FINAL REPORT

BIT MISSION 7052

11 December 1964

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File No. H-1155
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SPECIAL HANDLING

FINAL REPORT - BIT MISSION 7052

1. ~~(S)~~ MISSION SUMMARY.

1.1 ~~(S)~~ Program Objectives.

As part of the over-all problem of determining the vulnerability of the Agena satellites to Soviet radar detection and tracking, the objective of the BIT program is to determine if and when the radar system associated with the signal [redacted] acquires and tracks the Agena vehicle. The BIT system, designed to fulfill this objective, covers the frequency range from 154 to 164 Mc and accepts only those signals which have characteristics similar to [redacted] On those signals which qualify, the system will measure frequency, PRF, and signal amplitude along with the time of intercept to enable an analyst to identify the signal characteristics and to estimate a geographical area within which the emitter is located.

1.2 ~~(S)~~ Mission Highlights.

No signals of interest were intercepted during the effective mission life which started with orbit 9 and lasted until orbit 63. A problem in the vehicle's data link prevented recovery of the data recorded prior to orbit 9 and a commutator failure in the BIT system after orbit 63 prematurely terminated the mission which was programmed to last 160 orbits. The Signal Simulator and Activity Indicator in the BIT showed that the system was functioning properly during the entire mission for which data is available.

1.3 ~~(S)~~ Flight Summary.

Vehicle Number	1173
Launch Date	2 November 1964
Launch Time	2134 GMT
Inclination	80 degrees
Apogee	246 nautical miles
Perigee	99 nautical miles
Period	90.8 minutes

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2. ~~(S)~~ DATA ANALYSIS.

2.1 ~~(S)~~ System Coverage.

The BIT system was programmed on during 34 orbits of the 63 orbit mission life while the vehicle was over the northern hemisphere with an emphasis on the coverage over Europe, the USSR and Asia. On six occasions, the unit was on throughout the period while the vehicle was over the southern hemisphere.

The system monitors the 154- to 164-Mc frequency range with a receiver sensitivity of -54 dbm. With the inclusion of the antenna pattern, the over-all system sensitivity varies from approximately -44 dbm at the horizon to -52 dbm looking straight down. Signals intercepted by the system are rejected by qualification circuitry if the pulse widths are less than approximately 24 microseconds and if the PRFs do not fall within the 95- to 100-pps PRF acceptance band or harmonics of this band. The system measures amplitude, frequency, and PRF on those signals which qualify. If a signal has a power level at the receiver of -26 dbm or greater, it will also be fed into a high level channel which requires no qualification other than amplitude and which measures only the signal amplitude.

2.2 ~~(S)~~ Mission Results.

2.2.1 ~~(S)~~ Qualified Intercepts.

[redacted]

2.2.2 ~~(S)~~ Non-Qualified Intercepts.

[redacted]

3. (S) SYSTEM PERFORMANCE EVALUATION.

3.1 (S) System Description.

A block diagram of the BIT system is shown in Figure 1 although it is labeled by its in-house name of FIRE BOX. It is basically a TRF (tuned radio frequency) receiver with video logic for signal recognition and circuits for parameter measurement. An intercepted signal which exceeds the Detector B threshold of -53 dbm is amplitude standardized in the video threshold circuit and then qualified. If the pulse width is greater than 24 microseconds, the signal will be passed to the Pulse Rate Counter (PRC) and the PRF Qualifier. The PRC counts the total number of pulses received during one commutator read-in cycle (400 milliseconds) and the PRF Qualifier examines the pulse train for a PRF of 95 to 100 pps or harmonics of this PRF range. If the PRF qualifies, a pulse-by-pulse gate pulse is generated which opens the two gates to permit the Peak Level Detectors (PLD) to read amplitude and frequency. The PLD's store the lowest frequency and the highest pulse amplitude intercepted during the 400-millisecond read-in period. If the signal level exceeds -26 dbm at the receiver, the signal amplitude will be read in the Detector A channel without qualification. A Time Reference Generator provides a parallel octal time code reference for the system. It is also used to trigger the Signal Simulator on for four seconds every 256 seconds. The Simulator generates a 98-pps signal at a frequency of 160 Mc and a power level of -28 dbm which is used to test the entire system for proper operation plus providing a one-point calibration check of the system.

