~~SECRET - LIMITED DISTRIBUTION~~

~~SECRET~~ - LIMITED DISTRIBUTION

GEN-SE-0009-94

PROJECT GRAB

STANDARD OPERATING PROCEDURE NO. 2

* * * * * * * *

INTERROGATION

Copy #7

Prepared By:

U.S. NAVAL SECURITY GROUP
3801 Nebraska Ave., N.W.
Washington 25, D.C.

January 1962

EXCLUDED FROM AUTOMATIC
REGRADING; DOD DIR 5200.10
DOES NOT APPLY

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

STANDARD OPERATING PROCEDURE

* * * * * * * * *

INTERROGATION

TABLE OF CONTENTS

APPENDICES

RECORD OF CORRECTIONS

Change No.	Date of Change	Date Entered	By Whom Entered

STANDARD OPERATING PROCEDURE

INTERROGATION

I - INTRODUCTION

A. GENERAL

1. In order to obtain proper operation for this Project, certain basic operations are essential. Namely, the activation of the various sensors and data transmitter in the satellite (the function of the Interrogation or Control Hut), the reception and recording of data signals from the satellite (the function of the various Receiving Huts strategically located throughout the world), the processing of the data collected and the dissemination of the information developed therefrom. This document delineates the Standard Operating Procedure (SOP) necessary for the successful execution of the first operation, INTERROGATION of the satellite.

2. The primary function of the Interrogation Hut is the activation of the satellite, which is accomplished by the transmission of a radio signal on a specific frequency with a specific time duration and modulation frequency, directed toward the satellite at a specified time. However, in order to ensure that the transmitting antenna is directed at the satellite at the instant of interrogation and to further ensure that successful interrogation has been achieved, it is necessary that the Interrogation Hut be capable of receiving both of the data signals from the satellite (hereinafter designated CHANNEL A which is ON continuously and CHANNEL B which is turned ON by the Interrogation Hut). The Interrogation Hut contains a transmitter and modulation unit necessary to provide the interrogation signal to the satellite and is also equipped with two receiving systems, for CHANNEL A and CHANNEL B but no recorders or Time Code Generators have been installed.

3. The interrogation operation has been designed to utilize two operators; one to handle the CHANNEL A receiving system, manipulate the antennas, and operate the MODULATION/TIMER unit, the other to handle the CHANNEL B receiving system. The services of one electronics technician also will be required to check out the equipment, adjust the transmitters and make receiver sensitivity checks and control adjustments. All operators and technicians involved in the Project must thoroughly understand their respective operations as described in the SOP and be able to execute them without hesitation. Practice in reading the maps, developing charts, and operating the equipment is mandatory.

B. TRANSMITTING EQUIPMENT

1. The Interrogation Hut is equipped with two, identical, crystal controlled, 200-watt transmitters installed in ~~individual cabinets~~ the transmitter rack. To

~~SECRET~~ - LIMITED DISTRIBUTION

control these transmitters, a special MODULATION/TIMER UNIT (hereinafter designated MTU) is installed at the operating position. The MTU supplies the required modulation (as selected by the eight-position Modulation switch) to either of the transmitters (as selected by the Transfer switch on the MTU panel) as well as a timed pulse when the TRANSMIT button (also on the MTU) is pushed. The details on the two transmitters and the MTU are covered in the NRL Instruction Book No. 28 and Addendum, supplied separately.

It also selects the carrier frequency which is to be used

C. RECEIVING EQUIPMENT

1. The receiving equipment consists essentially of two model R-390A radio receivers and four amplifier-converters, one active and one spare for each receiver. Substantially, the R-390A receivers operate as the intermediate and audio frequency sections of a double superheterodyne system, and the converters act as the preamplifier and converter stages. The converters are pre-tuned permanently to the two frequencies on which reception will take place. Therefore, changes to the R-390A receiver frequency tuning is actually only a "vernier" tuning of the intermediate frequency of the system. The overall system, with controls properly adjusted, has a sensitivity of approximately -120dbm.

2. There are but two frequencies to be received, both of which are permanently fixed and crystal controlled. The signal on one frequency (CHANNEL A) is an amplitude-modulated, telemetry-type emission, and as such will be relatively easy to locate and follow during frequency changes (Doppler shift, receiver drift, etc.). The signal on the second frequency (CHANNEL B), however, consists of short, intermittent bursts, somewhat like keyed CW, which may be difficult to locate and follow during frequency changes. Two converters are provided for each of these frequencies; one active and one spare unit. These converters are fixed-tuned, and their conversion oscillators are crystal controlled so that no adjustments are possible or required in their use. The crystal frequencies and the internal adjustments of these converters have been chosen so that their output frequencies, feeding the R-390A receivers, are nearly the same. In this way, either of the desired signals will be received at nearly the same frequency setting of the R-390A receivers, within the limits explained below. The correct R-390A frequency settings will be provided at the appropriate time.

3. The CHANNEL B receiver is also used for reception of standard time signals, broadcast within its frequency limits. A two-way switch on the CHANNEL B converter and labeled "STANDARD TIME WHIP ANTENNA/CONVERTER" connects the CHANNEL B receiver directly to the whip antenna when it is in the "STANDARD TIME WHIP ANTENNA" position. Be sure that this switch is in the "CONVERTER" position at all times, other than when time signals are being received.

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

4. Additional technical specifications and details on the functions of all controls can be obtained from the NRL Instruction Book No. 25, supplied separately.

