HISTORY AND DEVELOPMENT OF THE OHIO STATE FLIGHT INVENTORY

PART II: RECENT VERSIONS AND CURRENT APPLICATIONS

Prepared

by

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Committee on Selection and Training of Aircraft Pilots

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LETTER OF TRANSMITTAL

NATIONAL RESEARCH COUNCIL

2101 Constitution Avenue, Washington, D. C.
Division of Anthropology and Psychology
Committee on Selection and Training of Aircraft Pilots

November 15, 1945

Dr. Dean R. Brimhall
Asst. to Administrator for Research
Civil Aeronautics Administration
Room 5835, Commerce Building
Washington 25, D. C.

Dear Dr. Brimhall:

Attached is a report entitled History and Development of the Ohio State Flight Inventory, Part II: Recent Versions and Current Applications. This report is submitted by the Committee on Selection and Training of Aircraft Pilots with the recommendation that it be included in the series of technical reports issued by the Division of Research, Civil Aeronautics Administration.

Part I of this report, issued as CAA Division of Research Report No. 47, describes the early basic research which culminated in the 1941 Version of the Inventory. The present report describes the intermediate forms and the current version of the Ohio State Flight Inventory and outcomes from the use of this instrument in later Committee research.

The Ohio State Flight Inventory, used in conjunction with standard flights, has provided a valuable source of criterion data in Committee research. The report both presents data of interest in connection with pilot evaluation and illustrates the adaptations and improvements of techniques which have accompanied continuous and prolonged research in this area.

A copy of the current version of the Ohio State Flight Inventory is attached to the report.

Cordially yours,

Morris S. Viteles, Chairman
Committee on Selection and
Training of Aircraft Pilots
National Research Council

MSV:rm

A-7-85

EDITORIAL FOREWORD

The history and development of the Ohio State Flight Inventory through 1941 have been discussed in CAA Division of Research Report No. 47. The present report describes subsequent revisions of the Ohio State Flight Inventory and presents data growing out of the use of these revisions for criterion purposes in studies conducted by the Committee on Selection and Training of Aircraft Pilots.

Many individuals have participated in the research involving further development and use of the Ohio State Flight Inventory. Dr. R. Y. Walker, one of the co-authors of the original inventory, has continued to conduct research with this instrument as Director of the Midwest-Navy Training Project in which the 1942 revision was used, and as Director of the Institute of Aviation Psychology, University of Tennessee, where the current version of the Ohio State Flight Inventory was employed as a criterion instrument. Cdr. J. G. Jenkins, USNR, and Lt. Cdr. E. L. Kelly, USNR, aided in the preparation of the "Manual for the Administration of the Ohio State Flight Inventory" (Second Edition). Dr. H. S. Odbert, as a member of the Editorial Staff of the Committee on Selection and Training of Aircraft Pilots, devised the format of the current version. Adaptations of the Ohio State Flight Inventory and "Directions to the Student Pilot" used in the current Visual Study were prepared largely by E. S. Ewart, also of the Editorial Staff. Statistical treatment of the data discussed in this report was largely the work of the staff at the Statistical Unit of the Committee on Selection and Training of Aircraft Pilots, located at the University of Rochester.

Acknowledgment is made to Dr. A. S. Thompson, formerly of the Editorial Staff, now at Vanderbilt University, for collating the materials and writing Part II of this report.

CONTENTS

SUMMARY

Part II of the report on the Ohio State Flight Inventory continues with the history and development of this technique and form for recording and grading flight performance. It describes the 1942 Version and the current version with its present applications. As in the previous versions described in Part I, these later versions were the outgrowth of use of the Inventory in research and field situations and the revisions were based upon experimentally obtained data.

The 1942 Version, with improved format and requiring observations in objective terms whenever possible, was used in the Boston-Midwest Project as a major source of criterion data. This report describes research findings based upon inventory data obtained during 412 check flights from the Spring and Summer programs in the Midwest Project.

The 1942 Version of the OSFI was scored by giving a value of +1 to items indicating desirable performance and -1 to those indicating undesirable performance. From the distributions of the algebraic sum of the plus and minus items checked for each maneuver, maneuver grades were obtained in the form of standard scores based on the standard deviations of these distributions. Two types of scores were developed for the flight as a whole: (1) Summation Score, obtained by averaging the maneuver grades for all maneuvers in the check flight and (2) Profile Score, based on a qualitative evaluation of the over-all performance as represented by the profile pattern of maneuver grades.

Treatment of the inventory scores from the Midwest Project revealed the following:

1. A correlation of .93 between Summation Scores and Profile Scores on 66 cases of Flight D performance indicated that the two methods of scoring gave essentially equivalent results.

2. From an item analysis based on 412 flight inventories and using a cut-off score based on Stage D flights, tetrachoric r's were obtained between each item and the pass-fail criterion. By eliminating items obtaining a tetrachoric r of less than .50 the size of the inventory was reduced from approximately 1400 items to 640 items.

3. A Short Form of the 1942 Version, consisting of those items selected by the item analysis, was compared with the Long Form by re-scoring 297 flight inventories, using the items retained in the Short Form. Intercorrelations between the two forms ranged from .79 to .93 when the results were broken down according to flights made during the four stages of instruction. For the total of 297 cases the intercorrelation was .86.

4. Critical ratios of differences between mean Summation Scores for flights during the four stages of instruction were obtained in

order to determine the discriminating value of both the Short Form and Long Form of the Inventory. Both forms yielded significant differences between Stage A flights and flights during the other three stages, but failed to discriminate among Stages B, C, and D.

The current version of the Ohio State Flight Inventory is essentially the Short Form of the 1942 Version with the addition of a few items considered to be of diagnostic value and improved format through printing items representing satisfactory performance in blue and those representing unsatisfactory performance in red. Use of the Inventory by field and research personnel has been facilitated through preparation of a "Manual for the Administration of the Ohio State Flight Inventory."

Work with the current version has been devoted to research with, rather than research on, the Inventory as a basic research tool in the program of the Committee on Selection and Training of Aircraft Pilots. Use of the Inventory as a training aid was an integral part of the design of the Midwest-Navy Training Project (1943-44). In this project the completed interview was reviewed with the student, maneuver by maneuver, and the student's performance discussed in detail, especially with respect to specific errors and "families" of errors. As a criterion instrument, the current version has been in use at the Institute of Aviation Psychology, Knoxville, Tennessee, where it has been found for example, that OSFI Summation Scores correlate highly with over-all flight grades assigned by flight inspectors.

The most recent use of the Ohio State Flight Inventory as a criterion instrument is in connection with the Visual Study currently being carried on at Ohio State University. In this study a modification of the method of using and scoring the Inventory has been made in that the items have been given numerical weights, in terms of the number of "demerits" to be subtracted from the over-all score if execution of that item of performance is less than satisfactory. In addition, the Inventory will be discussed with the student pilot before the flight is made so that the student will understand both what is expected of him during the check flight and the importance of each item for grading purposes.

Comparison of the current version of the Ohio State Flight Inventory with the preliminary version first developed in 1939 reveals that from a rough list of items representing instructors' opinions as to grades of performance, the Inventory has become a diagnostic and evaluative instrument consisting of items clearly stated, easily checked, and based on careful and critical use in a series of projects and on an experimental check of the value of each item through experimentally obtained research data. Its most useful application is in field and research situations in which detailed and diagnostic information is required concerning the way the pilot flies the plane. It is still limited, however, in that "judgment" aspects of piloting are inadequately surveyed, no proven method of weighting the importance of each item and of each maneuver so as to arrive at a valid over-all score is as yet available, and it tends to over-emphasize measurement of what the plane is doing without adequate indication of what the pilot is doing to make the plane perform.

