AD NUMBER: AD0419081

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Gov't. agencies and their contractors; Administrative/Operational Use; 1 Jun 1963. Other requests shall be referred to Army Office of the Chief of Research and Development, Washington, DC 20310.

AUTHORITY

OCRD D/A LTR, 22 MAR 1967

System of Flight Training
and Its Contribution to Better Training

(5) 419 600

A SYSTEM OF FLIGHT TRAINING QUALITY CONTROL AND ITS APPLICATION TO HELICOPTER TRAINING

by

John O. Duffy and Carroll M. Colgan

Approved:

J. Daniel Lyons

J. DANIEL LYONS
Director of Research

Donald J. Haid

DONALD J. HAID
Maj. SigC, Chief

U.S. Army Aviation Human Research Unit
Fort Rucker, Alabama

Consulting Report
June 1963

Task LIFT IV

The Human Resources Research Office is a nongovernmental agency of The George Washington University, operating under contract with the Department of the Army (DA 44-188-ARO-2). HumRRO's mission, stated by AR 70-8, is to conduct studies and research in the fields of training, motivation, leadership, and man-weapons system analysis.

Research is reported by HumRRO in publications of several types.

1. *Technical Reports* are prepared at the completion of a research Task or major portion thereof. They are designed specifically for a military audience and convey recommendations for Army action.

2. *Research Reports* may be prepared at any time during a Task. They are designed primarily for a research audience but may be of interest to a military audience. They report research findings of interest and value to the scientific community and do not recommend Army action.

3. *Research Memoranda* may be prepared at any time and need not be directly associated with a particular research Task. They report findings that may be of interest to a research or military audience or to both. They do not recommend Army action.

4. *Consulting Reports* are prepared upon completion of consulting action requested under HumRRO's Technical Advisory Services. They are intended for a specific military audience and usually contain guidelines for implementation.

5. *Research Bulletins* are prepared as nontechnical summaries of one or more research Tasks or as reports of other HumRRO activities. They are intended primarily for a military audience and do not present recommendations for Army action. Their distribution usually includes agencies and individuals conducting research, and the general public.

Technical Reports and Research Bulletins may be requested from the Director's Office, which also issues a complete bibliography. Other publications may be obtained from the Director of Research of the originating Unit or Division.

Published
June 1963
by
The George Washington University
HUMAN RESOURCES RESEARCH OFFICE
300 North Washington Street
Alexandria, Virginia 22314

Distributed under the authority of the
Chief of Research and Development
Department of the Army
Washington, D.C. 20310

CREDITS

Subtask IV of Task LIFT was carried out under the direction of Dr. Carroll M. Colgan, Task Leader. Other members of the research team were Wayne D. Smith, John O. Duffy, Lt.Col. Jack Blohm (Ret.), SP4 Jerry Eikermann, and Pfc Paul LaCapria.

The military and civilian personnel of the U.S. Army Primary Helicopter School, Camp Wolters, Texas, cooperated closely with the U.S. Army Aviation Human Research Unit in the development of the Quality Control Program. The program was implemented by the School with the assistance of the Aviation Unit.

The authors are especially appreciative of the help received from Lt.Col. James W. Hill and Maj. Edgar N. Anderson (Ret.).

CONTENTS

Appendices

Figures and Tables

SUMMARY

In order to provide a system that would enable the Army to evaluate—objectively and continuously—the quality of its primary helicopter training, work was initiated on a quality control system to be applied to the flight training course at the U.S. Army Primary Helicopter School (USAPHS), Camp Wolters, Tex. (now Fort Wolters).

This report describes the manner in which the concepts and principles of quality control were applied at the USAPHS. The quality control system herein described is characterized by:

(1) Comprehensive and consistent testing of students' flight proficiency
(2) Accurate and equitable evaluation of the efficiency of training personnel
(3) A high degree of uniformity of flight-check procedures and scoring practices
(4) Objective and detailed school standards by which individual students or classes may be evaluated

The Quality Control Program has been adopted by the USAPHS and has provided a satisfactory solution to the problems of monitoring the flight training of Army primary helicopter students.

Formal quality control methods may be applied profitably to a great variety of training programs. The basic prerequisites to their successful application are (1) a clear, detailed statement of the objectives of the training program; and (2) the conscientious application of valid, reliable, and comprehensive proficiency measures reflecting the training objectives.

A SYSTEM OF FLIGHT TRAINING QUALITY CONTROL AND ITS APPLICATION TO HELICOPTER TRAINING

Chapter 1

Description of the Flight Training Program of the USAPHS

INTRODUCTION

In 1958 work on the development of an objective grading system to be used in the primary training of helicopter pilots was begun at the U.S. Army Primary Helicopter School (USAPHS), Camp Wolters, Tex.,[1] by the U.S. Army Aviation Human Research Unit under Subtask II of Task LIFT.[2]

In the LIFT II study, a performance recording method called the Pilot Performance Description Record (PPDR) was constructed to provide a reliable and uniform grading system to serve as an instrument for establishing a quality control program. The PPDR method consists of a step-by-step presentation of the flight maneuvers on which new helicopter students are tested in their end-of-stage check rides.[3] The establishment at the USAPHS of a quality control system based on the PPDR constitutes the subject matter of this report, which deals with activities that supplement the research reported in HumRRO Technical Report 77.

The mission of the USAPHS is to provide flight instruction in light helicopters and the academic instruction necessary to support flight training. At the present time, all flight instruction at the USAPHS is given in the Hiller OH-23 helicopter. The school is operated on a contract basis.[4]

THE TRAINING PROGRAM

The flight program is divided into three phases of training: the Pre-Solo stage, the Primary stage, and the Basic stage. Upon completion

[1]Now Fort Wolters.

[2]George D. Greer, Jr., Wayne D. Smith, and Jimmy L. Hatfield, *Improving Flight Proficiency Evaluation in Army Helicopter Pilot Training*, Technical Report 77, Human Resources Research Office, Alexandria, Va., published in Washington, D.C., May 1962. The LIFT II research is described in this report.

[3]George D. Greer, Jr., Wayne D. Smith, and Jimmy L. Hatfield, *Manual of Instruction: Use of Pilot Performance Description Records in Flight Training Quality Control*, U.S. Army Aviation Human Research Unit, Fort Rucker, Ala., 1959. This manual provides a detailed description of the PPDR and instructions for its use. A revision of the manual is in preparation at the U.S. Army Aviation Human Research Unit, Fort Rucker, Ala.

[4]Since the establishment of the USAPHS at Camp Wolters, Southern Airways Corporation has been the contractor. The military operates only the Military Flight Evaluation Division. The contractor provides all other services of the USAPHS.

of his first solo flight, a student moves from the Pre-Solo stage to the Primary stage of training. The instructor determines when the student is ready to solo, except in the case of new instructor pilots. In the first, and sometimes the second, class of students for a new instructor, a Pre-Solo check ride is administered by a more experienced instructor pilot or by the flight commander.

In the Primary stage, the student learns more complex flight maneuvers and acquires additional skill in the handling of the aircraft. At the end of this stage, he is given a check ride by a member of the Military Flight Evaluation Division (sometimes referred to as the Military Check Section). This check ride is the first formal test of the student's skill, and it is scored with the aid of the Primary PPDR.[1]

The Primary PPDR in use at the time this report was written contains 15 maneuvers. Each maneuver is made up of "items" representing specific aspects of performance. The item is, in effect, the smallest scoring unit on the PPDR. (Figure 1 on page 10 is a sample page from a PPDR, showing maneuver, maneuver segments, and items.) The maneuvers in the Primary PPDR, and the number of items[2] in each maneuver, are given in Table 1.[3]

Table 1

Number of Flight Items by Maneuver: Primary PPDR

Maneuver	Number of Flight Items
1. 90° clearing turn	*
2. Normal takeoff	9
3. Traffic pattern	21
4. Normal approach	15
5. 180° clearing turn	4
6. Maximum performance takeoff	11
7. Traffic pattern	21
8. Steep approach	15
9. Basic autorotation	17
10. 180° autorotation	22
11. 360° clearing turn	4
12. Running takeoff	15
13. Traffic pattern	21
14. Running landing	18
15. Forced landing	23
16. Forced landing from a hover	8
17. Hovering autorotation	8

[1]A description of the check ride procedures is given in Appendix A.

[2]The items listed in Table 1 refer only to the flight performance items in the PPDR.

[3]Table 1 lists 17 maneuvers because the traffic pattern maneuver is flown and scored three times during the Primary check ride.

After the successful completion of the Primary check ride, the student enters the third or Basic stage of his training in which he is introduced to tactical application of the aircraft and is taught the more difficult flight maneuvers, such as pinnacle operations, confined-area operations, and slope operations. He is also required to fly both day and night cross-country missions.

A check ride, scored by means of the Basic PPDR, is given to the student at the end of the Basic stage by a member of the Military Flight Evaluation Division. The maneuvers in the Basic PPDR and the number of flight items in each maneuver are shown in Table 2.

TRAINING COURSES

Three training courses are given at the USAPHS:

(1) Officer Rotary Wing Qualification Course (ORWQC) or "Qualification Course" for officers who are already rated as fixed wing aviators

(2) Officer Rotary Wing Aviator Course (ORWAC) for officers who are nonrated

(3) Warrant Officer Rotary Wing Aviator Course (WORWAC) for warrant officer candidates who are nonrated

WORWAC and ORWAC students receive identical programs of flight instruction. However, the warrant officer candidates receive additional instruction specific to their training as warrant officers during a pre-flight phase of training. Both groups receive a total of 111 hours of

Table 2

Number of Flight Items by Maneuver: Basic PPDR

Maneuver	Number of Flight Items
1. High reconnaissance (confined area)	10
2. Low reconnaissance and approach (confined area)	20
3. Takeoff preparations	10
4. Takeoff	11
5. High reconnaissance (pinnacle operation)	10
6. Low reconnaissance and approach (pinnacle operation)	20
7. Takeoff preparations	10
8. Takeoff	12
9. High reconnaissance (running landing)	10
10. Approach (running landing)	16
11. Takeoff	16
12. Forced landing	20
13. Power recovery	3
14. Forced landing from a hover	8
15. Slope operation (right skid uphill)	11
16. Slope operation (left skid uphill)	11

flight training at the USAPHS. Ground school instruction includes such topics as basic aerodynamics, navigation, maintenance, flight theory, and map reading.

