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RADAR WARNING RECEIVER SPECIAL FUNCTION TRAINER:
PRELIMINARY EVALUATION(U) AIR FORCE HUMAN RESOURCES LAB
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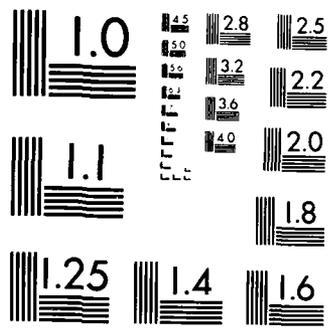
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HUMAN RESOURCES

**RADAR WARNING RECEIVER SPECIAL FUNCTION TRAINER:
PRELIMINARY EVALUATION**

By

Rebecca B. Brooks

OPERATIONS TRAINING DIVISION
Williams Air Force Base, Arizona 85240-6457

May 1985

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AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5601

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This paper has been reviewed and is approved for publication.

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Operations Training Division

CARL D. ELIASON, Colonel, USAF
Chief, Operations Training Division

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| 19. ABSTRACT (Continue on reverse if necessary and identify by block number) Radar Warning Receiver (RWR) skills are difficult for today's aircrews to acquire and maintain. One possible solution to this RWR training problem is the use of Special Function Trainers (SFTs) based on current microcomputer technology. The objective of this effort was to determine Tactical Air Command (TAC) pilots' perception of the usefulness of the device as a training aid. Questionnaires were administered to 12 instructor pilots and 6 student pilots. Both groups found the trainer to be "useful" to "very useful" as a training aid, and stated that it would be most useful to students during initial acquisition of the subject matter. All evaluators stated that the audio feature contributed little to the usefulness of the trainer. In addition, the evaluators stated that the instructions, touch panel, and menus could be made easier to use through modification. | | | | | | | | | | | | | | |
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**RADAR WARNING RECEIVER SPECIAL FUNCTION TRAINER:
PRELIMINARY EVALUATION**

By

Rebecca B. Brooks

**OPERATIONS TRAINING DIVISION
Williams Air Force Base, Arizona 85240-6457**

Reviewed and submitted for publication by

**Thomas H. Gray
Chief, Operational Unit Training Branch**

**This publication is primarily a working paper.
It is published solely to document work performed.**

SUMMARY

Current Radar Warning Receiver (RWR) skills can mean the difference between life and death for fighter pilots. These skills are so important that the pilot should not have to think, but should respond almost automatically. The pilot must understand the operation of the indicator control panel and the azimuth indicator, as well as have a current knowledge of threat capabilities, in order to utilize the RWR device. RWR skills are difficult to acquire and maintain. Pilots do not have free time to study and review the written procedures as frequently as necessary to stay current in RWR skills. In order to practice RWR skills in the aircraft, aircrews must fly over instrumented ranges. There are very few such ranges, and only limited range time is available to individual aircrew members for training. Aircrews currently have little opportunity to use their Electronic Combat (EC) systems, and they need alternative means of becoming proficient in order to maximize their chances of survival in a hostile environment.

The RWR skills are difficult for aircrews to acquire and maintain. A possible solution to this RWR training problem is the application of microcomputer technology to develop Special Function Trainers (SFTs). SFTs are microcomputer-based training aids designed to help the aircrew member acquire new skills or to refresh existing ones. The objective of this effort was to determine Tactical Air Command (TAC) pilots' perceptions of the usefulness of the trainer as a training aid. Questionnaires were administered both to instructor pilots and to student pilots. Both groups found the trainer to be "useful" to "very useful" as a training aid and stated that it would be more useful to students than to operational pilots. All evaluators stated that the audio feature contributed little to the usefulness of the trainer and, in addition, stated that several features could be made easier to use through modification. The RWR SFT offers flexible, relatively inexpensive training that the TAC pilots believe will be useful.

