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FINAL REPORT

BIT MISSION 7053

29 JANUARY 1965

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FINAL REPORT
BIT MISSION 7053

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 163 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 having parameters similar to [redacted] were intercepted during the mission which started on 18 November 1964 and ended after readout orbit 161 on 28 November. There was an unusually large amount of activity reflected in the PRC channel which counts the total number of wide pulses received. On several orbits this activity also resulted in PRF qualification at harmonic frequencies of the basic PRF range. These were not considered to be valid signals of interest. Because of the erratic nature of these intercepts it is concluded that they were due to radio frequency interference generated by other equipment carried on the vehicle. There are, however, three intercepts in the PRC channel which are regular enough to resemble valid tracking signals. The events, which occurred on orbits 18, 21, and 22 while the vehicle was over the north central part of Siberia, are of questionable validity in light of the unusually active responses noted in the PRC channel. That they were not repeated on similar orbits on following days also reduces the confidence in their validity.

Based on the system's response to the Signal Simulator, the voltage monitors, and the operating temperature, it is concluded that the system was functioning properly during the life of the mission.

1.3 (S) Flight Summary.

Vehicle Number	1180
Launch Date	18 November 1964
Launch Time	2040 GMT
Inclination	70 degrees
Apogee	197 nautical miles
Perigee	101 nautical miles
Period	89.7 minutes

2. (S) DATA ANALYSIS.

2.1 (S) System Coverage and Operation.

The BIT system was programmed to operate on 137 orbits of the 161 orbit mission life with an emphasis on the coverage over Europe, the USSR, and Asia. The system was not programmed for operation on the two or three orbits each day for which the ascending nodes fell in the region from 145 degrees to 215 degrees West longitude. During these orbits, the vehicle was in the Southern Hemisphere during its passage over the European and Asian longitudes. On two orbits of each 16-orbit day the vehicle was programmed to operate during the entire 90-minute orbital period. The ascending nodes of these two orbits fell in the vicinity of 80 degrees East and 100 degrees West longitude, respectively.

The system monitors the 154- to 163-Mc frequency range with a receiver detection sensitivity of -55 dbm. With the inclusion of the antenna pattern, the over-all system sensitivity varies from approximately -45 dbm at the horizon to -53 dbm looking straight down. Signals intercepted by the system are rejected by qualification circuitry if the pulse widths are less than 16 microseconds and if the PRFs do not fall within the 94- to 100-pps PRF acceptance band or harmonics of this band. The system measures the average PRF on those signals which qualify on pulse width only and PRF, amplitude, and frequency on those signals which qualify on pulse width and PRF. 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) General Comments.

[redacted]

2.2.2 (S) Intercept Summary.

[redacted]

2.2.2 (S) -- Continued.

[redacted]