A Signal Activity Indicator, designated as PRC-B, has been added to the system to provide a check on the operational status of the antenna and the PRF input line. The circuit, which is connected to the output of the Video Threshold circuit, counts every pulse received regardless of pulse width or PRF. Since it is primarily intended to indicate the presence of activity and it is an "add on" modification, no attempt was made to achieve accurate pulse count measurements.

A summary of the system specifications for the BIT system used in this mission is given below, and a plot of the system's detection sensitivity is shown in Figure 2.

Minimum Detectable Signal	-53 dbm (PLD-B) -26 dbm (PLD-A)
PRC Minimum Acceptable Pulse Width	24 microseconds
Frequency/Amplitude PLD Minimum Pulse Width	30 microseconds

FIRE BOX SYSTEM

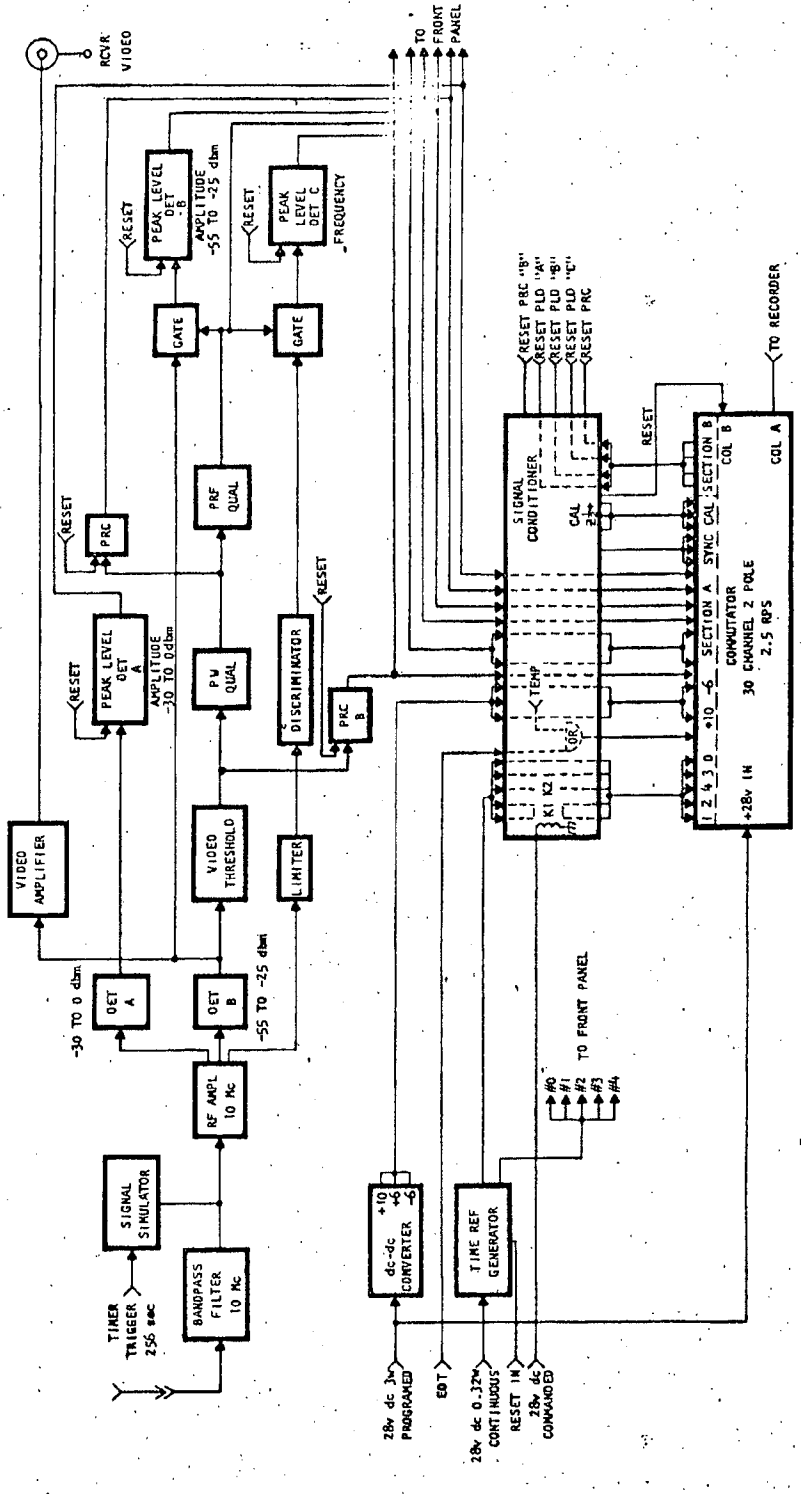

Figure 1

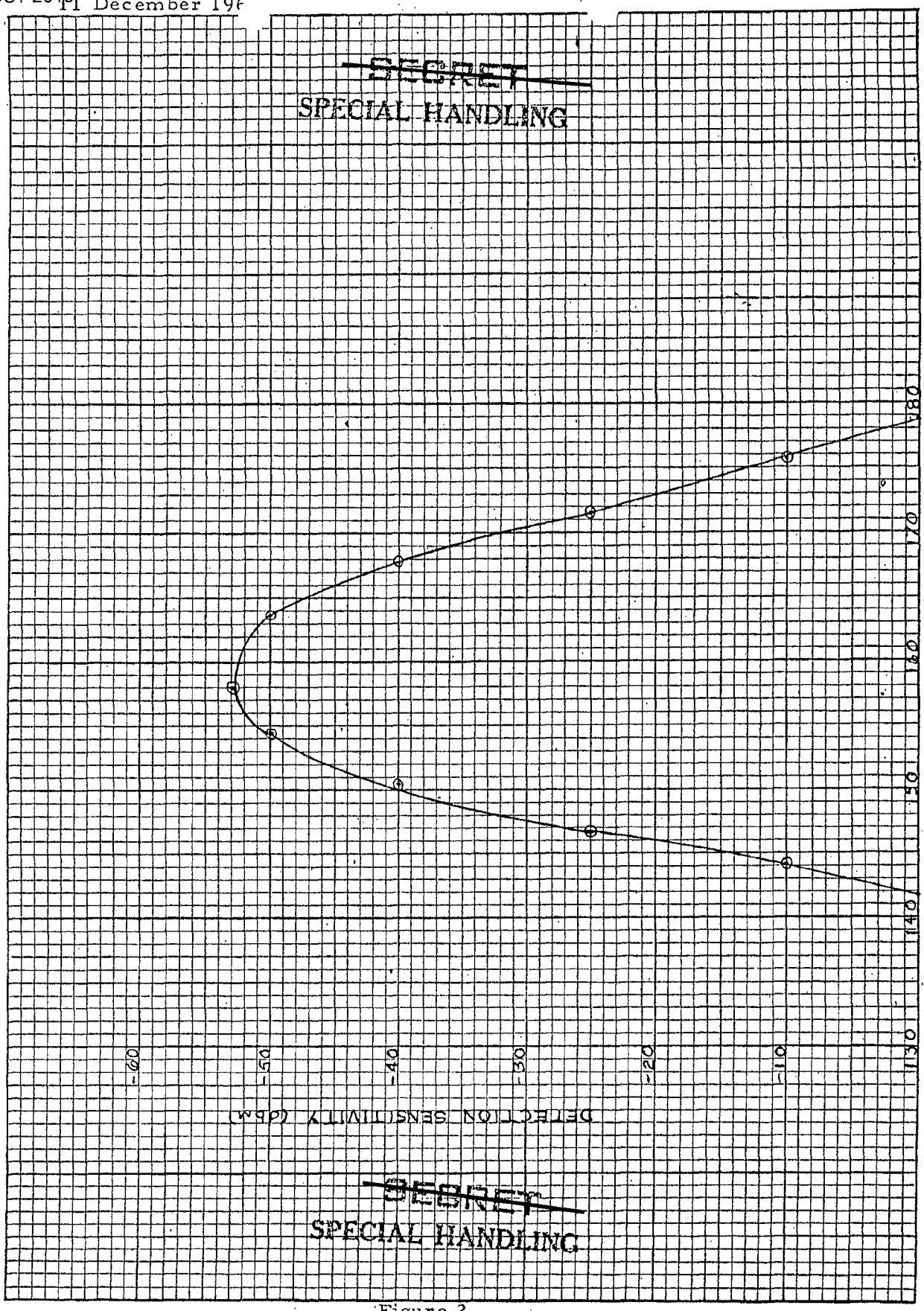

Figure 2

3.1 (S) -- Continued.

PRF Qualifier Acceptance Range	95-100 pps (fundamental) 189-201 pps (2nd harmonic)
RF Passband at -50 dbm	154.7 to 163.7 Mc

3.2 (S) System Performance.

The BIT system performed as designed for the duration of the useful life of the mission. Comparison of the system's response to the Signal Simulator during the mission with its response prior to launch showed that the detection sensitivity and the calibrations for frequency, amplitude, and PRF maintained their original levels. The system's operating temperature was 74 degrees Fahrenheit during the mission.

