DEVELOPMENT OF AN OBJECTIVE PROFICIENCY CHECK FOR PRIVATE PILOT CERTIFICATION

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C O N T E N T S

A P P E N D I C I E S

SUMMARY

As a specific contribution to the long range CAA aviation safety research program, the American Institute for Research has undertaken the development of an objective proficiency check for private pilot certification. The single and immediate purpose is to develop and objective flight-check which will improve the measuring and evaluation of the critical skills necessary for safe and efficient private flying.

The first step in the job analysis phase of the project consisted in an examination of all the accident reports for the year 1947 that involved the student or private pilot. Particular attention was paid to the accident report categories which showed the type of behavior involved in the pilot error accidents. The operational phase during which the accident took place was also included as a part of this job analysis.

In May, 1949 the first meeting of the panel of expert consultants and advisers was held in Pittsburgh. Using the accident report data, a tentative job analysis was formulated with the conclusion that the final flight-check should emphasize two major types of private flying: (1) pleasure flying around the home airport and (2) cross country flying. A rough draft list of possible maneuvers and specific items which might be included in an objective check for measuring the critical private pilot skills was accomplished in this first conference.

After a temporary lapse, the project was reactivated by the Research Division of CAA in June, 1950. In July a second conference of the advisors was called and after a review of the work during the preceding year, further refinements were made in the maneuvers and items to be included in the check. The basic guiding principles to be followed in developing this test were also outlined.

The accumulated experience and knowledge of the several hundred check pilots throughout the country was immediately recognized as a valuable and necessary resource to be used in developing and modifying the new objective flight-check. Active and continuous use was made of this professional group of experienced check pilots. A greater part of the summer of 1950 was spent interviewing Examiners, intructors, fixed base operators, private pilots and CAA Airman Safety Agents in several parts of the country. Repeated revisions of the flight-check were made in the light of the accumulated information provided by these field workers. Throughout these revisions, however, the guiding principles of an objective flight-check were maintained. These can be identified as: uniform statdards, on the spot recordings, efficient description, objective items, clearly defined tasks, consistent measurement, and critical components.

In the ranking of critical pilot skills, the priority position of "judgment" is recognized. The entire flight-check is designed to give a maximum measure of the judgment of the student pilot as shown in his actual performance during the flight. To measure this important variable, several new type maneuvers were introduced into the check.

Rather than following the traditional pattern of testing skills in the abstract, e.g., ability to glide, ability to control for wind drift and ability to coordinate, maneuvers are drawn up in terms of minature "job samples". This is believed to be a more realistic and practical approach since it measures the critical flying skills in the context of an actual and important flying situation in which the private pilot should be competent. Furthermore, the principle was

followed of combining several measures to test the maximum number of specific skills with the minimum number of maneuvers.

On the basis of a large number of personal interviews, group discussions and preliminary in-the-air tryouts, conferences with consultants and advisers, questionnaire returns from experts throughout the country, as well as two formal data gathering experiments, the following thirteen maneuvers were selected for the final form of the flight-check: I. Rented Airplane Pre-flight check, II. Taxi for Take-off, III. Crosswind Take-off, IV. Cross Country, V. High Forced Landings, VI. Strange Field Procedure with Power and Opposite Traffic Pattern, VII. Low Altitude Observing, VIII. Reorientation, IX. Stall Recognition, X. Stalls, XI. Landings, XII. Short Field Take-off, XIII. Final Taxiing.

The first formal experiment was a comparison of the results of the objective check given to ten student pilots near the end of training versus eight advanced pilots. The data showed a significant and consistent difference in favor of the advanced group which confirms the differentiating power of the objective check.

Following the revisions indicated by these findings, a more extensive test-of-the-test was again carried out at the Institute of Aviation, University of Illinois. Twenty-five student pilots received the objective check at the 20-hour level of training and again at the end of the course (40-hour). Results indicate that the objective "total points-off" score agrees with instructor's grade as well as does the check pilot's subjective grade. Furthermore, there is no consistent agreement between the check pilots subjective grades on each student at the 20-hour level as compared to the 40-hour period. In contrast there was a significant agreement between the 20 and 40-hour sets of objective scores.

The final systematic study was based on the 90 returns from a questionnaire mailed to CAA Airman Safety Agents and selected members of AOPA. By a ratio of 8 to 1, the replies indicated a favorable attitude for the continued development of the objective type of certification check. The greater emphasis on cross country training was particularly well received. On the basis of these replies plus a final conference with the panel of experts held in Washington in March, 1951, the final revision of the check was made in the form appearing in the Appendix of this report. In this final printing, particular attention has been given to the arrangement of the items in the test booklet so as to provide the most effective layout for efficient use by the check pilot in the air.

Several recommendations are made with the view of obtaining more empirical data concerning the reliability of the check but especially the validity of the objective score when compared with later accident reports on students who receive this check. This continued refinement and improvement is directed toward the goal of using the objective flight-check for the final certification of private pilots.

DEVELOPMENT OF AN OBJECTIVE PROFICIENCY CHECK FOR PRIVATE PILOT CERTIFICATION

C H A P T E R O N E

STATEMENT OF THE PROBLEM

I. The CAA Safety Research Program

In addition to the continuing responsibility of administrative supervision of American aviation, the Civil Aeronautics Administration has long sponsored and encouraged research on all aspects of commercial and private flying. The primary goal of this research sponsorship is greater safety and utility in flying. The research project to be reported here is directed toward these ends and finds its major justification in these goals.

The unique advantage of the present study is its direct approach to the major source of accidents - the pilot himself. Aviation safety has been greatly improved as the result of engineering developments and regulatory policies but exhortation and warnings have too often remained the major methods of controlling pilot safety. This project is directed at improving the measurement and evaluation of the critical pilot skills which are necessary for safe and efficient private flying.

II. The Specific and Immediate Objective

Our single and immediate purpose is to develop an objective flight-check for use in private pilot certification. The completed project herein reported should be considered as the initial step. Continued developmental research will provide information and data important as a basis for making administrative decisions and formulating policies regarding methods and procedures for private pilot certification.

The basic hypothesis of the project is reflected in the following statement:

> It is believed that safety in flying and the over-all proficiency level of private pilots will be improved if all Examiners have available a uniform and efficient objective procedure for making their in-the-air analysis of the student's judgment, technique, safety, and specific flying skills.[1]

III. Previously Published Report; Summary

In February, 1950, the American Institute for Research published a report of an incomplete survey, conducted under the sponsorship of the Committee on Aviation Psychology, National Research Council, with funds from the Division of Research, Civil Aeronautics Administration. That report states:

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1. Manual of Instructions, p. 1, see Appendix A

> In January, 1949, the National Research Council Committee on Aviation Psychology authorized the American Institute for Research to conduct a program of research aimed at the development of an objective flight-check for the initial certification of private pilots. Funds were supplied by the Civil Aeronautics Administration. In August, 1949, all activity on the project was brought to a temporary halt because the funds allocated to this project had to be used elsewhere.[2]

For a better understanding of the initial work done on the project, reference should be made to this preliminary report. Two important research phases are described in the following summary:

> The first step in the project consisted of an analysis, taken from the records of the Accident Analysis Division, Civil Aeronautics Board, of all the accidents that occurred during 1947 that involved error on the part of the student or private pilots and resulted in fatal or serious injury to personnel or in substantial damage to the aircraft.
>
> The analysis revealed the maneuvers flown by private pilot's which were critical; i.e., those maneuvers in which accidents most frequently occurred, and the pilot behaviors most frequently responsible for accidents were also extracted. These data, together with a review of previous work in the field of private pilot evaluation, were presented to a group of consultants and advisors at a conference on May 6 and 7. The conference resulted in two items of particular value to the project.
>
> (1) The group prepared an analysis of the activities of the private pilot which included those things he does in preparing for and flying a typical cross-country flight. The flight encompassed both general types of private flying carried on in the United States; i.e., the pilot who flies for the sport of flying and seldom leaves the immediate vicinity of the airport and the "business man"flier who makes longer cross country flights.
>
> (2) Items were then written by the consultants and others of the group to cover these phases of the private pilot's activities, including the following maneuvers:

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2. Nagay, John A. A Report of Progress on the First Steps in the Development of a Procedure for Measuring the Proficiency of Private Pilots. Committee on Aviation Psychology, National Research Council. Pittsburgh: American Institute for Research, February, 1950, p. 1.

1. Making Preparation for Take-off
2. Taxiing to Take-off
3. Crosswind Take-off
4. Forced Landing on Take-off
5. Cross Country Flight
6. Slow Flying
7. Low Forced Landing
8. High Forced Landing
9. Specified Field Forced Landing
10. Simulated Opposite Traffic Pattern and Wind-Direction Measure
11. Precautionary Landing
12. Crosswind Landing
13. Taxiing from Landing

Several phases of the project remain to be completed. These include:

(1) Tryout of the items in flight
(2) Further revision and development of the items including an additional content analysis of accident data in terms of the activities of the private pilot.
(3) Organization of the items into a sequence of maneuvers; i.e., a formal flight-check.
(4) A reliability study of the procedure to determine its observer-observer and ride-ride reliability.
(5) The establishment of procedures for the eventual validation of the measure against accident criteria; i.e., to affirm or deny the hypothesis that the procedures insure the certification of only those pilots who will fly safely.[3]

The project was reactivated by CAA in June, 1950, and in July most of the same persons who participated in the initial conference met together in Pittsburgh to plan the next phases in the development of the private pilot certification flight-check.

IV. Orientation Toward Civilian Private Flying Rather than Military

What should we expect the private pilot to do? The specific answers to this question will define the content of the final certification check. It was the consensus of the group of consultants and advisers that private flying should be emphasized in terms of its usefulness as well as pleasure. Two important aspects can be identified: (1) Pleasure flying around the home airport and (2) cross country flying. Each phase maximizes certain skills and abilities, all of which, however, should be adequately demonstrated on the final certification flight-check. These two major aspects: pleasure flying around the home airport and cross country flying represent the two major purposes of private flying toward which the objective certification flight-check would be directed.

V. What Are The Precedents for an Objective Type Flight-Check

The Division of Research in CAA was one of the first agencies to support exploratory work toward the development of objective measures of pilot proficiency.

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3. Nagay, John A., op. cit., p. ii.

As the result of a series of grants to the National Research Council, Committee on Aviation Psychology, the Ohio State Flight Inventory was developed and tested in several research projects.[4] Dr. Robert Y. Walker participated in much of this early research and served as an adviser to the present project.

In Report No. 8 of the Aviation Psychology Program in the Air Force is summarized another pioneer effort to construct objective measures of pilot proficiency. This research was directed at all levels of pilot training from primary to multi-engine intrument flying. Not a great deal of the specific findings of the development work done at the primary level is directly applicable to the present project but this experience and the research reports provide a valuable background permitting rapid and effective progress toward the construction of an objective type proficiency flight-check for the civilian private pilot.[5]

A more immediate precedent for the construction of objective type flight-check designed for non-military use is shown by the Airline Transport Rating Check, developed by the American Institute for Research.[6] This check has been submitted to the CAA and is in active use by Military Air Transport Service (MATS). Several of the commercial airlines gave their active cooperation in this development and have been experimenting with its possible use in the evaluation of their flying personnel.

Viewed against the background of traditional methods of pilot evaluation, the objective type check appears quite radical and the negative reactions that have and will appear from time to time are quite understandable. It should be clearly recognized, however, that the objective type check is not just an idea that needs to be "sold"; rather it is a scientific method of pilot evaluation, which must be supported or discarded entirely in terms of the evidence accumulated. Personal prejudice and tradition are not alone sufficient evidence.

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4. Edgerton, Harold A. and Walker, Robert Y., History and Development of the Ohio State Flight Inventory, Part I: Early Versions and Basic Research. Civil Aeronautics Administration, Division of Research, Report No. 46, Washington, D. C., July 1945.
   Thompson, A. S., History and Development of the Ohio State Flight Inventory Part II: Recent Versions and Current Applications. Civil Aeronautics Administration, Report No. 51, Washington, D. C., November 1945, pp. 19-20.
   Walker, Robert Y., Wapner, Seymour; Bakan, David, and Ewart, E. S. The Agreement Between Inspectors' Observations as Recorded on the Ohio State Flight Inventory and Instrument Readings Obtained from Photographic Records. Civil Aeronautics Administration, Division of Research, Report No. 67, Washington, D. C., August 1946, pp.9-28.

5. Miller, Neal E.(Ed.) Psychological Research on Pilot Training, Army Air Forces Aviation Psychology Program Research Reports, No. 8, 1947.

6. Gordon, Thomas. The Development of a Standard Flight-Check for the Airline Transport Rating Based on the Critical Requirements of the Airline Pilot's Job. Washington, D. C.: Civil Aeronautics Administration, Division of Research, Report No. 85, April, 1949.

The decision of whether this new private pilot proficiency measure should be objective or not was never a question in defining the goals of the over-all project. The specific issues revolved around what are the private pilot skills and abilities needed to be assessed and in what specific forms shall the different items making up the several maneuvers be presented to achieve a reliable and valid result.

C H A P T E R T W O

GUIDING PRINCIPLES IN DEVELOPING THE OBJECTIVE FLIGHT-CHECK

If we draw an arbitrary line between practical, everyday attempts to solve problems and the scientific approach, we can see the contrast between two major points of view directed at the problem of improved private pilot evaluation.

For many years check-pilots have been testing and grading student pilots and applicants for more advanced licenses, and during this time certain checking procedures have become fairly well "set". It can be assumed that the individual check pilot is satisfied with, and has some confidence in, the over-all evaluation he makes of the student. He is not exposed to systematic data or statistics which might cause him to question the validity of his assessment.

For an approximately equal number of years research workers have been improving our understanding of the crucial scientific principles or rules which must be followed in attempting to measure human abilities and achievements. Specific techniques and methods for measuring the human variable are now available as a result of this basic research effort. These methods have been checked and rechecked time and time again, and we can now expand into new areas the application to the scientific (objective) methods of human evaluation.

In a large sense, the present project is an attempt to focus on the practical problem of pilot proficiency measurement, the background of knowledge and techniques resulting from theoretical and applied research by scientists working on the human variable. However, this application of scientific measurement is guided and given direction by professional pilots working directly in the area of private pilot training and certification. The second group is as important as the first and it is this professional pilot group, in fact, that must bear the permanent responsibility of providing fair and accurate assessment of the private pilot candidates.

I. Limitations of Economy, Tradition, and Bias

The purpose of this project is to develop a flight-check which can be used by CAA designated Examiners in all parts of the country. These individuals are not employed by CAA and are, for the most part, fixed-base operators and instructors representing a wide variety of pilot training points of view and experience. We have proceeded with the development of the present flight-check keeping in mind the very definite limiting conditions which would apply to the use of this check by Examiners throughout the country.

One of these barriers is a problem of economy. Flight testing is expensive and few private school operators will want to demand of their students (customers) an expensive two or three hour flight-check when they already have confidence in the results of a forty to sixty minute check. Actually the question of how long must a flight-check be to provide a reliable and true measure of the student's proficiency has not yet been established on the basis of research findings. We attempted to limit the present check to approximately an hour and fifteen minutes flying time.

When checking students, certain terms and categories have become established as being both necessary and sufficient to evaluate the private pilot candidate. Perhaps the most common of these is "judgment." "Planning," "coordination," and "innate skill" are other terms which the check has traditionally been expected to include If these terms are omitted from the new check, the typical check pilot is quite likely to feel that some of the most important pilot skills have been left out. A little later in this report we will show the place of "judgment" in the use of this new objective flight-check.

These are simply two of the recognized limitations, which functioned as modifiers and restrainers during the development of the objective check. In this connection, it should be pointed out that the CAA specifically encouraged the project officers to pay minimum attention to these traditional states of affairs as well as to the existing CAA regulations, if it was felt that these were interferring with the development of the most effective certification procedures. Such open-mindedness is particularly necessary during the initial and survey phases of research development.

II. Importance of the Job Analysis

The most important things the pilot does should be the most important elements in the certification flight check. The first step in the development of an adequate evaluation procedure is a thorough job analysis which will reveal what the private pilot does, or can be legitimately expected to do. The immediate second question becomes: what particular information, skills, and abilities must the pilot have in order to control and execute his desired maneuvers? These are legitimate questions to ask but are difficult to answer, at least in a way that will receive general agreement. However, some answers must be given before even the first steps can be taken to outline the proficiency check since it is obviously inefficient to assess the private pilot candidate on irrelevant or minor skills and abilities.

A. Proceding with the Job Analysis Under the Objective Point of View

Nearly every pilot will willingly state his personal opinion regarding the critical attributes of the safe private pilot. This, however, is not enough, even though the respondent may be quite confident, if not dogmatic, regarding the validity of his answers. The objective and scientific point of view requires "public" agreement as to these critical skills. This agreement can be obtained by pooling the separate opinions of experts. Another type of answer, different but useful, is to examine those cases where the pilot skills were apparently inadequate or inappropriate to the specific situation. This is simply an academic way of saying that the pilot got in trouble and had an accident. Both methods of making the job analysis were used.

1. Accident Reports

Private pilot flying is a well established phase of aviation, concerning which considerable experience and information exists. Of initial importance in making use of this body of knowledge is an examination of the accident reports. These reports presumably indicate the specific kinds of situations in which either the plane and/or the pilot failed or were inadequate to meet the conditions.

"The first step in the project consisted of an analysis, taken from the records of the Accident Analysis Division, Civil Aeronautics Board, of all the accidents that occurred during 1947 that involved error on the part of the student or private pilot and resulted in fatal or serious injury to personnel or substantial damage to the aircraft.[7]

During the selected year, 1947, approximately 71% of the accidents were found to have "pilot error" as their primary cause. Table 1 shows the number of students in private accidents of all types in relation to various pilot behaviors that make up the term "pilot error."

Some of the entries in Table 1 give fairly specific leads as to the type of items which might be constructed to cover skills important for safe flying, e.g., 13 per cent of all the student accidents involving pilot error showed "misuse of brakes". In contrast, the 11 per cent placed under the omnibus heading "operating recklessly" cannot be subject to objective analysis until we know more specifically where, how, and what this reckless flying is. The biggest single cause of pilot error accidents is "misjudged distance". This may or may not be a general ability or skill but we do know that this variable in its specific expressions should be seriously considered in designing a certification flight check.

TABLE 1

PILOT ERROR IN RELATION TO PILOT CERTIFICATE (1947)[8]

Primary Cause	Student		Private	
	No.	Percent	No.	Percent
Misuse, powerplant and controls	143	07%	124	05%
Misuse brakes, flight cont., gr.	273	13%	218	08%
Improper use flight cont., air	34	02%	44	02%
Exceed stress limits, acft	1	00%	5	00%
Inattentive, fuel supply, valves	42	02%	127	05%
Failure to retract or extend gear	2	00%	38	01%
Selected unsuitable terrain	119	06%	303	11%
Failure to compensate for wind	111	05%	99	04%
Misjudged distance	228	11%	386	14%
Improper level off	411	20%	246	09%
Failure to observe acft, objects	157	08%	227	08%
Failure to maintain flying speed	196	10%	355	13%
Became lost (VFR)	50	02%	47	02%
Continued VFR unfavorable weather	25	01%	87	03%
Improper instrument operation	0	00%	1	00%
Operating recklessly	228	11%	303	11%
Inadequate flight prep.	9	00%	38	01%
Exceeded ability, experience	15	01%	51	02%
Improper use misc. equipment	2	00%	4	00%
Other	18	01%	32	01%
Improper training, super., flight	0	00%	7	00%
TOTALS	2064		2756	

7. Nagay, John A., op. cit., Table VII, p. 13.
8. Ibid., p. 13.

One of the chief difficulties in the use of accident data is the limitation imposed by the categories employed in making the accident report breakdown. Several different analyses were made in an attempt to isolate the specific pilot variables involved in these accidents. Tables showing frequencies of accidents of varying degree of seriousness in different flying situations and in terms of different categories appear in the published Preliminary Report.[9] Two of these tables, Appendices D and E, are reproduced to show two different ways in which accidents can be analyzed. Appendix D is drawn up in terms of pilot behavior while E represents an analysis in terms of the maneuver in which accidents occured.

Appendix D shows the frequency with which the pilot behavior was judged to be primarily responsible for accidents and also the frequencies of behaviors which were judged to be the secondary cause. For example, under the second category "Failure of lack of skill in handling controls" the biggest single cause of accidents was the second item "Failed or was too late in applying carburetor heat." It is apparent from this particular analysis that correct control of carburetor heat is an important pilot skill and we have, therefore, included carburetor heat items wherever appropriate throughout this check.

Appendix E shows the frequency of private and student pilot accidents grouped according to the operational phase in which they occurred. For example, under Operational Phase VIII, Landing, and sub-phase D, Go Around, 14 accidents occurred during the "pull-up" and 2 during the "level-off after the climb." This suggests that if one were choosing items for a take-off maneuver, an item covering the pull-up might more justifiably be added to a proficiency check than one on the level-off after climb.

Frequency of accident occurrence should not, however, be used as the sole criterion of the relative importance of items. It is for this reason that no over-all summary was made; these tables were simply available for continuous reference to help determine the pilot skills most important for safe flying and, conversely, the deficiencies which are most likely to lead to accidents. It was in terms of these variables that the original list of maneuvers and items were drawn up.

2. Panel of Experts

There is in this country a growing nucleus of scientists working on problems of the human variable in aviation. These individuals are sensitive to the problem of flying as viewed by the pilot, and the Examiner, in addition to knowing the value and possibilities of scientific research work aimed at safer and more efficient flying. Extensive use has been made of the larger perspective of this group of expert consultants and advisers.

On three different occasions a group of from ten to twelve of these expert advisers were called together. The job analysis was the first order of business and continued to be the number one criterion against which each new maneuver and item was evaluated. (See Acknowledgment for list of persons participating in these conferences.)

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9. Nagay, John A., op. cit.

The first meeting was May 6-7, 1949. At this time the over-all purpose of the project was discussed and the major steps for its accomplishment were outlined. More specifically the accident report data were analyzed and the job analysis carried out in some detail prior to constructing a rough draft series of items and maneuvers.

The second conference was held about a year later on July 7-8, 1950. By this time the sponsorship shifted from the National Research Council, Committee on Aviation Psychology, directly to the Research Division of CAA. Results of the initial conference were reviewed, especially with respect to the essential skills to be expected and required of the private pilot and the different maneuvers and items which should be included in any final certification flight-check.

A final conference was held on March 21, 1951 at which time the final form of the experimental flight-check was given a rigorous and critical analysis. Special consideration was given to the results of the 26 students tested with the Experimental Objective Flight-Check at the Institute of Aviation, University of Illinois. Results of the questionnaire sent to approximately 400 field workers were also given careful review and interpretation. During this final conference, an attempt was also made to establish the most effective method of scoring the objective flight-check.

III. Continuous Liaison with Professional Pilot-Training Personnel

It is important to make this objective flight-check available for criticism and constructive comments by those persons most immediately involved in its actual use - Instructors, Examiners, and CAA Aviation Safety Agents. Approximately eight weeks were spent conducting interviews and preliminary try-outs with such individuals in several parts of the country. This is an expensive and time consuming process but one well worth the time, money, and effort, especially during the early stages when it was necessary to select the particular maneuvers and decide on the specific items to be used for evaluating the student.

To obtain a wider sample than was possible via personal interviews, the flight-check, the Manual of Instructions, and an eleven-item questionnaire was mailed to about 200 CAA Safety Agents and 200 selected members of AOPA. (See Appendix C, this report.)

Only temporary freezes should be placed on the content and mechanics of handling this objective type flight-check. Helpful suggestions in the form of new maneuvers, specific items, and methods of handling the certification flight-check can always be expected from the pilots and Examiners as they become more familiar with this new method of proficiency evaluation.

IV. Survey of Related Research

One of the basic guiding principles characterizing the objective approach to this problem is the careful analysis of previous research work done on the problem of measuring pilot proficiency. Furthermore, an "open door" policy must be maintained to permit later modifications and adjustments in the light of current and future aviation research.

The published preliminary report of this project carries a review of the literature and summarizes the contributions made by the Psychological Research Program during World War II in the Air Force.[10] Special reference is made to the objective measures of flying skill developed at the primary level. The results of several studies using the Ohio State Flight Inventory are also summarized.

A major source of guidance and information was the development and final form of the Airline Transport Rating objective check prepared for the CAA by the American Institute for Research.[11]

The conclusions drawn from the series of studies done with the stall-warning device by the Educational Research Corporation were also incorporated in designing the new private pilot flight-check.[12]

The main point to be emphasized here is the crucial need of maintaining intimate liaison with any and all research projects related to the problem of pilot proficiency measurement. Whenever applicable, it is urged that these scientific findings be utilized more and more to replace the personal opinion and subjective judgment of separate individuals. As we have repeatedly emphasized, this latter source of information is, of course, vital but can be used with maximal efficiency only when a systematic compilation is made of the several divergent opinions of experienced and expert persons.

V. What is an Objective Flight-Check

A. Contrast with the Traditional Subjective Evaluation

"A blank sheet of paper is the best possible kind of grading sheet," according to one of our respondents in the questionnaire survey. This man expresses quite honestly the point of view of many experienced check pilots throughout the country - the student is judged to be "satisfactory" or "unsatisfactory". But, if greater precision (?) is demanded by some higher authority, the check pilot may assign a letter or per cent grade indicating the student's over-all level of proficiency. In this subjective method of grading, the student pilot is observed and evaluated against the frame of reference of the check pilot's own experience, special biases and preferences, and general attitude toward the student. It is quite understandable that the experienced check pilot, and most of them are experienced, has considerable confidence in the validity of his final assessment of the candidate. There is only one basic defect to this subjective method: other and equally well qualified check pilots do not agree at all well in their evaluation of the flying skills possessed by a given student. It inevitably follows, therefore, that as long as subjective grading produces disagreement, some other method of proficiency measurement must be introduced in an attempt to specify more accurately the particular deficiencies

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10. Nagay, John A., op. cit.

11. The Development of a Standard Flight-Check for the Airline Transport Rating Based on the Critical Requirements of the Airline Pilot's Job. Washington, D. C.: Civil Aeronautics Administration, Division of Research, Report No. 85, April 1949.

12. A Study of the Accuracy of Recognition of the Incipient Stall in Familiar and Unfamiliar Planes. Washington, D. C.: Civil Aeronautics Administration, Division of Research, Report No. 74, November, 1947

and abilities that the given student possesses.

Successful, efficient, and enjoyable cross country flying, for instance, cannot be accomplished with the aid of good intentions alone. Throughout the check, therefore, we should avoid any attempt to grade what the student pilot "intended" to do or knew he should (but did not) do. Grading should represent only those actual behaviors that the pilot demonstrated in his control of the plane. The traditional pilot maxim "if you can walk away, it's a good landing" is a good objective item but in a final certification flight-check we would like a more specific report in order to predict with more confidence how many more landings he can continue to walk away from. So, in place of grading ' did he walk or was he carried away from the plane,' a good many specific responses of the pilot and movements of the plane are isolated and graded in the same objective manner.