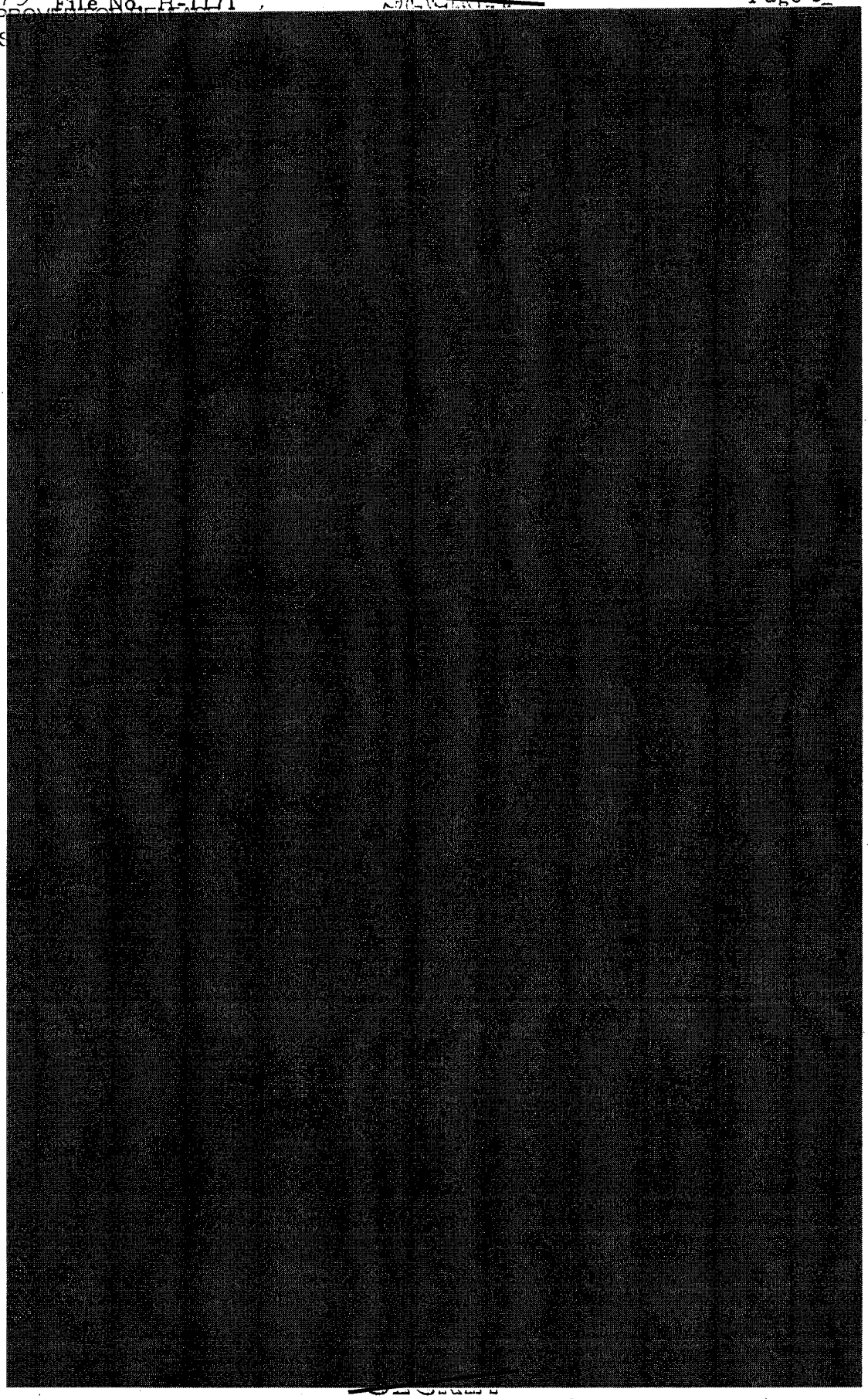

Figure 1

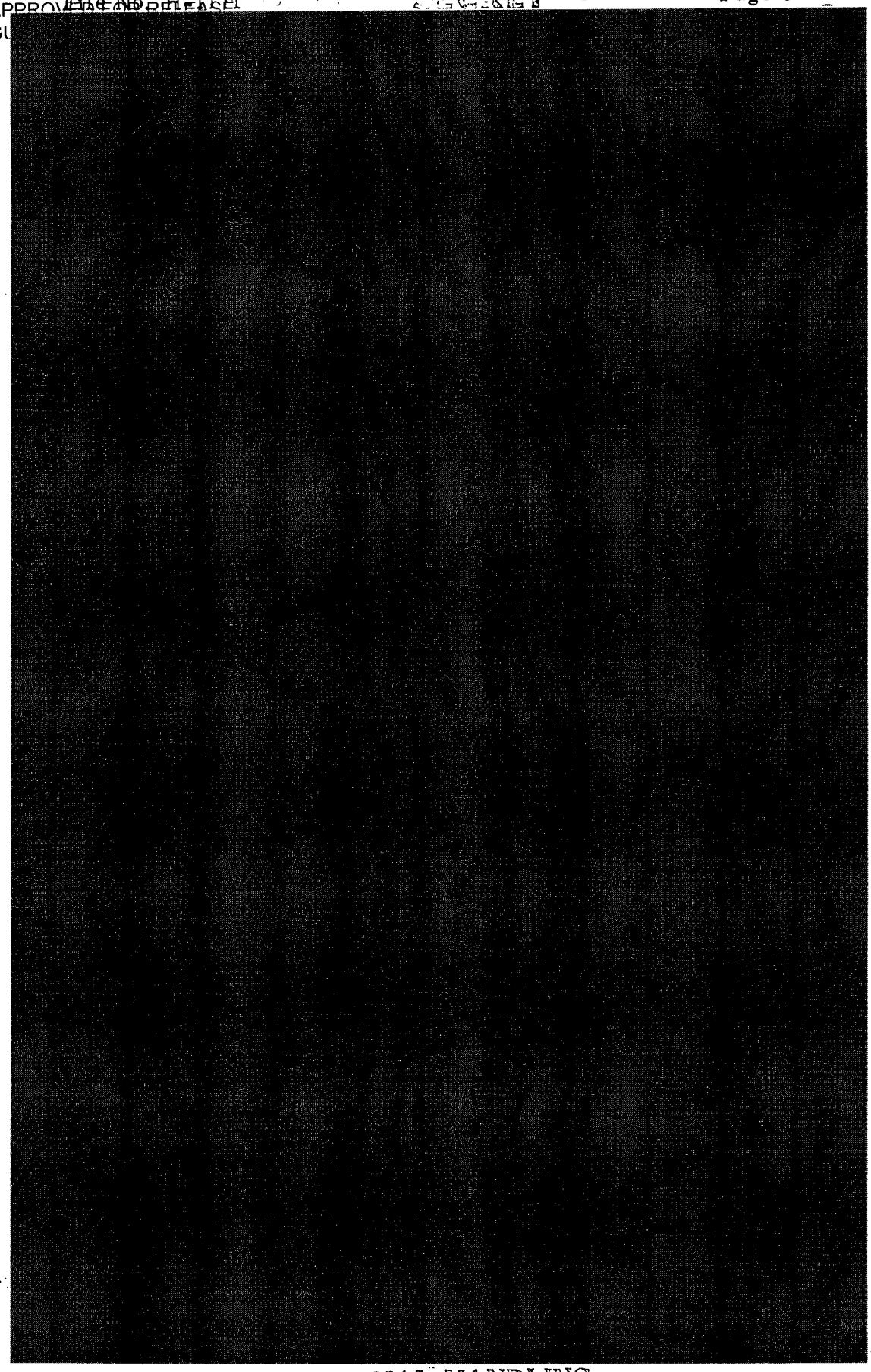

Figure 2

2.2.2 (S) -- Continued.

[redacted]

2.2.3 (S) Conclusions.

[redacted]

2.2.3 (S) -- Continued.

[redacted]

3. (S) SYSTEM PERFORMANCE EVALUATION.

3.1 (S) System Description.

A block diagram of the BIT system is shown in Figure 3, 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 -55 dbm is amplitude standardized in the video threshold circuit and then qualified. If the pulse width is greater than 16 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 94 to 100 pps or harmonics of this PRF range. If the PRF qualifies, a pulse-by-pulse gate 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 -28 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 -24 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 RF input line. The circuit counts every pulse received by the system regardless of the pulse width or PRF. Since it is primarily intended to indicate the presence of activity no attempt was made to achieve accurate pulse count measurements.