The ORWQC (Qualification) students receive 80 hours of flight training. Ground school instruction for this group is limited to operation and maintenance topics specific to the OH-23 helicopter. ORWQC students come to the USAPHS from field units and return to the field units upon completion of flight training.

The main features of the flight training schedules of the ORWAC, WORWAC, and ORWQC students are as follows:

Stage	WORWAC and ORWAC	ORWQC
Pre-Solo	20 hours Student is not permitted to solo prior to 12 hours; must solo prior to 20 hours or receive an evaluation ride from a member of Flight Evaluation Division.	12 hours Student is not permitted to solo prior to 6 hours; must solo prior to 12 hours or receive an evaluation ride from a member of Flight Evaluation Division.
Primary	45 hours Student is not given check ride before his flight time totals 55 hours.	33 hours Student is not ordinarily given check ride before his flight time totals about 35 hours.
Basic	46 hours	35 hours
Total	111 hours	80 hours

Some students solo earlier than others and receive their Primary and Basic check rides ahead of others. Although they have completed the check ride requirements, these students are continued in the program and are given specified amounts of dual instruction and solo practice until they have completed their allotted 111 hours (or 80 hours for ORWQC). The students then graduate from the USAPHS and go to the next phase of flight training at Fort Rucker or to their next duty assignment.

Chapter 2

The Essential Elements of Quality Control

The term "quality control" as used in industry refers to a system of inspection, analysis, and action applied to a production operation so that information on the quality of the current product can be used to determine what changes, if any, must be made in the production operation to maintain or adjust the quality level of the product. Formal quality control systems, although widely used in the assembly-line production of material objects (such as automobiles), have been only relatively recently applied by training establishments to the "production" of skilled personnel.[1]

The effectiveness with which a formal quality control system can be applied to a training situation depends upon the extent to which certain key elements are present or can be developed. These elements are:

(1) Detailed specification of training goals
(2) Accurate and appropriate proficiency evaluations
(3) Effective communication concerning training efficiency
(4) Effective procedures for corrective action
(5) Supervisory support

Definitive specification of training goals is necessary both to enable corrective action to be applied to pertinent features of the training and to provide a basis for developing appropriate proficiency measurement. Precise and realistic definition of training objectives is an obvious prerequisite to the establishment of any effective training program; it is of critical importance in the establishment of a quality control system. The adequacy of a quality control system depends directly upon the precision with which the training goals are defined.

Proficiency evaluation, or measurement of product quality, is the source of the feedback information that is the cornerstone of quality control in training. Because this information defines the need for and direction of corrective action, it is of critical importance that data on student proficiency be as valid, reliable, objective, and detailed as can be obtained. Measuring instruments must be developed on the basis of thorough research and must be subjected to periodic review to ensure that they are sufficiently accurate in measuring student proficiency.

Communication of data on student proficiency must be accomplished in ways that are clear, succinct, and meaningful to appropriate

[1]U.S. Army Air Defense School, *End-of-Course Qualification Test: A Key Element in Course Evaluations Systems*, Fort Bliss, Tex. A system of quality control applied to training is described in this report.

supervisory and instructor personnel. The mass of data obtained from the proficiency measuring instruments must be analyzed and summarized in such fashion that the strengths and weaknesses of the training program are readily identifiable. Emphasis must be placed on simplicity of presentation; usually this simplicity is accomplished by the use of graphs and charts comparing actual performance with the desired standards of performance.

Quality control is maximally effective only when corrective action is immediate and continuous. Such corrective action is best achieved through the skill of highly competent and experienced supervisors and instructors. It must ensure not only that ineffective training procedures are revised but that effective procedures are retained. If certain aspects of student performance are consistently below the desired standards, either different instructional techniques must be found or the standards must be reevaluated. The quality control system provides information on the comparative effectiveness of alternative instructional procedures.

Supervisory support for quality control embraces not only the establishment of appropriate procedures, rules, and regulations, but also, the orientation and training of all personnel in the benefits and operation of the system. Negative attitudes on the part of personnel engaged in instruction, evaluation, communication, corrective action, or supervision can readily vitiate the entire system.

Chapter 3

The Quality Control Program at the USAPHS

FEASIBILITY OF A QUALITY CONTROL PROGRAM AT THE USAPHS

In the initial stages of investigating the feasibility of instituting a formal quality control program at the USAPHS, it was necessary to determine the degree to which each of the key elements discussed in Chapter 2 was present or could be developed. The findings and the action taken on each element were as follows:

1. The existing training goals were clearly specified in sufficient detail for quality control purposes.
2. The proficiency evaluation techniques in use did not supply information that was sufficiently detailed, precise, or reliable for quality control purposes. Accordingly, a new system of measuring proficiency, the Pilot Performance Description Record (PPDR), was developed.
3. Techniques were developed for communicating the proficiency evaluation information to appropriate supervisory personnel. (These techniques are discussed in Chapter 5.)
4. The USAPHS staff, with minimal assistance from HumRRO personnel, developed effective techniques for instituting necessary corrective action.
5. The USAPHS supervisory personnel at all levels possessed the necessary experience, judgment, and enthusiasm to administer the quality control system effectively.

STUDENT EVALUATION

The main elements of the Quality Control Program at the USAPHS are the two end-of-stage check rides administered after a student completes the Primary and the Basic stages of training.

The PPDR upon which the Primary check ride is scored consists of 17 flight maneuvers, with a total of 236 separate items of flight performance. Each flight item within a maneuver segment is scored separately, then the maneuver segment as a whole is graded. A sample page from a PPDR is shown in Figure 1.

Each flight item is scored as a "proper" (correct performance) or an "error" with the direction and magnitude of the error indicated by means of penciled slash marks. At the completion of each maneuver segment the check pilot records a grade for that segment: AA (above average), A (average), BA (below average), and U (unsatisfactory). These grades are based on the check pilot's expert knowledge of flight

Sample Page From PPDR

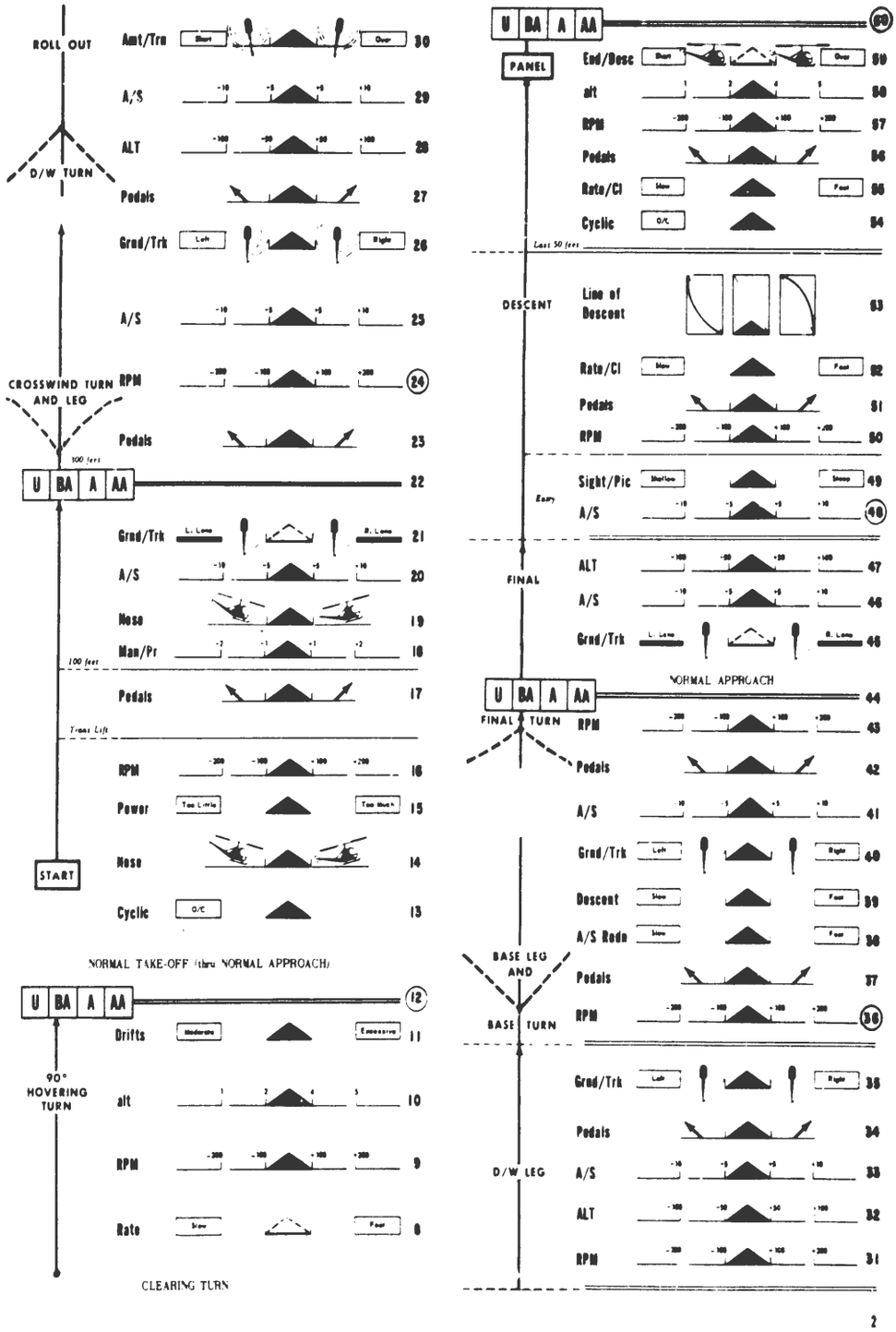


Figure 1

procedures and on the specific requirement to be met in the standardized check ride. (The manner in which standardization in check-pilot grading is achieved is discussed in Chapter 4.) The primary purpose of these segment grades is to assist the check pilot in making the complex judgment involved in the assignment of a numerical score for the entire check ride.

