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REVIEW OF THE AIR INTERCEPT CONTROLLER BASIC COURSE

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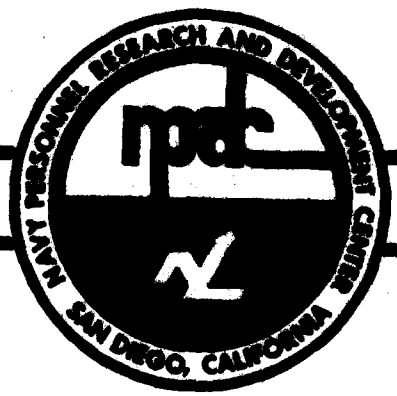

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REVIEW OF THE AIR INTERCEPT CONTROLLER BASIC COURSE

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To determine the causes of and suggest possible remedies for reducing the high student attrition rate in the AIC basic course, attrition data from the Fleet Combat Training Center air intercept controller (AIC) basic course were analyzed in several ways, the knowledge and laboratory sections of the course were reviewed using the instructional quality inventory (IQI) procedures, and several issues related to the AIC course and job were examined.

As a result of the course review, several recommendations were made concerning the AIC course materials and test items. Implementing these recommendations would improve course quality, but probably would not reduce academic attrition. The most effective strategy for reducing attrition would be to ensure that all students entering the course meet course prerequisites and successfully complete the preschool handbook. Students who do not meet these criteria should either not be permitted to take the course or receive remedial instruction before beginning the course.

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FOREWORD

This effort was conducted under the Navy Science Assistance Program (NSAP) in response to a request from the Commander in Chief, Pacific Fleet (CINCPACFLT) to determine the possible causes of and suggest remedies for reducing the high student attrition rate in the Air Intercept Controller (AIC) basic course. This effort was funded under the NSAP project number CPF-1-84. This is the final report on this effort.

Results of this effort are intended for NSAP, CINCPACFLT, CINCLANTFLT, and Fleet Combat Training Centers, Atlantic and Pacific (FCTCLANT, FCTCPAC).

Appreciation is expressed to the instructors at FCTCLANT and FCTCPAC for their time and effort in providing subject matter expertise in the conduct of this effort.

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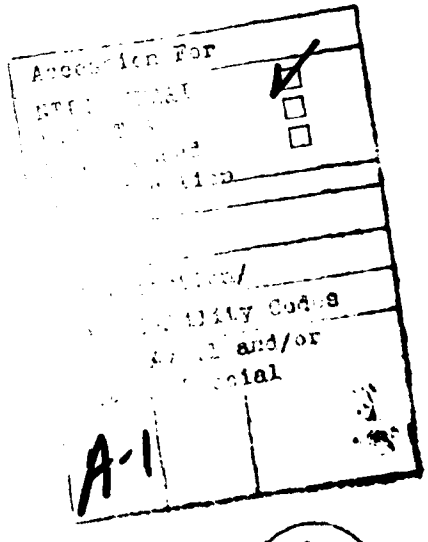

SUMMARY

Problem/Background

High attrition rates among students in the Navy Tactical Data System (NTDS) and, to a lesser degree, non-NTDS, Air Intercept Controller (AIC) basic course at Fleet Combat Training Center, Pacific (FCTCPAC) is an important problem for the fleet because there is a shortage of qualified AICs.

Purpose

The purpose of this effort was to determine the possible causes of and suggest remedies for reducing the high student attrition rate in the AIC basic course.

Approach

Examination of AIC training and attrition consisted of the following four separate investigations:

1. Analysis of the attrition data for FCTCPAC.
2. Review/analysis of the knowledge objectives and test items.
3. Review of the laboratory portion of the course.
4. Examination of issues related to AIC training and the AIC job in general.

Conclusions and Recommendations

Based on the findings from the attrition analysis, the most effective strategy for reducing attrition would be to ensure that all students entering the course meet course prerequisites and successfully complete the preschool handbook. Students who do not meet these criteria should either not be permitted to take the course or receive remedial instruction before beginning the course. FCTCPAC should retain the new course structure (introduced July 1982), which lowered attrition, shortened courses length, and eliminated academic attrition from the NTDS portion of the course.

As a result of the course review, it is recommended that FCTCPAC institute the following course changes listed below. Implementing these recommendations would improve course quality, but probably would not reduce academic attrition.

1. Eliminate the instruction and test items associated with unnecessary objectives from the course.
2. Eliminate the test items associated with nice-to-know objectives.
3. Test all essential objectives.
4. Use constructed-response (i.e., fill-in-the-blank, short answer, or listing) test items.
5. Inform students what is essential and what is nice-to-know.

