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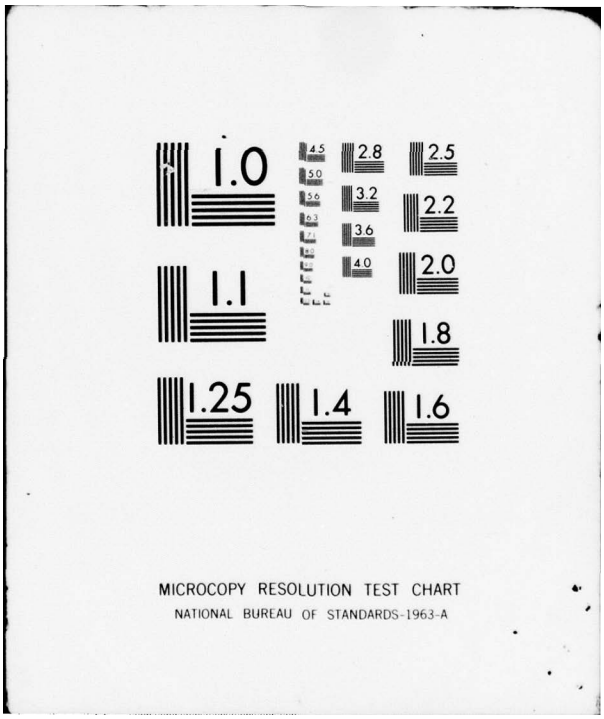
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Technical Report NAVTRAEQUIPCEN 75-C-0105-1

A7 TRAINING EFFECTIVENESS THROUGH PERFORMANCE ANALYSIS

Dunlap and Associates, Inc.
Western Division
La Jolla, California 92037

FINAL REPORT APRIL 1975 - DECEMBER 1977

April 1978

NAVAL TRAINING EQUIPMENT CENTER
ORLANDO, FLORIDA 32813

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

Training concepts which emphasize landing performance analysis, diagnostic feedback and remedial instruction for novice A7 pilots are described. FCLP performance is analyzed to identify low performers who are potential recycle trainees. A Night Carrier Landing Trainer (NCLT) provides individualized remedial training to improve eventual carrier landing performance. Results of a field test of the method are presented. Fleet performance of previous

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20. ABSTRACT (Continued from reverse side)

recycle trainees is reviewed and discussed along with recommendations for training implementation.

SUMMARY

Two training concepts designed to improve A7 Category I pilot training effectiveness were developed and tested. One concept involves the reduction of recycle training through the analysis of night FCLP landing performance, diagnostic training feedback and NCLT remedial instruction for all novice pilots. A second concept concerns the fleet follow-up and performance feedback for all recycled replacement pilots (RPs).

The following answers were obtained for four basic research questions asked about recycled pilots.

Question #1: Can potential recycle pilots be identified early?

Answer: Potential recycle pilots can be identified by the fifth night FCLP period by selecting an FCLP cutting score and determining if the RP is either erratic in performance or below the cutting score in three or four of the first five night FCLP periods.

Question #2: Can specific landing problem that lead to recycle training be identified?

Answer: An analysis of FCLP Landing Signal Officer (LSO) comments can be used to evaluate each RP landing technique and provide diagnostic feedback on landing deficiencies using a landing trend analysis form to summarize the data.

Question #3: Are landing problems correctable without recycle?

Answer: This question requires additional study before a firm answer is stated. In this study the landing problems of one RP who was a low performer were sufficiently corrected using NCLT remedial training to allow him to pass carrier qualification (CQ) on his initial try and avoid recycle training. A second predicted recycle RP was not salvaged by remedial training and was recycled through a complete second training cycle for CQ.

Question #4: Does CQ performance improve?

Answer: The results clearly indicate an improvement in Nugget CQ performance compared with non-remedial trainees. An exceptionally high night boarding rate of 83 percent was obtained compared to an average night boarding rate of 62 percent. Whether the improved performance is sustained in the fleet should be followed-up in a longitudinal study of all Category I pilots.

A fleet disqualification rate of 37.5 percent for eight recycled pilots was obtained when information on their fleet performance was analyzed.

PREFACE

The Human Factors Laboratory of the Naval Training Equipment Center has been engaging in a continuing program of research with three general goals: 1) improvement of the methodology associated with research in training effectiveness evaluations, 2) improvement of training methods with its corollary benefit of making more effective use of simulators, and 3) improvement of future simulator design and use through application of research results. Previous efforts have brought into focus the contribution that objective measures make in evaluation and the importance of proper simulator usage on transfer of training. In a recent evaluation of the NCLT, using an experimental syllabus, a positive transfer of training from the NCLT to actual A7E carrier qualification was found.

The present study is an exploratory effort in training methods improvement. Results indicate that: 1) an analysis technique can be applied to FCLP performance, 2) the results of the analysis provide a diagnosis of landing performance, 3) diagnostic information can be translated into remedial training objectives that can be accomplished in the NCLT, 4) NCLT remedial training produces an improvement in landing performance during FCLP, 5) the experimental NCLT training provides positive transfer of training from FCLP to actual carrier qualification, 6) the procedure is feasible for on-going operational training for carrier qualification, and 7) no change in trainer hardware is required to accomplish the increase in training effectiveness.

An important aspect of the study is that a method to determine specific and individual remedial NCLT instructional objectives has been integrated with the established training program objectives. Tailoring of any aspect of flying training to the individual is often sought but seldom realized. This study provides the means to individualize instruction in the NCLT. The concept can be applied across other weapon systems that use visual landing display simulators. Similar concepts can also be developed for application in other types of simulators.

The study discussed in this report was made possible through the cooperation and interest of VA-174 whose Commanding Officer, CDR J. McCain, gave us the necessary support and liaison. Outstanding contributions to the formulation of the project goals and their implementation were made by the team of LSOs assigned to the Fleet Readiness Squadron. The primary impetus was provided by LT Ross Fisher whose interest and enthusiasm led to the field test where he was ably assisted by LT Ron Boraten and LT Mike Wilson. Their extraordinary assistance and additional work made the project that much easier to accomplish.

Pete Pettigrew of Dunlap and Associates' staff provided a broad critique and review of the material and provided several insightful comments especially in potential applications of the results to fleet training. His unique blend of operational and project experience clarified many of the concepts presented and his overall involvement with the project was invaluable.

William B. Boney

WILLIAM B. BONEY
Scientific Officer

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SECTION I

BACKGROUND

In July 1976 a transfer of training effectiveness study for the Night Carrier Landing Trainer (NCLT) was completed. The results clearly indicated the positive transfer of training from the NCLT to actual Carrier Qualification (CQ) trials for novice (Category I) Replacement Pilots (RPs). Fifteen months of data collection were required to obtain a minimum sample of pilots for the trainer (N=26) and the control (N=27) groups which provided ample time to observe the A7 Fleet Replacement Squadron (FRS) training process.

One of the more interesting research results concerned the additional time and flight hours required to qualify pilots who failed carrier landing training in their initial training cycle. Pilot trainees were disqualified either during Field Carrier Landing Practice (FCLP) or CQ. Such pilots were usually recycled through another complete training period which, on the average, resulted in 12 more weeks at the FRS and 19 percent more flight hours than those pilots who successfully completed training in their first attempt.

"The problem with recycle and additional training time is cost. Increased time at the Fleet Replacement Squadron (FRS) (+12 weeks) and more A7E flight time (+19 percent) means delay in reporting to a fleet squadron and more money for fuel. Time and cost are also increased due to additional CQ ship trials, LSO time expenditure and aircraft demand to meet the burden of more FCLP and CQ trials."[1]

Based on our observations of FRS training it seemed highly probable that new training concepts which address the problem of recycle training time and increased flight hours would improve FRS training effectiveness. One proposed concept is that of individualized diagnostic training feedback and remedial instruction for Category I novice pilots.

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[1] Brictson, C.A. and Burger, W.J. Transfer of Training Effectiveness: A7E Night Carrier Landing Trainer (NCLT), Device 2F103. NAVTRAEQUIPCEN 74-C-0079-1, August 1976.

Another interesting aspect of our observations had to do with the eventual fleet performance of recycled Category I pilots. How did repeaters do in the fleet? While they represent a considerable investment in training by the time they complete FRS instruction very little formal follow-up of their fleet performance is conducted. A second proposed training concept is performance feedback from fleet squadrons. One of the topics covered later in the report is an informal fleet follow-up of a small number of A7E pilots who were recycled in their CQ training.

There are four crucial training questions about recycled pilots that are emphasized in this report. They are:

1. How can they be identified early in the FRS training program?

2. What are the specific landing problems that lead to their recycle training?

3. How can their landing problems be corrected?

4. How can their CQ performance be improved?

This report provides a description of the methods used to obtain preliminary answers to these questions which are important to A7 FRS training effectiveness, expeditious squadron assignment, and, ultimately, fleet performance.

The following material reviews the scope of carrier landing training as well as the nature of recycle training and considers the potential impact of these two training concepts.

SECTION II

CARRIER LANDING PERFORMANCE TRAINING

An evaluation of FRS CQ training was completed in order to determine how low performing RPs can be identified early in the training cycle. The ground and flight training syllabus for Phase III is shown in Table 1. An analysis of Phase III training shows that four types of training take place in an effort to teach sufficient knowledge and skills to the RP so that he can successfully demonstrate his landing ability aboard ship. This training is essentially sequential in nature with some overlap provided between NCLT and FCLP. Training is listed in Table 2 in decending order of importance. CQ performance is obviously most important to RP success in passing FRS training. While a pilot may fail in either CQ or FCLP, NCLT or lectures are never failed but simply repeated to encourage greater proficiency. Probably 95 percent of all performance related failures during FRS training occur during FCLP and CQ.

TABLE 2. PHASE III LANDING PERFORMANCE TRAINING

	Training Method	Output
1.	Lectures	Landing information and procedures.
2.	Night Carrier Landing Trainer (NCLT)	Practice landings with simulated aircraft and carrier.
3.	Field Carrier Landing Practice (FCLP)	Practice landings with real aircraft, stationary airfield.
4.	Carrier Qualification (CQ)	Actual landings with real aircraft, moving carrier.

TABLE 1. PHASE III GROUND & FLIGHT TRAINING SYLLABUS

GROUND TRAINING SUMMARY		Classroom Hours
FLIGHT SUPPORT PHASE LECTURES - LANDING		
FSCQ-1	Landing Techniques	1.0
FSCQ-2	Day FCLP/Optical Landing Aids	1.5
		2.5 hrs.
CARRIER QUALIFICATION LECTURES		
FSCQ-3	Day FCLP Review	1.0
FSCQ-4	Night FCLP/CCA Procedures	1.5
FSCQ-5	NCLT Brief/LSO CV NATOPS	1.0
FSCQ-6	Shipboard Orientation	1.0
FSCQ-7	Enroute/Recovery Procedures	1.5
FSCQ-8	Day CQ	2.0
FSCQ-9	Night CQ	1.5
FSCQ-10	Review and Exam	1.0
		10.5 hrs.
	TOTAL	13.0 hrs.

FLIGHT TRAINING SUMMARY		Flight Hours
MLP - (Mirror Landing Practice)		
PP-1		1.0
PP-2		1.0
		2.0 hrs.
FCLP - (Field Carrier Landing Practice)		
PP3-6	Day FCLP	4.0
PP7-15	Night FCLP	9.0
		13.0 hrs.
CQ - (Carrier Qualification)		
PQ1-2	Day CQ	4.0
PQ3-4	Night CQ	3.0
		7.0 hrs.
	TOTAL	22.0 hrs.

Lectures. Landing lectures supply the necessary information about aircraft and ship systems related to landing and generally prepare pilot trainees for day and night FCLP, NCLT and eventually CQ. However, since no attrition occurs here there is no indication yet of how well the pilot performs the landing task, merely some feedback (exams, questions, interest, etc.) on pilot intake and understanding of pertinent landing information and procedures.

NCLT. NCLT provides the first opportunity to observe the training behavior of the RP. During the NCLT study a standard NCLT syllabus consisting of 6.5 hours of simulator training was developed by senior LSOs. Table 3 describes the NCLT training schedule. Extensive use is made of the final approach simulation capability of the NCLT. About 85 simulated night carrier approaches are scheduled for each RP on the NCLT (during the NCLT study the average was 80 passes per pilot). The sequence of NCLT training provides for some overlap with FCLP training, usually during the early and middle portions of night FCLP, about one week prior to CQ detachment.

Realistically, the NCLT has many untapped resources and capabilities. Consider, for example, the following description of LSO interface with the NCLT.

"The LSO instructor can monitor trainee final approach and vary the degree of difficulty of each approach by selecting different aircraft, carrier or environmental (sea state, wind, horizon intensity, etc.) characteristics. Fourteen aircraft emergencies can also be programmed during any approach trial. For monitoring purposes the LSO can obtain records from an x-y plotter for altitude and lateral error deviations from desired glideslope and lineup. Display freeze is possible during flight and a replay function allows a review of the last minute of final approach for LSO/pilot debriefing and analysis. Terminal approach conditions (wire number, sink speed, etc.) also can be displayed at trainee and LSO stations and, if desired, a hard-copy of the results can be obtained from the line printer. The trainee can "fly" the aircraft with complete freedom and is provided with realistic aircraft sounds throughout the flight. Carrier arrestment is simulated by stopping the CRT display. In addition, the device has the capability of simulating bolters, touch-and-goes, wave-offs (and ramp strikes) and allows the trainee to reenter the final approach pattern after each missed landing."[1]

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[1] Op cit. Brictson, C.A.