The first page of the PPDR (Figure 2) provides space for recording information other than that pertaining to specific flight performance. Such information is relevant to the student's total performance on the check ride and must be considered in evaluating his performance of specific flight items. Included on the first page are:

(1) Wind velocity (at beginning and at end of flight)
(2) Turbulence (at beginning and at end of flight)
(3) Student tension (three levels)
(4) General evaluation of performance of maneuvers in terms of
    (a) Planning
    (b) Judgment
    (c) Coordination
    (d) Accuracy and technique
    (e) Division of attention
    (f) Alertness
(5) Cockpit procedures in terms of number of
    (a) Minor errors
    (b) Major errors
    (c) Propers
(6) Such additional or amplifying comments as the check pilot deems appropriate

The above information is used for two main purposes: (1) to assist the check pilot in assigning a single numerical score for the entire check flight and (2) to assist in determining the action necessary for a student whose check ride performance is unsatisfactory.

The manner in which the check pilot uses the information recorded on the first page of the PPDR in evaluating total performance is primarily a matter of individual judgment and discretion; however, the Manual of Instruction contains specific guidelines for the use of these areas of information. At the present time, for example, the USAPHS check pilots have agreed that information on performance of cockpit procedures will be applied by subtracting one point from the total numerical score for a minor error, and two points for a major error.

It is essential in a quality control system applied to training that those who evaluate student proficiency not be influenced by factors other than actual student performance. Therefore, it is highly desirable that proficiency evaluation be carried out by personnel not directly engaged in the training of the students being evaluated. The requirement for an independent assessment agency is met at the USAPHS by the Military Flight Evaluation Division whose principal function is the administration of check rides. In order to minimize further the possibility of biasing the check pilot's independent judgment of the student's performance, the students are randomly assigned to each check pilot; also, the name

Page 1 of the Primary PPDR

H-23 PRIMARY

PILOT PERFORMANCE DESCRIPTION RECORDS

STUDENT'S NAME		RANK		CLASS AND FLIGHT
CHECK PILOT		MISSION - - - - - - - - - - - - - - FLYING TIME		AIRCRAFT (TYPE AND MODEL)
DATE	INSTRUCTOR		INSTRUCTOR EVAL	CHECK GRADE

Weather at Hiller Field:

At beginning of check flight:

WIND: ☐ Headwind ☐ Slight Crosswind ☐ Direct Crosswind
Velocity: _____ under 10 Kn _____ 10-20 Kn _____ over 20 Kn

TURBULENCE: ☐ Calm ☐ Moderate ☐ Rough

At end of flight:

WIND: ☐ Headwind ☐ Slight Crosswind ☐ Direct Crosswind
Velocity: _____ under 10 Kn _____ 10-20 Kn _____ over 20 Kn

TURBULENCE: ☐ Calm ☐ Moderate ☐ Rough

TENSION

1 ☐ No apparent tension 2 ☐ Moderately tense, but not handicapped by it 3 ☐ Very tense, interfered with performance

MANEUVERS (General evaluation)

1	2	3	4	5	6
U BA A AA	U BA A AA	U BA A AA	U BA A AA	U BA A AA	U BA A AA
PLANNING	JUDGMENT	COORDINATION	ACCURACY AND TECHNIQUE	DIVISION OF ATTENTION	ALERTNESS

7 COCKPIT PROCEDURE [Major Errors] [Minor Errors]

Comments and Notes:

Specific Comments

Figure 2

of the instructor pilot, the instructor's evaluation, and the class and flight number are not entered on the PPDR by the quality control clerk until after the check pilot has completed his evaluation. This information is not available to the check pilot at the time of the check ride.

At the completion of the check ride the check pilot reviews his markings in the PPDR, assigns a numerical grade for the check ride, and delivers the PPDR to the quality control clerk. The quality control clerk completes the booklet by recording in it the information noted in the preceding paragraph. Any flight items that were not marked during the check ride are left unmarked in order to avoid errors caused by faulty memory. Because of the standardized procedure for administering the check rides, it seldom happens that an item is not marked.

ANALYSIS OF CLASS DATA

The quality control coordinator is a member of the Military Flight Evaluation Division. He participates in and supervises all standardization procedures of the Military Flight Evaluation Division as well as overseeing preparation of all quality control graphs, charts, Disposition Forms, and Instructor Pilot Logs. His duties also include supervision of any corrective measures undertaken as a result of quality control recommendations.

The first quality control analysis is a class summary prepared by a clerk trained in quality control procedures. As each class completes its end-of-stage check rides, an end-of-stage performance record is compiled and summarized as shown in Table 3. The class summary is submitted in turn to the Chief of the Military Flight Evaluation Division, the Director of Instruction, the Assistant Commandant, the Commandant, and also the Standardization Section of the contract school.

All the information in the PPDR booklets, except the written comments, is then transferred to punched cards for processing in the automatic data-processing machines at the USAPHS. (See Chapter 5.)

Table 3

Sample Class Summary Form for Class of 16 Students

Grade Received or Disposition	Number of Students Awarded Grade by	
	Instructor Pilot	Check Pilot
Above average (90 to 100)	2	4
High to average (80 to 89)	8	6
Below average (70 to 79)	6	2
Failures (below 70)	0	4
Total	16	16
	Passed rechecks	3
	Set back to Class No. ____	1

The next step in the Quality Control Program is the analysis of the check rides in terms of percentage error for each maneuver. This analysis is accomplished by determining the total errors made by the class for each of the separate maneuvers and converting these to percentages by means of the formula.

$$\% \text{ error} = \frac{\text{Total number of errors made}}{\text{Total number of errors possible}} \times 100$$

A graph showing the percentage error for each maneuver is prepared on conventional graph paper by the quality control clerk, who identifies each maneuver by name and lists it in order of its occurrence in the check ride. A typical graph is shown in Figure 3.

The broken line on the graph shows the average percentage error for the class. The solid line is the average percentage error for the school; it is based on the performance of a sizable number of students in classes preceding the class under consideration and thus provides a highly stable standard of comparison.

Copies of these graphs are submitted in turn to the Chief of the Military Flight Evaluation Division, the Director of Instruction, the Assistant Commandant, the Commandant, and also to the Standardization Section of the contract school.

The point-by-point comparison between the class average percentage error and the school average percentage error for the various maneuvers makes readily apparent any extreme variations of class performance, in the direction of either more or fewer errors. (See 180° clearing turn, Figure 3.)

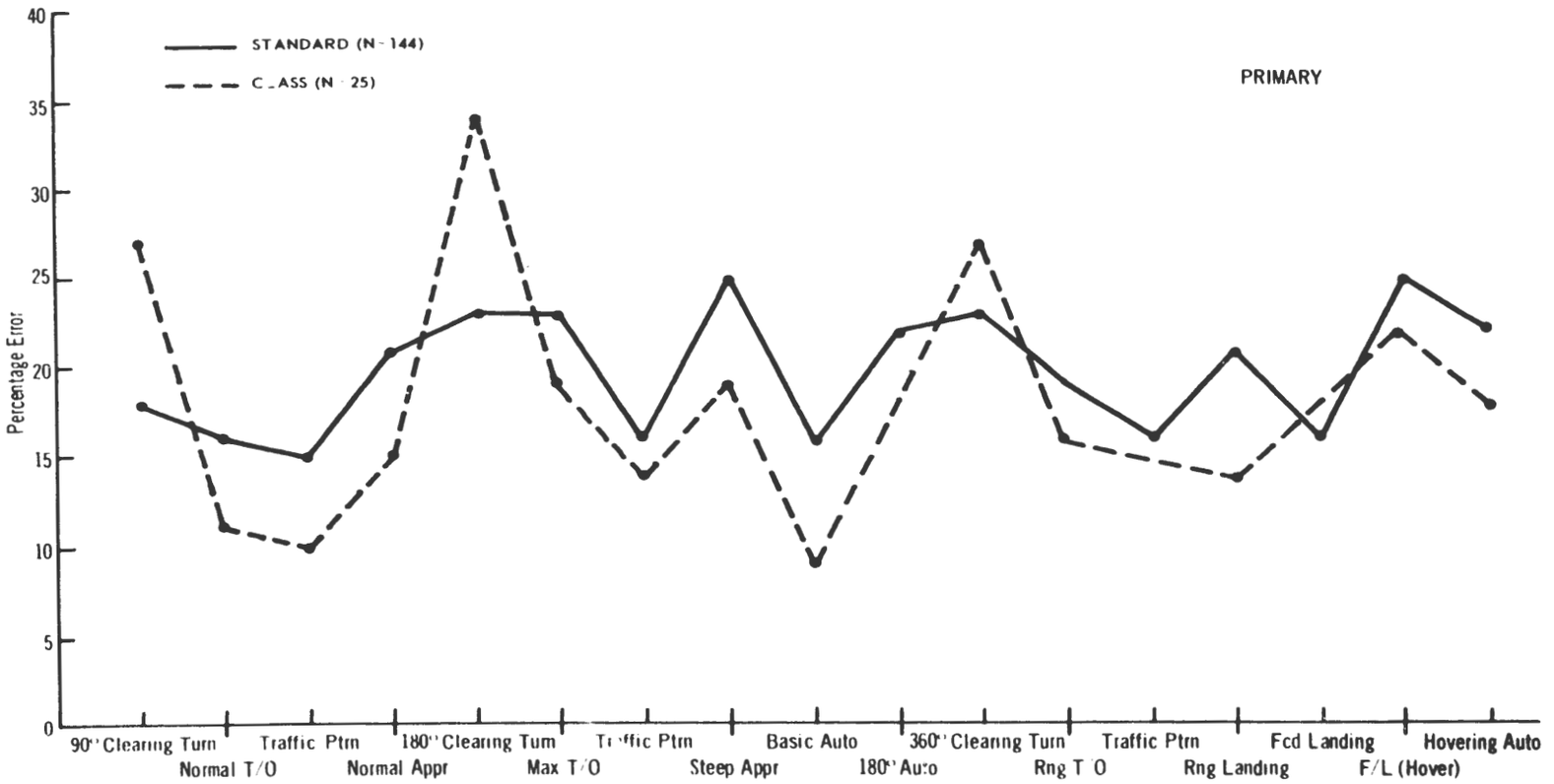
Sizable increases in errors by a class, as compared with the school average, may be an indication of a need for corrective action or at least a determination of the source of the deviation. Two general steps are essential in evaluating such deviations. First, it is necessary that the procedure establish the statistical reliability or significance of such a deviation. This is accomplished at the USAPHS through the use of appropriate tables (see Appendix B) which take into account size of class and variability of the maneuver concerned. Second, it is necessary to relate the significant deviations to causal conditions in order to determine whether the deviation is a product of instructional practices or of other causes. The first of these steps is routine; the second calls for considerable experience with flight training.