D. ANTENNAS AND ANTENNA ROTATION MECHANISM

1. The two sets of antennas used for this operation have been specifically designed to provide a maximum of gain, compatible with the required antenna beam pattern. The CHANNEL A antenna is a two-bay, 10-element Yagi antenna, vertically polarized, with a gain of 14db and a $\frac{1}{2}$-power beam width of 30° in azimuth and 50° in elevation. The CHANNEL B antenna is a four-bay, 10-element Yagi antenna, vertically polarized, with a gain of 16db and a $\frac{1}{2}$-power beam width of 22° in azimuth and 50° in elevation. The CHANNEL B antenna will also be used for transmitting the interrogation signal to the satellite. Due to the difference in azimuth beam widths, extreme care will have to be taken when moving the antennas to keep the satellite in the center of the antenna beam patterns. Easy movement of the antennas and antenna mast is accomplished through the use of a planetary gear system with a mechanical advantage of 6 to 1.

E. BRIEF CONCEPT OF OPERATIONS

1. Sites will be notified in advance, via an ALERT message, (Appendix A) of the missions to be interrogated. As specified further in this SOP, equipment adjustments will be performed, Predicted Time of Signal Acquisition computed and a time versus azimuth chart developed to aid in tracking the satellite during each mission to be interrogated. The electronic control of the various sensors within the satellite permit activation of any desired combination of two during a single mission. However, prior to activation of the sensors, an "arming" circuit in the satellite must first be energized. This "arming" circuit requires only one command, after which the various sensors may be activated in sequential order. The various modulations for the command transmitters required to energize the "arming" circuit and to activate the various sensors (hereinafter referred to as MODES ALFA thru HOTEL), are selected via the eight-position Modulation switch on the MTU. This project will be primarily concerned with the selected activation of two sensors during a single mission in the proper time sequential order (SEQUENCE INTERROGATION). Occasions may arise requiring the activation of only one sensor (SINGLE INTERROGATION). Detailed steps required to perform each type interrogation operation are contained in Section V of this SOP. Upon completion of the interrogation operation, a message report of the results will be made (Appendix E).

2. IT IS ESSENTIAL THAT TRANSMISSIONS BE KEPT OFF THE AIR AT ALL TIMES OTHER THAN WHEN INTERROGATION IS ORDERED (means are provided to permit testing and, if necessary, adjustment of the transmitters on a dummy load simulating the antenna).

F. TAPE RECORDING OF THE VARIOUS SIGNALS

1. A tape recording of the two data signals, provided separately, for instruction and indoctrination of new personnel, has been prepared to allow more complete familiarization with the signals that will be encountered in the operations. CHANNEL ONE contains the voice annotations. CHANNEL TWO contains a 10-minute recording of the CHANNEL A signal with the BFO OFF, a 10-minute recording of the CHANNEL A signal with BFO ON, and a 10-minute recording of the CHANNEL B signal. The Standard System Check Emission, mentioned further in this SOP, which is a burst of 2500 milliseconds duration, is not recorded on the CHANNEL B signal. The recording was made at a tape speed of $7\frac{1}{2}$ inches per second.

~~SECRET~~ - LIMITED DISTRIBUTION

II - PRE-INTERCEPT EQUIPMENT ADJUSTMENTS

A. GENERAL: The adjustments specified in this chapter must be performed by qualified maintenance personnel who are thoroughly familiar with the instrumentation of the Interrogation Hut. The successful execution of this mission is directly dependent upon the skill and care with which the technician performs these adjustments.

B. INSTRUCTION MANUALS: Instruction manuals which contain detailed information have been provided for each major item of equipment installed in the hut. Maintenance personnel should study the manuals so as to become thoroughly familiar with the equipment and its operation.

C. TRANSMITTER CHECK AND TUNING ADJUSTMENTS: (Includes Modulation Timer Unit)

1. When required:

a. During the initial set up of the Interrogation Hut equipment.
b. Whenever repairs have been made which could affect the tuning adjustments of the transmitters or the MTU.
c. Immediately prior to the commencement of a series of alerts.
d. Once each week if the station is operating at the rate of one or more missions per week.
e. At intervals as required to ensure the system is capable of operations on short notice (i.e. two hours after the receipt of an ALERT message, when there is a period of more than one week between missions).

2. Checks and Tuning Adjustment Procedure: Detailed instructions for the performance of the required transmitter checks and tuning adjustments are contained in the Instruction Book for Assembly, Installation and Maintenance of Control Huts (NRL Instruction Book No. 28 and Addendum), supplied separately.

D. RECEIVER SYSTEM SENSITIVITY CHECK: As prescribed in Section II of the SOP for this Project, Collection/Reporting, supplied separately.

E. ROTATING ANTENNA CHECK: Once each day, during daylight hours, a quick check of the rotating antenna system is to be made. This check is made by rotating the antenna in a wide arc and noting the rise and fall of the noise level. A rise and fall of from three to five VU as indicated by the LINE LEVEL meter of the R-390A receiver is indicative of a properly operating antenna system.

F. PRE-OPERATIONAL CHECKS: The following checks are to be performed by a qualified maintenance man prior to the operation of a mission:

~~SECRET~~ - LIMITED DISTRIBUTION

1. WARM UP EQUIPMENT: Two hours prior to the Predicted Time of Signal Acquisition (Section III), turn on all equipment that will be used in the intercept operation or for test purposes.

2. Approximately one hour prior to the Predicted Time of Signal Acquisition (Section III, sight-check all equipment to ensure that transmitters are properly adjusted, frequency dial settings on both the CHANNEL A and B receivers corresponds with those specified, all systems are functioning properly and the MODULATION SWITCH ON THE MTU IS PROPERLY SET AS SPECIFIED IN COLUMN (7) OF THE ALERT MESSAGE. The receivers and MTU controls should be adjusted as shown in Figure 1 (Systems Control Adjustment Chart).

