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THE CLASSIFICATION PROGRAM

Philip H. Dubois

Army Air Forces Washington, D.C.

1947

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Army Air Forces Aviation Psychology Program Research Reports

The

Classification Program

REPORT NO. 2

Edited by PHILIP H. DuBOIS Professor of Psychology Washington University

1947

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Preface

More than a thousand aviation psychologists and psychological assistants working in Psychological Research Units and Medical and Psychological Examining Units gathered and processed the data presented in this report. Most of these men worked in a specialized capacity: test development, administration of printed tests, administration of apparatus tests, scoring, and records and reports. The names of these men are given in Appendix D.

The Classification Program received general supervision from Col. John C. Flanagan, Chief of the Psychological Branch, Research. Division, Office of the Air Surgeon, Headquarters Army Air Forces, Washington, D. C., and detailed supervision from Col. Frank A. Geldard, Chief of the Psychological Section, Office of the Surgeon, Headquarters AAF Training Command, Fort Worth, Tex. The bulk of the validity studies were accomplished and many of the processing statistics accumulated by the Statistical Analysis and Records Unit, Office of the Surgeon, Headquarters AAF Training Command, directed by Lt. Col. Walter L. Deemer, Jr. Since Colonel Geldard had the direct responsibility during the war for the conduct of classification activities in the Training Command, he was originally scheduled to be the editor of this report. An overseas assignment to set up a selection and classification program for the Philippine Air Forces prevented Colonel Geldard from undertaking this responsibility.

The preparation of specific chapters and appendices was accomplished as follows:

Chapter 1:

The Selection and Classification of Air Crew: Maj. Philip H. DuBois.

Chapter 2:

Psychological Organizations Concerned with the Selection and Classification of Air Crew: Major DuBois.

Chapter 3:

The Classification Batteries: Major DuBois with the assistance of Master Sgt. Harley O. Preston, who prepared the tabular material.

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Chapter 4:

Results of Validity Studies: Major DuBois with the assistance of Master Sergeant Preston and Staff Sgt. Thomas E. Peltier, who brought together most of the tabular material.

Chapter 5:

The Experimental Group: Maj. Robert L. Thorndike. The experimental group project was initiated by Col. John C. Flanagan. Detailed plans and arrangements for recruiting the members of the group were made by Capt. Chester A. Harris assisted by Capt. William G. Mollenkopf. Assembly and analysis of the results were carried out by the Statistical Unit, Headquarters AAF Training Command. The case study materials were prepared by Maj. William E. Walton.

Chapter 6:

Special Activities Related to Selection and Classification: Cpl. Samuel B. Lyerly. The section on the Psychological Mission to the Philippines was written by Colonel Geldard.

Chapter 7:

Summary: Major DuBois.

Appendix A:

Processing Statistics: Staff Sgt. Harley B. Smith.

Appendix B:

Chronology: Corporal Lyerly and Staff Sergeant Peltier. Appendix C:

Illustrative Case Studies of Individuals in the Experimental Group: Major Walton.

Appendix D:

Personnel Records : Capt. Julien V. Weston assisted by Sgt. William

A. Crowdis, Jr., Cpl. Winifred S. Davis and Cpl. Noel W. Stewart. Corporal Lyerly, in addition to writing chapter 6, prepared the Table of Contents, the lists of tables and figures, and the index. In addition to their specific responsibilities the enlisted men assigned to the preparation of this report performed numerous duties such as checking source records and proofreading. Of the production staff, Miss Mary F. Kingrea deserves special mention for her expert assistance.

> PHILIP H. DuBois Lt. Col., Air Corps, Editor.

2 April 1946.

IV

Table of Contents

1 -

CL.

	Preface	III
pler		
1.	THE SELECTION AND CLASSIFICATION OF AIR CREW.	1
	The Psychological Problem of Selection	2
	The Problem of Classification	2
	Psychological Research at the AAF School of Aviation	
	Medicine	4
	Increased Research on Pilot Selection	6
	Selection and Training in the Army Air Corps	6
	Establishment of Psychological Research Organization	
	in Headquarters AAF	7
	Analysis of Faculty Board Proceedings	8
	Selection of Officers for Field Units.	9
	Opening of Psychological Research Unit No 1	10
	Enlargement of Plan to Include Bombardier and Navi-	
	gator Research	15
	The Development of the AAF Qualifying Examination.	16
	Decision to Use Psychological Tests for Classification	
	of Air Crew	17
	Activation of the Psychological Research Units and	
	of Psychological Section, IIq, AAF Flying Training	
	Command	21
	Psychological Basis of the Selection and Classification	
	Program	24
	Some Principles to be Followed in the Develop-	
	ment of Testing Procedures	25
	The General Plan for the Development of Pro-	
	cedures	28
2	PSYCHOLOGICAL ORGANIZATIONS CONCERNED WITH	
	SELECTION AND CLASSIFICATION OF AIR CREW	29
	Psychological Branch, Office of the Air Surgeon, Head-	
	quarters Army Air Forces	29
	Procurement of Personnel	30
	Procurement of Officers	31
	Procurement of Enlisted Mon	32

V.

Chapter

		T. ohe
2.	PSYCHOLOGICAL ORGANIZATIONS, ETC.—Continued	
	Psychological Branch, etc.—Continued	
	Provision for Civilian Personnel	33
	Procurement of Apparatus and Supplies	33
	Development of the AAF Qualifying Examination .	34
	Development of Printed Tests	35
	Policy in Regard to Research	36
	Psychological Section, Office of the Surgeon, Hq AAF	
	Training Command	38
	The Statistical Analysis and Records Unit	38
	The Perceptual Research Unit	40
	Field Studies Unit	41
	Reorganization of the Psychological Section	42
	The Test Operations Unit.	43
	Field Research Unit	44
	The Psychological Research Units and the AAF School	
	of Aviation Medicine	46
1	 Functions of the AAF School of Aviation Medicine 	•
	in Classification	48
	Psychological Research Unit No. 1	49
	Psychological Research Unit No. 2	53
	Psychological Research Unit No. 3	55
`	The Medical and Psychological Examining Units	58
	The College Training Program	58
	Preparation at Training Command Headquarters.	60
	Medical and Psychological Examining Unit No. 4.	61
	Medical and Psychological Examining Unit No. 5.	62
	Medical and Psychological Examining Unit No. 6.	63
	Medical and Psychological Examining Unit No. 7.	64
	Medical and Psychological Examining Unit No. 8.	65
	Medical and Psychological Examining Unit No. 9.	66
	Medical and Psychological Examining Unit No. 10.	67 ·
	Psychological Research Project (Combat Crew).	67
	Relation of Other Psychological Organizations in	
	the Training Command to the Classification Pro-	
	gram	68
-	Total Numbers Examined	68
3.	THE CLASSIFICATION BATTERIES	71
	The Classification Battery of February 1942	72
	Rationale of the Tests Employed	72
	Scoring Formulas	76
	The Use of Psychomotor Testz	78
	Classification Procedures	77
	Statistical Data	77
	The Classification Battery of April 1942	77

VI

1

*

.

Cheplar		Pup
3. THE	CLASSIFICATION BATTERIES-Continued	
The (lassification Battery of May 1942	82
0	Hassification Procedures	84
The (Classification Battery of June 1942	86
The (Classification Battery of August 1942	88
S	Status of Test Development and Procurement	88
I	Revision of the Classification Battery	88
The	Classification Battery of December 1942	91
(Changes in Tests	91
(Classification Procedures	94
5	Statistical Data	96
The C	Classification Battery of July 1943	96
	Changes in the Battery	96
Ċ	Officer Quality Score	98
	Classification Procedures	98
,	Statistical Data	98
The	Classification Battery of November 1943	99
(Classification Procedures	101
	Statistical Data	103
The	Classification Battery of Soutember 1944	103
1	Introduction of New Staning	105
1	Intercorrelations of Stanings	105
	lassification Procedures	107
Ì	Introduction of Single Digit Scores	167
1	Intercorrelations	109
The	Plassification Battary of June 1045	108
Roov	amination Policies and Practice	100
A REEL		112
7. NEBU Stani	na Validition in Dilot Training	112
i) iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii	Dediction of Success in Thementeur Dilot Train	110
	rediction of Success in Elementary rhot Aram-	115
1	mg	115
	vandities of the Dombardier and Navigator Sta-	320
1	Unitidities of Monteet Mariables in Dilat Training	120
	Validities of Montest Variables in Fliot Iraining .	19%
:	valuaty of the ruot stanine in dasic ruot intin-	141
1	$\mathbf{M}_{\mathbf{G}} = \mathbf{M}_{\mathbf{G}} = $	141
	Validity of the Flot Stanine in Advanced Flot	
•	$\mathbf{F}_{\mathbf{a}} = \mathbf{F}_{\mathbf{a}} + $	144
	Validity of the Pilot Staning in Transition Train-	
/mi -		144
Ine	rediction of Success in Navigator Training	140
	reduction of Navigator Success by Nontest Vari-	
/T11		157
The	rediction of Success in Bombardier Training .	158
	Frediction of Bombardier Success by Nontest Vari-	
•	adic s	169
•	VII	

Chapter

...

STATES TO THE PARTY OF

--

.....

•

2.

٠

let -		Page
4.	RESULTS OF VALIDITY STUDIES—Continued	
	Validities of Stanines for Predicting Success of Com-	
	bat Returnees in Elementary Pilot Training	171
	Validity of Stanines for Prediction of Success of Negro	
	Pilot Trainces	174
	Testing of Chinese Students with Chinese Translation	
	of the Classification Battery	174
	Results with Cadets of United States Military Academy.	176
	Validity of the Pilot Stanine in WASP Training	177
	Validity of Pilot Stanine, Class 42-X	177
	Validities of Stanines in Technical Training	179
5.	THE EXPERIMENTAL GROUP	181
	Introduction	181
	Administrative and Technical Procedures	182
	Selecting the Group	182
	Testing	183
	Records and Reports	184
	Characteristics of the Experimental Group	186
	Validity of Tests and Stanines	189
	Further Analyses of Validity Statistics	193
	Detailed Case Studies	195
	Summary and Conclusions	200
6.	SPECIAL ACTIVITIES RELATED TO SELECTION AND	
	CLASSIFICATION	259
	The Officer Quality Score	259
	The Use of the Educational Examination, AC20	261
	The D-8 Bombardier Selection Program	263
	The Selection of Bombardiers for Navigator Training.	265
	The Selection of Radar Observers	266
	The Selection of Flight Engineers	27
	Combat Crew Assembly	271
	Psychological Research Project (Combat Crew)	272
	Development of the French Classification Battery	284
	Mission to North Africa	284
	Use of the French Battery in the United States	289
	Psychological Mission to the Philippines	289
	Experimental Administration of Tests	293
	The Question of Time Limits	296
	Arrangements for Permanence.	297
	Combat Records	298
	Selection of Weather Observers	298
	Testing Facilities and Procedures Used at Camp	
	Murphy	300
	Termination of the Project	304
7.	SUMMARY	305
-		

VIII

¥

¥

-24

. '+ -

12

۲

-

. ...

Appendis	Pup
A. PROCESSING STATISTICS	309
B. CHRONOLOGY OF SELECTION AND CLASSIFICATION Activities in the Aviation Psychology Program .	355
C. ILLUSTRATIVE CASE STUDIES OF INDIVIDUALS IN THE	
Experimental Group	363
D. MILITARY PERSONNEL ASSIGNED TO THE AVIATION	
PSYCHOLOGY PROGRAM IN THE AAF TRAINING COM-	
MAND	377
INDEX OF NAMES	393
SUBJECT INDEX	393

NAME OF A DESCRIPTION OF A

NO. OF THE PARTY PARTY

۱

List of Tables

2.1	Summary of Testing Statistics	
3.1	The Classification Battery of February 1942 73	
3.2	Intercorrelations of Battery of February 1942 78	
3.3	The Classification Battery of April 1942 79	
3.4	Intercorrelations of Battery of April 1942 81	
3.5	The Classification Battery of May 1942 83	
3.6	The Classification Battery of June 1942 87	
3.7	The Classification Battery of August 1942 39	
3.8	Intercorrelations of Classification Battery of August	
	1942	
3.9	The Classification Battery of December 1942 93	
3.10	Intercorrelations of Classification Battery of Decem-	
	ber 1942	
3.11	The Classification Battery of July 1943	
3.12	Intercorrelations of Classification Battery of July	
	1943	i.
3.13	Test Validities Used in Determining Weights for	
	November 1943 Battery, Together with Approximate	
	Number of Cases	
3.14	Regression Weights of Classification and Research	
	Tests for Battery of November 1943 101	
3.15	The Classification Battery of November 1943 102	ŗ
3.16	Intercorrelations of Classification Battery of Novem-	
	ber 1943, PRU 1-3 Facing 103	ŀ
3.17	Intercorrelations of Classification Battery of Novem-	
	ber 1943, MPEU 4-10	•
3.18	The Classification Battery of September 1944 106	ł
3.19	Intercorrelations of Stanines and Officer Quality	
	Score of September 1944 Battery	

IX

3.20 Intercorrelations of Classification Battery of Septem-3.21 The Classification Battery of June 1945

Toble

۲.