The performance of a class is influenced by numerous and complex factors such as seasonal changes, predominant wind conditions, holidays, personalities, and many others. Therefore, before any decision is reached to take corrective action in the training program, the quality control coordinator reviews carefully all the factors that might account for undesirable class performance and, on the basis of his experience and expert knowledge, determines how to proceed in each specific instance.

As an aid in identifying the source of the undesirable class performance,[1] the quality control clerk, under the supervision of the quality

[1]While the emphasis in this discussion is on the finding of classes that make significantly more errors than the school average, this should not be construed as precluding the use of quality control data in the improvement of school averages. The ideal of errorless performance, while perhaps unattainable, is a desirable goal toward which the school should strive.

Average Percentage Error on Maneuvers for Class vs. Average Percentage Error for School[a]



[a]These graphs were prepared from a version of the PPDR earlier than the one currently in use at USAPHS.

Figure 3

control coordinator, prepares a graph for analysis of each deviant maneuver that warrants further examination. This second graph shows the percentage of errors for each PPDR item in the deviant maneuver, plotted against the school averages for these items. After evaluating this detailed comparison, the quality control coordinator prepares a report reviewing the nature of the performance on the deviant maneuver under consideration and suggesting a course of corrective action. A typical report of this type is shown in Figure 4, with its accompanying graphs shown in Figure 5 (Inclosure 1 in Figure 4), and Figure 6 (one of the other inclosures mentioned in Figure 4). These examples are actual records selected from the USAPHS files with the class identification removed. The first graph (Figure 5), on over-all class performance, clearly shows deviant performance—excessive errors—on the High Recon maneuver of the pinnacle operation as well as showing less marked deviation on other maneuvers. The second graph (Figure 6) gives an item-by-item analysis of the deviant maneuver, Pinnacle Hi-Recon. The error contribution of each performance item in the maneuver can be readily identified.

The report and accompanying graphs are reviewed by the Chief of the Military Flight Evaluation Division, a well-trained, experienced military officer who supervises this Division. His duties include monitoring all the procedures of the Quality Control Program and reviewing all the graphs, recommendations, and Disposition Forms prepared by the quality control coordinator before they are submitted to higher offices. With the Chief's approval, the report and graphs are sent to the Director of Instruction, who in turn sends them to the Assistant Commandant and the Commandant.

ANALYSIS OF INSTRUCTOR DATA

One of the most important features of the Quality Control Program at the USAPHS is that it provides an index of instructor pilot effectiveness. The system devised for producing instructor pilot evaluations uses the PPDR check ride data as source material and takes full advantage of automatic machine-processing methods.

Each instructor pilot has three students per class and normally teaches these students from the beginning of their flight training to graduation. Each student is given two PPDR-graded check rides, one at the end of the Primary stage, the other at the end of the Basic stage of training. Thus, a total of six PPDR-based check rides are administered to the students of each instructor pilot for each class that goes through the USAPHS.

By use of automatic machine-sorting methods, the check ride data on the three students of each instructor are assembled and furnished to the quality control coordinator. Every item on the PPDR on which two out of three of an instructor's students made an error is noted and appropriate entries are made in an Instructor Pilot Log. (See Figure 7.) When the data are displayed in this form, error trends or patterns of errors are readily detectable by a qualified observer. For example, if

Class Performance Review Report

SECURITY CLASSIFICATION (if any)

DISPOSITION FORM

FILE NO.	SUBJECT
AKPWO-HST	BASIC PERFORMANCE (CLASS_____)

TO	FROM	DATE	COMMENT NO. 1
Commandant and Assistant Commandant	Chief Flt Eval Div		Quality Control Coordinator

Thru:

Chief
Opns & Tng

1. The flight performance of Class_____for the Basic Stage of training was satisfactory for all maneuvers except High Recon for Confined Area, High Recon for Pinnacle Operation, Take-off Preparation from a Pinnacle and Slope Operation left skid.

2. Class performance shown in inclosure #1.

3. Maneuver performance for weak maneuvers shown on inclosure 2 and 3.

Chief
Flight Evaluation Division

Inclosures: A/S
Copy furnished contractor

DD FORM 1 FEB 50 96 REPLACES NME FORM SL 1 OCT 48 WHICH MAY BE USED

Figure 4

Evaluation of Class Performance (Errors vs. Maneuvers)

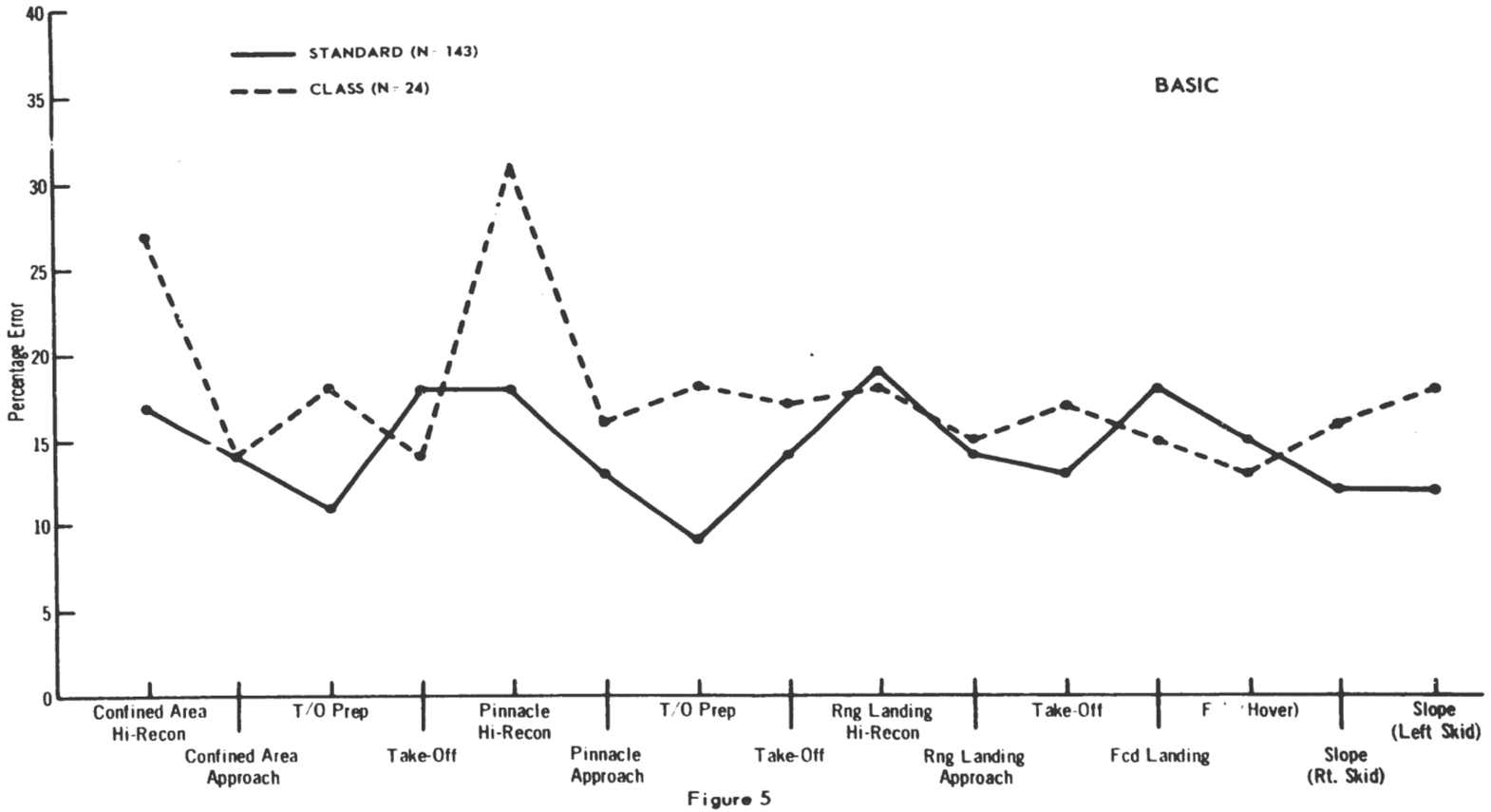


Figure 5

Class Performance on Critical Maneuvers (Errors vs. Items)