3. Turn the system over to the operators for the execution of the mission.

~~SECRET~~ - LIMITED DISTRIBUTION

SYSTEMS CONTROL ADJUSTMENT CHART

Meter Switch or Control	Sensitivity check both Receivers	Gain Control Adjustments	OPERATIONS CHANNEL A	OPERATIONS CHANNEL B
RECEIVERS:				
Line Meter	TBA	NU	NU	NU
Line Gain	TBA	NU	NU	NU
Ant. Trim	Maximize	Maximize	Maximize	Maximize
AGC	Fast	Fast	Fast	Fast
Limiter	OFF	OFF	OFF	OFF
Carrier Level	Variable	Variable	Variable	Variable
Bandwidth	16 kc	16 kc	2-16 kc	16 kc
BFO Pitch	NU	NU	Variable	Variable
Audio Response	Wide	Wide	Wide	Wide
Break In	OFF	OFF	OFF	OFF
Function	MGC	MGC	AGC	MGC
BFO	OFF	OFF	ON	ON
Dial Lock	NU	NU	NU	NU
KC Change	AV	AV	AV	AV
Zero Adj.	NU	NU	NU	NU
MC Change	AV	AV	AV	AV
Local Gain	CL	CL	CL	CL
RF Gain	TBA	TBA	Pre-set	Pre-set
MODULATION/TIMER UNIT:				
Output Meter	Instantaneous reading when TRANSMIT button depressed.			
Transmitter Switch	#1 or #2 (as desired)			
Modulation Switch	MODE ALFA thru HOTEL (as specified in the ALERT message)			
Transmit Button	Press at time specified in the ALERT message.			

LEGEND: TBA - To be adjusted as noted in SOP
NU - Not used
AV - Assigned value
CL - Comfortable level in earphone

Figure 1

III - PRE-INTERCEPT OPERATIONS

A. Pre-intercept operations will begin with the receipt of an ALERT message (Appendix A). Upon receipt of this message, proceed as follows:

1. Determine the Predicted Time of Signal Acquisition.

a. Normal Case: (Orbit-track passes well within the circle of intercept probability).

(1) Using the polar map provided separately, rotate the plastic disk until Point "A", the point at which the orbit of the satellite enters the Northern Hemisphere (hereinafter referred to as the point of equatorial crossing), is aligned with the longitude specified in the ephemeral data message (Appendix F).

(2) Count the number of minute intervals between the point of equatorial crossing and the first point of intersection between the orbit track and the station circle of intercept probability.

(3) Add the number of minutes obtained in step (2) above to "Time of Equatorial Crossing" specified in the ephemeral data message (Appendix F). This will be the predicted time of signal acquisition.

(4) The time for commencement of search for the CHANNEL A data signal will be a minimum of four minutes prior to the predicted time of signal acquisition.

b. Special Case: (Orbit-track barely passes within the circle of intercept probability, but successful interrogation considered probable).

(1) Compute the predicted time of signal acquisition as in para A.1.a. above. The time for commencement of search for the CHANNEL A data signal in this case will be a minimum of six minutes prior to the predicted time of signal acquisition.

2. Develop a Time Versus Azimuth Chart: Using the azimuth lines drawn on the polar map provided, determine the time at the intersection of the orbit with each 5° radial line and develop a time versus azimuth chart for the mission. Figure 2 is a sample Time Versus Azimuth Chart.

TIME VERSUS AZIMUTH

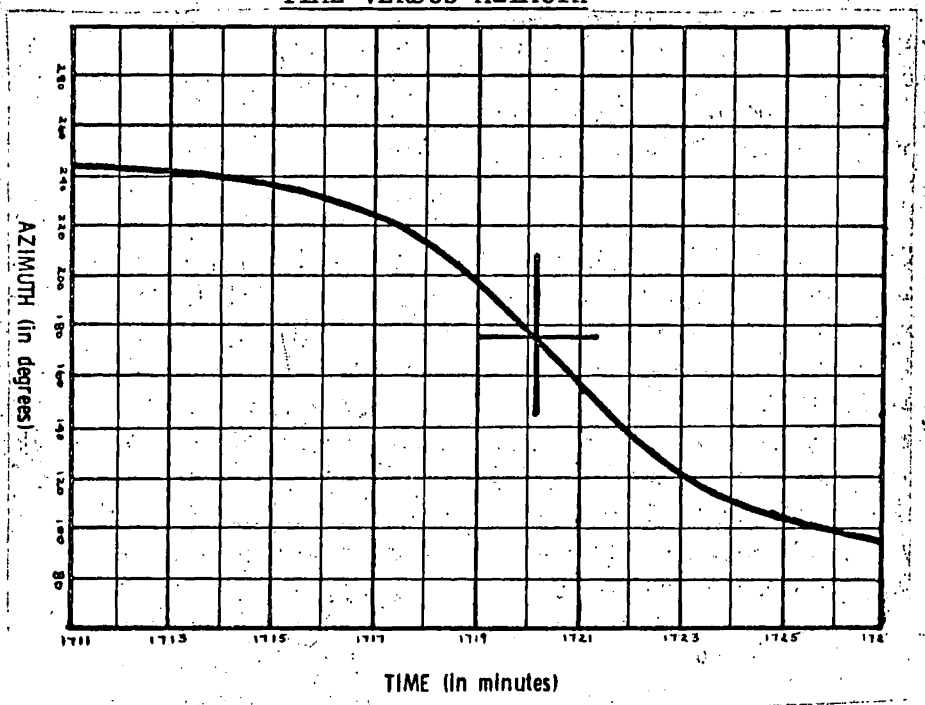


Figure 2.