6. Provide oral or written practice for each student for each essential objective.

7. The grading criteria (i.e., the checklists and rating scales) for the laboratory exercises should be reviewed and additional documentation should be provided where necessary.

8. The grading criteria should be included in the curriculum outline.

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INTRODUCTION

Problem/Background

In August 1983, Commander, Training Command, Pacific Fleet (COMTRAPAC 052117Z Aug 83) expressed concern about high attrition rates among students in the Navy Tactical Data System (NTDS) and, to a lesser degree, non-NTDS, Air Intercept Controller (AIC) basic course at Fleet Combat Training Center, Pacific (FCTCPAC). High attrition in AIC training is an especially important problem because there is a shortage of qualified AICs in the fleet. Commander in Chief, Pacific Fleet established a Navy Science Assistance Program (NSAP) task to identify deficiencies and recommend improvement in AIC training curriculum content, materials, and training methods.

Before this effort got underway, FCTCPAC changed the course structure, which significantly reduced NTDS student attrition; however, academic attrition for both NTDS and non-NTDS students was still over 25 percent.

Purpose

This effort was conducted to determine possible causes of and suggest remedies for reducing the high student attrition rate in the AIC basic course.

GENERAL APPROACH

Examination of AIC training and attrition consisted of the following four separate investigations:

1. Analysis of the attrition data for FCTCPAC.
2. Review/analysis of the knowledge objectives and test items.
3. Review of the laboratory portion of the course.
4. Examination of issues related to AIC training and the AIC job in general.

This report is organized into four sections, one for each investigation. Each section contains a discussion of the approach and results, followed by recommendations.

ANALYSIS OF ATTRITION DATA

Approach

Course records from October 1980 through December 1983 were obtained from FCTCPAC. Until the course structure was changed in July 1982, there were two separate AIC basic courses: a conventional course (K-221-0007) and an NTDS course (K-221-0027). Students in the NTDS course began working with the NTDS as soon as they began the laboratory portion of the course. In July 1982, the first 6 weeks of both courses were combined and NTDS and conventional AIC students began receiving identical instruction in both the academic and laboratory portions of the course. Conventional students graduated at the end of 6 weeks, while NTDS students received 2 weeks of additional training on the NTDS. Thus, NTDS students did not learn the NTDS until after they had been trained on the conventional system.

Attrition data were obtained from the course records at FCTCPAC and the following analyses and comparisons were performed:

1. Total attrition for NTDS and conventional students in classes conducted prior to July 1982 (old course) was compared with attrition for students in classes conducted after July 1982 (new course). These data were further analyzed to determine the attrition in each of the three phases of the course for both the old and new courses. The three course phases are (a) the classroom phase in which academic information is taught, (b) the synthetic phase in which students perform simulated intercepts, and (c) the live phase in which students conduct intercepts with live aircraft. The percentage of nonacademic attrition was also computed for both courses.

2. Attrition for students undergoing a permanent change of station (PCS) (moving from one duty station to another) and students on temporary assigned duty (TAD) at FCTCPAC was compared for calendar year 1983.

3. The relationship between completing the preschool handbook (FCTCPAC, 1982) and passing the course pretest was examined. The preschool handbook, which is sent to AIC students before they came to the course, is designed to prepare students for AIC training and contains information that is covered on the course pretest.

4. The time to complete the old and new courses was compared for all students.

5. The average number of days to attrite was compared for conventional and NTDS students in the new course.

Results

Because the attrition data are dichotomous, the results were adjusted so that valid F-tests could be performed (Winer, 1971).

1. Old and new course. Percent attrition for conventional and NTDS students in the old and new courses is presented in Table 1. The important finding is that attrition declined significantly in the new course $F(1,344)=4.44$, $p < .05$.[1]

Table 1

Attrition Rate in the Old and New Courses

Students	Attrition Rate (%)	
	Old Course (N=160)	New Course (N=188)
NTDS	46	29
Conventional	32	28

[1]Attrition in the new course is comparable with attrition at Fleet Combat Training Center, Atlantic (FCTCLANT), which has averaged 25 percent over the last three years.

Table 2 shows percent attrition for each phase of the old and new courses and the percent of nonacademic attrition for each course. There were no significant differences between courses for these measures.