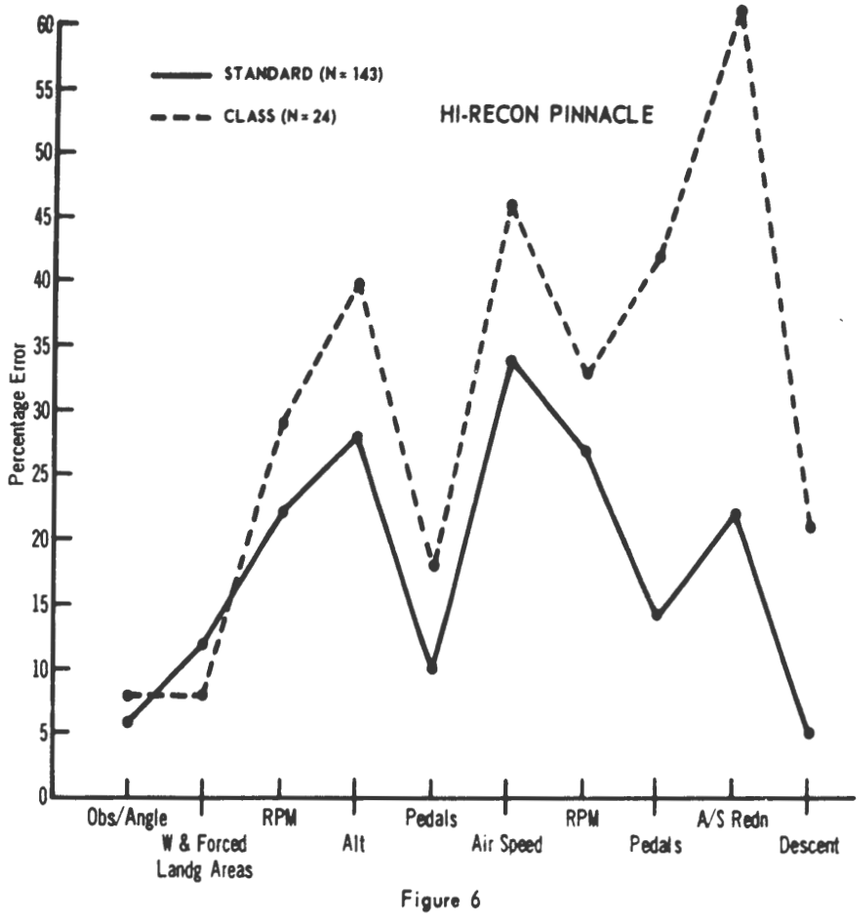


Figure 6

a student is weak on pedal controls, pedal errors may tend to appear in the check ride whenever a change of power setting is involved or where precise ground-track performance is required. If two, or perhaps all three, of an instructor pilot's students exhibit weaknesses of this kind and if this trend persists for the instructor pilot's students in class after class, then the assumption may be made that an instructional deficiency exists. It must be emphasized that considerable skill and long experience in flight-training procedures and problems are prerequisites to discovering and interpreting material of this type.

The method of instructor pilot evaluation described above not only exposes instructional weaknesses but also identifies those instructor pilots who are consistently above the average. Recognition of the best instructors in a program is as important as—or more important than—the identification of instructors who are less proficient. Such recognition, in addition to having a reinforcing effect on good behavior, serves as a source of information for candidates in determining promotions.

Sample Page From (Basic Stage) Instructor Pilot Log—Basic Trends

GENERAL EVALUATION

1. Planning
2. Judgment
3. Coordination
4. Accuracy & Tech.
5. Div. of Attention
6. Alertness
7. Cockpit Procedure

CONFINED AREA

I. High Reconnaissance

Pattern
8. Obs/Angle of Sight
9. Wind F/L Areas
10. RPM
11. Alt
12. Pedals
13. A/S

Approach Prep
14. RPM
15. Pedals
16. A/S Redn
17. Descent

18. Evaluation

II. Low Reconnaissance & Approach

Entry to Barrier
19. A/S
20. Approach Angle
21. RPM
22. Pedals
23. Date/Closure
24. Line/Descent

NOTE: A similar but separate Instructor Pilot Log is prepared for use with the Primary PPDR. Copies of both the PPDR and the IP Log forms may be obtained by writing the Commandant, USAPHS, Fort Wolters, Texas.

Figure 7

When an instructional deficiency is indicated by the data accumulated in an instructor pilot's log, the quality control coordinator informs the head of the contract school Standardization Section. Complex judgment is involved, not only in determining precisely what is wrong, but also in how to improve it. The usual procedure is to provide the instructor with information on the areas of instruction in which he appears to be deficient and to suggest means of correcting the difficulty. If improvement in the weak maneuvers is not apparent during the next analysis period, the instructor is given a standardization check ride by a member of the Military Flight Evaluation Division to determine the reasons for the deficiency and to provide such corrective training as seems indicated.

SCHOOL STANDARDS

The school standards or averages, described under "Analysis of Class Data" on page 13, are computed for the purpose of providing a stable basis of reference with which to compare the performances of individual classes. Four separate school averages are computed to correspond to the following four categories of students at the USAPHS:

Officer and Warrant Officer Aviator Course—Primary Stage
Officer and Warrant Officer Aviator Course—Basic Stage
Officer Qualification Course—Primary Stage
Officer Qualification Course—Basic Stage

The same standard serves for both officer and warrant officer aviator students since they receive identical flight training.

As each class finishes the Primary and the Basic stages of training, respectively, its performance records are first compared with the appropriate school average and then included in that average. Periodic review of the averages is desirable to ensure that they reflect the current product of the School. When a sufficiently large number of classes have gone through the USAPHS to ensure a stable school average, the earlier classes are dropped from the computations of the current school averages. This procedure will have the effect of keeping the school average representative of the last 12 or 15 months of school output and will forestall the possibility that the school average might become unrealistic. Also, about twice a year, or when enough check rides of a specific category have accumulated (generally about three classes), the data are tabulated and plotted against the longer-term school standards as shown in Figure 8.[1] Such a graph gives warning of any erosion of school standards and helps suggest areas in which standards need to be improved. It is, of course, necessary to compute new averages when major changes are made in the Program of Instruction or in the PPDR.

[1] Since the data in Figure 8 were collected, three additional check pilots have been added to the original five check pilots in the Military Flight Evaluation Division.

Comparison of a Short-Term School Record With the Long-Term School Average

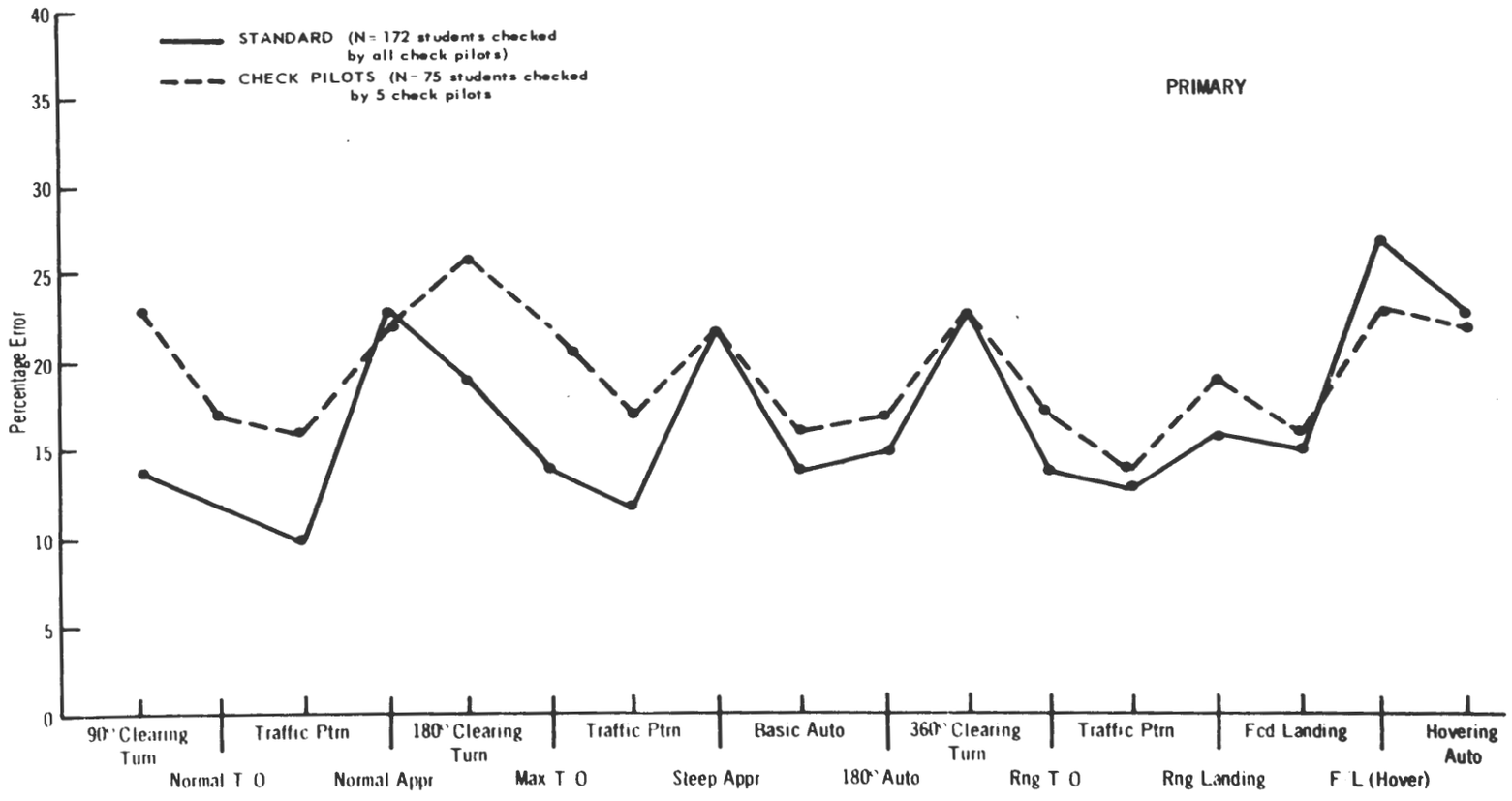


Figure 8

Chapter 4

Check Pilot Standardization

Since the data employed in every step of the USAPHS Quality Control Program are taken from Primary and Basic PPDR's, it is of critical importance that individuals who comprise the Military Flight Evaluation Division and who administer check rides use similar standards in scoring the various items and in grading the maneuvers that make up the PPDR. The check pilot standardization program is, therefore, one of the most important features of the Quality Control Program.

