Apr? 62

TOP SECRET [redacted] PROPOSED NAVY SATELLITE PROGRAM

INTRODUCTION

The U. S. Navy presently has a Satellite program in being which is producing ELINT information in response to National Requirements.

Basically this system is a very simple crystal video collector which is designed to have an estimated minimum life of one year and is carefully tailored to a given intercept band and provides unity probability of intercept in that frequency band. The Satellite responds pulse by pulse in real time, retransmitting the data collected to [redacted] existing ELINT ground stations on the Soviet periphery which are equipped to track the Satellite and record the data on multi-channel tape recorders. True time is also recorded in digital form to allow later reduction of the data and fixing the location of the emitters. Since the data are recorded in analog form it is amenable to reduction using the regular manual processing techniques. The National Security Agency has also developed a machine processing technique for this data which produces a tape output that is fed directly into a IBM 704 computer by which reduction of signal parameters and fix computation is done on a very rapid basis.

The intelligence product from this project is presently being utilized by all of the ELINT processing agencies, including the Strategic Air Command which is utilizing it to provide unique data for updating the Single Integrated Operational Plan. Some hundreds of emitter locations have been added and revised as a result of the input from this system. In addition to the emitter locations this program has also been the first to detect several new radar types.

One of the startling contributions of this Satellite program has been the discovery of a new Radar System thought to be part of the Anti-Ballistic Missile complex of the Soviet Union.

This program has an excellent valid cover in the Solar Radiation Program. Each Solar Radiation experiment is designed to measure characteristics of solar events and correlate them with changes in the earth's ionosphere. These changes affect many communication systems and a better understanding of the mechanisms of solar events is needed to improve communication system design. U. S. and foreign scientific groups are vitally interested in the cover experiment data collected on an unclassified basis. Distribution of the cover data is being made internationally by [redacted] of the U. S. Naval Research Laboratory, who is a foremost scientist in this field.

TOP SECRET [redacted]

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

ACCOMPLISHMENTS

In June 1960 the Navy launched its first Satellite in this series, an "S" band ball covering 2600 to 3250 Mc and the equipment in the Satellite operated exactly as predicted for a three-month period. Signal densities resulting from this collection effort were several times greater than had previously been anticipated.

In November 1960 a second launch was attempted but the rocketry malfunctioned and orbit was not achieved.

In June 1961 another Navy Satellite was launched into orbit covering 550 to 620 Mc and 810 to 920 Mc with the capability to select either or both of the intercept bands. After eight months this Satellite is still producing important ELINT data.

The Navy's first payload for Fiscal Year 1962 was called Composite 1A and was launched on a Thor-Able-Star in January on a 67 1/2° prograde orbit from Cape Canaveral. This launch failed to achieve orbit because of a defective second stage motor. Composite 1A had as its payload a group of five Satellites which were to be placed in orbit simultaneously. The GREB payload was a two band system covering 165 to 185 Mc and 2600 to 3250 Mc.

In April 1962 the Navy again attempted to use a Scout Vehicle from the Pacific Missile Range repeating the previous two band experiment covering 165 to 185 Mc and 2600 to 3250 Mc. This vehicle malfunctioned in the fourth stage and the payload failed to achieve orbit.

REQUIREMENTS FOR SATELLITE ELINT RECONNAISSANCE

GENERAL AIMS OF SATELLITE RECONNAISSANCE

The first aim of the Navy ELINT Satellite Reconnaissance Program is to determine the electronic Signal environment in the various frequency bands of the Sino-Soviet Bloc. If this information is collected using a simple crystal video system, unity probability of intercept will result. In collecting data by this system it is possible to measure many of the pertinent parameters of the emitter over a long period of time. These characteristics are sufficient to enable the analysts to note and analyze new equipments as they are introduced into use by the various countries.

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

A second requirement is to determine information on Soviet Radar Order of Battle. This is particularly important in those areas of the Soviet Bloc where it is not technically feasible to collect the ELINT data with any other vehicle. This collection effort should be capable

Of special concern are the changes in the radar order of battle from day to day, month to month, as well as changes throughout the hours of the day and days of the week. Does the enemy "stand down" at certain periods? If so, what are these periods? Also, how much does the ambient electronics atmosphere change when some provocatory action takes place? Satellite systems must be capable of dealing with all these questions.

