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AN/ALQ-135 TAIL WARNING SYSTEM FOLLOW-ON OPERATIONAL TEST AND E--ETC(U)
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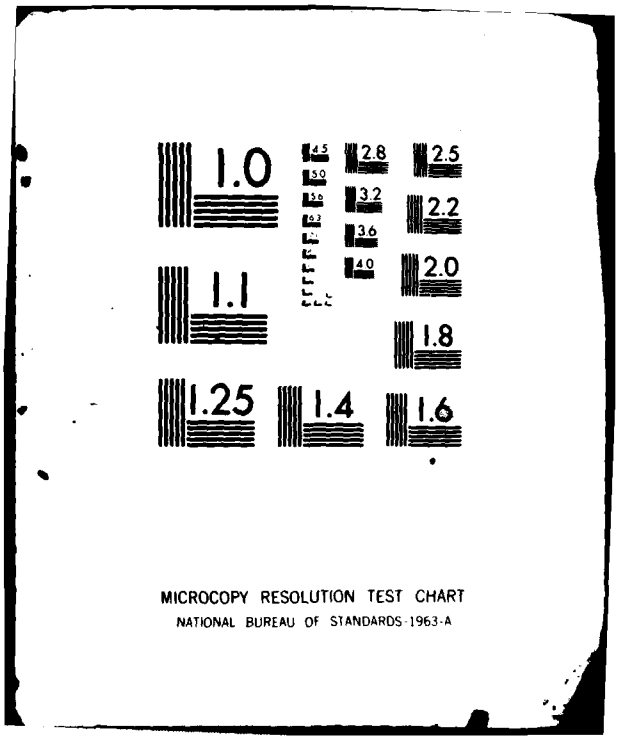
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HEADQUARTERS STRATEGIC AIR COMMAND

Directorate of Aircraft Maintenance

Aircraft Engineering Division

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Engineering Report No. P-405

AN/ALQ-153 Tail Warning System

Follow-on Operational Test and Evaluation

2 3 NOV 1981

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APPROVED: Specific action by organizations or units will not be taken as a result of this report unless requested by HQ SAC under separate cover.

FOR THE COMMANDER

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e. **PURPOSE:** To report on results of the maintainability and reliability of the AN/ALQ-153 Tail Warning System evaluated during the FOT&E testing at Barksdale AFB, LA.

2. **FOREWORD:** HQ SAC/LGME was assigned to evaluate the reliability and maintainability of the AN/ALQ-153 Tail Warning System (TWS) which is currently being installed on B-52G/H aircraft. Barksdale AFB was chosen as the test base. Ten TWS test flights were flown from Barksdale during the months of May and June 1981. Data was tabulated and maintained by the Logistics Supportibility and Evaluation Team composed of members from WR-ALC, OC-ALC and SAC.

3. **CONCLUSIONS:**

a. There were four TWS system failures.

b. The Mean-Time-Between-Failure was 9.75 hrs.

c. The Mean-Time-Between-Maintenance-Action was 3.00 hrs.

4. **RECOMMENDATIONS:** LGME recommends that:

a. OC-ALC conduct an investigation to determine feasibility of installing a viewing window to allow for visually checking the bit flags on the R/T unit in the vertical stabilizer without first removing panels. BIT flags could also be remoted to a more accessible location.

b. WR-ALC and SAC/LGMA continue to monitor the TWS to ascertain if the MTBF and MTBMA determined as part of this test is indicative of actual system performance. If the MTBF and MTBA is as low as these prelimianry tests indicate, steps must be taken to improve them.

5. **DISCUSSION:**

a. The AN/ALQ-153 Tail Warning System is a solid state pulsed doppler radar designed to provide warning of and initiate countermeasures against threats attacking from the tail of B-52G and H aircraft. The system consists of six LRUs:

(1)	Two antennas	(ANT)
(2)	Radar Receiver/Transmitter	(RR/T)
(3)	Analog Data Signal Processor	(ADSP)
(4)	Digital Data Signal Processor	(DDSP)
(5)	Control/Indicator	(CI)
(6)	Signal Data Converter	(SDC)

The system provides warning of both aircraft and missiles and can accurately distinguish between them. When aircraft are detected a display of the range (two indicator lights show range region within TWS coverage) of the threat is provided on the Control Indicator. When missiles are detected, the range of the threat is digitally displayed on the Control Indicator and a light

comes on indicating the threats relative position from the aircraft, i.e. "L MSL" for left of tail, "R MSL" for right of tail and both for directly behind the aircraft. Also a missile warning tone is heard through the airplane's interphone system, one at the EWO, Gunner and Defense Instructor crew positions. The system will direct appropriate countermeasures based on time and/or range limits (of the threat), selectable by the EWO. The system has Built In Test (BIT) capability which is performed continuously while the set is in operation. If the system detects a malfunction the malfunction (MALF) light on the control indicator comes on and the RRT/ADSP/DDSP lights indicate which unit has failed. Also, the operator can initiate a self test of the system anytime he desires to check the interface between the control indicator and the digital data signal processor.

b. HQ SAC/LGMA requested HQ SAC/LGME participate in the Follow-on Operational Test and Evaluation (FOT&E) of the AN/ALQ-153 TWS by performing the Logistics Analysis portion of the FOT&E. This assessment was to consist of an evaluation of the reliability, maintainability and support equipment.

c. The evaluation took three months (May-July) and was conducted at Barksdale AFB. Data for the test were derived from SAC/LGME supplied Assessment Data Sheets and AFTO Form 349s (Maintenance Data Collection Record). The Assessment Data Sheets were maintained by members of the Logistics Supportability Evaluation Team (LSET) which was composed of representatives from HQ SAC, WR-ALC, and OC-ALC.