TABLE 3. NCLT STANDARD SYLLABUS SCHEDULE*

Period	Description	Average Ball Control Approaches	Time (hrs)
NCLT-1	1 CCA from marshall to touch and go 3 CCA from 4.2 to touch and go to bolter pattern	4	1.0
NCLT-2	1 CCA from marshall to touch and go 2 CCA from 4.2 to landing to bolter pattern	3	0.5
NCLT-3-6	10 Ball control approaches from 1 to 1.5 to landing Vary weather conditions	40	2.0
NCLT-7-10	4 CCA from 4.2 to landing 4 Ball control approaches from 1 to 1.5 to landing Vary weather and approach conditions	32	2.0
NCLT-11	4 CCA approaches from 4.2 to landing to bolter pattern Vary weather and approach conditions Simulate emergency aircraft conditions	4	0.5
NCLT-12	1 CCA approach from marshall to landing 1 CAT shot into bolter pattern Vary weather and approach conditions Simulate emergency aircraft conditions	2	0.5
	Total	85	6.5

* Note: This syllabus has undergone considerable change since its use in the NCLT study (1976). The trend is toward fewer periods, more Whitehouse (FCLP) passes early in training and fewer overall ball control approaches. The results of these innovations are not yet formalized or documented.

In other words, the NCLT has a training playback capability which can be used to provide knowledge of results to the trainee including carrier landing trend analysis information. Additional performance measurement and scoring techniques are now under development.[2]

These relatively untapped capabilities are emphasized here because it is precisely through these unique monitor, control and input functions that learning "how to land" can be enhanced, promoted and individualized.

FCLP. Field carrier landing practice is the first intensive landing practice for the RP using actual aircraft and carrier landing aids coupled with carrier landing simulated by deck markings painted on a runway. The LSO conducts FCLP much the same as he does CQ, by monitoring and communicating with RPs during each day and night pass about the quality of their final approach and landing, as if it were being made on an aircraft carrier. Preflight briefs are held and debriefs provided on each pass which is recorded in the LSO log book. Usually eight to twelve RPs are scheduled for each FCLP cycle. Normally, 10 passes per period are given to each RP. LSO workload amounts to monitoring and debriefing about 100 night passes for each of nine FCLP periods. Close to 900 passes are monitored, graded, summarized and averaged during night FCLP, usually by two LSOs. Each pass is graded and summed according to a subjective LSO grading scale ranging from 1.0 to 5.0. The grading system is described in Table 4.

TABLE 4. LSO LANDING GRADING SYSTEM

Grade	Value	Description
OK	5	Perfect pass
OK	4	Reasonable deviations with good corrections
(OK)	3	Reasonable deviations
———	2	Below average but safe pass
WO	2	Waveoff
OWO	2	Own Waveoff
Comment	1	Emphasized correction
C	0	Unsafe, gross deviations inside waveoff point

[2] Klein, T.J. and Mattlage, C.E. Pilot performance measurement system for the A7 night carrier landing trainer (NCLT). Vought Corp. Undated, 1976.

To collect, organize, sum and average this massive data bank on landing performance the LSO relies exclusively on manual recording. The administrative sequence goes something like this. Record and grade each day and night FCLP pass in LSO log (1300 passes). Sum grades for each RP for each period. Cut up each FCLP sheet (3 forms per sheet) and compile each RPs FCLP forms separately. Sum day and night FCLP forms to obtain overall grade. Record grade on Carqual Phase Summary Form. Compute number of periods, approaches and landings, grade and class average for day and night FCLP.

FCLP training usually covers from two-three weeks of time, depending on weather and schedules with one firm requirement being that the last FCLP period usually not exceed five days prior to CQ.

CQ. Carrier Qualification (CQ) training culminates the FRS training cycle. Successful completion of CQ is the final performance test for demonstrating the combination of knowledge and skills required for safe arrestment day and night aboard an operational aircraft carrier. The minimum requirements for initial qualification of Category I pilots are two touch-and-go landings, ten day arrested landings, and six night arrested landings. Furthermore, a pilot may not exceed the following operational limits in any 24-hour period:[3]

- 10 arrested landings
- 4 night arrested landings
- 6-1/2 hours in cockpit
- 3 flights

Under special situations the LSO may recommend waivers of the above to twelve arrested landings and six night arrestments.

The same grading system used for FCLP is used by LSOs to evaluate CQ performance. In terms of day/night quals, a minimum of two day landings and one catapult launch must be completed prior to night qualification. The LSO is the final decision maker in whether an RP has satisfactorily completed day landings prior to any night work. An LSO may also recommend additional landings if pilot performance justifies such an action. Time required to complete this training evolution varies from a minimum of two days and nights to as much as one week depending upon number of qualifiers, ship schedule, weather and other operating conditions.

[3] NATOPS Manual: Landing Signal Officer. Dept. of the Navy, 15 Nov. 1975.

CQ Recycle Training. A typical Category I replacement pilot requires 101.6 A7 flight hours to complete the FRS training cycle successfully. This compares closely to the standard number of flight hours proposed in the A7 flight training syllabus (101.3). In the NCLT transfer of training study we found that 8 out of 27 pilots were disqualified during Phase III training and recycled through FCLP/CQ. The recycle process added 19 percent more flight time to the syllabus, increasing it to an average of 120.1 hours. About half of the increase was in night flight time which averaged 38.3 hours compared to 28.7 hours for successful RPs.

Besides the considerable increase in flight time, each recycled RP was delayed in reporting to a fleet assignment by an average of 12 weeks. This delay was caused by necessity. Recycled RPs must wait for the next training class to repeat their FCLP/CQ periods and these periods are scheduled as a function of carrier availability. Once a pilot is disqualified during either FCLP or CQ he is usually required to drop back one class to repeat four hours of day FCLP, nine hours of night FCLP and seven hours of day and night CQ. These 20 hours of landing practice are shown in Table 5 and represent the 19 percent increase in flight time for recycled pilots.

TABLE 5. NUMBER OF PRACTICE LANDINGS AND FLIGHT HOURS BY TRAINING PHASE

CQ Training Phase	Landings	Flight Hours
Day FCLP	40	4
Night FCLP	90	9
Day CQ	10	4
Night CQ	6	3
Totals	146	20

When a pilot is recycled he participates in additional training that results in as many as 130 more FCLP landings in order to pass successfully to the CQ phase. At present, there is little or no individualized training as far as number of FCLPs that must be accomplished prior to CQ. All pilots repeat the entire FCLP in most cases.

To understand the current carrier landing training for A7 pilots it is first necessary to grasp three dominant factors.

- Recycle rate
- Recycle decision
- Recycle results

First of all, although recycle rate tends to fluctuate, the generally accepted average recycle for A7 Category I RPs (1976) is about 26 percent. One in four drop back one class. Usually the dropbacks are recycled for another CQ syllabus. In our NCLT transfer of training study the recycle rate for RPs without NCLT training was 30 percent and 4 percent for RPs who were given the standard 80 ball control passes in the NCLT prior to CQ.

A second factor in FRS training is that almost all recycle occurs in Phase III Training. Very seldom is an RP disqualified during Phase I or Phase II Training. Thus, the LSO becomes the primary decision maker about recycle. He decides how the RP performs in FCLP, whether or not to take him for ship CQ trials, and whether he passes day and night CQ.

All recycle training in the NCLT study was identified either during night FCLP or shipboard CQ. Out of eight recycles, three failed night FCLP and four failed night CQ. The lone recycle from the trainer group failed during day CQ. The disqualified RPs were further broken down by flight experience. All eight were found to be direct from the Training Command (Nuggets) with an average jet flight experience of about 330 hours. Table 6 summarizes the data.

TABLE 6. A7E NCLT STUDY DISQUALIFICATION SUMMARY

Recycle Summary	NCLT (1)	No-NCLT (7)
Training Command	1	7
Recycle percent	8% (1/13)	44% (7/16)
Source:		
Day FCLP	0	0
Day CQ	1	0
Night FCLP	0	3
Night CQ	0	4

The third factor that predominates in FRS training is that most of the recycled pilots pass CQ on their second trial. Apparently, given the additional flight time and landing experience the recycled RP can successfully complete Phase III training and qualify day and night aboard ship. Although recycling RPs is costly and time consuming it appears to be effective if passing CQ is the criterion. The ultimate criterion, however, is how well pilots land during their fleet assignments and deployments. The relationship between CQ performance and fleet performance has not yet been subjected to study but would be useful to obtain training validation and effectiveness data for the FRS program.

SECTION III

NIGHT FCLP PERFORMANCE ANALYSIS

As we have indicated, each FCLP practice landing is graded by an LSO and the grades for each FCLP period are summarized to provide an LSO qualitative index of FCLP performance. Class averages are then computed for day and night FCLP. Considering the average number of FCLP periods per class a large amount of training data is collected. With a normal class size of twelve RPs and each pilot receiving 40 day and 100 night FCLPs there are about 1680 practice landings per class. That total represents a data base that was useful for providing information on the relative progress of each RP as he proceeded through Phase III training. For example, were there any differences in FCLP scores for recycle pilots as opposed to successful pilots? What differences and variability existed among the classes and between the pilot trainees? Finally, could the differences be used to identify potential recycle pilots based on FCLP performance progress as reflected by LSO grades?

To determine how potential recycle pilots can be identified prior to recycle a look was taken at how these low performers do in comparison with their successful RP peers. Again, using data from the NCLT study it was possible to survey and summarize the FCLP performance of 53 Category I replacement pilots. These data consisted of day and night final approaches across successive FCLP periods during the last two weeks of training and just prior to CQ. Because recycles occurred only during night FCLP or CQ only night data were considered meaningful for analysis. Those data in cumulative array represented over 5,000 night field carrier landings.

NCLT vs No-NCLT. Figures 1 through 4 depict those 5,000 landings. Figure 1 illustrates the successive differences in average FCLP grades for pilots who received NCLT training and those who did not. For diagnostic reasons, the most significant differences occur starting at period number 5. Here, for the first time, a difference between the two groups emerges. This relative performance difference, as recorded by LSO grades, was consistently higher for NCLT pilots from period 5 through period 8. To appreciate the differences in performance, recall that each data point is the average for 26 RPs, each of whom had about 10 approaches per period. That translates, roughly, into an average of 260 approaches per FCLP period for both groups.

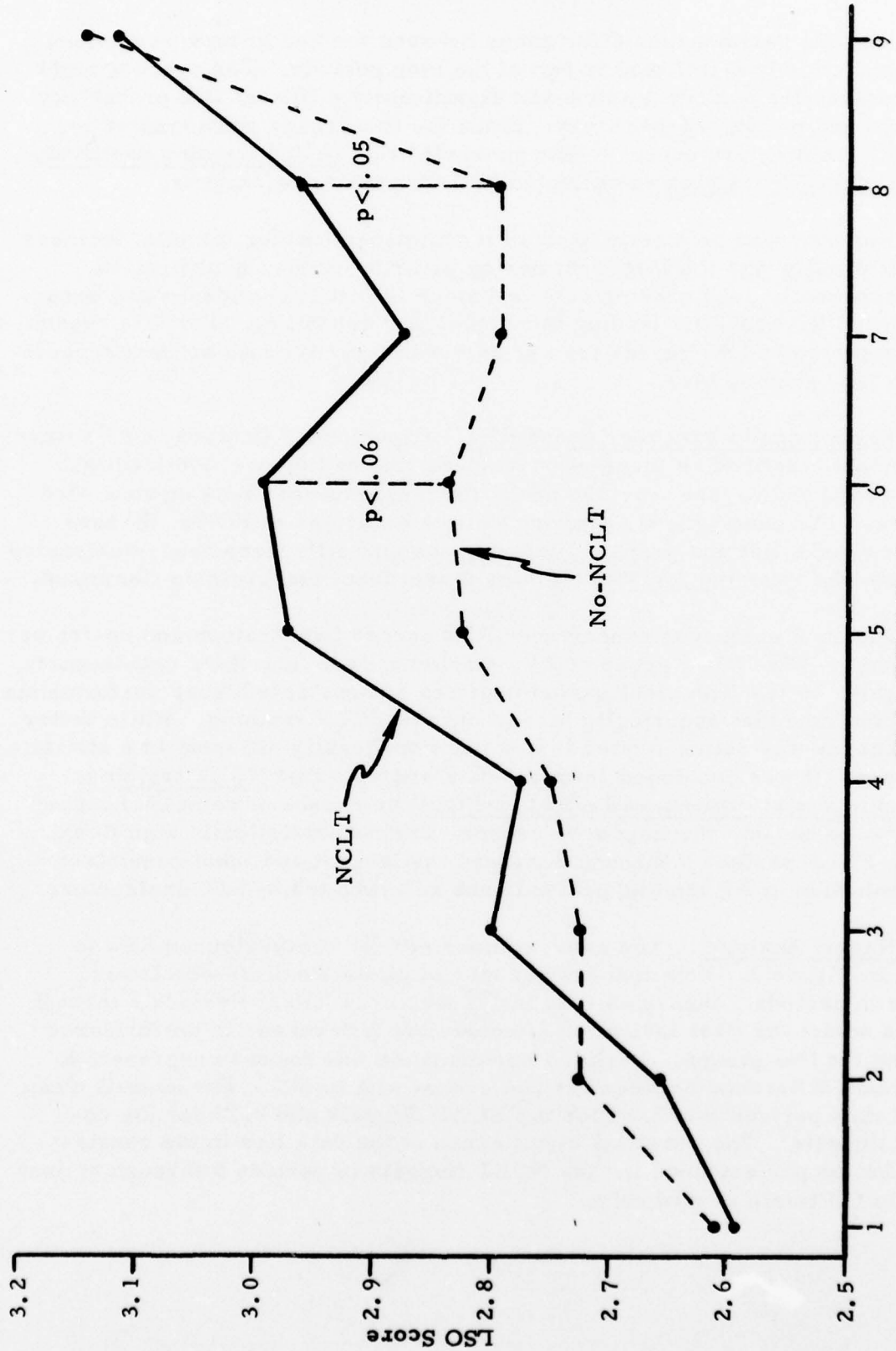

Figure 1. Comparison of NCLT vs No-NCLT groups across successive night FCLP periods.