扫描

3.21	The Classification Battery of June 1945	109
3.22	Correlations Between Original and Retest Raw Com-	
- 1	posite Aggregate Weighted Scores	110
3.23	Means, SD's, and Correlations of First and Second	
	Testing, Aircrew Candidates Retested after College	
	Training	110
3.24	Means and Standard Deviations of Original and	
•	Retest Stanines of 314 Bombardiers and Navigators	,
•	Retested After Tour of Combat Duty	111
4.1	Composition of Original Elementary Pilot Classes	
	43-H through 45-II (numbers by stapine)	115
4.2	Composition of Original Elementary Pilot Classes	
	43-H through 45-H (percent by stanine)	116
4.3	Disposition of Original Elementary Pilot Classes	
	43-II through 45-H	117
4.4	Augmented Pilot Stanines of Graduates and Elim-	
	inces of Elementary Pilot Classes 43-H through 45-H.	118
4.5	Percent Eliminated in Each Augmented Pilot Stanine	
	Group, Elementary Pilot Training Classes 43-H	
	through 45-H	119
4.6	Validity of the Augmented Pilot Stanine for Predict-	
	ing Graduation or Elimination from Elementary	
	Pilot Training, Classes 43-F through 45-H, Eastern	
	Flying Training Command	135
4.7	Validity of the Augmented Pilot Stanine for Predict-	
	ing Graduation or Elimination from Elementary Pilot	
	Training, Classes 43-D through 45-H, Central Flying	
	Training Command	135
4.8	Validity of the Augmented Pilot Stanine for Predict-	
	ing Graduation or Elimination from Elementary	
	Pilot Training Classes 43-B through 45-H, Western	
	Flying Training Command.	136
	The second s	

Pup

Validity of the Augmented Pilot Stanine for Predict-4.9 ing Graduation or Elimination from Elementary Pilot Training Classes 43-F through 45-H, All Com-136 4.10 Validity Coefficients for December 1942 and July 137 4 11 Validation Data for July 1943 and November 1943, 138 4.12 Validity of the Bombardier Stanine in Elementary

Pilot Classes 44-J through 45-H 139

<u>}</u>

Х

Telle	Page
4.13 Validity of the Navigator Stanine in Elementary Pilot Classes 44-1 through 45-H	140
4 14 Biserial Validities of Nontest Variables in Elementary	140
Pilot Training	140
4.15 Relationship of First Preference, Preference Waiver.	***
and Marital Status to Graduation-Elimination in	
Elementary Pilot Training.	141
4.16 Validity of the Augmented Pilot Stanine for Predict-	
ing Graduation or Elimination from Basic Training.	142
4.17 Validity of the Augmented Pilot Stanine for Predict-	
ing Graduation from Both Elementary and Basic	
Training	143
4.18 Validities of Nontest Data in Basic Pilot Training.	143
4.19 Validity of the Augmented Pilot Stanine in Advanced	
Pilot Training and in Elementary, Basic, and Ad-	
vanced Pilot Training Combined	144
4.20 Validity of the Pilot Stanine in Predicting Gradua-	
tion from Transition Pilot Training.	144
4.21 Validity of the Navigator Stanine for Certain Navi-	
gator Classes Graduating in 1942.	146
4.22 Validity of the Navigator Stanine for Prediction of	
Graduation from Navigator Training, Classes 43-12	
through 44–1	146
4.23 Validity of Navigator Stanine for Predicting Gradua-	
tion from Navigator Training, Classes 44-2 through	
44-7, New Aviation Cadets	147
4.24 Validity of Navigator Stanine for Predicting Gradua-	
tion from Navigation Framing, Classes 44-2 through	• • •
44-7, Eliminated Fliots Univ	140
of December 1042 and July 1012 for Decleting	
Graduation or Elimination from Nevigation Train-	
ing	140
4.26 Validity Coefficients of Rombardier Newigeton and	7.x 4
Pilot Stanines for Navigation Training	150
4.27 Validities of Stanines for Predicting Graduation or	
Elimination from Navigation Training, Classes 44-08	
through 45–13	151
4.28 Biserial Coefficients of Validity for Certain Nontest	
Variables for Prediction of Graduation or Elimina-	
tion from Navigation Training.	157
4.29 Relationship of First Preference, Preference Waiver,	•
and Marital Status to Graduation or Elimination in	
Navigation Training	158

XI

÷

٠

1 11-1

î

Tuble		Pape
4.30	Validities of Bombardier, Navigator, and Pilot Stanines for Predicting Graduation or Elimination from Bombardier Training, Classes 43-5 .hrough	150
4.31	Validity of the Bombardier Stanine for Predicting Graduation or Elimination from Bombardier Train-	144
	ing, Classes 43-4 through 44-1	160
4.32	Staning	160
4.33	Validity of the Bombardier Stanine (Battery of November 1943) for Predicting Graduation or Elimi- nation from Bombardier Training, Classes 44-09	
4.34	through 45-13	162
		162
4.35	Validity of the Pilot Stanine (Battery of November 1943) for Predicting Graduation or Elimination from	
4.36	Bombardier Training, Classes 44-09 through 45-13. Validity of the Augmented Pilot Stanine (Battery of November 1943) for Predicting Graduation or Elimi-	163
4.37	nation from Bombardier Training, Classes 44–09 through 45–13	163
	Flying Experience, and Strength of Interest for Different Types of Flying Training with Graduation	
4 29	or Elimination in Bombardier Training	169
. 1.00	the Prediction of Bombardier Success	170
4.39	Product Moment Correlations of Stanines with	
4.40	Primary Pilot Validities of Stanines of the Battery	170
4.41	Classes 45-A through 45-F	171
	bles in Battery of September 1944 for Officer Re- turnees in Elementary Pilot Classes 45-D through	
4.42	Primary Pilot Validities of Stanines for Returnee Officers Based on Original Testing with Battories of	172
4.43	July 1942 or December 1942	173
	September 1944 for Returnee Officers Previously Tested with Battery of July 1942 or December 1942.	173
XII		

Ģ

Table		Puji
4.44	Validities of Stanines for Negro Aircrew Trainces.	
	Battery of November 1943	174
4.45	Intercorrelations, Means, Standard Deviations, and	
	Validities of Tests and Stanines of the Classification	
	Battery of November 1943 for Negroes Tested at	
	MPEU No. 6	175
4.46	Validity of Pilot Stanine for Predicting Graduation	
	or Elimination of Chinese Students in Pilot Training.	176
4.47	Intercorrelations, Means, and Standard Deviations	
	of Classification Tests, Stanines, and West Point	
	Class Grades, Ratings, and Athletic Scores for West	
	Point Class of 1946, Together with Validities in	•
	Elementary Pilot Training in Class 45-H Facing	176
4.48	Validities of the Stanines in Prediction of Graduation	
	or Elimination of West Point Cadets in Elementary	
	Pilot Training, Class 45-H	176
4.49	Validity of the Pilot Stanine in W. A. S. P. Training.	177
4.50	Validity of the Pilot Stanine for Pilot Class 42-X	177
4.51	The Validity of Stanines of the December 1942 Classi-	
	fication Battery for Various Types of Technical	
	Training	178
4.52	Correlation of Stanines of September 1944 Battery	•
-	with Small Arms Performance	179 [.]
5.1	Disposition of Personnel Entered in Experimental	
	Group	187
5.2	Background Characteristics of Experimental Group.	188
5.3	AAF Qualifying Examination Scores of Experimental	
		188
5.4	Stanine Distributions of Experimental Group	198
0.0	Means and Standard Deviations of Raw Scores for	100
F 0	All Tests and of Stanines	198
J. 0	Experimental Group, validities for Complete Train-	100
E 7	Ing	190
0.1	tion	101
50	Europein and a Change Total Change Validities in Total Change	191
J. Q	and in Group Passing AAV Qualifying Promination	102
50	and in Oroup rassing AAP Qualitying Examination.	1 7 8
0.0	other Measures of Renaminantal Group	102
5 10	Regression Weights and Multiple Correlations AAP	1 V V
0.10	Ouslifying Examination AC191	195
5.11	Summery of Clinical Follow-Un	197
6.1	Composition of the Flight Officer Composite Score	259
6.2	Test Comprising the Officer Ounlity Score in	
~ 142	Successive Batteries	260
	A 111	

1

ļ

10		Manat
83	Arrangement of the Aviation Cadat Educational	T. MAR
V iV	Examination	282
6.4	Correlations of Classification Test Scores and Stan-	
V· 1	ines with Aviation Cadet Educational Examination	263
6.5	Correlations of D-8 Selection Battery with Low	200
•••	Altitude Bombardier School Criteria	264
6.6	Relation Between Composite Test Score and Gradu-	201
••••	ation or Elimination in D-8 Bombardier Training.	264
6.7	Number Tested with D-8 Selection Battery and	
••••	Number and Per Cent Selected for D-8 Training by	
	each Psychological Detachment	265
6,8	Bombardiers and Navigators Screened by Airborne	
	Testing Teams.	268
6.9	Bombardiers and Navigators Recommended for	
	Radar Training	269
6.10	Composition of Radar Observer Stanine, Battery	
	of June 1945	269
6.11	Composition of Flight Engineer Stanine, Battery	
	of June 1945	270
6.12	Distributions of Lead Crew Aptitude Scores	282
6.13	Intercorrelations of Variables Entering into the	'
	Pilot Lead Crew Aptitude Score	283
F 14	Intercorrelations of Variables Employed in De-	
	termining the Navigator Lead Crew Aptitude	
	Score.	283
6.15	Printed Tests in the French Classification Battery.	286
6.16	Psychomotor Tests in the French Classification	
A 17	Dattery	286
0.17	Aircen Testing of French	007
A 10	Microw Candinates.	281
0.18	to French Aircrow Condidator in North Africa	000
A 10	Vonne and Standard Deviation of Printed Clearing	200
0.13	fication Tosts for Four Filiping Groups and One	ţ
	United States Sample	904
R 20	Critical Ratios of Differences in Means of Printed	402
V.4V	Tests Among Four Filiping Groups and One United	
	States Sample	295
6.21	Tests in the Filipino Weather Observer Battery	299
VIN 4	a constant and a mprove of constant of the station	

• •

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XIV

4. ·

4

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The Selection and Classification of Air Crew

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In the development of plans for the application of psychological techniques to the selection and classification of air crew¹ in World War II there were three stages, distinct chronologically: (1) selection for the single air-crew speciality of pilot; (2) selection for air-crew training on the basis of a screening examination, with subsequent classification based partly on a battery of aptitude tests; and (3) preliminary selection with a screening examination, followed by further selection and eventual classification on the basis of the results of aptitude tests and other pertinent considerations.

Prior to the national emergency preceding World War II the only air-crew specialty was that of pilot. Selection was a matter of choosing the best applicants on the basis of age, educational qualifications, and the results of a thorough medical examination. The original plan for the use of psychologists in the Army Air Forces was to develop psychological tests to supplement the medical examination in the selection of pilots. By the time the Aviation Psychological Program was actually operating it became desirable for the psychologists to use their techniques both for selection for air-crew training and for later classification for a specific specialty: Pilot, bombardier, or navigator. The preliminary screening device was the AAF Qualifying Examination administered by hundreds of aviation cadet examining boards throughout the country, while classification was effected by the use of a battery of aptitude tests administered in the classification centers to candidates who had been selected for air-crew training through attaining a passing score on the screening examination.

As the classification tests came to show excellent prediction for success or failure in training of pilots and navigators and reasonable success in predicting the outcome of bombardier training, and as the supply of candidates greatly exceeded training requirements, the selection and classification program gradually moved into the third phase where acceptance by an aviation cadet examining board on the basis of the

³ In the early part of World War II the three officer air crew positions were pilot, bombardier and navigator. Later the officer air crew categories of radar observer and flight engineer were established.

This		Pept
6.3	Arrangement of the Aviation Cadet Educational	
	Examination.	262
6.4	Correlations of Classification Test Scores and Stan-	
	ines with Aviation Cadet Educational Examination .	263
6.5	Correlations of D-8 Selection Battery with Low	
	Altitude Bombardier School Criteria	264
6.6	Relation Between Composite Test Score and Gradu-	
	ation or Elimination in D-8 Bombardier Training.	264
6.7	Number Tested with D-8 Selection Battery and	
••••	Number and Per Cent Selected for D-8 Training by	
	each Psychological Detachment	265
6.8	Bombardiers and Navigators Screened by Airborne	
	Testing Teams.	268
6.9	Bombardiers and Navigators Recommended for	
••••	Radar Training.	269
6.10	Composition of Radar Observer Stanine. Battery	
••••	of June 1945.	269
6.11	Composition of Flight Engineer Stanine. Battery	
	of June 1945	270
6.12	Distributions of Lead Crew Aptitude Scores	282
6.13	Intercorrelations of Variables Entering into the	1
	Pilot Lead Crew Aptitude Score	283
6.14	Intercorrelations of Variables Employed in De-	
	termining the Navigator Lead Crew Aptitude	
	Score	283
6.15	Printed Tests in the French Classification Battery.	286
6.16	Psychomotor Tests in the French Classification	
	Battery	286
6.17	Weights Used in North African Testing of French	
	Aircrew Candidates	287
6.18	Means and Standard Deviation of Tests Administered	
	to French Aircrew Candidates in North Africa.	288
6.19	Means and Standard Deviation of Printed Classi-	
	fication Tests for Four Filipino Groups and One	
	United States Sample	294
6.20	Critical Ratios of Differences in Means of Printed	
	Tests Among Four Filipino Groups and One United	
	States Sample	295
6.21	Tests in the Filipino Weather Observer Battery	299
	•	I

XIV

4

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3

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CALCULATION 222

CHAPTER ONE

The Selection and Classification of Air Crew

In the development of plans for the application of psychological techniques to the selection and classification of air crew¹ in World War II there were three stages, distinct chronologically: (1) selection for the single air-crew speciality of pilot; (2) selection for air-crew training on the basis of a screening examination, with subsequent classification based partly on a battery of aptitude tests; and (3) preliminary selection with a screening examination, followed by further selection and eventual classification on the basis of the results of aptitude tests and other pertinent considerations.

Prior to the national emergency preceding World War II the only air-crew specialty was that of pilot. Selection was a matter of choosing the best applicants on the basis of age, educational qualifications, and the results of a thorough medical examination. The original plan for the use of psychologists in the Army Air Forces was to develop psychological tests to supplement the medical examination in the selection of pilots. By the time the Aviation Psychological Program was actually operating it became desirable for the psychologists to use their techniques both for selection for air-crew training and for later classification for a specific specialty: Pilot, bombardier, or navigator. The preliminary screening device was the AAF Qualifying Examination administered by hundreds of aviation cadet examining boards throughout the country, while classification was effected by the use of a battery of aptitude tests administered in the classification centers to candidates who had been selected for air-crew training through attaining a passing score on the screening examination.

As the classification tests came to show excellent prediction for success or failure in training of pilots and navigators and reasonable success in predicting the outcome of bombardier training, and as the supply of candidates greatly exceeded training requirements, the selection and classification program gradually moved into the third phase where acceptance by an aviation cadet examining board on the basis of the

¹ In the early part of World War II the three officer air crew positions were pilot, bombardier and navigator. Later the officer air crew categories of radar observer and flight engineer were established.

qualifying examination no longer constituted a final commitment for aviation cadet training. The candidate who succeeded in passing this test was accepted for further screening on the basis of the classification battery, which also helped determine the particular specialty in which he would be trained.

In addition to this psychological screening and classification other factors entered into consideration at each step. A candidate might be disqualified medically either by the aviation cadet examining board or at the classification center. Since only volunteers were accepted for air-crew training there was preliminary self-screening on the basis of motivation. Preferences were also important determiners of classification and relatively few men were ever trained for a specialty in which they did not evince a high degree of interest.