B. How Does the Objective Flight-Check Accomplish its Purpose

The main purpose of an objective flight-check is to help the check pilot make a detailed and diagnostic evaluation of the private pilot applicant. The objective type flight-check is by no means a mechanical substitute for the skilled observations of a qualified Examiner. Only the experienced observer can discriminate accurately and record correctly, the actual performance of the student pilot. The objective check sheet helps the examiner by providing a stable and agreed-upon standard against which the performance of the student can be assessed. This consistent and objective frame of reference is actually the pooled and combined judgment of a large number of experts and qualified Examiners and check pilots. In other words, the standarized flight-check attempts to maximize all of the best judgments and opinions of experienced persons as well as scientific research findings on the problem of private pilot evaluation.

If the full potentials of this new procedure are to be realized, it is essential that all Examiners have a clear understanding of the principles upon which it is based and the purposes served by its departure from the previous and traditional flight-check practices. These principles have been well summarized in the Manual to accompany the Pilot Flight Test Report for the Airline Transport Flight Examination.[13]

(1) Uniform Standards

The use of the objective flight-check will result in more uniform standards of proficiency. Everyone has to meet the same requirements and the standards are the same for everyone.

(2) On-the-Spot-Recording

Many studies on the reports of eye-witnesses have shown that memories of specific events tend to be blurred and distorted. The check pilot using the objective flight-check form need not rely on memory because all recording is done in the air immediately after observations are made.

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13. Flight-Check Manual to accompany the Pilot Flight Test Report for the Airline Transport Rating Flight Examination. Washington, D. C.: U. S. Department of Commerce, Civil Aeronautics Administration, April 1950, Pp. 3 - 7

(3) Efficient Description

In order to get a complete picture of what went on during the flight, the check pilot needs only to mark a few checks or X's in the flight-check booklet.

(4) Objective Items

A flight-check is objective if the student's score is based upon what he did rather than on who gave the check. This flight-check attains objectivity by the use of the following three techniques:

(a) The use of pictorial diagrammatic aids which portray various courses and attitudes of the plane for easy reference and comparison by check pilots.

(b) The use of quantitative data such as those which can be read accurately from flight instruments.

(c) The use of precise descriptions - not "how well" a pilot accomplished the traffic pattern as a whole, for example, but specifics such as altitude and airspeed control at several critical points in the pattern.

(5) Clearly-Defined Tasks

Many flight-checks do not spell out the task for the pilot -- he is uncertain as to precisely what is expected of him. For example, some people consider it most important not to lose any airspeed, while others emphasize the maintenance of a constant altitude. However, the candidate is frequently not informed of these individual standards.

This flight-check stipulates that the check pilot and student discuss the flight on the ground so that the student knows in advance the limits he is expected to maintain.

Another factor that contributes to misunderstanding of the task is the lack of clear and uniform instructions. The flight-check outlines each point to be covered in such a way that the possibility of misunderstanding on the part of the applicant is minimized.

(6) Consistent Measurement

If independent check pilots observing the same applicant can agree as to how well or how poorly he flew, the flight-check they are using is reliable.

(7) Critical Components

The intensive research that went into the development of this flight-check resulted in the preparation of a list of the critical components of the private pilot's job. The flight-check was built around these components.[14]

14. Ibid., Pp. 3 - 7

VI. "Judgment"

It is quite likely that if a group of experienced pilots were to list in rank order the most important abilities for a safe private pilot, the term "judgment" would head the list. With this high priority position, most of us are likely to agree. The crucial question is: How do we know whether or not a given student has good judgment? The answer must come from something we observed that the student did or said. The term "judgment," therefore, is nothing more than a label referring to a series of observed actual behaviors on the part of the student pilot. This new objective check attempts to evaluate judgment by recording the actual performance of the student in flight. The Examiner begins his observation of the student's judgment during the Pre-flight Check and even during routine maneuvers such as Taxiing to Take-off. In this case the Examiner must record whether the student showed proper judgment in using the throttle, the brake, the controls, his run-up position and the like. During the Crosswind Take-off, we observe whether the student showed good judgment in his correction for wind drift. Through out the Cross country maneuver, of course, the student is required to show careful and exact planning as well as judgment as he takes into account the many factors influencing his cross country flight. Probably the most important aspect of the entire Forced Landing maneuver is the opportunity it gives the Examiner to note whether the student shows good pilot judgment in his selection of the field, and the control of the plane to make the most efficient and safe approach and simulated landing.

As a matter of fact, this check is designed to give the private pilot applicant the maximum possible opportunity to demonstrate his judgment as a pilot. To do this we avoid routine mechanical maneuvers in favor of placing the student in conditions for which he cannot specifically practice. Good examples of this are maneuvers No. VI "Strange Field Procedure with Power and Opposite Traffic Pattern" and No. VII "Low Altitude Observing." The Stalls and Landings are, of course, more routine maneuvers but these have become well established as a necessary part of any flight-check since they are known to require good judgement for their most effective execution.

It seemed to be the concensus of the opinion of experienced pilots and Examiners that good planning and good judgment are known to exist only when the student can actually control the plane and make it follow through the required maneuvers. Good judgment, therefore, means good performance and poor judgment means poor performance. It is the performance rather than the inference that the objective flight-check attempts to measure. And, of course, in the last analysis it is the actual performance of the pilot which will take him through his cross country flight successfully.

It is in the execution of specific maneuvers that we assess the pilot's "judgment" and make a prediction as to his safe and efficient flying in future flight conditions. The only issue, and the problem for critical consideration is: What specific performances shall we demand of the student upon which we can base these predictions. The question of the content of the flight-check is the matter dealt with in the following section.

CHAPTER THREE

WHAT SHOULD BE INCLUDED IN THE FINAL FLIGHT-CHECK?

The previous chapter considered the guiding principles used in the development of an objective flight-check. In the present chapter, attention is focused directly on the specific problem at hand: What particular maneuvers, either old or new, should be included in the final certification flight-check? Obviously, they should be maneuvers which will best represent the actual skills and flying situations required of the private pilot.

After selecting the maneuvers, it must be decided just which particular aspects or phases of each should be especially observed and graded. The step by step progress toward constructing the final form of this new objective type flight-check is summarized in this chapter.

I. The Basic Elements

The careful inspection of accident reports and the rather detailed job analysis conducted by our panel of expert advisers were the necessary prerequisites determining to what extent and in what detail this flight-check should elaborate the basic pattern involved in all flying: take-off - fly some place or around - land. Since there are several ways of taking-off and landing an airplane, and because private pilots engage in a variety of air maneuvers, and since airplanes differ, and weather and field conditions are never exactly predictable, it is obviously a complex matter to decide which particular aspects of this entire range of multiple flying activities should be finally selected for careful testing in the certification flight-check.

In addition to whatever answers the accident report data and the job analysis might reveal, there has developed in aviation certain immutable "absolutes", which are believed to be an integral part of any pilot repertoire of skills and abilities. Two of these are the forced landing, and the stalls. To ignore these traditional maneuvers in any new flight-check would be an immediate invitation to considerable resistance and criticism. Both of these maneuvers reflect the necessary, but difficult to measure, ability of the pilot to respond appropriately in emergency conditions. As measures of judgment-under-stress they are a required part of this private pilot certification flight-check.

II. The First Step - Wide Coverage

All the traditional maneuvers used in private pilot certification flight-testing were carefully considered when outlining the content of the new objective flight-check. Flight-test maneuvers specific to military flying were not considered particulary applicable to our present task.

In addition to the traditional maneuvers, a rather extensive list of new types of tests were drawn up to cover those skills believed not to be adequately represented in previous types of private pilot flight-checks; most important among these were the cross country maneuvers, Stall Recognition, Strange Field Procedure and Low Altitude Observing.

Starting with initial interviews with the first group of pilots and Examiners and continuing on through the questionnaire survey, a serious attempt was made to devise new maneuvers or specific items which might be added to the

original list.

III. Combining to Test Maximum Number of Specific Skills with the Minimum Number of Maneuvers

The fundamentals of flight control are climb, glide, turns and straight and level flight. Since these are the necessary essentials of any and all flight maneuvering, it is easy to understand the traditional nature of pilot testing which emphasizes and attempts to measure these fundamental skills. If, however, in place of a separate maneuver for testing each one of these four fundamental skills, a single maneuver could be designed to assess a combination of these basic abilities, we would be on our way to a more efficient flight-check. Throughout the development of this check, therefore, one"ground rule" was to minimize duplication of the skills being measured, except where such repeat testing was purposely provided because of the importance of the ability for safe flying.

"Common sense" testing would indicate that if you want to know whether a pilot can correct for wind drift, simply test this skill via S-turns across the road, or pylon 8's. Check pilots will probably object, but this is actually theoretical testing rather than practical or common sense. It is theoretical because it assumes a general wind-drift-correction ability that the pilot takes with him and has on tap in any and all relevant situations. While this might be approximately true for the older, experienced pilot, it is certainly a weak assumption when applied to the beginner. Ability to coordinate or to execute a sequence of gliding turns at altitude is no particular guarantee that the same"general skill" will be evidenced when the new cross country pilot is nervously trying to follow through the pattern prior to a landing at a strange and busy airport.

This new experimental check attempts to be more realistic and practical in defining the tasks to be included in the final certification flight-check. It does this by setting up a series of minature "job samples" and thus measures directly the different critical phases of flying that the private pilot should be expected to perform efficiently and with an adequate margin of safety. This would be an efficient type of flight-check since the check pilot can evaluate both the end product - the actual task assigned the student - and the specific skills required in this and similar complex maneuvers. A good example of this method of testing is Maneuver No. 6, Strange Field Procedure with Power and Opposite Traffic Pattern. Not only can the Examiner note and observe the student's proficiency in the 'four fundamentals of flight' but he can also observe how well the student can "generalize" the whole concept of the traffic pattern when applied to a strange field and using an unfamiliar pattern direction. Airspeed and wind drift control must also be demonstrated along with other specific abilities important for the cross-country pilot or to the pilot seeking a safe landing area in an approaching emergency situation.

This"job sample" type of pilot evaluation should appeal to pilots generally because of its apparent and actual practicality. The test presents real and actual flying conditions rather than an attempt to assess general flying skills in the abstract.

Another example of combining is the new Maneuver No. 7, Low Altitude Observing. To a considerable extent this maneuver measures the critical elements involved in the traditional 720° turn at altitude, plus the pylon-8, S-turns and other low altitude maneuvers. Of particular importance is the addition of the divided attention characteristic required of the student as he carries out the ground inspection in answer to the check pilot's several questions.

IV. Successive Revisions of Control and Form

To translate this tentative check would provide a valid assessment of the private pilot candidate, was the primary objective of the next phase of the research project. Throughout the extended series of discussions, interviews, and try-outs that followed the 1950 conference, a considerable number of changes, additions, deletions, and mechanical rearrangements were introduced to help make this check an effective instrument in the air. This matter of the check sheet arrangement or layout was a difficult but practical problem which had to be solved. In order to be an accurate and valid measure of the student pilot this new check had to include a great many different items to be checked by the Examiner, who is, at the same time, serving as a safety observer for other aircraft as well as watching the student and and anticipating any dangerous conditions that the fledgling student might create. This question of legibility and ease of following in the air was one of the main reasons for undertaking the extensive series of interviews and tryouts described on the following page.

A. Chronological Sequence of Interviews and Try-outs

The first series of interviews were conducted in the Pittsburgh area during the latter part of July, 1950. The cooperating individuals were:

Mr. Carl Davis, CAA agent, Allegheny County Airport
Mr. Roy Hope, CAA Examiner, Allegheny County Airport
Mr. Paul Volzer, Instructor, Miller Aviation, Butler County Airport
Mr. J. W. Caufman, Instructor, Butler County Airport
Mr. Jack Lange, Instructor and Operator of the Seneca Flying Service, Oil City, Pennsylvania

Mr. Jack Lange served as the first subject and made the first in-the-air try-out with the writer as the Examiner. Our primary purpose was to determine the optimum sequence of maneuvers and the general flyability of this early form of the objective check.

On the basis of these few interviews and the single try-out, several copies were reproduced and labeled "Form A".

We then left the Pittsburgh area to continue our interviewing with expert Examiners in different parts of the country. The first group consisted of:

Mr. H. R. Swingle, CAA Examiner, Swingle Flying Service, Columbus, Ohio
Mr. R. C. Davis, Instructor, Swingle Flying Service, Columbus, Ohio
Mr. Foster A Lane, CAA Examiner, Lane Aviation Corporation, Columbus, Ohio
Mr. C. E. A. Brown, Director of Aviation, State of Ohio, Columbus, Ohio
Mr. William Plunkett, CAA Agent, Springfield, Illinois

Mr. Brown is well known as an active leader in the current trend toward greater cross-country emphasis in private flying training. Several hours were spend with Mr. Brown going over the check-ride form and discussing its merits and deficiencies with respect to the "new" emphasis in private pilot cross country training.

At the Institute of Aviation, University of Illinois, a day-long conference was held with Dr. William C. Matheny, Mr. Edward Brown and Mr. William Brown. Dr. Matheny is an aviation research specialist while the other two men are experienced

Air Force and civilian pilots and Instructors who have participated in much of the flight research being conducted at the Institute. Following the conference, two trial flights were made which suggested further revisions in the sequence of maneuvers and methods of in-the-air grading which were incorporated in the new "Form B". Most of these changes, however, concern themselves with the mechanics and layout of the flight-check rather than with the content. Our experience to date indicated that most of the people were in close agreement with the major content of the flight-check.

The next developmental step was the try-out "Form B" with ten student pilots and eight experienced pilots (six of them held the Commercial license) at the Institute of Aviation at the University of Illinois. This preliminary flight testing was carried out early in August, and the results are reported as Appendix table F. Following this flight testing, "Form C" was constructed.

In keeping with the objective of adapting the objective check to the interests and habits of CAA Examiners a cross-country tour was undertaken to discuss the check with at least ten Examiners in different parts of the country.

As a part of this tour a visit was made to the Educational Research Corporation in Cambridge, Massachusetts, and Dr. Phillip Rulon and Mr. Philip Sampson were interviewed. These men made a number of constructive suggestions but no important basic changes were indicated in any of the maneuvers making up the check. We were particularly interested, of course, in getting their reaction to the Stall Recognition maneuver since this represents our specific attempt to utilize what has been learned about stalls, their recognition, and their recovery. Both of these men have had considerable direct experience in "stall" research.

The following individuals were later interviewed during this tour:

Mr. R. A. Cummings, CAA Examiner, Oil City, Pennsylvania
Mr. Jack Lange, Instructor and Operator in Oil City, Pennsylvania
Mr. Lee Balestra, Chief Pilot and CAA Examiner with Aero-Ways, Inc., Cleveland, Ohio
Mr. Thomas Metcalf, Operator and CAA Examiner of the Metcalf Flying Service, Toledo, Ohio

In Toledo we also had a second interview with Mr. C. E. A. Brown, State Director of Aeronautics in Ohio. We also held an informal conference with the following officials in CAA:

Mr. George Childress, Chief of the Aviation Extension Division
Mr. Jesse D. Green, Chief of the Aircraft Utilization Branch.
Mr. Karl E. Boelter, Assistant to the Administrator of Aviation Development, Park Ridge, Illinois

The next interviews were held with:

Mr. Richard Chaplin, CAA Examiner and Operator of the Kalamazoo Flying Service in Michigan
Mr. Donald B. Gauss, Instructor with many years of experience in the same training school
Mr. C. R. Sinclair, Operator of the Sinclair Flying Service, Muskegon, Michigan
Mr. Magnus A. Sponass, CAA Examiner and Instructor in the same school

Mr. C. J Weisbruch, CAA Agent, South Bend, Indiana
Mr. L. J. Cooling, his Assistant, South Bend, Indiana

All of these above named individuals gave generously of their time and made helpful comments and suggestions. They also agreed to try to give the flight-check an actual trial in the air with one of their students. The reactions of the persons visited were quite positive. They encouraged us to proceed further with this line of research and expressed an understanding of the merits and ultimate goals of the objective type of certification flight-check.

By the first of September we were fairly well satisfied with the content of the flight-check and the mechanics of its administration. The CAA officials concerned with private pilot training and certification were then interviewed to determine whether they had any new ideas or plans for changes in the training program. Any contemplated change should be incorporated if possible into the flight-check, thus making the final product more consistent with CAA policies. These discussions were held with Mr. George Stathers and Mr. Bural Barclay in the Pilot Branch, CAA, Washington, D. C. We were encouraged to find that their current recommendations parallel closely the results of our two general conferences which initiated the specific developmental steps in this flight-check. The current recommendation pending before the CAB includes a marked increase in cross-country training as well as a decrease in some of the traditional air-work such as 720° turns, S-turns, and the like. A further recommendation would minimize the traditional 180° power-off approach and landing, substituting the power approach normal landing. These changes were reflected in the next revision, Form D, of our objective certification flight-check.

Brief discussions were also held in Washington, D. C. With Mr. Max Karant of the Airplane Owners and Pilots Association and Mr. Charles Parker of the National Aviation Trades Association.

The next step was a visit to the CAA Training School in Oklahoma City. Mr. T. E. Archer and Mr. Paul E. Young spend considerable time going over the content of the check as well as discussing the specfic scoring weight to be assigned to each item.

B. A Manual of Instructions

After completing the preliminary flight testing in August, it became apparent that a Manual of Instructions was needed. A copy of the final form of this Manual is included in Appendix section A. Its primary purpose is to provide a general introduction to the new type check and a short statement describing each maneuver, as well as specific instructions for administering and scoring the check.

Any check pilot using the new check for the first time must also examine carefully the Manual of Instruction, but it is not intended that the Manual be a part of the in-the-air use of the objective flight-check. Sufficient instructions are included on the check-form to make it self-sufficient for any Examiner who has already familiarized himself with the instructions contained in the Manual.

V. Final Selection of Maneuvers

Upon what basis do we justify the 13 different maneuvers included in the final form of the experimental objective flight-check? We will not attempt to

spell out all of the arguments which apply, but the following section does present a statement of each maneuver with some indication of its unique characteristics and the primary purpose it is intended to serve.

The following maneuver descriptions should be read concurrently with the flight-check, Appendix B. They are primarily a duplicate and an expansion of the material included in the Manual.

I. Rented Airplane Pre-Flight Check

The idea of the rented plane was to recognize the fact that a private pilot frequently flies someone else's plane and has, therefore, a greater responsibility for pre-flight check. It is recognized that the owner of the plane is also concerned with its flyability but the immediate responsibility rests with the pilot. The number of specific items that could be included in the pre-flight check is, of course, almost limitless. The present list is simply the basic check with provisions being made for additional items where they are appropriate for the particular plane being pre-flighted. In this maneuver the Examiner should ask the student to report why he is making each check as it occurs.

It is difficult to assess the importance of the pre-flight maneuver. Each item in the maneuver, as well as countless others, if neglected, is potentially dangerous. Nevertheless, on-the-ground performance, such as pre-flight check, ground school, information and achievement tests, and the like correlate only slightly with actual flying skills. But, in-the-air flying skills should not necessarily be the only criterion. Certain ground checks are actually and potentially important for safe private flying.

Since this over-all check represents a somewhat radical departure from conventional flight-check forms, it is believed that the drawing of the plane on the first maneuver will encourage the analytical "set" necessary to complete the rest of the flight-check. In other words, the Examiner should be introduced to the "newness" of this check as early as possible.

In this pre-flight check, it is not expected that the private pilot applicant will make many mistakes. Most applicants will make the check in the manner that they were instructed. Nevertheless, it is necessary to include this maneuver to emphasize the importance of a careful and adequate on-the-ground check.

II. Taxi for Take-off

Taxiing accidents are relatively numerous but not so serious. Since every flight involves some taxiing, there is no question about the necessity of including this maneuver in the check, giving it, however, perhaps less weight than some of the in-the-air maneuvers.

III. Crosswind Take-off

The assumption here is that if the student can make a satisfactory crosswind take-off, he probably could have done as well or better with a normal upwind take-off. It is recognized that most take-offs attempt to minimize the crosswind factor but, since this cannot always be done, no pilot can realize maximum utility and safety in his flying without possessing the skills required in the crosswind take-off.

IV. Cross-country

This maneuver reflects the increased emphasis on cross country training to be introduced at the private pilot level. The check assumes, that prior to the flight, the student will have passed a written test in planning and executing the cross country flight. The maneuver also assumes that considerably more time will be given to cross country training than is presently included in the private pilot training course.

We consider the maneuver as one of the distinct contributions given by this new check. It is a direct reflection of the job analysis information obtained from the initial study of accident reports, the first two conferences with expert consultants, interviews with experienced training personnel and finally, the expressed desires and wishes of private pilots themselves.

The importance of the maneuver itself will probably not be questioned so much as will the specific way in which the cross country flying skills are to be evaluated. It may, of course, be impossible to measure a long-term flying performance, such as is involved in cross country flying, within the limits of a 75 minute flight-check, which must necessarily also measure other skills than just cross country flying. However, it is believed that this miniature "job sample" will serve as the basic pattern for the longer maneuver which may be necessary.

V. High Forced Landing

This is the traditional forced landing in which the student selects the field, sets up his own pattern, and flys down over the field at between 50 and 100 feet. Some difference of opinion exists regarding the importance of this maneuver but since it is a conventional test, many pilots will accept it for no other reason. However, its presence in this check will be justified on better grounds.

Due to engineering improvements, forced landings attributable to engine failure are becoming an increasingly rare occurrence. However, they represent an ever present potential threat. The forced landing can be further justified in that it gives the Examiner an opportunity to present an emergency condition, and thus introduce the "surprise" element. The immediate and successful adjustment to unforeseen conditions has long been emphasized as a necessary characteristic of the qualified private pilot. It is believed that the various items included in this maneuver will reflect the candidate's judgment and ability to control the plane under these simulated emergency conditions.

VI. Strange Field Procedure with Power and Opposite Traffic Pattern

The cross country emphasis is reflected in this maneuver as well as including a semi-emergency condition (low on gas - looking for emergency landing field). While it is expected that each student will know in advance the maneuvers included in the check, he will not know the field to be designated as his landing area. The maneuver thus incorporates the surprise element, as well as calling for a demonstration of the judgment and planning skills required in cross country flying, such as landing at a strange field which may not have the traffic pattern direction that the student has been so thoroughly trained on. Since this maneuver will not require climbing to altitude, it provides an opportunity for measuring a maximum number of pilot skills in a minimum period of time.

VII. Low Altitude Observing

This is also a new type of pilot proficiency maneuver. Its basic purpose is to determine whether the student has safe control over the plane while circling or inspecting a ground object or area at low altitude. Grading in this maneuver should be careful and rigorous.

The presence of this maneuver in the flight-check in no way relieves training personnel of the responsibility for continuing to warn against low altitude flying. Every opportunity should be taken to point out the dangers and consequences of low altitude flying. However, since this cautioning has been present in aviation for many years, but students still insist on disregarding the safety of themselves and others by buzzing and low altitude circling, this test has been included in the flight-check with the stipulation that it be graded within rather tight limits.

The present maneuver should be more difficult than the traditional 720° turns at altitude, since it includes the divided attention element, the adjustment for wind drift, and the necessity of maintaining tight limits at such a low altitude.

VIII. Re-orientation

Since the student will have been concentrating on his air-work for the past fifteen or twenty minutes, it is believed that this test of Reorientation will be an additional measure of the student's cross country flying skills since it requires him to relocate his position within a specified period of time, his setting up the new return course, and a prediction of his ETA.

IX. Stall Recognition

Originally, we called this maneuver "Slow Flying" but changed the heading to "Stall Recognition" to highlight the critical pilot skill measured by the specific items in this maneuver. This maneuver prededes the traditional demonstration of the stalls and is given considerable weight in the present test as a recognition of the fact that the real danger from stalls is in the failure to recognize the approach to a stall. The stall is the last event (almost) in a sequence of events in which the pilot failed to repognize his compounding error. The focus of training should be on the ability to recognize the approach of a stall rather than the direct and somewhat mechanical recovery action following the stall "break". Training in slow flying seems to be the best way to increase the student's sensitivity to pre-stall conditions. The purpose of slow flying will be defeated if the maneuver regresses to a condition of standardized flying at an airspeed too far above the stalling speed.

In this present test we determine the ability of the student to fly at marginal speed by cutting the throttle during slow flight and observing the elapsed time until the stall actually occurs. The maneuver includes two stalls, both from the slow flying attitude - one straight ahead and the other from a turn.

This entire maneuver illustrates well that the "power to test is the power to define the curriculum". It is expected and desired that the entire training program will be altered and re-oriented more closely in line with the type of maneuvers included in this new objective certification check. Presumably, some of the training time heretofore devoted to stall recoveries will be shifted to

true marginal slow flying with emphasis on the several cues available to the pilot warning him of his dangerous flight attitude.

X. Stalls

Stalls have been a necessary part of private pilot flight-checks for a good many years. And we had, of course, a wide variety of stalls from different approach attitudes from which to select the ones to be included in the present check. In addition to the two stalls included in the preceding Slow Flying maneuver, the stalls from the climbing and gliding turns represented the concensus of opinion given by the more than 100 experienced pilots assisting in developing this check. The total of six stall demonstrations should give the Examiner adequate basis for judging this important pilot skill.

This maneuver is a good example of the free use the Examiner should make of the "Comments" part of each maneuver to provide a more complete description of the student pilot's ability.

XI. Landings

There are many different types of landings available for the private pilot. The type traditionally emphasized in training has been the power-off three point landing. However, many of the persons interviewed questioned the procedure of cutting the power at the point "when it might be needed most", namely, during the approach and landing. It seemed to be the concensus that the power-approach or power-on landing was actually the most commonly used type by the private pilot. For this reason, it is included in this check with the crosswind and 200 ft. spot features added to provide greater evidence of the student's skills.

Landing is a complex and difficult maneuver for the beginning pilot, and it is believed that one demonstration will not give a sufficiently stable measure of landing skill. The required second landing is the power-off up-wind approach within a 300 ft. spot. It will provide an opportunity for the student to demonstrate the necessary adjustment to the wind condition and airplane landing characteristics observed during the first landing. In addition it provides for a repeated demonstration of the crucial common elements involved in nearly all landings.

XII. Second Take-off

This is an up-wind take-off with a simulated short field feature added. In order to define the maneuver more specifically, we indicate that this is a short field take-off from a firm surface necessary to clear a high barrier rather than a short field take-off from a soft surface. Except for this feature, the skills and abilities measured are essentially those included in the original take-off.

XIII. Final Taxiing

This maneuver concludes the check and is justified by the same arguments that the original taxi to take-off maneuver carries.