Landing performance differences between the two groups were found to be statistically significant in two of the nine periods. The average night performance for periods 6 and 8 was significantly different at a probability of $p<.06$ and $p<.05$, respectively. Since the two groups were treated to different training protocols, it was concluded that NCLT training positively improved FCLP training as reflected by LSO grading techniques.

Period 9 was primarily used as a confidence builder for pilot trainees since it usually was the last night period prior to carrier qualification. LSOs apparently used grading as a technique to instill confidence and assurance in the RP about his landing techniques and capability. For this reason the sharp rise in LSO grades for period 9 was treated as an artifact accountable to LSO grading bias.

Experienced vs Inexperienced RPs. Experienced Category I RPs were operationally defined as those pilot trainees who had over 1,100 jet flight hours compared to just over 300 hours for inexperienced RPs or so-called Nuggets. The experienced Category I pilots consisted of POWs, Stashes and Plowbacks (jet and prop). The inexperienced RPs were newly designated aviators who reported for FRS training direct from the Training Command.

Figure 2 compares experienced RPs across both trainer and no-trainer categories. The NCLT group of RPs started slower than their counterparts, but, again, by the fifth night period began to demonstrate higher performance and maintained that superiority throughout the FCLP training. While better performance was demonstrated it was not significantly different in a statistical sense. It was concluded from the data analysis that NCLT training seemed to assist experienced pilots in FCLP by reason of somewhat higher LSO grades but that the improved scores were not statistically significant. Again, FCLP periods 5 through 8 showed the largest and most consistant differentiation in RP landing performance as evaluated by LSO instructors.

Nugget Analysis. The same comparison for inexperienced RPs is shown in Figure 3. Note that both groups of pilots start off with lower scores in periods 1 through 4 than the experienced RPs. Periods 5 through 8 again depict the first indication of consistent differences in performance between the two groups. Period 6 performance was found to represent a significant difference between the two groups at a $p<.05$. The overall mean for all nine periods was 2.84 for the NCLT Nuggets and 2.73 for the no-NCLT Nuggets. The practical significance of the data lies in the consistently better performance for the NCLT Nuggets in periods 5 through 8, just prior to CQ trials aboard ship.

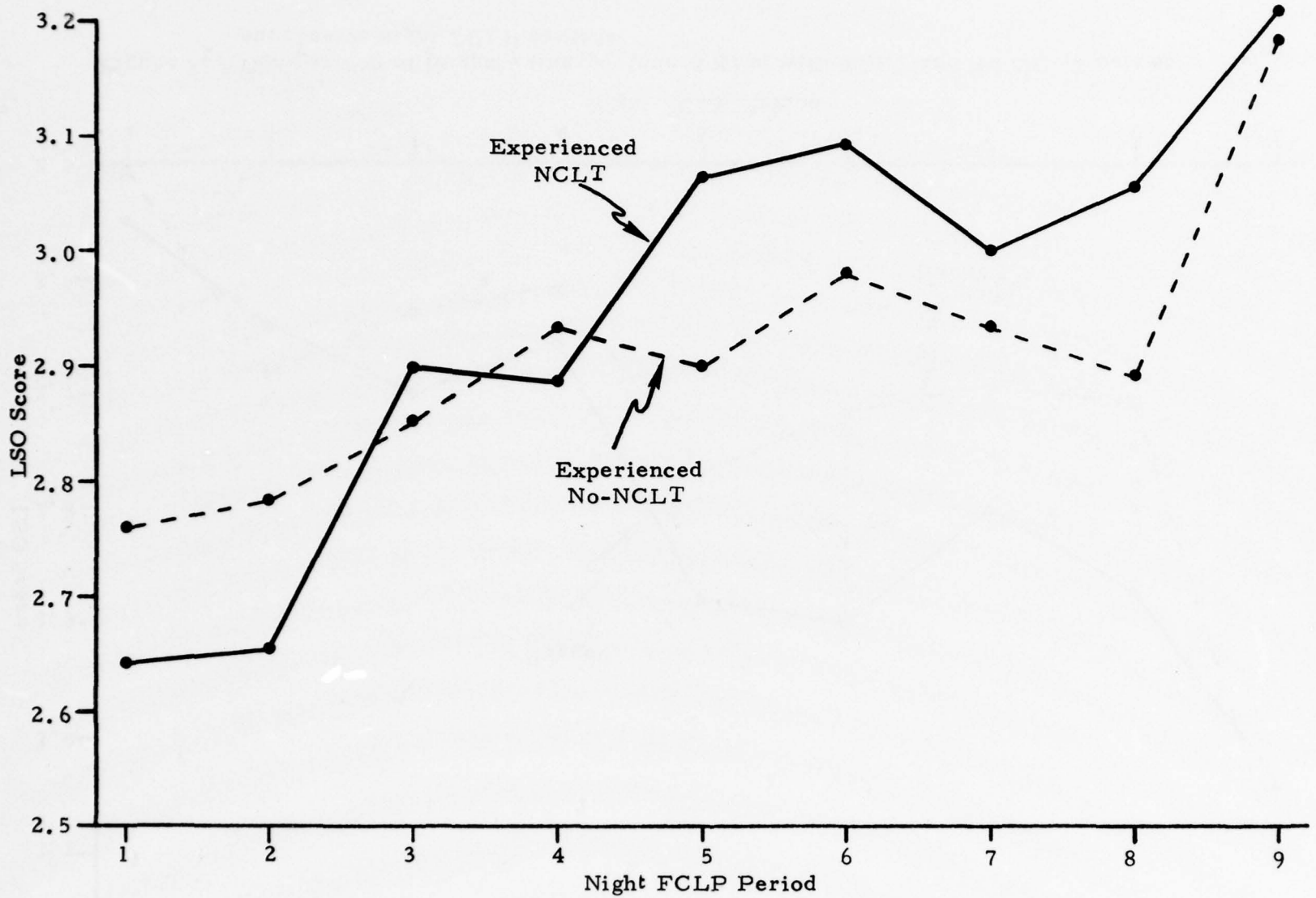

Figure 2. Comparison of Category I experienced RPs with and without NCLT training across successive periods of night FCLP periods.

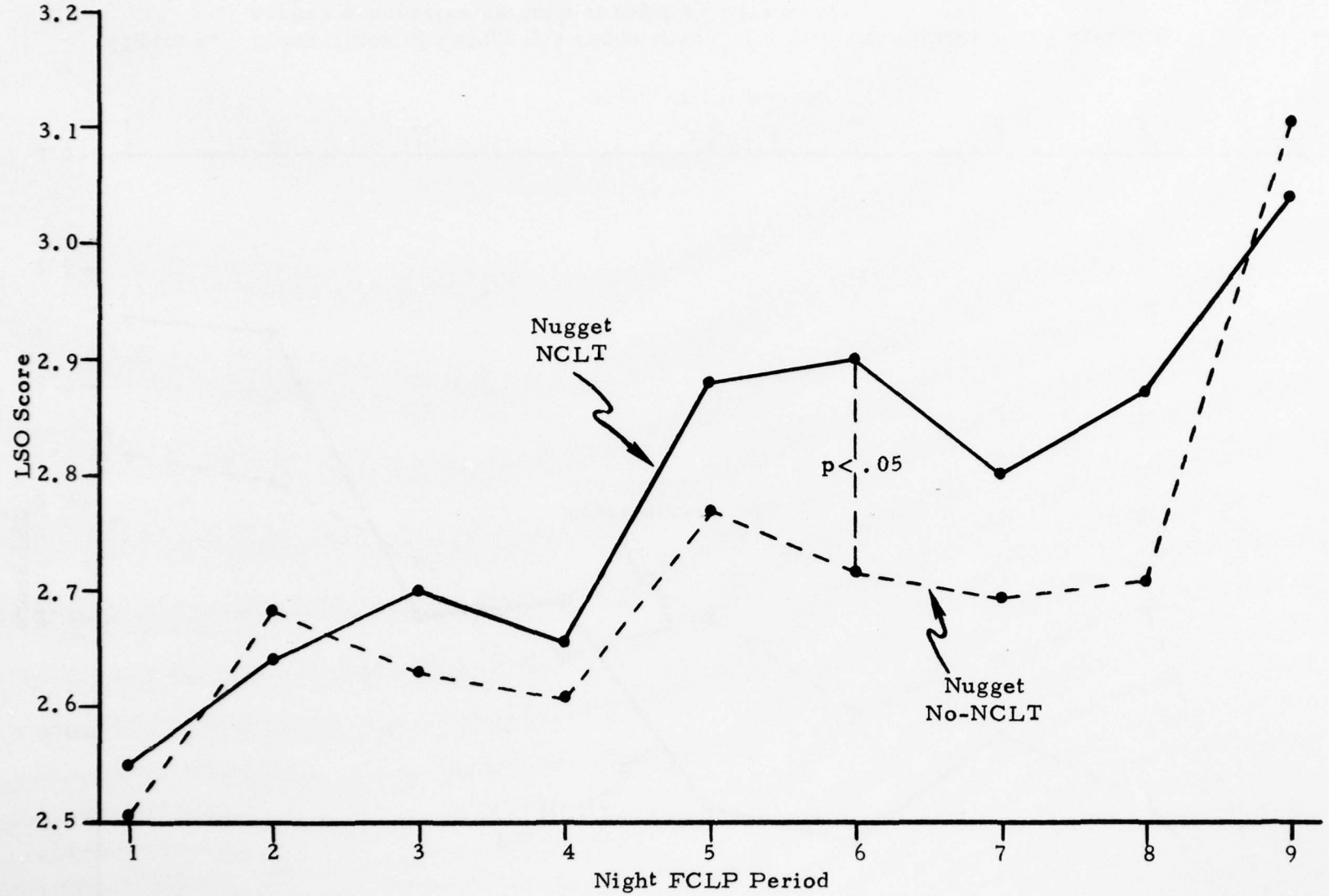

Figure 3. Comparison of Nuggets (inexperienced RPs) with NCLT and No-NCLT across successive night FCLP periods.

Successful vs Recycle Nuggets. The last of four figures which illustrates LSO performance evaluation of RP FCLP training progress describes the successive night field landing performance for sixteen inexperienced RPs direct from the Training Command. Figure 4 shows, for the first time, how performance during FCLP differs for successful versus recycle RPs. In other words, the figure compares the performance of low performers (recycle) with RPs who passed CQ on their first attempt (successful). None of these RPs had NCLT ball training which is now required. The trend is markedly different in this comparison. Successful RPs, on the average, scored consistently higher than unsuccessful RPs from the onset of night FCLP through period 8. The overall average for periods 1 through 8 was 2.78 for successful and 2.5 for recycle RPs.

With the exception of period 5, FCLP performance for recycle RPs was quite stable at about 2.5 for periods 2 through 8. Successful RPs improved their performance at period 5 and continued the same level of performance through period 8. The recycle RPs, as a group, also improved their performance at period 5 but then immediately regressed at period 6 and continued the low performance through period 8. The average FCLP performance for periods 5 through 8 was:

Successful RPs -- 2.82
Unsuccessful RPs -- 2.55

Recycle FCLP Performance. A graphic example of night FCLP performance for three recycle pilots is shown in Figure 5. Their individual performances are compared to the mean night FCLP performance for two groups of successful and recycle Category I RPs. Perhaps the most consistent portrayal of their performance is that of erratic and inconsistent grades across the first six periods. Recall that the score for each period represents the average of 10 FCLP landings. Only four scores for recycle pilots are above the mean for successful RPs for the first eight FCLP periods. The most erratic performance is found in pilot number 3 who was disqualified at FCLP and never taken to the ship. His grades are never above the mean and his sawtooth performance signifies extreme instability in the acquisition of FCLP landing skill. The other two disquals are also erratic but tend to stabilize and show a slight positive learning gradient starting at period 5.

