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REPORT NO. 87

**OPERATIONAL
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READINESS TRAINING**

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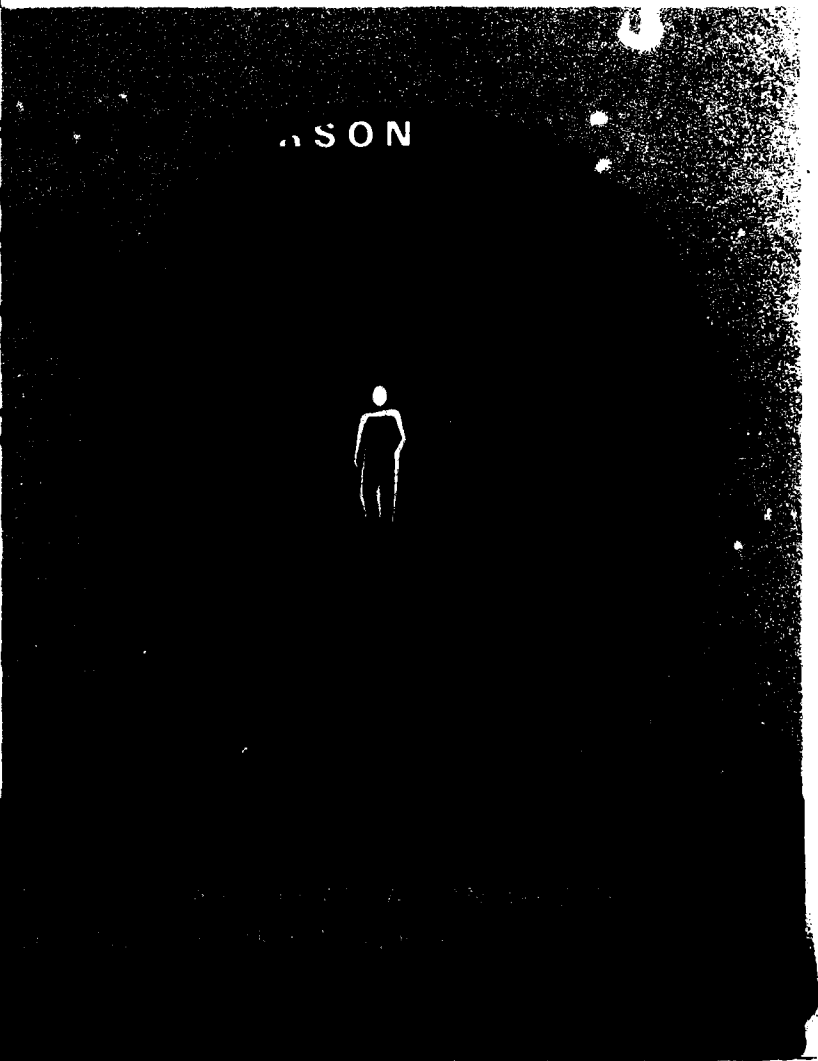
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OPERATIONAL PERFORMANCE OF P-3 PILOTS AS A FUNCTION OF VARIATIONS
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Training Analysis and Evaluation Group

June 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This study examines the long-term effects of simulator training at the Fleet Readiness Squadron on subsequent performance in operational squadrons. It utilizes a different approach for evaluating the training effectiveness of a flight simulator. An in-depth examination was made on operational performance data suitable for measurement of training effectiveness. In addition, the advantages of simulator trained pilots over nonsimulator trained pilots are detailed. (continued on reverse)		

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20. ACT (continued)

The major finding of the study indicates that students trained in Device 2F87F, Operational Flight Trainer, and with fewer P-3 inflight training hours, performed equally as well or better than those students trained only in the P-3 aircraft when subsequently assigned to fleet operational squadrons. The study recommends a system for tracking performance of pilots from initial selection for flight training to ultimate designation as a Patrol Plane Commander.