VI. Scoring

In scoring this flight-check we are using the system of points off since this will involve the least amount of addition and paper work by the check pilot. Correct performance is not scored but deviations from the normal or correct cost the student points, depending upon the degree of error or its importance in safety.

Throughout the check, correct performance is indicated by the dotted line box (⬚) while 1 point is taken off for each light-line box (☐). These light-line boxes are definite "down grades" but not so serious or severe as the errors shown by the heavy black box (■), which counts 3 points off as well as constituting a failure for that particular maneuver. In other words, any heavy-lined, black box, which is checked by the Examiner, automatically means that the student has failed that maneuver. The student must be checked again later on this particular phase of flying.

A student can also fail any particular maneuver if he accumulates too many checks in the light-line boxes. In other words, there are two ways to fail a maneuver: (1) receiving 1 or more checks in black boxes and (2) receiving too many checks in the light-lined boxes. In either case the student must repeat the maneuver successfully before being certified.

In addition to passing or failing each maneuver, it is important to obtain an over-all proficiency index. This over-all score is simply the sum of all the downgrades, i.e., the light-lined and black-lined boxes. In other words, each student must make a satisfactory over-all score as well as passing each maneuver.

A further modification of the scoring system would involve the differential weighting of the several maneuvers. If it is felt, for instance, that skill in cross country flying is more important than taxiing skill, then the cross country performance should contribute a greater share to the final over-all proficiency index.

A simple method of scoring is desired by everyone. However, the importance of an accurate evaluation of the student pilot is so great that it would be manifestly unfair to sacrifice any amount of proficiency information for reasons of personal ease and convience on the part of the check pilot. Considering the student pilot's large investment of time and money and effort, five minutes extra time spent in scoring the objective flight-check would not appear to be an excessive demand. Especially if this extra five minutes will improve to any degree the prediction of whether this private pilot candidate will be a safe and efficient pilot.

VII. This Check in Relation to Present CAA Regulations

As indicated earlier in this report, the project officers were encouraged by CAA to procede with the research development of this check without specific regard to current CAA regulations. In developing flight-check items which would accurately measure the recognized critical pilot skills, it soon became apparent that the requirements of several maneuvers would be in direct conflict with current regulations. Before such a check can be given widespread or routine use, either the maneuvers or the regulations will have to "give". As an experimental check in-the-air tryouts and testing should be recommended.

CHAPTER FOUR

OBJECTIVE EVIDENCE FOR AN OBJECTIVE FLIGHT-CHECK

While we hesitate to "freeze" the content of the check at any point, sooner or later it becomes necessary to test one particular set of maneuvers and items in some more rigorous and objective manner than is provided by individual interviews and group discussions. There are many different ways to test-the-tests. Summarized in the present chapter are three systematic attempts to make an empirical examination of the new check.

I. Preliminary Flight Testing with Two Groups of Students at Different Levels of Training

In August 1950, the Institute of Aviation at the University of Illinois made available to the project ten student pilots then completing the private pilot course. The flight-check was in only the second, Form B, revision but we were anxious to take advantage of this opportunity to obtain in-the-air evidence concerning the length of the check, the sequence of maneuvers, clarity of the instructions, the difficulty level and discriminating capacity of the items and maneuvers, and finally, and probably the most important in this phase, the mechanics of arranging of the items on the page. It is apparent that the flight-check must be easy to grade in the air without sacrificing the check pilot's functions as a safety observer.

A. Problem

The over-all purpose of this in-the-air testing program was simply to "wring-out" this early form of the check. When about half through with the testing of the ten student pilots, we were able to procure the cooperation of eight more advanced pilots (250 to 500 hours) to serve as additional subjects, thus providing a sample of check-ride results from a more proficient and experienced group.

While these were not large groups of subjects, they did make possible a preliminary try-out of the flight-check, both with respect to the flight content and the mechanics of grading in the air, as well as some indication of the differentiating value of the check. The final certification flight-check should be difficult, i.e., a real test of the student's maximum skill as a private pilot, but at the same time relatively easy for the more experienced pilot.

B. Procedure

Two experienced instructors served as check pilots and after each flight-check, the writer interviewed the check pilot and sometimes the student, making notes on their comments. Due to "flight time" limitations, it was not possible to complete the entire check with each student. These checks were given to the ten student pilots just prior to their official certification flight terminating the private pilot training course.

The check-pilots spent from 30 to 60 minutes with each student prior to the flight going over each maneuver and clarifying the instructions and procedures to be followed.

Mr. Edward Brown and Mr. William Brown, the two check pilots, were members of the Institute and in addition to their qualifications and experience as both military and civilian pilots and instructors, they have participated in many of the research projects carried out at the Institute of Aviation. Later revisions of the flight-check reflected their many constructive comments and suggestions.

C. Results

The objective data consists of a careful item analysis and a summation of all errors, "downgrades," made by both groups of subjects in this preliminary study. These data are shown in Appendix Table F. Many of the items in the flight-check in this early Form B have been either dropped or modified in later revisions. For instance, we changed the first landing from a "power-on wheels landing" to the "power approach, normal three point landing."

We have not included Form B of the flight-check used in this preliminary study, but reference can be made to the approximately similar copy of the final form in Appendix B if it is desired to obtain a more distinct picture of each maneuver and the relation of the items to each other within any given maneuver.

1. Meaning of Table Entries

The results of this preliminary flight-testing with ten 40-hour student pilots and eight commercial pilots (or the equivalent in flying time) warrant some significant conclusions regarding the experimental flight-check. The first impression upon examination of Appendix Table F is the tremendous amount of information obtained on each student. The seven pages composing the table are still in summary form since we omitted from each table entry the alternative choices which could have been marked by the check pilot. For example, in Maneuver III, Crosswind Take-off, Item 1 "Directional control on run" we have omitted the response categories of (a) Straight path, (b) Rolled to one side, and (c) Erratic. The table simply indicates that one of the ten students doing this maneuver either "rolled to one side" or was "erratic." The table entry also shows that for another student this item was omitted, the reasons for which we do not know. Presumably the remaining eight students maintained a "straight path" on their take-off run and so were not downgraded. None of the commercial pilots was downgraded or omitted this item.

2. Comparison of the Two Groups

It should further be noted from Appendix Table F that with the exception of the first maneuver, the Pre-flight Check, the total number of "downgrades" received by the student pilots were far in excess to the number of "downgrades" received by the commercial pilots. The ten student pilots, for example, accumulated a total of 19 "downgrades" on the Crosswind Take-off as opposed to only 1 "downgrade" by the eight commercial pilots. It is probably significant that, as a group, the student pilots did better than the experienced pilots on the Pre-Flight Check. This same inversion of the expected difference has been found in other studies where beginning pilots showed greater accuracy on "procedural" items than did the more experienced pilots. In terms of in-the-air skills, however, the check does differentiate clearly between the two contrasting levels of experience and training. To this extent it is a valid test.

3. Difficulty Level

The small number of subjects available in this preliminary experiment does not permit definite interpretations regarding each of the approximately 190 different items making up this early Form B of the objective flight-check. Furthermore, since the two check pilots said they had highly similar methods and habits of grading, we may have an additional biasing factor in the data.

A special comment might be made regarding Maneuver VII, Low Altitude Observing. There were 19 "downgrades" among the eight student pilots who attempted this maneuver and 13 by the same number of commercial pilots. This maneuver apparently does not discriminate well between these two groups. However, it should immediately be pointed out that this was a new task for both groups. The data, as given, do support the belief that this particular maneuver presents a rather difficult task.

Since no objective checks like the present one had been used at this level, we had no safe basis for predicting whether this new form would be too easy for the 40 hour student or considerably beyound his level of ability. The results from these first 10 students were examined with considerable interest to see how well this check hit the appropriate difficulty level for the private pilot applicant. The results carried in Appendix Table F show a satisfactory distribution of both correct performances and mistakes. The several maneuvers are apparently of sufficient difficulty that the superior student pilot makes only a few errors but the below average man has considerable difficulty which the objective flight-check is able to diagnose in a clear and exact manner.

4. Summary

A detailed statistical analysis of these data is not warranted due to the small number of cases involved and the fact that the different maneuvers were tried out by varying numbers of students. Within these limitations, however, the data in Appendix Table F do give conclusive evidence that this type of check can discriminate between different levels of training, and further indicate which maneuvers are easy and which are difficult. Additional positive findings were the favorable reactions of the students and commercial pilots serving as subjects, and especially the fact that the two check pilots became quite enthusiastic regarding the merits of this method of in-the-air proficiency analysis. As a result of this preliminary try-out, we can have considerably more confidence in the general flyability of the check and the expectation that the more refined final form will serve as an accurate and valid in-the-air yardstick for assessing pilot proficiency.

II. A Formal Reliability and Validity Study

The continued cooperation of the Institute of Aviation at the University of Illinois made possible the completion of a more systematic experiment to determine the difficulty level, the reliability, and the validity of the final form of the experimental flight-check. It was recognized from the very beginning of this project that it would be necessary to make an in-the-air test of the new objective check. Immediate advantage, therefore, was taken of the resources of the Institute, when the invitation to use these facilities was extended by Dr. A. C. Williams, Jr., Director of the Department of Psychology in this Institute. We were particularly fortunate in obtaining this cooperation, since

the Institute has already established an excellent reputation as a center of both training and aeronautical engineering research. The relatively large group of beginning students represents one of the few places in the country where flight testing information could be obtained on at least twenty-five students flying from the same field and operating under basically similar conditions.

The following study was introduced with the group of students starting their private pilot training in September, 1950.

A. Statement of the Problem

1. Difficulty level. The items making up the flight-check should be easier for students near the end of training than when only midway through the private pilot course. However, it should remain a real test for the completing student with the likelihood that no one would make a perfect score.

2. Reliability. How consistently does the check represent the actual performance of the student? This question can be partially answered by giving the check on at least two different flights to the same student, though with a different check pilot. In other words, how consistently does the objective flight check (and not just the Examiner) measure the way each student flies?

3. Validity. To what extent do the objective flight test scores agree with other proficiency evaluations such as those made by instructors and check pilots? Validity will also be indicated if the students make better scores at the end of training than at the half-way point (on the assumption that the 40-hour pilot is a more proficient flyer).

B. Procedure

1. The Twenty-hour Phase

A subjective over-all grade given in percentage terms was obtained from the regular instructor of each student after approximately the first 20 hours of training. The objective flight-check was then administered by a different instructor, i.e., someone who had never flown with the student before. At the conclusion of the flight this check pilot reported a subjective grade representing his personal evaluation of the student pilot's skill as demonstrated during the objective flight-check. This second set of subjective grades was also reported in percentage terms. The objective flight-checks were mailed to the project director in Nashville, Tennessee for scoring.

Since only six different instructors were involved in the flight testing at the 20-hour period, it is quite likely that they had some prior information about the student they flew with, since cross comparisons of students are characteristically made by instructors in any and all areas of teaching. The possibility of instructor-check-pilot discussion of students' progress was a source of error and contamination in the data which could not be rigidly controlled within the limits in this experiment.

Before each check-ride, the student was given an opportunity to study the flight-check and the Manual of Instructions. An average of about thirty minutes was spent in this ready room orientation with the check pilot.

2. The Forty-hour Phase

At the end of the training course, the objective flight-check was again administered to each student by still a different check pilot. The same subjective grades were obtained as described for the 20-hour phase.

In the original design of this experiment, it was planned to have a third administration of the objective check within the first or second day following the final certification ride. This comparison of two successive checks, each day by a different check pilot, would provide valuable information as to the reliability or consistency of the experimental flight-check. Furthermore, we hoped to use CAA Safety Agents and/or CAA designed Examiners as the check pilots for the third and final administration. Despite the crucial nature of these data, it was not possible to complete this aspect of the experiment. The entire schedule had already been delayed by the unusually severe winter and the difficulties of obtaining the services of the CAA Safety Agents and non-resident Examiners made it impossible to complete any more than four of these second 40-hour checks.

C. Results[1]

1. Scoring the Objective Flight-check

There are several different ways in which the objective flight-check can be scored. In this experiment, we tried three different methods of scoring but the simplest method and the one which best represents the total picture as given by the objective check is "total points-off." Each mistake made the student pilot resulted in a penalty of from 1 to 5 points depending upon the seriousness of the error. All of these penalties were added together to obtain the total points-off objective score.

2. The Twenty-hour Phase

The objective scores and the subjective scores can be compared and evaluated in several different ways. One comparison used here was to see which of these two scores agreed best with the regular instructor's grade of his student. The results of this comparison showed that the objective score was just as good as the check pilot's grade when compared against the instructor's over-all evaluation which, in this case, served as the base line or standard.

There is reason to suspect that the grades assigned by the check pilots were influenced by prior information with respect to the instructor's evaluation. If this advance information did exist, it would make the check pilot grade appear more valid than it really is. In spite of this advantage however, objective

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1. The discussion of the results of the Urbana study which follows is intended for readers not versed in the methods and terminology of correlational and sampling statistics. In preparing this section of the report it was at times necessary to deviate from the rigorously defined usuage of terms and concepts which the statistician would demand. The statistically sophisticated reader is encouraged to refer to the more complete analysis and discussion found in Appendix G.

measures possessed as high validity as did the check pilot grade. This suggests that if the instructor and check pilot grades were strictly independent, scores derived from the objective flight-check would provide a better basis for predicting instructor grades than would the subjective check pilot grade.

3. The Forty-hour Phase

Again at the 40-hour level the check pilot grade and the objective total points-off score showed about equal degrees of relationship to the instructor grade. This finding gives us further confidence in the basic validity of the objective flight-check form. If we again assume that the relationship between the check pilot grade and the instructor grade and the instructor grade is "boosted" as a result of communication between the instructors and check pilots, then the validity of the objective flight-check would probably be relatively higher than would a completely independent subjective score assigned by the check pilot.

4. Reliability of Subjective and Objective Proficiency Measures

Since the student-pilots went through the evaluation procedure after both 20 and 40 hours of training, we can get an estimate of the consistency of each of the subjective and objective scores by comparing the 20 and 40-hour scores for each individual. The instructor grade proved to be quite consistent between the two levels of training. This is not surprising, considering that the same individual (instructor) assigned both ratings to his own students that he had come to know fairly well. It is likely that unconscious personal likes and dislikes which were present at the time of both instructor evaluations but which were irrelevant to flying proficiency, acted to spuriously inflate the apparent amount of consistency between the two sets of grades given by the same instructor.

The check pilot grades which the student received at the end of the 40-hours of training bore virtually no relation to the check pilot grade assigned at the conclusion of 20-hours of training. Using a student's 20-hour check pilot grade as a basis for predicting what he will do on the 40-hour check pilot evaluation would result in only a 1% improvement in prediction over what one could do with a crystal-ball or by chance alone. The general unreliability of the check pilot grades is even more apparent when one considers the fact that both sets of check pilots filled out the same objective form during the check-flights on which their subjective grades were based. We can only guess as to how much lower would have been the relationship between the 20-hour and the 40-hour check pilot grades had the check-flight not been focused around the objective list of maneuvers and items.

In contrast to the almost complete lack of consistency between check pilot grades at the 20 and 40-hour levels, all scores derived from the objective flight-check form showed a moderate degree of consistency.

A check pilot's evaluation based upon the results of such an objective performance record represents a significant improvement over the present, subjective, check pilot grading procedure. This is the "pay off" statement. It represents an obtained scientific fact which no amount of personal bias, subjective opinion, or the voice of authority can discount. Within the limits of the present study, there can be no doubt of the superiority of the objective measuring instrument over the traditional subjective check pilot grade in predicting the future flying ability of private pilots. We recognize the many attenuating conditions which apply to these

data, but in the interest of giving each private pilot a proficiency score, based upon the fairest possible measure of how he actually flies the airplane, there can be no doubt that the objective performance record is the more effective method to follow up with continued research and developmental investigation.

Further evidence of the superiority of the objective approach to private pilot evaluation is found in the relative accuracy with which one can predict whether a student will be above (or below) average on the 40-hour instructor grade knowing only that he was above (or below) average on the 20-hour check pilot grade or the 20-hour objective total points-off score. As shown in Figure 1, the 20-hour objective flight-check score affords a more accurate and useful tool for predicting the final instructor grade than does the subjective check pilot grade.

5. Use of Weighted Scoring on the 40-hour Objective Form

The "total points-off" scores which have been described and reported above were simply the sum of the points-off on the individual maneuvers. As such, they may not represent the optimum weighting between the various maneuvers. That is, it is possible that a maneuver which experts would agree is of relatively minor importance in over-all flying skill and safety may actually have more influence in determing the total points-off score than some other maneuver which experts would agree is of great importance in flying skill and safety. Recognizing this possibility, two attempts were made to achieve an optimum weighting between maneuvers. One such attempt was very crude, whereas the other was somewhat more refined. Neither attempt resulted in an improvement in the degree of relationship between the 40-hour instructor grade and the total points-off score derived from the 40-hour objective flight-check forms, and so no further attempts to employ weighted scoring procedures were carried out at this time. This entire weighting procedure reflects the assumption that some maneuvers should count more than others. However, some pilots feel that since any maneuver is potentially dangerous if improperly done, all maneuvers should be given equal weighting.

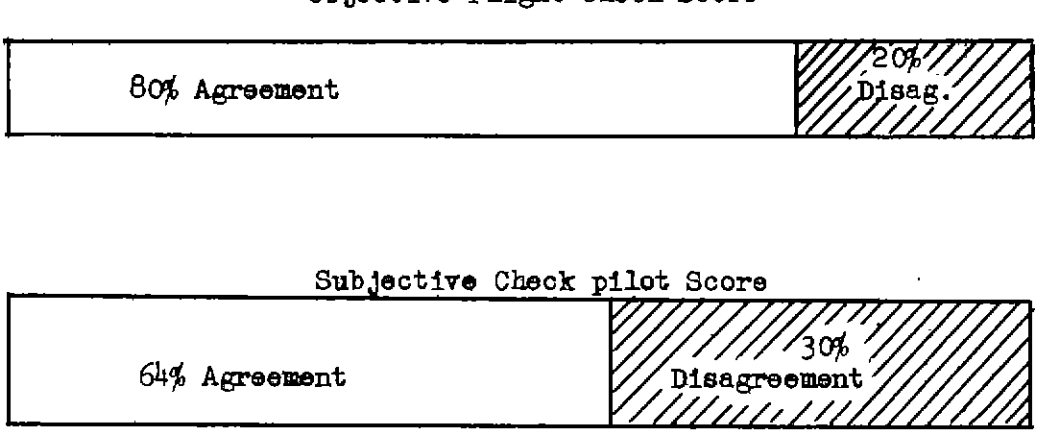


FIGURE 1

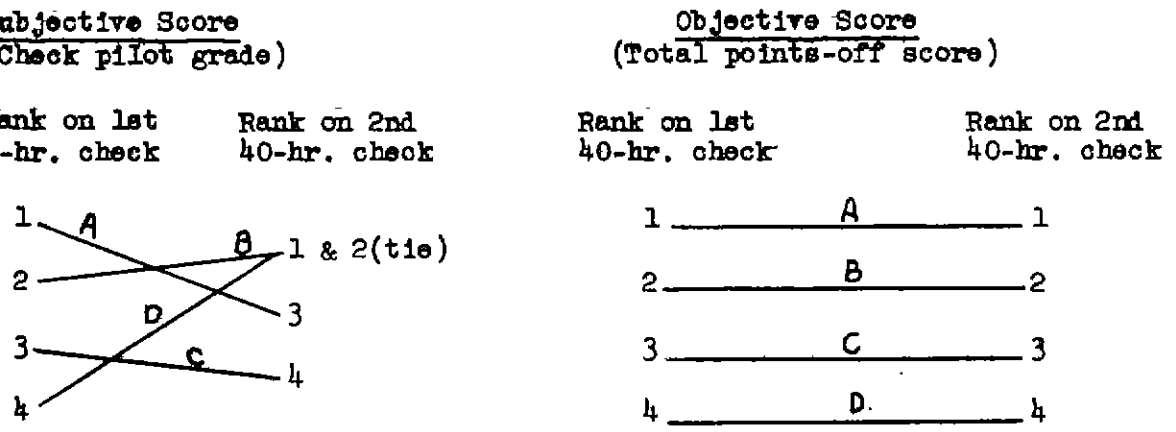
Accuracy with which one can predict whether a student will be above (or below) average on the 40-hour instructor grade knowing only that he was above (or below) average on the 20-hour check pilot grade or the 20-hour objective total points-off score

6. Analysis of Data from Four Students Who Were Given a Second 40-hour Flight-check

It had been planned originally to administer a second 40-hour flight-check to all students as soon as feasible after the regular 40-hour check.

An immediate test-retest of this type would give us the best possible basis for comparing the consistency of the present check pilot grading procedure with that of the objective flight-check form. Delays occasioned by the unusually severe winter weather disrupted the entire training schedule and rendered this second 40-hour flight-check impossible except in the case of four students. These students flew a second 40-hour check with a CAA designed Examiner who had never flown with that student before.

The accompanying diagram indicates the degree of consistency with which the subjective and objective flight-check procedures rated the performance of these four students. You will note that there was little correspondence between the way in which the four students ranked on the two 40-hour subjective check pilot grades. For example, student "D" who ranked at the bottom of the group on the initial 40-hour check pilot grade tied for top rank on the second 40-hour evaluation. Similarly, student "A" who ranked first among the group on the initial check pilot grade ranked next to the bottom on the second. On the other hand, there was perfect correspondence between the rankings of these four students on the two 40-hour objective total points-off scores.



Although this sample of only four cases is obviously too small to serve as a basis for any sweeping conclusions, the results serve to point-up the conclusion arrived at earlier: Whereas the check pilot grading procedure currently employed is quite unreliable, the objective flight-check form possesses sufficient reliability to make it a useful and dependable instrument for evaluating student pilot proficiency.

7. Evidence for Learning and Improvement of Skill Between the 20-hour and 40-hour Evaluations

Any real increase in flying skill and proficiency between the 20 and 40-hour levels should manifest itself through an improvement in the grade or score which the student earns at the two levels of training. Failure to obtain an improvement in proficiency score may be due to either, or both, of the following factors:

(1) There may have been no real improvement in proficiency, i.e., perhaps the student has learned all he will by the time he has completed 20-hours of training.

(2) The evaluation procedures may be so crude that they do not detect changes in performance efficiency even though they are present.

Certainly the second of these possibilities would be the more reasonable. If with increasing levels of practice or training we do not find a corresponding improvement in proficiency grades or scores we would certainly suspect that something was wrong with our evaluation procedure.

An analysis of the results of both the subjective and objective scores revealed that in each case there was a significant increase in the average performance grade or score of the group between the 20-hour and 40-hour evalnations. However, it should not be assumed that increased student proficiency was the only factor which could have produced this difference. In the case of the two subjective grades, it is possible that the instructors and check pilots assigned their grades, at least in part, according to a frame of reference in which it was "expected" that a person with only 20-hours of training could not perform above a certain level -- or conversely, that any person with 40-hours of training could be "expected" to perform at a level superior to that of a person with 20-hours of training. This tendency, if present at all, probably operated most strongly in the case of the instructor grades since for any given student both the 20-hour and 40-hour instructor grades were assigned by the same person. It is interesting to note that the poorest instructor grade at the 40-hour level is still five points above the highest of the 20-hour grades. For all other grades, in which different persons made the 20-hour and 40-hour evaluations, there was a reasonable amount of overlap between the best 20-hour grades and the poorest of the 40-hour grades. The greatest amounts of overlaping were found in the case of the objective measures in which the rater's a priori expectations regarding the level of performance which the student "should" show would have minimal influence.

III. A Sample of Opinion by Field Workers

1. The Purpose

It is important in the development of a new check like the present one to avoid the potential bias that can result from a too limited contact with persons interested in aviation research and matters of training policy and standards, avoiding thus, the healthy counter-acting influence of individuals working and facing the actual problems of private pilot training and examining in the field. These persons have had wide and extensive experience with many of the problems faced in developing this check, and it would be extremely short-sighted to overlook their potential and cooperative contributions to this project. Since the CAA Safety Agents, designated Examiners and the Fixed Base Operators and Instructors would be among the first to receive the check, it is highly important that they be given a prior opportunity to express their positive and negative feelings toward the whole idea in general or to any particular aspect of the experimental check.

2. Procedure

a. Mailing Sample

For these reasons, arrangements were made to mail approximately 400 copies of the experimental flight-check, the Manual of Instructions and a short questionaire to specified individuals in all parts of the country. The Airman's Division of the CAA mailed 200 copies to the Airman Safety Agent in all regions. These Safety Agents are the responsible persons for the supervision of private pilot training and certification. It was intended that every agent receive a copy. Mr. Max Karant, Assistant General Manager of the Aircraft Owners and Pilots Association, Washington, D. C., selected as respondents about 200 members of his organization. This was not a random sample but, for the most part, represented persons known to be personally interested and qualified to evaluate and to make comments to this new flight-check.

b. The Coding System

As soon as the first 15 replies were received, the author of this report scanned through them and prepared a series of code numbers to be applied to each of the eleven questions in turn. Each code number represented a rather specific category of response. The key to this code is found in the Appendix Table H. No attempt was made to standardize this coded system by checking it with other observers but we used the code number "5", "Special Comments", with considerable freedom.

It is interesting to note that after the coding system was established, following the analysis of the first 15 replies, only four or five additional code numbers had to be introduced to account for the responses shown by the 75 remaining questionnaires. On the other hand, some two or three of the original code numbers were never used again and these responses were later put into the "special comments" category.

Appendix section C is a copy of the questionnaire. It was decided to use the "open end" type of question in order to encourage greater freedom of expression on the part of our respondents. An open end type of question is one in which the respondent is requested to write a short statement or paragraph giving his opinion and his arguments relative to the question being considered. This form of response gives a more satisfactory and detailed picture of opinion than could be obtained by simply asking a series of yes - no questions. The open end form of question is more difficult to complete and this may in part account for the rather low proportion of returns. However, we were anxious to move beyound the "threshold of indifference" and obtain the constructive comments and the expression of ideas about which the respondents have rather definite opinions and interests.

3. Results of the Questionnaire

a. Number of Replies Received

A total of 90 replies were received by March 15, 1951. This is about one-fourth of the total mailed. No marked or consistent differences appeared in the type of replies of the two groups sampled, so for purposes of this report they are all combined and treated as a single group of 90 cooperating respondents.