PREFACE

This work was conducted under work unit 11232501, Special Function Trainer Technology. The purpose of this effort was to determine Tactical Air Command (TAC) pilots' perceptions of the usefulness of the Radar Warning Receiver (RWR) Special Function Trainer (SFT) as a training aid. Mr. Garry Boyle served as the Project Engineer and Mr. Scott Butzke and Mr. Scott Mankey were the SFT software programmers.

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RADAR WARNING RECEIVER SPECIAL FUNCTION
TRAINER: PRELIMINARY EVALUATION

I. INTRODUCTION

Current skills in the use of the Radar Warning Receiver (RWR) can mean the difference between life and death for fighter pilots. These skills are so important that the pilot should not have to think, but should respond almost automatically. The pilot must understand the operation of the indicator control panel and the azimuth indicator, as well as have a current knowledge of threat capabilities, in order to utilize the RWR device. RWR skills are difficult to acquire and maintain. Pilots do not have free time to review and study the written procedures as frequently as necessary to stay current in RWR skills. In order to practice RWR skills in the aircraft, aircrews must fly over instrumented ranges. There are only a few such ranges, and only limited range time is available to individual aircrew members for training. As aircrews currently have little opportunity to use their Electronic Combat (EC) systems, they need alternative means of becoming proficient in order to maximize their chances of survival in a hostile environment.

A possible solution to this RWR training problem is the application of microcomputer technology to develop Special Function Trainers (SFTs). SFTs are microcomputer-based training aids designed to help the pilot or aircrew member acquire new skills or improve existing skills. From a single microcomputer, training can be conducted on a variety of subjects through the use of unique software.

The Air Force Human Resources Laboratory has developed unique software for three models of the RWR for seven different aircraft: the ALR-46 (A-10, F-4E, RF-4C), the ALR-69 (A-10, F-16, F-4D), and the ALR-62 (F-111). The different aircraft configurations of RWR were easily accommodated through the use of a touch-sensitive panel and graphic representations specific to each system/aircraft. Updates or modifications can easily be made through modifications in the software.

The objectives of this research and development (R&D) effort were, first, to develop a microcomputer-based RWR SFT and, second, to determine the perception of the usefulness of this device by Tactical Air Command (TAC) pilots. This paper will focus on TAC pilots' perceptions of the usefulness of the RWR SFT as a training aid. The development of the RWR SFT is treated separately by Butzke and Mankey (1984).

Subjects

Twelve Air Force (TAC) instructor pilots and six student pilots participated in the evaluation of the unclassified ALR-69 version of the EC SFT. Eight of the instructor pilots were from the Fighter Weapons School at Nellis AFB, and four were from the F-16 Replacement Training Unit (RTU) at Luke AFB. All six students were F-16 B-course student pilots from Luke AFB. The instructors had a mean of 2,142 hours of flying time; the mean flying time for the students was 633 hours.

II. METHOD

Apparatus

The RWR SFT station (see Figure 1) was designed around a Cromemco Z80-based microcomputer. Additional hardware needed to complete the SFT station includes a specialized multi-plane color graphics system and color monitor, and a touch sensitive screen. This paper addresses the evaluation of one version of the ALR-69 for the F-16 aircraft.



Figure 1. RWR SFT Station

The RWR SFT is operated through the use of a menu. When the trainer is started, a numbered list of options is presented, including interactive text, real-time scenarios, and malfunction analysis.

Interactive Text. Lessons are available on audio indications, indicator control button operation, RWR scope interpretation, and malfunctions, to name just a few. Text and hands-on usage are combined to provide the total concept of RWR operation. After reading the text on some RWR topic, the user can press the touch-sensitive panel and see a graphic demonstration of what was just read.

Real-Time Scenarios. The operational section of the RWR SFT provides the opportunity to use the RWR as it might be used in actual combat (see Figure 2). The RWR symbology that is shown in the figure is representative of the kind that a pilot might see on a real mission. The appropriate audio for each symbol can be heard. All buttons and switches function as they do in the aircraft.