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TAEG Report No. 87

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	INTRODUCTION.	3
	Purpose	3
II	APPROACH.	5
	Performance Data.	5
	Training Performance Measures.	5
	Operational Performance Measures	5
	Subjects.	5
	Procedure	5
	Data Processing.	6
	Study Design.	7
III	RESULTS	9
	Designation as PP3P	9
	Effects of Simulator Training on Total, First Pilot, and Copilot Time	9
	Designation as PP2P and PPC	10
IV	DISCUSSION.	13
	Operational Performance Measures.	13
	Chronological Time to the PP3P Designation	13
	NATOPS Evaluation Flight Scores.	13
	Flight Time in the P-3 Aircraft to Each Designation.	13
	Operational Performance as a Function of Previous Training.	13
	Selection of PP3P as Comparison Point.	13
	Findings on Group Comparisons at PP3P.	14
V	SUMMARY	15
	Post Note	16
	REFERENCES.	17
	APPENDIX - FEEDBACK INFORMATION SHEET	19

TAEG Report No. 87

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Data Summary of Response Return by Treatment Groups.	6
2	Summary of Operational Performance Data by Squadron.	8
3	Comparison of Fly Only Group and Simulator Group on Matching Variables	7
4	Comparison of Time in Month and Flight Hours to PP3P Designation.	9
5	Comparison of Flight Hours to PP3P Designation (VP-30 FAM/INST Flight Hours Deleted).	10
6	Comparison Between Groups: Time in Months, Flight Hours, and NATOPS Evaluation Scores at PP2P Designation	10
7	Comparison Between Groups: Time in Month, Flight Hours, and NATOPS Evaluation Scores at PPC Designation.	11

SECTION I

INTRODUCTION

The Training Analysis and Evaluation Group (TAEG) has been involved in a program concerned with the fleet readiness training of replacement pilots for the P-3 aircraft. The effort began with an analysis of training practices and an assessment of the training resources at the fleet readiness squadron (FRS) level. The Training Analysis and Evaluation Group has worked directly with Patrol Squadron THIRTY (VP-30) to improve the utilization of existing resources in pilot production for fleet assignments (references 1, 2, and 3).

With the advent of a new state-of-the-art Operational Flight Trainer (OFT), Device 2F87F, TAEG was requested to assess the training potential of the new simulator and assist in integrating it into the ongoing P-3 training program. A series of transfer of training studies (references 4, 5, and 6) were accomplished on-site at VP-30 to determine the potential of the new device as a substitute for portions of inflight training, including the learning of aircraft tasks previously trained in the aircraft. The training context for those studies is described below.

The studies addressed the Familiarization/Instrument (FAM/INST) phase of pilot training which is designed to transition recent graduates of Navy Undergraduate Pilot Training (UPT) into the P-3 aircraft. The FAM/INST phase includes instruction and practice in transition training tasks such as takeoffs and landings, instrument flight, airways navigation, and inflight malfunctions and emergencies.

In the study program three classes of training devices were employed: the new 2F87F OFT and the older 2F69D OFT; the Cockpit Procedures Trainer, Device 2C45; and the Cockpit Familiarization Trainer, Device 2C23. All simulator and inflight training was conducted by VP-30 instructor pilots. Training was conducted with squadron resources and flight syllabi.

Concomitant with the on-site experimental program, TAEG was tasked to initiate a longitudinal study to determine how students trained in the 2F87F OFT performed in their operational assignments compared with those trained only in the aircraft. A feedback questionnaire was developed and distributed via VP-30 to the appropriate operating squadrons to gather information for this determination. The emphasis on this initial and rudimentary effort was to determine if the receiving squadrons perceived any performance differences among students as a function of the various training regimes utilized by VP-30 (reference 5). Responses to the questionnaire (N=36) indicated a general satisfaction with the VP-30 training program. More importantly, however, was the finding of no difference in the overall performance of students who received training in the 2F87F OFT with 8.6 flight hours and those trained only in the aircraft with 15.1 flight hours in the FAM/INST phase of training.

PURPOSE

The present study continues the earlier effort examining in-depth the effects of variations in the FRS training regime on subsequent operational performance. The intent is to determine specifically if pilots trained on

TAEG Report No. 87

Device 2F87F with reduced inflight training performed as well as pilots trained in the conventional syllabus in the aircraft alone. Those students trained under varied training regimes at VP-30 were tracked from completion of training until they were designated as Patrol Plane Commanders (PPC) (see the appendix).

