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A-7E THERMAL RADIATION CLOSURE FUNCTIONAL EVALUATION, (U)
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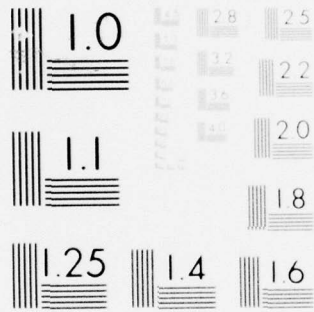
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THERMAL
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NWEF Report 1089

NAVAL WEAPONS EVALUATION FACILITY

CAPT Richard H. STOLPE, USN
Commanding Officer

A-7E
THERMAL RADIATION CLOSURE
FUNCTIONAL EVALUATION

by

LCDR James E. Fordice, Project Officer

and

Lawrence L. Langdon, Project Engineer

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Albuquerque, New Mexico

18 March 1972

FOREWORD

Functional tests to evaluate thermal radiation closure operation from the closed position were conducted at the Naval Weapons Evaluation Facility, Kirtland Air Force Base, Albuquerque, New Mexico, on 16 February 1972. Tests were initiated upon a request from Naval Air Systems Command (AIR-530323A) to evaluate closure operation for possible binding, interference with canopy release handles, and ease of detent-release handle actuation.

These studies were conducted under AIRTASK A340340B/2068/2F00523401 dated 28 June 1971 from Naval Air Systems Command (AIR-530323A).

ABSTRACT

Tests detailed in this report were conducted by Naval Weapons Evaluation Facility personnel to evaluate ease of operation, binding encountered, and any possible interference with canopy release handle or other instrumentation/equipment while manually actuating the thermal radiation closure from the closed to the open position. Three pilots in full flight gear, two maintenance personnel, and one project engineer participated in these tests. No particular problems were encountered which could lead to inadvertent canopy ejection. Use of the left arm to actuate the detent release lever presented no problems, and *minimal sliding friction* between segments with no evidence of binding was observed.

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INTRODUCTION

Functional testing of the thermal radiation closure (TRC) installed in Naval Weapons Evaluation Facility (NWEF) A-7C aircraft BuNo 156739 was initiated in response to a request by AIR-530323A to evaluate TRC operation for possible binding, interference which could lead to inadvertent actuation of canopy release handles, and ease of detent-handle actuation. These tests evolved as a response to AIR-530323A letter of 8 February 1972 requesting NWEF review and comment on recommendations defined by the Aircraft Accident Board as a result of an A-7E aircraft accident involving inadvertent canopy jettison, TRC implosion on the pilot, and subsequent pilot seat ejection.

PURPOSE

The purpose of tests conducted by NWEF was to functionally evaluate manual TRC operation from the closed position to check for any contributory factors which may have led to pilot ejection.

TESTS AND RESULTS

NWEF tests employed the TRC installed in A-7C aircraft BuNo 156739. This aircraft has been used for extensive TRC light-leakage tests at NWEF, but the TRC has been actuated only rarely during flight. During light-leakage tests conducted in April 1971, this closure was actuated approximately 40 times pneumatically and 70 times manually. No problems involving binding or interference during either opening or closing operations were noted during the entire test series. Details of light-leakage tests are presented in NWEF Report 1079 dated 20 April 1971.

Three A-7 pilots were selected to participate in this test series. All were dressed in full flight gear (Fig. 1) and were buckled in to simulate as closely as possible pilot restrictions at the time of the accident. Each pilot was instructed to manually open the TRC from the closed to the open position a minimum of five times. Each was also instructed to use one hand only at the center (Fig. 2) right side (Fig. 3) and left side of the TRC in an effort to induce binding. The TRC handles on left and right sides were also used individually for opening the closure. No binding was encountered either by the pilots, the maintenance personnel, or the project engineer. The maintenance personnel and the project engineer performed the same operations but were not strapped in or dressed in flight gear. Further, the project engineer was able to open the TRC with his left arm only without removing his right hand from the control stick. This was accomplished by actuating the detent release handle with the left elbow and applying an upward opening pressure on the handle at the forward left edge of the TRC. However, one of the pilots who was of smaller stature than the engineer, noted that it was next to impossible for him to open the closure with one hand, but he had no difficulty whatsoever in depressing the detent release handle with his left elbow and opening the closure with his right hand (Fig. 4).

It was noted by all test personnel that the TRC could be manually raised approximately 2 inches before encountering resistance to further motion because of the detent slots. This condition is illustrated by Fig. 5.

At no time was any interference with the canopy release handle or the emergency canopy release handle noted. It is



FIGURE 1. TRC in Ready Position, Pilot in Full Flight Gear.



FIGURE 2. TRC Operation, Hand Pressure at Center of TRC.



FIGURE 3. TRC Operation, Hand Pressure on Right Side of TRC.