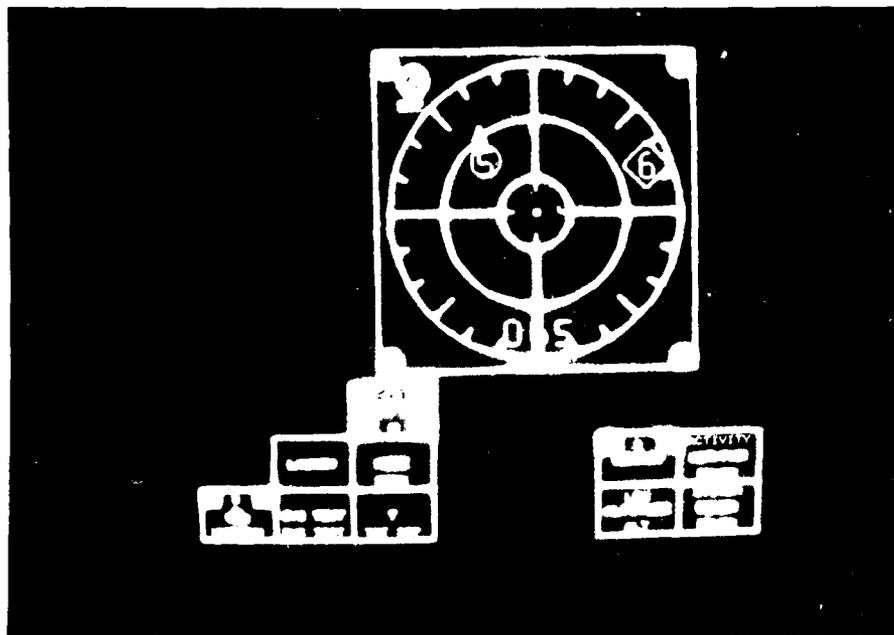


Figure 2. RWR SFT Real-Time Scenarios

Malfunction Analysis. The RWR SFT includes a comprehensive malfunction analysis package covering some 19 possible RWR malfunctions. Malfunctions can be examined separately with text and graphics or in any combination in real-time scenarios.

Procedure

Each pilot received an independent explanation and demonstration of the unclassified ALR-69 radar warning receiver portion of the RWR SFT and was then allowed to freely interact with the trainer. During this interaction time, the pilots gained practice in the use and content of the SFT. A questionnaire was then administered to determine the pilots' perception of the usefulness of the EC SFT as a training aid.

The questionnaire had a five-point rating scale ranging from "Not Useful At All" to "Very Useful" or "Not Easy At All" to "Very Easy," and each pilot rated four major issues associated with the EC SFT: usefulness as a training aid for B-course students, usefulness as a training aid for operational pilots, overall usefulness as a training aid, and ease of use (user-friendliness). The first two areas, usefulness as a training aid for B-course students and usefulness as a training aid for operational pilots, were subdivided into the following subject-matter areas: Power On, System Test, Symbology, Indicator Control Panel Operation, Azimuth Operation, System Operation, Audio, and Malfunctions. The item concerning ease of use was subdivided into the following areas: Instructions, Touch Panel, Graphic Simulation, Size of Color Monitor, and Menus. The questionnaire is reproduced in Appendix A.

III. RESULTS AND DISCUSSION

As the data did not appear to be skewed, the mean rather than the median was used as the measure of central tendency. The mean best reflects the total of the scores and is least

sensitive to sampling fluctuation under ordinary circumstances. The overall evaluation of the RWR SFT by the instructors (mean = 4.83) and the students (mean = 4.33) indicates that both groups found the trainer to be "useful" to "very useful" as a training aid. Tables 1 through 3 contain the means of instructor and student evaluations.