THE PSYCHOLOGICAL PROBLEM OF SELECTION

The psychological problem involved in selection is relatively simple and straightforward. Given a number of candidates of which only a smaller number can be trained, the problem is simply to apply the available measures which will best predict success and to choose the top ranking candidates in sufficient numbers to fill quotas. When more than a single measure is available, results are combined into a single composite score. If this single score is to be maximally predictive, two facts about each component must be established on the basis of studies with previous groups of subjects: the degree to which the test predicts success, and the relationships of the test with the other tests in the battery. With this information, it is possible to provide a suitable weight for each test. In general, the better a test predicts success, the more it should be weighted, while the higher its relationships with the other tests in use the less it should be weighted relative to the other tests. With the weights determined, the score on each test is multiplied by the appropriate weight, and the results added together. Since this sum is often a large number, it may be reduced in size without appreciable loss of predictive efficiency by dividing all weighted sums by the same arbitrary number or by other statistical treatment. In the classification battery, the final scores were single digits, with 1 the lowest possible score and 9 the highest.

THE PROBLEM OF CLASSIFICATION

The problem of classification is more complex, one important difference being that in classification there are no men left unassigned. The goal is fairly clear, namely to maximize the effectiveness of an organization, in this case the combat units of the Army Air Forces, by making appropriate training assignments. To accomplish this, informa-

tion would have to be available not only on the probable success of each individual in each specialty but also the relative importance of each position in the over-all organization. While predictive scores were available for all air-crew positions, the relative importance of each specialty remained unknown. Moreover, a judgment made in this respect would have temporary value; with changing equipment and shifting logistics different specialties assumed different positions on the scale of importance. The solution actually worked out in practice did not have complete theoretical justification, although it appears to have been successful and the pragmatic test is clearly the important one for a nation at war.

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Most men volunteering for air-crew training during the war wanted to be pilots. The quotas for pilot training greatly exceeded the quotas for the other air-crew positions. The result was that in the early part of the war practically every candidate who met the medical qualifications, passed the screening examination and wanted to be a pilot was sent into pilot training. The losses of pilots in combat were fewer and training elimination rates were lower than anticipated, so that more pilots were available than were actually needed in operations. It was possible to practice continued selection of pilot personnel in the later stages of training and in the combat theaters and still have a sufficient supply to meet all demands.

Quotas for navigator and bombardier training were always small in comparison to quotas for pilot training. For the early portion of the war, approximately half of these quotas were filled with men eliminated from the pilot schools and approximately half with students without prior air-crew training. Later the proportion of new trainces increased. While interest in these specialties was never as great as for pilot training, it was generally possible to fill quotas with men evincing high degrees of interest. Because of the early recognition of the importance of having good navigators and because of the interest shown in this specialty, navigator training was the first air-crew position for which it was possible to establish minimum standards in terms of aptitude scores on the classification battery. Men with mathematical skills appeared to be especially interested in navigation. Subsequent need for navigators in the theaters of operations was such that good navigators were practically always available.

The picture with regard to bombardiers was somewhat different. In comparison to the needs, relatively few men preferred bombardier training to pilot or navigator training. Until the bombardier training program was relatively complete, high standards in terms of aptitude scores were not employed. In all theaters of operation superlative bombardiers were scarce. The reasons for this scarcity were probably three-fold: (1) The continuously increasing importance of

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good bombardiers in combat operations throughout World War II attendant upon the unprecedented swing to heavy and very heavy bombardment techniques; (2) shortcomings in the recruitment, selection and classification of bombardiers; and (3) deficiencies in their training, at least in the early part of the war. It is probable, however, that the program for selection and classification of bombardiers was successful to a fair degree, perhaps to a greater degree than can be known with certainty. The problem of assessing the results of classification is a complex one, especially so in the case of the bombardier whose performance in combat is not entirely self-determined. Faulty navigation or piloting caused bombing missions to abort; moreover, there are innumerable conditions, instrumental and meteorological, which may render even the best bombardier's skill ineffective.

At the end of the war the psychologists were able to predict success in all the air-crew specialties, including two new positions introduced during the course of the war, those of radar observer and flight engineer. It is not possible, however, to state that maximum results were obtained from the use of the available data.

PSYCHOLOGICAL RESEARCH AT THE AAF SCHOOL OF AVIATION MEDICINE

The prewar work most directly influencing the Aviation Psychology Program in World War II was carried on by flight surgeons at the AAF School of Aviation Medicine, which was established originally at Mitchel Field, N. Y., moved later to Brooks Field, Tex., and finally to Randolph Field, Tex. Most prominent in this program was Col. Neely C. Mashburn, who taught aviation psychology to medical officers taking the flight surgeons' course and who conducted a program of psychological research and development. One of his associates at the school was Brig. Gen. Charles R. Glenn, who during the early part of World War II was the surgeon of the AAF Training Command, in which the classification of air crew was carried out. He was succeeded in this post by Colonel Mashburn.

Building upon earlier work during World War I on tests of reaction time, steadiness and observation, experiments with psychological tests for the selection of pilots were resumed in 1926 when the school was at Brooks Field. Tests were administered before the students began flying training and records were kept confidential until the students were graduated or eliminated from the advanced flying school.

The first apparatus test in this experimental program was the Thorne Reaction Time apparatus developed in 1925 by Col. Frederic II. Thorne. It measured simple and discriminative reaction time to visual or auditory stimuli. Of a sample of 1,274 students tested between 1926 and 1930, 468 were graduated and 806 were eliminated either in primary or advanced flying school for failure to make satisfactory progress in flying training. A definite relationship between success in training and scores on the test was observed, the biserial validity coefficient being .17.

In 1926 a complex coordinator consisting of an adjustable seat, and airplane stick and rudder, and somewhat akin to the Reid apparatus, was constructed by Dr L. J. O'Rourke and tried out at the School of Aviation Medicine. In front of the controls was a panel on which were rows of parallel lights. Certain stimulus light patterns were presented on the apparatus and the subject had instructions to make appropriate responses with the controls. Reactions were made with the rudder alone, the stick alone, or with the stick and rudder combined. A score based on complex reaction time yielded a biserial validity coefficient of 0.38 for graduation-elimination in flight training. This was based on 1,394 cases entering training between November 1927 and November 1931, of which 582 were graduated and 812 were eliminated.

In 1931, active work began on a serial reaction apparatus devised by Colonel Mashburn. This test, under the name of the complex coordinator, was used in the classification of air crew throughout World War II. It involves serial reaction to light patterns by means of manipulation of a stick and rudder bar. It has numerous advantages over prior apparatus tests, including automatic presentation of stimuli and ease in administration and scoring. In its current form only 15 minutes are required for administration compared with 2 hours for the O'Rourke test and one operator can test several subjects simultaneously. The first study of its validity showed that it was as valid as the O'Rourke complex coordinator, the biserial validity coefficient against graduation-elimination being 0.37 for 1,713 cases, of which 789 were graduated and 924 eliminated.

The importance of the development of speedy and effective methods of pilot selection was pointed out by Colonel Mashburn in 1938:[±]

In a period of emergency such as existed in 1917, where the time faclor is of such great importance, the present system of selection will slow up the training programs tremendously. These inapt students are slow in absorbing instruction and set the pace or rate of advance for the entire class. These failure students are not only expensive liabilities from a monetary standpoint, but in time of war the expense would be of small importance compared to the loss from the service of badly needed personnel caused by slowing down the flow of graduate pilots by choking the training schools with unpromising students. These failure students are a liability themselves, and in addition exclude other more promising students from training.

In addition to the work on apparatus tests steps were also taken at

³ Mashburn, N. C. Psychology, School of Aviation Medicine, Randolph Field, Tex., 1938, p. 190.

the School of Aviation Medicine to standardize a personal history and psychiatric interview designed to yield an "adaptability rating for military aeronautics," which became a part of the medical examination given to all candidates for flying training during the war.

Increased Research on Pilot Selection

With the outbreak of war in Europe in 1939 new impetus was given to the problem of developing practical procedures for the prediction of aptitude for flying. Psychological studies were resumed in Great Britain, Canada, France and Germany. In the United States the Civil Aeronautics Authority (CAA) obtained its first allotment of funds for research on problems of the selection and training of aircraft pilots. These funds were administered by a committee of the National Research Council appointed for the purpose. Later, psychologists were commissioned for service in the United States Navy to work on problems of naval aviation. The CAA and Navy programs were, however, contemporaneous with the work in the Army Air Forces. With men with experience in the CAA testing program entering both services, it provided in individual cases certain orientation in the problems of aviation that might otherwise have been lacking. The CAA findings, reported during the course of the war, added considerably to the sum of knowledge on aviation psychology.

SELECTION AND TRAINING IN THE ARMY AIR CORPS

With the mounting international tension in Europe and the outbreak of actual hostilities in 1939 the Army Air Corps (which was to become the Army Air Forces in 1942) rapidly expanded. While the air arm of the Army had been active in the 20 years following the armistice of 1918, appropriations, equipment and facilities were limited. In the 1920's strength was generally under 1,000 officers and 10,000 enlisted men. In the following decade slow expansion began but the selection of men for flying training was chiefly a matter of choosing a relatively small proportion of applicants on the basis of educational requirements and high physical standards.

Of the pilot trainces approximately 20 percent were commissioned personnel of the regular army and about 80 percent were cadets between the ages of 20 and 26 who entered training directly from civilian life. For these cadets 2 years of college work or its equivalent was the educational requirement. The medical examination was so rigid that approximately 80 percent of those applying failed to pass. About twothirds of the rejections were for what are ordinarily called physical reasons while the other rejections were for psychiatric reasons.

During the 8 months of primary training and 4 months of specialized or advanced training eliminations were very numerous. Of 4,177 who began flying training between 1926 and 1935, 1,633 completed the

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course and 2,544 were eliminated, an elimination rate of 61 percent.

While it was recognized that the disqualification rate prior to training and the elimination rate in training were both high, the matter was not of great concern to the Army so long as it was on a peacetime basis. There were always sufficient numbers of trained pilots for peacetime needs. The extremely small proportion of applicants who finally became rated pilots was, however, of great concern to officers who were planning for expansion of the training program in a time of emergency.

In the years immediately prior to American participation in World War II expansion of the Air Corps gradually accelerated. When on 12 January 1939 the President asked Congress for \$30,000,000 for Air Corps personnel and equipment, the Air Corps had only two fields, Kelly and Randolph, near San Antonio, devoted to the training of aviation cadets. Shortly thereafter the authorized peacetime strength of the Air Corps was increased to 3,203 officers and 45,000 enlisted men. Plans were made to utilize civilian flying schools for the primary training of flying cadets, a program which began on 1 July 1939. In June 1940, as France was overrun by the German armies. the War Department announced plans for training 7,000 pilots and 3,600 bombardiers and navigators annually. New army air fields were built and instead of a single Air Corps Training Center at Randolph Field, Tex., three air corps training centers were established with headquarters at Maxwell Field, Ala.; Randolph Field, Tex.; and Moffett Field, Calif. Bombardier training was inaugurated at Lowry Field, Colo., on 16 July 1940 with the entrance of the first class of bombardier instructors. In August a course for Air Corps navigators was begun by the Pan-American Airways at Miami, Florida. The first navigator training in Air Corps schools began at Barksdale Field, La., in November of that year.

ESTABLISHMENT OF PSYCHOLOGICAL RESEARCH ORGANIZATION IN HEADQUARTERS AAF

Throughout World War II the Aviation Psychology Program was the responsibility of the Air Surgeon, Headquarters Army Air Forces, Washington. As early as 1912, responsibility for determining what army personnel were eligible to fly was a function of medical officers. While determination of fitness for flying had been largely a matter of physical examinations, it was a logical extension of the surgeon's function to include aptitude requirements when plans were made for selecting large numbers of pilot trainces.

The organization which came to be the Psychological Branch of the Office of the Air Surgeon, Headquarters Army Air Forces, began its history as a psychological research project in the Medical Division,

Office of the Chief of the Air Corps. The continued acceleration of the pilot training program and the realization that psychologists in Europe, Canada, and the United States were making new advances in the prediction of pilot success led the Chief of the Medical Division of the Office, Chief of the Air Corps, to initiate on 23 May 1941 a proposal to establish a psychological agency to develop and validate a battery of printed and apparatus tests for use in the selection of pilots.

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The proposal was approved by the Chief of the Air Corps on 14 June 1941. Col. John C. Flanagan, in civilian life associate director of the Cooperative Test Service, New York City, was commissioned in order to direct the work of the new agency and he reported for duty on 16 July 1941.

Work was begun immediately on the development of a program of psychological research on aviation cadets. On 15 August 1941 plans for psychological testing had progressed to the point where it was possible to make specific arrangements for testing. An agreement was reached with the Training Division, Office of the Chief of the Air Corps, whereby 6 hours were to be set aside in the program of the pilot replacement training centers for the administration of psychological tests to all cadets passing through these centers. Results of the tests were to be used only for research purposes until such time as their validity had been established. The Training Division agreed to make records of all cadets available to the Medical Division so that test scores could be correlated with success or failure in training.

Analysis of Faculty Board Proceedings

One of the first studies undertaken was an analysis of the reasons stated in Faculty Board proceedings for the elimination of cadets from pilot training. On the basis of a preliminary analysis of 300 cadets who were eliminated from flying training during early summer of 1941, categories were established for analyzing the cases of 1,000 additional cadets eliminated during the summer and fall of the same year.

Faculty Board proceedings consisted of reports prepared by flight instructors and check pilots giving reasons why cadets failed to learn to fly. Categorizing these reasons under four main headings the frequency of comments was found to be: coordination and technique, 81 percent; alertness and observation, 70 percent; intelligence and judgment, 68 percent; and personality and temperament, 43 percent. Under each of these categories were a number of more or less general traits definable in terms of observable behavior in the flight situation. Under intelligence and judgment these subtraits were: judgment, foresight and planning, memory, and comprehension. Under alertness and observation the subtraits were: visualization of the flight

course, estimation of speed and distance, sense of sustentation, division of attention, orientation, and speed of decision and reaction. The subtraits under coordination and technique were: coordination, appropriateness of controls used, feel of the controls, smoothness of control movement, and progress in developing technique. The traits under personality and temperament were: absence of tenseness, absence of confusion and nervousness, absence of fear and apprehension, suitable temperament, and motivation and attitude.

This analysis, carried along concurrently with the plans to establish testing facilities, provided not only a number of Lypotheses on which research tests could be constructed but also a framework for assigning areas of research to the four psychological research organizations which were to be established in the field. One unit was to work on tests of personality and emotion, another on psychomotor tests, a third on intellectual tests, and the fourth on tests of perception.

In selecting the original research battery all available tests were considered and the evidence which had been accumulated in earlier studies was evaluated. The problem was approached by establishment of the characteristics for which it was desired to test and by selecting various tests which were judged to be suitable for the measurement of these traits.