During the course of this program, a newly appointed check pilot receives approximately 19 hours of ground instruction and 10 hours of flight instruction devoted to the use of the PPDR in evaluating various performances that students are likely to exhibit. The Program of Instruction for check pilot standardization is given in Table 4.

Ten Primary and ten Basic PPDR booklets have been prepared as training materials for new check pilots. In these booklets all of the flight items are marked in terms of "errors" and "propers" but all of the maneuvers and maneuver segments (letter grades) are blank. The veteran members of the Military Flight Evaluation Division have graded these standard booklets and have reached agreement on the proper grading of the "standard check rides." When a new man enters the Military Flight Evaluation Division he is required to grade the standard booklets. Any disagreement between his grades and those that constitute the consensus of the check pilots is pointed out and explained to him.

In the flight-training portion of the indoctrination program, several of the more experienced members of the Military Flight Evaluation Division ride with the new man and demonstrate how certain errors look in flight and how they are to be marked in the PPDR. Also, during these flights the new check pilot is trained in what tolerance limits to apply in the observation process and marking procedure.

The indoctrination program has proved to be effective, but it is only the first step in the standardization procedure. Individual standards and criteria tend to drift away from the standardized procedures and criteria unless constantly refreshed. To counteract this tendency, the quality control coordinator monitors and participates in a continuous program (on a time-available basis) in which the check pilots administer check rides to each other. The PPDR's for these rides are compared and discussed to discover and correct any tendencies away from the norm, either in flight techniques or in scoring. Periodically, the average scores on maneuvers during actual check rides with students are plotted graphically for each check pilot against the averages for the entire Military Flight Evaluation Division as shown in Figure 9.

Table 4

Program of Instruction for Check Pilot Standardization Training

Step of Training	Content	Classroom Hours	Flight Hours per Check Pilot
1	Lecture and discussion on purpose, policy, and plans (type of errors noted, etc.) of the PPDR program.	2	—
2	Preliminary flight familiarization; Primary and Basic normal flight procedures.	—	3
3	PPDR scale definitions; administrative procedures; marking PPDR; briefings prior to ride; debriefing after ride.	2	—
4	Identification of check pilot standards; comparison with accepted set of standards; familiarization with scoring process; 10 Primary and 10 Basic PPDR's scored by each check pilot. Discussion of differences.	6	—
5	In-flight buddy-ride practice with both Primary and Basic PPDR's; discussion of both objective and subjective scales of PPDR; flight demonstration of correct and incorrect performance of those items involving subjective judgments.	1.5	3
6	Instructor standardization rides covering all items on both Primary and Basic PPDR.	5.5	4
7	Final discussion on all work performed; check on all graded PPDR's—10 Primary and 10 Basic.	2	—
8	Continuous comparative analysis of actual PPDR's by supervisory personnel; indications of deviation from the norm to be immediately brought to the attention of the individual concerned; corrective action to be immediate and continuous.	—	—
	Total	19	10

The graph plotted for the check pilot is not affected by individual instructor weaknesses because students are assigned to each check pilot on a random basis. Figure 9 shows that on maneuvers involving turns this particular check pilot was employing more stringent criteria than were the other check pilots. A deviation of such nature and magnitude would result in additional standardization training for the check pilot in question on the pertinent areas.

A comparison of the individual graphs for all check pilots provides a sound qualitative evaluation of the performance of the Military Flight Evaluation Division as well as a quantitative evaluation of the performance of each check pilot.

At the USAPHS, corrective action is taken when an individual check pilot's scores deviate significantly over time from the mean score of the entire Military Flight Evaluation Division. Procedures for evaluating such deviations are similar to those described previously for evaluating class deviations. Corrective action may take the form of discussion or of flight checks in which the specific scoring standards in question are brought under sharp scrutiny to determine the cause of the deviation.

Comparison of Record of a Single Check Pilot With Record of All Check Pilots

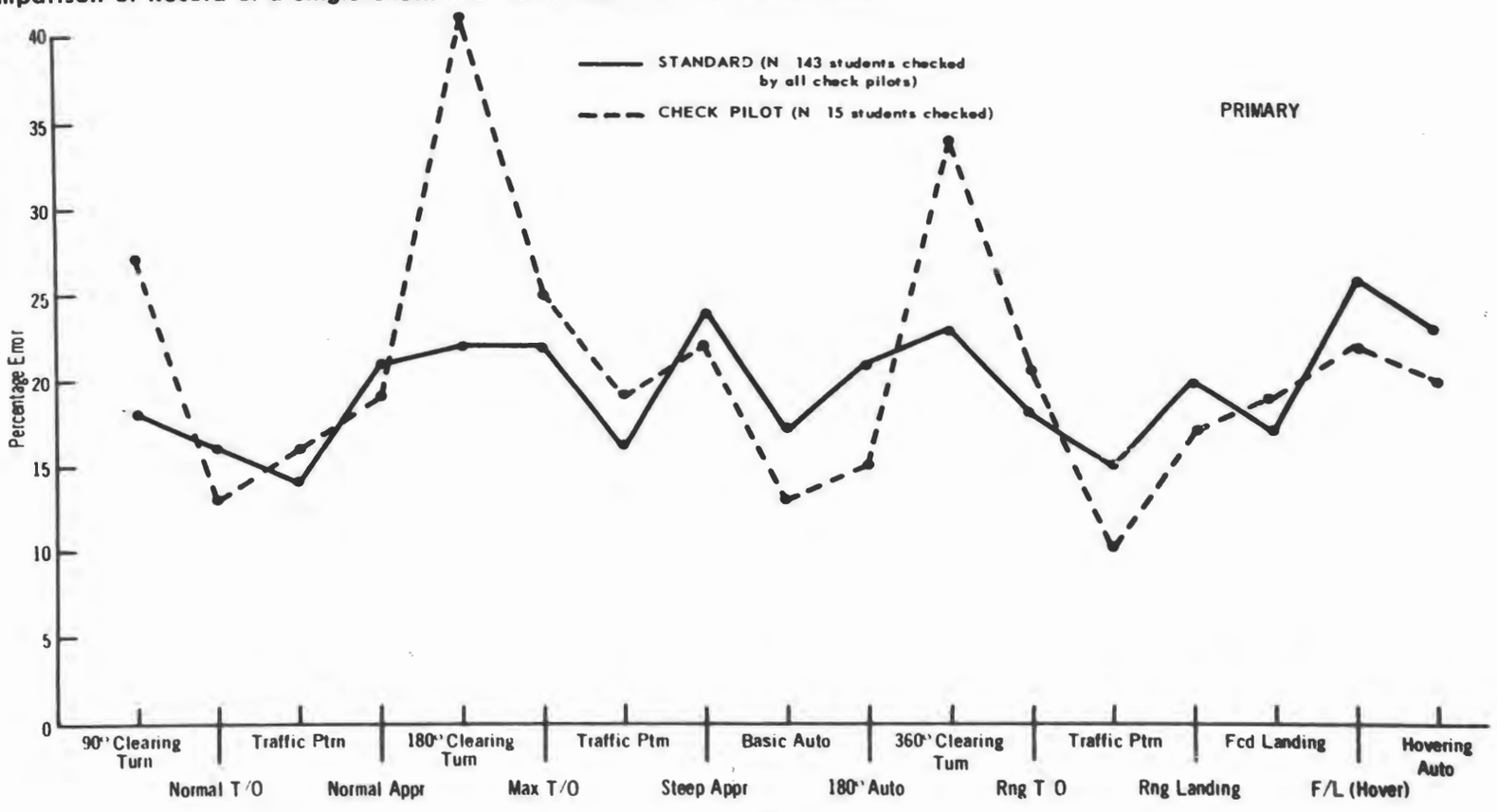


Figure 9

Chapter 5

Field Test of the Quality Control Program

For a year prior to its formal adoption at the USAPHS, the Quality Control Program was administered on a trial basis under the direct supervision of personnel from the Aviation Human Research Unit. The trial period was devoted to (1) determining the utility and feasibility of the program, (2) perfecting administrative procedures, (3) evaluating alternative methods of data processing, (4) developing appropriate methods of summarizing and displaying the data, and (5) familiarizing the USAPHS with the operation of the program. Personnel of the USAPHS participated actively and enthusiastically during this trial period. A considerable portion of the operating procedures that were adopted resulted directly from contributions and suggestions by USAPHS personnel.