Table 2

Attrition Rate for Each Phase of the Old and New Courses

Course Phase	Attrition Rate (%)	
	Old Course (N=63)	New Course (N=53)
Academic	13	10
Synthetic	49	50
Live	13	20
Nonacademic	25	20

2. PCS and TAD students. The mean attrition rate was 33 percent for PCS students and 24 percent for TAD students in the new course in 1983. Although this difference is not statistically significant, the trend is for higher attrition rates for PCS students. One explanation for this trend may be that PCS students usually come from a shore assignment where they have had little opportunity to work with radar displays. Experience with radar displays is a course prerequisite. TAD students almost always come to the school on temporary duty from a ship where they have been working with radar displays.

3. Impact of preschool handbook (FCTCPAC, 1982). One problem that PCS students have that most TAD students do not have is that they typically do not receive the preschool handbook. This occurs because the school is often not told which students are PCS or where they are coming from, which makes it difficult for the school to provide an advance copy of the handbook. The handbook contains information and practice exercises useful in preparing for the course pretest and the course itself. Of 20 questions on the course pretest, 18 are covered in the handbook. Thus, a student who has completed the handbook is likely to pass the pretest. This is important because almost 40 percent of the students who fail the pretest later fail the course. Only 10 percent of the students who pass the pretest later fail the course.

4. Time to complete the course. The average time for students to complete the old course was 57 days. They completed the new course in 45 days, which is significantly faster; $F(1,244)=51.56$, $p < .001$.

5. Days to attrite. The average number of days before failing for students who failed the new course was 29 days for conventional students and 22 days for NTDS students. NTDS students failed earlier than conventional students; $F(1,51)=3.8$, $p < .05$. Although the reason for this is unclear, this finding shows that NTDS students who attrite do so before they reach the NTDS portion of the course. This finding was confirmed by FCTCPAC personnel who report that academic attrition in the NTDS portion of the course is zero.

Recommendations

1. FCTCPAC should retain the new course structure, which lowered attrition, shortened course length, and eliminated academic attrition from the NTDS portion of the course.

2. The Navy Manpower and Personnel Command should ensure the PCS students receive the preschool handbook (FCTCPAC, 1982) in advance.

3. FCTCPAC should give students who fail the pretest immediate remedial instruction prior to beginning the course. At a minimum, this instruction should require successful completion of the preschool handbook.

4. Personnel who do not meet stated course prerequisites should not be permitted to take the course.

ANALYSIS OF KNOWLEDGE OBJECTIVES AND TEST ITEMS

Approach

A survey of course objectives was conducted in an earlier phase of this effort (Joy & Ellis, 1985). Course task/skill objectives were surveyed separately from course knowledge objectives. With very few exceptions, respondents agreed that the task objectives were essential for the course. For over half of the knowledge ojectives, however, there was considerable disagreement among respondents.

Because of the survey findings, three course managers from FCTCPAC acting as subject matter experts (SMEs) reviewed all the course knowledge objectives to determine if they should be included in the course. Objectives that were to be included were further reviewed to determine if they should be tested. The SME review resulted in three categories of objectives: (1) objectives that the SMEs considered essential to the course, (2) objectives that they believed should be included in the course but not tested (i.e., nice-to-know), and (3) objectives that they said should not be included in the course. The appendix lists the course knowledge objectives and their designation as essential (E), nice-to-know (N), or unnecessary (U).

The test items associated with the knowledge objectives were also examined by the instructional quality inventory (IQI) (Ellis, Wulfeck, & Fredericks, 1979). The IQI is a set of quality control or evaluation procedures for assessing the consistency among and the adequacy of the objectives, tests, and instructional materials or presentations of an instructional program.

Prior to using the IQI procedures, an attempt was made to match each test item with an objective. Test items that matched were reviewed using IQI procedures to determine if they were consistent with their associated objectives. Finally, the number of test items for each of the three categories of objectives was determined.

In addition to examining the objectives and test items, some lectures associated with the knowledge objectives were observed and instructor and student guides were reviewed according to IQI procedures.

Results and Discussion

The total number of knowledge objectives is 51. Table 3 shows the number of objectives in each category. Less than 50 percent of the current course knowledge objectives were considered essential.

Table 3

Analysis of Knowledge Objectives by Category

Item	Number of Objective by Categroy		
	E	N	U
Objectives	20	16	15
Test items	30	19	42
Objectives tested	8	7	10

E = essential
N = nice-to-know
U = unnecessary

The 130 multiple-choice test items in the AIC basic course are given in four 20-question weekly tests and a 50-question final exam. Sixteen of these questions are skill questions. Of the remaining 114 knowledge test items, 91 could be matched with an objective, which means 23 test items are not associated with a course objective.