HISTORY AND DEVELOPMENT OF THE OHIO STATE FLIGHT INVENTORY

PART II: RECENT VERSIONS AND CURRENT APPLICATIONS

INTRODUCTION

As stated in Part I of the history and development of the Ohio State Flight Inventory (OSFI), the major objective of the research was to develop a standardized procedure for recording flight performance which would be descriptive, objective, discriminating, practical, and diagnostic.[1] To this end, the Ohio State Flight Inventory underwent a series of revisions based on research and trial in a wide variety of field situations.

Part II of the report on the Ohio State Flight Inventory continues with its history and development, describing the 1942 Version, and finally, current versions. These revisions were the outgrowth of additional experimentation and field trial, on an even wider scale, and were designed to reach more completely the objectives described above. In general, the improvements embodied in these later versions were in the area of increased ease of recording observations, greater objectivity of scoring, and the preparation of standardized instructions for their use.

In Part II, as in Part I, the report will describe each version, particularly the nature of the revisions over previous versions, indicate methods of scoring, and present data resulting from its use in research projects. A copy of the "Manual for Administration of the Ohio State Flight Inventory," which presents both the current version in its entirety and detailed instructions for its use, is attached to the flyleaf of this report.

THE 1942 VERSION

Description of the 1942 Version. Exhibits 1 and 2 present the check sheets for Final Approach and Landing and Take-off and Straight Climb, respectively. These maneuver sheets illustrate the changes incorporated in the 1942 Version. The changes were of the following types:

1. The format was improved through the use of boxes (☐) for checking items.

2. All items were grouped into pairs (or a series) of mutually exclusive items. With but a few exceptions,[2] each group in-

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[1] Edgerton, H. A., and Walker, R. Y. History and development of the Ohio State Flight Inventory. Part I: Early versions and basic research. Washington, D. C.: CAA Division of Research, Report No. 47, July 1945, p. 3.

[2] For example, in Take-off and Straight Climb (Exhibit 2) under Tail, the pair of items "tail high, prolonged run" and "tail low, tends to stall" both represent unsatisfactory performance.

FINAL APPROACH AND LANDING

Deviation in Direction & Lateral Balance

During Glide: Direction _____° [L] [R] or [S]
Lat.Bal. _____° [L] [R] or [S]
During Roll: Direction _____° [L] [R] or [S]
Lat.Bal. _____° [L] [R] or [S]

Throttle

Does [ ] or does not [ ] keep hand on throttle

Planning

Does [ ] or does not [ ] consider other traffic
Drift [ ] or no drift [ ]
Corrects [ ] or fails to correct [ ] for drift

Level Off

Levels off _____ ft. too high

Stall

Abrupt [ ] irregular jerky [ ] smooth [ ] action on elevator
Complete stall [ ] or wheel landing [ ]
Stalls at the ground [ ] 1 to 3 ft. above the ground [ ]
more than 3 ft. above ground [ ]

Landing

Satisfactory [ ] unsatisfactory [ ] landing
Corrects [ ] or fails to correct [ ] for poor landing by
adequate use of throttle [ ] or controls [ ]

Lands _____ ft. beyond [ ] or in front of [ ] "spot" line
Observer assisted [ ] or did not [ ] assist in landing
Final approach begun _____ ft. from field boundary

EXHIBIT 1

SAMPLE PAGE FROM 1942 VERSION

TAKE-OFF AND STRAIGHT CLIMB

Deviation in Direction and Lateral Balance

During Roll: Direction _____° ☐ L ☐ R or ☐ S
Lat.Bal. _____° ☐ L ☐ R or ☐ S

During take-off: Direction _____° ☐ L ☐ R or ☐ S
Lat.Bal. _____° ☐ L ☐ R or ☐ S

Throttle

Smooth and deliberate ☐ or abrupt ☐
Full open to start ☐ after starting ☐ never full ☐
Adjusts ☐ or fails to adjust ☐ throttle on completion of take-off to _____RPM at _____ft.

Tail

Tail raised abruptly ☐ smoothly ☐
Tail high, prolonged run ☐ tail low, tends to stall ☐
Flies ship off ☐ yanks ship off ground ☐

Speed

Levels off ☐ or fails to level off ☐ after take-off to gain flying speed

Climb

Assumes optimum climbing speed while maintaining flying speed ☐ or after gaining flying speed ☐
Climbing speed _____MPH
Constant ☐ or varies _____MPH

Traffic

Frequent ☐ infrequent ☐ or no traffic check ☐
Does ☐ or does not ☐ use all available field
Take-off _____degrees from into wind
Cross wind take-off required ☐ not required ☐

Observer assisted in take-off ☐ did not assist ☐

[illegible]

3. [illegible] For [illegible] landing [illegible] deviation in direction [illegible] at time of level-off [illegible] distance [illegible] distance from [illegible] beginning of [illegible]. Likewise, on the [illegible] Take-off [illegible] the observer records the [illegible] completion of take-off.

4. Additional [illegible] needed to improve the diagnostic [illegible]. In Landing, for example, [illegible] whether or not the [illegible] the first approach was begun, [illegible] correcting for a poor landing, [illegible] the plane was flown off [illegible] the Take-off in relation [illegible]. Finally, a check sheet on "Trimming of Ship" was added.

5. A graphic rating scale [illegible], entitled "Overall Rating of [illegible] scale,[4] adapted from the "Purdue Scale for Rating Pilot Competency," gave the observer an opportunity to rate the pilot's over-all performance in subjective terms. It was added primarily for experimental purposes, with the assumption that such subjective ratings would be more accurate and reliable when based upon the detailed, specific observations required by the [illegible]tory proper. It replaced the check sheet on Coordination and Tension originally tried out in the 1940 Version.

6. Check sheets were developed for the following maneuvers: [illegible] Take-off, Trimming of Ship, Climbing Turns, [illegible] Turns, [illegible] off [illegible], Forward Slip, Straight Glide, [illegible] Climb, [illegible] and Level Flight, S-Turns, Rectangular Course, [illegible] Eight, 180° Side Approach, Gliding Turns, [illegible] Approach, Final Approach and Landing.

Collection of Data. The 1941 Version of the C.A.A. State Flight Inventory found its most extensive use in one of the courses of [illegible]

[4] Kelly, [illegible] The Development of [illegible] Scale [illegible] Pilot [illegible] [illegible] CAA Division of Research, [illegible]

OVER-ALL RATING OF FLIGHT

On the basis of observation of the flight as a whole, indicate your over-all judgment of the flight by checking those points on the following scales which represent the best answers to the following questions:

1. How tense or relaxed was he during the flight?

Extremely tense	Rather tense	Slightly tense	Sufficiently relaxed	Ideally relaxed

2. How did he handle the controls? (underline over or under control.)

Greatly over or under controls	Considerably over or under controls	Somewhat over or under controls	Fairly smoothly	Very smoothly & correctly

3. Compared with others of the same amount of training how well did he perform on this flight?

Exceptionally well	Above Average	Average	Below Average	Very Poorly

4. Considering his amount of training how well did he plan his flight path in terms of where he should fly?

Exceptionally well	Above Average	Average	Below Average	Very Poorly

5. How observant and cautious was this student of other traffic?

Blind	Below Average	Average	Above Average	Exceptionally observant

EXHIBIT 3

SAMPLE PAGE FROM 1942 VERSION

in the Boston-Midwest Project.[4] In this project, flight inventories were filled out by trained check pilots during standard flights flown by student pilots at various stages of training.

The analysis of the 1942 Version of the Ohio State Flight Inventory described below was made from data obtained during the Spring and Summer programs at seven CPT flight operations in the Midwest area. The flights, made for research purposes, were administered by two check pilots familiar with the Inventory and with the standard flights.[5] These two pilots went from school to school, as part of the Midwest Project, administering the flights and filling in the flight inventories on the basis of direct observation of the student pilots' performance. Table 1 presents the total number of check flights flown in this project.