One of the major questions to be resolved during the trial period was whether the student proficiency data should be processed by hand or by machine. The major factors to be considered were economy, time requirements, and availability of mechanical data-processing equipment. The comparison between hand processing and machine processing was conducted by having the PPDR check ride data processed simultaneously by the two methods. In hand processing, it was found that the verifying and posting of PPDR data could be accomplished by one well-trained clerk; but additional assistance would be required to tabulate, compute, and analyze the necessary statistical summaries. With machine processing, it was found that one well-trained clerk could produce all the graphs, file entries, and reports required to keep the quality control system on a current basis.[1] As a result of this comparison, machine processing of the data was adopted.

In actual practice at the USAPHS it is necessary to schedule specific dates on which the data-processing machines will be made available for processing the PPDR data. On these dates, all of the card punching, verifying, and computing of the accumulated data are accomplished. If specific quality control information is required at a time when the machines are not available, the computations are performed by the quality control clerk using a desk calculator. Because such requirements have occurred infrequently, there has been no serious overload in the work schedule of the quality control clerk.

[1] HumRRO's Statistical Services Office assisted the USAPHS personnel in the development and evaluation of coding and data-processing procedures.

During the trial period, considerable effort was devoted to developing methods of summarizing and displaying the PPDR data in a form that would be most useful to training personnel. Most of the quality control data—such as class means, check-pilot means, and school standards—are displayed as simple line graphs which are well suited to this type of information. Moreover, the line graph has the advantage of being a mode of presentation familiar to military training personnel. Typical graphs used in this program are shown in Figures 6 and 7 in Chapter 3. The only data not readily amenable to line graph presentation are the cumulative data on instructor pilot effectiveness. These are displayed in the Instructor Pilot Log (Figure 8, Chapter 3).

The trial period also provided an opportunity to accumulate data on check ride performance which could be used as standard-performance reference material, or school averages, during the initial portion of the implementation of the quality control system. During the trial period, performance data on the Primary check ride were collected for 79 ORWAC students and 172 ORWQC students and on the Basic check ride, for 158 ORWAC and 347 ORWQC students.

At the time this report was written, the Quality Control Program described herein had been administered by the USAPHS personnel with minimal assistance from HumRRO personnel for over six months. Reports from School personnel indicate that this program is providing the USAPHS with a highly satisfactory system for evaluating the effectiveness of its instructional program.[1]

[1]Col. Jack K. Norris, Commandant, USAPHS, "USAPHS Military Flight Evaluation System," *Army Aviation Magazine*, July 1962, pp. 361-363. The views of the USAPHS on the operation and effectiveness of the Quality Control Program are presented in this article.

APPENDICES

Appendix A

Standing Operating Procedure for Scheduling and Conducting Check Rides at the USAPHS[1]

The Military Flight Evaluation Division administers check rides to student aviators in order to check the flying proficiency of the students, the quality of instruction received, and the standardization of maneuvers.

Pre-Solo stage check rides will be given only to the students of new or inexperienced instructors as a precautionary measure to insure that the student is ready to solo. Primary and Basic stage checks will be conducted by the Military Flight Evaluation Division. Primary check rides will not be administered to ORWAC and WORWAC students until they have completed a minimum of 55 hours of flying time. In the case of ORWQC students the check ride will be given only after a minimum of 35 hours. Students will receive their Basic check ride sometime during the last two weeks of the course, by which time the students will have received all or nearly all of their allotted flight time.

Both Primary and Basic check rides will consist of the maneuvers taught during the stage of training being checked. These maneuvers are specified in the Pilot Performance Description Records (PPDR's). When the first performance of a maneuver is below average or unsatisfactory, it will be so recorded by the check pilot. A maneuver may be repeated at the check pilot's discretion to determine the student's ability to perform the maneuver satisfactorily. Although a student may be allowed a second attempt, the marks and grade on the first attempt will not be changed. Consequently, a student could have an "unsatisfactory" on a graded maneuver yet demonstrate a proficiency that warrants a satisfactory over-all grade for the check ride.

Student aviators who cannot reach the desired degree of proficiency commensurate with their flight experience will be given a progress check ride by the contractor flight commander or section commander. If this check ride is unsatisfactory, the student may be given additional time by the contractor or may be transferred to the Flight Evaluation Division for a second progress check ride. If the second check ride is unsatisfactory, the Flight Evaluation Division may recommend that the student be given additional time and a recheck or that he appear before a faculty board for further disposition.

A progress check ride conducted by the contractor will not be considered as an end-of-stage check ride even if the student receives a satisfactory grade and is in the prescribed time bracket. On progress

[1]This SOP was in use at the USAPHS at the time this report was written.

check rides, the number of attempts at each maneuver will be determined by the check pilot.

Check rides will be requested by the section commanders of the civilian contractor by notifying the scheduling officer of the Flight Evaluation Division, 24 hours in advance, as to the number of check rides desired for the following day. At this time, the scheduling officer will tell the section commander the exact number of rides that will be taken. Students will not be notified in advance of pending check rides.

All students scheduled for check rides will report to the Flight Evaluation Division Office where they will be assigned to check pilots. At this time, one of the check pilots will brief the reporting students on the grading system used and will inform them of the performance expected. Every attempt should be made to put students at ease at this time. They should be informed that no attempt will be made to trick them during a check ride and that they are to fly as if solo. Check pilots will accompany students to the aircraft and will supervise preflight and starting procedures.

Students scheduled for second flight-period check rides will be told where and when to meet check pilots. Students will not perform preflight procedures or start the aircraft engine until told to do so by a check pilot.

The check pilot will reemphasize to the student that the student is to perform all maneuvers just as he has been taught and, for all practical purposes, is to consider the flight as a solo ride. Check rides will start at preflight and will end after the engine is shut down and the main rotor blades have been secured. On Primary check rides, check pilots will tell the student prior to each maneuver what the next maneuver or maneuvers will be. Throughout the check ride, the check pilot will keep conversation to a minimum. Check pilots will not demonstrate maneuvers or instruct students in any way. The check pilot will take control of the aircraft only if he deems this necessary to keep a student from getting into a dangerous situation.

On the first period of Primary stage check rides from the main heliport, a student will be allowed to make a normal takeoff and accomplish one normal approach to the selected stagefield before actual flight-maneuver grading begins. However, during this period the student will be expected to fly to the stagefield and enter the traffic pattern properly. He will be told to fly to the stagefield, enter traffic, and make a normal approach. During the time before grading begins, the student should become familiar with the individual characteristics of the aircraft such as control feel, condition of trim, and so forth. He should also become familiar with the existing wind conditions.

When actual grading begins, the student will be told to make a 90° clearing turn (either direction), a normal takeoff, and a normal approach. After the normal takeoff he will be graded on a complete traffic pattern around the stagefield. Upon completion of a normal approach, he will be instructed to make a 180° clearing turn (either direction), a maximum performance takeoff, and a steep approach. He will again be graded on a complete traffic pattern around the stagefield. After the

termination of a steep approach to either lane 1 or 2, the check pilot may request either a normal takeoff or a maximum performance takeoff and a straight-in autorotation (basic autorotation). If the first autorotation is unsatisfactory, the check pilot may allow the student to make a second one; however, the grade on the first one will remain. When straight-in autorotations are completed, the check pilot will direct the student to hover from lane 3 to lane 4 or 5 provided stagefield control has given clearance for this hovering.

After arriving on lane 4 or 5 the student will be instructed to make a 360° clearing turn (either direction), a running takeoff, and a running landing. The check pilot will grade a student on the technique used in determining maximum power to be used. During the running takeoff maneuver the check pilot will pay particular attention to drift on climb-out to make sure the student does not cross over the center line or adjacent lane. The student will also be graded on a complete traffic pattern around the stagefield.

Upon completion of a running landing, the check pilot may request another running takeoff or instruct the student to hover forward to a taxiway and cross to lane 6 for a normal takeoff, after which the student will make a 180° autorotation. This autorotation also may be repeated if the first one is considered unsatisfactory. At any time during the check ride, a student may be asked to perform a forced landing maneuver from altitude, preferably after at least one approach has been accomplished. If possible a sod touchdown will be accomplished. Also, at any time the check pilot may ask the student to perform a forced-landing-from-a-hover maneuver. After this maneuver has been completed, the student will be required to perform a normal hovering autorotation.

When a check ride is completed, the check pilot will instruct the student to break out of traffic and to return to the stagefield parking area or main heliport, whichever is appropriate. After the aircraft engine is shut down and helmets removed, the student will be thoroughly debriefed. The check pilot will go over the complete ride, covering both minor and major errors. When debriefing is completed, the check pilot will make sure that the student understands all scored errors. The student will be told whether his check ride was satisfactory or unsatisfactory but no numerical or letter grade will be given at this time.

Basic stage check rides will be conducted in the same manner. The check pilot will point out to the student the area that he expects to use during the check ride. He should state where confined area, pinnacle operation, or running landing maneuvers are to be performed and make sure the student understands which areas are intended for use in these maneuvers. The student will accomplish one complete operation without further instructions from the check pilot. When the aircraft has been properly secured in an area, the student will exit the aircraft and perform a suitable ground reconnaissance as if he were solo. The student will be required to perform a confined-area operation, a pinnacle operation, and a running landing operation during the course of the Basic check ride. The check pilot will exit the

aircraft and will observe the ground reconnaissance at least once during a check ride. At this time the check pilot will have the student explain his hovering plan, the type of takeoff required, and his intended flight path.

At any time during a Basic check ride, the student may be told to perform a forced landing maneuver. Sod condition permitting, the student will be required to make a sod touchdown. If the first attempt is unsatisfactory, another may be given to determine the student's ability to perform this maneuver satisfactorily.