In addition, data were assembled on the selection test results of these students and on their performance through UPT. Detailed data on these students gathered during FRS training were also utilized in the study. It was envisaged that these classes of data would provide a substantive correlative base for making certain predictions about pilot performance in the subsequent operational assignment.

SECTION II

APPROACH

PERFORMANCE DATA

The statistical analyses to identify relationships of training and operational performance were based on two categories of performance measures: training performance measures recorded prior to fleet assignment and operational performance measures obtained after fleet assignment.

TRAINING PERFORMANCE MEASURES. In the course of the TAEG P-3 studies, an extensive data bank was established on the performance of students used as experimental and control subjects throughout their flight training. These data included pre-Navy flight experience, FAR and AQT selection test scores, and UPT performance measures including basic and advanced raw and standard flight grades, stage grades, and flight hours. Measurement data collected at VP-30 included simulator and aircraft trial data on check tasks, average flight grades, check flight grades, and FAM/INST flight hours.

OPERATIONAL PERFORMANCE MEASURES. From the training and operational performance records maintained by the fleet squadrons, four standard measures were identified. These measures were recorded for each pilot. The measures were: (1) chronological time in months to each designation; i.e., Patrol Plane Third Pilot (PP3P), Patrol Plane Second Pilot (PP2P), and Patrol Plane Commander (PPC); (2) P-3 aircraft flight time to each designation apportioned as first pilot time and copilot time; (3) NATOPS evaluation flight grades, which were further broken down into 12 area and subarea scores corresponding to 12 of the check tasks trained at the FRS; and (4) check flight grades.

SUBJECTS

Ninety-two pilots were involved in the testing of four distinct FAM/INST training syllabi at VP-30 (different simulator/aircraft mixes) during the period October 1976 to March 1978. All students received common training in academics, the Cockpit Familiarization Trainer, and the Cockpit Procedures Trainer. Beyond this, students received training in either the old 2F69D simulator and the P-3 aircraft, the new 2F87F simulator and the P-3 aircraft, or the P-3 aircraft only. Twenty-seven received training in the 2F87F under a block syllabus (Experimental Group); 39 were trained in the 2F87F using an integrated syllabus (Operational Group); 16 were trained in an older OFT, Device 2F69D (Concurrent Control Group); and 10 received training in the P-3 aircraft only (Fly Only Group). To complete the FAM/INST phase, all students were required to pass a check flight in the P-3 aircraft.

To obtain operational performance measures, the Commander, Naval Air Force, Atlantic, distributed the Pilot's Training Information Data Sheet (see appendix) to the assigned squadron of each of the 92 pilots with instructions to return the completed data sheet and supporting documentation to TAEG.

PROCEDURE

Initial plans for data analysis were predicated on a high percentage of return (80-90 percent) from the fleet squadrons. Since various measures of

operational performance were obtained, the decision was made to utilize multivariate statistical procedures in data analysis. A multivariate analysis of variance was planned to test for differences among the various training regimes employed at VP-30. Also, in the event significant differences were found, post-hoc comparison testing would be accomplished by discriminant analysis. A factor analysis of the performance measures intercorrelations was also planned to identify relationships of operational performance with training performance. Because of the mass of data and the complex analyses required, arrangements were made to utilize the computer facilities at the University of Central Florida, Orlando.

DATA PROCESSING. The operational measurement data and the training measurement data for each individual were assembled and the entire data file was keypunched. However, several problems became apparent upon initiation of data processing that substantially affected the study design. These problems centered around a lower than expected return of operational performance measurement data, the grading criteria of check flights, and an unexpected variability in the operational performance data. These shortcomings are outlined below:

Returns of Operational Performance Data. The TAEG received a 53 percent return of the requested data, well below the goal of 80-90 percent. This limited the sample size to 49 students and essentially ruled out the use of multivariate analysis techniques for data analysis. Unequal distribution of returns for the identified training groups further complicated this problem. For example, returns were received for 8 of 10 pilots in the Fly Only Group; but returns for only 5 of 16 students were received for the Concurrent Control Group. Table 1 presents the response return of pilots in the various training regimes and summarizes operational performance data through the PP3P designation.