3. Preparing for Operation: Approximately 1/2 hour prior to the PREDICTED TIME OF SIGNAL ACQUISITION the operator will enter the hut and make preparations for the mission. The following steps are accomplished at this time:

a. Check Equipment A sight check of all equipment, paying particular attention to equipment control settings will be made. Ensure that all controls are set in accordance with the settings provided in Figure 1. Set the frequency of the Channel A and B receivers to the frequency provided and monitor both receiver noise levels to confirm that they appear to be operating properly. Ensure that the "STANDARD TIME WHIP ANTENNA/CONVERTER" switch on the CHANNEL B converter is in the "CONVERTER" position. BE CERTAIN THAT THE MODULATION SWITCH ON THE MTU IS SET TO THE MODE SPECIFIED IN THE ALERT MESSAGE. (Column (7)). Standby to commence search at the time established for the particular pass.

~~SECRET~~ - LIMITED DISTRIBUTION

IV - DURING SEARCH AND ACQUISITION

A. DESCRIPTION OF SIGNALS

1. The CHANNEL A signal, because of the type emission employed, serves a dual purpose. The signal from CHANNEL A is on at all times, hence it can be used to track the satellite. The telemetry information conveyed on this signal provides "housekeeping" information on the condition of the satellite.

2. The CHANNEL B signal, which is turned on by the Interrogation Hut, conveys the data from the sensors in the satellite. This signal consists of random groups of pulses and is received only intermittently. Immediately upon activation of the "arming" circuit and each sensor in the satellite, there will be emitted on CHANNEL B, a burst of 2500 milliseconds duration. The CHANNEL B transmitter is simultaneously turned on with the activation of the first sensor and not with the activation of the "arming" circuit. Immediately upon turn-on of the satellite transmitter, the 2500-millisecond reference burst on CHANNEL B will be followed by random groups of pulses received at intermittent intervals, ranging from a few milliseconds to several seconds duration. The 2500-millisecond reference pulse, previously referred to as a "Standard System Check Emission" (hereinafter designated SSCE), is used as a positive reference to verify the successful activation of the "arming" circuit and sensors within the satellite. The reception of random groups of pulses on CHANNEL B is also used as a verification reference for SINGLE INTERROGATION, but should only be considered as secondary to the reception of the SSCE immediately after transmission of the interrogation signal. The reception of the SSCE immediately after each interrogation is vitally important to this operation, not only to ensure that the desired activation has occurred, but also to avoid excessive transmission of the interrogation signal.

B. SYSTEM VARIATIONS

1. Every effort has been made to assemble a highly stable receiving system. However, the operators must keep in mind several facts which bear on receiving signals from satellites:

a. Crystals in a circuit do not necessarily ensure absolute frequency accuracy. The crystal accuracy will vary considerably because of temperature changes, associated circuit capacitance changes, tube variations, and grinding tolerances.

b. The accuracy of receiver dial settings is no better than the adjustment of the circuitry behind them. Mechanical linkage misadjustment or slippage, oscillator drift, calibrator shift, etc., can all cause erroneous readings.

c. Reception can be assured only when the entire system, i.e., transmitters, receivers, and the space in between, is attuned. The following possible sources of failure in reception should be kept in mind:

(1) The satellite transmitter may have drifted or changed frequency.

(2) The converter frequency may have drifted or changed.

(3) The receiver setting may not really indicate the frequency to which the receiver is tuned, even though the calibrator seems to confirm the setting.

(4) There may be an excessive Doppler shift in the transmitted frequency enroute to the receiving point. Doppler shift is a change in received frequency from that actually transmitted which occurs in space as a result of the relative velocity with which the transmitting and/or receiving stations are moving away from or toward each other. Refer to Figures 3, 4, and 5 for a review of the relative Doppler shift to be expected on CHANNEL B during representative missions. The magnitude of the shift on CHANNEL A will not be as great, but the shift will take place in the same manner.

C. COMPENSATING FOR DOPPLER SHIFT

1. The CHANNEL A signal is an amplitude modulated telemetry emission which will be relatively easy to follow as it shifts frequency as a result of Doppler effect. The CHANNEL B signal, however, consists of short, intermittent bursts which may be difficult to locate and follow during Doppler shift. Therefore, the CHANNEL A signal is to be used to provide a reference for the proper tuning of the CHANNEL B receiver.

D. ANTENNA TRACKING

1. The antenna arrays used with this Project are highly directive. For this reason it is necessary that the antenna array be rotated to follow the movement of the satellite as it progresses in its orbit. The CHANNEL A operator, in addition to keeping the CHANNEL A receiver tuned to follow the Doppler shift of the signal, is tasked with the rotation of the antenna, as required, to track the satellite. The antenna is most easily directed for the best reception by slowly swinging the antenna back and forth in a short arc ($\pm$ 10°) while keeping a sharp eye on the LINE LEVEL METER (on AGC). The meter will start "dipping" when the antenna is too far to either side of the best direction. The antenna must always be pointed to the center of the two positions where the LINE LEVEL METER (on AGC) starts to "dip". The TIME VERSUS

AZIMUTH CHART is to be used as a guide in the proper orientation of the antenna. Slight deviations from the TIME VERSUS AZIMUTH CHART may be necessary to overcome local interference and to optimize signal strength. The operator must make every effort to keep the main beam of the antenna pointed directly at the satellite to ensure proper orientation of the transmitting antenna at the time the interrogation signal is radiating.

E. CHANNEL A SEARCH

1. Begin searching for the CHANNEL A signal four minutes prior to the Predicted Time of Signal Acquisition for a mission in the Normal Case, and six minutes prior to this time for a mission in the Special Case (Section III). With the BFO ON and the BFO PITCH set at zero, slowly tune the CHANNEL A receiver back and forth within +5 and -2 KCS of the dial setting provided, at a rate of not more than 0.5KC/SEC until the CHANNEL A signal is heard. In order to increase the system sensitivity the operator may reduce the receiver bandwidth from 16 KCS to as narrow as 2 KCS until the signal is acquired.