Slope landings will be demonstrated by the student during the Basic check ride. This maneuver may be requested by the check pilot at any time where the terrain permits. If a slope landing is required upon termination of an approach, the student will be expected to accomplish this without instruction from the check pilot.

The student will also be told to perform a forced-landing-from-a-hover maneuver. The time of this maneuver will be at the discretion of the check pilot—it may be given on termination of any approach, while hovering in areas, or just after takeoff.

When the check ride is completed, the student will be instructed to return to the stagefield or main heliport. Debriefing will be conducted in the same manner as in the Primary stage check ride.

No numerical or letter grade will be given to the student. He will be informed only as to whether his check ride was satisfactory or unsatisfactory. The grade will be determined by the check pilot after he reports back to the Flight Evaluation Division Office and will be placed on a flight evaluation grade slip. The check pilot will not tell a student his recommendations if the student's grade is unsatisfactory.

Appendix B

Construction and Use of Tables for Determining Statistical Significance of Class Deviations From School Average

The tables referred to under "Analysis of Class Data" (page 13) are used to determine the significance of deviations from the school average by individual classes on the various maneuvers. The tables list for each maneuver, by size of class, the amount (in terms of percentage error) by which a class average may be randomly expected to show a rate of error higher than the school average

column 1	25% of the time
column 2	10% of the time

Table B-1 presents the information for use with the Primary PPDR and is based on the PPDR records for 341 students in 10 classes during 1962. Table B-2 presents the information for the Basic PPDR and is based on the performance of 329 students in the same 10 classes.

The tabled values correspond to the 10% (1.28 SE_M) and 25% (0.67 SE_M) one-tailed probability points. The standard error of the mean (SE_M) was computed by the formula

$$SE_M = \frac{SD}{\sqrt{N}}$$

in which N is the number of students in the class and SD is the standard deviation for the maneuver concerned. The standard deviation for each maneuver was computed by the formula

$$SD = \sqrt{\frac{\Sigma X^2 - \frac{(\Sigma X)^2}{N}}{N-1}}$$

in which X is the percentage error score on the maneuver concerned for each student in the large normative group, X^2 is the square of each student's percentage error score, and N is the number of students in the normative group. The symbol Σ means "the sum of."

The two values tabled[1] give for each maneuver three possible evaluations of the significance of a deviation. If the class average percentage error exceeds the school average by an amount greater than that in column 2 of the table, the deviation should definitely be investigated. If the class average exceeds the school average by an amount between the values in columns 1 and 2 of the table, the deviation warrants preliminary investigation as to cause. If the class average

[1]The values of 1.28 SE_M and 0.67 SE_M have been rounded to the nearest whole number.

Table B-1

Information for Use With the Primary PPDR

Maneuver	Column	Size of Class							
		10	15	20	30	40	50	60	100
90° Hovering	1	4	4	3	3	2	2	2	1
Clearing Turn	2	8	7	6	5	4	4	3	3
Normal	1	3	3	2	2	2	1	1	1
Take-off	2	6	5	4	3	3	3	2	2
Traffic	1	2	2	2	1	1	1	1	1
Pattern	2	4	3	3	2	2	2	2	1
Normal	1	2	2	2	1	1	1	1	1
Approach	2	5	4	3	3	2	2	2	1
180°	1	5	4	4	3	3	2	2	2
Clearing Turn	2	10	9	7	6	5	5	4	3
Maximum	1	4	3	3	2	2	2	1	1
Take-off	2	7	6	5	4	3	3	3	2
Traffic	1	2	2	2	1	1	1	1	1
Pattern	2	4	4	3	2	2	2	2	1
Steep	1	3	2	2	2	1	1	1	1
Approach	2	5	4	4	3	3	2	2	2
Basic	1	2	2	2	1	1	1	1	1
Autorotation	2	5	4	3	3	2	2	2	1
180°	1	3	2	2	2	1	1	1	1
Autorotation	2	5	4	4	3	3	2	2	2
360°	1	5	4	4	3	3	2	2	2
Clearing Turn	2	10	8	7	6	5	5	4	3
Running	1	3	2	2	2	1	1	1	1
Take-off	2	6	5	4	3	3	3	2	2
Traffic	1	2	2	2	1	1	1	1	1
Pattern	2	5	4	3	3	2	2	2	1
Running	1	2	2	2	1	1	1	1	1
Landing	2	5	4	3	3	2	2	2	1
Forced	1	3	3	2	2	2	1	1	1
Landing	2	6	5	4	3	3	3	2	2
Forced Landing	1	4	4	3	3	2	2	2	1
From Hover	2	8	7	6	5	4	4	3	3
Hovering	1	4	3	3	2	2	2	2	1
Autorotation	2	7	6	5	4	4	3	3	2

NOTE: Values at 0.67 SE_M (column 1) and 1.28 SE_M (column 2) in terms of percentage error by maneuver for selected class sizes; Primary PPDR.
Data based on 341 Primary check rides for 10 classes; 62-8AB - 63-1WA.

Table B-2

Information for Use With the Basic PPDR

Maneuver	Column	Size of Class							
		10	15	20	30	40	50	60	100
Confined Area	1	4	3	3	2	2	2	2	1
High Recon.	2	7	6	5	4	4	3	3	2
Low Recon.	1	2	2	2	1	1	1	1	1
and Approach	2	5	4	3	3	2	2	2	1
Take-off	1	3	2	2	2	1	1	1	1
Preparation	2	5	4	4	3	3	2	2	2
Take-off	1	3	3	2	2	2	1	1	1
	2	6	5	4	3	3	3	2	2
Pinnacle	1	4	3	3	2	2	2	2	1
High Recon.	2	7	6	5	4	4	3	3	2
Pinnacle Low Recon.	1	2	2	2	1	1	1	1	1
and Approach	2	5	4	3	3	2	2	2	1
Take-off	1	2	2	2	2	1	1	1	1
Preparation	2	5	4	4	3	3	2	2	2
Take-off	1	3	2	2	2	2	1	1	1
	2	6	5	4	3	3	3	2	2
Running Landing	1	3	3	2	2	2	1	1	1
and High Recon.	2	6	5	4	3	3	3	3	2
Running Landing	1	3	2	2	2	1	1	1	1
Approach	2	5	4	4	3	3	2	2	2
Take-off	1	3	2	2	2	1	1	1	1
	2	5	4	4	3	3	2	2	2
Forced	1	3	2	2	2	2	1	1	1
Landing	2	6	5	4	3	3	3	2	2
Forced Landing	1	4	3	3	2	2	2	2	1
From Hover	2	7	6	5	4	4	3	3	2
Slope	1	3	2	2	2	1	1	1	1
Right Skid	2	5	5	4	3	3	3	2	2
Slope	1	3	2	2	2	2	1	1	1
Left Skid	2	6	5	4	3	3	3	2	2

NOTE: Values at 0.67 SE_M (column 1) and 1.28 SE_M (column 2) in terms of percentage error by maneuver for selected class sizes; Basic PPDR.
Data based on 329 Basic check rides for 10 classes; 62-8AB - 63-1WA.

exceeds the school average by an amount less than that in column 1 or if the class average is less than the school average, the deviation does not warrant detailed study.

The two values selected, and hence the three evaluation categories, are arbitrarily chosen. However, they are chosen on the basis of experience to give reasonable evaluation guidelines to the quality control system. These three evaluations may be characterized as (1) the deviation from school average is not large enough to warrant detailed study (the "no investigation" category); (2) the deviation, while not

serious, is large enough to warrant preliminary examination as to cause (the "optional investigation" category); and (3) the "mandatory investigation" category. The two points selected will result in approximately 75% of the comparisons falling in category (1), 15% in category (2) and 10% in category (3).

Application of the above probability estimates to the Primary PPDR's (17 maneuvers) for a group of 10 classes would result in an expectation of about 17 of the maneuvers falling in category (3), the "mandatory investigation" category; about 25 in category (2), the "optional investigation" category; and 128 in category (1), the "no investigation" category.

Stated differently, in a typical class on the Primary check ride there might be one or two "mandatory investigation" maneuvers, two or three "optional investigation" maneuvers, and 12 or 13 "no investigation" maneuvers. Obviously, some classes will be better than this and some worse, but this would be the average expectation. For the Basic check ride, with its 16 maneuvers, the expectation would be approximately the same as above.

As an example of how to use the table, assume that a class of 50 students has an average percentage error of 25 on the first maneuver of the Primary PPDR—the 90° clearing turn. If the school average for this maneuver is 20% error, this class exceeds the school average by five percentage points. Reference to Table B-1 shows that 5% is greater than the value tabled in column 2 for this maneuver (4%) for a class of 50 students. Thus, the deviation of five percentage points from the school average falls in the "mandatory investigation" category. However, assuming the same class percentage error (25) and the same school average (20), but with only 20 students in the class, the same 5% deviation would fall into the "optional investigation" category. For a class of 20 students a deviation of 5% for this maneuver falls between the values tabled in columns 1 and 2. Thus, the same amount of deviation has less statistical significance when it is based on a small class than when it is based on a large class. Similarly, the significance of a given deviation (holding size of class constant) will vary from maneuver to maneuver. The 5% deviation for a class of 50 students in the above example falls in the "mandatory investigation" category. The same deviation for a class of 50 on the 180° clearing turn maneuver falls into the "optional investigation" category.

While the variability measures[1] in the tables (SE_M and SD) will be less likely to show marked change over time than will the school average percentage errors, it is recommended that the tables be revised about once a year. At this time new SDs and SE_Ms should be computed, based on the most recent 300-500 students going through the school.

[1]Only the values 1.28 SE_M and 0.67 SE_M are actually tabled. The SD is used in computation of the SE_M.

UNCLASSIFIED