TABLE 1. DATA SUMMARY OF RESPONSE RETURN BY TREATMENT GROUPS

Treatment Group	No. of Students	Months to 3P	First Pilot Hours to 3P	Copilot Hours to 3P	Total Hours to 3P
Experimental	22	2.3	60.0	36.4	96.4
Concurrent Control	5	3.2	70.6	43.6	114.2
Operational	14	2.9	71.1	47.1	118.1
Flight Only	8	2.9	76.8	50.5	127.3

Check Flight Grades. There was no standardized scoring or grading of check flights. The lack of common scale rendered check flight grades inappropriate for use in further analyses. The primary reason for this lack of a common scale is attributed to the period of transition from a program prescribed by

the Commander, Patrol Wings, Atlantic, to the fleet-wide Personnel Qualification Standards (PQS) system of training records.

Variability of Operational Performance Data. Initial computer runs were made on the data files for the 49 pilots in order to verify accuracy of the data base and obtain measures of central tendency. Examination of these measures of central tendency revealed that variations in data by squadron assignment were so extreme that they overshadowed differences in simulator/ aircraft mixes at the FRS. Table 2 provides a tabulation of the means of performance data by squadron. Comparison of the tabular data in tables 1 and 2 depicts the variability among fleet squadrons and how this overshadows differences among the four designated training groups. For example, the mean total flight hours in the P-3 aircraft to reach the PP3P designation ranged from 96.4 hours for the Experimental Group to 127.3 hours for the Flight Only Group (see table 1). Pilots assigned to squadron "F" averaged 44.3 hours before designation as PP3P, while pilots assigned to squadron "E" averaged 147.7 flight hours (see table 2). Because of these shortcomings, the use of multivariate statistical techniques was rejected and the original study plan was modified.

STUDY DESIGN

It was subsequently determined that the appropriate analyses should be limited to data that could be matched on some basis that would reduce the effects of variability in squadron designation practices and training procedures. This was done by selecting a student from those trained only in the P-3 aircraft (Fly Only Group) and then matching him with a student from the same squadron who was trained in Device 2F87F and the aircraft (Simulator Group). The matching was based on equivalent UPT flight scores, UPT flight hours, and FRS flight grades. This was continued on a one-to-one basis until matches had been obtained on all students from the Flight Only Group on which returns were received. Thus the precision of the analyses, while confined to a smaller group, was increased as well as the confidence level in the findings. Table 3 presents the mean values of the matching variables for the two groups.

TABLE 3. COMPARISON OF FLY ONLY GROUP AND SIMULATOR GROUP ON MATCHING VARIABLES

	Fly Only Group (N=8)	Simulator Group (N=8)
UPT Average Standard Flight Score	55.2	54.7
UPT Flight Hours	206.0	203.0
FRS Average Flight Grade	3.04	3.04
*FRS Average Aircraft Flight Hours to Proficiency FAM/INST Phase	15.4	8.6

*Not matched on this variable; data presented to show differences in Aircraft Flight Hours at FRS between the two groups.

TABLE 2. SUMMARY OF OPERATIONAL PERFORMANCE DATA BY SQUADRON

Fleet Squadron	No. of Students	Months to 3P	First Pilot Hours to 3P	Copilot Hours to 3P	Total Hours to 3P	Months to 2P	First Pilot Hours to 2P	Copilot Hours to 2P	Total Hours to 2P	NATOPS Grade 2P	Months to PPC	First Pilot Hours to PPC	Copilot Hours to PPC	Total Hours to PPC	NATOPS Grade PPC
A	4	3.5	80.5	40.0	120.5	13.0	255.8	181.0	436.8	3.66	24.0	444.0	355.0	799.0	3.76
B	1	2.0	69.0	43.0	102.0	11.0	332.0	316.0	648.0	3.69	22.0	406.0	386.0	792.0	3.67
C	1	2.0	56.0	21.0	77.0	15.0	300.0	228.0	528.0	3.77	-	-	-	-	-
D	10	3.6	82.6	57.1	139.7	13.6	229.1	194.8	423.9	3.57	22.7	364.0	302.6	666.6	3.69
E	3	3.0	82.0	65.7	147.7	12.3	243.3	196.3	439.6	3.66	21.3	449.7	378.3	828.0	-
F	8	1.0	33.4	10.8	44.3	11.8	197.1	146.5	343.6	3.72	24.2	388.7	317.7	706.4	3.75
G	2	3.0	57.0	28.0	85.0	14.5	243.0	197.0	440.0	3.70	28.5	484.0	398.0	882.0	3.74
H	5	3.2	72.0	48.8	120.8	14.2	242.6	202.2	444.8	3.50	24.0	400.0	336.5	736.5	-
I	4	3.5	77.0	53.8	130.8	13.5	302.0	221.3	523.3	3.67	24.8	576.5	465.0	1041.5	3.83
J	7	2.1	66.0	40.9	106.9	15.7	301.3	249.4	550.7	3.73	24.6	478.6	409.6	888.2	3.76
K	4	2.0	64.0	42.0	86.0	13.5	265.8	196.3	462.1	3.75	21.3	394.7	310.0	704.7	3.73
Subjects Overall Average		2.6	67.2	42.6	109.8	13.5	246.7	196.0	443.9	3.66	23.6	422.0	355.7	777.8	3.74