FIGURE 4. TRC Operation, Hand Pressure on TRC Handle.



FIGURE 5. TRC Operation, Clearance at First Detent Position.

considered highly unlikely that either handle could be actuated during opening of the TRC from its closed position.

ABNORMAL SITUATIONS CONSIDERED

It was considered that for some reason the seat may not have been fully lowered and the back segment may have been binding against the top of the seat. It was found possible to move the closure to the ready position with some binding observed. However, as the TRC was moved through the rest of its travel, the seat was automatically moved to its lowest position and the seat up/down switch was disengaged. If the system is operating properly, there is no possibility of binding on the top of the seat from the fully closed position.

Comments by maintenance personnel revealed that if the TRC segments got out of their track, it could become impossible to induce further motion. However, this condition would not cause canopy jettison.

There is also a possibility that phrasing of operational checkout procedures could lead to possible problems in stowing the TRC past its second detent position. The procedures in NAVAIR 01-45AAE 2-3, Section VII, Step 6, do not specify that it is necessary to continue depression of the detent release handle past the second detent (ready position) for smooth closure operation. Failure to continue depression can result in locking up of the closure at the ready position. Continued application of force will then result in bending or possible breakage of the locking arm assembly.

CONCLUSIONS

1. No evidence of binding was noted during TRC manual opening operations.
2. The TRC can be easily opened manually with a minimal amount of practice by placing the left arm on the detent release handle and either pulling on one or both handles located on the forward edge of the TRC or at the center forward edge of the TRC itself.
3. There is no apparent way in which either the normal canopy release handle or the emergency canopy release handle could be actuated during TRC manual opening operations.
4. The TRC can be opened approximately 2 inches before engagement of the first detent.

RECOMMENDATIONS

1. Ensure adequate TRC maintenance is performed to ensure ease of operation without binding.
2. Prior to any flight in which the TRC is to be used, require the pilot to manually close and open the TRC as part of preflight checks.
3. When it becomes necessary to open the TRC during flight, require that altitude and heading hold be actuated so that both hands may be used to open the TRC.

APPENDIX A
TEST PLAN 72-7

APPENDIX A

3 February 1972

THERMAL RADIATION CLOSURE OPERATION

1. Test Plan No.: 72-7
2. Project Officer: LCDR J. E. Fordice, X-3151
3. Project Engineer: Mr. L. L. Langdon, X-3151
4. Other Key Personnel: None
5. TA No.: A340340B/2068/2F00523401
6. WR or PO No.: EOB
7. Segment (Charge) No.: 1927
8. Test Dates: 3-7 February 1972
9. O. D. No.: Not Required
10. Hazard Form: Not Required
11. Test Location: All tests will be conducted in the NWEF hangar or on the NWEF flight line.
12. Test Items: One A-7C with a manually operable TRC will be used.
13. Test Purposes: To gather additional facts and experience which, when added with the remarks of fleet pilots gained in many conversations, will enable NWEF to make a determination on the suitability of pilot/maintenance personnel depressing the detent release handle while manually operating the TRC to the stowed position.
14. Test Description: A minimum of three (3) A-7 qualified pilots in full flight gear and two (2) maintenance personnel (who normally work on the A-7 TRC) will

manually operate the TRC in the A-7C a minimum of five (5) times each from the closed position to the stowed position.

15. Anticipated Behavior of Test Items During Tests: After one or two cycles of the TRC, pilot/maintenance personnel will have no particular difficulty in depressing the detent release handle.
16. Data Requirements: Each person participating will write a memorandum stating his opinion of the TRC operation. This memorandum will include a discussion of ease of operation, any binding encountered, and possible interference with canopy release handle or other instrumentation/equipment.
17. Instrumentation Requirements: None
18. Test Equipment Material Requirements: One A-7C with a manually operable TRC will be required.
19. Storage Requirements: None
20. Handling Requirements: None
21. Assembly Requirements: Standard TRC installation will be required.
22. Loading Requirements: None
23. Flight Requirements: None
24. Recovery Requirements: None
25. Safety Precautions: All personnel involved in the test will be briefed and observed by the project officer or engineer. No unusual dangers should exist since the TRC will only be operated manually.

26. Services Required:

a. Aircraft Projects Department

(1) Provide project engineer and project officer.

(2) Provide a minimum of three (3) A-7 qualified pilots.

b. Maintenance Department

(1) Provide one A-7C with a manually operable TRC installed.

(2) Provide a minimum of two (2) maintenance personnel who normally work on A-7 TRC.

27. Reports Required of Project Engineer and Project Officer:

No formal report of this test program is required; however, a message collating the facts gathered will be prepared for release to NAVAIRSYSCOMHQ with a determination on the suitability of pilot/maintenance personnel depressing the detent release handle while manually operating the TRC to the stowed position.

28. Disposition of Leftover Material: A file of the memorandums received and any other information gathered will be maintained by the project officer.

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