Sclection of Officers for Field Units

In order to staff the Aviation Psychology Program, records of officers in the Office Reserve Corps were inspected and qualified Reserve officers who were available were transferred into psychological work. The majority of officers originally assigned to the program, however, were men selected and commissioned from civilian life. In selecting these officers extensive use was made of information obtained from the National Research Council and the National Roster of Scientific and Specialized Personnel. Invitations to apply for a commission were extended to approximately 55 psychologists selected on the basis of education, leadership, and achievement in the field of psychology. Certain men were selected for assignment to research in fields such as intelligence and judgment, perception and observation, coordination and technique, and personality and temperament. Others were selected for duties such as the construction of tests, the application of testing procedures and the statistical analysis of results.

The director selected for what became Psychological Research Unit No. 1, Maxwell Field, Ala., was Lt. Col. Laurance F. Shaffer. The research area assigned to this unit was the development of tests of personality and temperament. Research in the area of psychomotor tests was to be concentrated at San Antonio, Tex., joint responsibilities being assigned to Psychological Research Unit No. 2 at Kelly Field, with Lt. Col. Robert T. Rock as director, and the Scherr' of Aviation

Medicine, Randolph Field, of which the Research Section of the Department of Psychology was headed by Lt. Col. Arthur W. Melton. The reason for this joint arrangement was that the school had better facilities for the development and construction of psychomotor apparatus than would be available in any of the processing units, although actual try-out would have to be conducted at such a unit. Lt. Col. J. P. Guilford was selected to head Psychological Research Unit No. 3, Santa Ana, where the development of printed tests of intellectual functions was the primary research responsibility. Col. Frank A. Geldard was selected as director of Psychological Research Unit No. 4, Ellington Field, Tex., with primary responsibility for perceptual test development. Although this fourth unit was formally activated, it never materialized and Colonel Geldard headed the Psychological Section, Office of the Surgeon, Headquarters, AAF Flying Training Command. Other psychologists were commissioned for the key positions in the various units.

OPENING OF PSYCHOLOGICAL RESEARCH UNIT NO. 1

On 6 September 1941 the first of the Air Corps Replacement Centers was officially opened at Maxwell Field, Ala. Fifteen days later Lt. Col. Laurance F. Shaffer reported to supervise psychological testing. His mission was indicated in the letter quoted below:

WAR DEPARTMENT

OFFICE OF THE CHIEF OF THE AIR CORPS

WASHINGTON

OCTOBER 2, 1941.

Subject: Selection of Aviation Cadets.

To: Commanding General, Southeast Training Center, Maxwell Field, Montgomery, Ala.

1. A research project has been initiated by the Medical Division of the Office of the Chief of the Air Corps for the purpose of improving the methods of selecting and classifying aviation cadets. It is believed that procedures may be developed which will increase the efficiency of selection so that a larger proportion of those individuals selected for training will be able to complete the course satisfactorily. It is also hoped that by obtaining fuller knowledge of the special abilities and psychological characteristics of the prospective cadets, it will be possible to prevent rejection, because of minor defects, of individuals who might become outstanding pilots.

2. To accomplish this purpose, as indicated in the Program of Instructions for Pilot Trainces in the Air Corps Replacement Center (W-5124, A. C.), arrangements have been made to have a six-hour battery of ability and performance tests administered by a staff of psychologists. These tests are being developed by the Research Section of the Medical Division of the Office of the Chief of the Air Corps and the results will be analyzed and recommendations made by this office, as soon as data concerning the performance in flying training schools of the cadets tested is available.

3. Major Laurance F. Shaffer, (Specialist Reserve O-426875), on leave of absence from his position as Professor of Psychology and Head of the Bureau of Measurement and Guidance at the Carnegie Institute of Technology, has been assigned to duty at the Air Corps Replacement Center to have immediate supervision of this work and to serve as a member of the Medical Board.

4. A request has been made for the assignment of a number of enlisted men (selectces) with special training in psychology to assist in the administration of the psychological tests.

5. Requests for transfer or assignment of additional officers to supervise various aspects of the project have been made.

By order of the Chief of the Air Corps:

(s) H. W. Bowman, H. W. Bowman, Major, Air Corps, Assistant Executive.

Although the psychological testing of all aviation cadets had been authorized and time had been allotted in the official program of their activities while at the training center, considerable of Colonel Shaffer's timé was taken in explaining the new program to training center officials and in securing space, equipment and personnel. The official plan was given by the Office of the Chief of the Air Corps as an inclosure to the following letter of 26 November 1941.

WAR DEPARTMENT

OFFICE OF THE CHIEF OF THE AIR CORPS

WASHINGTON

NOVEMBER 26, 1941.

Subject: Research Program on Selection of Aviation Cadets.

To: Commanding General, Southeast Air Corps Training Center, Maxwell Field, Montgomery, Alabama.

1. Information:

A research project has been established in the Office, Chief of the Air Corps to study the psychological characteristics which contribute to the successful performance of the duties of the flying personnel of the Army Air Corps, and to develop practical procedures for identifying these characteristics at the time of induction.

2. General objectives:

The general objectives of the program are as follows:

a. To develop additional procedures for selecting Aviation Cadets which will make it possible to increase the proportion able to complete their flying training successfully.

b. To prevent the rejection, for reasons of miner or remediable defects, of candidates whose abilities and characteristics are such that they would probably become successful military aviators.

c. To determine the psychological characteristics of Aviation Cadets that are associated with specific reasons for failure, or with specific difficulties in training, so that in the future these difficulties may be anticipated and prevented.

8. Immediate Objective :

The immediate objective of the program will be to determine, by methods of psychological research, the special abilities and psychological characteristics of Aviation Cadets that are associated with subsequent success or failure in flight training.

4. General Plan:

The general procedure of the psychological research program will be as follows: a. Each class of Aviation Cadets will be given a series of psychological tests, to be selected by the Medical Division, Office, Chief of the Air Corps. The tests will be coordinated with those administered in other Air Corps Replacement Training Centers (Aircrew) in the United States, to facilitate the comparison and interpretation of results. The officers in charge of the research program at the Replacement Training Centers will be consulted, and will advise, concerning the selection of these tests.

b. The test papers will be returned to the Medical Division, Office, Chief of the Air Corps, where they will be scored and the results entered on an individual record for each Cadet. A scatistical staff is to be maintained in the Office, Chief of the Air Corps for this purpose.

o. After each class has completed its flight training, a statistical analysis will be made of the test scores of the successful and unsuccessful Cadets. This will show what test scores are significantly different for those who pass as compared with those who fail the flight training. The reasons for failure will be taken into account whenever possible. Since the largest proportion of eliminations occur in elementary flight training, a preliminary analysis will be made after the completion of this stage.

d. Those tests which are found to differentiate consistently between several thousand successful and several thousand unsuccessful Aviation Cadets after tryout with the Cadets of a large number of the elementary flying fields will be recommended for use in selection and classification of subsequent classes of Aviation Cadets at the Replacement Training Centers.

5. Organization and Personnel:

a. For the purpose of effecting this program, a Psychological Research Section is instituted at each of the Air Corps Replacement Training Centers.

b. The officer in charge of the program is designated as Director, Psychological Research Section, and will be responsible to and report through the Post Surgeon.

a. The services of several additional officers with qualifications as psychologists will be procured by the Office, Chief of the Air Corps for each Air Corps Replacement Training Center for this purpose.

d. The services of a number of non-commissioned officers and enlisted men with qualifications as psychologists will be procured for each Air Corps Replacement Training Center. The men transferred to the Air Corps Replacement Training Centers for this purpose, will be assigned to Detachment, Medical Department, Air Corps Replacement Training Center.

e. The Director of the Psychological Research Section shall also serve as a member of the Medical Board in judging as to whether the Cadets fulfill the requirements for flying training.

6. Funds and Supplies:

a. In general, test materials and equipment will be procured by the Medical Division, Office, Chief of the Air Corps, and shipped to the Replacement Training Centers for their use. Funds have been allocated at Wright Field for this purpose. b. A procurement authority, authorizing the expenditure of up to \$1,000.00 of this fund for Linking emergency replacements and repairs is being transmitted to each of the three Air Corps Replacement Training Centers. By order of the Chief of the Air Corps:

> GROWGE E. STRATEMETER, Brigadier General, Air Corps, Assistant Chief of the Air Corps.

Incl. (1)

Plan for Research Project on Selection of Aviation Cadets.

PLAN FOR BESEARCH PROJECT ON SELECTION OF AVIATION CADETS

.1 Testing Periods:

a. Time Allotment—Six (6) clock hours (300 minutes) will be allotted to the psychological testing of each United States Aviation Cadet, Pilot Wing, at the Air Corps Replacement Training Center.

(2) Individual Tests______ 2 hours. The individual tests will be scheduled in a manner similar to the Medical Examinations, and each Cadet will be excused from other duties for the time required for his individual tests. The individual tests will be administered to Cadets one at a time. The materials consist of specially devised testing apparatus for the measurements of psychological characteristics as outlined below in Section 2 b.

2. Testing Procedures:

a. In the administration of tests in this research program, the following considerations will be regarded:

(1) The fundamental test of flying aptitude is actual performance in flight. This test is excessively wasteful, however, since it requires from 10 to 30 or more hours of flight instruction, and uses instructional facilities that might be employed for the training of more capable Cadets. The psychological research program will endeavor to develop substitute tests that can be given at an earlier stage, more quickly, and more economically.

(2) Tests selected or devised for investigation by the psychological research program are being drawn from the following sources:

(a) An analysis of the performance of flying, with respect to the psychological abilities, skills and characteristics required.

(b) An analysis of the reasons for failure in flight training as revealed by the board findings concerning Cadets who have been eliminated.

(c) An analysis of testing procedures that have been found to possess predictive value by previous research studies, including those conducted at the Army Air Corps School of Aviation Medicine, in the United States Navy, in the Civilian Pilot Training Program, and in various foreign countries, including especially Great Britain, Canada, Germany and Italy.

(d) Expert judgment as to those miniature situations which approximate

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the conditions of flight in certain specific respects. The services of a number of civilian experts are being utilized in the planning and developing of such tests.

b. Thé testing procedures will measure characteristics such as the following: (1) Mental Factors:

(a) Ability to understand instructions and follow directions.

(b) Ability to remember instructions.

(c) Ability to plan and use foresight.

(d) Ability to estimate speed and distance.

(c) Ability to make sound judgments in practical situations.

(f) Ability to make decisions quickly and accurately.

(g) Ability to divide attention successfully.

(h) Ability to become oriented in space quickly and accurately.

(2) Motor Factors:

(a) Ability to coordinate hands and feet.

(b) Ability to make smooth motor responses.

(c) Reaction time in simple and complicated situations.

(d) Steadiness and lack of sway or tremor.

(e) Feel of the plane.

(f) Ability to learn motor skills rapidly.

(3) Personality Factors:

(a) Absence of tendency to become agitated or nervous under conditions inducing strain.

(b) Absence of undue tension.

(c) Lack of tendency to become confused when difficulties occur.

(d) Absence of overcautiousness.

(e) Adequate degree of motivation and interest in aviation.

(f) Suitable personality; stable temperament.

3. Research Procedures:

a. The examination papers and other tests recommended will be forwarded to the Medical Division, Office, Chief of the Air Corps, each week along with a report of the testing activities of that week and the program for the following week. It is desired that the Director of the Psychological Research Section at the Training Centers be permitted to communicate directly with the Medical Division, Office, Chief of the Air Corps, on such technical matters.

b. Reports on the progress of the Aviation Cadets in their flying training will also be sent from each of the flying training schools to the Medical Division, Office, Chief of the Air Corps.

c. A staff of personnel technicians with special training in problems of prodicting success in various types of work is employed in the Medical Division, Office, Chief of the Air Corps. This staff will analyze the test results from the three Air Corps Replacement Training Centers in relation to the flight performance records from the various flying training schools. Extensive use will be made of the tabulating machine equipment in the Office, Chief of the Air Corps, in performing these analyses. Progress reports will be prepared in the Office, Chief of the Air Corps, concerning the effectiveness of the various tests being tried out in predicting success in flying training. Various studies are also being made as to the relative importance of the various types of tests and of the best combination of these tests to predict success in military aviation.

d. The setting up of requirements based on logical analyses of the duties of personnel has often led to the establishment of restrictions in the selection of incoming personnel which, however reasonable in appearance, are not later found to be justified when an actual comparison test is made. Therefore, recommendations for the use of a specific group of tests in the selection of Cadets for flying training will be made only after this combination of tests has proven effective in selecting the more promising Cadets in two or three classes containing several thousand individuals.

A similar letter and inclosure were also sent to the Commanding General, Gulf Coast Air Corps Training Center, to cover the activities of Psychological Research Unit No. 2.

In the meantime, psychological testing at Maxwell Field began. Between 13 October 1941, the first day on which tests were administered in the psychological program, and 30 October, 628 aviation cadets in class 42-E took certain experimental printed tests which had been secured from the Cooperative Test Service, New York City. These tests included Vocabulary, Comprehension of English, Information about Current Events and Aviation, Reasoning and Judgment, Numerical Operations, and Quantitative Perception. Test papers were forwarded to the Office of the Chief of the Air Corps for statistical analysis.

It was the policy of the psychologists in the Medical Division at Headquarters in Washington to make decisions affecting the testing program on the basis of accumulated scientific evidence and the judgment of professional psychologists associated with the program. The first conference in the field relating to the development of the psychological program was held in the latter part of October 1941 at Maxwell Field and was attended by Dr. A. W. Melton, who had not yet been commissioned, and Dr. Robert H. Scashore, of Northwestern University, as well as by psychologists already in uniform. The findings and recommendations of this conference were used in preparing the directive of 25 November 1941 quoted above.

The second psychological unit to open was at Kelly Field, Tex., where its director, Lieutenant Colonel Rock, arrived in November 1941. Experimental testing began the following month.

ENLARGEMENT OF PLAN TO INCLUDE BOMBARDIER AND NAVIGATOR RESEARCH

The original plan for bombardier and navigator training was to train men eliminated from pilot training who met the qualifications and who were willing to volunteer. Responsibility for the study of the aptitudes required for success as bombardiers and navigators was originally given to the Air Corps Technical Training Command, Channte Field, Ill. In May 1941 a section under Richard W. Faubion, senior personnel technician, was established in the Trade Test Division at Chanute Field, under the general supervision of the Training Division, Office of the Chief of the Air Corps. This section was authorized to make studies at the posts where bombardier and navigator training was carried out. Validation of experimental tests resulted in the recommendation that the Army General Classification Test, a physics test and a mechanical comprehension test be used for the selection of bombardiers and navigators. This recommendation was approved in November 1941.

As the accelerated aviation cadet training plan went into effect, it became evident that aviation cadets without prior training as pilots should be admitted to the training for these specialties and also that uniform procedures should be developed for use in the selection of all air-crew personnel. Because of the urgent need for a coordinated program, the Chief of the Air Corps directed that representatives of the interested divisions at Headquarters in Washington confer to formulate a plan for the assignment of responsibilities in air-crew selection and classification.