Methods of Scoring. A change in the system of scoring took place with the development of the 1942 Version. Instead of the items being given scale values (on a 5-point scale) as in previous versions, the items were scored either plus or minus, plus items indicating desirable performance and minus items indicating undesirable performance. The assignment of plus and minus weights was made on an authoritative basis by Dr. Walker in consultation with flight instructors, flight inspectors, etc.

For example, in Take-off and Straight Climb (Exhibit 2) under Throttle, the item "smooth and deliberate" was scored plus and "abrupt" was scored minus. For items requiring quantitative entries such as degrees of deviation, MPH, altitude changes, etc, "satisfactory" and "unsatisfactory" performance was defined in quantitative terms. For example, in Final Approach and Landing (Exhibit 1) under Deviation in Direction during Glide, deviation from 0 to 5° was scored plus and deviation of 6° or more was scored minus. Likewise, landing 300' or less beyond the spot line was scored plus while landing more than 300' beyond the line was scored minus.

From these plus and minus items various types of measures were obtained, as follows:

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[4]The Boston-Midwest Project, conducted under the auspices of the National Research Council Committee on Selection and Training of Aircraft Pilots, was designed to provide a field trial for selection techniques and criterion instruments developed by the Committee research program. For a description of the procedures and findings of this project, see: NRC Committee on Selection and Training of Aircraft Pilots. Report on the Boston-Midwest Project. (A final report in preparation for the CAA Technical Series.)

[5]Dr. R. Y. Walker, who had participated in the original development of the Inventory, and Mr. Gerald Kitto, a flight instructor specially trained by Dr. Walker for this research project. Detailed instructions for administering the standard flights and for use of the inventories in this study are found in: Walker, R. Y., Lipman, E., and Wantman, M. J. Manual for the administration of the Ohio State Flight Inventory. NRC Division of Anthropology and Psychology, Committee on Selection and Training of Aircraft Pilots. Progress Report, December 1940. (Copy in the files of the NRC Committee on Selection and Training of Aircraft Pilots.)

TABLE 1

DISTRIBUTION OF CHECK FLIGHTS IN THE MIDWEST PROJECT

School	1942 Program	A only	B only	C only	D only	A & B	A & C	A & D	B & C	B & D	C & D	A B C	A B D	A		
[illegible]	Fall				18											
[illegible]	Spring	1			3	1		2	1		4	2	1	8		
[illegible]	Spring		9		8											
[illegible]	Spring		1	1		1				1	1	2	2	2	[illegible]	21
[illegible]	Spring				12											
[illegible]	Summer	1						1			2		2	12	2	9
[illegible]	Summer	1	3	5	11			1	2	2					2	
[illegible]		3	13	6	52	2	0	4	3	3	7	4	5	22	21	40

[illegible] number of individual check flights 412

[illegible] number of students tested 185

[illegible] number of Flights D 154

1. Maneuver Grades. The algebraic sum of the plus and minus items checked for each maneuver was computed. Distributions of these algebraic sums for each maneuver were obtained from the inventories of the 154 Stage D flights.[6] On the basis of the means and standard deviations of these distributions maneuver grades were assigned as follows:

   a. A grade of 1 to scores larger than 1½ standard deviations above the mean.

   b. A grade of 2 to scores from ½ to 1½ standard deviations above the mean.

   c. A grade of 3 to scores within the range of the mean plus and minus ½ standard deviation.

   d. A grade of 4 to scores from ½ standard deviation to 1½ standard deviations below the mean.

   e. A grade of 5 to scores below 1½ standard deviations below the mean.

These "maneuver grades" were thus essentially standard scores ranging from 1, best, to 5, poorest, so as to be analogous to the rating scale in CPT use at the time.

2. Summation Score. An over-all flight score was obtained by averaging the maneuver grades for all the maneuvers in the check flight. This over-all score was termed the "Summation Score."

3. Profile Score. Another method of evaluating over-all performance was attempted as follows:

   a. Maneuver grades, obtained as described above, were plotted in profile form. Profiles of 66 Flight D performances were prepared in this manner.

   b. Six individuals[7] ranked these 66 profiles from "best" to "worst" by a qualitative evaluation of the over-all per-

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[6]The Stage D flights were used as the basis for scoring in order to have a standard level of performance against which to compare a performance during any stage of flight training. Since the Stage D flights were made just prior to completion of the 35 hours of primary training, they were considered best representative of the performance of private pilots.

[7]The six raters included: (1) Dr. Walker, (2) a flight supervisor, (3) a pilot with 200 hours of flying time, (4) a student pilot with approximately 35 hours of flying, (5) another student with only 4 hours of flying time, and (6) a secretary who had had no flying time. The group, therefore, was composed of 3 individuals with considerable knowledge of flying and 3 with relatively little or no direct knowledge of flying.

formance as represented by the particular profile pattern of maneuver grades. In making this ranking the importance of different maneuvers was taken into account by considering Climbing Turns, Gliding Turns, Straight Climbs, and Straight Glides as the four most important maneuvers and the other maneuvers as of equal weight.

c. For each individual rater the rank orders assigned to each of the 66 cases was converted to a scale score, using Hull's conversion formula.[8] The 6 scale scores for each subject were then summed to arrive at the final over-all value. In addition, separate scale scores were computed from the results of the 3 experienced raters and the 3 inexperienced raters.

The correlation between the groups of experienced and inexperienced raters was .94. The intercorrelations among the 6 raters are presented in Table 2.

TABLE 2

INTERCORRELATIONS AMONG RANKINGS OF 66 PROFILES

		Experienced Pilots			Inexperienced Pilots		
	Rater	1	3	2	4	5	6
Experienced Pilots	1	--					
	2	.74	--				
	3	.85	.60	--			
Inexperienced Pilots	4	.75	.55	.92	--		
	5	.89	.67	.88	.83	--	
	6	.87	.71	.82	.78	.83	--

The average intercorrelation among all 6 raters is .78. Applying the Spearman-Brown formula (to estimate the reliability of the rankings based on all 6 raters) yielded a reliability coefficient of approximately .96.

Analysis of Data from the 1942 Version. From the flight inventory data obtained in the Midwest Project, as described above, a detailed study of the 1942 Version was made. The analysis involved the following treatment of the data:

1. Relationship between Summation Scores and Profile Scores. Correlations were computed between the Summation Scores and the Pro-

[8] From Hull, C. L. The computation of Pearson's r from ranked data. J. Appl. Psychol., 1922, 6, 388-390.

file Scores of 66 cases based on Flight D performance. The obtained correlations were as follows:

	N	r
Spring Program	32	.94
Summer Program	34	.91
Combined	66	.93

It is evident that there is a very high correlation between the Profile Scores and the Summation Scores and that the relationship holds when the total group of 66 cases is broken down into two sub-groups, namely, those in the Spring program and those in the Summer program.

Additional information concerning the relationship between the two methods of scoring was obtained by means of a Wherry-Doolittle analysis of the maneuver grades of the 24 Flight D maneuvers, using the Profile Scores as the criterion. Table 3 presents the correlation matrix on which the analysis was based.

The analysis revealed that 9 maneuvers, with their derived weights, yielded a multiple correlation coefficient of .985 with the Profile Scores. The maneuvers, in order of selection by the Wherry-Doolittle method, were Climbing Turn, Rectangular Course Turn No. 3, Forward Slip, Straight Climb, Rectangular Course Turn No. 1, Right Power Turn, Gliding Turn, Right Medium Turn No. 4, and Rectangular Course Turn No. 2. Inspection of the weights, however, suggested that refined weighting added little to the prediction. The maneuver grades for these 9 maneuvers were therefore merely added and the sum correlated with the Summation Scores. The Pearson r between the sum of the 9 maneuver grades and the Summation Score (actually the sum of all 24 maneuver grades) was .986.