Continuation of the Navy Program can satisfy the above requirements. It has already demonstrated unique contributions in each band it has covered and the recent discovery of the type radar has resulted in a major break through for the intelligence community in answer to a difficult problem which has cost hundreds of millions of dollars in its solution.

What frequency coverage should be attempted in a Satellite is a good question. In general, it is conceded that first priority is those higher-power longer-range systems used in the Defensive and Anti-Missile effort. This radar complex might be located anywhere in the frequency spectrum from perhaps 20 Mc to 7000 Mc. The difficulty in generating high powers and the absorption in the atmosphere are serious limitations and generally relegate those radar systems above this frequency band to shorter range assignments. At the lower end of this frequency range, television, FM, communications and other service functions dominate the spectrum. These restrictions being recognized, the first priority should be to cover the entire spectrum as soon as possible so the frequency band indicating major activity can be inspected in as much detail as desired. The ELINT Satellite system engineering design must be carefully done so that there is no possibility of the system generating or responding to any spurious signals.

Pulse repetition rates, are all major parameters which should be accurately indicated in any ELINT Satellite system. A simple crystal video system presents these parameters automatically in real time and provides a simple long life collection system capable of providing many thousands of orbits over the target area.

Frequency resolution in general is a second order objective. For radar order of battle a resolution of about 20% is all that is required. Once alerted to the existence of a Sino-Soviet signal of interest in a given frequency band, other methods of reconnaissance can provide pertinent data on Indications of are also desirable factors to know for the scientist or engineer in doing a technical evaluation of the enemy's state of engineering advancement. However, it is doubtful if knowledge of these system parameters would change the method of dealing with such systems during offensive operations.

Location of emitters is an important requirement of this Satellite system. Though rough early locations (perhaps on the more important interior emitters may be satisfactory, collection systems must ultimately have the capability of refining this portion of their product to a value more useful for military planning (perhaps less than .

Reliability is a paramount requirement in any Satellite system. Analog systems satisfy this requirement and have the added advantage that they place the interpretive function on the ground where interpretive technical competence is highest. Any design, that causes unreliable data to be generated is useless and destroys all confidence of potential users.

Satellite systems should comprise a compatible series of equipments. The operating and analysis procedure for each unit should be essentially the same, in this way competence can be developed to the highest state of efficiency thus insuring a uniform quality intelligence product.

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

PROPOSED ACCELERATED PROGRAM

1. Booster Requirements

The Navy proposes to accelerate its ELINT Satellite program to meet urgent national requirements by utilizing Thor-Able-Stars on all future launches and by placing in orbit two 24-inch Satellites simultaneously. This will allow for coverage of eight RF bands simultaneously with some band coverage overlap [redacted].

The Thor-Able-Star rocket combination has been selected because of its ready availability, excellent suitability from payload handling and environment, adaptability to multiple payload operations, launch reliability, payload field crew familiarity, and relatively moderate cost. Also since the Navy's Transit program has selected the Thor-Able-Star as an interim operational launch vehicle these two programs would be utilizing the same vehicle with resultant reduction of costs and improved vehicle reliability.

Launch vehicles will be procured by the Space Systems Division of the Air Force Systems Command in the usual manner. However, better operational control of the launch vehicle will be exercised to assure that the vehicle failures due to known faulty parts as in the past are eliminated. Depending on Thor booster availability seven months lead time is presently required from procurement initiation to launch. An expanded program requiring continuing vehicle production will provide stability to the program by increased numbers to sustain continuous production.

An orbit of 67 1/2 degrees prograde will be required for this operation with an altitude of 450 nautical miles in a circular orbit. Since orbits of this inclination are not approved from PMR, launch operation from Complex 17 at the Atlantic Missile Range will be utilized. Because of the facilities availability, proximity to payload assembly and thoroughly trained launch crews, lower costs and more reliability for each launch should ensue. The schedule of Satellite launches could be met with the new vehicle program starting eight months after firm funding and would proceed at a three month's interval.

2. Satellite Instrumentation

Continuing under the present Solar Radiation "cover" the accelerated Navy Program would envision a series of Solar Radiation experiments of increasing scope under NRL's [redacted] guidance. This would complement on an international scope the work of other experimenters in this field.