F. CHANNEL B SEARCH

1. When the CHANNEL A operator has acquired and is tracking the CHANNEL A signal, the CHANNEL B operator will begin tuning the CHANNEL B receiver in direct relation to changes in frequency dial setting, caused by Doppler shift, as passed to him by the CHANNEL A operator. (Refer Section V, paras A.1. thru A.6.).

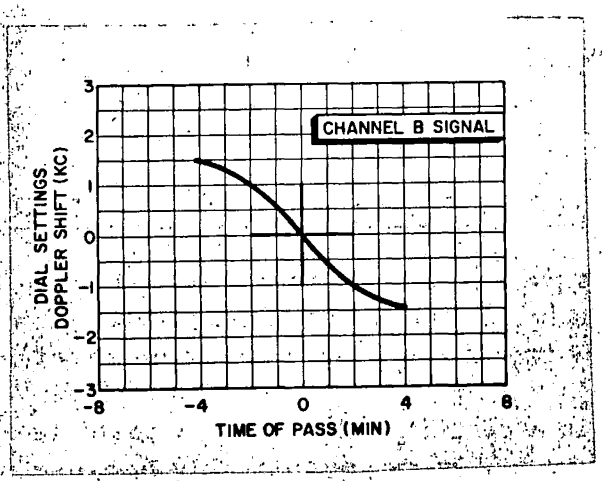


Figure 3.

SECRET - LIMITED DISTRIBUTION

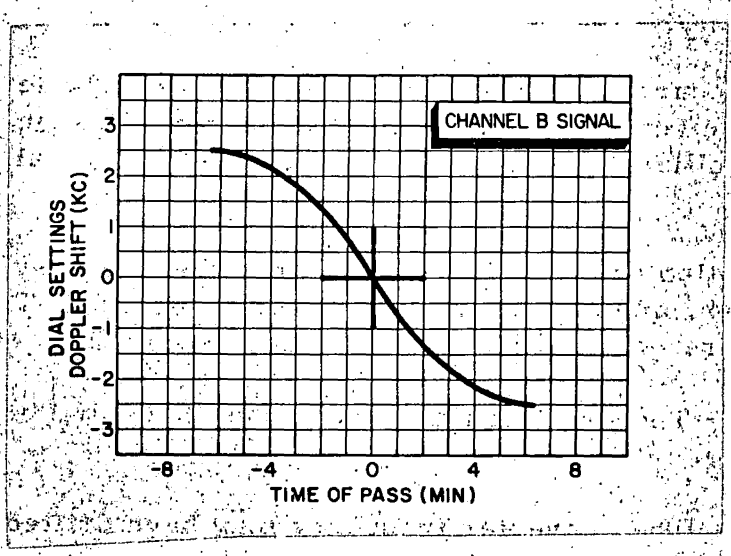


Figure 4.

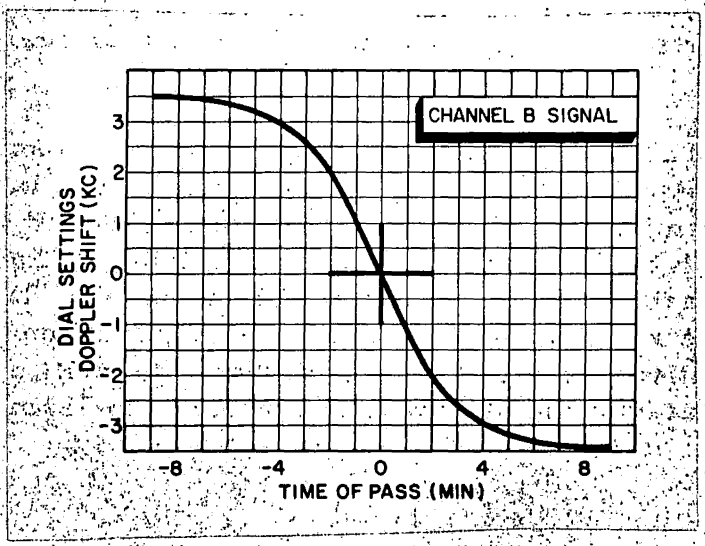


Figure 5.

SECRET - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

V - DURING ACTIVATION

A. Once the CHANNEL A signal has been acquired, it will be necessary to keep track of it until the time is reached when the TRANSMIT button must be pressed. Retention of the CHANNEL A signal is necessary if the antennas are to be kept properly oriented on the satellite, and if the CHANNEL B Doppler shift is to be properly compensated for. In order to ensure that the signal is retained after it is first acquired, the CHANNEL A receiver shall be adjusted as follows:

1. After the signal has been acquired and the antenna properly oriented, temporarily "steady" the antenna and then adjust the KILOCYCLE CHANGE knob so that the CARRIER LEVEL meter reading is maximized. This should also cause a near-zerobeat condition if the BFO PITCH control has been properly set on zero.

2. If a zerobeat condition is not realized, adjust the BFO PITCH control until a zerobeat is reached. Due to the multiplicity of channels on the basic carrier, several zerobeats will be encountered. Select the one that is most convenient to a BFO PITCH control setting of zero. An accurate zerobeat will cause the LINE LEVEL meter to drop to a very low reading.

3. Note the frequency dial reading to the nearest 100 cycles (the 1 kc counter has a vernier on its right-hand side marked in 200-cycle increments).