These results, in addition to the direct comparison described above, led to the general conclusion that the two methods of scoring yielded essentially equivalent results. Since the Summation Score method was more practical, this method was selected for use in the field and in later research.

2. Item Analysis of the 1942 Version. In filling out the 1942 Version of the Ohio State Flight Inventory for the 24 maneuvers in Flight D, an observer had to consider over 1400 items. In order to reduce the size of the Inventory, an internal consistency analysis was made by determining the correlation between each item in a maneuver and the over-all score for that maneuver, i.e., the maneuver grade.

In this analysis the results of 412 flight inventories were used (see Table 1), representing all the check flights in the Spring and Summer Midwest programs. As a pass-fail criterion, scores below 1.5 standard deviations below the mean in Stage D flights were considered as representing "failing" performance. With this cut-off score all test flights for all stages were sorted for pass or fail and item

TABLE 3

INTERMANEUVER r's
(N = 65)

Maneuver	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1.	--																								
2.	06	--																							
3.	-06	-06	--																						
4.	07	23	17	--																					
5.	-05	-21	43	23	--																				
6.	07	19	11	10	16	--																			
7.	15	24	22	27	27	19	--																		
8.	-17	08	14	28	13	21	-02	--																	
9.	-05	-06	25	10	39	16	35	11	--																
10.	01	46	-03	13	04	25	11	23	19	--															
11.	07	30	21	37	06	11	21	12	07	11	--														
12.	-24	-14	25	14	07	08	08	03	37	14	21	--													
13.	27	17	13	24	-04	20	02	28	04	20	35	19	--												
14.	15	13	07	34	19	39	07	39	05	02	18	11	43	--											
15.	07	14	05	20	11	20	08	-15	05	06	30	-03	-07	12	--										
16.	03	01	08	18	10	02	22	07	08	10	08	-16	11	21	27	--									
17.	11	19	-02	39	-06	00	-01	05	-15	13	06	-01	32	21	18	51	--								
18.	02	21	16	27	14	14	41	17	12	27	25	-08	-04	08	20	46	30	--							
19.	46	39	03	20	-11	-01	22	-13	-25	09	17	-10	28	12	16	16	44	10	--						
20.	37	26	00	36	04	09	11	-03	-13	22	15	-07	27	30	16	06	36	15	28	--					
21.	23	02	-05	15	20	14	21	-10	-02	12	-04	10	17	-02	16	20	32	18	14	21	--				
22.	11	00	38	18	26	14	21	18	04	08	21	04	15	01	02	02	19	14	24	16	02	--			
23.	08	15	18	11	-01	-03	10	-01	-10	16	11	-18	-08	-08	28	14	13	38	12	27	02	18	--		
24.	24	11	13	34	02	-01	11	17	-17	06	19	03	32	28	-04	07	19	-01	38	25	-06	21	-04	--	
25.	27	24	58	54	48	31	47	29	27	33	37	32	48	41	37	49	45	46	42	30	36	45	35	36	--

Note: No decimal points are used.

Variables

		Mean	Sigma			Mean	Sigma			Mean	Sigma
1.	Taxi	2.68	.75	10.	L. Turn No. 2	2.97	.91	18.	Rec. Course No. 4	3.02	.87
2.	Take-off	2.65	.94	11.	L. Turn No. 3	2.95	.87	19.	R.C. Over-all	2.48	.89
3.	Climb. Turn	3.11	1.08	12.	R. Turn No. 4	3.22	.93	20.	S Turns	2.95	.90
4.	L. Pow. Turn	2.83	.93	13.	Str. Climb	2.80	.98	21.	Eights	3.08	.94
5.	R. Pow. Turn	3.28	.99	14.	St. & Level	2.86	.90	22.	180° Side Ap.	2.8	.87
6.	Stall	3.03	.82	15.	ec. Course No. 1	3.08	.97	23.	Glidin Turn	[illegible]	.87
7.	Forw. Sl	3.11	.94	16.	" " 2	88	.91	24.	La	[illegible]	1.1
8.	Str.	2.97	.89					25.			

counts of plus and minus for all items in each maneuver were run. From this procedure tetrachoric r's were derived from four-fold tables based on pass or fail, marked or unmarked for each item. For example, a coefficient of -.57 was obtained between pass-fail on Take-off and Straight Climb and the item "Tail Raised Abruptly," and a correlation of +.58 between pass-fail and "Tail Raised Smoothly." (See Exhibit 2.)

A tetrachoric r of .50 was arbitrarily assumed as the minimum level for satisfactory item validity[9] and items yielding an r below this value were eliminated, except for a few items considered to be of sufficient diagnostic value to warrant continued use. Through this item analysis, which produced a more homogeneous instrument, the size of the inventory was reduced to approximately 40 per cent of its previous size. The retained items were then formed into what was termed the "Short Form" of the 1942 Version.

3. Comparison of the Short Form and the Long Form of the 1942 Version. The reduction in the number of items led to a narrowing of the range of scores and produced a distribution skewed toward the poor end of the scale. The Short Form thus distinguished poor performance from average performance but was not so discriminating at the upper levels. To determine the relationship between the Long and Short Forms of the Flight Inventory, correlations were obtained between Summation Scores on the two forms. The Scores for the Short Form were obtained by re-scoring 297 of the flight inventories from the Spring program, using the items retained in the Short Form. Table 4 presents the results, with the total group subdivided into the four stages of CPT flight instruction.

TABLE 4

OHIO STATE FLIGHT INVENTORY SUMMATION SCORES:
CORRELATION OF SHORT VS. LONG FORMS BY STAGES
MIDWEST PROJECT (Spring 1942)

		Short Form		Long Form		
Stage	N	M	σ	M	σ	r
A	53	3.39	.49	3.31	.50	.86
B	69	3.06	.37	3.15	.38	.80
C	68	2.98	.40	3.09	.43	.79
D	107	3.00	.45	2.92	.45	.93
Total	297	3.08	.46	3.08	.46	.86

[9] The frequency with which a tetrachoric r of .50 would be obtained from a universe when the true relation was zero was computed for each maneuver. For all but 2 of the 24 maneuvers the frequency was .01 or less and for 18 of the 24 maneuvers was .005 or less.

As can be seen from Table 4 the intercorrelations between the two forms ranged from .79 to .93 and for the total of 297 cases was .86. These results indicated that although the two forms could not be considered as equivalent forms, they provided results sufficiently similar for practical purposes.

A factor which may have been expected to contribute to differences in results obtained on the two forms was the fact that the inventories were filled out by two different check pilots. The data were therefore treated separately for the two observers. The results of this analysis are presented in Tables 5 and 6.

TABLE 5

CORRELATION OF SHORT VS. LONG FORM FOR INDIVIDUAL OBSERVERS
MIDWEST PROJECT (Spring 1942)

			Short Form		Long Form		
Stage	N	Observer	M	σ	M	σ	r
A	25	RYW	3.55	.48	3.50	.51	.94
	28	GEK	3.26	.46	3.14	.43	.76
B	33	RYW	3.13	.34	3.06	.40	.92
	36	GEK	3.00	.39	3.24	.33	.87
C	34	RYW	3.13	.41	3.07	.46	.88
	34	GEK	2.83	.33	3.11	.40	.86
D	60	RYW	3.13	.40	2.98	.44	.95
	47	GEK	2.82	.45	2.84	.44	.95
Total	152	RYW	3.20	.43	3.10	.48	.93
	145	GEK	2.95	.45	3.06	.43	.82

TABLE 6

CORRELATION OF SHORT VS. LONG FORM BY STAGES
MIDWEST PROJECT (Summer 1942)

		Short Form		Long Form		
Stage	N	M	σ	M	σ	r
A	25	3.33	.55	3.26	.52	.97
B	22	3.07	.41	2.90	.40	.89
C	34	3.15	.33	3.01	.30	.81
D	34	3.03	.31	2.98	.32	.85
Total	115	3.14	.41	3.04	.40	.90

Table 6 presents results from the Summer program in which all but a very few of the flights were observed by GEK who appears second on Table 5.