The ELINT portion of these Satellite launches would employ the, long life, unity probability system already described and would consist of two balls launched simultaneously with a small incremental difference in velocity to accomplish the program as proposed by NSA. A total of eight RF frequency bands would be covered in relatively small increments of band coverage so as to pinpoint the actual bands being utilized by the Sino-Soviet Bloc countries for radar coverage. Overlap between the various frequency bands would be provided on a planned basis to allow the capability to be applied on as large a portion of the Soviet occupied frequency spectrum as possible.

Each Satellite would consist of a 24-inch ball having an ultimate maximum individual weight of perhaps 100 pounds. Within the shell would be the conventional solar cell chemical battery charging system and two separate data transmitters. Each data transmitter would be capable of being modulated by two completely separate intercept, video amplifiers and modulation systems. Which system is providing the pulse modulations would be determined by the differences in the lengths of the modulator pulses coming from the two systems. Two associated interrogation receivers would provide redundancy in the system to improve its component reliability. These receivers would allow any combinations of data intercept systems to be turned on by choosing the proper commands. Also they would allow for turning off the "cover" transmitter which is also used by the ground stations for tracking. Ordinarily the Solar Radiation "cover" transmitter would transmit continuously.

The entire system would be housed in a 24-inch sphere. Mechanical design would be such to permit the maximum flexibility and interchangeability in the instrumentation packages up until three months prior to launch. It is visualized that these future Satellites would allow for extensive configuration changes to take place in the ELINT portions of the Satellite to meet changing national requirements with a minimum effort. Reliability will be stressed in this new design concept and all the units will be subjected to the usual severe environmental tests as in the past Navy programs.

A preliminary schedule of proposed band coverage is shown in Figure 1. These would be varied and modified in keeping with the changing national requirement.

A continuing research program will be carried on with the Satellite development program outlined above. In these research studies such things as improved reliability of components will be stressed.

PRESENT NAVY PROGRAM

1. Satellite Description

In July the second Scout launch for 1962 is scheduled. This was to be a Scout vehicle launched in a prograde orbit of 75 degrees from the Pacific Missile Range. Since the Scout has limited weight carrying capacity the GREB Satellite would be a 60-pound ball which will be identical to the one which was scheduled to go in April on the Navy's First Unsuccessful Scout Launch.

It is proposed to forego this launch and go directly to the Two Ball launches using Thor-Able-Star Vehicles.

2. Operational Data Collection Network

In connection with tasking the GREB Satellite system for data collection, the Navy has developed an operational control system for this function under the direction of the Director of Naval Security Group. The principal control stations in the network are the Navy Security Group Stations at At these stations all prograde orbits are interrogated. Utilizing the Naval Communications System, it is possible to interrogate the Satellite for a "target of opportunity" over the Soviet Union in a matter of

Data readout for the Satellite System is effected in real time by operational intercept sites. Each of these sites is equipped with a "readout" hut capable of tracking the Satellite on the cover and data frequencies with steerable antennas. Receiving and recording equipment are available to record the data on the several frequencies employed. A seven-channel recorder is provided for recording the signal data and an associated digital time on the tape.