Each recycle pilot was able to score above 2.6 in night FCLP only once in the first five periods. This is a remarkable difference from successful RPs who show one, or at most two grades below 2.6 in the

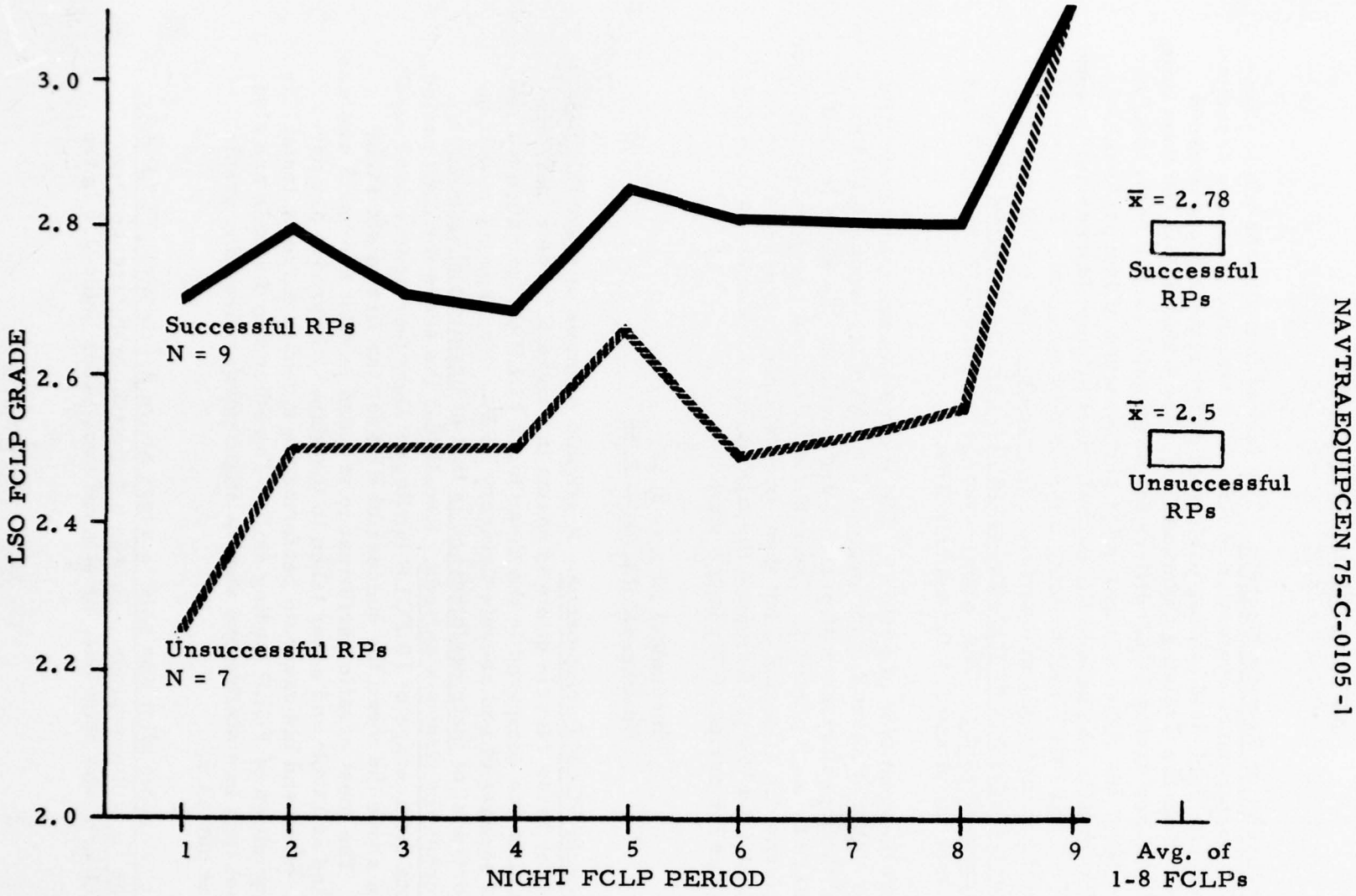

Figure 4. Comparison of Night FCLP (LSO Grades) for Successful and Unsuccessful RPs from the Training Command (Nuggets).

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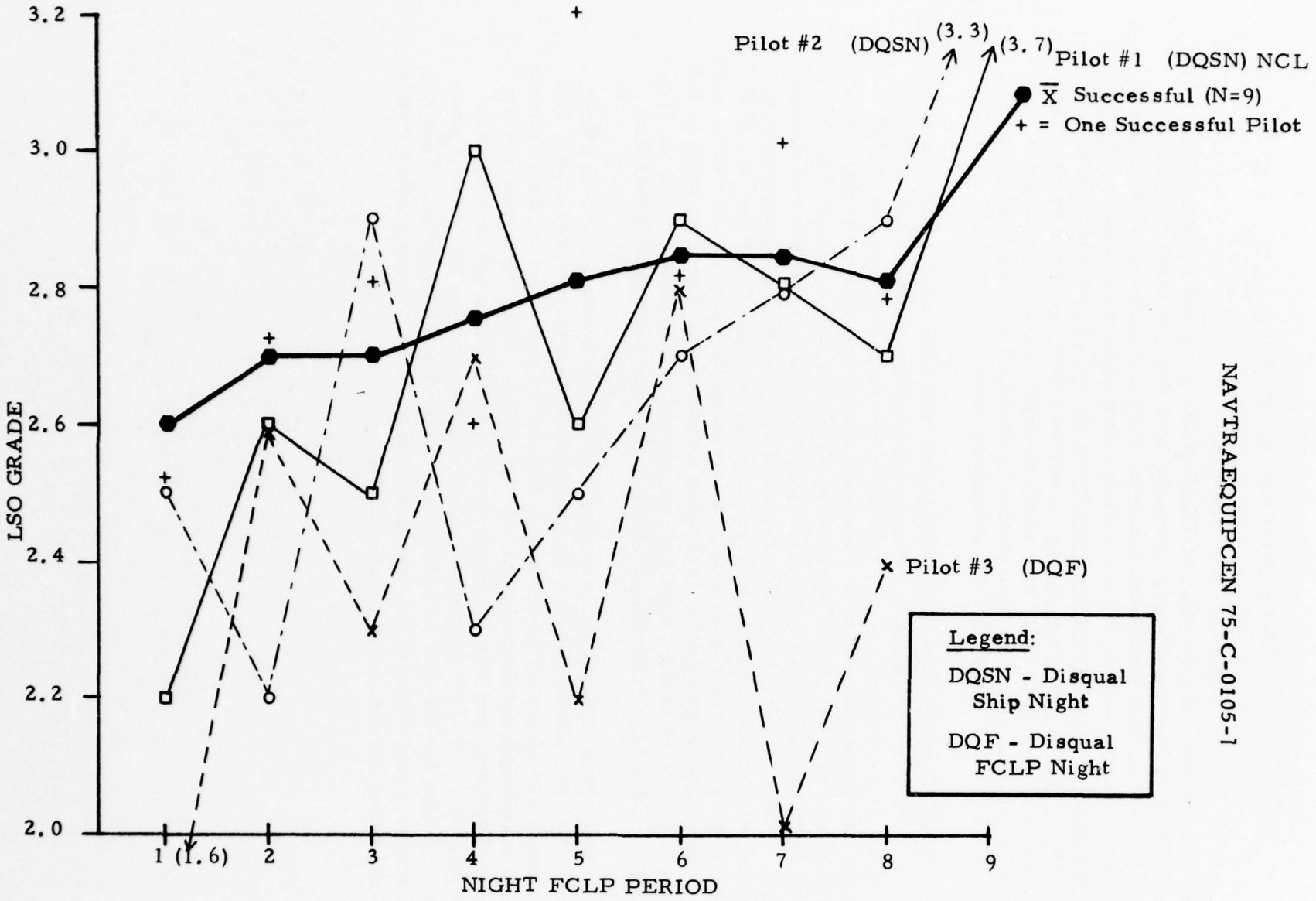

Figure 5. Comparison of three disqualified RP grades for night FCLP with mean performance for successful pilots (Nuggets).

first five periods. By the time of FCLP pilots have had a considerable number of A7E hours and many landings, both day and night. Although these are not carrier simulated landings, they do represent experience in controlling and landing the aircraft in a day/night environment. Erratic landing performance during the first five night NCLT periods is seen to be a characteristic of 'recycle' pilots. Recycle pilots are more variable than successful pilots, especially on a night-to-night basis. For contrast, a single successful pilot has been plotted in Figure 5 to graphically show the reduced individual variability for successful pilots.

FCLP Cutoff Scores. In an effort to determine what FCLP score to use as a criterion or cutoff in determining whether or not an RP would be identified as a potential recycle candidate an analysis of recycle FCLP grades was conducted. Figure 6 shows the results of the analysis. The graph shows the percentage of actual grades at or below each of four FCLP grade levels for all FCLP periods (1 through 9) for successful and recycle pilots. For example, using a criterion of 2.8 shows that 85 percent of all recycle pilot grades were at or below 2.8 across nine FCLP periods while 57 percent of successful pilots were at or below that grade. As can be seen, the percentage progressively decreases as the scores decrease until at 2.5 sixty-four percent of the recycle pilots scored at or below 2.5 for all FCLP periods. Only 17 percent of the successful pilots were graded that low.

The graph is based on an analysis of 1270 individual FCLP landings across 16 RPs, seven of whom recycled while nine were successful. The particular use of any of the scores as a cutoff is dependent on the efficiency of any cutoff score in identifying a recycle pilot. Since LSO grading may tend to fluctuate, any use of cutting scores should be based on a current analysis of FCLP-LSO grading trends much the same as the running averages are kept for the last 50 RPs across all FRS training areas. That way the scores would be more representative of the most recent grading trends and averages for the latest group of RPs.

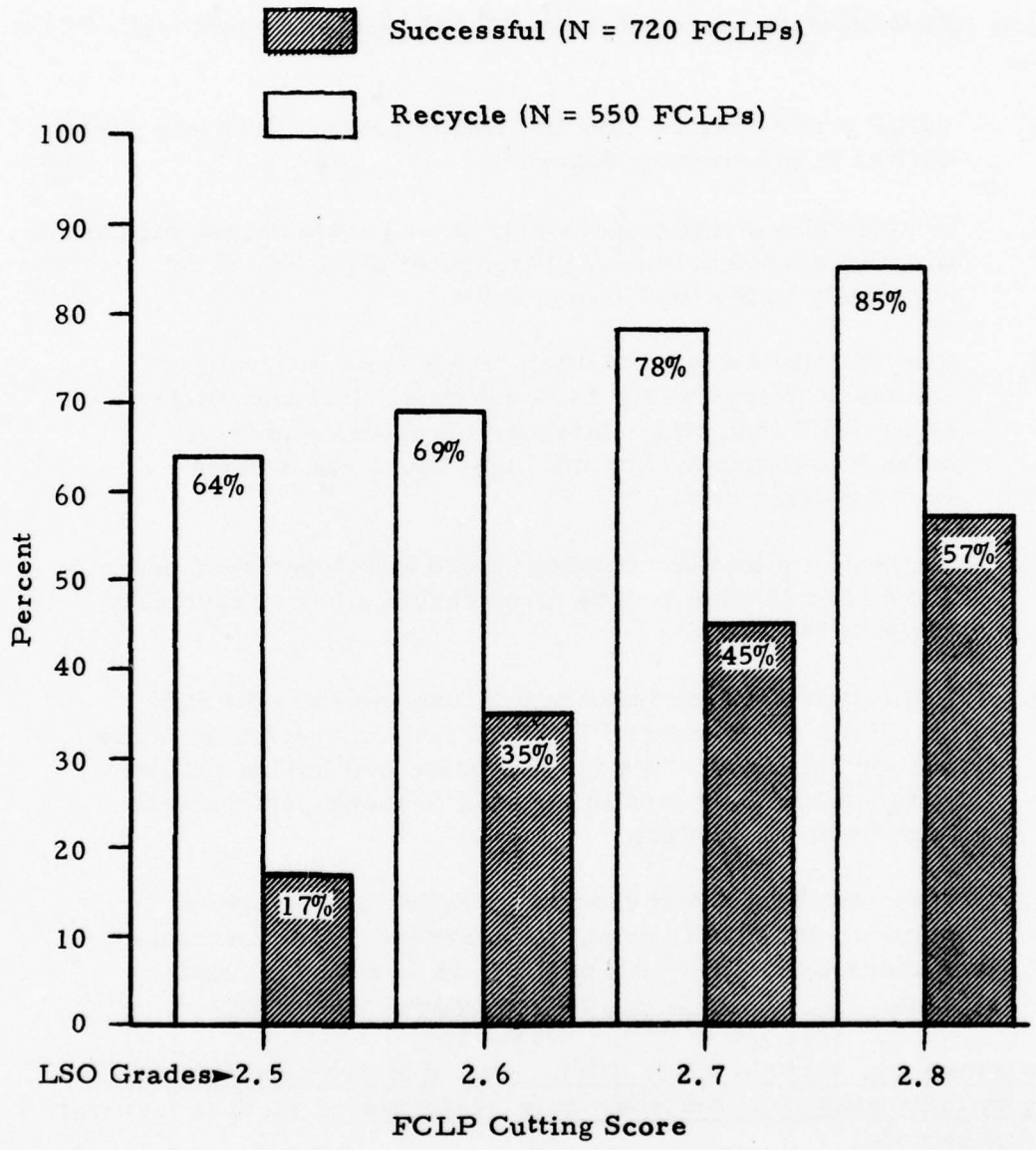

Figure 6. Percent of Night FCLP Scores at or Below Three Cutting Scores for Recycle and Successful Novice Pilots.