From Tables 5 and 6 it will be noted that the Spring program inventory data of Observer RIW yielded higher Short Form-Long Form correlation coefficients in Stages A, B, and Total than did those of the other observer (GEK) [redacted] e Summer program flights were administered by [redacted], namely, GEK. It may be noted that this obse[redacted]orm correlations tended to be higher for the [redacted] the Spring program. During the Summer he was [redacted]d by Observer RIW in the Spring program. This [redacted]nts and more reliable instruments than the numer[redacted]ng the latter's Spring program observations. T[redacted]-Long Form correlations may have been due to a [redacted]ted by the additional experience with the flight inventory which Observer GEK had acquired by the time of the Summer program.

As a further check on the two forms of the flight inventory and as additional evidence of their use as a source of criterion data, critical ratios were determined for the differences between the mean Summation Scores for flights during the four stages of instruction on the assumption that student pilot performance would improve as flight instruction proceeds and a discriminating criterion instrument would reveal these changes. Table 7 presents critical ratios for flight inventory data from the Spring program.

TABLE 7

CRITICAL RATIOS OF DIFFERENCES BETWEEN MEAN SUMMATION SCORES OF FOUR STAGES OF INSTRUCTION
MIDWEST PROJECT (Spring 1942)

Observer		Stages	A	B	C	D	
RIW		A		3.72	3.53	3.85	
	Long	B	3.55		.00	.00	Short
	Form	C	3.33	.10		.00	Form
		D	4.44	.89	.93		
GEK		A		2.39	4.13	4.04	
	Long	B	1.02		1.98	1.96	Short
	Form	C	.28	1.48		.11	Form
		D	2.91	4.76	2.87		
Combined		A		4.07	4.94	4.88	
	Long	B	1.95		1.21	.97	Short
	Form	C	2.56	.87		.30	Form
		D	4.81	3.65	2.50		

Table 7 shows that for the combined Spring program data, the Short Form as a whole gave higher critical ratios than did the Long Form for Stage A against all other stages, the ratios being highly significant for all three differences, viz., Stage A vs. Stage B, Stage A vs. Stage C, and Stage A vs. Stage D. For the differences among Stages B, C, and D for both forms, the critical ratios are not highly significant, although somewhat lower for the Short Form.[10] Table 7 also presents critical ratios for the difference between the means of the four stages computed separately for the individual observer. There is little difference for Observer RYW between the Long and the Short Form of Stage A against other stages, but considerable difference for Observer GEK in favor of the Short Form.

From these results it may be concluded that the Short Form of the Flight Inventory is sufficiently sensitive to detect improvement in flight performance from Stage A to later stages. Neither of the two forms is sufficiently sensitive to detect significant differences between adjacent stages of flight performance other than Stage A.

Table 8 gives critical ratios for differences between means for the Summer program, consisting almost entirely of data from Observer GEK. In this case the critical ratios are not highly significant for either the Long or Short Form but are somewhat higher for the Long Form, a reversal of the trend this observer exhibited on the Spring program data.

TABLE 8

CRITICAL RATIOS OF DIFFERENCES BETWEEN MEAN SUMMATION SCORES OF FOUR STAGES OF INSTRUCTION MIDWEST PROJECT (Summer 1942)

	Stages	A	B	C	D	
Long Form	A		1.90	.77	.39	Short Form
	B	2.67		.90	.18	
	C	2.16	1.10		1.56	
	D	2.39	.79	.40		

A further check on the comparability of the two forms was made by obtaining, from the Midwest Project data,[11] the correlation of each of the forms with other criteria used in the project. Table 9 presents this information.

The results in Table 9 indicate that little effect, in terms of correlation with other criteria, resulted from the elimination of approxi-

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[10]This finding is consistent with an observation made previously (page 10), i.e., that the Short Form did not discriminate well at the upper levels of performance.

[11]Op. cit. (Report referred to in Footnote 4.)

mately 60% of the items in the Long Form.

TABLE 9

CORRELATIONS BETWEEN OHIO STATE FLIGHT INVENTORY SUMMATION SCORES AND OTHER CRITERIA (FROM STAGE D FLIGHT INVENTORIES)

	Spring Program			Summer Program		
	Long Form	Short Form	N	Long Form	Short Form	N
Time Stage D	.11	.08	85	-.05	.14	34
Total Time	.24	.26	85	.30	.32	34
Purdue Scale Item 14, Stage D	.12	.15	41	.13	.13	45
Photographic Criterion V	.67	.67	36	.22	.36	33
OSFI Profile Score	.94	.92	31	.92	.77	34
Ground School Grades	.07	.18	50	-.08	-.04	34

In summary, the item analysis based on internal consistency produced a Short Form of the 1942 Version which correlated rather highly with the Long Form, discriminated among the early stages of flight training as well as or better than the Long Form, and was more practical with respect to length. The evidence warranted the general conclusion that the Short Form was an adequate substitute for the Long Form and should replace it in further work.

THE CURRENT VERSION

Description. From experience during the Midwest Project and treatment of inventory data resulting from that project the current version of the Ohio State Flight Inventory was prepared. This version is presented in its entirety in the attached Manual for Administration of the Ohio State Flight Inventory. The changes incorporated in the current version are as follows:

1. On the basis of the item analysis described above, the number of items in the Inventory was reduced from over 1400 to approximately 640 by eliminating those items not correlating highly with the Summation Score for the maneuver as a whole. For example, comparison of the check sheets for Take-off in the 1942 Version (Exhibit 2, page 3) and in the current version (Manual for Administration of the Ohio State Flight Inventory, page 12) reveals considerable simplification through elimination of "deadwood" items.

2. A few items were added in order to provide diagnostic information considered to be of value.

3. Items dealing with incorrect aileron control during turns were deleted, after consultation with CAA General Inspection flight

inspectors and CPT flight supervisors, on the basis that the rudder is a secondary control used to prevent skidding and slipping and that control coordination during turns should be that of coordination of rudder with aileron rather than aileron with rudder. Experience had shown that some observers would check an error as "aileron error with correct rudder use," while others would mark the same error as "rudder error with aileron correct." By the elimination of the aileron items it was arbitrarily assumed that the aileron control is correct and that the rudder must be properly coordinated.

4. To further simplify the use of the Inventory as a diagnostic as well as a criterion instrument, the format and printing of the Inventory was improved. As shown in the attached Manual for the Administration of the Ohio State Flight Inventory (Second Edition, August 1943), each item representing satisfactory performance was printed in blue and its unsatisfactory correlate in red. In addition, the check sheet on Taxiing was changed to require a check of satisfactory or unsatisfactory on each item rather than a rating on a 5-point scale as in the 1942 Version.