The IQI assessment of the test items associated with objectives found none of the 91 test items consistent with associated objectives. The primary reason for this was that all the test items were multiple choice. According to IQI criteria, multiple choice format is not acceptable for knowledge tests, because very few job situations are multiple choice. For example, if a student needs to know the function of a dial or switch, four choices are not listed below the dial or switch out on the job. Therefore, the student must memorize the function, not just be able to recognize it. Table 3 also shows the number of knowledge test items associated with each objective category.

The SMEs considered that almost 50 percent of the test items tested unnecessary objectives. Another interesting finding is that, although 30 test items test some of the 20 essential objectives, not all the objectives were tested. Table 3 also shows how many of the objectives actually tested are in each objective category.

Finally, the IQI review of the lectures and instructor and student guides found that the instruction was generally consistent with the objectives and adequately presented.

The only problem was that sporadic oral quizzing by the instructor was the only provision for students to practice recall of knowledge information.

Recommendations

It is recommended that FCTCPAC institute the following course changes.

1. Eliminate the instruction and test items associated with unnecessary objectives from the course.

2. Eliminate the test items associated with nice-to-know objectives.

3. Test all essential objectives.

4. Use constructed-response (i.e., fill-in-the-blank, short answer, or listing) test items.

5. Inform students what is essential and what is nice-to-know.

6. Provide oral or written practice for each student for each essential objective.

REVIEW OF LABORATORY EXERCISES

Approach

The curriculum and grading procedures for the laboratory exercises were reviewed using the IQI (Ellis, Wulfeck, & Fredericks, 1979).

Results

The laboratory training for AIC basic course is excellent. The student progresses through six levels of synthetic intercept training of graduated difficulty followed by live intercept training. At level 1, the student begins with a single simulated aircraft. At level 6, the student is performing synthetic intercepts with several aircraft on the scope. The grading criteria accurately reflect job requirements. The only problem is that the documentation for the grading criteria for each level is not in the curriculum outline. In addition, some of the grading criteria are not documented as thoroughly as they could be.

Recommendations

1. The grading criteria (i.e., the checklists and rating scales) for the laboratory exercises should be reviewed and additional documentation should be provided where necessary.

2. The grading criteria should be included in the curriculum outline.

DISCUSSION OF RELATED ISSUES

The following issues related to AIC training and the AIC job were identified during discussions with SMEs from both FCTCPAC and FCTCLANT.

1. As training equipment in the laboratory portion of the AIC basic course is limited to one or two types of ship's equipment, students may learn to operate equipment that they may not encounter aboard ship. This situation is potentially demotivating for students. Possible solutions are to purchase additional equipment or to stress to students that the skills they are learning will generalize to different types of equipment.

2. The majority of PCS students come from shore assignments, which means that, although they meet course prerequisites, they lack recent experience with shipboard operations or equipment. This may be part of the reason PCS students have a higher attrition rate. One solution might be not to allow PCS students from shore assignments to take the course; another, to provide intensive remedial training for these students.

3. There are no incentives to become an AIC or to maintain AIC qualifications. The AIC job is complicated and demanding. At sea, AICs are usually on-call 24 hours a day and many stand regular watches in addition to their AIC duties. Many AICs believe this additional work and responsibility merits additional incentives. One solution would be to reinstitute propay for AICs.

CONCLUSIONS AND RECOMMENDATIONS

As a result of the course review, several recommendations were made concerning the AIC course materials and test items. Implementing these recommendations would improve course quality, but probably would not reduce academic attrition. Based on the findings from the attrition analysis, the most effective strategy for reducing attrition would be to ensure that all students entering the course meet course prerequisites and successfully complete the preschool handbook (FCTCPAC, 1982).

Students who do not meet these criteria should either not be permitted to take the course or receive remedial instruction before beginning the course.

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APPENDIX

KNOWLEDGE OBJECTIVES

KNOWLEDGE OBJECTIVES

This appendix lists all of the air intercept controller (AIC) basic course knowledge objectives. The appropriate designation--"E" for essential, "N" for nice-to-know, or "U" for unnecessary--precedes each objective. The number in parentheses following each objective refers to the AIC course lesson number in which the objective is taught.