We were disappointed, but not surprised, at the small number of returns. One of the main reasons was probably the short interval between receipt of the questionnaire and the deadline indicated for its return. However, most persons had from two to seven days time to make their comments. In an effort to receive a greater number of replies, the AOPA office mailed a follow-up post card encouraging more returns and indicating the extended deadline from February 1 to March 1. However, this second appeal produced only 10 additional returns.

b. General Reaction

On the basis of the special comments and letters, it was possible to make some identification of the over-all reaction of the respondent to this type of flight-check. Item 11 reads as follows: "In this space add any other comments about any part of the check (or the whole idea in general), which might help us develop better methods of private pilot certification." Of the 90 replies received, 33 indicated no general reaction. They either left Item 11 blank or made some specific comment to a particular aspect of the check. Of the remaining, six replies were definitely critical of the whole idea of objective flight testing, while 47 appeared to be favorably disposed to this approach and ranged from mild to strong encouragement. How accurately this ratio of almost eight to one in favor of this experimental check represents the larger population is, of course, a matter speculation. If the general principle is true that in questionnaire studies, negative replies are easier to get than positive replies, then this proportion can be taken as strong evidence in favor of continued efforts to develop more objective types of private pilot certification.

c. Results from the Specific Questions

The replies to the eleven questions asked in this survey are carried in Appendix Table H. The replies are described fairly well in the different categories listed under each of the eleven questions. Only those "special comments" are included which are not well represented by the different categories.

The major interpretation given to the replies to each of the eleven questions in sequence are as follows:

"1. Are some of these maneuvers unnecessary so far as private pilot skills are concerned? If so, which ones would you drop out and for what reason?"

Sixty-five of the 90 respondents indicated that all of the maneuvers were important and that none should be dropped. Six believed that the cross-country would not be adequately tested in this limited check and five were concerned about the dangerous habits encouraged by the low altitude maneuvers.

"2. What different type of maneuver would you like to see included in this check? If you have a suggestion, show us what specific abilities should be observed and graded. In other words, what important skills or abilities are not adequately covered by this check?"

The category with the largest single number of comments suggested that considerably more emphasis should be placed on the "knowledge" elements involved in private flying. The Manual of Instructions simply states "Prior to the flight, the student will have passed a written test on planning and executing a cross-country flight." Such a test should be developed and given considerable emphasis

in the new curriculum. The other replies suggested that the present check does not give sufficient emphasis to slips, stalls of all varieties, and to landings under windy conditions.

"3. Do you have any important changes to make in the sequence of maneuvers?"

The present sequence of maneuvers is apparently satisfactory. At least the replies to this question were not particularly fruitful.

"4. Do you have any suggestions as to how the Manual of Instructions should be improved?"

The replies to this question specify no general change in the Manual of Instructions though some of the special comments do point out minor and technical deficiencies.

"Pilots differ in their opinions as to how the items making up the different maneuvers should be scored. Please give us your suggestions. Read the material under Scoring on Page 6 of the Manual.
5. In your opinion, how should the final grading be made?
A. Should every maneuver be passed or should a total score on the entire check-ride determine final certification?"

The modal response was to the effect that the student candidate should pass each maneuver although many respondents said that in addition he should have a satisfactory total score.

"B. Should some of the maneuvers be weighted more than others in determining final level of proficiency? If so, which ones?"

Here we find a difference of opinion though the majority do vote for placing more weight on some maneuvers than on others.

"C. Do ou think we should change the score value for any of the items (indicated by the "dots")? List your suggested changes in this space."

The general preference for a subjective grading system is evidenced in the several categories and the special comments made to this question. On the basis of these returns we would predict that much of the opposition to the objective check will be focused on the method of scoring. This would indicate the need for devising the simplest possible method of scoring consistent with accurate evaluation.

"6. Should this type of check include the forced landing?"

Nearly everyone answered "yes" and in the majority of cases some special comment or exclamation point was added to show the strong emphasis behind the "yes" reply. For the most part, the special comments shown in the table under Question 6 reflect the minority point of view.

"7. a. What type of landings are most important for the private pilot?
b. How many landings should be given with the check?"

A. The crosswind landing was listed more frequently than any other single type though most of the conventional landings were included in the list of types which should be included in this certification check.

B. It was particularly interesting to note how many respondents believed that three or more landings should be given in the final check.

"8. How important is it to limit this check-ride to one hour?"

Most of the respondents believed that there would be no advantage to limiting the check to one hour. The two main reasons given for the time limit, however, were the cost and fatigue to the student.

"9. What special difficulties would occur in the use of the present check in your part of the country? (For example, mountains, congested area, air traffic, and the like?)"

None of the respondents said that it would be impossible to give the cross-country check in his part of the country. However, in certain areas some modification in the maneuver conditions would have to be permitted.

"10. Please give us any suggestions as to how the check might be modified to meet your local conditions."

The special comments illustrate the adjustments which would be needed to meet the special terrain and weather conditions.

"11. In this space add any other comments about any part of the check (or the whole idea in general), which might help us develop better methods of private pilot certification."

The replies to this question have already been discussed previously on page 35 . Those special comments are interesting in that many of them reflect the respondent's "philosophy" of private pilot training and flying.

We developed the very definite feeling having read and analyzed the 90 questionnaire returns that throughout this country there are a great many intelligent pilots who are sophisticated regarding the crucial problems of training and certification. Some of the replies showed nothing but a negative and hostile attitude and others were too lavish and uncritical in their praise. But for the most part the questionnaire seemed to accomplish its purpose by stimulating these respondents to think carefully about the basic problems involved in a final certification flight-check. At least 25 of the respondents wrote accompanying letters presenting their views and supporting arguments. In general, this questionnaire survey confirmed our basic hypothesis that the field workers represent a potential pool of expert advisers who stand in a key position to make this an effective check in actual operation or to cause its dismal failure.

CHAPTER FIVE

SUMMARY AND RECOMMENDATIONS

I. Summary

As a specific contribution to the long range CAA aviation safety research program, the American Institute for Research has undertaken the development of an objective proficiency check for private pilot certification. The single and immediate purpose is to develop an objective flight-check which will improve the measurement and evaluation of the critical skills necessary for safe and efficient private flying.

In a preliminary report already published, four initial steps are summarized.

1. The review of the relevant literature and research studies dealing with objective measures of pilot proficiency.

2. An extensive analysis of the 1947 accident reports for private pilots made as a part of the first job analysis.

3. A tentative job analysis formulated by a panel of expert advisers and consultants.

4. A rough draft listing of the maneuvers and specific items which might be included in an objective check for measuring the critical private pilot skills.

After a temporary lapse, the project was re-activated by the Research Division of CAA in June, 1950. In a second conference of the advisers, it was agreed that the final flight-check should emphasize two major types of private flying: (1) pleasure flying around the home airport, and (2) cross-country flying.

The guiding principles outlining the procedure to be followed are basically those known to be important in any type of scientific testing program centered around the human variable. Certain general barriers exist relative to pilot flight-checking. Traditions and conventions can best be met by presenting empirical evidence either supporting or denying the value of an objective certification flight-check.

A critical job analysis is the necessary first step. This was accomplished by the analysis of accident reports showing in as much detail as possible the particular pilot deficiencies and conditions of flight which are most likely to lead to trouble. An extensive and continuing use was made of the available expert aviation research personnel as well as experienced private pilot Examiners and supervisors in the field.

The main purpose of an objective flight-check is to help the check pilot make a detailed and diagnostic evaluation of the private pilot applicant. It accomplishes its purpose by providing a stable and agreed upon standard against which the performance of the student can be assessed. This consistent and objective frame of reference is actually the pooled and combined judgment of a large number of experts and qualified Examiners and check pilots.

The particular characteristics of this type of check are as follows:

1. Uniform standards
2. On the spot recordings
3. Efficient description
4. Objective items
5. Clearly defined tasks
6. Consistent measurement
7. Critical components

In the ranking of critical pilot skills, the priority position of "judgment" is recognized. The crucial question is: How do we know whether or not a given student has good judgment. The answer must come from something we observed that the student did or said. The objective flight-check, just like the subjective check pilot, attempts to evaluate "judgment" though the former does it by recording the actual performance of the student in flight. Good judgment means good performance, and poor judgment, poor performance. It is the performance rather than the inference that the objective flight-check intends to measure.

The content of the objective flight-check must be defined by the skills and abilities considered most important for safe and efficient private flying. But rather than following the traditional pattern of testing skills in the abstract, e.g. (glides, turns, and stalls), maneuvers are drawn up in terms of minature "job samples". This is believed to be a more realistic and practical approach since it measures the critical flying skills in the context of an actual and important flying situation in which the private pilot should be competent. Furthermore, the principle was followed of combining several measures to test the maximum number of specific skills with the minimum number of maneuvers. The Low Altitude Observing is a good example of a realistic maneuver based on such a combination.

Another principle recognized in deciding on the content of the objective flight-check was to maintain continuous and intimate laison with persons actually working in the field of private pilot training and certification. On the basis of a large number of personal interviews, group discussions and some preliminary in-the-air try-outs, the following maneuvers were selected for the final form:

1. Rented airplane pre-flight check
2. Taxiing to take-off
3. Crosswind take-off
4. Cross-country
5. Forced landing
6. Strange field procedure with power and opposite traffic pattern

7. Low altitude observing
8. Re-orientation
9. Stall recognition
10. Stalls
11. Landings
12. Short field take-off
13. Final taxiing

While we hesitate to "freeze" the content of the check at any point, sooner or later it becomes necessary to test one particular set of maneuvers and items in some more rigorous and objective manner than is provided by individual interviews and group discussions. Three systematic projects were undertaken in making this empirical examination of the new check.

The first was a series of in-the-air checks with 10 student pilots near the 40-hour level of training. The results were compared with the objective-check records of eight more experienced pilots, commercial pilots or the equivalent in flying time. An item analysis was made to determine the relative difficulty of all items in the check. The data showed a marked and consistent (with the single exception of the Pre-flight check) difference in favor of the advanced group. This preliminary try-out also led to a good many improvements in the "mechanics", thus making the form much easier to follow and grade in the air.

The most extensive test-of-the-test was also carried out at the Institute of Aviation at the University of Illinois. Twenty-five students received the objective check at the 20-hour level of training and again at the end of the course (40 hours). The regular instructor for each student turned in a subjective per cent grade representing the over-all proficiency of the student at both the 20 and the 40-hour periods. The objective checks were given by a different instructor who also reported a subjective grade indicating his evaluation of the student's ability as demonstrated during the check-ride. A comparison of the different scores indicates that the objective "total-points-off" score agrees with the instructor's grade as well as does the check pilot's subjective grade. This was true at both levels of training. It was also found that the rank order proficiency among the 25 students as determined by the check pilot's subjective overall score at the time of the 20 hour check, bears practically no relationship to the relative proficiency ranking shown by a different set of check pilots at the 40 hour level. This means that two equally qualified sets of check pilots do not agree as to which of the 25 student pilots are the best, the average or the below average flyers. On the other hand, the agreement between the 20 and 40 hour objective scores was considerably better, though, as would be expected, the rank order positions within the group of 25 student pilots did shift considerably since some of these young men made more rapid progress in the last half of the training program than did others. The interpretation is made that within the limits of the present study, there can be no doubt of the superiority of the objective measuring instrument over the traditional subjective check pilot grade in predicting the future flying ability of private pilots. Many attenuating conditions apply to these data but it is believed that in the interest of giving each private pilot a proficiency score, based upon the fairest possible measure of how he actually flies

the airplane, the objective performance record is the more effective method to follow up with continued research and developmental investigation.

The final systematic study was based on the 90 returns from a questionnaire mailed to CAA Airmen Safety Agents and selected members of AOPA. It is recognized that these persons have had wide and extensive experience with many of the problems faced in developing this check and it would be extremely shortsighted to overlook their potential and cooperative contribution to this over-all project. The questions were "open end", requiring coding of the replies. By a ratio of eight to one the replies indicated a favorable attitude toward the continued development of the objective type certification check. The idea of greater emphasis on cross-country training was particularly well received.

II. Recommendations

The principal recommendation growing out of the research and developmental work done on this project to date is singular and clean-cut: continued refinement and improvement toward the goal of using an objective flight-check in the final certification of private pilots.

Continued research development is a necessary prerequisite for this final objective. This new check is in close to finished form and further testing in the field will provide extremely valuable information, especially with respect to the primary purpose of predicting safe and efficient private pilots. For example, if this new check were administered either officially, or on an experimental bas s, to all new private pilot applicants during the next twelve months we would then have available a permanent and diagnostic record of each of these new pilots to be used later as the basis for analysis if and when any of these new pilots were involved in an accident. This type of comparison between the flight-check performance and later safety as a pilot is, of course the ideal and perfect test of the validity of any certification flight-check. This long range research program is obviously the most important next step.

Another valuable project would be to repeat the type of experiment described in Chapter Four of this report. In this next study, the main purpose would be to obtain <u>independent</u> check rides on two successive days (or as close together as possible) using as check pilots CAA designated Examiners and CAA Safety Agents, who should be made available for the particular purpose of completing this experiment. The students to be used in the study would be those completing the regular 40-hour private pilot training course (probably at the Institute of Aviation, University of Illinois). Since the checks would be given in immediate succession, the experiment would provide crucial data relevant to the reliability of the new objective score.

In addition to this basic finding, considerably more information could be obtained regarding the mechanics of conducting the new objective flight-check; the determination of the best scoring system and the performance limits to be established; plus additional data regarding the difficulty level of the specific items and the different maneuvers.

The final recommendation is to encourage the continued development of the paper and pencil test to be used in connection with this objective flight-check. A large proportion of our questionnaire respondents indicated the need of obtaining a more accurate picture of the private pilot applicant's knowledge and information about the relevant conditions involved in private pilot flying, such as

weather, navigation, radio procedures, flight plans, weights and loadings, fuels and equipment, and, of course, the basic mechanical information necessary for safe pre-flighting and in-the-air operation.

As suggested above, all of these recommended follow-up studies are directed toward the final goal of using an objective flight-check in the final certification of the private pilot. This would be an important decision and should be supported with all the necessary scientific and empirical evidence to demonstrate the superiority of this new procedure. The several research phases suggested above should provide this additional supporting information and evidence.

A final statement is directed toward the thousands of professional pilots operating under the general jurisdiction of CAA and in whose interest this new research development has taken place. We view the research and development required by this new type of flight-check as but one example of an effective and progressive step to encourage and expand private pilot activity by increasing the safety, proficiency and pleasure of this vital group of American aviation participants.

A P P E N D I X A

Manual of Instructions for Using the Experimental Private Pilot Certification Flight-Check

FLIGHT-CHECK MANUAL

to accompany the
FLIGHT - CHECK FOR THE CERTIFICATION
OF PRIVATE PILOTS

MAY 1951

U. S. Department of Commerce
Civil Aeronautics Administration
Washington 25, D. C.

MANUAL OF INSTRUCTIONS FOR USING THE PRIVATE PILOT CERTIFICATION FLIGHT-CHECK

PURPOSE

It is believed that safety in flying and the overall proficiency level of private pilots will be improved if all Examiners have available a uniform and efficient procedure for making their in-the-air analysis of the student's judgment, technique, safety, and specific flying skills.

The main purpose of this objective type flight-check is to provide (1) a uniform set of standards of proficiency of those (2) critical components necessary for the private pilot when he flys for pleasure around the home airport or makes a cross country trip. Some other advantages in this new type check are: (3) on the spot recording; (4) efficient description - by simply placing his check marks in the appropriate boxes, the check pilot can construct a rather detailed and diagnostic picture of the student pilot's flying ability; the tasks are (5) clearly defined so that the student pilot will know precisely what is expected of him. The (6) objective items making up this check result in (7) consistent measurement, resulting in a fair record of how the student performed on his flight-check.

The maneuvers and items composing the check are selected to place maximum weight on the students judgment. He will not be able to carry through the assigned tasks without calling upon sound judgment and planning. The careful use of this check will show clearly whether the student has satisfactory judgment as well as indicating other skills where he is adequate or needs further training.

DEVELOPMENT OF THIS CHECK

Since the purpose of this flight-check was to promote greater safety and pleasure in private flying, the first concrete step was to analyze all of the private pilot and student pilot accident reports for a recent year to determine in just what type of situations these flyers got in trouble. This information served as an important basis for selecting the maneuvers to be used in the check which test those critical pilot skills which are most important for safe and efficient flying

From the very beginning of the work on this flight-check, continuous use was made of a great many expert and experienced private pilots, Examiners, instructors, fixed base operators CAA Safety Agents, supervisory personnel, and experts in aviation research.

For more than six months, the several preliminary forms of this flight-check were examined by private pilot training personnel in the field and were given extensive in-the-air tryouts. In addition to these direct personal interviews and "wringing out" in-the-air, copies of the flight-check were mailed to over 400 CAA Safety Agents, Examiners and private pilots. These people were requested to give the check a careful examination and to make comments regarding its usefulness. On the basis of the replies from this extensive questionnaire, changes were made. This check therefore represents the pooled judgment of several hundred experienced persons directly interested in private pilot training and certification.

No flight-check will ever satisfy all Examiners and this one is no exception, but by combining the opinions and careful suggestions of a great many qualified persons as well as subjecting the new check to careful scientific testing, a more uniform and accurate in-the-air flight-check has been developed for assessing the critical deficiencies and skills of private pilot applicants.

ADMINISTERING THE FLIGHT-CHECK

One of the main purposes of the present type check is to encourage uniform standards of private pilot evaluation. It is important that each Examiner conduct this check in the same way that other check pilots are using it in other training centers; this means following the instructions rather closely. Certain local adjustments will, of course, have to be made since flying in Illinois is different from that in New England or the Rocky Mountains.

This form requires more training and practice than earlier forms. However, most Examiners have learned to use it very effectively after a few tryouts.

The student should have an opportunity to examine the check ride form and to discuss with the Examiner the sequence of maneuvers and methods of grading. It is important that the student know what aspects of his flying will be most carefully observed by the Examiner and what standards are expected of him.

The question is frequently asked by Examiners: When should I check the different boxes? The best answer is simply: as soon as you feel that it is safe to do so following the completion of the maneuver. Examiners who have had experience with this check report that they can easily keep right up with the student in their marking of the check ride form, except in the critical phases of some of the emergency maneuvers and during the landings when they wait until it is safe to turn to the check form.

The instructions are short and grading is simply a matter of marking the appropriate boxes on the answer sheet. On the back of this answer sheet is a section for "Comments". The Examiner is strongly encouraged to to make whatever statements he feels will add to the description of the student's performance, particularly

comments about the student's degree of tension, his generally relaxed or nervous attitude, or simply whether he seems to be "in control of the plane," flying mechanically or the like. Unusual performance, either good or bad, should be noted here, particularly if it adds to the total picture of how the student is performing the maneuver under consideration.

It is, of course, impossible to include items covering all possible aspects of the different maneuvers which might be graded. However, it is intended to include the more important and critical aspects of each maneuver, using the minimum number of carefully selected items as the basis for evaluating performance on the total check ride.

SCORING

In scoring this flight-check we are using the system of points off since this will involve the least amount of addition and paper work by the check pilot. Correct performance is not scored but deviations from the normal or correct cost the student points, depending upon the degree of error or its importance in safety.

Throughout the check, correct performance is indicated by the dotted line box (⋮⋮) while 1 point is taken off for each light-line box (□). These light-line boxes are definite "down grades" but not so serious or severe as the errors shown by the heavy black box (■), which counts 3 points off as well as constituting a failure for that particular maneuver. In other words, any heavy-lined, black box, which is checked by the Examiner, automatically means that the student has failed that maneuver. The student must be checked again later on this particular phase of flying.

A student can also fail any particular maneuver if he accumulates too many checks in the light-line boxes. In other words, there are two ways to fail a maneuver: (1) receiving 1 or more checks in black boxes and (2) receiving too many checks in the light-line boxes. In either case the student must perform the maneuver successfully before being certified.

In addition to passing or failing each maneuver, it is important to obtain an over-all proficiency index. This over-all score is simply the sum of all the down-grades, i.e., the light-lined and black-lined boxes. In other words, each student must make a satisfactory over-all score as well as passing each maneuver.

On the answer sheet and at the end of each maneuver the Examiner should mark the two entries: (1) SCORE - which is the sum of the points off for all the light-

lined boxes checked (1 point each) and the points for heavy-lined boxes (3 points each). (2) Encircle P for "pass" if no black boxes were marked in this maneuver and if the numerical score is satisfactory (below the cut-off); if one or more heavy-lined boxes were checked or too many points off accumulated, encircle the F for "fail".

After the flight enter the total points off score for each maneuver in the appropriate space on the back of the answer sheet. These maneuver scores are then added together and entered at the bottom as the "Total Check Score".

DESCRIPTION OF EACH MANEUVER

I. Rented Airplane Pre-Flight Check

The idea of a rented plane is to recognize the fact that the private pilot generally flys someone else's airplane and has, therefore, greater responsibility for a careful pre-flight check. It is expected that for many types of aircraft the Examiner will want to "write in" items on the blank spaces provided, e.g., "main gear bolts," "weight loadings," etc.

The Examiner should ask the student to tell him why he is making each check as it occurs. If, for the particular aircraft being pre-flighted, one of the items on the check is not applicable, the Examiner should cross out the entire item, both the box and the statement. Be careful to mark all items. If the student gave a poor explanation for a particular pre-flight or starting-engine check, mark the light-line box.

The "starting engine" procedure is included in the pre-flight check. Additional items may be written in, especially for planes equipped with radio, for seaplanes, and for two-engine aircraft.

II. Taxi for Take-off

If there is no wind, the Examiner might ask the student to demonstrate his use of controls in a strong downwind, upwind, or crosswind. The Examiner, of course, should take into account traffic, field conditions, and the like when he makes comments.

III. Crosswind Take-off

Under Item 3a, the "normal" power setting refers to the one that the student was taught to use making this initial climb.

In the 4th item, "Track in climb to first turn," the second choice described as "drifts off to either side" refers to the errors of heading control as well as inadequate or improper wind correction.

No. 6 is not intended to make this procedure inflexible and rigid but should reflect the student's training program as well as the conditions of traffic and weather at the time of the flight-check.

Item 7c "Coordination": Some planes need a little opposite rudder to maintain a controlled turn. In these cases the "crosses controls" box should be checked only if excessive compensation was made.

IV. Cross Country

This manuever reflects the importance of cross country training for the private pilot. Prior to the flight the student is to be checked on planning and executing a cross country flight. The Examiner should be very careful that the student understands the material in the paragraph describing the flight. However, the validity of the cross country test probably depends upon its impromptu quality. This purpose may be served if the Examiner has five or six possible cross country flights for each airport he serves.

Note that item 1 is simply the computed heading; the student is not expected to fly within these limits.

Item 3: Throughout the maneuver the phrase "positive identification of the position on the chart" means: (a) that a specific check-point is identified, or (b) that the applicant can identify a limited area of the chart bounded by identifiable check-points, within which he must be. Item 3 will not be checked except when the student fails to recognize or identify his first check-point. No. 8 applies to the second and third check-points.

Item 5 is simply an opportunity for the Examiner to remind the student of the continuing need of forced landing possibilities. It is not intended that the student should change his heading or altitude appreciably in giving his answer to this question. This item can be given almost any time during the cross country maneuver.

Nos. 6, 7, and 8 cover the second and third check-points. Use the right hand column on the answer sheet for grading the second check-point, the left hand column for grading the third check-point.

Item 12 is intended to give an estimate of the student's future course if he were to continue with the heading that he has established during the past ten minutes of flying over his three check-points and toward his destination. The Examiner will select the alternate by simply giving the name of the town to the student. The alternate should be at least 45° off course and the Examiner should avoid a routine selection.

For Item 14 the Examiner will have to use his own judgment as to the probable success of the heading the student takes toward his alternate.

Difficulties exist in giving this cross country maneuver, not only because the student may be fairly familiar with the area within 15 minutes of the home airfield but also because conditions vary widely in different parts of the country. The local Examiner will have to use judgment and ingenuity in setting up this maneuver as closely as possible to the specifications. This maneuver should test the student's fundamental skills in cross country flying, at least the initial orientation. It is suggested that an altitude limiting visibility to about 5 miles should be selected. Since this will be relatively familiar terrain, some precision should be expected in the student's performance; in other words, the items should be graded strictly.

Some flight time can be saved in those cases where the student is approaching his third check-point on a direct course by giving him instructions about turning to the alternate before the third check-point is actually reached. Furthermore, on the following air-work maneuvers, the Examiner should keep the plane flying toward the home airport as much as possible. The different short cuts will become apparent to the Examiner after he has given two or three checks.

V. High Forced Landing

This is the traditional forced landing in which the student selects the field, sets up his own pattern, and flies down over the field at between 50 and 100 feet. This last condition, however, is not graded. The Examiner controls the throttle. Rather than specify a 90^{o} base leg, item 5 permits the student to make a different approach if, in his judgment, this will put him in a better position for a safe landing considering such things as his present position, surrounding terrain, obstacles and the landing field itself.

Since "overshooting" is characteristic of many forced landings a "too fast" airspeed, item 7 is considered a failure just as is "too slow."

Item 8 includes the same "judgment" choice shown in No. 5.

VI. Strange Field Procedure with Power and Opposite Traffic Pattern

The Examiner selects the field primarily to save time. Actually he doesn't need to select the best available field, but on the final pull-up he might ask the student questions regarding the adequacy of the field.

The Examiner chooses a field and requires a traffic pattern opposite to that at the student's home field.

Grade the first pattern and approach in the boxes on the right side. Following No. 13, return to item No. 2 in the left hand column.

For this check the proper altitude for dragging the field has been designated as 50 to 75 feet, with airspeed at approximately the gliding speed for the aircraft being used. These are arbitrary decisions made primarily in the interest of safety.

Items 13 and 16 should be carefully graded since so many accidents occur during a climb out of a field. Errors other than those reflected in the airspeed should be mentioned.

The Examiner's comments might be particularly helpful following this maneuver as an indication of the student's over-all control of the plane, degree of tension, and general ease during the flight.

VII. Low Altitude Observing

The basic purpose of this maneuver is to determine whether the student has safe control over the plane when circling and inspecting a ground object or area at a low altitude. The check-pilot selects a field or area containing 10-25 objects, such as livestock, rock outcroppings, trees, automobiles, etc., which can be distinguished and described at an altitude of 500 feet. Be sure that the student understands the instructions as given in the check sheet.

As soon as the turn is established, ask a series of questions which require the student to give frequent attention to the ground. Typical questions might be: What is the direction of that row of trees (fence, road, stream, etc.)? How many different kinds of trees do you see in that group? Count the cars (rocks, trees, livestock,

etc.) in that area. About how tall is that biggest tree? How would you lay out a baseball diamond in that area? Name the things growing in that field. What different colors do you see in those rocks? Describe some of the things you see down there. What direction is the wind blowing across the field?

Grading in this maneuver should be careful and rigorous. The presence of this maneuver in the flight-check in no way relieves the training personnel of the responsibility of continuing to warn against low altitude flying. Every opportunity should be taken to point out to the student pilots the dangers and consequences of low altitude flying. However, since this cautioning has been present in aviation for many years, but students insist on disregarding the safety of themselves and others by their buzzing and low altitude circling, this test has been included in the flight-check with the caution that it be graded within rather strict limits. The items should be marked after the maneuver - perhaps during the climb back to 800 feet.