To facilitate use of the Inventory by field and research personnel a "Manual for the Administration of the Ohio State Flight Inventory" was prepared. This manual, designed particularly for the flight instructor in the field, describes the major functions of the Inventory and gives general suggestions for its use. It also includes specific directions for marking each maneuver sheet, pointing out the types of observations required, and showing sample sheets as marked in actual flight.[12]

Applications of the Current Version. The changes incorporated in the current version reflect increased emphasis upon the possible use of the Inventory as a diagnostic and instructional aid as well as a rating device to yield a criterion of flight proficiency. A review of the history and development of the Inventory from its inception in 1939 reveals that the methods employed in developing the Flight Inventory resulted in a compilation of the most common errors of flying. Furthermore, these errors are of the kind for which there are fairly definite standards of satisfactory and unsatisfactory flight performance for the various flight examinations, i.e., private license, commercial license, or instructor rating. With a rating device containing flight characteristics of this kind, it is possible for an instructor to give his student an examination or check flight covering any particular maneuvers he desires or all the maneuvers to be incorporated in the examination for which the student is preparing. Following the check flight, the instructor can review the Flight Inventory results with the student, pointing out in detail the student's specific strengths and errors. Subsequent flight lessons, either solo or dual, can then be adapted to the individual needs

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[12]This manual was prepared with specific reference to the use of the Inventory in the 1943 CAA-WTS Elementary Flight Course (Navy) and includes a Standard Check Flight appropriate for Stage B in that course.

of each student by paying particular attention to those elements of flight performance, or whole maneuvers, in which the student has shown need for improvement.

The Flight Inventory has an additional advantage in that many items are common to more than one maneuver. Items dealing with directional control, altitude control and turn control are common to all degrees of Level Turns, Climbing Turns, and Gliding Turns. If a student manifests improper rudder action as a common characteristic of his flight, it will tend to show up in related maneuvers. If the instructor finds he has checked improper rudder performance occurring at about the same point in all turn maneuvers, he then has a definite type of error to which he can direct the student's attention. If the error is apparent in only one turn, it is probably an atypical error and not consistent with the student's general flying performance. Obviously, it is advisable to call the student's attention to this error as it is undoubtedly an indication of incomplete learning for that particular performance.

The Ohio State Flight Inventory has other direct advantages both as a teaching aid and as a rating device. It is rather common knowledge that individual pilots pay particular attention to certain items of flight performance and neglect other items. The items observed and items neglected are not common from instructor to instructor or from observer to observer. The items in the Ohio State Flight Inventory have been selected on the basis of consultation with and the experience of a large number of flight instructors and inspectors as well as research personnel. When an observer is required to look for specified elements of flight performance (which must be marked as satisfactory or unsatisfactory) it leads to greater uniformity and completeness of observations by the observer. Furthermore, it helps the beginning flight instructor, who is in the process of developing habits of observation, to make a comprehensive appraisal of the majority of the significant characteristics of proficient flying.

A common reaction, when the Ohio State Flight Inventory was submitted even to experienced instructors for use, was "I didn't realize there were so many things I had to look for." While there were individual differences as to the importance of some items, practically all of the instructors agreed that all the items in the OSFI should be considered in analyzing or rating a student pilot's proficiency. Such a form, directing attention to specific attributes of performance, requires the observer to develop an observational habit pattern, leading to greater accuracy and completeness of observation and greater uniformity and reliability of ratings.

Research Involving the Current Version. Use of the current version has been devoted to research with, rather than research on, the Inventory as a basic research tool in the program of the Committee on Selection and Training of Aircraft Pilots. It has been used both as a training aid and as a source of criterion data.

1. As a Training Aid. Use of the Inventory as a training aid was an integral part of the design of the Midwest-Navy Training Project (1943-44).[13] In this project the flight instructors of student pilots serving as subjects in the "experimental group" filled out the Ohio State Flight Inventory during check flights at six specified periods in the training program. After the check flight, the completed Inventory was reviewed with the student, maneuver by maneuver, and his performance discussed in detail. Specific errors and "families" of errors were pointed out, as well as the student's good points. The Inventory was taken home by the student for further study and was also reviewed just before the next flight lesson.[14] The treatment of the "control group" students differed only in that the standard CAA rating sheet, Form ACA 342A, was used instead of the Ohio State Flight Inventory.

Unfortunately, however, operational difficulties, inadequate control of experimental conditions, and incomplete data prevented valid comparison of the performance of the two groups and statistical evidence as to the efficacy of the Ohio State Flight Inventory as a training aid was not yielded by the research project.

2. As a Criterion Instrument. The current version of the Inventory has been in constant use at the Institute of Aviation Psychology, Knoxville, Tennessee, where it forms one of the major sources of criterion data in studies on training variables such as slow-flying, use of prescribed flight instruments, etc. For example, in one of these projects the flight inspector administered a standardized check flight after every 5 hours of training with an additional flight on the 34th hour so that there were two successive check flights for each student at the 34th and 35th hours of training. In addition to marking the Ohio State Flight Inventory the inspector assigned a grade for each maneuver and an over-all grade for the flight as a whole. Table 10 shows the correlations between the Ohio State Flight Inventory Summation Score and the over-all flight grade assigned by the inspector.

Table 10 suggests that the Ohio State Flight Inventory correlates very satisfactorily with over-all grades, especially in view of the fact that the inspector's grade is influenced by items of performance not included in the Inventory.

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[13] Walker, R. Y., and Rogers, R. C. Proposed research on the relative effectiveness of teaching aids. July 1943. (Copy in the files of the NRC Committee on Selection and Training of Aircraft Pilots.)

[14] Detailed instructions for the use of the Ohio State Flight Inventory as a training aid may be found in Appendix 1, which presents: Walker, R. Y., Thompson, A. S., and Ewart, E. S. Manual for the use of the Ohio State Flight Inventory as a training aid in the Midwest-Navy training project. November 1943.

TABLE 10

CORRELATIONS BETWEEN INSPECTOR'S OVER-ALL FLIGHT GRADE AND OHIO STATE FLIGHT INVENTORY SUMMATION SCORE
INSTITUTE OF AVIATION PSYCHOLOGY - 1944

Hours of Training	5	14	25	N
1st Flight Class*	.72	.95	.92	19
2nd Flight Class**	.93	.83	.90	23

* Rank order r
**Pearsonian r

The most recent use of the Ohio State Flight Inventory as a criterion instrument is in connection with the Visual Study, currently being carried on at Ohio State University, Columbus, Ohio. In this project, designed to study the relative progress and ultimate flight proficiency of subjects with varying degrees of visual efficiency, the current version of the Ohio State Flight Inventory is being used with the following modifications:

1. A few items have been made more diagnostic by requiring separate checks for different types of errors rather than a mere indication that an error has occurred. For example, for the item "Levels Off" in Final Approach and Landing, the observer checks not merely the fact that the pilot levelled off at an inappropriate height but whether the inappropriate height was too high or too low.

2. Additional check sheets, specific to the Visual Study, have been devised, including Traffic Pattern, Power Landings, and Strange Field Landings.

The major adaptation, however, is with respect to the use and scoring of the Inventory. Supplementing the instructions to the check pilot, directions to the student pilot have been prepared, designed to aid the student pilot in understanding what is expected of him during the check flight and how the Inventory is being used for grading (criterion) purposes. These directions, illustrated in Exhibit A for Take-off, include a summary of the requirements of each maneuver and indicate clearly the importance of each item of performance in terms of the number of "demerits" to be subtracted from the over-all score on the flight if the student's execution of that item of performance is less than satisfactory.[15] The item

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[15] An approach similar to that given field trial at the Army Air Forces Training Command, Fort Worth, Texas under the direction of the Psychological Branch, Office of the Air Surgeon, AAF. In this study student pilots were given specific instructions as to the elements of performance being observed in each maneuver and as to the numerical weights assigned to each.