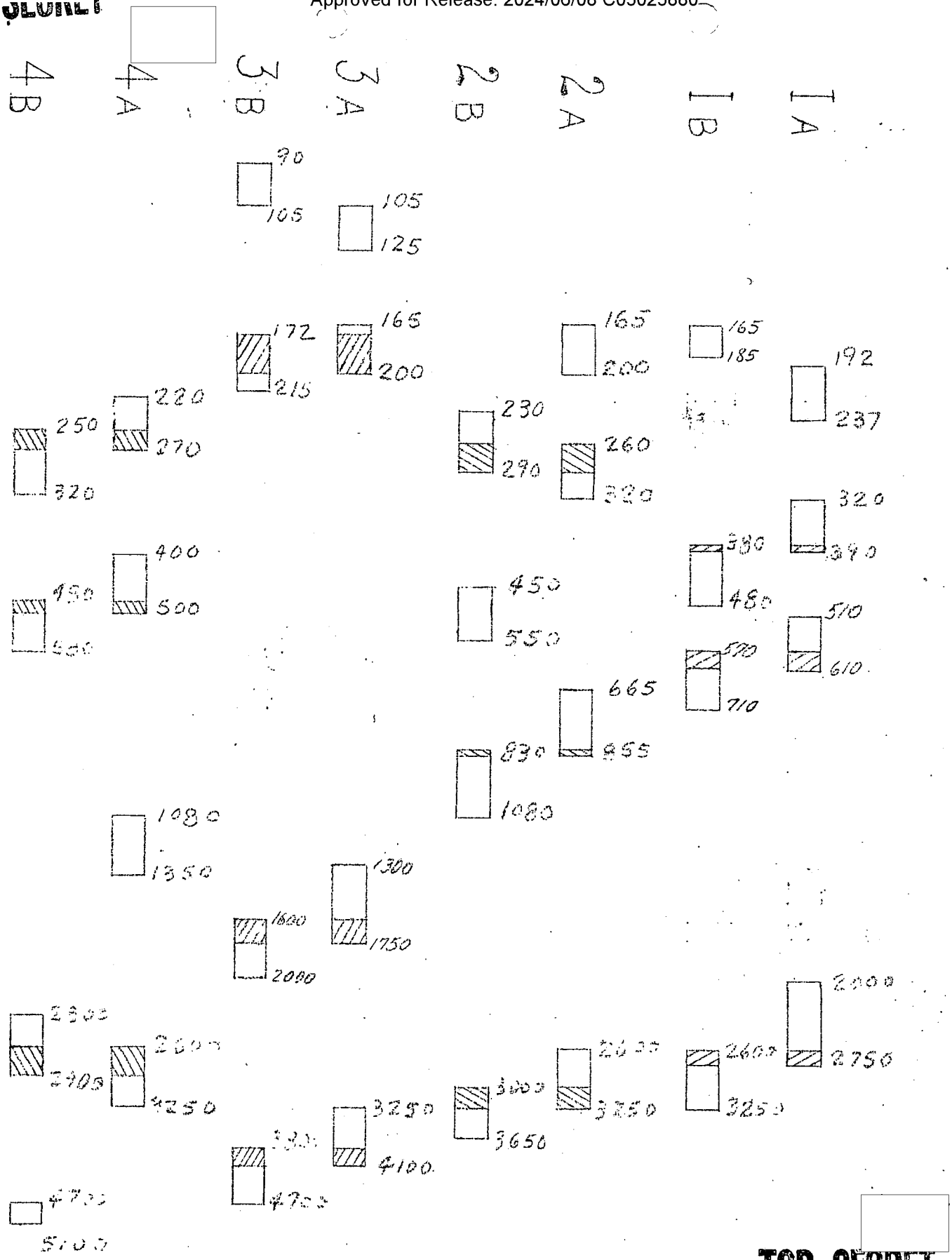
The sites utilized in recording the data are U. S. Navy Stations at All of these stations have demonstrated exceptional ability to collect excellent data, utilizing enlisted station personnel for this collection effort. Cooperation from the Air Force stations has been excellent.

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

These stations are being updated to collect data from more than one data channel simultaneously and will be completed in the near future.

3. Processing Status

Data from this Satellite system, since it is in analog form, is amenable to processing by usual manual methods or by complete machine processing. NSA has developed both systems of readout and has equipment on hand which is capable of handling the presently contemplated flow of data. Also, NSA has various computer programs which will identify and locate specific emitters. Locations are being made to an estimated accuracy of on certain high-interest-types of radars and to in the case of a fairly high percentage of the remainder. Great strides in the processing have been made by NSA in dealing with this type of analog data. NSA has retained its competence in manual processing, as demonstrated by the recent discovery of the by manual methods.