Note: Flight Hours are P3 Flight Hours only

SECTION III

RESULTS

Results of the analyses of operational performance data are presented for each designation achieved during fleet assignment.

DESIGNATION AS PP3P

Table 4 presents the results of the analysis of operational performance data at the PP3P designation.

TABLE 4. COMPARISON OF TIME IN MONTHS AND FLIGHT HOURS TO PP3P DESIGNATION

	Fly Only Group Mean (N=8)	Simulator Group Mean (N=8)	t
Time in Months to PP3P	2.9	2.6	0.552
P-3 First Pilot Flight Hours	76.8	55.6	3.236*
P-3 Copilot Flight Hours	55.5	38.4	3.265*
P-3 Total Pilot Flight Hours	127.3	87.9	3.431*

*Critical value of $t_{.05,7df} = 2.365$

Results of these analyses indicate no significant differences between the two groups in time in months to reach PP3P designation. The results do, however, indicate a significant difference in first pilot, copilot, and total P-3 flight hours.

EFFECTS OF SIMULATOR TRAINING ON TOTAL, FIRST PILOT, AND COPILOT TIME. Since all subjects trained in the 2F87F received fewer flight hours than the Flight Only Group in the FAM/INST phase of VP-30 FRS training, the effects of deleting these hours from the comparison were examined. FAM/INST flight hours were subtracted from each subject's flight time and the resultant flight hours were again compared. The results of this comparison are contained in table 5.

Although there is a large difference between the first pilot time means for the two groups at PP3P designation, the difference is not statistically significant. However, the analysis did reveal significant differences between groups in copilot time and total P-3 time after the completion of FAM/INST phase and designation as PP3P. The data show the Simulator Group required fewer copilot and total flight hours after completion of the FAM/INST phase at VP-30 to reach PP3P designation (table 5).

TABLE 5. COMPARISON OF FLIGHT HOURS TO PP3P DESIGNATION
(VP-30 FAM/INST FLIGHT HOURS DELETED)

	Fly Only Group Mean (N=8)	Simulator Group Mean (N=8)	t
P-3 First Pilot Flight Hours	61.3	47.1	2.174
P-3 Copilot Flight Hours	55.5	38.4	3.265*
P-3 Total Pilot Flight Hours	117.0	85.4	2.737*

*Critical value of $t_{.05,7df} = 2.365$

DESIGNATION AS PP2P and PPC

Similar analyses were performed for chronological time and flight hours to PP2P and PPC designations. Additionally, the NATOPS overall flight grades were examined for the two groups. Tables 6 and 7 present the data summary for PP2P and PPC, respectively. Results indicate no significant differences between the two groups at PP2P or PPC designations.