On 18 December 1941 the Assistant Chief of the Air Corps signed a directive which made the Medical Division responsible for the preparation of tests to be used in the selection and classification of air-crew personnel and for all research connected therewith, including research on the selection of bombardiers and navigators, and the preparation of statistical studies showing results. The field projects conducted by the Technical Training Command were continued through 30 June 1942 under the general supervision of the Medical Division, since funds had been allotted to that time. Certain of the personnel were then absorbed into the Aviation Psychology Program.

THE DEVELOPMENT OF THE AAF QUALIFYING EXAMINATION

The aircrew training program in effect in the fall of 1941 called for the production of 30,000 pilots a year. Difficulties developed in finding sufficient numbers of candidates who met the requirement of a minimum of 2 years college education. The Personnel Procedures Section of The Adjutant General's Office prepared a set of objective examinations on various school subjects to enable applicants lacking the prescribed two years of college training to show that they possessed the "equivalent" education.

In the meantime plans were made by the psychologists in the Medical Division for the development of a psychological test which could be substituted for the two year college requirement. Work on the examination began in August 1941. The first form of the Aviation Cadet Qualifying Examination (later called the AAF Qualifying Examination) was ready for use when the aviation cadet program was greatly expanded after Pearl Harbor. In developing this test the findings of the analysis of 1,000 eliminated pilot trainees who had appeared before Faculty Boards were utilized, and the test was administered experimentally to aviation cadets at Maxwell and Kelly Fields.

A directive on the procurement of Aviation Cadets issued by the Chief of Staff on 7 January 1942 provided for an increase in the number of cadet examining boards throughout the country and authorized immediate enlistment of qualified applicants, with decision as to the type of training to be given each individual to be made after his arrival at an Air Corps Replacement Training Center. The new qualifying examination was approved on 14 January 1942 by a special board appointed by Gen. H. H. Arnold, chief of the Air Corps, and was then released officially to the several hundred aviation cadet examining boards in the various corps areas. All educational restrictions upon the appointment of aviation cadets were removed and the attainment of a certain score on this examination was established as the sole mental requirement for appointment. Although a cadet might be disqualified later on medical grounds, or other sufficient reasons, appointment constituted selection for aircrew training, with classification to be effected later. The psychological testing necessary for determining the aptitude of cadets for bombardier, navigator, or pilot training was to be undertaken by the Psychological Research Units at the Replacement Training Centers.

DECISION TO USE PSYCHOLOGICAL TESTS FOR CLASSIFICATION OF AIR CREW

On 25 January 1942 the directors of the psychological units at Maxwell and Kelly, as well as of the units yet to be opened, met for a conference in Washington. At this conference it was announced that in a few days psychological tests would be used for classification purposes at the Air Corps Replacement Training Centers. The directive which was formulated at this conference and sent to the Commanding Generals of the Air Corps Training Centers is quoted below, together with the technical plan for carrying out testing and research.

WAR DEPARTMENT

HEADQUARTERS OF THE ARMY AIR FORCES

WASHINGTON, D. C.

2 FEBRUARY 1942.

Subject: Classification of Aviation Cadets.

To : Commanding General, Guif Const Air Corps Training Center, Randolph Field, Texas.

1. Information:

A procedure is established by the Office, Chief of the Air Corps for the classification of Aviation Cadets.

2. Objectives:

The objectives of this procedure are as follows:

a. To clussify newly enlisted Aviation Cadets, Air Crew, for training as bombardlers, navigators, or pilots on the basis of psychological aptitude tests, meas-

ures of skill, knowledge, interest, physical qualifications, and other pertinent considerations.

b. To collect data and carry out research relating to the construction, improvement, and development of psychological aptitude tests for this purpose.

3. General Plan:

a. Psychological aptitude tests will be constructed under the direction of the Office, Chief of the Air Corps, for the measurement of the aptitudes, skills, and knowledge that distinguish bombardiers, navigators, and pilots.

b. These tests will be administered to all Aviation Cadets, Air Crew, who report to the Air Corps for training as indicated in the plan attached.

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c. * Classification Board consisting of an officer of the Psychological Classification and Research Section, a Flight Surgeon, and an Air Corps Officer, will consider the results of the aptitude tests, the physical examination for flying, the Cadet's preferences, and other relevant facts, and will assign him to one of the following classifications:

- (1) For training as pilot.
- (2) For training as bombardier.
- (3) For training as navigator.
- (4) For consideration for Aviation Cadet ground duty training.

d. After the completion of the classification of Aviation Cadets, the answer is sheets and other test forms will be forwarded to the Office, Chief of the Air Corps, for checking and for the compilation of records to be correlated with the subsequent success of Aviation Cadets in training and performance.

6. Work on the construction and improvement of testing procedures will be carried out at the Gulf Coast Air Corps Training Center, and at other Air Corps Training Centers under the direction of the Office, Chief of the Air Corps. To coordinate this work effectively, it is directed that all proposals for the construction of classification testing devices or for the experimental use of tests with Air Crew personnel be forwarded to the Office, Chief of the Air Corps for coordination.

f. Data concerning success in training for correlation with the aptitude test results will be supplied the Office, Chief of the Air Corps by the Training Centers.

g. Data concerning performance in Combat Units is to be obtained from the Combat Command.

4. Classification and Personnel:

a. For the purpose of effecting this program, a Psychological Classification and Research Section is instituted at the Gulf Coast Air Corps Training Center.

b. The officer in charge of the program is designated as Director, Psychological Classification and Research Section, and will be responsible to and report through the Surgeon.

o. The services of additional officers with qualifications as psychologists will be produced by the Office, Chief of the Air Corps for each Air Corps Training Center for this purpose.

d. The services of a number of non-commissioned officers and enlisted menwith qualifications as Psychological Assistant (Occupational Specialty 428) will be procured for each Air Corps Training Center. The men transferred to the Air Corps Training Centers for this purpose will be assigned to Headquarters Squadron, Air Corps Training Center in accordance with the recent directive of the Chief of Staff.

o. The Gulf Coast Air Corps Training Center will employ such clerical civilian personnel as is required to assist in carrying out this program.

f. Direct communication regarding technical matters between the heads of psychological units and the Medical Division, Office, Chief of the Air Corps through the Surgeon is authorized.

5. Funds and Supplies:

a. Fiscal estimates for the execution of this program shall be prepared by the Commanding General, Guif Coast Air Corps Training Center. In submitting requests for funds for personnel, specify grades and designations and the number required for each.

b. Procurement authorities, authorizing the expenditures of funds for the procurement, construction, and maintenance of equipment and materials for the research aspects of this program, are being transmitted to the Gulf Coast Air Corps Training Center and to the other Training Centers. These funds are expendable by the properly authorized procurement officers upon request of the Director of the Psychological Classification and Research Section and indorsement by the Surgeon.

c. The Commanding General, Gulf Const Air Corps Training Center will be responsible for providing buildings, equipment, and supplies for the requirements of this program.

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Plan for Classification of Aviation Cadets.

PLAN FOR CLASSIFICATION OF AVIATION CADETS

1. Testing Periods:

a. Time Requirement—Two days (including not mere than eight hours testing altogether) will be allotted for obtaining the inferences, skills, knowledge, and interest to be a set the classification with regard to type of training of each United States Aviana Cadet.

(1) Group Tests—6 hours. Three testing periods of tw hours each should be scheduled. The group tests will be administered to about 100 to 150 Cadets at a time, scated in an examination room. The materials are especially developed tests in booklets and taken with answer sheets designed for machine scoring.

(2) Individual Tests—2 hours. The individual tests will be administered to Cadets one at a time. The materials consist of specially devised testing apparatus for the measurement of specific aptitudes and skills.

2. Classification Procedures:

a. The first step in the classification procedure is the presentation of materials describing the respective duties of Bombardiers, Navigators, and Pilots and giving specific information concerning the aptitudes and other characteristics necessary for successful performance of these functions. After reading these descriptions, the Cadet will be required to answer a number of questions about their contents to insure that he reads and understands them fully.

b. The second step for the Cadet is to indicate his preference for one of the specific types of training based on his own analysis of his interests and aptitudes and his judgment as to the type of service in which he could render the greatest contribution to the Air Forces' effort.

c. The next step is the taking of individual and group tests including tests of graph reading, dial reading, table reading, line length, point distance, path distance, numerical operations, speed of identification, spatial orientation, mathe-

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matics, following directions, feel of controls, coordination, serial reaction time, and finger dexterity as supplied by the Office, Chief of the Air Corps.

d. On the basis of the results obtained as outlined in the preceding paragraph, predictive scores (ranging from 1 to 9) are assigned each Cadet for each of the three types of Aviation Cadet (Air Crew) training. In this process, previous training will be credited as follows:

(1) Solo Certificate-2 points to be added to pilot score.

(2) Solo Certificate and 30 more log hours--3 points to be added to pilot score.

e. A specific recommendation as to type of training for each Aviation Cadet is made on the following basis:

(1) Cadets stating that they prefer assignment to the type of Aviation Cadet training in which their aptitude is most outstanding will be so recommended.

(2) Those Cadets whose predicted performance is above average (a grade of 6 or better) with respect to the type of training listed as their First Preference will be recommended for their First Preference.

(3) Of these Cadets remaining unassigned after those steps, those whose predicted performance is above average with respect to their Second Preference will be recommended for that type of training.

(4) The Third Preference will be treated in the same manner for the remaining group and recommendations made.

(5) The remainder of the Aviation Cadets will be recommended for the type of training in which they make the highest score without regard for preference, except in the following two situations. First, if the Aviation Cadet indicates a higher preference for training as Aviation Cadet in one of the ground crew categories and appears to have the necessary qualifications for such training, the necessary credentials for him should be submitted to the Office, Chief of the Air Corps for consideration for assignment to that speciality; second, if the Aviation Cadet indicates a higher preference for training for Air Crew duty in an enlisted status than for the type of Aviation Cadet training for which his predicted performance is highest, this preference should be confirmed by an interview and the recommendation should be made that he revert to enlisted status and be assigned to the preferred type of training.

(6) These Cadets assigned for a type of training for which their predicted performance is low (a grade of 4 or below) will be recommended for training probationally with the request that their performance be observed closely in the initial stages of training with a view to early elimination if they prove unsatisfactory.

3. Research Procedures :

a. The examination papers and other test records will be forwarded to the Medical Division, Office, Chief of the Air Corps each week along with a report of the testing activities of that week and the program for the following week.

b. Coordination of the development of aptitude tests for this program will be effected by the circulation of ideas for such tests to various centers from the Office. Chief of the Air Corps and by monthly reports on the progress being made on new tests.

c. A staff of personnel technicians with special training in problems of predicting success in various types of work is employed in the Medical Division, Office, Chief of the Air Corps. This staff will analyze the test results from the three Air Corps Training Centers in relation to the performance records from the various training schools. Extensive use will be made of the tabulating machine equipment in the Office, Chief of the Air Corps in performing these analyses. Progress reports will be prepared in the Office, Chief of the Air Corps concerning the effectiveness of the various tests being used in predicting success in training. Various studies are also being made as to the relative importance of the various types of tests and of the best combination of these tests to predict success in military aviation.

Although a number of modifications were made in this plan from time to time the general framework continued to be used in the classification of air crew throughout World War II. The printed or "group" tests were given in sessions aggregating approximately 6 hours. The so-called "individual tests" were apparatus tests and, as classification tests, were ultimately administered to groups of four candidates at a time. These psychomotor tests, when the battery was fully organized, required 11/2 hours testing time. Many of the types of tests prescribed in this original directive were included in the battery throughout the war. The predictive scores ranging from 1 to 9 and based upon combinations of the aptitude tests weighted for the several air-crew specialties, later come to be known as "stanines." This term was originated at Psychological Research Unit No. 1, Maxwell Field, Ala., and is a contraction of the phrase "standard nine." since these aptitude scores were designed as standard scores with a mean of 5, a standard deviation of 2 and a range of 1 to 9. The extra credits added to the pilot score for previous flying experience were designed to favor the classification as pilots of men with pilot experience.

Throughout the war it was the responsibility of the psychologists to determine the preferences of each aviation cadet for the type of training desired and to make appropriate recommendations based upon aptitude scores and preferences. The military channels for transmitting these recommendations varied from time to time.

It will noted that plans for the classification of aviation cadets which accompanied this directive called for a continuous research program with the circulation of test ideas, coordinated development of new aptitude tests, and continuous validation of classification and experimental tests.

ACTIVATION OF THE PSYCHOLOGICAL RESEARCH UNITS AND OF PSYCHOLOGICAL SECTION, HQ., AAF FLYING TRAINING COMMAND

By order of the Secretary of War, four Psychological Research Units were formally activated on 23 January 1942. Two of the four were already in existence at the Air Corps Replacement Centers at Maxwell Field, Ala., and Kelly Field, Tex. The third Psychological Research Unit No. 3, began activities on 3 March 1942 when Lt. Col. J. P. Guilford assumed his duties as director. This unit was located at Santa Ana Army Air Base, Santa Ana, Calif. The fourth unit was to be at Ellington Field, Tex. Like the other units, it was to process

cadets with the uniform battery of classification tests. Col. Frank A. Geldard was to have been its director and to have charge of research in the general area of observational and perceptual capacities.

Rapidly changing plans prevented the actual establishment of a psychological research unit at Ellington Field. A new factor in the situation was the activation of the AAF Flying Training Command on 23 January 1942. Decision was made to center responsibility for psychological testing operations in the headquarters of the command. Certain of the personnel originally scheduled for Ellington became the key personnel of the Psychological Section, Office of the Surgeon, at Training Command Headquarters. The necessity for performing perceptual research was not altered by these administrative decisions and the plan was therefore developed to include perceptual research personnel in this organization.

As a result of the War Department reorganization in March 1942, the psychological agency in Washington eventually became the Psychological Branch, Office of the Air Surgeon, Headquarters Army Air Forces. Its functions were formally recognized on 12 May 1942 when a directive issued by the Chief of Staff definitely assigned responsibility for the development of tests for the selection and classification of air-crew personnel and related functions to the Commanding General, Army Air Forces, rather than to the Adjutant General's Department, which was, however, concerned with the classification of all other personnel in the Army Air Forces.

By AAF Regulation 35-24, dated 22 May 1942, the responsibilities for the selection and classification of air-crew personnel of Headquarters Army Air Forces and Headquarters AAF Flying Training Command were defined. This document is quoted below.

A. A. F. Regulation No. 35-24

WAR DEPARTMENT, Headquarters Army Air Forces, Washington, May 22, 1942.