HANDLE VIA BYEMAN CONTROL SYSTEM ONLY

~~TOP SECRET~~

~~TOP SECRET~~

FUNDING REQUIRED

1. Vehicles

Recent estimates prepared by the Space Systems Division of AFSC indicate the following figures for a schedule of five Thor-Able-Star operations per year. It is estimated that a total of at least four successful launch operations can be conducted on an annual basis with this program. Launch operations are planned to occur at three-month intervals. Launch failures will be backed up by following operations. Cost estimates for Vehicles are estimated as follows:

	FY 63	FY 64
1st Stage Thor and DAC Launch	5,275 K	5,275K
2nd Stage Able Star and A/J Launch	7,500 K	7,500 K
BTL Guidance	1,250 K	1,250 K
Technical Assistance	800 K	800 K
Propellants, Transportation, Communications, Administration, etc.	800 K	800 K
Total Vehicle Costs	15,625 K	15,625 K

Other possible additional costs are anticipated from the requirement for an improved Able-Star stage. The least complex improvement that promises significant increases in orbital weight capability involves merely a change in propellants. The vehicle currently utilizes unsymmetrical Dimethyl Hydrazine with Inhibited Red Fuming Nitric Acid as an oxidizer. The proposed improvement will use Mono-Methyl Hydrazine and Nitric Tetroxide as an oxidizer. The new fuel will provide relatively large improvements in specific impulse, and, since optimum mixture ratios are the same for both fuel combinations, there is no change in tankage required. Costs for this improvement are estimated at approximately 1.2 million dollars and will require an estimated ten months to accomplish. Program share of either AMR or PMR Able-Star capability is estimated at approximately 1.0 million.

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

Totals for Boosters are as follows:

	FY 63	FY 64
Vehicles	15,625 K	15,625 K
Improvement Program	1,200 K	1,200 K
Launch Program Share	1,000 K	1,000 K
	17,825 K	17,825 K

2. Satellite Instrumentation

Though the Satellite structure will have the greatest possible mechanical flexibility to accommodate interchangeability of the various electronic units and selection of best performing components, standby components which must be available at the launch site will require development of more than just the bare minimum of components. Complete mechanical design of the launching support mechanism to properly release the Satellites into orbit will require continuing mechanical design support and coordination. Cost estimates for the eight satellites and backup units required per year are as follows:

	FY 63	FY 64
Satellite Structure	1,500 K	2,000 K
Mechanical Design	1,000 K	1,000 K
Satellite Power Supplies	1,500 K	1,500 K
Electronics	7,000 K	6,000 K
Environmental Tests	1,500 K	1,500 K
Technical Check Out at Launch Site	1,500 K	1,500 K
Technical Research	2,850 K	2,000 K
	16,850 K	15,500 K

3. Ground Support

Modifications at the ground stations to accommodate several Satellites in Orbit simultaneously and track them individually will require

modification of the ground instrumentation. Estimates to cover this cost are as follows:

	FY 63	FY 64
Ground Support Modernization	1,150 K	250 K

4. Project Totals

	FY 63	FY 64
Vehicles and Launching	17,825 K	17,825 K
Satellite Instrumentation	16,650 K	15,500 K
Ground Support Modernization	1, 150 K	250 K
TOTALS FOR PROJECT	35,625 K	33,575 K

HANDLE VIA
BYEMAN
CONTROL SYSTEM ONLY

LIMITED DISTRIBUTION

~~TOP SECRET~~

~~TOP SECRET~~ - LIMITED DISTRIBUTION
SPECIAL HANDLING REQUIRED

SPECIAL HANDLING REQUIRED

BYE-057440-99

From: Secretary of the Navy
To: Secretary of Defense

Subj: Project POPPY (TS)

Encl: (1) Frequency Coverage Plan for Four Dual-Satellite Events
(2) Program Costs
(3) Summary of Launch Vehicle Considerations

1. Project POPPY involves a satellite reconnaissance program providing ELINT information in direct response to national intelligence requirements. Its most significant contribution to date has been the recent discovery of a new and highly sophisticated radar apparently used as a critical part of the Soviet anti-ballistic missile system. As you are aware, a more detailed knowledge of this system is of paramount importance.

2. Based on our knowledge derived from the above noted success and other related data, it now appears appropriate to expedite further coverage of the Soviet ABM system as well as other Soviet R&D and operational electronics. The POPPY Project Director has proposed four launch events, each of which will consist of two 24-inch satellites designed to cover eight selected increments of the frequency spectrum, four increments in each satellite. Enclosure (1) sets forth the detailed coverage plan for these events.