The major problem encountered was the failure of the commutator to start when the system was turned on for the orbit 64 read in. Turn on commands on succeeding orbits failed to start the commutator so all data after orbit 63 were lost. A check of the commutator speed during the mission showed it to be running at the correct speed on orbit 16 and 12 to 18 per cent slow on orbits 33 and 63. The power supply voltage was 26 volts on orbit 16 and 24 volts on orbit 63. This is within the specified operating range of the commutator. The unit on Mission 7051 was still operating at the end of the flight when the supply voltage was approximately 18 volts.

Since it is not possible to predict when a commutator will fail, succeeding BIT units, with the exception of those used on Missions 7053 and 7054, will be modified so that the commutator will run during the entire mission rather than being switched on and off for each read in and read out operation. This will greatly reduce the chances for future commutator failures.

4. (S) COMMENTS AND RECOMMENDATIONS.

4.1 (S) Receipt of Data.

The first data available for analysis were received on 10 November. The remaining data for the first 65 orbits were received by 17 November and information regarding the condition of the commutator on orbit 160 was received on 1 December. In general, the receipt of the data was much improved over the first mission.

4.2 (S) System Modifications.

All BIT units with the exception of the one scheduled for use on Mission 7054 and the one used on Mission 7053 will be modified so that the commutator will operate off of continuous vehicle power rather than programmed power. This will eliminate the on-off switching which should improve the reliability of the commutator operation.

A request was received from Lockheed representatives to isolate the signal grounds in the BIT system from the chassis ground because the chassis in turn is grounded to the vehicle frame. This is for the purpose of reducing the ground loops in the vehicle frame for it is desired that all equipment on the vehicle be grounded at one point. To comply with this request, an electrically insulated plate was bonded to the base of the BIT box which isolates the signal ground from the vehicle frame. All units starting with Mission 7054 will be isolated from the ground in this manner.

The modification which provides for the addition of the 256-second output from the Time Reference Generator to the recorded data was made in all units starting with Mission 7054. This modification was described in the report on Mission 7051.