FCLP Summary

The following statements summarize what is known about night FCLP training.

1. FCLP grades can be used to identify potential recycle pilots earlier in the training sequence.

2. Recycle pilots tend to have erratic and unstable performance (usually graded below 2.6) throughout night FCLP but especially in the first five periods.

3. Recycle pilots are most often direct from the training command (Nuggets) and have substantially fewer flight hours (330) than other Category I trainees who have three to five times as many flight hours and a much lower recycle rate.

4. Successful pilots demonstrate more stable performance and higher landing scores than recycle pilots, especially early in FCLP.

5. FCLP performance tends to improve mid-way through FCLP for all Category I RPs and remains generally above 2.8 for successful RPs for the entire last half of FCLP. Unsuccessful RPs tend to regress to lower performance in periods six to eight.

6. A substantial amount of administrative paperwork is required of LSOs to compile the necessary performance records for FCLP. All of the work is manually performed.

In summary, recycle pilots can be identified early in night FCLP training by their consistent below average performance (2.6) in the first five FCLP periods.

Two training questions addressed in this report are: 1) early identification of potential recycle candidates, and 2) disclosure of their specific landing deficiencies. As for the first question, FCLP training, as described here, presents the first intensive opportunity to identify low performing RPs who may be candidates for recycle. In terms of the second question, FCLP performance, as described by LSO log entries, provides an efficient and realistic way to determine the specific landing problems associated with each RP.

SECTION IV

FCLP DIAGNOSTIC TRAINING FEEDBACK

The data just reviewed represents a performance analysis which was useful in isolating night FCLP periods which tend to reflect below average performance by recycle pilots. Specific individual landing deficiencies, however, are difficult to identify with summary statistics or grades. Therefore, LSO comments on each landing as recorded on FCLP grade forms were used to obtain diagnostic training information.

FCLP Grade Form. An example of a FCLP grade form is shown in Figure 7. This form is a raw data sheet. The LSO logs and grades each pass and then averages them into a composite score for each FCLP period. To a seasoned LSO the raw data sheet is a shorthand record of FCLP performance which he can integrate into a comprehensive analysis of landing problems specific to each replacement pilot trainee. While the LSO can accomplish this task by mentally reviewing the shorthand symbols and compiling a succinct summary statement, an actual written summary of landing deficiencies for each RP, for every FCLP period, is not provided.

Take the form shown in Figure 7 for example. What are the landing deficiencies for this pilot trainee? What diagnostic training feedback could be given to him on his overall landing technique? What are his strengths? What are his weaknesses? What should he work on to improve his technique? What should be stressed in his next NCLT training? Except to a seasoned LSO those questions cannot be answered from the FCLP landing form. The raw data, however, are amenable to diagnostic interpretation and a summary statement of each FCLP grade form can be provided by the LSO staff.

A diagnostic FCLP summary statement of landing deficiencies would be useful for several reasons. For instance, any interested party, including LSOs and RPs, could get quick feedback on landing capabilities and problems without first translating and interpreting the shorthand. Second, a diagnostic feedback summary could serve as a reference for progress in FCLP and be compared with each succeeding FCLP summary to determine RP progress in improving his landing technique. Third, and most important, a diagnostic summary could be used as a basis for NCLT remedial training to correct any deficiencies noted by LSOs during FCLP. This would be especially useful in early remedial training for low performers who are prime candidates for recycle training.

FCLP Grade Form

FCLP

LOW MAN 424
Name A/C

Date: 8/4 D (N) HOP #5

1. (OK) HAW CDTL	3
2. (OK) NEPSIC (LOAR)	6
3. ~~B~~ NERDIG OC TMRDIC ~~X~~	8
4. — HAW EGTL	10
5. ~~B~~ OC SRD FIM NEPIC ~~X~~ AR	12
6. (OK) NEPIC CDAR	15
7. (OK) COX HFIM NEPCDL	18
8. WOFD (OK) NEPSIG	21
9. — HX TMRDIG OC SIC	23
10. (OK) DECIM TMRDIC	26
11.	
12.	

Comments: Avg (2.6)

LSO: Sx

Figure 7. Example of FCLP grade form and entries for ten night passes.

Carrier Landing Trend Analysis. Fortunately, there is a standardized fleet-wide OPNAV form that can be used for the purpose of presenting FCLP diagnostic feedback. It is called the Carrier Landing Trend Analysis Form and is shown in Figure 8. The form is used primarily by LSOs of deployed units to record pilot landing performance over time. The purpose of the trend analysis record is to provide a running account of pilot performance for review and to notify pilots of any dangerous trends. It can be used for identical reasons for FCLP performance.

Basically, the form would be used to summarize RP FCLP performance. It would provide a landing performance record for each FCLP period. The form has been revised slightly for this purpose. The recording of wires, obviously, is not needed for FCLP since all landings are touch and go on the field, so that was deleted in the example. The OPNAV form could be used as is, however, without any detraction from its purpose of providing feedback for LSO and RP review and to notify both parties of and landing technique deficiencies or dangerous trends.

The form has been validated through fleet use and is familiar to and accepted by most LSOs. The content of the form is essential to its purpose. Namely, the columns are categorized by the prevalent landing technique factors that are considered necessary for successful touchdown. For our purposes, the form provides an off-the-shelf technique to classify landing deficiencies. The categories provide the basic information needed to produce a diagnostic error analysis for each final approach and landing. The categories are:

- Glideslope Errors
- Speed Errors
- Power Control Errors
- Attitude Errors
- Lineup and Wings
- Remarks (special comments)

The abbreviations under Glideslope and Speed Errors are short for various stages of approach. They are:

Symbol	Meaning
AW	All the way
OT	Out of turn
X	Start
IM	In middle
IC	In close
AR	At ramp

CARRIER LANDING TREND ANALYSIS

PILOT _____ YEAR _____

ACFT _____ SQUADRON _____ SHIP _____ FCLP _____

DATE	D N	GR	GLIDESLOPE & SPEED ERRORS						CONTROL ERRORS		LINEUP & WINGS	REMARKS - include use of APC and ACLS
			AW	OT	X	IM	IC	AR	POWER	ATT.		
	D N											
	D N											
	D N											
	D N											
	D N											
	D N											
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Figure 8. Example of Carrier Landing Trend Analysis form.

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These information categories form the basis for specific diagnostic training feedback for different parts of the approach to the RP and LSO. The completed form is shown in Figure 9 for the same night FCLP data that was described in the FCLP grade form (Figure 7). As illustrated, the LSO comments are rearranged into specific carrier landing technique categories and make interpretation of the FCLP data easier for all interested parties. In the example, the RP shows the largest number of Glideslope and Speed Error comments in the final stages of approach (in the middle, in close and at the ramp). It also shows a number of power control errors, mostly in close. No errors were recorded for attitude or lineup.

In a diagnostic sense, the information described in the Trend Analysis Form indicates that the RP does not control his power adequately. He tends to start high and take off power, but does not put the power back on again soon enough to stop from going through the glideslope which catches up with him in close. He either ends up underpowered, which accounts for the NEP (not enough power) and CD (come down) comments, or flat which accounts for his bolters. This RP would benefit from power management training to improve his glideslope control. He needs training in how to anticipate power corrections while flying the glideslope.

FCLP LANDING TREND ANALYSIS

PILOT LOW MAN YEAR 76

ACFT A7E SQUADRON FRS SHIP FCLP FCLP X

DATE	D	N	GR	GLIDESLOPE & SPEED ERRORS AW	OT	X	IM	IC	AR	CONTROL ERRORS POWER	ATT.	LINEUP & WINGS	REMARKS - include use of APC and ACLS
8/4	D	(N)	(OK)	H					CD				
	D	(N)	(OK)					S	(LO)	NEPIC			
	D	(N)	B				NERD	OCTMRD	X				
	D	(N)	—	H						EGTL			
	D	(N)	B				OC SRDF		X	NEPIC			
	D	(N)	(OK)						CD	NEPIC			
	D	(N)	(OK)			C	HF			NEPIC			
	D	(N)	(OK) WOFD				S			NEPIC			
	D	(N)	—			H	TMRD	OC S					
	D	(N)	(OK)				DEC	TMRD					
	D	N											
	D	N	2.6										
	D	N											

ACTION:

POWER MANAGEMENT TRAINING IN NCLT TO IMPROVE GLIDESLOPE CONTROL. INSTRUCT IN HOW TO ANTICIPATE POWER CORRECTIONS WITH NARROWING FRESNEL GLIDESLOPE ENVELOPE.

SIGNED: LSO

Figure 9. Example of FCLP Landing Trend Analysis form and entries for ten night passes.

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SECTION V

NCLT REMEDIAL TRAINING

The analysis of FCLP performance data provides the basis to identify potential recycle pilots and the specific landing problems that lead to their recycle training. The next step in the proposed training concept is to determine whether landing problems specific to recycle pilots can be corrected by any means besides additional recycle training.

The technique proposed is that of NCLT remedial training. Since the NCLT is a trainer with vast training capabilities in the area of night landing it was considered an appropriate vehicle to provide individualized remedial training to potential recycle pilots. Because NCLT training is usually interspersed with FCLP it could be used to provide immediate and specific training to correct landing technique deficiencies that were noted in the FCLP Landing Trend Analysis Form.

At present, the specific use of the NCLT to provide the remedial training is best left up to an experienced LSO who is qualified to provide NCLT training. The training could be provided in several ways. First, it might be given only to Nuggets, relatively inexperienced RPs direct from the training command. Second, it might be given to RPs anytime they score below a given criterion (FCLP score) for any chosen FCLP period. Third, it could be given to all Category I RPs routinely as part of individualizing the NCLT syllabus. Fourth, it could be programmed for any RP who has a certain number of FCLP periods below a selected score. For example, anytime an RP reached three grades below a cutoff score (say 2.6) he would be programmed to receive NCLT remedial training based on FCLP diagnostic feedback. Finally, the remedial training could be used in reverse fashion by reducing the FCLP/NCLTs for high performers (much like Category II training now) and using that time to provide extra training to potential recycle pilots. In this instance, an FCLP criterion score at the high end could be set to identify acceptable and required FCLP performance. For any of the above implimentations the LSO would remain the final authority on RP landing readiness.

Proposed Training Sequence. A block diagram sequence of how the FCLP diagnostic training feedback and NCLT remedial training would be incorporated into the present FRS instruction is shown in Figure 10. Training time remains the same depending upon which of the alternatives for Category I training are followed.

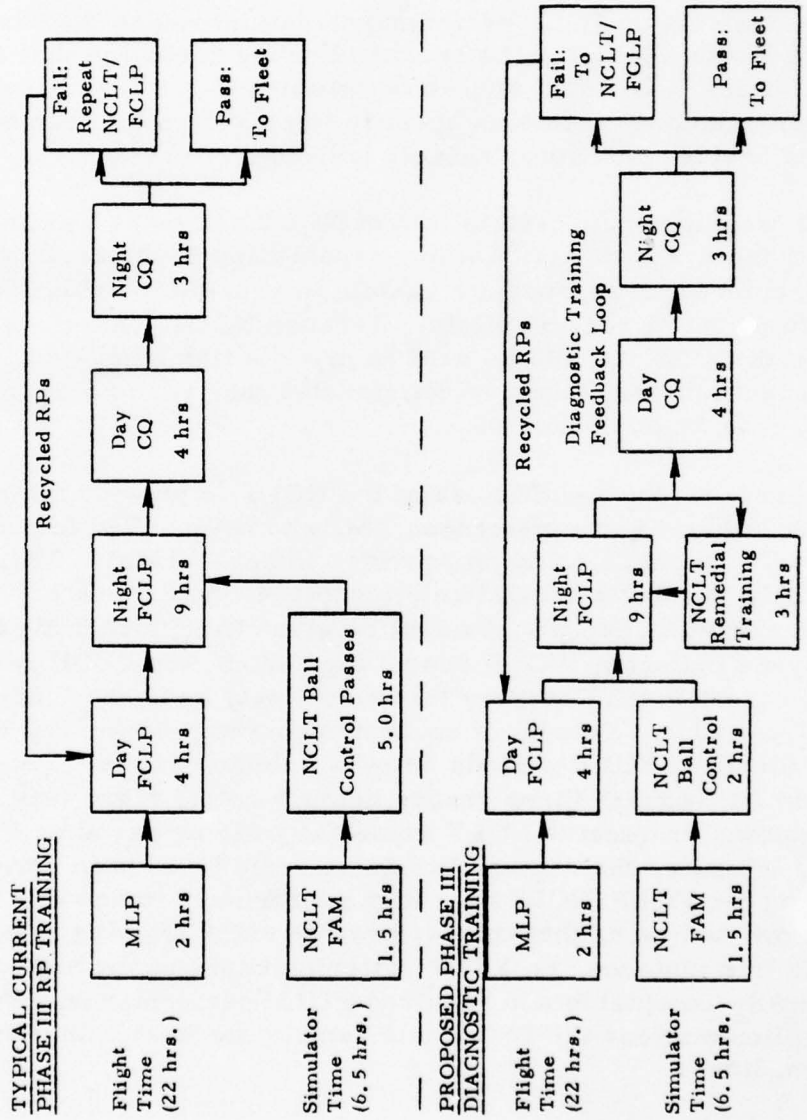

Figure 10. Current and Proposed FRS Carrier Landing Training.