VIII. Reorientation

The Examiner should pick up the chart from the student when beginning the airwork maneuvers. He now returns it to the student with instructions to make a positive identification of his present position. This reorientation should be done at an altitude giving visibility of five miles. The altitude will vary, of course, with atmospheric conditions and terrain. In clear weather 800 feet should suffice.

Since there is no prescribed procedure for this final reorientation toward the home airport, the rough sketch simply illustrates the type of track the student may have made. Again, all of these maneuvers should be graded strictly, since the student will be flying over familiar terrain and since he knows in advance that his maneuver will be given.

IX. Stall Recognition

This maneuver should be emphasized because the real danger from stalls is in the failure to recognize the approach to a stall. It is intended that the training program will get away from the practice frequently found of making slow flying a mechanical operation of flying at a designated airspeed well above the marginal speed.

It is a routine maneuver, except for the requirement to maintain altitude limits of 100 feet while setting up the new attitude and airspeed. A distinctive feature is also given in Item 3, in which the Examiner cuts the power. The instructions to the student should be clear and explicit, so that he will hold his slow flying attitude and make his power recovery when the actual break occurs in the stall. The Examiner grades the item as an objective index of how close to actual stalling speed the student was flying the aircraft.

Many students will show "no sign of stall" in Item 2 but will fail Item 3 since they were flying too fast, well above the marginal speed, when the Examiner cut the throttle.

Item No. 4 is to be graded in terms of amount of altitude lost as a function of the student's control. The emphasis here is on the recovery procedures performed by the student, and not on the stalling characteristics of the aircraft. For the more common very light planes not more than 150 feet altitude should be lost if the recovery procedure is to be graded as "adequate." For other aircraft the Examiner will have to judge what would be an equivalent level of skill.

The instructions to the student are to make medium bank turns. Item 9 will grade this aspect and is particularly important in those cases where the turn is too shallow and the student takes excessive time to complete the 180° turn.

The first 180° turn is a normal turn, but on the second one the check pilot cuts the power again and grades in the same way as during the straight and level phase. This slow flying maneuver should be given on the way home to utilize this flying time.

X. Stalls

Stall recoveries from the climbing and gliding turns are traditional parts of private pilot flight-checks. The four stalls in the present maneuver plus the two stalls in the preceding maneuver, should give the Examiner an adequate basis for judging this important pilot skill. The Examiner may ask for additional stall demonstrations though these extras should not be graded.

The student is required to "clear the area" only before the first two and the last two stalls. Note that the CLIMBING TURN stalls require the addition of power. The presence of any secondary stalls should be graded in Items 7 and 14. In all these emergency maneuvers the Examiner is encouraged to add his comments to describe any special weakness shown by the student which is not adequately covered by the available items.

XI. Landings

The main agrument for calling for a power-approach, 3 point landing is simply the fact that private pilots frequently make landings of this type. The introduction of the crosswind and the 200 foot spot features should provide greater evidence of the student's skill in this landing maneuver. The second, power-off, landing should show necessary adjustments to the wind conditions and airplane landing characteristics obserbed during the first landing. The spot referred to is a predetermined 200 feet for the power-on landing and 300 feet for the power-off landing.

You will notice the requirement that the student hold his final approach airspeed to a plus or minus 5 mph.

This may be beyond the accuracy limits of some of the instruments, which should be taken into account by the Examiner in grading Item 3b.

Item 4a, "Reduction of Power," is particularly important for the first or power-approach landing.

The Examiner may find it helpful to add his own comments describing the student's performance in these landing maneuvers, since it would take at least twice as many pages as are now in the check to include everything that student pilots might do. Furthermore, neither of these two landings measure the commonly used Power-Approach but wheels first landing.

XII. Second Take-Off

The items to be graded in this maneuver are essentially the same as in the original take-off. Item 1 should show if the student left the ground in approximately the 3-point position or whether he raised the tail. Item 2 is particularly critical as a measure of performance just after becoming airborne in this short field take-off. Other than the short field element this maneuver is quite conventional and since it is an up-wind take-off it puts the student in the correct traffic pattern for his second landing which is power-off, up-wind.

XIII. Final Taxi

The Examiner should make his comments describing those taxiing characteristics of the student which might lead to minor or major taxi accidents if not corrected.

A P P E N D I X B

Flight-Check, Final Form

FLIGHT-CHECK

for the

CERTIFICATION OF PRIVATE PILOTS

May 1951

U. S. Department of Commerce
Civil Aeronautics Administration
Washington 25, D. C.

I. RENTED AIRPLANE PRE-FLIGHT CHECK — I.

"CONSIDER THIS A RENTED AIRPLANE - ONE YOU'VE NEVER FLOWN BEFORE. SHOW ME YOUR PRE-FLIGHT CHECK AND DESCRIBE WHAT YOU ARE DOING AS YOU MAKE YOUR CHECK". Check (✓) the dotted-line box if, satisfactory; the light-line box if omitted or inadequate; the black-lined box if a failure for the maneuver.

1. switch off a
gas b
oil c
prop d
tires e
control play f
struts and braces g
fuselage and cowling h
tail or nose-wheel assembly i
other important check items: _____ j
_____ k

2. Starting engine: safety of others a
chocks, brakes b
switch off c
safety belt d
gas valves e
control of prop blast f
other important check items: _____ g

3. Follows prescribed and/or safe starting procedure for type of engine (mixture settings, oil pressure, and temperature, etc.) 3

SCORE S

4. OVERALL PRE-FLIGHT CHECK (careful and efficient - or hesitant or haphazard) 4
S Pass or Fail S

II. TAXIING TO TAKE-OFF — II.

1. Clears for taxi 1

2. Taxi to take-off position: uses throttle properly a
uses brakes properly b
makes S-turns when necessary c
maintains safe taxiing speed d
uses controls correctly e

Check ☑ if yes or safe
☐ if no or careless
☐ if no or careless on items 4 or 5

3. Positioning for run-up 3

4. Use of checklist or systematic procedure in run-up check (control freedom, altimeter setting, mag, rpm, trim, etc.) 4

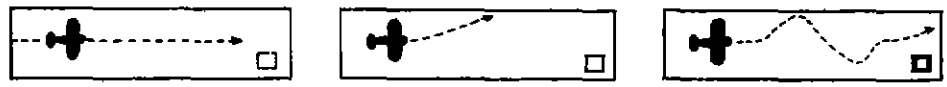
5. Clears for take-off 5

SCORE S

III. CROSSWIND TAKE-OFF — See Reverse Side for Instructions — III.

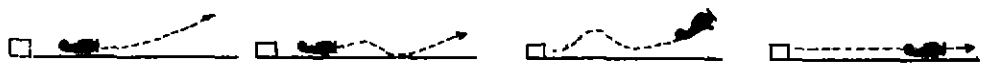
Select a runway which will give, if available, a reasonable degree of crosswind. (Between 80° with 10 mph and 10° with 20 mph.)

1. Directional control on run:



straight path — rolled to one side — erratic or dangerous — 1

2. Flight path just after becoming airborne:



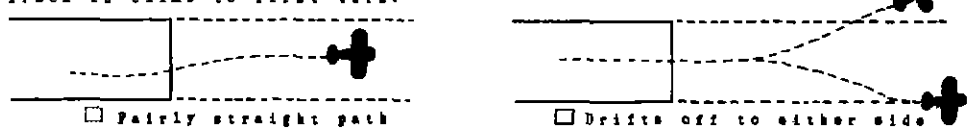
normal — touches down again — staggers off — remains on ground too long. — 2

3. Initial climb:

a. power setting: ☐ normal ☐ too little ☐ excessive---- a

b. attitude: ☐ normal ☐ nose too low ☐ nose too high b

4. Track in climb to first turn:



☐ Fairly straight path — ☐ Drifts off to either side — 4

5. Looking around: ☐ O.K. ☐ a little ■ Not

6. Leaves pattern with prescribed procedure: ☐ Yes ☐ Not

7. Climbing turns:

a. use of power: ☐ about right ☐ variable ☐ beyond limits---------- a

b. attitude: ☐ normal ☐ nose high ☐ nose low ☐ bank too steep b

c. coordination: ☐ smooth, coordinated turn ☐ over controls ■ crosses controls---------- c

SCORE 8

IV. CROSS COUNTRY

The Examiner will select a destination 125-200 miles away on an outbound track from the airport, cross wind if possible, which passes over three identifiable check-points within the first 15 to 17 minutes of flying. The applicant will draw a track line on the chart and mark the check-points. After obtaining compass deviation from the plane, he will compute a compass heading for flying the course if wind data are available; otherwise he will compute a compass course. The computed heading or course should be correct within ±3°. The Examiner will specify that the plane will fly at an altitude of 500 feet above terrain (or higher to give 5 miles visibility). This will be converted to sea level altitude by the applicant. The applicant will be required to fly the track, reporting each of the three selected check-points. The first check-point should be about 5 miles out. The Examiner should not help the student or indicate whether or not he identifies the check-points correctly.

IV.

1. Computes heading or course correct within ±3°: Yes a / No b

2. First check-point (mark one): identifies correctly a / does not recognize b / corrects initial error c / other error (add comments) d

3. If not reported, Examiner allows two minutes to pass then calls for a positive identification of position on chart: this item does not apply a / makes positive ident. b / does not make positive ident. c

4. Altitude control before and at first check-point: stays within ±200 ft. a / climbs over 200 ft. b / loses over 200 ft. c

5. "WHERE WOULD YOU MAKE A FORCED LANDING?" (this item can be given a little later in this maneuver): immediate selection of good field a / more than 10 sec. delay; good field b / immediate but poor selection c / excessive delay and poor selection d

6. Track between check-points: [ ] almost straight a / [ ] unnecessary heading changes b / [x] heading changes of more than ±20° c

7. Check-point identification: [ ] identifies correctly a / [ ] does not recognize b / [x] corrects initial error (add comments) c

8. If not reported, Examiner allows two minutes to pass then calls for positive identification of position on chart: [ ] this item does not apply a / [ ] makes positive identification b / [x] does not make positive identification c

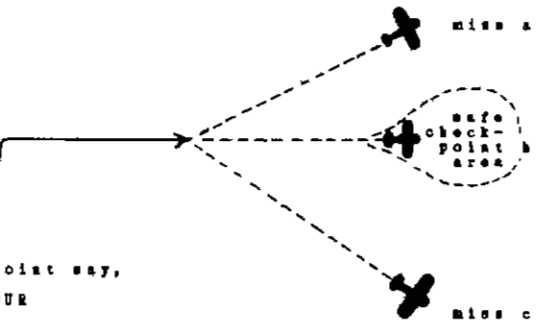
9. Altitude control before and at third check-point: stays within ±200 ft. a / climbs over 200 ft. b / loses over 200 ft. c

10. Maintains power settings within cruising specifications for type aircraft: Yes a / No b

IV.

11. Looks around enough for safety purposes: Yes a / No b

12. If the next check-point were 30 minutes ahead, the student's direction control during past ten minutes indicates that he will:



Just after the third check-point say,

"WE HAVE JUST LEARNED THAT OUR DESTINATION IS CLOSED. TURN TO _____ AS YOUR ALTERNATE."

13. Orientation and procedure in setting up new course: minimum delay; efficient procedure a / some confusion, delay and variable headings b

14. Established heading at end of five minutes will: probably take him within sight of alternate a / probably miss the alternate b

15. Altitude control during orienting and first 5 minutes of new course: stays within ±200 ft. a / climbs over 200 ft. b / loses more than 200 ft. c

GET MAP BACK FROM STUDENT

SCORE S

See Reverse Side for Instructions V.

V. FORCED LANDING - at cross country altitude.

"FORCED LANDING" Field unspecified.
Examiner looks after clearing of engine and controlling throttle.

1. Did student turn on carburetor heat: Yes a / No b

2. Adjusts altitude properly: Yes a / No b

3. Misuse of controls: none a / a little, but not serious b / bordering on dangerous c

4. Turns near ground (under 800 ft): coordinated a / dangerous slip or skid b

5. Uses adequate approach direction: Yes a / No b

6. Choice of field: adequate a / poor choice b

7. Air speed on final is:

☐ safe limits a
☐ too slow b
☐ too fast c

8. Comes in: upwind or appropriate to conditions a / downwind b / crosswind c

9. Landings: would have made field easily a / would have made field only with violent maneuvering b / would not have made field or unsafe to try c

10. Examiner has to take over to avoid danger before end of maneuver: No a / Yes (add comments) b

SCORE S

VI. STRANGE FIELD PROCEDURE WITH POWER AND OPPOSITE TRAFFIC PATTERN

"YOU ARE RUNNING LOW ON GAS. GO DOWN AND DRAG THAT FIELD (pointing). GO INTO IT WITH A (RIGHT, LEFT) HAND TRAFFIC PATTERN, THEN COME BACK UP AND REPEAT THE SAME PATTERN BEFORE COMING DOWN TO THE SIMULATED FORCED LANDING".
Check pilot controls the throttle on final approach to simulated landing.

VI.

1. Enters pattern with: minimum maneuvering a
about two unnecessary turns b
excessive and confused maneuvering c

2. Enters "downwind" leg: downwind a
upwind b
crosswind c

3. Carburetor heat on: Yes a
No b

4. Altitude on entry into downwind leg: within ±100 feet a
beyond 100 ft. limits b

5. Looks around on correct side before base leg turn: Yes a
No b

6. Airspeed on base leg is: about right a
too fast b
too slow c

7. Does pattern opposite to home field: correctly a
minor errors b
major errors (add comments) c

8. Use of controls on final turn (include slips) is: smooth and coordinated a
rough and uncoordinated b
bordering on dangerous c

See Reverse Side for Instructions

VI.

1st approach: "Dragging" the field.

9. Flies just off suitable lane: Yes a
No b

10. Height over the field is: 50-75 feet a
over 75 feet b
under 50 feet c

11. "Dragging" airspeed: about gliding speed a
over gliding speed b
below gliding speed c

12. Turns off carburetor heat: Yes a
No b

13. Airspeed in climb out of field: normal speed a
too slow b

2nd approach: Simulated landing

14. Student would make field easily a
make field only with violent maneuvering b
not make field or unsafe to try c

15. Turns off carburetor heat: Yes a
No b

16. Airspeed in climb out of field: normal a
too slow b

SCORE S

VII. LOW ALTITUDE OBSERVING

"FLY OVER THE MIDDLE OF THAT FIELD (pointing and defining area) AT AN ALTITUDE OF 600 FEET. WHEN YOU REACH THE FAR END OF THE FIELD GO INTO A MEDIUM-STEEP TURN TO THE LEFT AND FLY TWICE AROUND THOSE (objects) AND COME OUT ON THE SAME HEADING YOU HAVE WHEN CROSSING THE FIELD. DON'T LOSE SIGHT OF THE (object:) THROUGHOUT THE TURNS"

VII.

1. Maximum altitude deviation during two turns:	stays within ±100 ft.	a
	gains over 100 ft.	b
	loses over 100 ft.	c
2. Airspeed control:	☐ ±10 mph	a
	☐ too fast	b
	■ too slow	c
3. Bank during turns:	correct	a
	too shallow	b
	too steep	c
4. Wind correction: (to keep objects in view).	satisfactory adjustment to maintain even track	a
	over-compensation for wind drifts	b
		c
5. Use of controls:	smooth and minimum action	a
	frequent and unnecessary control action	b
	rough and uncoordinated movement	c
6. Ground inspection:	adequate examination of ground	a
	pays too much attention to ground	b
	only brief and superficial examination of ground	c
7. Heading on rollout:	within ±15°	a
	recovers too early	b
	recovers too late	c
8. Examiner has to take over to avoid danger before end of maneuver:	No	a
	Yes (add comments)	b

"CLIMB BACK TO 600 FEET"

SCORE S

VIII. RE-ORIENTATION VIII.

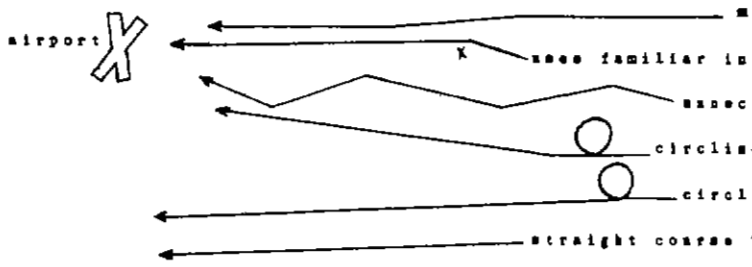
At 800 ft. or an altitude to give 5 miles visibility, Examiner returns map to student and says, "WHERE ARE WE?"

1. Within time limit of 3 minutes and no help from Examiner:
   positive identification with minimum delay a
   slow and hesitant identification b
   confusion - fails to make positive identification c

2. Altitude control during orientation:
   within ±200 ft. limits a
   climbs over 200 ft. b
   loses over 200 ft. c

After orientation is completed, or failed; "NOW TAKE UP A HEADING FOR THE HOME AIRPORT"

3. In setting up return course, student's track shows:



4. Established heading:
   will probably bring airport in sight a
   will require more than ±30° changes to sight field. b

5. Estimated minutes to airport traffic pattern given by student: _____ minutes.
   this is within 25% error limits a
   this is more than 25% error limits b

SCORE S

IX. STALL RECOGNITION IX.

"FLY TO A SAFE MINIMUM ATTITUDE FOR SLOW FLYING... NOW I WANT YOU TO SLOW-FLY AT THE MINIMUM CONTROLLABLE AIRSPEED -- JUST ABOVE STALLING SPEED. FLY STRAIGHT AND LEVEL."

1. While changing attitude and during first minute:
   stays within ±100 ft. a
   climbs over 100 ft. b
   loses over 100 ft. c

2. During the first minute there is:
   no sign of stall a
   some buffeting b
   actual stall occurred c

Now say to the student, "I AM GOING TO CUT THE THROTTLE. HOLD THIS ATTITUDE UNTIL YOU STALL AND RECOVER WITH POWER AFTER THE STALL BUT WITH MINIMUM LOSS OF ALTITUDE."

3. Examiner cuts throttle:
   immediate burble prior to actual stall a
   signs of stall delayed - flying too fast b
   makes recovery before stall occurs c

4. Recovery procedure for minimum loss of altitude is:
   adequate (less than 150 ft. in Cub or Aeronca) a
   inadequate (more than 150 ft. lost) b

5. Heading after recovery (deviation):
   ☐ left a
   ⋮ ±15° b
   ☐ right c

After re-establishing slow-flying straight ahead and at the assigned altitude, say, "NOW MAKE A 180° MEDIUM BANK LEVEL TURN TO THE RIGHT"

6. During this 180° turn there is:
   no sign of stall a
   some buffeting b
   actual stall occurs c

IX.

7. Use of controls during turn: smooth and minimum movements a
rough and excessive movements b

8. Altitude control during turn: stays within ±100 ft. a
climbs over 100 ft. b
loses over 100 ft. c

9. Degree of bank: about right a
too shallow b
too steep c

10. Heading at end of 180° turn: ☐ left a
☐ ±10° b
☐ right c

"NOW MAKE A 180° TURN TO THE LEFT." Before turn is completed give student same instructions as for item #8 above.

11. Cut throttle: immediate burble prior to actual stall a
signs of stall delayed - flying too fast b
makes recovery before stall occurs c

12. Recovery procedure for minimum loss of altitude is: Adequate (less than 150 ft.) a
Inadequate (more than 150 ft.) b

13. Examiner has to take over to avoid danger before end of maneuver: No a
Yes b

SCORE S

X. STALLS (at safe altitude) X.

"DO A STALL AND RECOVERY FROM A CLIMBING TURN TO THE LEFT AND THEN TO THE RIGHT."

1. Clears area: Yes a
No b

2. Uses climbing power with medium bank: Yes a
No b

3. Continuous rate of turn until time of stall: Yes a
No b

4. Recovers: about right a
too soon b
too late c

5. Recovers with minimum loss of altitude: Yes a
No b

6. Heading control: within ±15° a
loses heading b

7. Control of dive and pull-out: normal a
excessive b

"DO A STALL AND RECOVERY FROM A GLIDING TURN TO THE LEFT AND THEN TO THE RIGHT."

8. Clears area: Yes a
No b

9. Establishes medium bank turn: Yes a
No b

10. Continuous rate of turn until time of stall: Yes a
No b

11. Application of power: about right a
too soon b
too late c

12. Recovers with minimum loss of altitude: Yes a
No b

13. Heading control: within ±15° a
loses heading b

14. Control of dive and pull-out: normal a
excessive b

15. Examiner has to take over to avoid danger before end of maneuver: No a
(add comments) Yes b

SCORE S

XI LANDINGS XI.

There should be at least two landings. The first: power-approach, 3-point, crosswind and within a 200 ft. 'spot'. The second: power-off, up-wind and within a 300 ft. 'spot'.

1. Pattern procedure: Check each of the following items: the Yes box if done correctly; the No box if done incorrectly.

- 45° approach a
- position of downwind leg b
- altitude on downwind leg c
- carburetor heat d
- cuts power at right place e
- airspeed reduction f
- glide attitude g
- turn onto base leg h
- base leg altitude i
- clears engine j
- visual safety clearance k

2. Final turn
   - a. airspeed: ☐ ±10 mph a; ☐ too fast b; ■ too slow c
   - b. control of turn: fairly square a; overshot b; undershot c
   - c. use controls: smooth and coordinated a; rough and unnecessary movement b

3. Final Approach
   - a. Heading: fairly straight track a; S's down final b
   - b. Final approach airspeed: (deviation) ☐ ±5 mph a; ☐ +10 b; ☐ too fast c; ☐ -10 d; ■ too slow e

(Grade this page after landing-roll and turn-off) XI.

4. Flare-out and touchdown

- reduction of power: O.K. a; too soon, (had to use power) b; too late c; did not use power d
- start of level-out: about right a; too high b; too low c
- wind drift correction (slip and crab): correct a; uncorrected drift b; over-corrected drift c
- touchdown: Where- spot - 200 ft. a; spot - 300 ft. b; beyond spot c; should go around but didn't d; had to go around e
- touchdown: How- three-point or normal a; nose high or tail first b; nose too low or wheels first c
- bounced or dropped: normal a; excessive b; ballooned c
- recovery from bad landing: does not apply a; satisfactory b; needed help c

5. Roll
- track: fairly straight path a; rolled to one side b; rolled off runway c
- stick control: correct for type of landing a; wrong or inadequate stick control on roll b

SCORE 8

XII. SHORT FIELD TAKE-OFF (Upwind) XII.

"MAKE THIS A SHORT FIELD TAKE-OFF FROM A FIRM SURFACE"

1. Wheels-off attitude:
   approximate 3-point position a
   tail too high b

2. Flight path just after becoming airborne:
   normal a
   touches down again b
   staggers off c
   remains on ground too long for safe clearance d

3. Initial climb: Power setting:
   normal a
   too little b
   excessive c

   Attitude:
   normal a
   nose too low b
   nose too high c

4. Track in climb to first turn:
   fairly straight path a
   drifts off to either side b

5. Looking around
   O.K. a
   a little b
   Not c

6. Climbing turns

   use of power:
   about right a
   variable b
   too rough or beyond limits c

   attitude:
   normal a
   nose high b
   nose low c
   bank too steep d

   coordination: smooth, coordinated turns a
   crosses controls b
   overcontrols c

When entering downwind leg for 2nd, (power-off) landing, turn back to preceding maneuver.

SCORE 8

XIII. FINAL TAXIING XIII.

1. Clears for turn off runway: Yes a
   No b

2. Taxiing to parking position:
   uses throttle properly a
   uses brakes properly b
   makes S-turns when necessary c
   uses controls correctly d

SCORE 8

PRE-FLT. I	X-WIND TAKE-OFF III	X-COUNTRY IV	Con't IV	FORCED L'NDG V	STRANGE FLD. VI	Con't VI	OBSRVTN. VII	TAXIING XIII	SHORT-FLD TAKE-OFF XII	LANDINGS (con't) XI	LANDINGS XI	STALLS X	STALL RECOG. IX.	STALL RECOG. IX	RE-ORIENT VIII
Taxi-ing II		Sch. pt / Sch. pt			2nd pattern / 1st					2nd ldg / 1st ldg	2nd ldg / 1st ldg	To R / To L			
SCORE S P F	S P F		S P F	S P F		S P F	S P F	S P F	S P F	S P F		S P F	S P F		S P F

DATE	PLACE	EXAMINER	STUDENT

S U M M A R Y	POINTS-OFF SCORE	PASSED	FAILED	C O M M E N T S
I. Pre-Flight Check		P	F	I.
II. Taxiing to take-off		P	F	II.
III. Crosswind Take-Off		P	F	III.
IV. Cross Country		P	F	IV.
V. Forced Landing		P	F	V.
VI. Strange Field Procedure		P	F	VI.
VII. Low Altitude Observing		P	F	VII.
VIII. Re-orientation		P	F	VIII.
IX. Stall Recognition		P	F	IX.
X. Stalls		P	F	X.
XI. Landings		P	F	XI.
XII. Short Field Take-Off		P	F	XII.
XIII. Final Taxiing		P	F	XIII.
XIV. Total Check Score		P	F	XIV.

AMERICAN INSTITUTE FOR RESEARCH
413 Morewood Avenue, Pittsburgh 13, Pa.

REQUEST FOR SUGGESTIONS ON PRIVATE PILOT FLIGHT-CHECK

For more than a year now, under the auspices of CAA, The American Institute for Research has been working on a new type of private pilot certification flight-check. A copy of this experimental check and a Manual of Instructions is attached.

This check, as it now stands, represents the cooperative effort of quite a large number of expert pilots and Examiners. It has been flight-tested with both students and experienced pilots but the next crucial phase of this research project requires the comments and criticisms of a large but selected sample of pilots, experienced in the field of private pilot training and certification.

Before answering the questions, however, you should know that it is our purpose to include in the check those maneuvers which would test the skills most important for the private pilot. We view the private pilot as a man who is capable and anxious to use his plane for cross-country flying as well as for pleasure flying around his home airport. With emphasis put on these objectives, private flying can be encouraged and expanded beyond its current level.

HOW TO PROCEED

Read the first half of Page 1 of the Manual of Instructions. Then, examine each of the check-ride maneuvers along with the Manual of Instructions. The Manual is intended to answer most of the questions you might raise.

Having looked over the entire check-ride, please state briefly your opinion regarding the following problems.

1. Are some of these maneuvers unnecessary so far as private pilot skills are concerned? If so, which ones would you drop out and for what reasons?

2. What different type of maneuver would you like to see included in this check? If you have a suggestion, show us what specific abilities should be observed and graded. In other words, what important skills or abilities are not adequately covered by this check?

3. Do you have any important changes to make in the sequence of maneuvers?

4. Do you have any suggestions as to how the Manual of Instructions should be improved?

Pilots differ in their opinions as to how the items making up the different maneuvers should be scored. Please give us your suggestions. Read the material under Scoring on Page 6 of the Manual.