3. The proposed schedule for these events, all utilizing THOR ABLESTAR boosters launched from the Atlantic Missile Range, involves about one launch per quarter commencing in October/November 1962. Completion of this planned coverage is dependent on four successful launches. In order to assure this and also to provide for repeat coverage or investigation of new Soviet electronic developments, four additional THOR ABLESTAR launches are programmed to occur at quarterly intervals thereafter through calender year 1964.

~~TOP SECRET~~ LIMITED DISTRIBUTION
SPECIAL HANDLING REQUIRED

Handle Via BYEMAN/Talent-Keyhole/Comint control systems only jointly

TOP SECRET [redacted] DISTRIBUTION
TOP SECRET [redacted] DISTRIBUTION
SPECIAL HANDLING REQUIRED
SPECIAL HANDLING REQUIRED

4. The total cost of this program is $31,100,000 for Fiscal Year 1963 and $31,400,000 for Fiscal Year 1964. After deducting the fiscal year budget apportionment already allocated to this program, the additional funds required to accomplish the planned program are $21,600,00 in Fiscal Year 1963 and $18,900,000 in Fiscal Year 1964. Enclosure (2) sets forth details of these program costs. Enclosure (3) provides the considerations supporting the selection of THOR ABLESTAR boosters for use in carrying out this program.

5. It is requested that the foregoing program be approved for detailed planning and implementation, and that the required additional funds be provided.

Handle Via BYEMAN/Talent-Keyhole Comint Control System Only

[redacted]
SPECIAL HANDLING REQUIRED

~~TOP SECRET~~ [redacted]

~~TOP SECRET~~ - LIMITED DISTRIBUTION
SPECIAL HANDLING REQUIRED

SPECIAL HANDLING REQUIRED

PAYLOAD COSTS

	(in thousands of dollars) Fiscal '63	Fiscal '64
a. Satellite design, development, and fabrication	9,500	10,500
b. Sensor R&D and integration	3,500	3,750
c. Payload support mechanism design, development, and fabrication	1,500	1,200
d. Payload/Vehicle integration and launch support	900	1,200
e. Ground station re-design, modification and operation	2,500	800
f. Data reduction and processing	250	350
Total	18,150	17,800
Vehicle Costs	12,950	13,600
Total Costs	31,100	31,400
Fiscal Year Budget Appropriement	9,500	12,500
Balance Required	21,600	18,900

Handle Via Talent-Keyhole (Comint
Channel Control Systems
Codes Jointly

[redacted]

~~TOP SECRET~~ - LIMITED DISTRIBUTION
SPECIAL HANDLING REQUIRED

Enclosure ( )

SPECIAL HANDLING REQUIRED

~~TOP SECRET~~ ~~LIMITED DISTRIBUTION~~

~~TOP SECRET - LIMITED DISTRIBUTION~~
~~SPECIAL HANDLING REQUIRED~~
SPECIAL HANDLING REQUIRED

~~SUMMARY OF VEHICLE LAUNCH CONSIDERATIONS~~

1. The THOR ABLESTAR satellite launch vehicle has been selected as the launch vehicle to support the Project POPPY program. This vehicle is believed to be the most suitable from the points of view of availability, reliability, operational readiness, facilities and personnel training, cost, and program security.

2. A vehicle launch reliability of 65 percent has been assumed and requirements are based on this figure. While earlier launch operations with this booster have not achieved 65 percent success, it is believed that a rigorous quality control in both vehicle fabrication and pre-launch testing coupled with a more detailed launch countdown will result in improved reliability.

3. Launch vehicle leadtimes are such that funding must be made available at an early date if a quarterly launch schedule is to be maintained commencing in October or November 1962. The vehicle to support the initial operation has been ordered and partially funded. The only THOR ABLESTAR vehicle that could be made available earlier is currently programmed to support the launch of the ANNA 1B Geodetic experiment in August 1962.

4. Other launch vehicles considered were:

a. ATLAS AGENA - This vehicle was rejected because its use would have created unnecessary disruption of other programs and excessive costs.

b. THOR AGENA - Long leadtimes, high unit costs, development status of the AGENA D, and facilities crowding were considered as reasons for rejecting this vehicle.