4. Rotate the BFO PITCH control clockwise approximately 1 kc (to about +1). The Doppler shift will bring the signal back to a zerobeat condition.

5. When the signal nears the zerobeat condition (300-400 cycles), change the PITCH control to zero and carefully move the KILOCYCLE CHANGE knob to maximize the CARRIER LEVEL meter reading.

6. Note the new frequency dial reading to the nearest 100 cycles. Calculate the difference between the previous and present frequency dial readings. By the use of the tabulation in Figure 6, the new frequency about which search for the CHANNEL B signal should be conducted, will be determined and passed to the CHANNEL B operator.

7. Repeat paragraphs 2 thru 6 above until the desired activation in the satellite has been verified.

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ LIMITED DISTRIBUTION

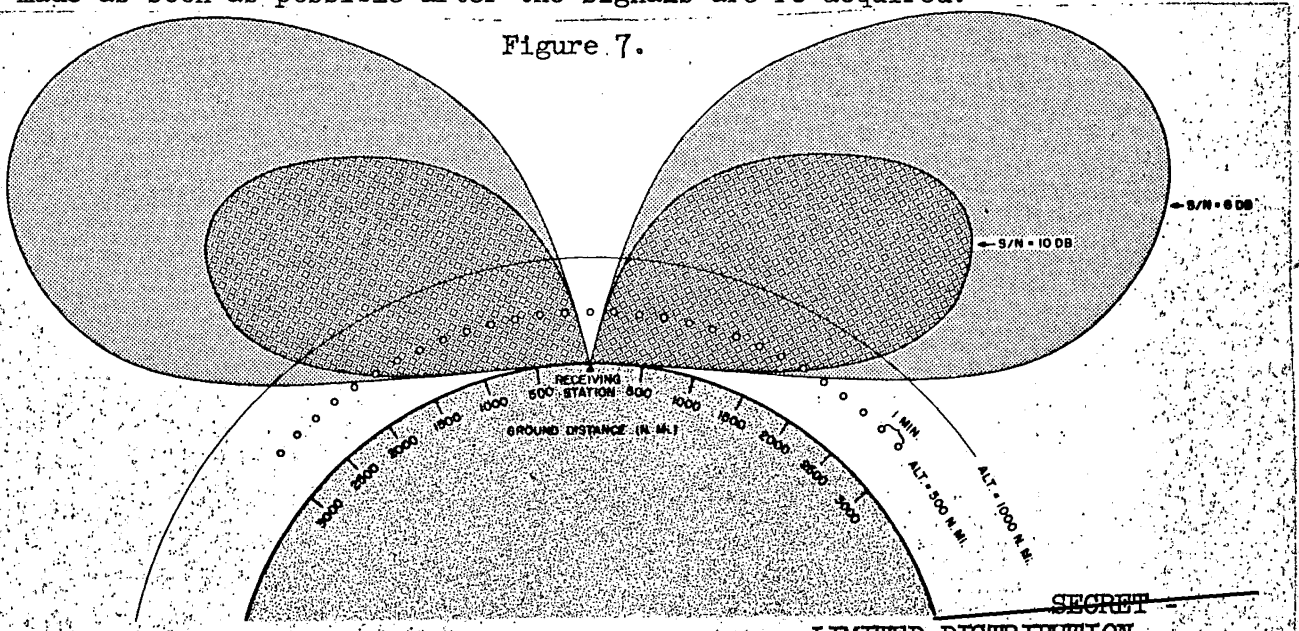
CHANNEL A Difference (cycles)	CHANNEL B Change Required (cycles)
100	140
200	280
300	420
400	560
500	700
600	840
700	980
800	1120
900	1260
1000	1400

DOPPLER SHIFT TABULATION

Figure 6.

B. In some cases, the satellite may pass directly over the intercept site. If this occurs, a very rapid fade, a loss of signal for up to two minutes, and than a rapid return of the signal will be observed during the middle of the intercept. This is occasioned by a vertical gap in the antenna coverage pattern directly over the site (see Figure 7.) Do not alter the receiving system settings during this period, but make certain that the antenna is oriented in accordance with the time versus azimuth chart. The signal may appear throughout a broad range of bearings, and the only one that will ensure maximum retention of the signal is the bearing specified in the time versus azimuth chart. It should also be noted that the maximum rate of Doppler shift will be encountered during this period, and frequency corrections should be made as soon as possible after the signals are re-acquired.

Figure 7.



VERTICAL COVERAGE FOR TRACKING

~~SECRET~~ LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

C. Continue to compensate for Doppler shift and satellite position until the time is reached for activation of the "arming" circuit and desired sensor in the satellite, then proceed as follows:

1. SINGLE INTERROGATION: (Only one sensor activated)

a. Press the TRANSMIT button on the MTU exactly on the minute and at least one full minute after CHANNEL A is acquired (e.g. if CHANNEL A is acquired at 0801:03Z press TRANSMIT button at 0803:00Z; if CHANNEL A acquired at 1823:55Z, press TRANSMIT button at 1825:00Z, etc.). It is not necessary to hold the button down. Observe the meter on the MTU, and if it deflects instantaneously to about mid-scale, assume that the "arming" circuit in the satellite has been energized.

b. Immediately upon pressing the TRANSMIT button and with the BFO ON, rapidly sweep through ± 2KCS of the CHANNEL B receiver dial setting specified separately (as modified by paragraphs A.1 thru A.6. above) in search of the SSCE (2500-millisecond reference burst). Attempt to zerobeat the CHANNEL B receiver on the SSCE. Reception of the SSCE on CHANNEL B during this phase is evidence that the "arming" circuit in the satellite has been energized.

c. In the event the "arming" circuit is not verified to be energized, wait fifteen seconds, press the TRANSMIT button a second time and again attempt reception of the SSCE.