TABLE 6. COMPARISON BETWEEN GROUPS: TIME IN MONTHS, FLIGHT HOURS,
AND NATOPS EVALUATION SCORES AT PP2P DESIGNATION

	Fly Only Group Mean (N=8)	Simulator Group Mean (N=8)	t*
Time in Months to PP2P	13.5	13.1	.438
P-3 Total Flight Hours	467.0	417.0	1.679
NATOPS Evaluation Grade	3.65	3.67	.525

*Critical value of $t_{.05,7df} = 2.365$

TAEG Report No. 87

TABLE 7. COMPARISON BETWEEN GROUPS: TIME IN MONTHS, FLIGHT HOURS,
AND NATOPS EVALUATION SCORES AT PPC DESIGNATION

	Fly Only Group Mean (N=5)	Simulator Group Mean (N=5)	t*
Time in Months to PPC	22.0	22.4	.302
P-3 Total Flight Hours	794.0	679.0	2.654
NATOPS Evaluation Grade	3.72	3.79	1.640

*Critical value of $t_{.05,4df} = 2.776$

SECTION IV

DISCUSSION

OPERATIONAL PERFORMANCE MEASURES

The three classes of operational performance measures used in this study are discussed in the following paragraphs.

CHRONOLOGICAL TIME TO THE PP3P DESIGNATION. Chronological time appears to be based on individual squadron policy rather than on individual aviator performance. Effects of deployment schedules of operational squadrons further confound use of chronological time to designation as an operational performance measure. Chronological time to the PP2P and PPC designations is generally scheduled to coincide with guidance provided in the OPNAVINST 3710.7 series (reference 7). This instruction states, "It is expected that, under normal conditions, a pilot serving in a billet which required eventual qualification as aircraft commander will gain initial qualification as such within 24 months after reporting to the command." Thus, the time to designation is primarily the result of a planned training program leading to initial designation as PPC in 24 months.

NATOPS EVALUATION FLIGHT SCORES. These scores may be unduly biased by low or high grades in each area thereby reducing the validity of the overall score as an indication of pilot performance. For example, high scores in Preflight and Postflight may affect a low score in Landings to yield a better than average overall score. Poor pilot performance during actual flight may be offset by scores on less complex, although not less important, areas of evaluation. NATOPS evaluation flights are required to achieve the PP2P designation and are given annually thereafter. The flight evaluation is generally accomplished in one flight. Thus, the validity of the NATOPS evaluation score as a measure of operational performance could be questioned due to considerable day-to-day variations in individual performance and the unknown reliability of evaluator ratings. Based on individual squadron NATOPS mean evaluation scores (table 2) there appeared to be inconsistencies among the fleet squadrons.

FLIGHT TIME IN THE P-3 AIRCRAFT TO EACH DESIGNATION. The use of flight time as a performance measure has the same general constraint as chronological time to designation. The requirements set forth in OPNAVINST 3710.7 series specify 500 hours total time to the PP2P designation and 700 hours total time for the PPC designation. Thus, pilots demonstrating the potential performance required for these designations could be restricted from designation until these flight hour minimums are met.

OPERATIONAL PERFORMANCE AS A FUNCTION OF PREVIOUS TRAINING

SELECTION OF PP3P AS COMPARISON POINT. Considering limitations of each operational performance measure used in this analysis, it was determined that the data obtained at PP3P designation was the most valuable indicator of operational performance as a function of previous training. The selection of the PP3P designation was deemed advantageous because:

TAEG Report No. 87

- it is the first designation en route to PPC
- it provides a clearly defined point in the fleet assignment to obtain operational performance measures
- there are no minimum flight hour or chronological time requirements
- the relatively short time from FRS graduation to PP3P designation (\cong 3 months) minimized possible biases attributable to variations in individual squadron training programs.

FINDINGS ON GROUP COMPARISONS AT PP3P. Reduction of FRS flight hours due to simulator training does not require additional chronological time (months to designation) to achieve the PP3P designation nor does it require aviators to fly additional flight hours to achieve the PP3P designation. Furthermore, there were significantly fewer flight hours required for PP3P designation for the Simulator Group. This reduction in total flight hours to PP3P for the Simulator Group is not surprising when the salutary effect of copilot training in Device 2F87F is considered. In Device 2F87F, two students were trained simultaneously, alternating between first pilot and copilot duties. In the aircraft, both groups received training in first pilot duties only.

The central finding of the study is that students trained in the simulator and receiving fewer aircraft flight hours to proficiency at the FRS performed, throughout their operational assignment, at least as well as students trained to proficiency in the aircraft alone. There were no statistically significant differences between the Simulator and Fly Only Groups at PP2P or PPC designations (tables 6 and 7).