PERSONNEL, MILITARY

Responsibilities for Selection and Classification of Personnel for Air Crew Assignments

1. Under the direction of the Commanding General, Army Air Forces, the Air Surgeon shall be responsible for:

a. The development and refinement of the Aviation Cadet Qualifying Examination.

b. The development and refinement of the battery of tests for the original classification of men for the various types of air-crew assignment.

c. The determination of appropriate tests for classification and the preparation of directions for administering, scoring, and combining results from these tests for the purpose of determining the type of duty for which the Aviation Cadet is best suited. d. The procurement of new tests and testing apparatus for use in selection and classification of air crew.

e. The procurement of personnel to effect the selection and classification of air crew.

2. The Commanding General, Flying Training Command shall be responsible for:

a. Carrying out directives pertaining to various classification tests, and making suitable reports and recommendations to the Commanding General, Army Air Forces, relative to such tests.

b. Collecting classification test results and data on success in air crew training schools and performing the statistical analyses necessary to determine the accuracy of prediction of classification tests.

c. Preparing the budget for operating the classification testing project,

3. To coordinate effectively the research and development work necessary to establish policies on appropriate tests to be used, it is directed that all proposals for the construction of classification testing devices or for the experimental use of tests with Air Crew personnel be forwarded to Headquarters, Army Air Forces, for coordination.

4. To effectively administer and coordinate this project, it is further directed:

c. That correspondence relative to technical matters only, be carried on directly between the various directors of Psychological Research Units and the Office of the Air Surgeon.

b. That all communications relative to changes in policy or any changes in the testing program pass through Command Channels in order that all may be informed relative to these changes whether they be major or minor.

5. Any changes in standards or methods of selection that may be recommended will be forwarded to the Military Personnel Division, A. A. F. for coordination and approval. All matters pertaining to the physical and psychological selection and classification of air crew will be coordinated with the office of the Air Surgeon.

By command of Lieutenant General Arnold:

MILLARD F. HARMON, Major General, U. S. Army, Chief of the Air Staff.

Official:

WILMAN W. DICK, Colonel, A. G. D., Air Adjutant General

It will be noted that Headquarters Army Air Forces retained direct responsibility for the development and refinement of both the Aviation Cadet Qualifying Examination and tests for air-crew classification, while Headquarters AAF Flying Training Command was responsible for validating classification tests and making recommendations for changes in the battery as well as for carrying out actual testing operations.

The provision for direct technical correspondence between the directors of the Psychological Research Units and the Office of the Air Surgeon, Headquarters Army Air Forces, gave a means by which ideas for the development of the psychological program could be freely circulated without the delays incident to the use of normal military channels. Communications relative to changes in policy or in the testing 阙

program were required to pass through normal command channels. Without the flexibility provided by technical correspondence, it is doubtful whether the program could have been successfully coordinated in a reasonable length of time.

PSYCHOLOGICAL BASIS OF THE SELECTION AND CLASSIFICATION PROGRAM

Along with the organization of the selection and classification program, its psychological basis was formulated. Based partly on professional knowledge and partly on the specific problems encountered in the Army Air Forces, a statement of the psychological basis of the program was presented by Col. Flanagan in a paper read at a meeting of medical and psychological officers at Training Command Headquarters, Fort Worth, on 14 July 1942. A paraphrase of a part of this paper is presented.

As in any selection and classification program the fundamental assumption was that individuals differed in their aptitudes for the task for which they were being considered. Differences among individuals in aptitude for flying had long been recognized in the Army Air Forces. After rejecting a large majority of those applying for flying training, instructors still eliminated about half of the group during the training course. Since most aviation trainees had a strong desire to learn to fly and appeared to work hard at their training, it could be concluded that many were deficient in certain aptitudes essential to developing superior flying skill.

It was important to select not merely individuals who could complete training but men who would be outstanding members of the combat teams. In training for any specialized jobs some individuals have more natural ability than others and these differences persist in spite of the efforts of training personnel. In the Air Forces it was obvious that a first-class fighter pilot was worth several mediocre ones and that the same was true for all other types of air-crew personnel. It was known that special aptitudes play an important part in determining success or failure in a particular task. While many of the aptitudes required for a good bombardier were also essential for a good navigator or a good pilot, there were certain important differences.

The first problem in any program to develop selection and classification procedures is to identify traits associated with success or failure in the activity. The usual approach to this problem includes a review of the findings of previous studies, actual participation in the activity, asking the judgment of instructors and other persons frequently required to evaluate the success of individuals, and interviews of persons actually engaged in the activity, whether successfully or unsuccessfully.

The specific problem in this case was to identify traits common to successful bombardiers, navigators, and pilots for use in a preliminary qualifying examination, and then to discover the specific traits differentiating the superior navigator from the superior bombardier or pilot,

Once certain traits believed to be associated with success or failure in an activity were identified, it was next necessary to develop practical procedures for measuring these traits in each individual. For this purpose both printed tests and apparatus tests came to be used in the classification of air crew.

When measures of success were obtained, us ally in training, these criterion measures were compared with test scores obtained as a candidate. From the correlations of each test with success in different types of training, and from the interrelationships of the tests it was possible to determine the best weighted combination of tests for predicting success in each specialty: bombardier, navigator, and pilot.

The final problem was to formulate administrative procedures which would make it possible to operate a classification program in a satisfactory manner in spite of last minute changes in quotas, deficiencies in personnel, and the many other difficulties which tended to upset carefully prepared plans and procedures.

Some Principles To Be Followed in the Development of Testing Procedures

The first problem in the development of testing procedures is the identification of the traits which it is desired to measure. Principles that governed the selection of such traits for the Air Force psychological classification testing program follow:

(1) Predictive Value.—The primary consideration in the selection of the traits to be tested was positive evidence of the importance of the trait in question as a factor in determining success or failure in a particular air-crew assignment. For classification purpose, it was desirable that the trait not be equally important for all types of assignment being predicted.

(2) Uniqueness.—Traits selected for testing were to be as independent of each other as possible. As a corollary to this, the traits had to be as simple as possible so that they would not be a combination of two factors, one of which was important for bombardiers and another for pilots.

(3) Stability.—The traits selected should be of such a fundamental nature that individual differences in them were not due to specific training. The traits tested should not be greatly affected by small amounts of practice. In cases in which the ability to learn was being measured, this ability to learn should not be greatly affected by moderate amounts of training.

Having selected a number of traits, the next problem was to develop testing procedures for these traits. A few principles which govern the development of such tests follow.

(1) Validity.—The traits being measured were to be defined in such detail as to make it apparent exactly what trait was being measured, why this trait was considered to be important, and the reasons for believing that the testing procedures presented provided a satisfactory measure of the trait. These materials were to enable a judgment to be made concerning the rational basis for selecting the particular test procedures and the adequacy of the proposed test procedures in attaining the desired ends. All tests were to have a definite theoretical rather than a purely empirical basis.

(2) Objectivity.—All testing procedures where to be standardized in such a manner that both the administration and scoring were as objective as possible. It was important that an individual's score not be affected by such irrelevant factors as the particular apparatus used, the particular examiner, or other variables in administration. The necessity for the use of subjective judgment by the examiner or the candidate in deciding how best to approach the particular test problem was to be minimized. The scoring was also to be independent of the judgment of the scorer.

(3) Acceptability.—Testing procedures were to impress both aviation cadets and Air Force officers as reasonable, thorough, and fair methods of evaluating the cadet's potentialities for the particular type of assignment for which the cadet was being considered.

(4) Practicability.—Testing procedures were to be such that they could be administered by individuals with only a limited amount of training. They were also to be economical in original cost and also in cost of administering and scoring. The value for classification and predictive purposes was to be high for a given amount of testing time.

(5) Sampling.—Testing procedures were to consist of objective measures of actual performance on which the task was simple and straightforward. The cadet was not to believe that he could increase his chances of being given a particular training assignment by approaching the test in any way other than that specified in the directions.

The final problem was the actual classification of individuals by means of the testing procedures selected. Principles to be followed in developing these classification procedures were:

(1) Efficiency.—The most important principle in the selection of tests for classification was maximizing the total predictive efficiency of the battery. To accomplish this objective, it was desirable to maximize the average predicted performance of aviation cadets for each of the various types of assignments. Before maximizing these scores, it was necessary to weight the various types of assignment according to the importance of obtaining superior personnel in each particular assignment. It was also desirable to prevent the assignment of cadets to training in which they would be potential sources of danger to themselves or others, by means of minimal or "cut-off" scores.

In maximizing the efficiency of the battery, it was noted that making a particular test with reliability of 0.80 four times as long would increase the validity coefficient of the particular test only from 0.36 to 0.39 or from 0.18 to 0.195. The use of this time for other tests making a unique contribution to the battery was ordinarily more desirable. The importance of independence in the predictive tests was indicated by the fact that only four independent tests (r=0.00) with validity coefficient of 0.30 each would provide a battery with validity of 0.60. The addition of one independent test with validity of 0.40 contributed as much to the total prediction as the addition of four independent tests each with validity of 0.20.

(2) Differentiation.—To insure adequate differentiation for classification purposes it was desirable that there be as little correlation as possible between errors of measurement in the classification scores for different assignments. This was especially true when a number of short tests were used. The contribution of additional tests to a battery of tests which already contained certain tests of a given function was likely to be insufficient to compensate for the addition of chance factors which tended to make the predictions for all types of training spuriously similar.

(3) Criteria.-The principal objective of the selection and classification procedure was to produce as efficient combat units as possible. In the absence of criterion data on performance in actual combat, it was believed desirable to predict as accurately as possible estimates of success in Air Forces training schools. It was desirable for improving and refining test batteries to obtain ratings on the various factors believed to be important in training and in later performance. It was noted that all statistical studies of the predictive value of testing procedures were to be done by taking into account units which were as small as possible to avoid the introduction of spurious elements due to trends. For example, the grouping together of classes ending in different months, and the selection of groups all of the members of which were college students, and so forth might have obscured certain trends. Constant errors due to differences in policies of passing and failing were to be avoided by controlling on schools as a variable and differences in individual instructors were to be accounted for in the same manner.

The General Plan for the Development of Procedures

The principal elements in the plan for developing suitable procedures for the classification of Aviation Cadets were:

1. To provide a basis for the selection of the traits for which testing procedures were to be developed, studies were to be made from time to time of the characteristics which were important contributors to success in the various air-crew assignments. These studies were to be coordinated by Headquarters, Army Air Forces and that office was to prepare and distribute an official statement of the traits indicated as important for each of the air-crew assignments. This statement was to be revised from time to time as additional evidence became available. It was believed to be especially important that information be obtained concerning the qualifications revealed as important in actual combat situations.

2. To develop effective procedures for testing the traits judged to be of importance, primary responsibility for work on tests of each of the four types was delegated to specific units by the directive of 2 May 1942. To coordinate the test development work a system of circulating test ideas for criticisms was established. It was planned that more extensive use be made of expert assistance available in civilian institutions. This was to be particularly in the form of consultation and carrying out studies which could not be done conveniently within the service.

3. To perform the statistical analyses essential to the development of procedures for obtaining predicted scores for success in the various types of assignment a statistical unit was established in the Psychological Section, Headquarters, AAF Flying Training Command. Data for studies of the predictive value of testing procedures were forwarded to that office. To keep the personnel informed concerning the results of various research studies, a series of Research Bulletins was published by Headquarters, Army Air Forces.

CHAPTER TWO

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Psychological Organizations Concerned With Selection and Classification of Air Crew

PSYCHOLOGICAL BRANCH, OFFICE OF THE AIR SURGEON, HEADQUARTERS ARMY AIR FORCES

From its inception in July 1941 the Psychological Branch, Office of the Air Surgeon, Headquarters Army Air Forces, was concerned with the general direction of the Aviation Psychology Program and the coordination of matters affecting psychological work with other agencies within the Headquarters. As a staff agency it had general responsibility for originating policies and procedures to be used in the air-crew classification program and prepared directives to be transmitted to subordinate headquarters and units. All matters of general policy were coordinated with interested staff divisions before a directive was issued. In the early months of the Program it was the sole directing, coordinating, and administrative agency; later, as the Headquarters of the Training Command came to assume a more central position, certain responsibilities were delegated to it.

The office at Hq. Army Air Forces coordinated all research activities of the Aviation Psychology Program and maintained liaison with military and civilian organizations working on related problems. It evaluated suggestions originating at lower headquarters or in the field units for changes in psychological selection and classification tests and procedures and made recommendations to the Air Surgeon for appropriate action.

Until August 1943 the Psychological Branch also carried on an active program of test development and research. It produced all the early forms of the AAF Qualifying Examination as well as the printed tests in the early classification batteries. It performed the first statistical analyses of test results, on which decisions for the improvement of selection and classification procedures were based.

In addition to Col. John C. Flanagan, chief of the Psychological Branch, other members of the staff during the first 2 years included

29

Le Col. Paul Horst, Lt. Col. Paul M. Fitts, Jr., Maj. Robert L. Thorndike, Capt. Frederick B. Davis, Capt. Chester W. Harris and Capt. William G. Mollenkopf, Civilians serving in a professional capacity included Dr. William O. Jenkins, Dr. Tracy S. Kendler, Mrs. Virginia F. Sheffield, Dr. Mary D. Willis, Mrs. Dorothy Bechtoldt, Mr. William J. McCabe and Mrs. Welliam G. Mollenkopf.

In August 1943 the Aviation Ps, chology Program underwent a major change. Responsibility for detailed supervision of classification research and test development was centered in Headquarters AAF Training Command, Fort Worth, with the Psychological Branch in Washington responsible for final evaluation and the determination of policy. Staff members charged with operating and research functions were transferred to other stations.

With the development of psychological organizations in the AAF Personnel Distribution Command, the Continental Air Forces, and overseas, as well as in the Training Command, the Psychological Branch was no longer concerned primarily with air-crew classification but with matters primarily involving planning, coordination with other staff divisions, and with "public relations" capacity of the program. At the end of the war the professional staff, in addition to Colonel Flanagan, consisted of Maj. Robert L. Thorndike, Maj. A. C. Tucker, Dr. William O. Jenkins, and Dr. Tracy Kendler.

Procurement of Personnel-

In the early months of the Aviation Psychology Program and during subsequent periods of expansion, much attention was given to the procurement of personnel required for psychological activities. In order to procure personnel for a specialized program in the Army framework, it was necessary to have appropriate classifications both for officers and enlisted men. For officers a category of aviation psychologist (MOS 2251) was established, official specifications for which are quoted below:

AVIATION PSYCHOLOGIST

Under supervision of the flight surgeon of base or unit, conducts or supervises psychological testing for selection and classification of air-créw members. Engages in research for design, development, and validation of psychological tests and procedures such as apparatus tests, motion-picture tests, and other special tests for classification of pilots, bombardiers, navigators, gunners, and other specialists in the air crew; develops criteria for use in checking psychological techniques against results of selection, classification, and training procedures; conducts research studies on probasts of procurement, classification, and distribution of personnel; administers tests and standardizes testing procedures, conducts special studies to determine degree to which use of various training procedures and special training equipment achieves training objectives; prepares reports of research findings and results achieved by various psychological procedures. Must have experience in experimental psychology, differential psychology, psychometrics, or related branches of applied psychology, including experience in psychological research related to problems of aviation.