d. If the SSCE is still not received after pressing the TRANSMIT button the second time, switch to the second transmitter via the Transfer switch on the MTU, wait fifteen seconds, press the TRANSMIT button for the third time and again attempt reception of the SSCE.

e. If the "arming" circuit still cannot be verified to be energized after pressing the TRANSMIT button for the second transmitter, wait fifteen seconds, press the TRANSMIT button for the fourth and LAST time and again attempt reception of the SSCE.

f. Immediately upon successful activation of the "arming" circuit above, or failure to activate this circuit after a total of four attempts, reset the Modulation switch on the MTU to the MODE specified in the ALERT message (Column 5), wait fifteen seconds, then press the TRANSMIT button.

g. Immediately upon pressing the TRANSMIT button and with the BFO ON, attempt to receive and zerobeat the SSCE in the CHANNEL B receiver. When a zerobeat has resulted, switch the BFO OFF and listen for random groups of pulses on CHANNEL B, compensating for Doppler shift if necessary. If the SSCE has not been received within 3 to 4 seconds, start searching +5 KCS and -2 KCS around the CHANNEL B

receiver dial setting, mentioned above, for random groups of pulses. Reception of either the SSCE or random pulses on CHANNEL B during this phase is sufficient evidence that both the desired sensor and CHANNEL B transmitter in the satellite have been activated.

h. In the event activation of the sensor is not verified within fifteen seconds after pressing the TRANSMIT button for the first time, press the TRANSMIT button for the second time; verify activation as in step C.1.g. above.

i. If activation cannot be verified within fifteen seconds after pressing the TRANSMIT button for the second time, switch to the second transmitter via the Transfer switch on the MTU. Press the TRANSMIT button for the third time; verify activation as specified in step C.1.g. above.

j. If activation still cannot be verified within fifteen seconds after pressing the TRANSMIT button for the second transmitter, press the TRANSMIT button for the fourth and LAST time; verify activation as specified in step C.1.g. above.

2. SEQUENCE INTERROGATION: (Two sensors activated)

a. Carry out steps C.1.a. thru C.1.j. above as necessary, in an attempt to activate the "arming" circuit, the first sensor and turn on the CHANNEL B transmitter. In the event that no evidence exists up to this point to verify that either the "arming" circuit has been energized or the first sensor has been activated, secure the interrogation operation and submit a message report of the details (Appendix E).

b. Immediately upon verification of both the "arming" circuit being energized and the first sensor being activated or the verification of the "arming" circuit being energized and failure to activate the first sensor, reset the modulation switch on the MTU to the MODE specified in the ALERT message (Column 6) for activation of the second sensor, wait fifteen seconds and press the TRANSMIT button.

c. Upon pressing the TRANSMIT button, immediately attempt reception of the SSCE (2500-millisecond reference burst) on CHANNEL B. Only the reception of the SSCE will positively verify the activation of the second sensor since any random pulses received may be the result of the first sensor, activated previously.

d. If the activation cannot be verified by the reception of the SSCE in step C.2.c. above, after fifteen seconds, press the TRANSMIT button a second time; verify the activation as specified in step C.2.c. above.

~~SECRET~~ - LIMITED DISTRIBUTION

e. If the activation is still not verified in step C.2.d. above, after fifteen seconds, switch to the second transmitter via the Transfer switch on the MTU, press the TRANSMIT button for the third time; verify the activation as specified in step C.2.c. above.

f. If activation is still not verified in step C.2.e. above, after fifteen seconds, press the TRANSMIT button for the fourth and LAST time; verify the activation as specified in step C.2.c. above.

~~SECRET~~ - LIMITED DISTRIBUTION

VI - AFTER ACTIVATION

A. Upon completion of the operation to activate the sensors in the satellite, report results, using format as prescribed in Appendix E.

B. After all operations in the hut have been completed, and if no ALERTS are expected within the next three hours, turn off all equipment. If another ALERT is expected within the next three hours, leave the receivers ON, but turn OFF the transmitters. Leave the R-390A receiver FUNCTION SELECTOR switches in the AGC position, not on STANDBY.

VII - MAINTENANCE

A. In order to ensure maximum performance from the equipment, strict adherence to standard maintenance procedures as outlined in the equipment instruction manuals and the installation manual is mandatory.

B. Each malfunction and the action taken to repair it shall be reported on an "as-occurring" basis. Electronic Failure Report forms (DD Form 787) should be used (see Appendix D). Forward these reports direct to:

Director, Naval Security Group (Op-94G/G52)
3801 Nebraska Ave., N. W.
Washington 25, D. C.

Enter the covername for this Project in Block 20.

C. Any difficulties encountered with the equipment which cannot be handled by station forces should be reported in detail immediately to DIRNAVSECGRU by message.

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

INTERROGATION ALERT MESSAGE FORMAT

PRECEDENCE DATE/TIME GROUP

FM DIRNAVSECGRU

TO

INFO

C L A S S I F I C A T I O N

Project (Covername for this project)

1. Read six/seven columns:

ONE	TWO	THREE	FOUR	FIVE	SIX	SEVEN
(Mission number to be interrogated (four digits)				(MODE setting for activation of first sensor)	(MODE Set ting for activation of second sensor; if second sensor not to be activated, will list "NONE")	(MODE setting for energizing "arming" circuit (See Note 1))

2. Remarks:

Note 1: Unless otherwise directed, the MODE setting for energizing the "arming" circuit will always be MODE ECHO. This will be denoted by the omission of column seven from the ALERT message. In the event the back-up MODE for energizing the "arming" circuit is required, column seven will then appear specifying the appropriate MODE.