Handle Via TK Comint Channels Only

~~TOP SECRET~~ ~~LIMITED DISTRIBUTION~~
~~SPECIAL HANDLING REQUIRED~~
SPECIAL HANDLING REQUIRED

Enclosure ( )

~~Top Secret~~/ [redacted]

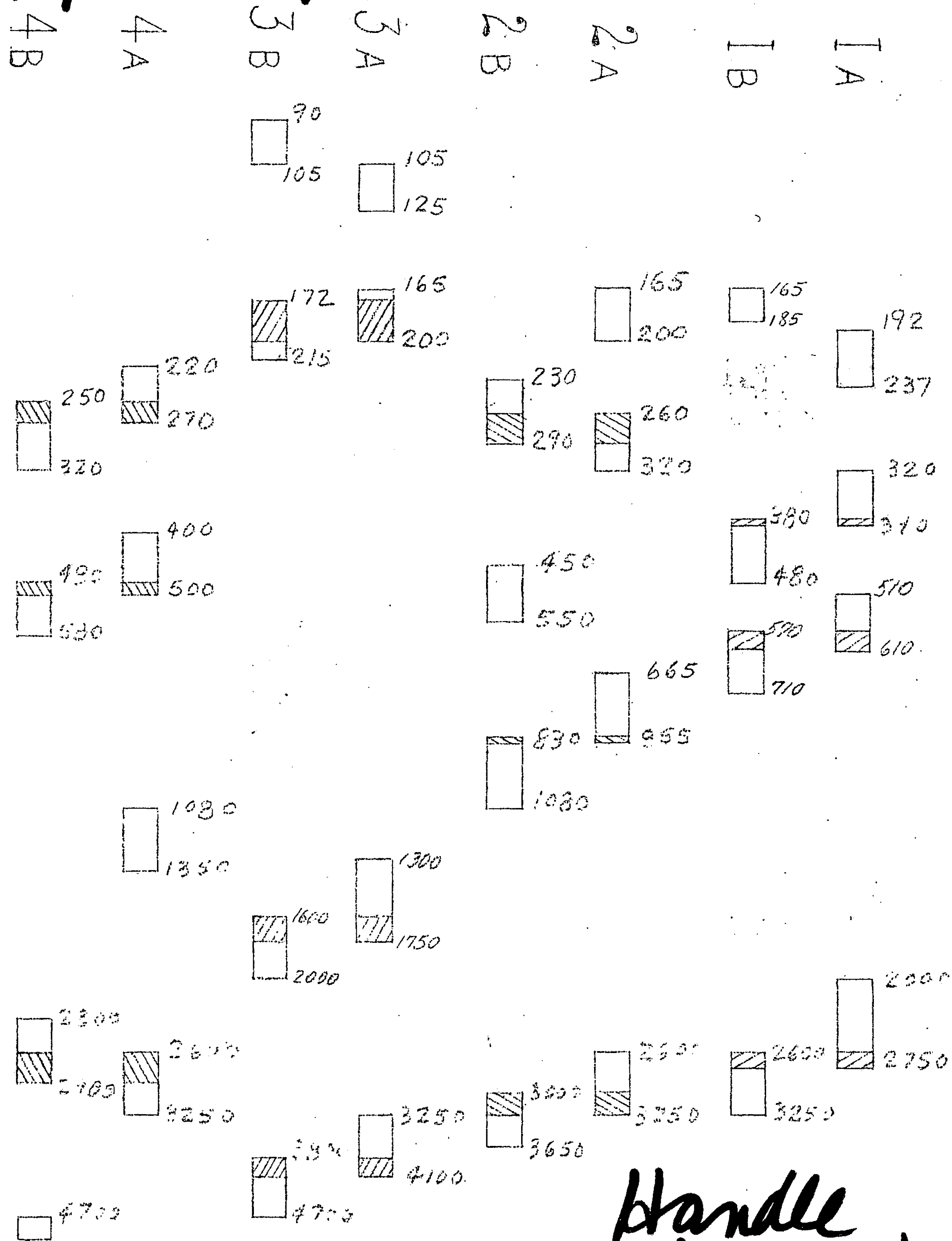


Figure 1a

~~Top Secret~~/ [redacted]

Handle Byeman [illegible] control system only