Should have a Doctor of Philosophy degree from an accredited college or university, or equivalent training and experience in psychology.

For enlisted men, the category of "psychological assistant" (MOS 428) was established. The specifications required a bachelor's degree with a major in psychology. Practically all of the enlisted men originally procured for the program met this requirement and others were classified as psychological assistants after appropriate experience in psychological work. In the fall of 1943 the category of psychological assistant was abolished by the Personnel Division, as part of a general attempt to simplify the military occupational specialty system of classification, and psychologically qualified enlisted men in the program were reclassified as personnel consultant assistants. Specifications for this classification are given below:

PERSONNEL CONSULTANT ASSISTANT (Military Occupational Specialty 289)

Assists in the adjustment of individual personnel matters of a psychological nature and in the specialized training and rehabilitation of the mentally or physically limited, illiterate, and non-English-speaking enlisted men.

Administers and evaluates psychological minimum literacy, and other individual and group tests. Interviews callsted men concerning problems of a psychological nature and submits reports of findings and recommendations. Assists classification personnel on matters of a psychological nature involved in the classification work of a unit. May assist in the construction and evaluation of psychological tests.

Civilian experience in educational, clinical, vocational, or industrial psychology or equivalent experience required.

The first paragraph of the job description, characterizing the work of those originally given this MOS, obviously does not apply to those engaged in the Aviation Psychology Program. Considerable administrative confusion resulted from this bracketing of two diverse occupations. However, practical resolution of the difficulty eventually came by way of a common understanding, on the part of those responsible for writing orders, etc., that a 289 was really a 428, especially since it developed that there were hardly any 289's, in the original meaning of this designation, in the AAF.

Brocurement of Officers

During the first year of the psychological program, 45 officers were assigned to the Psychological Branch or to subordinate units. A few were members of the Officers Reserve Corps, but most were psychologists directly commissioned from civilian life. In the following year officer strength was built up to a total of 85. Procurement of psychological officers by direct commission was terminated late in 1942. Most of the junior officers added to the program had been enlisted menin one of the psychological research units and were reassigned to psychological work upon graduating from an officer candidate school. The number of officers engaged in classification activities was greatly increased when the classification program was expanded in the fall of 1943. New officers included more graduates of the officer candidate schools as well as psychologists who had been commissioned for other duties, such as test administration for the Adjutant General's Department and teaching in Army Air Force ground schools, and whose services were requisitioned for the expanded classification program. As classification activities decreased, most of these officers remained under the jurisdiction of the Air Surgeon but were assigned either to psychological research activities in the Training Command or to new psychological programs in the AAF Personnel Distribution Command and the Continental Air Forces.

Procurement of Enlisted Men.

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It was foreseen that considerable numbers of enlisted men would be needed in the psychological units to administer tests and to carry out the research program. Much difficulty was experienced in locating, enlisted men with professional qualifications in psychology. In September 1941 the Personnel Procedures Section of the Adjutant General's Department agreed to request the assignment of sufficient numbers of enlisted men qualified as military psychologists to meet the needs of the psychological research units. Up to 1 January 1942 fewer than 20 men were so transferred, since the few military psychologists in the Army were greatly needed for service in the classification work of the Adjutant General's Department. With the establishment of the military occupational specialty of psychological assistant shortly thereafter, provision was made for the assignment of qualified mon directly to the research units. Men with adequate psychological training who wished to volunteer for psychological work in the Air Corps or who were about to be inducted into the armed forces were given-letters from the office of the Chief of the Air Corps stating that they met these requirements. Upon entry into the service they were sent directly to one of the psychological units.

Original authorization was for 50 enlisted men in each of the four units that were planned. When only 3 units actually materialized, the over-all allotment of 200 men was divided among the 3 existing units, 66 to each. On the basis of 66 enlisted men in each unit, noncommissioned officers grades were authorized as follows: 1 first sergeant, 2 master sergeants, 10 technical sergeants, 10 staff sergeants, 15 sergeants, 12 corporals and 16 privates first class. All units were soon required by heavy processing loads and the demands of the research program to exceed the authorized strength by 40 or 50 men. While there was no difficulty in retaining the additional personnel, all efforts to secure a number of noncommissioned officer grades commensurate with the numbers and quality of the enlisted men in the units were unavailing. Until mid-1943 sufficient numbers of the senior enlisted men left for officer candidate schools so that promotions were generally possible. After that time many enlisted men with excellent professional qualifications remained in the lower army grades with little chance of promotion.

For two of the units, procurement of enlisted personnel was largely, handled through the Office of the Air Surgeon. The unit at Santa Ana, however, was able to make special recruiting arrangements and secured a large proportion of its personnel locally.

A major factor in the achievements of the psychological units was the high calibre of the enlisted men. Of the approximately 300 enlisted men who were on duty on 30-June 1943, approximately 40 percent had master's degrees and practically all had a bachelor's degree with a major in psychology. To staff the enlarged program in the fall of 1943, 200 graduates of the Army Specialized Training Program, with 6 months' intensive training in psychology in major universities, were secured by the Psychological Branch. These men, who had been selected on the basis of a test prepared by the Adjutant General's Department and by special boards, also proved to be unusually capable. Procurement by direct assignment of qualified inductees, which had been suspended after original allotments were exceeded, was also resumed. Other men were procured at this time by Training Command Headquarters and by the local units.

Provision for Civilian Personnel

Provision for civilian personnel was made by the Psychological Branch in the directives issued to subordinate commands, but actual procurement was a matter for each local station. Outside of Headquarters Army Air Forces only a few civilians were employed in a professional capacity. Civilian women, however, worked in all of the units as stenographers, typists, clerks, and scoring-machine operators, handling a large portion of the detailed work. While the work of these civilians is not mentioned frequently in this and the other reports of the Aviation Psychology Program, it was essential in all units, since military personnel were not available with the stenographic and clerical skills necessary for the large volume of correspondence, reports, and paper work connected with the program.

Procurement of Apparatus and Supplies

At the beginning it was recognized that, in addition to the supplies and equipment available through normal army supply channels, various special items would be required to conduct the work of the units. In

its diréctives Headquarters Army Air Porces authorized the procurement of office furniture, equipment, and supplies from the ordinary issuing organizations. Because the program was the responsibility of the Medical Department and the personnel were Air Corps, it was possible to utilize three supply services, Medical, Air Corps, and Quartermaster.

For special equipment, such as the large punch-card installation authorized for Headquarters AAF Training Command in Fort Worth and the IBM test-scoring machines in processing units, special efforts were needed. The Psychological Branch also took steps to procure ample supplies of IBM test-answer sheets and the tabulating cards used for test data and statistical purposes.

The procurement of psychomotor equipment required special attention. It was found that the facilities of the AAF School of Aviation Medicine at Randolph Field were especially adequate for acquiring unusual items. Accordingly, funds for the procurement of psychomotor apparatus were allotted to the School, and the Psychology Department, headed by Lieutenant Colonel Melton, handled all procurement of classification models of apparatus tests.

Each of the original psychological units was also allotted a fund each fiscal year for the purchase of needed materials that could not be secured through regular army supply channels.

Certain items, such as typewriters and calculating machines, were scarce even in army supply channels, but with the cooperation of supply officers, all units were eventually well-equipped. The original Psychological Research Units ultimately had excellent shop facilities which permitted the construction of experimental apparatus tests, as well as routine maintenance of the tests in the classification battery.

Development of the AAF Qualifying Examination

The AAF Qualifying Examination was the psychological instrument used for the preliminary screening of applicants for air-crew training, both civilians and enlisted men. It was designed and constructed by the Psychological Branch for the purpose of measuring the aptitudes, skills and proficiency required for the successful completion of the air-crew training and for effective participation in combat activities. Another purpose was to select men who would make good Air Corps officers.

It was primarily a power test administered under a 3-hour time limit. Applicants were permitted to take different forms of the examination as many times as they wished, provided that at least 30 days elapsed between each testing. The content of the examinetion was modified in successive forms as the result of studies of the efficiency of the items in predicting training success.

As mentioned in the previous chapter, the examination replaced all

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educational requirements for air-crew training which existed prior to the war. Thousands of items were constructed, many of them based upon materials taken from Army technical manuals and training texts. The examination was aimed to predict success in pilot training particularly since the bulk of the men selected were to be trained in that specialty. Directions for administration and scoring were such that it could be administered by the hundreds of aviation cadet examining boards in the United States and in army bases overseas by men with no professional psychological training. Sections of the test measured the following characteristics: comprehension and judgment, mathematical ability, mechanical comprehension, and observational accuracy.

The first form was released in January 1942 and work was begun immediately on the construction of an alternate form, which was completed in April. Other forms followed in rapid succession, each based upon detailed analyses of the results with preceding forms and of experimental-material tried out on aviation cadets in the classification centers. During the war more than a million individuals took one or another form of this examination. Approximately half were accepted for further examination at a classification center or a basic training center. The general design of the examination changed somewhat with the changing requirements of the Air Forces. After the Flight Officer Act was passed by Congress, in the summer of 1942, some aviation trainces became commissioned officers while others became flight officers, the final differentiation occurring near the end of training. Some of the burden previously carried by the Qualifying Examination, viz., that portion directed to "practical judgment," was transferred to the Flight Officer Final Examination, also constructed within the Aviation Psychology Frogram. This permitted the Qualifying Examination to become less of a substitute for educational requirements and more of an aptitude test for air-crew personnel. New information on the validity of perceptual items in an unessentially untimed test resulted in further changes in the general plan of the examination. In August 1943 responsibility for the development of the qualifying examination was delegated to Headquarters Training Command which, in turn, delegated it to Psychological Research Unit No. 3, to which personnel from the Office of the Air Surgeon concerned with its development were transferred. Details of the development and use of the examination are given in Report No. 6 of this series.

Development of Printed Tests

For the first 2 years of the program the Psychological Branch way artively engaged in the production of the printed tests used in the classification batteries. A nong the tests developed at the Washington Headquarters and used for classification throughout the war were

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Speed-of Identification, Dial and Table Reading, and Spatial Orientation. The Psychological Branch also produced the first forms of, certain other tests used in most of the batteries, including Reading Comprehension and Numerical Operations, which were later revised at Psychological Research Unit No. 3. Other printed tests produced by the Psychological Branch were used in the early batteries but were replaced as new tests developed by the units became available.

The program of test development, guided by the original job analyses and hypotheses regarding the traits required for successful aircrew performance, was successful in that a considerable proportion of the tests produced showed good validities throughout the war. Despite the much larger program of test development which was carried out in the subordinate units, the core of the printed test battery consisted of tests originally produced in Washington.

Policy in Regard to Rescarch

From its inception the Aviation Psychology Program emphasized continued research directed toward finding definite answers to problems in aviation psychology. No psychological study could be justified unless it was potentially of direct or indirect use in helping to winthe war. While the psychologists who entered the program represented diverse research interests, this restriction was readily understood and served merely to focus all attention on the problems of the relatively new field of aviation psychology.

The first problem attacked was that of devising tests for the selection of pilots, with work on selection tests for navigators and bombardiers beginning in late 1941. For a period of over 2 years the chief efforts of the aviation psychologists were devoted to making job analyses of the three original aircrew positions, developing tests which might predict success in one or more of the specialties, and validating these tests against success in training. Combat criteria were not overlooked, but in the initial period it was not feasible to obtain combat records on-men who had been tested by the psychological units, since the carliest classes were still in training in the United States. It was not until late 1943 and early 1944 that appreciable numbers of pilots, bombardiers, and mavigators who had been selected by psychological tests were sent into combat.

While all psychological research in the program had to be accomplished in the general army framework, it was recognized by the Psychological Branch that creative professional work could not be accomplished simply by military orders. Accordingly, arrangements were made for planning and evaluative conferences, direct technical correspondence among the aviation psychologists, and publication in confidential or restricted form of all research findings. Meetings of representatives of the Psychological Branch, the directors of the Psychological Research Units, the chief of the Psychological Section at Fort Worth and the head of the Department of Psychology, School of Aviation Medicine, took place frequently. In these meetings plans were agreed upon for new developments, research findings were evaluated, and drafts were developed of the directives which would be issued by Headquarters Army Air Forces and which would apply to all the subordinate units. At these meetings differences in point of view were settled as far as possible by mutual agreement, but since the final responsibility for all over-all decisions affecting the program lay with Headquarters Army Air Forces, decisions were occasionally reached which did not have the unanimous approval of the subordinate units.

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In the earlier meetings many decisions as to the tests to be included in the battery and the weights to be assigned to them in predicting air-crew success were necessarily a matter of professional judgment rather than of evaluating scientific evidence. The availability of equipment suited to mass testing was a limiting factor in deciding what psychomotor tests could be included. However, as there accumulated evidence of the usefulness of specific classification and experimental tests for predicting training success, the directors' meetings became more a matter of weighing scientific evidence and less a matter of having to pass professional judgment. The later batteries were agreed upon almost exclusively on the basis of known test validities and intercorrelations. The conference system throughout the war was exceedingly valuable not only in the interchange of experience and the development of a unified plan of action, but also as a method by which the professional approach to problems of aviation psychology could be made effective in the military situation.

The technical channels of correspondence which had been authorized for the psychologists in an Air Force regulation permitted continuous interchange of ideas between the personnel of the headquarters organizations and the operating units. Research findings were immediately reported to headquarters. It was also possible for the psychologists in headquarters to criticize proposed research plans and to suggest changes. This semioflicial correspondence was supplemented by personal letters and telephone conversations so that at all times the heads of the psychological organizations were in relatively close contact with developments throughout the program.

Important during the early period was the system of test ideas. The Psychological Branch, Headquarters AAF, set up a system by which ideas for tests could be submitted by officer or enlisted personnel, through the director of the unit, to the office of the Air Surgeon. Test ideas and pertinent criticisms were duplicated and circulated throughout the program. While only an extremely small percentage of the test ideas circulated in this way ever resulted in tests used for classification purposes, the system was partly responsible for the development of a large number of experimental tests of considerable potential usefulness and, quite as important, it probably prevented waste of time and efforts in the uncritical development of unfruitful test ideas.