5. In your opinion, how should the final grading be made?

   A. Should every maneuver be passed or should a total score on the entire check-ride determine final certification?

   B. Should some of the maneuvers be weighted more than others in determining final level of proficiency? If so, which ones?

   C. Do you think we should change the score value for any of the items (indicated by the "dots")? List your suggested changes in this space.

Some additional problems are:

6. Should this type of check include the forced landing?

7. What type of landings are most important for the private pilot? How many landings should be given with the check?

8. How important is it to limit this check-ride to one hour?

9. What special difficulties would occur in the use of the present check in your part of the country? (For example, mountains, congested area, air traffic, and the like?)

10. Please give us any suggestions as to how the check might be modified to meet your local conditions.

11. In this space add any other comments about any part of the check (or the whole idea in general), which might help us develop better methods of private pilot certification.

We appreciate the time and effort called for by this questionnaire but can think of no other feasible way to receive the honest opinions of experienced pilots directly concerned with private pilot training and certification. We feel that this is an important problem and hope you will give us your cooperation and return this questionnaire to:

Dr. Stanford C. Ericksen
American Institute for Research
413 Morewood Avenue
Pittsburgh 13, Pennsylvania

The questionnaire filled out by: Name_____

Title or position _____

Place_____

The deadline for returning is February 1, 1951.

FREQUENCY OF ACCIDENTS RESULTING IN FATAL OR SERIOUS INJURY TO PERSONNEL OR TOTAL DESTRUCTION OF AIRCRAFT (WITHOUT INJURY TO PERSONNEL) GROUPED BY THE PILOT BEHAVIORS RESPONSIBLE FOR THEM

Pilot Behavior	Frequency of Behaviors Judged to be Primary Cause	Secondary Cause
I. Carrying Out Check and Preparation for Flight		
1. Made inadequate or no check	5	5
2. Failed to check fuel supply and valves	3	9
3. Failed to run-up engine	1	
4. Failed to check stick travel		1
5. Failed to check or adjust trim tabls	1	1
6. Failed to check carburetor heat control		2
7. Failed to set brakes	1	
8. Misset flaps	5	
9. Failed to fasten or unfastened safety belt	4	
10. Failed to set or misset altimeter	2	
II. Failure or Lack of Skill in Handling Controls		
1. Failed to clear or neglected engine	12	6
2. Failed or was too late in applying carburetor heat	22	28
3. Selected wrong propeller pitch	1	4
4. Applied excessive back pressure on stick	5	
5. Failed to set stabilizer properly	1	
6. Failed to set or adjust trim tabs properly	1	
7. Jammed rudder	1	
8. Applied or closed throttle too abruptly	12	
9. Held controls in extreme position	1	
10. Failed to adjust or wrongly adjusted fuel valves	10	12
11. Inadvertently lowered gear	3	
12. Failed to raise gear		1
13. Actuated wrong controls	3	2
14. Applied brakes too hard or rode brakes	6	
III. Estimating Altitude or Position of Plane		
1. Misjudged altitude	6	
2. Misjudged distance travelled	1	
3. Misjudged distance to obstructions	1	
IV. Maintaining Lookout		
1. Failed to survey terrain for obstructions	29	
2. Failed to make a clearing turn before take-off	1	
3. Failed to observe approaching acft	26	
4. Overtook acft in flight path	3	

Appendix D (Contd.)

Pilot Behavior	Frequency of Behaviors Judged to be Primary Cause	Secondary Cause
V. Failure to Estimate Speed Accurately		
1. Take off too soon	3	3
VI. Knowledge and Judgment of Proper Procedure		
1. Positioned aircraft incorrectly for take-off or landing	17	2
2. Started with full throttle	1	
3. Followed incorrect propeller procedure	2	2
4. Exceeded stress limits of aircraft	3	
5. Allowed passenger to wing-walk	1	
6. Flew contact in instrument conditions	3	
7. Exhausted fuel supply	5	
8. Used improper gasoline		30
9. Misjudged suitability of landing field		1
10. Continued flight in adverse conditions	17	
11. Misidentified terrain feature	1	
12. Mistakenly estimated fuel supply	1	
13. Landed on wrong runway	1	
14. Walked into propeller	8	

FREQUENCY OF ACCIDENTS RESULTING IN FATAL OR SERIOUS INJURY TO PERSONNEL OR IN TOTAL DESTRUCTION OF AIRCRAFT (WITHOUT INJURY TO PERSONNEL) GROUPED BY THE MANEUVER IN WHICH THEY OCCURRED
(1947)
N-1563

Operational Phase, Sub-Phase, and Maneuver	Frequencies		
	Op. Ph.	Sub-Ph.	Maneuver
I. PRE-TAKE-OFF	28		
A. Visual Check and Pre-Starting		28	
1. Visual check			1
2. Preparation of acft and apt for flight			3
3. Cockpit check and run-up			19
4. Starting			1
5. Pulling prop			3
6. Boarding acft			1
II. TAXIING	12		
A. To Take-Off		7	
1. Positioning acft			2
2. Taxiing			5
B. From Landing		5	
1. Taxiing			2
2. Clearing			2
3. Other			1
III. TAKE-OFF	290		
A. Run		49	
1. Start of run			5
2. During run			17
a. Turn during run			2
3. Past take-off point			25
B. Climb		227	
1. Becoming airborne			25
2. In climb			115
3. Turn			78
a. Turn just completed			1
4. Pull-up			7
5. Pull-up in turn			1
C. Discontinued take-off		14	
1. Run			1
2. At point of take-off			9
3. Airborne			4
IV. ACROBATICS	103		
1. Chandelle			3
2. Snap roll			3
3. Slow roll			7
3a. Roll (unspecified)			1
4. Wingover			7
5. Spin			26
6. Loop			9
a. Loop recovery			1
7. Inverted flight			2

Appendix E (cont'd)

Operational Phase, Sub-Phase, and Maneuver	Frequencies		
	Op. Ph.	Sub-Ph.	Maneuver
8. Level-off			2
9. Steep turn (incl. 1 "S" turn)			5
10. Pylon 8's			2
a. Lazy 8's			2
b. Elementary 8's			1
11. Power-off stall			5
12. Stall (unspecified)			4
13. Acrobatics (unspecified)			12
a. Acrobatics (pull-up)			1
14. Vertical Bank			1
15. Dive			4
a. Dive pull-up			2
16. Dog fighting			3
V. NORMAL FLIGHT	340		
1. Let down through overcast			12
2. Level flight			19
3. Circling			18
4. Glide			13
5. Descent			2
6. Spin (inadvertent)			2
7. Steep bank			3
8. Spiral descent			2
9. Pull-up			8
a. Pull-up to turn			1
b. Pull-up from glide			1
10. Climb			9
a. Establishing climb			1
b. Level off after climb			2
11. Dive			8
12. Turn			113
13. Climbing turn			24
14. Diving turn			3
15. Dragging field			5
16. Undetermined			92
17. Zoom			2
VI. BUZZING	225		
1. Turn			81
2. Climbing turn			24
3. Climb			9
4. Dive			15
5. Pull-up			27
6. Buzzing (unspecified)			98
7. Split "S"			1
VII. FORCED LANDING	168		
A. Approach		129	
1. Approach (unspecified)			34
			61

Appendix E (cont'd)

Operational Phase, Sub-Phase, and Maneuver	Frequencies		
	Op. Ph.	Sub-Ph.	Maneuver
2. Final approach			61
a. Turn on final			3
b. Pull-up on final			1
3. Turn			25
4. Pull-up			2
5. Dive			1
6. Glide before climb-out			1
7. Before touchdown			1
B. Level-off		7	
C. Roll		32	
VIII. LANDING	367		
A. Approach		224	
1. Approach (unspecified)			78
a. Low approach			27
b. Straight-in approach			1
2. Final approach			59
3. Turn			32
a. Turn into final approach			10
4. Circling			4
5. Glide			6
6. Letdown			1
7. Forward slip			3
8. Pull-up			1
9. Dive			1
10. Power-stall approach			1
B. Level-off		44	
1. Level-off			27
a. Just before touchdown			10
b. Touchdown			3
2. Turn after level-off			2
3. Forward slip			2
C. Roll		17	
D. Go-around		74	
1. Go-around (unspecified)			32
2. Turn			15
3. Climbing turn			11
4. Pull-up			14
5. Level-off after climb			2
E. Deplaning		8	

TOTAL NUMBER OF STUDENT PILOTS (NEAR 40 HOURS) VERSUS COMMERCIAL PILOTS (OR EQUIVALENT) RECEIVING A "DOWNGRADE" ON EACH ITEM OF AN EARLY FORM OF OBJECTIVE FLIGHT CHECK

Maneuver and Sub-phase	No. of S's Downgraded		Omit	
	Student N=10	C. P. N=8	Student N=10	C. P. N=8
I. RENTED AIRPLANE PRE-FLIGHT CHECK				
Gas and oil	0	1	0	0
Switch off	1	1	1	0
Aileron and rudder play	0	0	0	0
Fuselage and cowling	0	0	0	0
Prop	1	2	0	0
Tires	0	0	0	0
Tail or nose wheel assembly	0	0	4	0
Elevator and rudder hinges and braces	0	0	0	0
Overall check	0	0	0	0
	2	4		
STARTING ENGINE				
Safety of Others	0	0	1	0
Trim tab	0	0	4	0
Switch	1	0	2	0
Gas valves	0	0	1	0
Chocks, brakes	0	0	0	0
Safety belts	0	0	1	0
Control play	3	1	2	0
Prop blast	1	0	4	4
Follows prescribed procedure	1	0	1	0
	6	1		
II. TAXIING TO TAKE-OFF				
1. Clears for taxi	0	0	0	0
2. Taxi to position:				
smooth use of throttle	0	0	0	0
smooth use of brakes	0	0	0	0
S-turn when necessary	1	0	0	0
safe taxiing speed	1	0	0	0
control for wind	3	1	0	0
2. Position for run-up	2	0	0	0
4. Use of check-list, etc.	0	0	0	0
5. Clears for safety	0	0	1	0
	7	1		

Appendix F (cont'd)

Maneuver and Sub-Phase	No. of S's Downgraded		Omit	
	Student N=10	C. P. N=8	Student N=10	C. P. N=8
III. CROSSWIND TAKE-OFF				
1. Directional control on run*	1	0	1	0
2. Flight path just after becoming airborne	0	0	0	0
3. Initial climb				
a. Power setting	2	0	0	0
b. Attitude	0	0	0	0
4. Track in climb to first turn	2	0	0	0
5. Looking aroung	8	0	0	0
6. Leaves pattern procedure	2	0	2	1
7. Climbing turns				
a. Use of power	1	0	0	0
b. Attitude	0	1	0	0
c. Coordination	3	0	0	0
	19	1		
IV. CROSS COUNTRY N=	8(1)	8	8	8
1.a. First checkpoint	0	0	0	0
b. Positive identification	0	0	8(2)	8(2)
c. Altitude	2	0	1	0
2. 2nd checkpoint				
a. Heading	3	2	1	0
b. Identified & reported	1	0	0	0
c. Positive identification	0	0	7(2)	8(2)
d. Altitude	1	0	0	0
e. Forced landing	4	2	0	0
3. 3rd check point				
a. Heading	2	1	1	0
b. Identified & reported	3	0	0	0
c. Positive identification	1	0	7(2)	8(2)
d. Altitude	1	0	0	0
4. Maintained power setting	0	0	1	0
5. Looking around	7	0	0	0
6. Would hit 30 min. c-p	1	0	0	0
7. Heading to alternate	1	0	0	0
8. Altitude next 5 min.	0	0	0	0
	27	5		

*The specific items of choice are omitted from the rest of this table.

(1) Due to time limitations, some students were not required to perform some maneuvers. Note the N for each maneuver.

(2) Item omitted if preceding item O. K.

Appendix F (cont'd)

Maneuver and Sub-Phase	No. of S's Downgraded		Omit	
	Student N=10	C. P. N=8	Student N=10	C. P. N=8
V. HIGH FORCED LANDING				
1. Attitude	1	0	0	0
2. Misuse of controls	6	0	0	0
3. Turns near ground	2	0	1	0
4. Simulates base leg	4	0	0	2
5. Airspeed on final	1	1	1	0
6. Came in (upwind, etc.)	6	1	0	1
7. Landing (safe)	4	0	0	0
8. Examiner took over	1	0	1	0
	25	2		
VI. STRANGE FIELD PROCEDURE WITH POWER AND OPPOSITE TRAFFIC PATTERN				
N=	8	8	8	8
Dragging				
1. Enters pattern	1	0	3	0
2. Enters "downwind" leg	1	0	1	0
3. Carburetor heat	1	0	1	0
4. Proper speed on downwind leg	0	0	2	0
5. Altitude on downwind leg within 100'	3	0	1	0
6. Looks around to correct side	2	1	1	0
7. Simulates base leg	1	0	1	0
8. Airspeed on base leg	0	2	1	0
9. Safe final turn and approach	2	0	3	0
10. Does opposite hand pattern	5	0	0	0
11. Use of controls on final	0	0	2	0
12. Flew just off suitable lane	0	0	2	0
13. Height over field	2	2	2	0
15. Dragging Airspeed	3	1	2	0
16. Turn off carburetor heat	1	0	4	0
Simulated Landing				
1. Entered pattern	0	0	3	0
2. Enters "downwind" leg	0	0	1	0
3. Carburetor heat on	1	0	1	0
4. Proper speed on down leg	2	0	1	0
5. Altitude on down leg within 100'	3	0	0	0

Appendix F (cont'd)

Maneuver and Sub-Phase	No. of S's Downgraded		Omit	
	Student N=8	C. P. N=8	Student N=8	C. P. N=8
VI. Strange Field Procedure - cont'd				
6. Looks around to correct side	4	0	0	0
7. Simulates base leg	0	0	0	1
8. Airspeed on base leg	3	1	0	0
9. Safe final turn and approach	1	0	3	0
10. Does opposite hand pattern	4	2	1	0
11. Use of controls on final	2	0	1	0
12. Simulated landing	3	1	0	0
13. Turn off carburetor heat	0	0	3	0
	45	10		
VII. LOW ALTITUDE OBSERVING N=	8	8	8	8
1. Altitude control	3	3	0	0
2. Airspeed control	2	1	0	0
3. Bank during turns	2	4	3	0
4. Wind correction	4	3	0	0
5. Use of controls	1	1	0	0
6. Ground inspection	2	0	0	0
7. Heading on rollout	5	1	0	0
	19	13		
VIII. REORIENTATION N=	8	8	8	8
1. Positive identification	0	0	0	0
2. Orienting for identification	2	0	0	0
3. Altitude control	2	0	0	0
4. Heading	1	1	0	0
5. Setting up track	1	0	0	0
6. Altitude control	1	0	1	2
7. Est. minutes to field	2	0	0	0
	9	1		
IX. SLOW FLYING N=	9	8	9	8
1. Altitude while setting up	5	1	0	0
2. Marginal speed	8	5	0	0
3. Stall action	8	4	0	0
4. Altitude recovery	2	0	0	0
5. Heading	1	0	0	0
6. Ist 180° turn (stall)	7	4	1	0
7. Use of controls	1	1	2	0
8. Altitude in turn	1	1	1	0
9. Heading	2	0	2	0

Appendix F (cont'd)

Maneuver and Sub-phase	No. of S's Downgraded		Omit	
	Student N=10	C. P. N=8	Student N=10	C. P. N=8
10. Throttle cut in turn	8	4	0	0
11. Altitude recovery	2	0	0	0
12. Use of power and controls	1	0	1	0
	46	20		
X. LANDINGS - POWER-ON, WHEELS				
1. Pattern procedure:				
45° approach	1	0	0	0
position of downwind leg	1	0	0	0
altitude on downwind leg	0	1	0	0
carburetor heat	0	0	0	0
cut power at right place	0	0	0	0
airspeed reduction	0	1	0	0
glide attitude	0	1	0	0
turn onto base leg	0	0	0	0
base leg altitude	0	0	0	0
position of base leg	2	2	0	0
clears engine	4	5	0	0
visual safety clear	6	0	0	0
2. Final turn, A/S	2	2	0	0
Heading	5	1	0	0
Use of controls	1	0	0	0
3. Final approach, Heading	3	0	0	0
Airspeed	0	1	0	0
4. Wheel landing				
a. application of power	1	2	5	0
b. start of level out	2	1	1	0
c. Wind drift correction	3	0	0	0
d. touchdown - where	6	2	1	0
e. touchdown - how	4	0	0	0
f. cut power	2	4	6	0
g. bounced or dropped	1	2	3	0
h. recovery, if needed	1	0	4	5
5. Roll				
a. track	2	0	0	0
b. stick control	3	2	3	0
	50	27		

Appendix F (cont'd)

Maneuver and Sub-phase	No. of S's Downgraded		Omit	
	Student N=5	C. P. N=8	Student N=5	C. P. N=8
X. LANDINGS - POWER-OFF, 3 POINT				
1. Pattern procedure				
position of downwind leg	0	0	0	0
altitude on downwind leg	0	0	0	0
carburetor heat	0	0	0	0
cut power at right place	0	0	0	0
airspeed reduction	0	0	0	0
glide attitude	0	0	0	0
turn onto base leg	0	0	0	0
base leg altitude	0	0	0	0
position of base leg	0	1	0	0
clears engine	1	3	0	0
visual safety clear	2	1	0	0
2. Final turn, A/S	0	0	0	0
Heading	1	1	0	0
Use of controls	0	0	0	0
3. Final approach				
heading	1	0	0	0
airspeed	0	0	0	1
4. Landing				
start of level out	2	0	0	1
wind drift correction	1	0	0	0
touchdown - where	2	3	0	0
touchdown - how	3	3	1	0
bounced or dropped	1	1	1	1
recovery - if needed	0	0	4	7
5. Roll				
track	0	0	0	0
stick control	1	0	0	0
	15	13		

Appendix F (cont'd)

Maneuver and Sub-phase		No. of S's Downgraded		Omit	
		Student N=3	C. P. N=8	Student N=3	C. P. N=8
XI. SECOND TAKE-OFF					
1. Directional control		0	0	0	0
2. Flight path in air		0	1	0	0
3. Initial climb					
a. power setting		0	0	0	0
b. attitude		0	0	0	0
4. Track in climb to Ist turn		0	0	0	0
5. Looking around		2	1	0	0
6. Climbing turns					
a. use of power		0	0	0	0
b. attitude		1	0	0	0
c. coordination		0	0	0	0
		3	2		
XII. FINAL TAXI	N=	4	8	4	8
1. Clears for turn off		1	0	0	0
2. Taxi to park		0	0	0	0

APPENDIX G_I

Results of the Formal Reliability and Validity Study Carried Out at the Institute of Aviation

The present section contains a more complete analysis and discussion of the results of the formal reliability and validity study carried out at the Institute of Aviation than was given in Chapter IV., pages - 29 - 33.

The results reported in this section, as well as all the other data referred to in Appendix G, were obtained on tentative and early forms of the objective flight-check. The final form included in this report, Appendix B, is basically similar and duplicates most of the items. The major differences are in the layout, the scoring weights, and the addition of the Stall maneuver, No. X.

The form of the flight-check used in the present study was scored as follows: correct performance carries 0 weight. Negative weights of from one to five are assigned to the item scoring boxes. Boxes carrying a negative weighting of five were identified by an asterisk and when marked indicated a "failure" on that maneuver.

1. Scoring the Objective Flight-check

Not all of the items were marked by the check pilots for all of the students. These omits were probably simple over-sights in some cases, but more generally were due to the fact that the 20-hour students had not yet received training on some of the maneuvers, and for this reason the check pilots did not require the student to complete the maneuver. The best example of this is the power-approach wheels landing (after the experiment started, it was decided to change this first landing to a power-approach normal three-point landing). Apparently all of the landing instruction and practice up to the 20-hour period had been with the power-off landing. Consequently, scores on this first landing were omitted from the 20-hour calculations. Other omitted items and maneuvers were due to flight time limitations and adverse weather conditions.

In the case of these omits at the 20-hour level, we derived a "best guess" score. The procedure employed in obtaining this estimated score is presented in detail in Appendix G_{II}. There were a total of 16 omits out of the 312 possible maneuver scores (12 maneuvers for each of 26 subjects), and only four students had two or more maneuver omits. On the 40-hour check there were no cases in which a total maneuver was omitted, and only a few scattered individual items were omitted.

From the experimental flight-check, it was possible to derive three objective proficiency measures for each student: (1) total points-off on the flight-check (each "error" response on the check carries a penalty of 1 to 5 points), (2) the total number of asterisk marks (a specific "failing" item) received by the student, and (3) the number of maneuvers on which that student's performance fell below an arbitrary cut-off point. The arbitrary cut-off point employed for this purpose was the rounded Q1 score for each maneuver - the bottom 25 per cent. (The procedure employed in obtaining this Q1 cut-off score is given in Appendix G_{II}.

This method of scoring was followed for both the 20 and 40-hour phases, although the number of omits was practically nil at the 40-hour phase.

2. The Twenty-hour Results

Table G_I-A presents the basic data for the 20-hour comparison. For each of the 26 subjects, the subjective percentage grades given by the regular instructor and the check pilot are shown plus the three different objective scores calculated for each student. (See preceding section.) Table G_{III} carries the separate maneuver scores for all subjects.

The distribution of subjective scores given by the regular instructor and the check pilot are remarkably similar as to range and mean. The bottom score in both columns is 35 while the high score in first column is 72 and the second 70. Two students had a total points-off score of only 23 while the opposite extreme score was 194. The mean and range of the asterisk scores is small, though it is interesting to note that one student made a "failing" score eleven different times during this one check-ride. The data shown in Table G_I-A provide the basic information for the correlational analysis shown in the next table, Table G_I-B.

Table G_I-B presents the basic comparison data for the 20-hour phase. Correlations were computed between the ten possible pairings of these five performance measures. The negative correlations obtained between the objective and subjective scores arise because the subjective scores vary directly with absolute proficiency whereas the objective scores vary inversely with absolute proficiency. For purposes of interpretation, the negative signs can be ignored.

TABLE G_I-A

PROFICIENCY SCORES: 20-HOUR

	SUBJECTIVE		OBJECTIVE		
Subjects	Instructor Grade	Check Pilot Grade	Total Points-Off	No. of Asterisk	No. Man-uevers Below Cut-Off
1.	55	57	23	0	0
2.	45	45	119	2	5
3.	35	43	133	4	5
4.	66	65	62	1	0
5.	61	57	71	0	2
6.	61	54	53	2	1
7.	72	52	23	1	0
8.	55	58	41	1	1
9.	60	53	46	2	0
10.	55	50	52	0	1
11.	51	50	141	4	6
12.	55	50	77	3	2
13.	55	55	135	2	5
14.	58	50	111	7	4
15.	64	60	93	3	3
16.	45	35	182	11	9
17.	57	56	51	1	0
18.	45	58	49	0	1
19.	55	56	43	1	1
20.	57	60	87	2	2
21.	51	49	194	6	9
22.	60	52	72	3	1
23.	61	50	88	5	3
24.	60	70	62	0	1
25.	61	62	60	0	1
26.	55	55	94	3	4
27.	No Data Available				
M	55.88	53.92	83.15	2.42	2.61
	7.31	6.96	44.17	2.78	2.56

TABLE G_I-B

Intercorrelations Between Two Subjective Proficiency Scores and Three Objective Proficiency Scores: 20-Hour Evaluation

(N = 26)

	Subjective	Objective		
	Check Pilot Grade	Total Points-Off	No. of Asterisk	No. Manuevers Below Cut-off
Instructor Grade	.58	-.52	-.30	-.57
Check Pilot Grade		-.58	-.64	-.62
Total Points-Off			.72	.80
No. of Asterisk				.72

An r of .496 is required for rejection of the null hypothesis at the 1% level; .388 at the 5% level.

If we use the instructor's grade as the criterion, we see immediately that two of the objective measures - the total points-off and the number of maneuvers below the cut-off - predict performance about as well as the check pilot's subjective grade. The instructor-check pilot correlation of .58 is an inflated value to the extent there may have been collusion or prior information on the part of the check pilot.

The three different objective measures do not indicate clearly where the check pilot obtained his subjective percentage scores since the three correlations of .58, .64, and .62 are not significantly different from each other.

The three intercorrelations between the objective scores are somewhat inflated as a function of our arbitrary scoring system, since every asterisk added five points to the total points-off score and also contributed heavily to putting the student into the bottom 25 per cent, (which is considered as failing for a given maneuver). On the other hand, the absolute number of asterisks given is not large (see Table G_I-A above). Not withstanding the above qualifications, the objective score intercorrelations indicate some degree of internal consistency within the scores derived from the objective check.

3. The forty-hour Phase

The flying proficiency of each student was re-examined at approximately the 40-hour point which is the end of the formal private pilot training program. We obtained the regular instructor's over-all estimate of the student, the check pilot's subjective grade and the objective flight-check form which was filled out during the check-ride. The general procedure employed in the analysis of these data was similar to that employed with the 20-hour results. (See Table G_{IV} for basic data.)

At this more advanced level each student attempted and was rated on all twelve flight maneuvers covered by the objective flight-check, so, it was not necessary to derive any "best guess" scores to fill in missing data. The same three objective proficiency scores were derived for each student from the 40-hour objective check that had been obtained previously from the 20-hour data.

Table G_I-C gives each of the three objectively derived 40-hour performance scores along with the two subjective scores for each student. Here again we note the similarity between the two distributions of subjective grades. The means are approximately the same, though the variability in the check pilot's subjective grade is relatively greater at the 40-hour level in comparison to the instructor's grade than was true at the 20-hour. The marked step-up in the absolute level of scores will be referred to again on a later page. Subject No. 16 withdrew from the training course at the 20-hour check and Subject No. 27 listed in Table G_I-C did not take the 20-hour check, so, we have only 25 cases in which complete records were obtained at both the 20 and the 40-hour testing period.

TABLE G_I-C

SUBJECTIVE AND OBJECTIVE PROFICIENCY EVALUATIONS; 40-HOUR CHECK

	SUBJECTIVE		OBJECTIVE		
Subjects	Instructor Grade	Check Pilot Grade	Total Points-Off	No. of Asterick	No. Maneuvers Below Cut-Off
1.	82	78	42	2	2
2.	75	74	44	1	1
3.	75	72	39	1	2
4.	83	75	57	0	4
5.	84	82	30	0	2
6.	83	88	6	0	0
7.	84	80	38	0	3
8.	81	82	35	0	0
9.	85	85	49	0	1
10.	82	74	41	2	1
11.	80	82	49	0	2
12.	80	78	67	1	3
13.	77	80	64	0	4
14.	86	78	31	2	0
15.	86	84	34	0	1
16.		NO DATA AVAILABLE			
17.	84	78	38	1	2
18.	75	60	109	0	4
19.	78	72	51	0	1
20.	80	65	91	4	5
21.	75	60	149	4	8
22.	83	83	10	0	0
23.	80	85	20	0	0
24.	83	83	49	1	3
25.	81	80	33	0	1
26.	81	79	47	1	3
27.	76	74	46	0	3
M	80.73	77.35	48.88	.77	2.15
	3.55	6.97	29.00	1.15	1.84

Intercorrelations were computed between the ten possible pairings of the five 40-hour proficiency measures and are presented in Table G_I-D. Again the negative signs with the correlations between objective and subjective performance measures may be disregarded for purposes of interpretation.