E 1. State the meaning of prowords used in an intercept control when given sample transmissions. (2.1.1)

N 2. Describe the primary and secondary methods of intercept control employed by Soviet block forces. (3.2.1.1)

E 3. Describe the primary and secondary methods of intercept control employed by U.S. forces. (3.2.2)

N 4. Describe the philosophy underlying the method of intercept control employed by Soviet block forces. (3.2.2.1)

N 5. Describe factors such as lift, weight, thrust, and drag on an airplane in terms of how they interact to affect flight. (4.1.1)

N 6. Describe the functions of the control surfaces of an airplane when given the name of the control surface. (4.1.2)

U 7. Describe the three factors which determine the turning diameter of an airplane. (4.1.3)

U 8. Describe the effect that "G" has on an airplane's capability to turn. (4.1.4)

U 9. Explain current U.S. aircraft and squadron designation systems. (4.2.1)

U 10. Explain the current NATO code-name system for aircraft and missiles. (4.2.2)

E 11. Describe the characteristics, capabilities, and limitations of current U.S. fighter aircraft. (4.3.1)

U 12. Determine the capabilities and limitations of current U.S. air-to-air weapons. (4.3.2)

U 13. State the minimum and maximum ranges of current U.S. air-to-air weapons. (4.3.3)

N 14. State the calibre of guns carried on U.S. aircraft, given the aircraft designation. (4.3.4)

U 15. State the characteristics, capabilities, and limitations of current U.S. attack aircraft. (4.4.1)

E 16. State the prohibitions on restrictions that apply to various definitions of special use airspace. (5.1.1)

E 17. Explain SOCAL OPAREA synopsis procedures. (5.1.2)

E 18. State the purpose of the operational navigation chart. (5.1.3)

E 19. Describe the contents of various flight information publications. (5.1.4)

E 20. Describe the various missions of combat air patrol in terms of their main objective. (6.1.1)

E 21. Describe the factors to be considered in establishing an AAW defensive posture when given the force mission, capabilities, and limitations. (6.2.1)

E 22. Recognize conditions requiring CAP/MISSILE coordination. (6.2.2)

N 23. State the NATO names of Soviet bomber aircraft capable of launching ASCMs. (7.1.1)

N 24. State by NATO name and designation the missiles which can be launched by each Soviet bomber. (7.1.2)

N 25. Describe the characteristics, capabilities, and limitations of current threat fighter aircraft. (7.2.1)

N 26. Describe the characteristics, capabilities, limitations, and firing envelopes of threat fighter air-to-air missiles. (7.2.2)

N 27. Describe the capabilities of current threat surface-to-air missiles. (7.3.1)

E 28. Describe the purpose of the vector logic grid. (8.1.2)

N 29. State the rule of thumb for converting indicated air speed to true air speed. (9.2.4)

N 30. State the rule of thumb for determining aircraft turning diameter at 45 degree angle of bank. (9.2.5)

E 31. Describe attack-reattack/conversion geometry when given a tactical situation. (9.2.6)

E 32. Describe basic combat formations as applied by threat nations. (10.1.1)

E 33. Explain the terms used by interceptor aircrews during air combat maneuvering (ACM). (10.2.1)

N 34. Describe Soviet fighter tactics and U.S. countertactics. (10.3.1)

N 35. Define peacetime rules of engagement applicable to interceptor aircraft. (10.3.2)

N 36. Identify the reference documents containing combat rules of engagement. (10.3.3)

E 37. State the purpose of an IFF system. (11.1.1)

E 38. State the functions of the major components of AIMS MK XII IFF. (11.1.2)

E 39. Explain the use of each of the modes in the MK XII IFF system. (11.1.3)

U 40. Explain safe passage procedures using AKAA 283/285. (11.1.4)

U 41. Explain doctrine pertaining to Mode 4 of the MK XII IFF system. (11.1.6)

U 42. State the current IFF radiation policy. (11.1.6)

N 43. Explain the functions of the KIR-IA and KIT IA TSEC computers. (11.1.7)

E 44. Locate the primary controls and indicators of the UPA-59/UPA-59A. (11.2.1)

E 45. Describe each of the display presentations when all decoder group UPA-59/UPA-59A controls have been properly set up for desired operational functions. (11.2.2)

E 46. Describe the peacetime search and rescue (SAR) organization. (12.2.1)

U 47. Define command responsibilities during a peacetime SAR mission. (12.2.1.1)

U 48. Describe CAP and/or HELO procedures for a combat SAR mission. (12.2.2)

U 49. Describe aircrew identification (ID) procedures for a combat SAR mission. (12.2.2.1)

U 50. State the types of information contained in the airplan which are of most interest to the AIC. (13.1.1)

U 51. Describe the carrier control area in terms of size, control responsibility, and separation requirements when given aircraft type and weather conditions. (13.1.2)

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