FIRE BOX SYSTEM

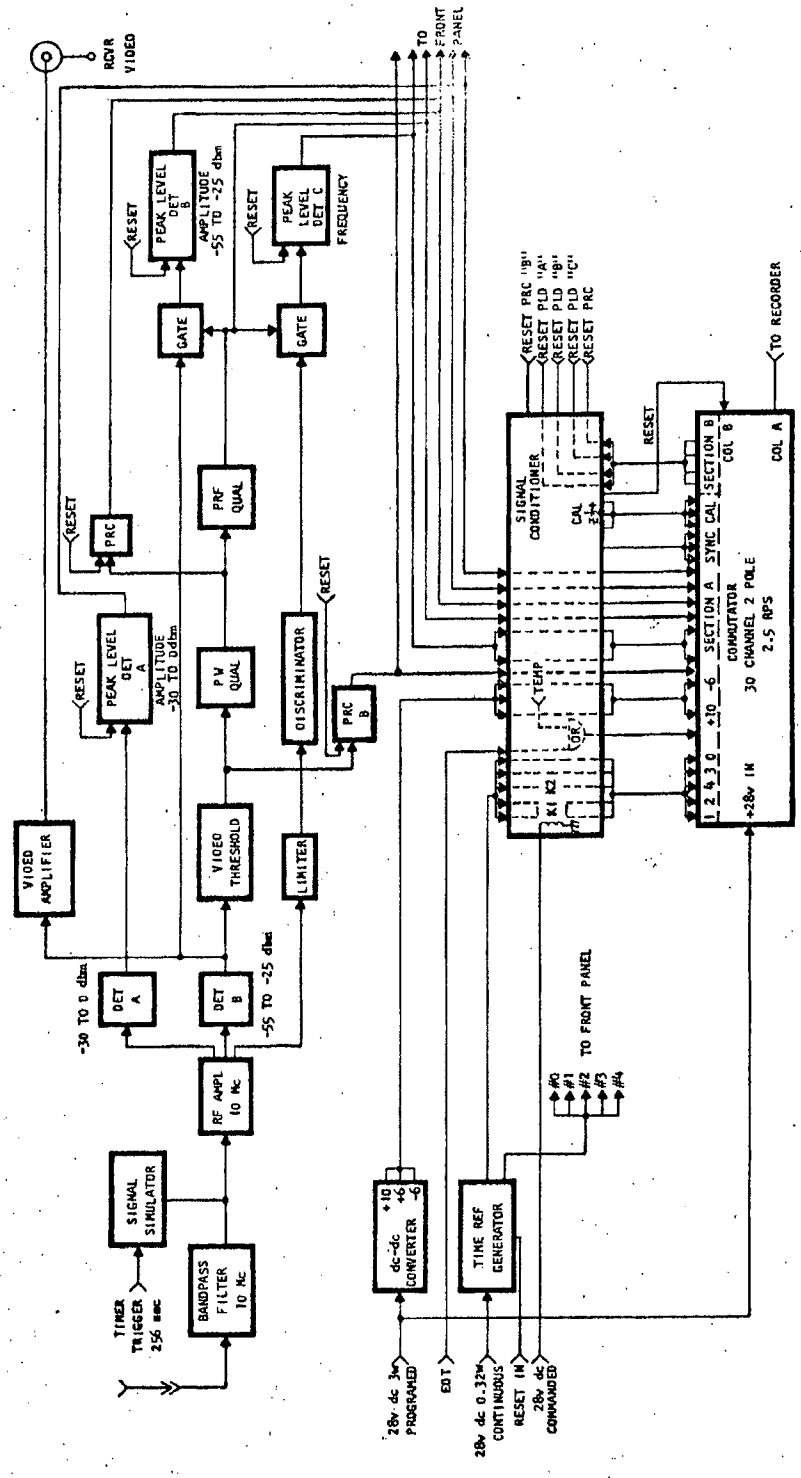

Figure 3

3.1 ~~(S)~~ -- Continued.

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 4.

Minimum Detectable Signal	-55 dbm (PLD-B) -24 dbm (PLD-A)
PRC Minimum Acceptable Pulse Width	16 microseconds
Frequency/Amplitude PLD Minimum Pulse Width	19 microseconds
PRF Qualifier Acceptance Range	94-100 pps (fundamental) 189-201 pps (2nd harmonic)
RF Passband at -52 dbm	154.3 to 162.5 Mc

3.2 ~~(S)~~ System Performance.

The BIT system performed as designed for the duration of the mission with the exception of the possible malfunction of the Signal Activity Indicator, PRC-B. 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 operating temperature of the system, which was approximately 85 degrees Fahrenheit at the start of the mission, stabilized at approximately 60 degrees after the first day of operation.

As indicated in Section 2.2.3, it is concluded that the PRC activity was due to RF interference from a vehicle borne source and not due to a system malfunction. Although the same conclusion is suggested for the reaction of PRC-B, there is too little data available to reasonably determine the cause of this abnormal channel activity.