Eventually it may be possible to identify a number of landing deficiencies that are common to most Category I pilots due to the specific landing profile, maneuverability and control characteristics of the A7E aircraft. There are already some indications that that is the case. If so, a complete revision of the NCLT syllabus to emphasize those problem areas might have a direct operational payoff of lower recycle rates and better landing performance.

SECTION VI

FIELD APPLICATION AND TEST

A field test of the FCLP diagnostic technique and NCLT remedial training was undertaken to judge and evaluate the potential of these two training concepts. With the cooperation of VA-174 personnel the training concepts were applied and tested for one class of Category I pilots during mid 1977.

Four research questions required answers to substantiate and support the proposed training changes. They were:

1. Can potential recycle pilots be identified early?
2. Can specific landing problems that lead to recycle training be identified?
3. Are landing problems correctable without recycle?
4. Does CQ performance improve?

Method

Sample. The small sample chosen to test the feasibility of the approach and provide preliminary answers to the questions consisted of one class of six Category I RPs and five Category II pilots who were used as partial controls. Of the six Category Is, four were direct from the training command (Nuggets), one was a jet instructor pilot (plowback), and one was previously assigned to a billet with variable flying time (stash) prior to FRS training. The sample composition closely resembled training classes from the NCLT study and was found to be representative of a typical FRS training class. The four inexperienced (Nugget) pilots averaged 354 jet flight hours and the two experienced pilots (plowback and stash) averaged 1,703 hours in various jet aircraft.

Performance Measures. The criterion selected to identify potential recycle candidates in this study was a LSO grade of 2.6 or below for any three of the first five night FCLP periods. This criterion was chosen in conjunction with senior LSOs to minimize false negatives and was based on an analysis of previous recycle pilot trainee performance. In addition, it was decided to give the NCLT remedial training to all Category I RPs

regardless of flight hours for the duration of training. In other words, each FCLP period was used to provide diagnostic feedback and remedial NCLT training for each Category I trainee.

Three performance measures were used to evaluate the influence of the training techniques on performance effectiveness. The primary measure was the Landing Performance Score (LPS), an objective method used to evaluate carrier landings.[4] The LPS was calculated for all day and night CQ performance. A second quantitative measure was day and night boarding rate. LSO qualitative scores for FCLP and CQ performance was the third measure used in the evaluation.

Schedule of Training. NCLT training was interspersed with FCLP training during preparation for CQ trials. NCLT training began about three weeks prior to ship CQ and one week before FCLP workups. The exact integration of the NCLT/FCLP training is shown in Table 7. The key periods were weeks two and three when NCLT sessions followed FCLP night training in order to provide individualized training feedback.

The amount of landing practice by each training category is shown in Table 8. NCLT landings were 30 percent less than the standard syllabus in this class due to NCLT trainer malfunctions. In fact, some of the NCLT approaches were flown without aircraft motion due to a trainer malfunction. FCLP practice and CQ landings were quite close to the curriculum requirements. FCLP landings were about 10 percent less than the curriculum requirement while CQ trials were very close to the required number.

TABLE 8. AVERAGE NUMBER OF LANDINGS DURING TRAINING

	Actual		Curriculum
Training	Day	Night	Required
NCLT	--	56	80
FCLP	36.7	83	40 & 90
CQ	10.1	7.2	10 & 6

[4] Brictson, C.A. Validation and Application of a Carrier Landing Performance Score: The LPS. Dunlap and Associates, Inc. March, 1973. See the Appendix for further discussion of LPS.

TABLE 7. SCHEDULE OF NCLT AND FCLP TRAINING FOR SIX CATEGORY I RPs

Week 1	M	T	W	T	F	S
NCLT	-	-	1	-	-	-
FCLP	-	-	-	-	-	

Week 2		Remedial Training				
NCLT	-	2	3	4	-	
FCLP	1D/1N	-	2N	-	2D/3N	-

Week 3	Remedial Training					
NCLT	5	-	6	7	-	
FCLP	4N	5N	6N	7N	3D/8N	9N

Week 4		
NCLT	8	-
FCLP	4D/10N	-
Ship CQ	USS Saratoga	

Note: D = Day, N = Night, 1 = 1st training period,
e.g. 3D = 3rd Day FCLP period.

Procedure. Normal syllabus-related Phase III instruction was followed throughout the class training with the addition of individualized diagnostic feedback and remedial NCLT for each night FCLP period by the LSOs. These summaries were developed from the raw FCLP Data Forms and used to identify specific landing problems for each RP during every FCLP period. In addition, for each diagnostic summary, LSOs prescribed a remedial action designed to use the NCLT capabilities to correct or provide training in the specific problem areas. Remedial NCLT training periods followed most night FCLP sessions (usually the same day) in order to provide the individualized training. Thus, a written diagnostic FCLP summary and a recommended remedial action was available at the very next NCLT period for each RP after every FCLP period. This required a considerable amount of extra paper work for the LSOs involved. A normal night FCLP period would end anywhere from midnight to 2 a.m. after which debriefs of at least one hour were held. Sometime between then and the following afternoon LSOs had to transcribe the FCLP data from their log book to the FCLP Data Forms, then to the Trend Analysis Forms, write a summary and prescribe a remedial action for each RP.

Recycle Predictions. After the fifth night FCLP period an independent (non-LSO)evaluation of all RPs was conducted and, using the 2.6 or below grading criterion, predictions were made to identify potential recycle candidates based on their FCLP performance. On the basis of that evaluation two RPs were predicted as recycle candidates. One had three FCLP grades below the 2.6 criterion while the other had four FCLP grades below 2.6 after five night periods. Based on an analysis of 53 previous RPs from the NCLT study neither of these RPs was expected to pass CQ training based on their FCLP performance in the first five FCLP periods.

Results

The results of the field test are shown in several tables and graphs which illustrate the average performance of selected RPs across FCLP and CQ training periods. Three sets of performance data are provided for contrast and comparison.

- NCLT - Remedial Group (individualized training for Cat Is)
- NCLT - Normal Group (regular NCLT syllabus given to Cat Is)
- NCLT - Experienced Group (regular NCLT given to RPs with over 1,000 flight hours)

Data for the NCLT normal and experienced groups are taken from the NCLT study for comparison purpose.

Performance. Table 9 and Figure 11 show the results of the field test. For the two primary objective measures - LPS and Boarding Rate - the remedial group scored higher in both measures, day and night, compared to the Normal and Experienced NCLT Groups.

Remedial night LPS was higher (4.63) than the NCLT-Normal and NCLT-Experienced Groups (4.27) as was their day LPS (5.19 vs 4.52 and 4.81, respectively). The most significant finding was in night and day boarding rate which was substantially higher for the Remedial Group. At night their boarding rate was 21 percent higher (83 percent) than their Nugget counterparts (62 percent) who had a normal NCLT course and also slightly higher (83 percent vs 79 percent) than that for experienced Category I pilots. Further evidence of high performance was the fact that the CQ period required only two days and nights, an absolute minimum time to qualify aboard ship.

LSO qualitative grading of day and night approaches supported the same higher performance trend. Remedial pilots were graded higher in day and night CQ by the training LSOs and were judged to be above the mean performance of the last 50 RPs who graduated.

FCLP LSO grades were only slightly higher for the Remedial Group, day (3.0 vs 2.88) and night (2.9 vs 2.84). Compared to experienced RPs, day performance was somewhat higher for the Remedial Group (3.0 vs 2.88) and about the same at night (2.9 vs 2.92).

Recycle Prediction Results. Two RPs were predicted as recycle pilots. The results confirmed one prediction (4 of 5 FCLPs below 2.6) and were false on a second (3 of 5 grades below 2.6) who passed CQ on his initial attempt. The recycle ratio was 1/6 for the Remedial Group, 1/13 for the Normals and 0/13 for the Experienced Group.

Night FCLP Performance. The results of the FCLP performance analysis shows an overall night average of 2.9 for the five successful RPs and 2.4 for the one recycle pilot. A plot of the comparative performance is shown in Figure 12. Successful pilots show a rather consistent and gradual learning curve that starts at about 2.6 and reaches an average of 3.0 for the last three FCLP period. Actually, except for period 7, six out of the last seven periods show a consistent performance level of 3.0.

TABLE 9. COMPARISON OF NUGGET AND EXPERIENCED RP CQ PERFORMANCE FOR TWO TYPES OF NCLT TRAINING

	Nuggets		Experienced RPs
	NCLT - Remedial N=6	NCLT - Normal N=14	NCLT - Normal N=13
Day FCLP	3.0	2.88	2.88
Night FCLP	2.9	2.84	2.92
Day CQ (LSO)	2.90*	2.82	2.86
Night CQ (LSO)	2.91*	2.75	2.77
Day CQ (LPS)	5.19*	4.52	4.81
Night CQ (LPS)	4.63*	4.27	4.27
Boarding Rate			
Day	98%	88%	91%
Night	83.3%	62%	79%
Recycle Ratio	1/6	1/13	0/13
Recycle %	16%	8%	0

* - N=5

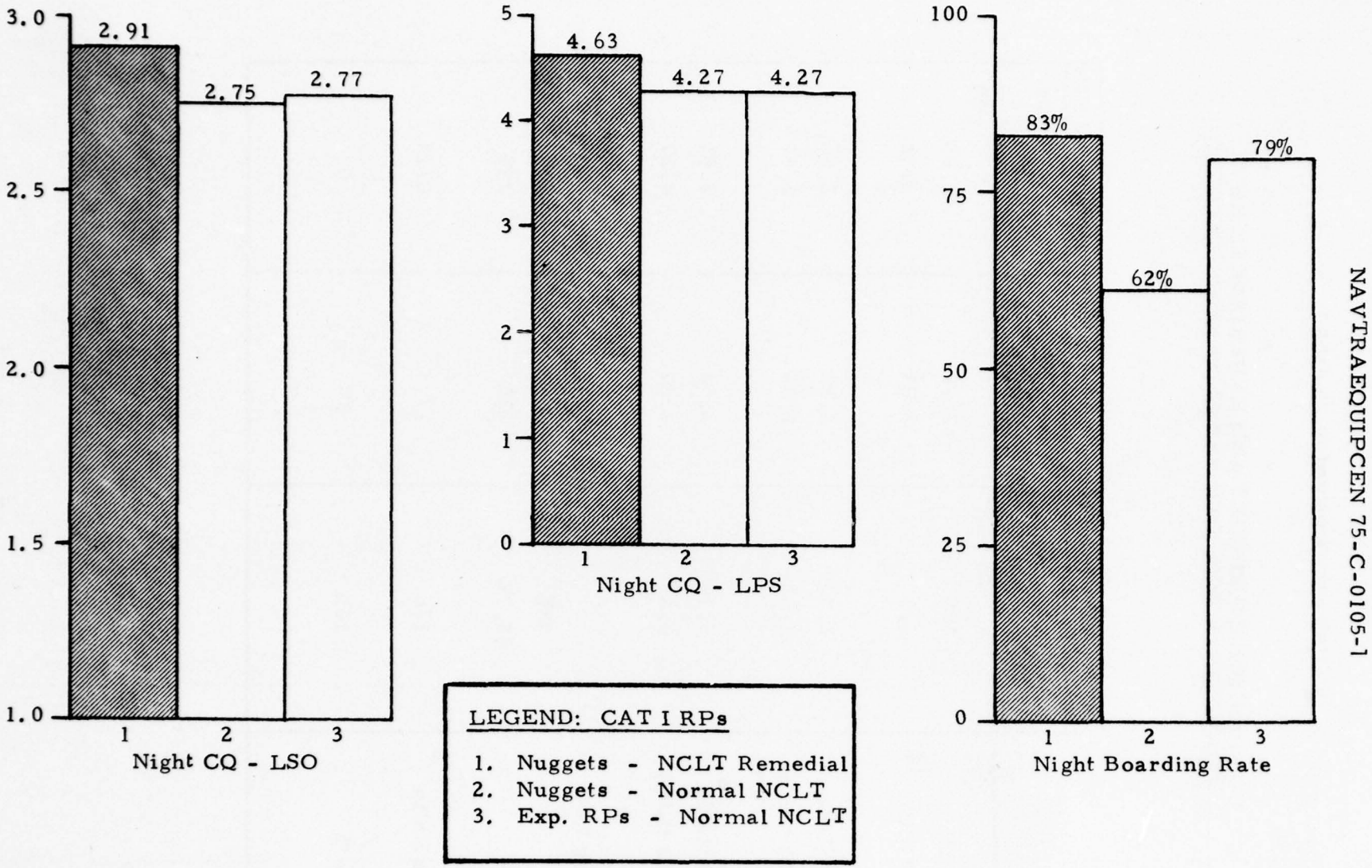

Figure 11. Summary Comparison of Nugget and Experienced RPs for Two Types of NCLT Training