EXHIBIT 4

SAMPLE PAGES FROM "DIRECTIONS TO STUDENT PILOT"
(From Materials used in the Visual Study, 1945)

T A K E - O F F

Item of Performance	Error	Demerits
CONTROL OF PLANE		
During roll on ground	varies 5-9° varies 10-14° varies 15° or more	1 2 3
On leaving ground	varies 5-9° varies 10° or more	1 2
Wing level on take-off	wing 5-9° low wing 10-14° low wing low 15° or more	1 2 3
Throttle opened	Abruptly Full at start of roll	2 2
Elevator		
Tail raised	Abruptly	2
At take-off	Plane stalled off.	3
Climbing speed: Too fast:	5-9 mph 10-14 mph 15 mph or more	1 2 3
Climbing speed: Too slow:	5-9 mph 10 mph or more	2 3
SAFETY		
Point of take-off	All of available field used	
Di		
Re		

T A K E - O F F

Be certain that you use all of the available field. "Clear for traffic" before beginning the take-off run.

In evaluating your performance the flight examiner will give particular attention to the items listed on the opposite page, although other factors will also be taken into account to lesser degree. The importance of each item of performance listed is indicated by the number of "demerits" assigned to unsatisfactory performance in terms of that item.

This maneuver will be included in all check flights.

"weights" have been assigned on an authoritative basis through consultation with research personnel, flight instructors, and flight inspectors. As such, they represent a modification in the method of scoring of the Inventory, since in the previous versions items were given equal weight in scoring.[16]

CONCLUSION

Comparison of the current version of the Ohio State Flight Inventory with the preliminary version first developed in 1939 reveals considerable evolution both in its form and in the underlying principles on which the Inventory is based. From a rough list of items representing instructors' opinions as to grades of performance, the Inventory has become a diagnostic and evaluative instrument consisting of items clearly stated, easily checked, and based on careful and critical use in a series of projects and on an experimental check of the value of each item through experimentally obtained research data. The various versions have found important use in a number of research projects and have demonstrated useful application in a wide variety of field situations.

The present form of the Ohio State Flight Inventory finds its primary value in the identification of specific habits of flying. Its most useful application is in field and research situations in which detailed, diagnostic information is required concerning the way the pilot flies the plane.

The present form of the Inventory, however, still has several limitations. These limitations arise primarily out of the fact that "judgment" aspects of piloting are not directly or systematically surveyed. For example, items relating to the estimation of altitudes and distances, to decisions in emergency situations, to proper selection of terrain, etc., are not included. This omission, however, has been due largely to the inability of obtaining consistent agreement among experts as to what constitutes judgment.

The second major limitation of the Inventory is the difficulty of obtaining a valid measure of the flight as a whole since the observations are in terms of specific elements of specific maneuvers. No proven method of weighting the importance of each item and of each maneuver so as to arrive at a valid over-all score is as yet available. This limitation, however, applies when the Ohio State Flight Inventory is used as a rating or grading device and not when used as a teaching device.

The third major limitation of the Inventory at the present time is that it tends to overemphasize measurement of what the plane is doing without adequate indication of what the pilot is doing to make the plane perform. For example, in landings there are no items to show whether the

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[16] Evaluation of this modified method of using and scoring the Inventory must await the treatment of the data from the Visual Study, currently being conducted at the Ohio State University under the auspices of the Committee on Selection and Training of Aircraft Pilots.

student is continually testing the controls to determine how much response he is getting from the controls. This is a rather important function, especially when the student is handling the plane close to its maximum performance.

These limitations suggest that further revision and standardization of the Ohio State Flight Inventory are required. The first deficiency, in the area of "judgment," suggests that some clarification be made of the meaning of this term. If a large enough sampling can be obtained from a group of competent pilots and instructors, it may be possible to classify "judgment" into a restricted number of kinds of judgment. When this has been done, adequate items covering this field can then be added to the Flight Inventory. The second deficiency mentioned above could be corrected by the addition of a sheet for evaluation of the flight as a whole with special emphasis on flight performance between the specific maneuvers. The third deficiency can probably be corrected by: (a) the addition of new items which, however, would tend to make the Inventory more cumbersome for field use, (b) the addition of new items with elimination of some of the present items, or (c) the alteration of present items from that of plane attitude to that of control function and use.

APPENDIX 1

MANUAL FOR THE USE OF THE OHIO STATE FLIGHT INVENTORY AS A TRAINING AID IN THE MIDWEST-NAVY TRAINING PROJECT

APPENDIX 1

MANUAL FOR THE USE OF THE OHIO STATE FLIGHT INVENTORY AS A TRAINING AID IN THE MIDWEST-NAVY TRAINING PROJECT

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November 1943

One of a series of projects conducted under the provisions of a contract between the Civil Aeronautics Administration and the National Research Council by means of grants-in-aid from the Committee on Selection and Training of Aircraft Pilots.

APPENDIX 1

MANUAL FOR THE USE OF THE OHIO STATE FLIGHT INVENTORY AS A TRAINING AID IN THE MIDWEST-NAVY TRAINING PROJECT

I. To the Instructor.

The good instructor can be described as one who "knows his trainees." This means that he knows the specific weak points, and the specific strong points of each of his trainees' performance. He has definite plans, and takes definite steps to correct the weak points in each trainee's performance, before such mistakes become habits. He is able to point out the strong points of the trainee's performance so that he knows definitely what he is doing correctly.

In these days of accelerated flight instruction it is especially hard for an instructor to keep track of the details of all of his trainees' performances. Any technique or training aid which will help the instructor keep track of these details should prove helpful.

Used properly, the Ohio State Flight Inventory can be just such a training aid. It is designed to help instructors in two important ways:

1. It will help the instructor make a systematic analysis of a trainee's performance on a "spot check" by identifying the specific strengths and weaknesses of his performance. Thus it provides a permanent record of performance on "spot checks" at various periods during the training course.

2. Equally important, when used as the basis for ground discussion after the flight, such an analysis can be of great help to the trainee. Such discussion can make clear to the trainee his own errors, and good points, in performing the integrated series of maneuvers in the flight sequence.

II. How to Use the Ohio State Flight Inventory as a Training Aid.

The Ohio State Flight Inventory should be used in conjunction with Standard Flights at six points in the elementary course. In brief the procedure is as follows:

Before the flight, the trainee should be given the general directions for the Standard Check Flight (outlined below). During the flight, the OSFI should be filled out completely. On the ground, after the completion of the flight, the form should be talked over with the trainee. The good points of his performance should be pointed out. His mistakes should be discussed, with particular emphasis on what he should do to correct them. Then he should be allowed to take the form home, study it himself, and bring it back for a brief discussion before the next flight. Specifically, here's how other instructors have used the training aid profitably.

1. Preparation.

When the trainee has received the hours of training necessary for a specific Standard Check Flight, plan the next lesson so that the check flight will come in the first part of the lesson. (See Sequence of Maneuvers for Standard Check Flights in the Midwest-Navy Training Program.) The majority of these flights will not require all of the lesson period, so plan to carry on the normal assignment for the remaining part of the period.

2. Ground Instruction.

a. Before going into the air explain to the trainee that you are going to use the first part of the training period as a check flight so that both you and he can get some measure of his progress.

b. Give the trainee a card with the list of maneuvers in the sequence that will make up the Standard Check Flight.

c. Tell him that you will signal him when to start each successive maneuver, and not to begin before the signal.

d. State that during the Standard Check Flight portion of the lesson you will give no instruction, and will make no comments on his performance, but that after the flight you will discuss his performance thoroughly.

3. Air Work.

a. During the check flight, tell the trainee which maneuver he is to perform and when to start.

b. Be sure that your form is completely marked for a given maneuver before signalling the trainee to begin the next one. In the Series of Turns, particularly, caution the trainee not to begin successive turns until you give the signal.

c. After completing the Standard Check Flight, use the rest of the lesson time for the normal scheduled flight work.