SPECIAL HANDLING

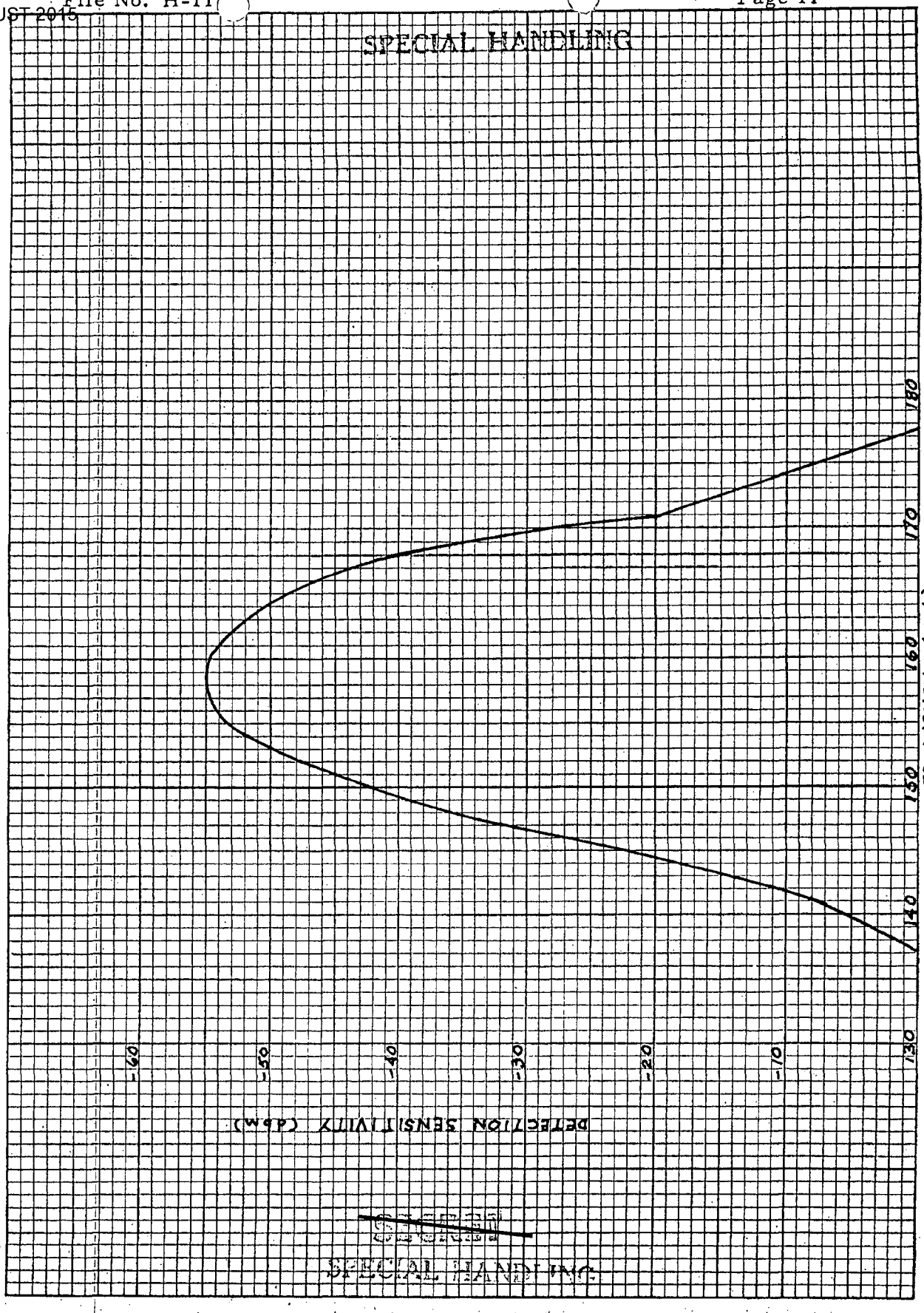

Figure 4

SPECIAL HANDLING