Table 1. Instructors' Evaluations of the Usefulness of the RWR SFT as a Training Aid for B-Course Students and Operational Pilots

| Sub-Category of RWR | B-Course Students | | Operational Pilots | |
|--------------------------------------|-------------------|------|--------------------|------|
| | Mean | SD | Mean | SD |
| Power On | 4.42 | .64 | 3.17 | 1.14 |
| System Test | 4.75 | .43 | 3.83 | .69 |
| Symbology | 4.75 | .43 | 3.75 | .60 |
| Indicator Control Panel Operation | 4.58 | .64 | 3.83 | .69 |
| Azimuth Operation | 4.58 | .64 | 3.75 | .60 |
| System Operation | 4.67 | .47 | 4.25 | .60 |
| Audio | 3.75 | 1.09 | 3.67 | 1.25 |
| Malfunctions | 4.50 | .65 | 4.42 | .64 |

Table 2. Students' Evaluations of the Usefulness of the RWR SFT as a Training Aid for B-Course Students and Operational Pilots

| Sub-Category of RWR | B-Course Students | | Operational Pilots | |
|--------------------------------------|-------------------|------|--------------------|------|
| | Mean | SD | Mean | SD |
| Power On | 4.43 | .45 | 3.17 | .69 |
| System Test | 4.63 | .73 | 3.17 | .69 |
| Symbology | 3.67 | 1.49 | 3.17 | 1.34 |
| Indicator Control Panel Operation | 4.17 | .69 | 3.50 | .96 |
| Azimuth Operation | 4.17 | .69 | 3.67 | .94 |
| System Operation | 4.33 | .47 | 3.50 | .96 |
| Audio | 3.33 | 1.25 | 2.67 | 1.37 |
| Malfunctions | 4.17 | .37 | 3.33 | .94 |

**Table 3. Instructor and Student Evaluation of the
Ease of Use of the Features of the RWR SFT**

| SFT Feature | Instructor | | Students | |
|-----------------------|------------|-----|----------|-----|
| | Mean | SD | Mean | SD |
| Instructions | 3.83 | .37 | 3.83 | .90 |
| Touch Panel | 3.93 | .64 | 3.83 | .69 |
| Graphic Simulation | 4.25 | .43 | 4.67 | .47 |
| Size of Color Monitor | 4.42 | .49 | 4.67 | .47 |
| Menus | 3.92 | .49 | 4.00 | .82 |

There is little difference between instructor and student evaluations. Both the instructors and students stated that the RWR SFT would be more useful for B-course students than for operational pilots. All evaluators stated that the audio feature in an unclassified format contributes little to the usefulness of the trainer; it is quite possible that this feature may be of greater training value in a classified format. All evaluators also stated that the graphic simulation and the color monitor were "easy" to "very easy" to use.

The instructions, touch panel, and menus were rated by all evaluators as only "moderately easy to use." Modification of these features may result in increased ease of use. The instructions could be made easier to use through overall simplification and the addition of an escape key. The escape key would allow the user to exit the instructions at any time. Modification of the software to increase the accuracy of the touch-sensitive panel would also make the trainer easier to use. The menus could be made more user friendly through the addition of a "return to main menu option" on all of the sub-menus.

IV. CONCLUSION

The use of microcomputer technology offers one method of providing a relatively inexpensive EC training aid for today's pilots. Preliminary user evaluations indicate that TAC pilots believe that the RWR SFT will prove to be an effective training aid. The questionnaire provides insight on the usefulness of the trainer, but its training effectiveness cannot be determined. Therefore, a transfer-of-training study is recommended to determine the extent that knowledge acquired on the SFT transfers to operational environments.

REFERENCES

- Butzke, S. and Mankey, S (1984). Development of special function trainers for electronic combat skills. Proceedings of the Sixth Interservice/Industry Training Equipment Conference, Washington DC.

APPENDIX A: F-16R WARNING RECEIVER (RWR)
PART TASK TRAINER (PTT) QUESTIONNAIRE

PURPOSE OF QUESTIONNAIRE: The purpose of this questionnaire is to determine the extent to which you perceive the RWR PTT as potentially useful for training various aspects of RWR.

CONFIDENTIALITY: Please respond candidly to all questions. Your responses will be treated as confidential, reflecting your own personal opinion and not that of the Tactical Air Command or the United States Air Force.