The correlation between the instructor's grade and the check-pilot's grade showed an insignificant change from .58 at the 20-hour level to .63 at the 40-hour level. Again, the total points-off objective score showed about as much agreement with the instructor's grade as did the check pilot grade. The other two objective measures dropped appreciably in their correlation with the instructor's grade. One marked change was the significant ($p_{=}.05$) increase from .58 to .87 in the correlation for total points-off and the check pilot's subjective grade. In this comparison, the other objective scores did not change appreciably.

In both Tables G_I-B and G_I-D the total points-off score appears to be a better single objective measure than either the number of asterisks or the number of maneuvers below the cut-off point.

At both the 20 and 40-hour levels, the total points-off objective score correlated with the instructor's grade just about as well as did the check pilot's subjective grade. If the regular instructor's over-all estimate is accepted as the criterion, the objective flight-check score represented the relative ranking of the students about as well as did the check pilot evaluation. If we assume that the check pilot - instructor correlation is spuriously high as the result of contamination due to prior communication between the instructors who also served as check pilots, then the validity of the objective test would probably be relatively higher than a completely independent subjective score given by the check pilot.

Within the design of the present study it was not possible to evaluate the effect which the presence of the objective form during the check-ride had upon the frame of reference of the check pilot when he later assigned his subjective grade. Obviously, we need further data from flight-checking conditions guaranteeing independent grades by the instructors and the check pilots when both are asked to observe the same type of flying maneuvers.

4. Reliability of Subjective and Objective Proficiency Measures

Twenty-five student pilots participated in both the 20-hour and 40-hour proficiency testing programs. A crude index of the reliability of each of the five measures of proficiency (two subjective and three objective) may be obtained by correlating performance scores at these two levels of training. If the learning curves for all 25 subjects were parallel from the 20 through the 40-hour period, these two different tests would be appropriate reliability measures.

TABLE G_I-D

Intercorrelations Between Two Subjective Proficiency Scores and Three Objective Proficiency Scores: 40-Hour Evaluation. (N = 26)

	Subjective	Objective		
	Check Pilot Grade	Total Points Off	No. of Asterisk	No. Maneuvers Below Cut-off
Instructor Grade	.63	-.58	-.17	-.38
Check Pilot Grade		-.87	-.60	-.67
Total Points-Off			.57	.88
No. of Asterisk				.52

An r of .496 is required for rejection of the null hypothesis at the 1% level; .388 for rejection at the 5% level.

However, this assumption is certainly untentable since the relative rankings of the students undoubtedly changed from the 20 to the 40-hour period due to differences in ability, training conditions, and any and all variables other than the reliability of the objective flight-check itself. These conditions effect the correlation between subjective grades as well as the correlations between the sets of objective scores. The absolute value of the 20- 40-hour correlations is not so meaningful, therefore, as the relative, e. g., the subjective measures versus the objective measures. The results of such a correlational analysis are presented in Table G_I-E.

It will be noted from Table G_I-E that there is fairly close agreement between the 20-hour and 40-hour instructor grades ($r = .78$). However, there was scarcely any agreement between the grades assigned by the check pilots at the 20-hour and 40-hour levels ($r = .11$). Adequate interpretation of these findings rests upon a recognition of certain factors which were, or may have been, present within each of these evaluation situations.

1. Among the variety of influences which may have been operating to produce the apparent discrepancy between the reliability of the instructor grade and of the check pilot grades, perhaps the following was the most important. Whereas the same instructor assigned both the 20-hour and 40-hour instructor grades, in every case different check pilots administered the 20-hour and 40-hour evaluations for a given student.

2. As a consequence of the fact that for a given student the same instructor made both the 20 and 40-hour instructor grade evaluations, it is possible that the correlation between these two grades is spuriously inflated because of halo effects which were present at the time of both of the instructor evaluations, but which were irrelevant to flying proficiency as such. It is not possible to demonstrate conclusively that such factors were operating, but certainly it is not unreasonable to suspect that they were present. It would be interesting to observe what would have happened to the correlation between the 20-hour and the 40-hour instructor grades had the students changed instructors at the end of the 20 hours, and had the two different instructors assigning grades to each student done so entirely independently and without knowledge of the ratings each student had been given by the other instructor. There is every reason to suspect that the use of different instructors making independent ratings at the 20 and 40-hour levels would result in a lowering of the 20 - 40-hour instructor grade correlation.

3. The obtained correlation of .11 between the 20-hour and the 40-hour check pilot grades indicates that the check pilot grade assigned at the conclusion of 40 hours of training bore virtually no relation to the check pilot grade assigned at the end of 20 hours of training. This being the case, one can scarcely avoid raising the question as to what is the legitimate function, if any, of either (or both), of these check pilot grades. Using a student's 20-hour check pilot grade as a basis for predicting what he will do on the 40-hour check pilot evaluation would result in only a 1% improvement in prediction over what one could do with a crystal-ball or table of random numbers. The general unreliability of the check pilot grades is even more apparent when one considers the fact that the check pilots filled out the objective evaluation form during the check-flights on which the check pilot grades were based. We can only guess as to how much lower the correlation between the 20-hour and the 40-hour check pilot grades would have been had the check-flight not been structured around the objective list of maneuvers and items.

TABLE G_I-E

CORRELATION BETWEEN THE 20-HOUR AND THE 40-HOUR PROFICIENCY SCORES (N = 25)

Subjective Measures:

Instructor Grade	r = .78
Check Pilot Grade	r = .11

Objective Measures:

Total Points-off	r = .43
Total Number of Asterisk	r = .29
Number of Maneuvers Below Cut-off	r = .40

An r of .505 is required for rejection of the null hypothesis at the 1% level; .396 for the 5% level.

4. We have previously noted (See Table G_I-B and G_I-E) that there was a moderate correlation between the instructor grade and the check pilot grade at both the 20-hour and 40-hour levels (r = .58 at the 20-hour level, and .63 at the 40-hour level). This relationship is a little surprising considering the almost total unreliability of the check pilot grades themselves. The data suggest that there may have been some extraneous factor present to produce this moderate correlation between check pilot and instructor grades. One such possible extraneous factor would be that of collusion between check pilot and instructor in the assignment of grades. There is no direct evidence for such collusion, and it is not suspected that willful and deliberate collaboration took place. However, recognizing the devious and subtile ways in which biasing factors can enter in to data such as these, the possibility that the instructor grades and the check pilot grades were not independently derived presents itself even though it cannot be directly substantiated.

5. Although each of the three objective performance measures do not have very high reliability in themselves, it is apparent that a check pilot evaluation based upon the results of such an objective performance record represents a significant improvement over the present check pilot evaluation procedure. This is the "pay off" statement and is based upon the correlation of .43 between the objective total points-off score versus the .11 correlation between the two sets of check pilot's subjective grades. This comparison between .43 and .11 represents an obtained scientific fact which no amount of personal bias, subjective opinion, or the voice of authority can discount. It is true that, under a different set of measuring conditions, these values would probably not be the same and the difference might be greater or might be less. But within the limits of the present study, there can be no doubt of the superiority of the objective measuring instrument over the traditional subjective check pilot grade in predicting the future flying ability of private pilots. We recognize the many attenuating conditions which apply to these data, but in the interest of giving each private pilot a proficiency score, based upon the fairest possible measure of how he actually flies the airplane, there can be no doubt that the objective performance record is the more effective method to follow up with continued research and developmental investigation.

The obtained correlation of .29 between the 20-hour and the 40-hour objective total-number-of-asterisk-marks score was somewhat attenuated because of the restricted number of categories into which the scores fell at both the 20-hour and the 40-hour levels. For example, at the 40-hour level the least number of asterisk marks was zero and the largest number was four (only two of the 26 students received more than two). This same factor also served (but to a lesser degree) to attenuate the correlation between the 20-hour and the 40-hour number-of-maneuvers-below-cut-off scores. (In this case the range of scores was from zero to eight, with all but two being between zero and four). Parenthetically, it might be well to note that this same attenuation, because of the restricted number of categories available, was present in the correlations involving number-of-maneuvers-below-cut-off scores reported in Table G_I-B and G_I-D.

5. Use of Weighted Scoring on the 40-Hour Objective Form

The "total points-off" scores which have been described and employed in the analysis reported above were simply the sum of the points-off on each individual maneuver. As such they may not give the most desirable weighting to each maneuver in determining the individual's total score. This possibility arises because of several factor:

(1) The range of possible points-off on each maneuver was in part dependent upon the number of sub-items to be scored within that maneuver.
(2) The range of possible points-off on each maneuver was also dependent upon the values of the scoring weights previously assigned to each item.
(3) Although it had been previously recognized that various maneuvers differ quite markedly in their importance as components of over-all flying skill, no very deliberate or systematic attempt had been made to weigh the crude individual maneuver scores so that they would reflect this varying importance.

Recognizing the above possibilities, two attempts were made to achieve an appropriate weighting of the individual maneuver scores in terms of their importance in over-all flying skill. One of these attempts involved a crude weighting of the individual measures so that the $Q_1 - Q_3$ difference for each maneuver would roughly reflect the project director's best-guess as to the importance of that maneuver in over-all flying skill. The weighted scores for each maneuver were summed for each individual to obtain a weighted total-points-off score. These weighted scores correlated -.49 with the corresponding 40-hour instructor grade. It was apparent that this crude weighting procedure did not improve the validity of the objective flight-check when validated against instructor grade since the corresponding correlation derived from the original unweighted scores was -.58 (see Table G_I-D).

The second attempt at weighting the total-points-off scores derived from the objective flight-check forms involved a somewhat more elaborate weighting procedure which was carried out as follows:

(1) The crude individual maneuver scores given in Appendix G_{IV} were transformed so that the standard deviations of the distributions of individual scores were approximately equal for all maneuvers.

(2) These equalized scores were then multiplied by a weighting factor which reflected the project director's "best guess" as to the importance of that maneuver in over-all flying skill. The maneuver weights applied to the equalized scores from (1) above were:

Maneuver	Weighting Factor
I. Pre-flight Check	4
II. Taxiing to Take-off	3
III. Crosswind Take-off	8
IV. Cross Country	16
V. Forced Landing	7
VI. Strange Field	11
VII. Low Altitude Observing	8
VIII. Re-orientation	5
IX. Slow Flying	12
X. Landings	15
XI. Short Field Take-off	8
XII. Final Taxiing	3
	100

The weighted scores for each maneuver were then summed for each individual to obtain a weighted total-points-off score. When these weighted scores were correlated against the corresponding instructor grades they yielded an r of -.52 (as compared with an unweighted points-off and instructor grade correlation of -.58). The correlation between the check pilot grade and these weighted scores was -.83, as compared with a corresponding r of -.87 between check pilot grade and unweighted total-points-off score as reported in Table G_I-D.

It is apparent that neither of the weighting procedures improved the validity of the objective total-points-off score when validated against either instructor grade or check pilot grade. No further attempts to employ weighted scoring procedures were carried out at this time. This entire weighting procedure reflects the assumption that some maneuvers should count more than others. However, some pilots feel that since any maneuver is potentially a killer if improperly done, all maneuvers should be given equal weighting.

6. Analysis of the Distribution of Subjective Scores

It has been noted previously that both the instructor grade and the check pilot grade are subjective evaluations in the sense that they are relatively susceptible to influence by a variety of factors associated with the personality of the rater and of the person being rated which may be irrelevant to the flying skill presumably being evaluated. If personality factors do enter in to the evaluational procedures, they may manifest themselves in at least two ways.

1. To the extent that personality factors may cause one instructor or check pilot to be a "hard" (or "easy") grader, this tendency should be reflected through a displacement of the mean of that instructor's or check pilot's grades from the general group mean. Because six different instructors were used, the number of students handled by each instructor was too small to make this measure useful in the analysis of the instructor grades at both proficiency levels. This was also true of the 20-hour check pilot evaluation in which seven different check pilots were employed. (Of the seven 20-hour check pilots, six were instructors. However, a given instructor never served as check pilot for one of his own students.)

The 40-hour flight-checks were conducted by a group of three check pilots, CAA designated Examiners, who had not previously flown with these students. In this case it was possible to make a crude evaluation to determine whether the mean of a particular check pilot's subjective grades tended to be higher or lower than the mean of the grades assigned by the other check pilots. Figure G_I-1 shows a tabulation of the grades assigned by each of the three check pilots who participated in the 40-hour evaluation. It will be noted that there is no observable tendency for the grades from any one check pilot to differ systematically from those of the others. The mean grades assigned by the three Examiners agree surprisingly well considering the small number of cases involved.

2. It is widely known that in the absence of well defined objective criteria, judges or raters may exhibit a unique preference for certain points or numbers along an evaluation continuum. One of the most general of these tendencies is to assign numer grades which are divisible by 5, i.e., to assign grades which end in either 0 or 5. The instructor grades and check pilot grades at both the 20-hour and 40 hour levels were analyzed to determine whether or not such a tendency was operating in the assignment of these grades. The results of this tabulation are given in Table G_I-F. On the assumption that grades ending

in <u>each</u> of the 10 digits, 0 through 9, are equally likely to be assigned, we would expect that a mean of $\frac{2}{10}$ X 26 or 5.2 of the grades would end in either a 0 or a 5. (This follows since there were 26 grades in each series and each of the 26 grades would have two chances out of 10 of ending in either a 0 or a 5.) We note from Table G_I-F that the number of grades ending in either 0 or 5 actually ranged from 9 to 15.

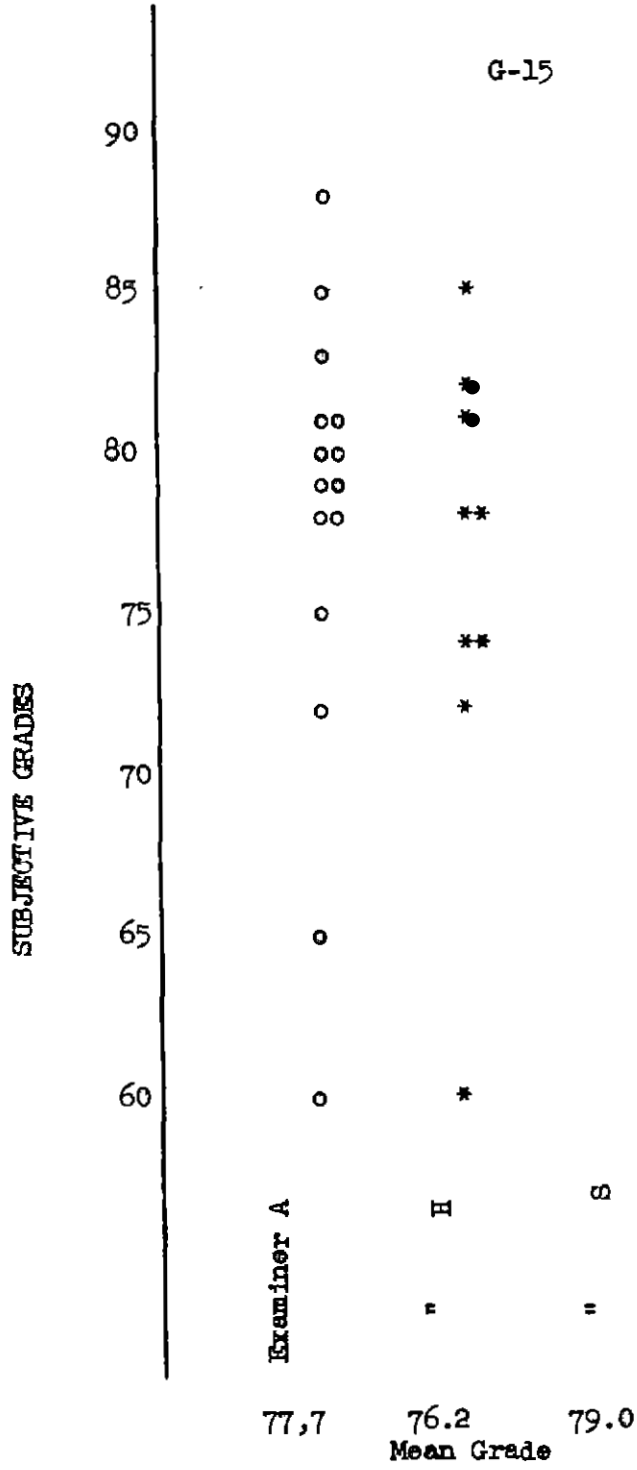


FIGURE G_I-1

DISTRIBUTION OF CHECK PILOT GRADES ON THE 40-HOUR EVALUATION, TABULATED ACCORDING TO CHECK PILOT

TABLE G_I-F

COMPARISON OF THE EXPECTED AND OBTAINED FREQUENCIES WITH WHICH GRADES ENDING IN EITHER 0 or 5 WERE ASSIGNED

	20-Hour		40-Hour		
	Instructor Grade	Check Pilot Grade	Instructor Grade	Check Pilot Grade	All Taken Together
Expected No. of "0's" and "5's"	5.2	5.2	5.2	5.2	20.8
Obtained No. of "0's" and "5's"	15	13	9	9	46
χ^2 =	23.09	14.62	3.47	3.47	38.16

For 1 d. f. a χ^2 value of: 6.535 is significant at the 1% level.
3.841 " " " " 5% ".
2.706 " " " " 10% ".

The χ^2 values for these deviations from the expected number are given, although the limitations of the χ^2 test when small frequencies are involved is recognized. For all four subjective grades taken toghther, 46 our of the 104 (i.e., four for each of 26 students) ended in either 0 or 5. This number yielded a χ^2 value of 38.16 when tested against the expected frequency of 20.8. Thus it is apparent that subjective factors did enter in to the assignment of specific grade scores. Certain instructors and check pilots were much more inclined than others to assign grades which were divisible by five. For example, on the 20-hour evaluation, three of the six instructors assigned grades all of which were divisible by five. On the other hand, another instructor assigned grades divisible by five in only three out of ten cases. It is not likely that this particular subjective factor was of very great importance in influencing the reliability of the assigned grades, but it does suggest that other and more detrimental subjective factors may have been present.

7. Analysis of Data from Four Students Who Were Given a Second 40-Hour Flight-Check

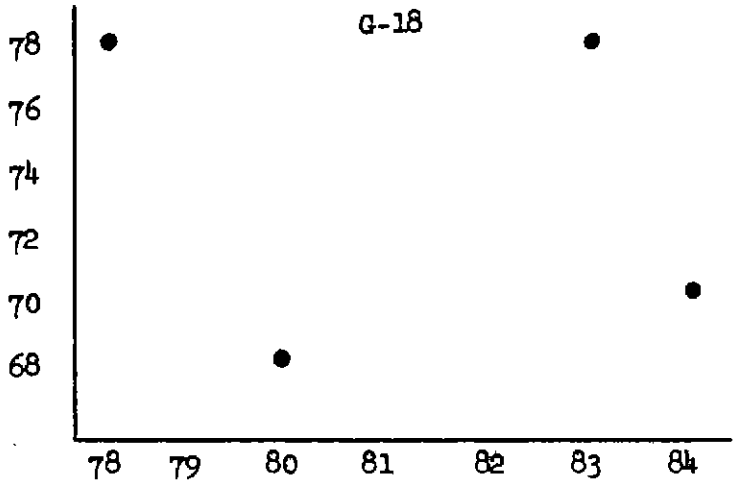
Four out of the 26 students who completed the regular 40-hour examination routine were given a second 40-hour flight-check. The check pilots used on this second 40-hour check had not previously served either as instructor or check pilot for that student. During this extra examination the check pilot filled out a second 40-hour check pilot objective grade.

Although this sample of four cases is so small as to be of little value for purposes of generalization, the analysis of these data are included here primarily because the trends which it reveals are in harmony with the observations noted earlier in this report. Thus, they give us reason to place a little greater confidence in our previous findings.

The relationship between the first and second 40-hour check pilot grades for these four cases are shown in the scattergram in Figure G_I-2. Figure G_I-3 shows the relationship between the first and second objective total-points-off scores. The corresponding product-moment and rank-order correlation coefficients are also given. It will be noted that again the check pilot grades are so unreliable as to be of little or no value. In fact, for these four cases there was a slight inverse relationship ($r = -.21$ and $\rho = -.15$) between the two 40-hour check pilot grades. On the other hand, the relationship between the 40-hour objective total-points-off scores was quite high ($r = .78$ and $\rho = 1.00$). It is unfortunate that more students were not given this second 40-hour flight-check. Since this extra flight-check was administered under very nearly the same conditions of experience and training as was the first 40-hour check a comparison of these two performances would give us the best availabale index of the comparative reliability of the check pilot grade and of the total-points-off score from the objective form. The limited evidence from these four cases suggests that the check pilot grade is totally unreliable. On the other hand, the total-points-off score from the objective form may possess rather high reliability.

8. Significance of the Difference Between the 20-Hour and 40-Hour Proficiency Scores

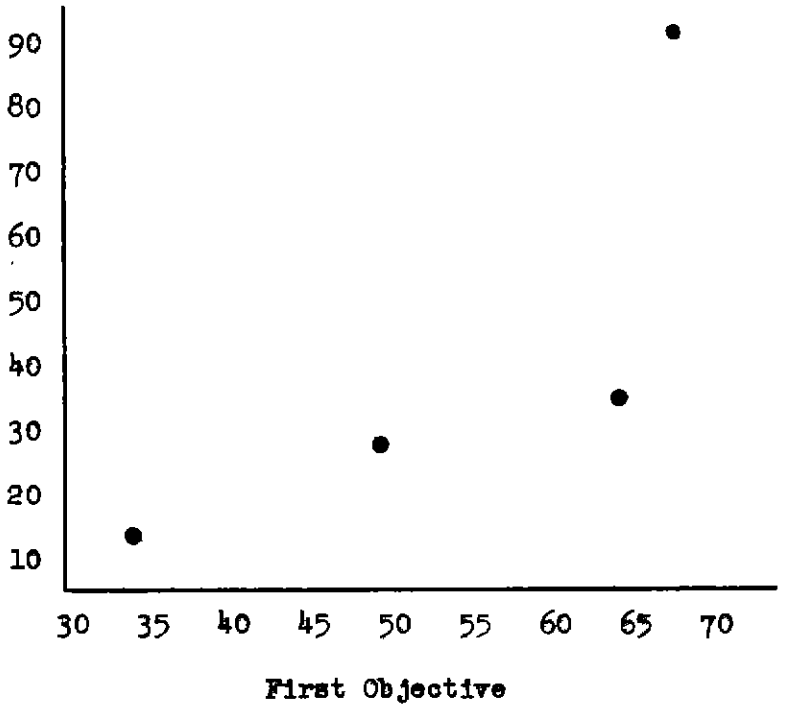
Any real increase in student proficiency between the time of the 20-hour and 40-hour proficiency evaluations should manifest itself in a difference between the performance ratings secured at those two times. Accordingly, the "t" test for related measures was applied to evaluate the significance of the difference



r = -.21 = -.15

Figure G_I-2

SCATTERGRAM SHOWING RELATIONSHIP BETWEEN FIRST AND SECOND 40-HOUR CHECK PILOT GRADES (N = 4)



r = .78 = 1.00

Figure G_I-3

SCATTERGRAM SHOWING RELATIONSHIP BETWEEN FIRST AND SECOND 40-HOUR OBJECTIVE TOTAL-POINTS-OFF SCORES (N=4)

between the 20-hour and the 40-hour scores on each of the subjective and objective proficiency measures. The results of this analysis are given in Table G_I-G.

Since, (for reasons discussed earlier in this report), the first (power-on) landing was eliminated from the scoring of Maneuver X, Landings, on the 20-hour objective form, it was also necessary, for purpose of the present analysis, to remove errors made on this part of Maneuver X from the scoring of the 40-hour objective forms. Had this not been done, the "t" test of the significance of the difference between objective scores at the 20-hour and 40-hour levels would not have adequately evaluated the significance of the mean change in student proficiency since the 40-hour scores would have been inflated due to the greater opportunity to make errors on the 40-hour check form.

It will be noted that for all proficiency measures, both subjective and objective, there was a significant difference in the performance scores given at the time of the 20-hour and 40-hour evaluations. However, it should not be assumed that increased student proficiency was the only factor which could have produced this difference. In the case of the two subjective grades, it is possible that the instructors and check pilots assigned their grades, at least in part, according to a frame of reference in which it was "expected" that a person with only 20-hours of training could not perform above a certain level -- or conversely, that any person with 40-hours of training could be "expected" to perform at a level superior to that of a person with 20-hours of training. This tendency, if present at all, probably operated most strongly in the case of the instructor grades since for any given student both the 20-hour and 40-hour instructor grades were assigned by the same person. It is interesting to note that the poorest instructor grade at the 40-hour level is still five points above the highest of the 20-hour grades. For all other grades, in which different persons made the 20-hour and 40-hour evaluations, there was a reasonable amount of overlap between the best 20-hour grades and the poorest of the 40-hour grades The greatest amounts of overlapping were found in the case of the three objective measures in which the rater's a priori expectations regarding the level of performance which the student "should" show would have minimal influence.

9. Item Analysis Showing Level of Difficulty at the 20 and 40-Hour Levels

a. Problem and Procedure

A distribution was made of all the check marks carried on each of the objective flight-checks by all students on both levels of training. Such an analysis will reveal those items which were rarely or never missed as well as the specific errors which more commonly occur when flying the different maneuvers.

The primary value of these data is reflected in later revisions of the check where it is important to know if a given item does help to discriminate between poor and good pilots as well as indicating the amount of weight which should be given to the item. Of course, many items must be included in the check even

TABLE G_I-G

SIGNIFICANCE OF THE DIFFERENCE BETWEEN PERFORMANCE SCORES AT THE 20-HOUR AND 40-HOUR LEVELS (POWER-ON LANDING ELIMINATED FROM SCORING FLIGHT-CHECK MANEUVER X AT BOTH THE 20-HOUR AND 40-HOUR LEVELS)

Performance Measure	Difference Between the 20 & 40-Hr. Means	Value of "t"	Level of Sign
Subjective:			
Instructor grade	24.60	19.90	p = .001
Check pilot grade	22.80	12.81	p = .001
Objective:			
Total-points-off on Flight-check	38.16	5.55	p = .001
Total number of asterisk	1.28	3.22	p = .01
Total number of maneuvers below the 40-hour Q_1 cut-off value	3.08	8.78	p = .001

though they are rarely missed. This is illustrated in the pre-flight check where few errors are even made though it would not be accepted by most pilots to omit from the pre-flight check items which, if ignored, could be a real threat to safety. In other words, such items as have "face" validity as well as potential "real" validity.

b. Results

Each item in the flight-check represents a good many man-hours of discussion and research. The empirical data obtained here with the 26 students is not strong enough to serve as a basis for deciding whether a given item should remain or be thrown out of the check. Nevertheless, the item analysis may help to make decisions on marginal cases. In the following summary only the results of the 40-hour data will be referred to.