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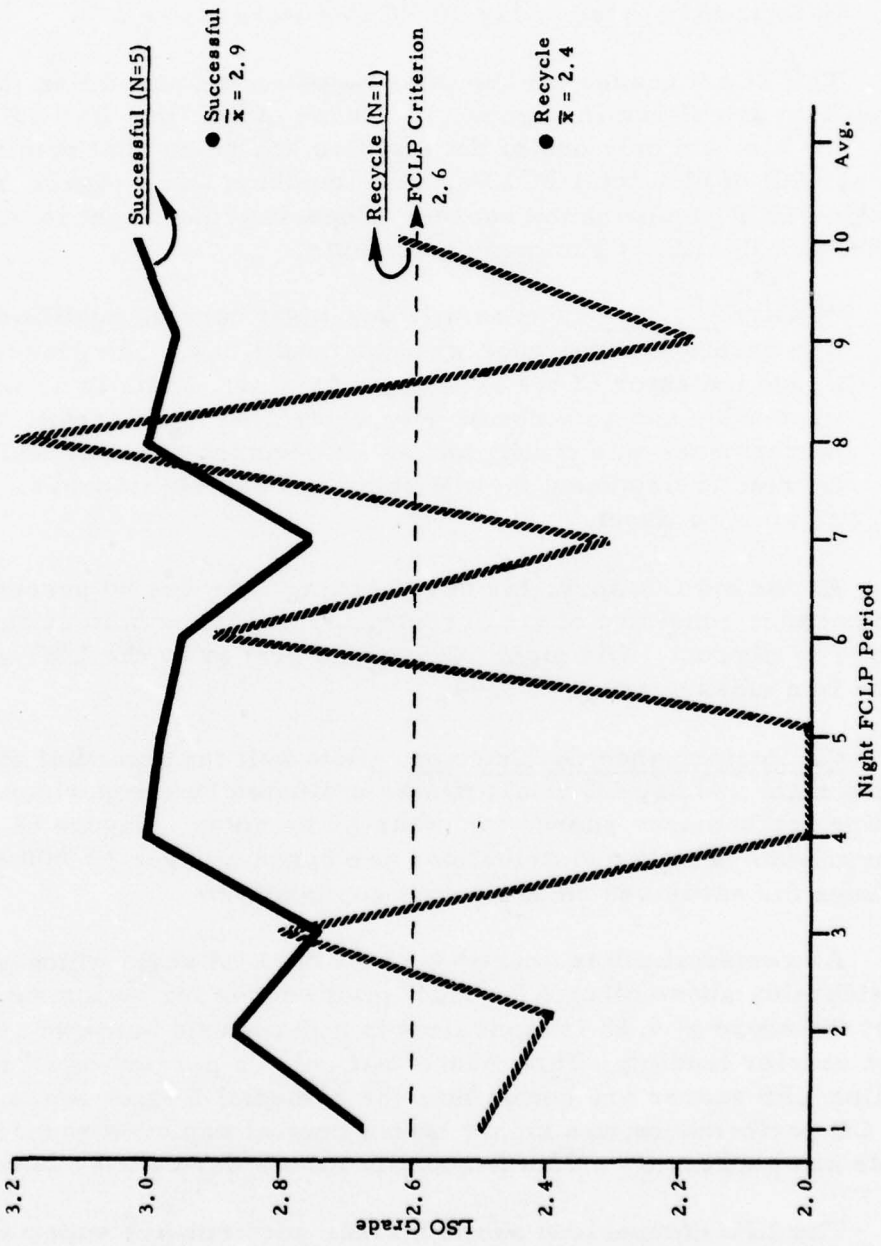

Figure 12. Comparison of Successful vs Recycle Night FCLP Performance for Category I (Nugget) Pilots.

The recycle RP performance is characterized by the expected erratic performance with no consistent learning curve or gradual improvement. As can be seen, four of his first five night FCLP periods were graded below 2.6. In fact, only three of his 10 FCLPs were above 2.6.

The FCLP grades for the false negative RP prediction (3 of 5 FCLPs below 2.6) are shown in Figure 13. Three of his first five FCLPs are at or below 2.6, but only one of the last five are below that cutoff criterion score. Out of nine total FCLPs, five are above 2.6. Again, notice the erratic FCLP performance scores. Especially pertinent to this false prediction are the LSO's summary comments.

> "Ensign _____ successfully day/night carrier qualified aboard USS Saratoga under good weather conditions. His grades are not a true indicator of his skill as an aviator. Initially he was somewhat tense and as a result over controlled the aircraft. His field performance was strong and as he becomes familiar with the carrier environment he will relax and rapidly improve. He will be a major asset."

As for his CQ work, his day boarding rate was 90 percent and his night performance consisted of six arrestments and three bolters for a boarding rate of 67 percent. His night CQ work as graded by the LSO was 2.3 compared to a class average of 2.94.

CQ Performance Comparison. How well the remedial pilots scored during night and day CQ trials can be evaluated by comparison to carrier landing performance scores for other A7 samples. Figure 14 shows that comparison. The two distributions are based on over 25,000 carrier landings for seventeen ship/aircraft combinations.

A7 remedial pilots scored 4.63 on the LPS scale which places them considerably above other A7 Nugget pilot scores for both night and day. A night CQ score of 4.63 is equivalent to a percentile score of .62 for all night carrier landing. That means that only 28 percent of all night carrier landing LPS scores are better than the remedial Nugget score. In fact, the day CQ performance was higher than a combat deployed squadron of A7 pilots and represents a 90th percentile for all day carrier landings.

The LPS comparison shows a clear performance superiority for remedial NCLT pilot performance compared with all other types of CQ training groups.

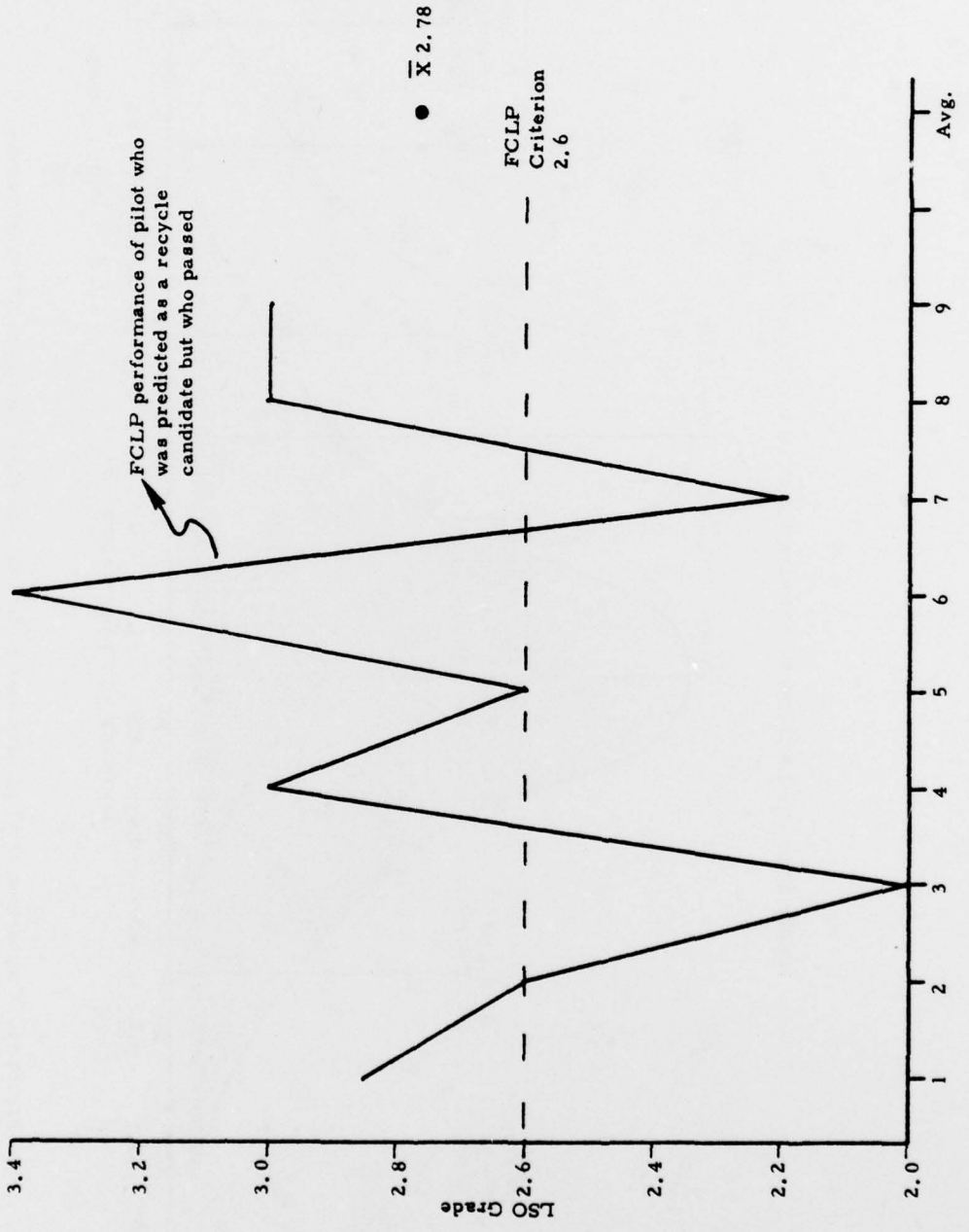

Figure 13. Night FCLP Performance for False RP Recycle Prediction

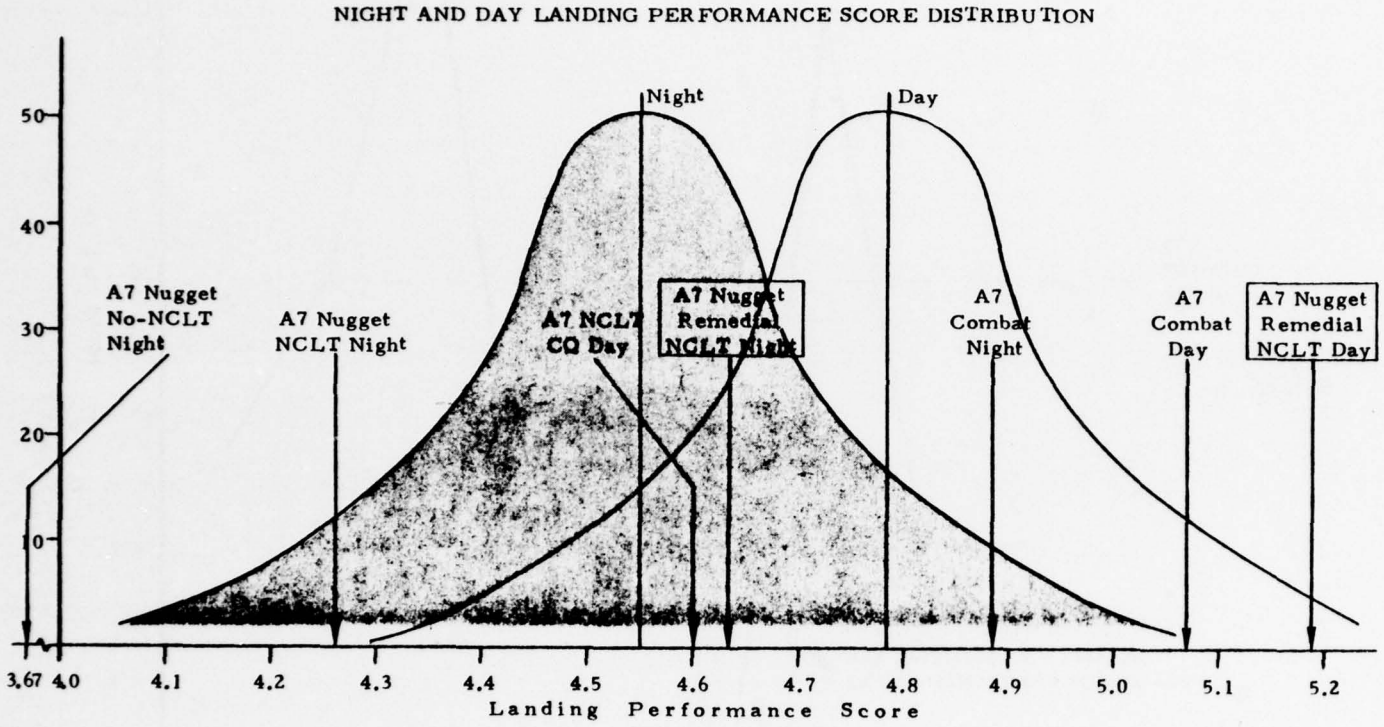

Figure 14. Comparison of A7 performance across day and night normative LPS distributions for 25,000 landings across seventeen ship/aircraft combinations.