4. Ground Discussion after the Flight.

a. Go over the training aid with the trainee, maneuver by maneuver. Use the record of his performance on the Ohio State Flight Inventory as "notes" and discuss his performance of each maneuver in detail. Point out his good characteristics as well as his errors.

b. Note particularly "families of errors" -- errors which occur in a number of maneuvers, and which can be attributed to a single cause. Skidding on the recovery from all turns, for instance, is usually due to the consistent tendency to use too little rudder in recovery from turns.

c. Discuss particularly the measures that the trainee can take to correct his mistakes, and to improve his good points.

d. Give the Ohio State Flight Inventory to the trainee and tell him to take it with him and to study it. Ask him to hand it back to you before his next flight.

e. Before the next flight, summarize briefly his performance on the Standard Check Flight, and answer any further questions he may have.

f. After the trainee has returned the Training Aid to you, file it with the WTS field representative. If you care to review successive records during the trainee's elementary course, obtain the forms from the WTS representative.

5. In summary, remember the following points:

a. Fill in the Training Aid completely. Incomplete records are of little value.

b. The purpose of the Ohio State Flight Inventory is to help you turn out better students. Use it that way. Due to periodic changes in the curriculum, and in the stated requirements for certain maneuvers, a few specific sections of the Training Aids may not apply to certain maneuvers. In such cases you should either disregard the section of the Training Aid which does not apply, or should adapt the section to meet the requirements of the curriculum, or the maneuver. For example, the page on "Spirals" includes an entry "Holds Pattern." If your requirements for this maneuver do not necessitate spiraling over a spot, "Holds Pattern" would merely refer to whether or not the trainee kept a constant degree of bank. Or again, the page on "Medium Turns" includes an entry "Flight path between turns." If in the early stages of training you do not require a specific flight path to be held between turns on the check flight, this entry should be disregarded.

SEQUENCE OF MANEUVERS FOR STANDARD CHECK FLIGHTS IN THE MIDWEST-NAVY TRAINING PROJECT

The training aids used in the Midwest-Navy Training project will be used at six specified periods in the training course rather than during every instruction flight. So as to insure their use under standard conditions standardized check flights have been set up for each of these periods.

These Standard Check Flights consist of two types of maneuvers: (1) critical maneuvers, i.e., those stressed in the CAA-WTS Controlled Elementary Flight Course (Navy); and (2) transition maneuvers, i.e., those which intervene between critical maneuvers and by means of which the plane is maneuvered into position to enter the next critical maneuver.

Description of Final Standard Check Flight

1. TAXI: To take-off line plus pivot for observation of approaching aircraft.

2. TAKE-OFF: In accordance with Traffic Tee. Transition Maneuver: Leave field after take-off in accordance with local traffic pattern. On the way toward the practice area trim the plane properly.

3. STRAIGHT AND LEVEL: Fly straight and level for two minutes on way to practice area, at an altitude of 500 feet, unless otherwise specified. Transition Maneuver: Proceed to the practice area, attaining the specified altitude for the following maneuver. Locate the boundaries of a rectangular course and place the plane in the correct position for entry into the following maneuver.

4. RECTANGULAR COURSE: Begin parallel to one side of the rectangular course, and maintain a constant altitude and straight course between turns. The course should be parallel to, and equidistant from, the sides of the field. Transition Maneuver: Proceed to correct location for S-Turns, selecting as landmark a road or fence line running approximately crosswind.

5. S-TURNS: Begin into the wind and make one left and one right turn, the radius of turn and altitude to be the same for both turns. Transition Maneuver: Proceed to correct location and altitude for the next maneuver, selecting appropriate landmarks.

6. SERIES OF EIGHTS: Elementary Eights Nos. 1, 2, and 3: Perform this series in accordance with the standard CAA-WTS procedure. Transition Maneuver: Proceed to desired location for entry to the succeeding maneuver.

7 & 8. CLIMB AND CLIMBING TURN WITH 15° BANK: Enter from straight and level flight and climb for 30 seconds. Then enter directly into

the climbing turn. Maintain a 15° bank and recover to straight and level flight 90° from direction at entry. Transition Maneuver: Proceed to correct location and altitude for the succeeding maneuver, selecting appropriate landmarks.

9, 10, 11, 12, 13, 14. SERIES OF TURNS: Enter from straight and level flight, and perform the series of turns specified in the CAA-WTS training program. Enter from and recover to straight and level flight of 30 seconds duration between each separate turn. Transition Maneuver: Proceed to an altitude of 2,000 feet, making a clearing turn in each direction before performing succeeding maneuver.

15. NORMAL POWER-OFF STALL: Enter from straight and level flight, with stick full back at break. Recover to straight and level flight. Transition Maneuver: Short, straight and level flight.

16. FORWARD SLIP: Maintain straight flight path. Recover to straight and level flight after loss of 200 feet from entry. Transition Maneuver: Select reference point, and place plane in position for succeeding maneuver. Altitude should be sufficient to complete 1080° spiral at not less than 1000 feet.

17. 1080° SPIRAL TO THE LEFT: Maintain constant distance from reference point, or constant bank according to the requirements for the maneuver. Transition Maneuver: Short, straight and level flight.

18 & 19. STRAIGHT GLIDE AND GLIDING TURN: Maintain a straight glide for 30 seconds, obtaining optimum gliding speed. Then enter directly into 90° gliding turn with 45° bank. Recover to straight and level flight. Transition Maneuver: Return to airport, gradually reducing altitude to 500 feet, or specified altitude for circling airport. Enter traffic in accordance with local traffic pattern.

20. CIRCULAR APPROACH TO PRECISION LANDING: Cut motor while flying downwind, opposite landing "spot," and begin circular approach.

21. FINAL APPROACH AND LANDING: To a clearly indicated circle 200 feet in diameter.

22. LANDING RUN AND TAXI: To specified position in accordance with traffic rules.

Series of Standard Check Flights

The series of six flights and the time at which each is to be administered is given below. Since the series is cumulative in the sense that the later flights include the maneuvers of the earlier flights, the critical maneuvers will be numbered as in the final flight.

STANDARD CHECK FLIGHT 1
(After 4½ Hours of Instruction)

1. Taxi
2. Take-off
3. Straight and Level Flight
4. Rectangular Course
5. S-Turns
7, 8. Straight Climb and Climbing Turn
9-12. Series of Turns, omitting the 360° Steep Turn
15. Normal Power-off Stall
18, 19. Straight Glide and Gliding Turn
21. Final Approach and Landing
22. Landing Run and Taxi

STANDARD CHECK FLIGHT 2
(After 7½ Hours of Instruction)

1. Taxi
2. Take-off
3. Straight and Level Flight
4. Rectangular Course
6. Series of Eights, omitting Eight No. 3
7, 8. Straight Climb and Climbing Turn
9-14. Series of Turns
15. Normal Power-off Stall (No. 2)
18, 19. Straight Glide and Gliding Turn
20. Circular Approach
21. Final Approach and Landing
22. Landing Run and Taxi

STANDARD CHECK FLIGHT 3
(After 5½ Hours <u>After Solo</u>)

Same sequence as in Standard Check Flight 4.

STANDARD CHECK FLIGHT 4
(After 9 3/4 Hours <u>After Solo</u>)

1. Taxi
2. Take-off
3. Straight and Level Flight
4. Rectangular Course
5. S-Turns
6. Series of Eights
7, 8. Straight Climb and Climbing Turn
14. Series of Turns
15. Normal Power-off Stall (No. 2)
17. 1080° Spiral to the Left
18, 19. Straight Glide and Gliding Turn
20. Circular Approach to Precision Landing
21. Final Approach and Landing
22. Landing Run and Taxi

STANDARD CHECK FLIGHT 5
(After 6 Hours of <u>Stage B</u>)

Same sequence as in Standard Check Flight 4.

STANDARD CHECK FLIGHT 6
(After 12 Hours of <u>Stage B</u>)

Same sequence as described in detail above, under Final Standard Check Flight.