I. Rented Airplane Pre-flight Check

Only five of the seventeen formal items were missed by the twenty-six 40-hour students. Despite these findings no one would be willing to say that any of these items could be omitted as being unnecessary in the preparation for a safe flight.

II. Taxiing to Take-off

Of the nine items three were missed, the most common ones being "Did he use brakes properly," and "Did he use controls" correctly while taxiing.

III. Crosswind Take-Off

Of the ten items, each carried at least one "downgrade" except the "attitude" item on the initial climb. This last item is either too easy or is not defined in such a way as to permit the check pilot to made accurate discriminations. It should be pointed out that the attitude item under "climbing turns" carried one or more "downgrades" in each of the three error boxes.

IV. Cross-Country

No tallies are indicated in the first item, "Computed heading or course correct within - 3 degrees," since this particular item was not a part of the check at the time of this experiment. Errors by this group of twenty-six students were scattered fairly evenly throughout the remaining items in the maneuver. Item No. 4 concerning power setting was the only one without a "downgrade" among the 40-hour students.

V. Forced Landing

Items 3 and 4 "Turns near ground" and "Simulates base leg" were both done correctly by all students. All the other items showed error responses.

VI. Strange Field Procedure with Power and Opposite Traffic Pattern

The two easiest items here were No. 3 "Carburetor heat on" and No. 6 "Simulates base leg." Both of these items were always correct in both patterns. All other items showed some error. In fact, the number of "downgrades" would indicate that this is a rather difficult maneuver, and, if it does measure impor-

pilot skills, the total maneuver should be considered of basic importance in private pilot final evaluation.

VII. Low Altitude Observing

This is another rather difficult maneuver since every item carries at least two or more wrong responses.

VIII. Re-orientation

The diagrams making up Item 3 may not be worth the space and confusion they produce since no one of the twenty-six students was "downgraded" on this phase of flying. Items 2,4, and 5 likewise appear rather easy. As a matter of fact only the first item in this maneuver possesses much discriminating power.

IX. Slow Flying

We first notice that all students were graded as making adequate stall recoveries with minimum loss of altitude, 150 feet or less. The more critical question, however, is how well could they recognize the approach to the stall. Item 2 and 11 show that the students are not so uniformly proficient in this pre-stall sensitivity. In other words, we might conclude that it is easier to make recovery from a stall, with minimum loss of altitude, than it is to fly the plane at a marginal airspeed. It further follows from this that the training should emphasize those aspects of flying which are most difficult to accomplish, in this case slow flying rather than stall recovery. However, this conclusion is somewhat of an over-statement since these students had received more formal training on stall recovery than they had in the type of slow flying required in this maneuver.

X. Landing

It is interesting to note the superior performance of the students on the second pattern procedure than on the first. All of the remaining items seem to be worthwhile, at least errors were recorded on all the remaining items.

XI. Short Field Take-off

Item 3-a "Power Setting in initial climb" was the easiest part of this maneuver though the entire "climbing turn" contributed very little to the final differentiating score.

XII. Final Taxiing

The easy items here were the same as in the earlier "Taxiing to Take-off" maneuver.

c. A Concluding Note

We should continuously keep in mind the fact that the specific findings of any study such as this are a joint function of the measuring instruments employed and the characteristics of the subjects involved. To the extent that the 27 students from the Institute of Aviation are not representative of all private pilot students, either because of their background and ability or because they were exposed to unique and non-representative training procedures, conclusions

based upon this group may not be universally applicable. This caution applies to all data derived from this sample, but it is particularly important in the case of the item analysis data.

APPENDIX G_{II}

Procedure Employed in Handling the Data from the 20-Hour Flight-Check Forms

1. The 26 20-hour flight-check forms were scored for points-off on each item within each maneuver using the scoring weights previously assigned. Because so few students had received the training necessary to make a power-on, wheels first landing, only performance on the second (power-off) landing was employed in scoring Maneuver X, Landings.

2. The individual item scores from 1. above were summed to obtain a total-points-off score for each maneuver.

3. Special note was made of those items for which an asterisk rating had been given and of maneuvers which were omitted.

4. The data from 2. and 3. above were summarized on a tabulation sheet according to student name and maneuver.

5. a. Using the tabulation from 4. above, tentative median, Q_1 and Q_3 scores were computed for all maneuvers, including those with empty cells due to omitted maneuvers.

   b. A total-points-off score was computed for each of the 18 students from whom no maneuvers were omitted.

   c. Tentative median, Q_1 and Q_3 measures were determined for the distribution of 18 total-points-off scores from 5.b. above.

   d. For each of the six students with one or more "omits" a tentative-total-points-off score was computed by assigning the tentative median maneuver score (from 5.a. above) to each "omit" cell.

   e. If the tentative-total-points-off score fell below the Q_1 point (from 5.c. above) the one or more "omit" spaces for that subject were finally filled with the rounded Q_1 (from 5.c. above) the one or more "omit" spaces for that student were finally filled with the rounded median score (from 5.a. above) for that maneuver.

   f. If the tentative-total-points-off score fell above the Q_3 score (from 5.c. above) the one or more "omit" cells for that subject were finally filled with the rounded Q_3 score (from 5.a. above) for that maneuver.

6. Final median, Q_1 and Q_3 scores for each maneuver column wer computed using the best-guess value (from 5.a-f. above) wherever a student had omitted a maneuver.

7. For each of the six students who omitted one or more maneuvers a final total-points-off score was computed using the best-guess scores to make the data complete.

8. The total-points-off scores from 5.b. and from 7. above constitute one of three objective proficiency measures available for each student.

9. A second objective proficiency measure derived from the flight-check forms is the total number of asterisk marks received by the student.

10. The third objective proficiency score for each student was derived from the flight check data by computing the number of maneuvers on which the student's performance fell below an arbitrary cut-off point. The arbitrary cut-off point employed for this purpose was the Q_1 score from 6. above, generally rounded to the next lowest figure.

TOTAL POINTS-OFF ON EACH MANEUVER: 20-HOUR CHECK

Subject	Pre-Flight Check I(24)	+	Taxiing to Take-off II(20)	+	Cross-Wind Take-off III(29)	+	Cross-Country IV(50)	+	Forced Landing V(29)	+	Strange Field VI(76)	+	Low Alt. Observing VII(27)	+	Re-Orientation VIII(21)	+	Slow Flying IX(34)	+	Power-Off Landing X(70)	+	Short-Field Take-off XI(23)	+	Final Taxiing XII(11)
1.	3		0		0		3		3		9		0		0		3		5		(0)		0
2.	5		3		11		11		8		16		7*		8*		3		27		7		3
3.	0		4		6		11		10*		38*		7		8*		10		32*		5		2
4.	3		3		0		8		3		17		11*		7		8		2		0		0
5.	0		2		5		4		4		17		8		2		17		4		5		3
6.	2		0		2		12*		2		7		13		0		3		10		(2)		0
7.	3		2		5		0		8*		0		0		3		0		2		(0)		0
8.	0		0		3		4		3		2		14*		0		8		6		(1)		0
9.	1		0		0		6		8*		11		2		5*		9		2		2		0
10.	4		9		2		0		3		9		3		2		3		17		0		0
11.	0		0		9		18*		9		33*		12*		7		12		30*		11		0
12.	3		3		2		5		2		30*		7*		8*		7		2		8		0
13.	0		0		4		36*		7		29*		12		9		8		17		10		3
14.	0		0		5		17**		28***		28*		5		14*		5		5		4		0
15.	1		3		14		20**		2		17*		5		0		12		11		6		2
16.	4		5		10		39****		24***		31*		5		17**		12		24*		(11)		0
17.	0		8		13		0		5		11		(3)		0		(3)		6		(1)		1
18.	0		0		2		5		0		7		13		0		10		10		2		0
19.	1		0		2		0		3		14		7		9*		3		3		(1)		(0)
20.	4		0		2		(8)		13*		20		2		(5)		9		18*		4		2
21.	0		2		4		23*		11		41*		21*		21**		15		42*		(11)		(3)
22.	0		5		3		13*		5		27**		0		2		4		10		0		0
23.	1		0		2		15*		15*		21*		13*		5*		6		8		2		0
24.	4		3		3		(8)		2		14		6		(4)		0		18		3		0
25.	3		2		2		8		3		10		6		4		16		6		0		0
26.	0		0		9		7		15*		8		18*		0		9		20*		8		0
M	1.62		2.08		4.61		10.81		7.65		17.96		7.69		5.38		7.88		12.96		4.00		.73
Min	1.00		1.75		3.17		8.00		6.00		16.50		6.75		4.50		8.17		9.83		2.50		.36
Q_1(prat)	3.20		3.20		6.00		15.00		10.00		28.00		12.25		7.67		11.67		18.25		7.00		1.67
Q_3(bst)	.32		.26		1.94		4.25		2.75		9.25		3.25		.46		3.40		4.75		.67		.18
Cut-off Score	4		4		6		15		10		28		13		9		12		19		8		3

Note: * Includes a "failing" item: () Indicates a cell filled by best-guess; - Maximum possible points-off

APPENDIX G_{IV}

TOTAL POINTS-OFF ON EACH MANEUVER, 40-HOUR CHECK

Subjects	Pre-Flight Check I(24)	+	Taxiing to Take-off II(20)	+	Cross-wind Take-off III(29)	+	Cross-Country IV(50)	+	Forced Landing V(29)	+	Strange Field VI(76)	+	Low Alt. Observing VII(27)	+	Re-orientation VIII(21)	+	Slow Flying IX(34)	+	Two Landings X(136)	+	Short Field Take-off XI(27)	+	Final Taxiing XII(11)	+
1.	1		0		0		7*		12*		2		3		0		0		11		6		0	
2.	0		0		2		2		9*		5		0		2		3		19		2		0	
3.	2		0		8		17*		7		0		0		0		0		2		5		0	
4.	0		0		0		0		2		20		3		4		7		21		0		0	
5.	0		0		2		7		0		10		0		3		0		4		3		1	
6.	0		0		0		2		2		0		0		0		0		2		0		0	
7.	3		0		6		10		2		0		0		0		0		15		2		0	
8.	0		0		0		5		4		4		0		0		2		20		0		0	
9.	1		0		0		4		2		3		0		0		2		31		5		1	
10.	1		0		0		7*		0		2		0		3		3		22*		3		0	
11.	2		4		4		11		2		12		5		0		3		3		3		0	
12.	0		0		2		13*		7		7		12		0		0		23		3		0	
13.	0		0		2		5		4		21		13		0		10		7		0		2	
14.	0		0		0		0		14**		9		0		0		5		0		3		0	
15.	0		0		0		5		0		9		0		0		8		12		0		0	
16.	NO DATA AVAILABLE																							
17.	1		0		7		0		2		9		0		5*		0		8		5		1	
18.	1		0		3		6		3		13		9		0		8		61		5		0	
19.	0		0		0		9		10		12		5		0		0		10		5		0	
20.	5		2		0		34***		8		18*		0		3		9		12		0		0	
21.	2		4		6		6		17**		28*		21*		0		2		42		16		5	
22.	0		0		0		0		0		0		0		0		0		5		5		0	
23.	0		0		2		3		2		2		0		0		3		8		0		0	
24.	0		0		7		14*		9		4		0		0		6		9		0		0	
25.	0		1		3		6		10		2		4		0		0		7		0		0	
26.	0		4		4		2		0		12*		9		0		12		1		3		0	
27.	0		2		9		8		4		6		8		0		5		4		0		0	
Mean	.73		.65		2.58		7.04		5.08		8.08		3.54		.77		3.38		13.81		2.85		.38	
Mdn	.43		.32		1.90		5.83		3.50		6.50		.43		.32		2.50		9.50		2.67		.31	
Q_1	1.12		.49		4.25		9.00		8.75		12.00		5.25		.49		6.00		20.00		4.75		.47	
Q_3	.22		.16		.29		2.33		1.71		2.12		.22		.16		.32		4.25		.32		.15	
Rnd. Cut-Off	2		2		6		10		9		13		6		2		7		21		6		1	

TABLE H

QUESTIONNAIRE RESULTS: TABLE SHOWS: THE QUESTION, THE DIFFERENT CODE-CATEGORIES, WITH NUMBER OF RESPONSES: SPECIAL COMMENTS

1. Are some of these maneuvers unnecessary so far as private pilot skills are concerned? If so, which ones would you drop out and for what reasons?

Code	Category	Replies
1	All ok; drop none	65
2	Drop x-c, not important, etc.	6
3	Drop low-altitude maneuvers	5
4	Wrong interpretation	4
5	Special Comments (see below)	15
9	Omitted	5

"Airspeed reading in the glide should be eliminated. Applicant should be graded on his ability to maintain normal gliding attitude."

"As regards to cross-country part of the examination, we feel it is not feasible because of the time involved."

"Too much emphasis on precise altitude control in cross-country and slow turns."

"Eliminate third cross-country check point and the five minute flight following selection of heading to alternate."

"Your list of items for the examiner to check might even be considered a reflection of the intelligence of CAA personnel. It may be possible to eliminate the third check point in cross-country as well as the forced landing."

"Eliminate the 200 and 300 foot limits on spot landings."

"The computed compass course is expecting the impossible from the applicant when utilizing the average equipment contained in the trainer. In the proposed cross-country the check points are too close and too many for the time involved."

"The examiner should emphsize that different types of planes require different checks."

"Landings should be judged entirely upon the applicant's ability to land on a designated spot at or near stalling speed, regardless of the use of power so long as he is in full control of the airplane at all times."

"This test is more in line with the requirements for the commercial license.... All of this points up to the need for the intermediate pilot grade, say sub-commercial, with an experience requirement of more than 100 hours."

TABLE H (cont'd)

QUESTIONNAIRE RESULTS

2. What different type of maneuver would you like to see included in this check? If you have a suggestion, show us what specific abilities should be observed and graded? In other words, what important skills or abilities are not adequately covered by this check?

Code	Category	Replies
1	Slips to landing	15
2	x-controlled stalls	7
3	Stalls, variations, e.g., approach	14
4	None suggested	18
5	Special comments	22
6	Radio and pattern procedures, flight	22
7	Steep turn plan, weather	6
8	More and different landings-sp. wind	12
9	Omitted conditions	8
10	Spins	1

"The most important item in the training of the student is "effect of the controls" and the application of this basic fundamental to all maneuvers. There has been no provision for an adequate grading and check on the student's ability and demonstration of same in this new form."

"Add rectangular course. Also, your low altitude observing maneuver should be retained but should be supplemented since it requires need of constantly changing angles of bank."

"Add to pre-flight, type and consumption of fuel and oil, such as octane ratings and specific gravity of oil, detergent or non-detergent flying. Weight and loadins should be a must rather than a writing-in."

"Demonstration maneuvers - abnormal attitudes and unusual characteristics of the type of aircraft used."

"Maneuver 4, Item 13 should be added "Use of throttle in slow flight"; Maneuver 10 'Use of throttle' should be an item to be graded on first landing."

"Make S-turns regardless so he will keep in practice in the event he flies other more blind aircraft."

"Take student to a rain shower. Show him what three, five, and ten mile visibility means to him."

"I would like to see inclusion of an "orientation when lost' procedure."

"There is no place to sum up and grade the applicant's over-all head work and judgment, which I consider important."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

3. Do you have any important changes to make in the sequence of maneuvers?

Code	Category	Replies
1	No changes	66
3	Optional sequence	4
5	Special comments	5
9	Omitted	16

"I would not have the first take-off item cross wind. Why not let applicants start check-ride as easily as possible?"

"Insert forced landing after slow flying - more altitude shows student's planning ability and is more realistic from a cross country standpoint than 800 feet."

"Have a break for smoke or a coke after Item 6."

4. Do you have any suggestions as to how the Manual of Instructions should be improved?

Code	Category	Replies
1	No changes	45
3	Wrong interpretation, or irrelevant	6
5	Special comments	9
6	Scoring section	2
9	Omitted	14

"I think the instructor should stress all-around judgment on the student's part."

"The third item to be marked 'corrects initial error' is mystifying to me. I suggest that additional downgrading be made for each 100 feet beyound the limit or that the test be voided should he fly more than 400 feet above the correct altitude. The check pilot cannot always tell if the extrapolated heading is correct or not."

"Re-word for less confusion the instructions for maneuver V, Items 4 and 7."

"More emphasis should be placed on power-off landing."

"Eliminate about 90% of it."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

4. Cont'd. "Special comments".

"First landing should be called a power approach three point landing."

"Entire check list is still in reference to mechanical flying."

"Too much emphasis on compass heading accuracy."

"Believe it should be set up similar to the pilot examiner handbook now used by CAA."

"Believe many of the maneuvers are broken into too many items and could be shortened or simplified."

"The use of '0' in a box for unsatisfactory might be confusing when 0 is considered the perfect score."

"Add a few words on judgment."

"There is too much detail."

"Suggest revision of test first."

"Perhaps flight instruction should be listed as a profession and the instructors placed on a higher level mentally."

"It is not clear whether or not the student must draw on the chart and prepare the outline track in flight or on the ground before talk-off."

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5. Pilots differ in their opinions as to how the items making up the maneuvers should be scored. Please give us your suggestions. Read the material under Scoring on Page 6 of the Manual.

   5. In your opinion, how should the final grading be made?

      A. Should maneuver be passed or should a total score on the entire check-ride determine final certification?

Code	Category	Replies
1	Prefers subjective grading	4
2	Pass each maneuver	48
3	Get total score	18
4	Wrong interpretation	4
5	Special comment	4
9	Omitted	17

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

5-A. Cont'd "Special comments".

"Maneuvers 7 and 9 and 10, first landing, should be passed for certification."

"I like the negative plan of scoring."

"Both. Students should come up to minimum possible standards on major maneuvers and minimum total score should be graded and sum of minimum individual maneuvers scores."

"Training of Examiners to properly evaluate the pilot is more important than any grading system."

5-B. Should some of the maneuvers be weighted more than others in determining final level of proficiency? If so, which ones?

Code	Category	Replies
1	Equal weight	19
2	Variable weight	36
3	Special comment	4
9	Omitted	31

"In cross country grading, I believe that correcting the initial error is less serious than not recognizing the check point at all."

"Who cares what the final level of proficiency is. The only thing the applicant wants to know is'did I pass?' What purpose these statistics serve has been a mystery to the industry for years."

"Who cares about final proficiency. Applicants should pass or fail."

"Only one item should be given more credit than others and that is the most important item which can be graded in any and all maneuvers JUDGMENT."

5-C. Do you think we should change the score value for any of the items (indicated by the "dots")? List your suggested changes in this space.

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

5-C. Cont'd.

Code	Category	Replies
1	No change	39
2	Prefers subjective grading	10
3	Wrong interpretation	4
4	Pass or fail; sat. vs. unsat.	5
5	Special comment	13
9	Omitted	23

"Use a grading system similar to the system used in the past on all CAA exams."

"I still like the 1, 2, 3, 4, 5 grading systems."

"I think the reverse should be true, an airplane which staggers off and which the pilot can maintain airborne shows better control of the airplane than one which touches down again regardless of the airspeed of the take-off."

"The student should fail if he does not clear for take-off. Also, greater penalty for not looking around and failure if 'rolled off the runway'."

"Asterisk for erratic take-off and bordering on dangerous misuse of controls on forced landing."

"Grading procedure should be more flexible to meet existing conditions."

"Throw the dots out, too complicated. Show as many starred boxes as are believed essential to the maneuver graded. All of the boxes count one off."

"Believe the dot system should be dropped. Possibly for a numerical value in the box."

"In the final outcome, passed or failed is the only thing we are concerned with. The seventy per cent pilot has the same privileges as the 100 per cent pilot."

"Forget about the grading system. Place the emphasis on perfecting the test and educating the Examiner."

6. Should this type of check include the forced landing?

Code	Category	Replies
1	Yes	72
2	200' min. altitude	4
3	No, or not necessary	6
5	Special comments	10
9	Omitted	8

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

6. Cont'd. "Special comments".

"Pilot proficiency and the planning of the forced landing is more important and the examination should stress this point."

"Yes, but they can be overdone in practice and be against the safety of the pilot even before certification."

"Leave this to discretion of the Examiner."

"Only if terrain is suitable."

"Yes, however, not always strictly from a sense of sudden stoppage of the engine."

"Maneuver No. 6 should be called 'Delayed Emergency Landing'."

"Yes, one power-off forced landing. However, stress should be placed on the precautionary or safety landing."

"Yes, but should not be graded."

"Yes, on the airport or a field expecially designated for that purpose."

7-A. What type of landings are most important for the private pilot?

Code	Category	Replies
1	x-wind	34
2	Power approach	27
3	Power-off	20
4	Wheel and 3-point	24
5	Special comments	12
6	Short field and soft field	14
9	Omitted	11

"I believe more landings at a strange field, including radio patrol fields and small fields."

"Power-off and slips to a landing."

"He should be able to execute all types, wheel, three-point, cross-wind, power on and off."

"Include recovery from a bounced landing."

"Accuracy landings."

"Spot landings within the 200 or 300 foot spot should be discontinued."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

7-B. How many landings should be given with the check?

Code	Category	Replies
2	Two	17
3	Three	28
4	Four or more	17
9	Omitted	28

No comments.

8. How important is it to limit this check-ride to one hour?

Code	Category	Replies
1	Not important	53
2	1-hour limit	23
5	Special comments	4
9	Omitted	12

"More than an hour but with a break."

"Make it longer and break it up into two or three parts."

"To be successful, this flight test must be shortened. Otherwise, it will be corrupted. Scientific and knowledge must be applied to this test to reduce the length without reducing what it tests."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

9. What special difficulties would occur in the use of the present check in your part of the country? (For example, mountains, congested area, air traffic, and the like.)

Code	Category	Replies
1	None	52
2	Mountains	9
3	Congested area	3
4	No safe low-altitude area	5
5	Special comment	9
6	Weather delays	3
9	Omitted	15

"Mountains. Student points out where down drafts will occur, gets his altitude by up-drafts. Forced landings always up hill, across rides at 45° angle."

"Greater distances between fields would require more time per satisfactory check (a Montana report)."

"Increase the minimum altitudes."

"Again I say, students must know how to handle himself in traffic and in and out of controlled airport."

"We frown on teaching people to fly cross country at 500 feet under any conditions. If he learns to fly in a flat country he is lost when he gets in a hilly country."

"Absence of check points in uniformly wooded areas."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

10. Please give us any suggestions as to how the check might be modified to meet your local conditions.

Code	Category	Replies
1	O.K., no suggestions	35
2	Remove time limit	5
3	Omit x-c	2
4	Permit non-direct x-c	2
5	Special comments	14
9	Omitted	33

"Keep altitude at least 500 feet higher than highest point on course."

"Try and get across country so as not to get too far from home base in a straight line."

"In mountains or rolling terrain, the examiner could or should tell student what altitude he should hold."

"Reduce allowable landing area if airport is too large."

"Some oral exam might be added for mountain flying."

"Oral test would serve the purpose and involve less flying time. This is to replace the cross country."

"Permit variations in cross country altitude appropriate to the terrain."

"If traffic permits, forced landings could be given from various positions into the local airport."

"A more careful advanced check of weather conditions."

"Carry minimum load to increase safety margin, e.g., two persons in a four place airplane (from Denver). In my opinion, any flight-check report where the examiner has to look down to grade the maneuver is dangerous to the aircraft and himself."

"More emphasis on navigation by countour and terrain, peaks, bodies of water, shapes of valleys, and so on. Less on compass heading."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

11. In this space add any other comments about any part of the check (or the whole idea in general), which might help us develop better methods of private pilot certification.

Code	Category	Replies
1	Favorable	47
2	Include Examiner's subjective judgment	6
3	Different maneuvers discussed	7
4	Generally critical	6
5	Special comments	30
6	Add "knowledge" factors	5
9	Omitted	16

"The use of a three point cross country flight with landings being made at one of two airports, one radio controlled and the other a small single strip type."

"Essential character of student needs greater emphasis. Above all is he thorough by nature? A sense of responsibility is vitally important."

"Bear in mind that the object is for a man that flys a plane, (1) what to do when the motor quits, (2) return to ground safely under all wind conditions, (3) get it off the ground safely."

"A marginal weather flight dual would be of great benefit to the student pilot."

"The proposed form for executing the private flight test in my opinion would not be necessary if the examiner is sincere and properly instructed on how to execute the flight test."

"We are basically very satisfied with the present set-up and feel it has accomplished the job quite satisfactorily. Safety is something that must be built as an attitude into the thinking of the beginning pilot rather than as a matter that we might act to legislate against."

"It seems to me that we should either eliminate the cross country portion or make it long enough to get a clearer picture of the applicant's ability."

"The proposed revision is undoubtedly a step in the right direction but falls short of being satisfactory. I am convinced that the correction of pilot deficiencies must be made in the curriculum. The present test would result in a curriculum designed from the very first dual ride to pass the flight test and ignores the practical everyday application of what is being taught."

"The less complicated the flight procedure the better. An ideal grading sheet is blank sheet of paper."

TABLE H (cont'd)
QUESTIONNAIRE RESULTS

11. Cont'd. "Special comments".

"Simply score as good or not good."

"Think this plan is a great improvement."

"Greatest stress must be on judgments, not mechanical proficiency."

"The final recommendation of our group was to the effect that the most effective report to cover such tests would be a simple statement by the examiner that he has flight-tested the applicant and deemed him qualified to operate aircraft as a private pilot."

"A conclusive and final question on the examination could and should be 'Would you commit this applicant to be pilot in command of an aircraft in which someone who is near and dear to you, that is, mother, father, sister, brother, sweetheart, wife, husband, is a passenger, Yes, No.'"

"Have you seen the latest USAF Green Card Check, Form ATRC Form 60-4, dated 2 September 1950, put out by the Air Training Command, I think that the size is ideal, each maneuver on a separate page."

"The idea of an objective type test is desired. However, my impression of the proposed test is that it is mechanical and detailed but impractical and inadequate."

"I am very much in favor of the maneuver you list as Low Altitude Observing which more or less disguises doing steep turns at low altitude."

"Grading of the maneuvers in a more general way would be desirable."

"Eliminate the details regarding the maneuvers. Stress the art of flying and boost the instructor up to a level where he is proud to be an instructor and of his profession. We are not in the dire need of a private pilot flight-check as much as we are in need of a good course of study. I don't possibly see how an instructor could ride with the private pilot applicant and do a good job of analyzing if he must have his head down in the cockpit checking off such things as suggested on different maneuvers."

"This type of flight test has been and is needed badly. An examiner will be able to evaluate a pilot's skill and ability much better than with the flight test now being given."