Research Answers

The field test described here was designed to provide preliminary verification and support for two training concepts designed to reduce the impact of FRS recycle training for Category I pilot trainees. Answers obtained to the four basic research questions follow.

Question #1: Can potential recycle pilots be identified early?

Answer: Potential recycle pilots can be identified by the fifth night FCLP period by selecting an FCLP cutting score and determining if the RP is either erratic in performance or below the cutting score in three or four of the first five night FCLP periods.

Question #2: Can specific landing problems that lead to recycle training be identified?

Answer: An analysis of FCLP LSO comments can be used to evaluate each RP landing technique and provide diagnostic feedback on landing deficiencies using a landing trend analysis form to summarize the data.

Question #3: Are landing problems correctable without recycle?

Answer: This question requires additional study before a firm answer is stated. In this study the landing problems of one RP who was a low performer were sufficiently corrected using NCLT remedial training to allow him to pass CQ on his initial try and avoid recycle training. A second predicted recycle RP was not salvaged by remedial training and was recycled through a complete second training cycle for CQ.

Question #4: Does CQ performance improve?

Answer: The results clearly indicate an improvement in Nugget CQ performance compared with non-remedial trainees. An exceptionally high night boarding rate of 83 percent was obtained compared to an average night boarding rate of 62 percent. Whether the improved performance is sustained in the fleet should be followed-up in a longitudinal study of all Category I pilots.

SECTION VII

RECYCLE PILOT FLEET PERFORMANCE

Eight recycled Category I pilots were the subjects of a fleet follow-up study to determine how well they performed in a fleet squadron. For the covered period nine pilots were recycled through Phase III CQ training but data were obtained on only eight of that group. Of those eight pilots, one received the full NCLT syllabus and seven did not receive any NCLT training in their first CQ cycle. The NCLT trainee was the only pilot to disqual because of day performance and was the only pilot who received three training cycles. He is identified as pilot #2 in Table 10.

Table 10. DAY AND NIGHT FCLP GRADES FOR RECYCLED CATEGORY I PILOTS

	Day FCLP	Night FCLP		
Pilot	1st Cycle	1st Cycle	Recycle	
1	2.23	2.22	2.40	Given Pilots Board in Fleet
2	2.55	2.67	DQ	
3	2.15	2.42	2.56	
4	2.60	2.67	2.64	
5	3.05	2.73	2.50	
6	3.07	2.35	2.40	
7	2.55	2.70	2.94	
8	2.71	2.71	3.02	
Avg.	2.62	2.56	2.64	

Night FCLP performance improved only slightly during the recycle session. The recycle pilots averaged 2.56 and 2.64, respectively, in their first and second night FCLP training. Recycle day performance (2.62) was also lower on the average than successful pilots. The average grade for successful pilots was 2.82 day and 2.75 night.

Fleet performance of each recycled trainee was obtained and is presented in Table 11.

TABLE 11. RECYCLE PILOT FLEET PERFORMANCE

Pilot	Fleet Performance
1	Given pilots board and disqualed from his fleet squadron. Last at sea period his boarding rate was 35%. Major difficulty was day pattern. Slightly better at night but was getting worse. Made improper corrections.
2	Minor ramp strike and was boarded out after 105 traps. Was hot and cold.
3	Boarded for poor landings. Fleet training limited and performance unsatisfactory. Returned to FRS for NCLT/ FCLP full syllabus.
4	Started out poorly but has progressed. Last at sea period 85% boarding rate. Total traps to date, 48 day and 18 night - average grades.
5	Last at sea period, 6 day and 4 night, 3.55 grade. No problems at present time.
6	No problems; doing well.
7	No problems. LSO says he is their bad weather pilot.
8	Doing good - ranks in top third of squadron.

Three of the eight recycled pilots were unsatisfactory in their fleet performance. All three received pilot boards and there was one aircraft accident (ramp strike). The fleet failure rate for recycled pilots was 37.5 percent for the sample of A7E Category I trainees.

Pilots #1, #2 and #3 received the fleet disqualifications. Their FCLP grades during recycle were all below the mean for all recycle pilots (2.64). Pilot #2, the lone NCLT trainee, received three training cycles. He was disqualed for day CQ performance in his first cycle, passed night CQ but again failed day CQ in his second cycle and passed on his third cycle. He was also the lone pilot to have an accident.

An analysis of FCLP grades for the three fleet disquals was performed to see if additional information could be obtained on the relation between early FCLP performance and fleet disqual performance. Applying an FCLP criterion cutting score of 2.6 the three pilots performed as shown below.

	No. of FCLPs below 2.6		
Pilot	Day	Night	Night %
1	2 of 3	6 of 7	86%
2	2 of 3	6 of 11	55%
3	2 of 2	8 of 9	89%

Pilots #1 and #3 had a high percentage of night FCLP scores below the 2.6 criterion (86% and 89%) and would have been identified as low performers using the 2.6 cutoff. Additional remedial training may have salvaged pilot #3 since he had to return for what amounted to a 3rd recycle with his pilots board action. His current fleet performance is not known. Pilot #2 indeed ran "hot and cold" and his FCLP night performance showed that he was below criterion in his last five night FCLPs.

In terms of time of FRS recycle the three fleet disquals were somewhat unique. Two were recycled due to night FCLP (#1 and #3) while #2 was a day CQ recycle. Most recycles (50%) who succeeded in the fleet were recycled due to poor night CQ performance. Apparently, all of these pilots mastered the FCLP landing skill but not the CQ skill.

For future reference it is interesting to note that novice pilots who recycle due to night FCLP or day CQ have a high (75%) fleet disqualification rate (3 of 4). On the other hand, novice pilots who recycled due to night CQ were successful in their fleet assignments in every case (4 of 4) for this small sample of trainees.

Presentation of this information on fleet performance of recycled pilots may prove useful to FRS COs, training officers and LSOs who are responsible for decisions on recycle training. Although the equivalent fleet failure rate for successful Category I pilots is not known it is suspected to be much lower than the 37.5 percent failure rate disclosed for recycled pilots. On the other hand, five of the eight pilots were successful in fleet performance and are now considered fully qualified and acceptable fleet aviators. What does seem clear, although based on the limited data of this study, is that three recycles are rare and not very successful. Further fleet performance follow-up of recycle and other Category I trainees is recommended as a training method to provide feedback and validation to FRS personnel to improve training effectiveness.

SECTION VIII

RECOMMENDATIONS

1. The training concept of night FCLP performance analysis, diagnostic feedback and NCLT remedial training should be validated through a more intensive field study of A7 pilot trainees. In addition, the concepts should be applied across other FRS squadrons (F4, A7, A6, F14) especially those with visual landing simulators (F14).

2. Fleet performance follow-up of all recycled pilots should be started and formalized with fleet squadrons. All Category I trainees should be tracked in their fleet performance in order to provide operational feedback for FRS training personnel.

3. FCLP performance analysis should be automated to reduce LSO administrative workload, assure effective remedial training and provide for eventual integration with the Variable Training System (VTS) now under development for pilot readiness training.

4. Further refinements in the sequence of FCLP/NCLT training, identification of specific A7 trainee landing problems and innovative remedial instruction techniques to reduce recycle training and enhance fleet performance should be investigated.

5. Greater use of NCLT capabilities as a trainer should be emphasized. These uses should include more NCLT instruction specific to individual pilots to include acquisition of basic landing skills and correction of specific landing problems. Another use would be to train pilots to a criterion rather than a standard syllabus which is now given to all pilots regardless of their unique learning requirements.

6. Some form of instructional systems technology should be applied to Phase III CQ training to emphasize and incorporate the above recommendations. Included in this approach would be examination of the potential benefits of a positive CQ experience (successful)as opposed to recycle, and the possibility of forwarding all FCLP and NCLT remedial summary sheets to each pilot's new squadron for training purposes.

APPENDIX A

THE LANDING PERFORMANCE SCORE (LPS) AS A CRITERION

THE LPS[1]

There are a number of desirable characteristics that our criterion or LPS should exhibit. It should be objective, generally applicable to the various system components, readily available and easily applied. It must be a valid and reliable measure of operational performance.

Objectivity - An objective criterion measure, uncontaminated by subjective bias and inherent rater variability across individual data collectors would be more useful to system design evaluation than conventionally available subjective estimates of system performance.

Generality - A criterion measure which is generally related to various system components is most efficient. Ideally, we would like a single measure which could serve to discriminate, for example, among performances obtained under different ship, aircraft, pilot, LSO or environmental conditions across several training and operational recovery modes.

Availability - Inherent variability in system equipment, environment, experience, and operations produces substantial criterion variability with the consequence that landing statistics need to be based upon large samples. A technique which requires unique measurement equipment or extensive data manipulation is less desirable than one which requires only data normally collected and available as a matter of policy. Landing data now routinely recorded aboard ships are easily obtained and are likely to be available in the quantities necessary to allow use of large sample statistics.

Operational Validity - To be useful our criterion must be operationally valid, that is, it should measure and reflect actual landing performance and be closely related to aircraft recovery criteria which have been used in the fleet. As mentioned earlier, operational criteria which have been used include accident rate, boarding rate, bolter rate, LSO approach evaluations and final approach parameters.

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[1] Extracted from: Brictson, C.A. et al. Validation and Application of a Carrier Landing Performance Score: The LPS. Dunlap and Associates, Inc. March 1973.

Reliability - Our criterion must be reliable if it is to be of any use at all. To be reliable it must provide a stable and consistent measure of similar performance, i.e., if landing performance is high the criterion will consistently register it as being high. Some measure of reliability is required to reflect the consistency of performance over time and the stability of performance measured.

Each of the carrier landing criterion measures we have used previously is lacking with regard to one or more of those desirable characteristics. In this section we describe in detail the LPS which has all the desirable characteristics and in addition integrates several operational criteria into a single landing performance score which reflects the quality of final approach and landing.

Some of our previous research indicates that the longitudinal touchdown point on the carrier deck, i.e., wire arrestment number, is highly predictable from final approach measures such as lateral and altitude errors from glideslope and sink rate. Sixty-five percent of the variance in touchdown point has been accounted for by measures recorded during final approach. Final approach variables have been combined by multiple correlation techniques to predict the quality of pilot landing performance during night carrier recovery when a linear regression model was used to predict landing quality from final approach measures. A multiple R of .81 was obtained for inexperienced F4 pilots and an R of .71 for combat experienced A4 pilots. Both Rs were found to be significant at the $p < .01$ level and were validated against independent samples. Thus, touchdown point is seen to be related to, and can be predicted from, measures of final approach performance. Consequently, a criterion which integrates the degree or quality of landing success in terms of touchdown point (wires) as well as the degree of landing failure (in terms of bolters and technique waveoffs) and scales success and failure on a relative basis can be used as a more versatile objective measure of approach and touchdown performance than is currently available.

Final approaches must result, with a few exceptions such as accidents, foul deck waveoffs and flybys, in one of the landing categories shown below. By obtaining LSO estimates of the relative weights for each landing category the following criterion scoring system was devised.

The LPS

Landing Categories	Rank Order	LSO Scaled Landing Score Intervals
Wire 3 (target)	1	6.0
Wire 2	2	5.0
Wire 4	3	4.5
Wire 1	4	3.5
Bolter	5	2.0
Own or technique waveoff	6	1.0

It should be noted that in this scoring system, hook-skips are corrected for the appropriate wire number and foul-deck waveoffs or other failures not due to performance, such as equipment malfunctions or ship turns, are excluded.

The landing categories were rank ordered by 22 senior LSOs to obtain an ordinal scale of landing quality ranging from a target wire arrestment to a technique wave-off. The next step in the development of the LPS was to convert the rank order data into an interval scale to obtain a single quantitative value for each landing category. It was thought that the scaling technique of paired comparisons could be used to order the variability among raters and serve as the basis for forming such an interval scale of landing quality. However, a pre-test of this approach resulted in a lack of variability and for statistical purposes an almost universal agreement concerning which of each pair of categories was superior in quality to the other. It was finally decided to use the 22 LSOs as judges to scale the landing outcomes by having them assign numbers to each landing category on the basis of the relative value of each outcome with respect to every other outcome. The method of successive categories, also called the method of successive intervals, as described by Guilford (1954) was used to derive the interval scale measurements. A five-point graphic scale ranging from 1 to 6 and graduated in half unit intervals was used. LSOs were asked to assign a value from 1 to 6 to each landing category. A value of one was used to represent the poorest and six the best landing outcome in their judgment. LSO categorical judgments were then scaled to obtain a central value representative of each category. The scaling technique revealed relatively equal discriminal dispersions between landing categories and a high degree of internal consistency in the data. The final result was an equal interval scale of landing quality that represented an LSO concensus of the relative numerical value of each possible landing outcome.

The principal advantage of the LPS is that it is based upon data routinely recorded on all CVAs. The data source is typically the LSO landing log which identifies each landing attempt as to time of day, pilot name, aircraft side number, weather, lighting, glideslope and, most important, the landing status . . . wire number, bolter or waveoff. Those data are recorded routinely in the same manner for all carrier landings, across all CVAs.

Comparisons within the carrier landing system and across its system components can be made by transforming each pilot/aircraft approach into a performance score and computing simple statistics. Means and variances can then be used in tests to determine any statistically significant or practical differences in the comparisons.

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