the system.

TASK 4D: DEFINE SYSTEM-INTEGRATING ACTIVE AND PASSIVE SENSORS

Assumptions: Task 4D is the definition of the near-term system where the onboard sensors are constrained to be both active and passive.

1. Communications: Task 4D.1 will determine the means of communication between the satellite and the ground and the optimum locations of the ground and relay stations. This communication subsystem will be very similar to that developed under Task 4C.1.

2. Satellite Intercept: Task 4D.2 is identical to Task 4C.2.

3. Satellite Processing: Task 4D.3 will be very similar to Task 4C.3 with the exception of the processing changes needed by the on-board radar and the integration of the radar fixes with the passive data.

4. Satellite Active System: Task 4D.4 will investigate the feasibility of implementing an active radar in the system under computer control. This task will strongly depend upon the similar effort going on elsewhere in the 749 program.

5. Ground Processing: Task 4D.5 will define the required ground station processing capability. The task will be very similar to Task 4C.5 with the addition of programming to take position reports relative to the satellite's position in space.

6. Interaction: Task 4D.6 will establish the interaction with external systems. It will be identical with Task 4C.6.

7. Design Criteria: Task 4D.7 will present, from a systems point of view, the design criteria, tradeoffs, technical risk areas, cost, time schedules, size, weight and power constraints which led to the system definition.

8. Procurement Specification: Task 4D.8 will conclude with a report including a detailed procurement specification for all the hardware and software elements of the system.

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5. IMPLEMENT THE NEAR-TERM SYSTEM

a. Identify the critical equipments and techniques common to all approaches and initiate early development.
   1. On-board equipment
   2. Ground station computer plus software
   3. Ground station preprocessor
   4. Model ground station

b. Identify model-dependent equipments requiring development as soon as possible.
   1. On-board communications
   2. On-board intercept
   3. On-board processing
   4. On-board active - radar

c. Procure the near-term system in an orderly fashion.

TASK 5.1

Task 5.1 is the development of critical components of the satellite including the communication, intercept and processing subsystems. The critical components in the active area are being funded elsewhere. In the communications area, the first sub-task will determine the feasibility of relaying wide band portions of the spectrum to the ground (30-50 MHz). The second sub-task will determine the optimum combination of sensor satellites, ground stations and communication center(s). The critical intercept sub-task will investigate the feasibility of operating HF, VHF, UHF and microwave (above 15 GHz) receivers in a spaceborne environment. The critical satellite processing will study encoders, exclusion trackers and spaceborne general purpose computers.

TASK 5.2

Task 5.2 is the selection of a ground station computer based on availability of suitable software to handle the fixing, control and communications functions. At this time, there does not appear to be any requirement for custom GP hardware, with the exception of a small amount of interface hardware. There is, however, the requirement for custon software. In order to determine the type and volume of data sent from the satellite, one critical factor is to determine the amount of data which can be processed on the ground.

TASK 5.3

Task 5.3 is the development of a preprocessor to sort the pulsed information into blocks of data, each belonging to a separate emitter. This preprocessor must be able to take data from the communications subsystem at its maximum data rate, compare pulse words with the known environment at half the maximum incoming data rate, block the data by emitters and pass the block to the GP on request. The design of the preprocessor must be very flexible to allow different types of pulse word descriptors and provide the capability of running more than one recognition algorithm in an interleaved mode. These recognition algorithms must be changeable, on-line, under the control of the GP.

TASK 5.4

Task 5.4 will integrate the satellite-surface communication link, preprocessor (AP), GP computer, special purpose interface hardware and the processing software into a prototype ground station.

6. DEFINE THE LONG TERM SYSTEM

a. Repeat the analysis of the interim system.

b. Define the long term system in detail.

c. Identify the critical components for continuing development.

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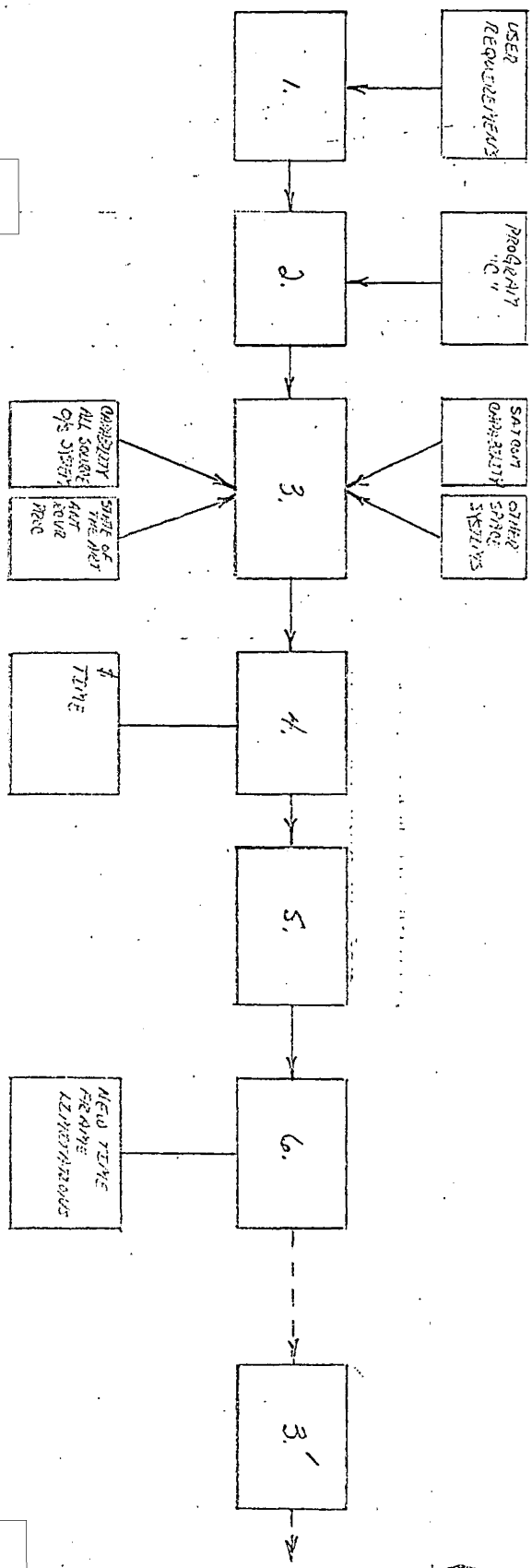

OPERATIONAL DIAGRAM OF INTERIM SYSTEM DEVELOPMENT

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CONTROL SYSTEM ONLY

TASK	FY 71		FY 72	
1	~~30~~	60		
2	~~35~~	70		
3	150	~~70~~ 700	~~70~~ 150	
4	60	~~35~~ 100	~~70~~ 150 500	
5	~~70~~ 150 2000	150	~~70~~ 9200	
6			30	~~20~~ 100

FUNDING	FY 71	FY 72
NRL	~~240K~~ 490K	~~230K~~ 480K
CONTRACT	2800K	9800K

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TASK 5	FY 71			FY 72		
AP	1100			1000		
GP		400			200	
Satellite Hardware			500			5600
Ground Station					3000	

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