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

	Alternate

TIME CHECK OBSERVATORY DESIGNATION LIST

This list is provided only as a guide line, and does not preclude the use of any station listed in Appendix C if the suggested stations do not provide adequate signals.

FOR APPENDIX C,

SEE APPENDIX F,

STANDARD OPERATING PROCEDURE

FOR

THIS PROJECT

(COLLECTION/REPORTING)

DATED

JUNE 1961

REPORT THE FAILURE OF ONLY ONE PART OR TUBE ON THIS FORM

1. REPORT NO.	2. REPORTING ACTIVITY	3. REPAIRED OR REPORTED BY (NAME)	4. DATE OF FAILURE
5. EQUIPMENT INSTALLED IN (TYPE AND NO.)	6. TIME METER READING OR INSTALLATION LOG TIME	7. WAS MISSION ABORTED? ☐ YES ☐ NO	8. OPERATIONAL CONDITION

EQUIPMENT	9. MODEL DESIGNATION AND MOD. NO.	10. SERIAL NO.	11. CONTRACTOR	12. CONTRACT OR ORDER NO.
COMPONENT (MAJOR UNIT)	13. MODEL DESIGNATION AND MOD. NO.	14. SERIAL NO.	15. CONTRACTOR	16. CONTRACT OR ORDER NO.
ASSEMBLY OR SUBASSEMBLY	17. ASSEMBLY AND MOD. NO.	18. SERIAL NO.	19. MANUFACTURER	20. (LEAVE BLANK)

PART DATA	21. PART NAME OR TUBE TYPE	22. STOCK NO. (FAILED ITEM)	23. PART REF. DESIG. (V-101, R-101, ETC.)	24. REPAIR TIME (MAN-HOURS)
	25. HOURS IN SERVICE	26. MANUFACTURER OF FAILED PART	27. SERIAL NO.	28. WAS REPLACEMENT PART AVAILABLE LOCALLY? ☐ YES ☐ NO

29. FIRST INDICATION OF TROUBLE

1	INOPERATIVE
2	INTERMITTENT
3	LOW PERFORMANCE
4	NOISY
5	OFF FREQUENCY
6	OUT OF ADJUSTMENT
7	OVERHEATING
8	UNSTABLE
9	OTHER

30. CHECK TYPE(S) OF TUBE OR PART FAILURE

007	ARCING	001	GASSY	790	OUT OF ADJUST.		
710	BEARING FAILURE	300	GROUNDED	006	SHORTED		
780	BENT	380	LEAKAGE	770	SLIP RING OR COMMUTATOR FAILURE		
040	BINDING	730	LOOSE				
070	BROKEN	004	LOW GM OR EMISSION	018	TESTED OK, DID NOT WORK		
720	BRUSH FAILURE	750	MISSING				
080	BURNED OUT	008	NOISY	020	WORN EXCESSIVELY		
130	CHANGED VALUE	450	OPEN		SEE INSIDE FLAP FOR ADDITIONAL CODES		
170	CORRODED	099	OTHER				

31. CAUSE OF FAILURE

2	FAULTY PACKAGING
5	MISHANDLING
6	INSPECTION OR TEST
1	NORMAL OPERATION
3	STORAGE
7	ASSOCIATED FAILURE—EXPLAIN
4	OTHER

32. WAS THE PART REPLACED DURING PREVENTIVE MAINTENANCE? ☐ YES ☐ NO

33. REMARKS (CONTINUE ON REVERSE SIDE IF NECESSARY)

DD (1 AUG 54) 787 U. S. GOVERNMENT PRINTING OFFICE : 1957 O-F—431088 **ELECTRONIC FAILURE REPORT**

ELECTRONIC FAILURE REPORT FORMS (DD Form 787)

~~SECRET~~ - LIMITED DISTRIBUTION

INTERROGATION REPORT MESSAGE FORMAT *

FM

TO DIRNAVSECGRU

INFO

C L A S S I F I C A T I O N

Project (Covername for this project)

ALFA: (Mission number)

BRAVO: (GMT to nearest second CHANNEL ALFA first heard)

CHARLIE: (GMT TRANSMIT button was pressed followed by MODE setting. (Report time of each attempt to nearest second, e.g. 1945:00/ECHO, 1945:15/GOLF, 1945:30/GOLF, etc.))

DELTA: ("Arming" circuit energized ("YES" or "NO")

ECHO: (Activation of first sensor successful ("YES" or "NO")

FOXTROT: (Activation of second sensor, if any, successful ("YES" or "NO"). If no attempt required, list "NONE")

GOLF: (GMT to nearest second, of each SSCE received followed by MODE setting of the MTU during the particular activation (e.g., 1945:02/ECHO, 1945:31/GOLF, etc.)). If no SSCE received list "NONE".

HOTEL: (If any attempt to interrogate is unsuccessful, outline difficulty and make comment on corrective measures taken.)

- -

* When using this format, ensure report is so worded that it will not reveal that reference is being made to transmitter or interrogation equipment or satellite operations.

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION

EPHEMERAL DATA MESSAGE

PRECEDENCE DATE/TIME GROUP

FM DIRNAVSECGRU

TO

INFO

C L A S S I F I C A T I O N

Project (Covername for this project)

(INFO will be formated across the page into three separate divisions, each of which will consist of three columns. INFO in each division will be as follows):

(DATE)			(DATE)	(DATE)
(MISSION NUMBER)	(GMT OF EQUATORIAL CROSSING)	(LONGITUDE OF EQUATORIAL CROSSING)	(REPEAT INFO)	(REPEAT INFO)

~~SECRET~~ - LIMITED DISTRIBUTION

~~SECRET~~ - LIMITED DISTRIBUTION