BACKGROUND:

1. Current status (check one):
 a. F-16 B-Course Student Pilot
 b. F-16 Instructor Pilot
 c. Fighter Weapons School Student
 d. Fighter Weapons School Instructor
 e. Other (please indicate) _____

2. Total Flying Hours: _____
3. Type of Aircraft: _____
4. Are you a graduate of the Fighter Weapons School? Yes _____ No _____
Date of graduation _____
5. Are you a graduate of the Electronic Combat Instructor's Course? Yes _____ No _____
Date of graduation _____
6. How much actual combat experience do you have? _____ hours

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DIRECTIONS: For each of the following questions, mark the one response alternative that best describes your answer. For each item that you mark "Not Useful at All" or "Slightly Useful," please tell us your reason in the space provided at the end of the questionnaire.

1. How useful do you think the RWR PTT would be in providing effective RWR training for B-course students for each of the following areas?

| | Not Useful At All | Slightly Useful | Moderately Useful | Useful | Very Useful |
|---|----------------------|--------------------|----------------------|--------|----------------|
| | 1 | 2 | 3 | 4 | 5 |
| a. Power On | 1 | 2 | 3 | 4 | 5 |
| b. System Test | 1 | 2 | 3 | 4 | 5 |
| c. Symbology | 1 | 2 | 3 | 4 | 5 |
| d. Indicator Control Panel Operation | 1 | 2 | 3 | 4 | 5 |
| e. Azimuth Indicator Operation | 1 | 2 | 3 | 4 | 5 |
| f. System Operation | 1 | 2 | 3 | 4 | 5 |
| g. Audio | 1 | 2 | 3 | 4 | 5 |
| h. Malfunctions | 1 | 2 | 3 | 4 | 5 |

2. How useful do you think the RWR PTT would be in providing effective RWR refresher/review training for operational pilots in the following areas:

| | Not Useful At All | Slightly Useful | Moderately Useful | Useful | Very Useful |
|---|----------------------|--------------------|----------------------|--------|----------------|
| | 1 | 2 | 3 | 4 | 5 |
| a. Power On | 1 | 2 | 3 | 4 | 5 |
| b. System Test | 1 | 2 | 3 | 4 | 5 |
| c. Symbology | 1 | 2 | 3 | 4 | 5 |
| d. Indicator Control Panel Operation | 1 | 2 | 3 | 4 | 5 |
| e. Azimuth Indicator Operation | 1 | 2 | 3 | 4 | 5 |
| f. System Operation | 1 | 2 | 3 | 4 | 5 |
| g. Audio | 1 | 2 | 3 | 4 | 5 |
| h. Malfunctions | 1 | 2 | 3 | 4 | 5 |

3. Rate how easy it is to use the following RWR PTT features:

| | Not Easy At All | Slightly Easy | Moderately Easy | Easy | Very Easy |
|---|--------------------|------------------|--------------------|------|--------------|
| | 1 | 2 | 3 | 4 | 5 |
| a. Instructions for the user | 1 | 2 | 3 | 4 | 5 |
| b. Touch-Sensitive Panel | 1 | 2 | 3 | 4 | 5 |
| c. Graphic Simulation of Indicator Control Panel and AZ Indicator | 1 | 2 | 3 | 4 | 5 |
| d. Size of Color Graphic Monitor | 1 | 2 | 3 | 4 | 5 |
| e. Menus | 1 | 2 | 3 | 4 | 5 |

4. Overall, I feel that the RWR PTT is:

| Not Useful At All | Slightly Useful | Moderately Useful | Useful | Very Useful |
|-------------------------|--------------------|----------------------|--------|----------------|
| 1 | 2 | 3 | 4 | 5 |

Use the remainder of this page to explain your reasons for rating the RWR PTT as "Not Useful at All" or "Slightly Useful." In addition, please add any comments that may help us to make the RWR PTT a more effective training aid.

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