d. The AN/ALQ-153 TWS had a total operating time of 39.0 hours and had 4 malfunctions. This equated to a Mean-Time-Between-Failure (MTBF) of 9.75 hrs. The MTBF is found by dividing the total operate time by the total number of failures. There were two DDSP failures. The Bit circuitry of the TWS properly identified the DDSP as the failed item in both cases. There were two ADSP and one R/T failure. Again, the TWS BIT circuitry properly identified these LRUs as the failed items.

e. The use of the Bench Mock-Up (BMU) along with the DDSP test set appeared to work well in identifying and isolating failures. In the case of the DDSP failures, the failures were isolated to an A-12 board in one case and to the 5 volt inverter in the other. The A-12 board was a modified board for the instrumentation that was used on the aircraft during the service test; therefore, the failure cause may be due to some component that will not be part of the production LRUs. In the case of the two ADSP and one R/T failure, there is no test set available for these units; therefore, the failures had to be verified and isolated on the BMU. In each case failures were verified and failed units were returned to Westinghouse for repair. One feature of the TWS that enabled quick verification and isolation of LRU failures are the failure mode flags on the ADSP and R/T. These flags indicate which SRU in the LRU has failed.

g. Another indicator of equipment reliability is the Mean Time Between Maintenance Action (MTBMA). It is found by dividing the total equipment operating time by the number of maintenance actions. One maintenance action was considered for any equipment removal or servicing. There were thirteen maintenance actions during this test. The MTBMA was found to be 3.00 hrs.

This is unusually low as was the MTBF of 9.75 hrs; however, the small sample size must be taken into consideration. The TWS will eventually be installed on 265 B-52G and H aircraft. Only ten flights were scheduled and this severely limited teh number of TWS operating hours and served to magnify the significance of any equipment failures. The first few flights of the FOT&E were used by Westinghouse as equipment optimization flights. This meant that they were allowed to make changes in equipment to correct deficiencies. All of the above help to account for the low MTBF and MTBMA.

f. One problem area that surfaced as part of this test was the inaccessibility of the BIT flags on the R/T unit in the vertical stablizer. A maintenance action performed by the ECM shop is to take a look at the unit to see which, if any, of its BIT flags were tripped. But to do this required the removal of approximately eighty fasteners which took 30 minutes. This is an unnecessary waste of time and manpower just to view these BIT flags. A viewing port in the vertical stablizer is needed to allow viewing of the BIT flags.

h. More data on the TWS will have to be obtained and evaluated to determine if results found in this test are valid. Further evaluation will help uncover problem areas and possibly point the way to methods which might help improve system reliability. The MTBF and MTBMA determined in this test (9.75 and 3.00 respectively) are extremely low and if indeed they do accurately depict actual system performance then we can expect system down time, maintenance costs and operator dissatisfaction to be quite high. The time to begin to correct any TWS problems and/or improve reliability is now, before the system becomes fully operational.

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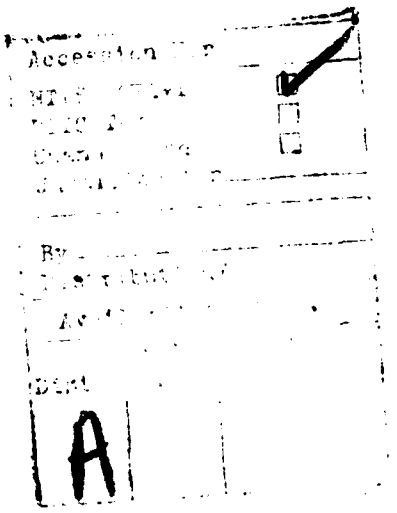

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This is a study of the reliability and maintainability of the tail warning system (TWS) AN/ALQ-153. This TWS is a solid state pulsed doppler radar designed to provide warning and initiate countermeasures against threats attacking from the tail of B-52G/H aircraft.

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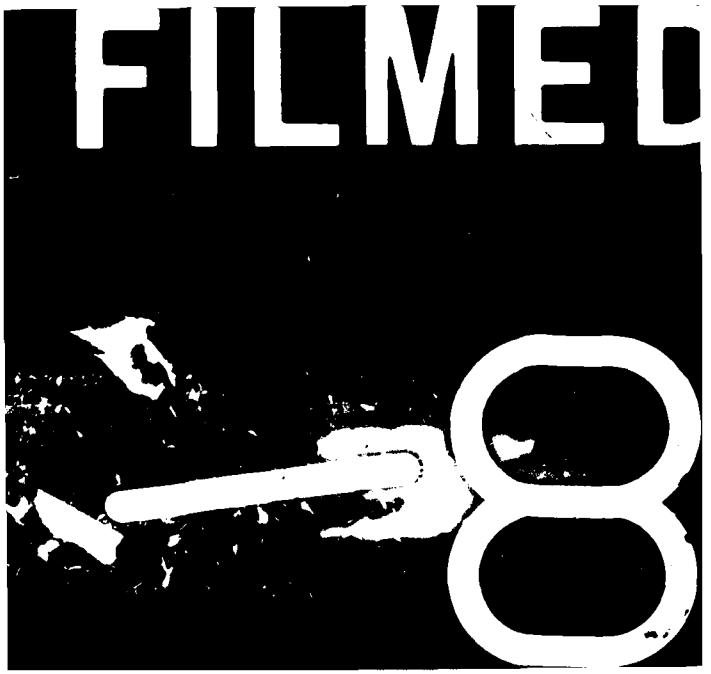
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