SECTION V

SUMMARY

This section summarizes the findings of the study. In addition, a perceived need for more effective utilization of pilot performance histories is discussed in a post note. This perception, while not directly resulting from the statistical analyses contained in the present study, is nevertheless considered worthy of management concern.

No adverse effects on operational performance occurred when the simulator was effectively employed in conjunction with reduced aircraft training in the FAM/INST phase at the FRS. An appropriate mix of simulator and inflight training hours produced certain advantages for the receiving operational squadrons. The specifics are listed below.

- Substitution of simulator training for inflight training at the FRS resulted in a reduction of first pilot, copilot, and total flight hours required to demonstrate proficiency for designation as a PP3P.
- Based on hours accumulated after FAM/INST phase of FRS training, the number of first pilot hours required by simulator trained pilots to qualify for PP3P was substantially less (61.3 hours vs. 47.1 hours).
- Based on hours accumulated after FAM/INST phase of FRS training, the number of copilot hours required by simulator trained pilots to qualify for PP3P was significantly less (55.5 hours vs. 38.4 hours). The enhanced copilot performance was presumably due to simulator copilot training at the FRS.

Extreme variations in operational performance data were found among fleet squadrons. These variations mask differences in individual pilot performance to the extent that performance independent of squadron assignment cannot be determined with any precision. Specific findings relative to operational performance data are listed below.

- Fleet squadrons varied substantially in the amount of flight time required for PP3P designation. Those squadrons requiring significantly higher amounts of flight time for designation are losing any advantage of flight time savings resulting from effective simulator utilization at the FRS. Also, this situation will selectively penalize pilots capable of demonstrating capability for early designation.
- NATOPS evaluation grades presently used to determine qualifications of pilots appear to lack the precision needed for comparative measures of pilot performance among fleet squadrons. This shortcoming should be resolved in order not to compromise this valuable means for maintenance of flight standards across all squadrons.

OPNAVINST 3710.7 series set minimum flight hour requirements for PP2P and PPC designations. Inflexible minimum flight hour requirements could have

TAEG Report No. 87

the undesirable effect of reducing the need for establishing and maintaining effective/efficient flight training programs.

POST NOTE

The efforts of TAEG have identified the need for a system to track pilots from assignment to the FRS until designation as PPC. Development of such a system when used in conjunction with that established and operating in UPT would provide a continuum of performance data on each patrol plane commander from initial selection testing through UPT, FRS, and the operational squadron.

Despite the difficulties involved in such a longitudinal approach, the feasibility of tracking prospective patrol plane pilots from initial selection for UPT to ultimate designation has been demonstrated. What is evident is the need for both short- and long-term control procedures to insure continuity in the management of training. A "corporate memory" is clearly indicated to maximize the benefits of experience and lessons learned.

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7. OPNAVINST 3710.7 Series. NATOPS General Flight and Operating Instructions Manual. Office of the Chief of Naval Operations. Washington, DC 20350.

TAEG Report No. 87

APPENDIX
FEEDBACK INFORMATION SHEET

PILOT'S TRAINING INFORMATION DATA SHEET

Officer Name _____ SSN _____ VP _____

1. Date reported to squadron _____
2. Date designated PP3P _____
3. First pilot P-3 flight time at PP3P designation _____
4. Copilot P-3 flight time at PP3P designation _____
5. Date designated PP2P _____
6. First pilot P-3 flight time at PP2P designation _____
7. Copilot P-3 flight time at PP2P designation _____
8. Date designated PPC _____
9. First pilot P-3 flight time at PPC designation _____
10. Copilot P-3 flight time at PPC designation _____
11. Was a waiver requested to extend the maximum time to any designation?
If YES, briefly explain reason for waiver(s) _____

12. Field Naval Evaluation Board during training? _____
If YES, briefly explain reason for Board action.

13. Attach copy of PP3P Check Flight Grade Sheet(s)
Attach copy of PP2P Check Flight/NATOPS Check Grade Sheet(s)
Attach copy of PPC Fly 5 Check Flight Grade Sheet(s) (IF APPLICABLE)
Attach copy of PPC TAC 9 Check Flight Grade Sheet(s) (IF APPLICABLE)
Attach copy of PPC PQS CHECK AND NATOPS CHECK (NATOPS CHECK CLOSEST TO PPC CHECK)

TAEG Report No. 87

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