PSYCHOLOGICAL SECTION, OFFICE OF THE SURGEON, HQ. AAF TRAINING COMMAND

The Psychological Section, Office of the Surgeon, AAF Flying Training Command, was activated on 21 April 1942 for three primary purposes: (1) to maintain liaison with staff agencies at Training Command Headquarters and to act as an agency intermediate between Headquarters Army Air Forces and the operating units; (2) to act as a central statistical laboratory where all classification test data would be collected and correlated against training records; and (3) to carry out the perceptual test research originally scheduled for the Ellington Field unit.

The first three officers assigned to the Psychological Section were Col. Erank A. Geldard, who was its chief throughout the war, Lt. Col. Walter L. Deemer, Jr., chief of the Statistical Analysis and Records Unit, and Maj. James J. Gibson, who was chief of the Perceptual Research Unit until October 1943.

For approximately 2 months, the section remained in Washington and its activities were largely concerned with plans. A number of aviation psychologists were procured for service in the section and placed on duty temporarily in the psychological research units. After Flying Training Command headquarters moved from Washington to Fort Worth, Tex., on 1 July 1942, the section was gradually increased to 15 officers and approximately 30 civilians.

To attain its objectives, the section was originally divided into three coordinate units: the Statistical Analysis and Records Unit, the Perceptual Unit and the Field Studies Unit.

The Statistical Analysis and Records Unit

The functions of the Statistical Analysis and Records Unit, directed by Lt. Col. Walter L. Deemer, Jr., were to tabulate and analyze data obtained from the field and to prepare reports, tables, and charts showing essential findings. A large installation of punch card tabulating machines, together with accessory computational aids, was installed at Fort Worth, and arrangements were made for gathering from the three psychological units all test scores and other pertinent data on examinees. During the war, complete records were secured on more than a half million individuals and the unit had approximately six million punch cards in its files. To handle this volume of records it was necessary, for extended periods, to use the tabulating

equipment 24 hours a day, with operators working in three shifts. The types of research work conducted by the Statistical Unit included: (1) studies to determine the degree to which stanines, test scores, and nontest data such as age, education, and previous flying experience predicted success in training and combat; (2) studies of appropriate weights to be applied to classification tests and experimental tests. under consideration for use in the classification battery, in order to determine the most predictive aptitude scores; (3) studies for other psychological units in the Aviation Psychology Program for which the units did not have adequate facilities; (4) theoretical studies on the nature of the statistical measures commonly used in research in aviation psychology; and (5) studies performed for the surgeon of the Flying Training Command, such as those concerned with the physical examination. In addition, the unit performed a number of service functions, the most extensive of which was the preparation of complete rosters of men processed and of men graduating from various phases of training. These rosters were eventually placed on microfilm, distributed to processing and research organizations throughout the Aviation Psychology Program, including overseas detachments, and were used in many of the later psych-legical studies of the program. Another service function was supplying stanines and test data on men who were tested in a unit which later had closed and whose scores were available only in the central files at Fort Worth.

Validation research on tests and stanines was continuous. Not only were studies made of new aviation trainees who were selected by means of the AAF Qualifying Examination and the classification battery and who entered bombardier, navigator, or pilot training, but also studies were made of the value of predictive measures applied to special groups. Sch as student officers, men previously eliminated from one phase of training, members of the Women's Auxiliary Service Pilots organization (WASP's), enlisted and officer personnel who had returned from combat, and cadets of the United States Military Academy.

Many of the research findings of the unit are given in detail later in this report. From the earliest studies, the pilot and navigator stanines were demonstrated to be effective in predicting success in these two types of training, as evidenced by the high relationship between stanines and graduation-elimination. While the validity of the bombardier stanine was not as high, it nevertheless was shown to be a satisfactory device for the classification of bombardiers.

The early results, presented both in terms of statistical tables and by charts constructed by the drafting section of the Statistical Unit, increased confidence in the use of psychological procedures and eventually resulted in the use of the classification battery for the selection of air-crew candidates as well as for their classification after their acceptance for air-crew training.

In order to make changes in the classification battery that would improve the relationship between stanines and later success, it was necessary to gather a great deal of statistical information, including the relationship between all the tests considered for use in a new battery and success in different types of training, and the intercorrelations of the tests. On the basis of this information, it was possible to determine what changes should be made in the classification battery and the best weights to be applied to the test scores in computing stanines. Until September 1943, data analyzed by the Statistical Unit were transmitted to the Psychological Branch, Headquarters Army Air Forces, which retained responsibility for determining weights and judging the merits of the various experimental tests. Later, complete recommendations for changes in the battery were prepared by the Psychological Section at Fort Worth and forwarded to Headquarters Army Air Forces for approval.

During the war the Statistical Unit produced approximately 500 research studies, involving many thousands of correlation coefficients and other statistical constants. Charts and graphs were prepared to show the results of the classification testing program and of special studies. The most important charts showed the percentages of elimination at several stages of each type of training according to the aptitude ratings of men composing the classes, the relationship of preferences, previous flying experience, age, and education to success in training as well as the value of particular printed and apparatus tests in predicting training success.

The Perceptual Research Unit

The Perceptual Research Unit, headed by Maj. James J. Gibson, was concerned with the construction of aptitude tests involving perceptual skills and the conduct of research in the field of perception. Early printed classification tests that were perceptual in nature showed substantial validity for predicting graduation-elimination in flying training. Job analyses indicated that visual perception was important in the work of all members of the air crew, especially the pilot. The study of 1,000 eliminated pilots made by the Psychological Branch, Office of the Air Surgeon, indicated that deficiencies in such traits as alertness and observation, visualization of flight course, estimation of speed and distance, orientation in the air and division of attention were factors in numerous eliminations.

The Perceptual Unit worked on two types of perceptual measures, printed tests and motion picture tests. Printed tests were developed involving judgment of map distances, estimation of the length of lines, judgment of proportions, directional orientation, and picture integration.

On the assumption that tests requiring discriminations of time and of events-in-sequence were necessary to supplement the motionless type of visual discriminations required by the printed tests, plans were made for the development of a series of perceptual tests in motionpicture form. It was believed that motion-picture tests would make possible a wide range of judgments involving motion which would be close to the realities of the job situation in the air.

Since the use of motion pictures for the administration of group tests was a new development, considerable effort was expended on fundamental problems of technique, such as methods of insuring adequate visibility of the screen, of the photographing of stimuli and of giving directions by sub-titles or sound track. Among the motionpicture tests which were developed at Hq. Flying Training Command were tests designed to measure speed estimation, flexibility of attention, and integration of attention. Preliminary work on a number of other motion-picture tests was also accomplished, with actual development taking place after the motion-picture test program was transferred to the Psychological Test Film. Unit at Santa Ana, Calif. in October 1943.

A special project of the unit was research on the role of color vision in the performance of air-crew duties. This project was executed by Maj. S. Rains Wallace, in cooperation with a representative of the AAF School of Aviation Medicine. On the basis of this study a recommendation was made and accepted by the Air Surgeon that color vision requirements be relaxed for men who were to be trained as bombardiers, navigators, and guinners.

Field Studies Unit

The Field Studies Unit, which was organized on 1 August 1942 with Maj. Edwin E. Ghiselli as chief, had three main functions: job analyses of the air-crew specialties, research on criterion problems, and supplying the Statistical Unit with criterion data for use in test validation. The Field Studies Unit coordinated the psychological aspects of various programs within the Training Command, such as the experimental pilot instructor's course, the selection of D-8 bombardiers, the use of an educational examination in connection with the program by which air-crew trainees were sent to college training detachments prior to their entry into preflight school, and the program of giving certain trainees both bombardier and navigator training. The first validation of stanines of the three air-crew positions was performed by the Field Studies Unit before this type of work was turned over to the Statistical Unit. The Field Studies Unit introduced a pilot rating scale, called the Rating Scale for Aviation Cadets, Form C-Pilot, into the flying training schools of the command. Personnel of the unit visited all flying schools in the Training Command and explained the use of the scale to supervisors and instructors. The scale called for ratings of aviation cadets by their instructors on 20 traits falling under the rubrics of intelligence and judgment, alertness and observation, coordination and technique, and personality and temperament, as well as an over-all prediction of probable success as a military pilot. While the schools found the scale useful in directing the attention of instructors toward analytical judgment of their students, other criteria of student success such as graduation or elimination from a given phase of training proved to be a more satisfactory standard against which to judge the usefulness of tests in the classification battery. Eventually the use of this rating scale was discontinued.

In its early validation studies the Field Research Unit could perform its work only by tediously working over the graduation rosters from some 120 training schools; matching by hand the test scores secured from the units at the classification centers with the graduation-elimination records. Despite the laboriousness of this procedure a number of studies were accomplished. In May 1943, after certain preliminary studies, the Statistical Unit devised a method by which criterion data from rosters could be matched with test scores by machine and large-scale validation projects became feasible. With this development routine validation studies became a function of the Statistical Unit.

Among the research studies carried out by the Field Studies Unit were analyses of the reliability of the criteria employed in the evaluation of classification tests, relationships among these criteria and the factors affecting them. The unit also carried out studies designed to serve as a background for the analyses of traits and abilities important in air-crew training, together with the causes of elimination in such training. The internal consistency, reliability, and validity of the pilot rating scale in predicting success in primary and basic training were investigated as well as the effectiveness of various aptitude scores in predicting success in air-crew training.

Reorganization of the Psychological Section

On 7 July 1943 the AAF Training Command was activated as a combination of the AAF Flying Training Command and the AAF Technical Training Command. It became apparent that this change in administrative organization would introduce a number of new problems and procedures which would, in turn, lead to a reorganization of the Psychological Section. After a program of training air-crew candidates in the colleges prior to preflight was initiated on 1 March 1943, it was recognized that classification testing should be performed before college training in order to prevent the wastage which resulted

when a man was found unqualified for air-crew after completion of the college course. When the Flying Training and Technical Training Commands were independent, the proper coordination and supervision of such a precollege testing program were regarded as difficult to achieve. If psychological testing organizations had been transferred to Technical Training Command Centers, either dual control of stations or parallel headquarters administrative agencies would have been necessary. When a unified command was activated, these difficulties disappeared and precollege testing became easier to inaugurate and administer.

To supervise testing procedures in the Medical and Psychological Examining Units which were to be established, a Test Operations Unit was established on 16 August 1943. The Perceptual Research Unit, which had functions more appropriate to a field organization than to a headquarters unit, was disbanded. The development of printed perceptual tests was transferred to Psychological Research Unit No. 3, while on 9 October a Psychological Test Film Unit was activated to carry on the development of motion picture tests. In place of the Field Studies Unit, a Field Research Unit with considerably amplified functions was organized on 16 August.

The Test Operations Unit

The Test Operations Unit supervised the greatly enlarged classification testing program in the Army Air Forces Basic Training Centers, where seven Medical and Psychological Examining Units were activated to handle classification testing of air-crew candidates. It was the original plan that after a short period these units would handle all air-crew classification testing and that eventually the Psychological Research Units would be concerned only with advising on the classification of men in the preflight schools and with classification test research. Since uniform standards for acceptance or rejection of air-crew candidates and uniform procedures for reporting classification tests results to Headquarters were essential, it was necessary to supervise carefully the program in all these new processing units. Accordingly, Lt. Col. Laurance F. Shaffer, the original director of Psychological Research Unit No. 1, was brought to Fort Worth headquarters as chief of the new Test Operations Unit. When he was transferred to the AAF Personnel Distribution Command to direct the newly established psychological program in that command, Maj. Edwin E. Ghiselli became the chief of the unit.

The Test Operations Unit produced the manual of the Standing Operating Procedures used in all the Medical and Psychological Examining Units and, by correspondence and personal visits, was able to effect a uniform testing program. In its manual it gave specific instructions for the conduct of processing procedures and, by a system

of regular reports from the examining units, was able to insure uniformity of processing. It took appropriate action in regard to the staffing of these units since personnel already available in the Psychological Research Units was not sufficient to staff the enlarged program. In April 1944, as the processing load in the units was reduced and several units were closed, the functions of the Test Operations Unit were divided between the Administrative Section and the Statistical Analysis Unit. Later, testing procedures in the field units having become completely routinized, the Test Operations Unit was formally inactivated.

Field Research Unit

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The chief of the new Field Research Unit was Lt. Col. J. P. Guilford, who was transferred to Fort Worth from his position as director of Psychological Research Unit No. 3. The four major functions of the unit were coordination of research activities of subordinate units and projects, research studies on data available in Training Command Headquarters, service functions in connection with testing, and publications.

In the matter of test development the unit received, classified and numbered, distributed and, in many instances, criticized a number of test ideas suggested by one or another of the subordinate units or projects. It maintained a file of these test ideas, together with notations on subsequent development, including distribution statistics, reliabilities, and validity data when available. During the course of the war the test idea file came to include approximately 600 items, of which approximately one-half were available as actual blanks or test apparatus of varying degrees of completeness. Approximately 200 tests were validated against success in one or more of the aircrew specialties.

The Field Research Unit supervised the construction of additional forms of the AAF Qualifying Examination after responsibility for this test was delegated from Headquarters Army Air Forces to Headquarters Training Command and until responsibility was transferred late in 1944 to the AAF Personnel Distribution Command, along with the transfer of officers particularly concerned with the development of the éxamination.

The Field Research Unit supervised the production of new forms for several of the tests in the classification battery, such as the General Information Test, Mechanical Principles Test, Instrument Comprehension Test, Mechanical Information Test, Judgment Test and Rudder Control Test. In recognizing the peculiar difficulties of administering research batteries for the selection of bombardiers and navigators, it made arrangements for the administration of special batteries in preflight schools devoted to training in these specialties. In this way the data from practically all students tested would be useful and the length of time intervening between testing and subsequent gradnation or elimination from training was shortened. If these tests had been administered only in the processing units where the bulk of the population went into pilot training, the process of validation would have required more time and would have been considerably more expensive. Another experimental battery, together with the tests in the classification battery, was administered to groups at the Air Forces Administrative Officer Candidate School at Miami Beach in order to judge the usefulness of these tests for predicting officer qualities. Other studies undertaken included the testing of special groups such as WASPs, cadets of the United States Military Academy and combat returnees. Attempts were also made to differentiate the aptitudes required for flying fighter planes as contrasted with the aptitudes required for piloting heavy bombers. The Field Research Unit, by means of field trips, technical correspondence, and personal correspondence, maintained close supervision of the research programs of all the subordinate units. All major research projects in the units were required to be submitted to the Psychological Section for clearance prior to any considerable investment of time. The Field Research Unit reviewed and evaluated these research proposals, making suggestions for their improvement in view of the over-all needs of the classification program. On occasion it suggested new studies which should be undertaken, such as the administration of large batteries of experimental tests to candidates passing through Sheppard Field, Tex., and Keesler Field, Miss., in 1945 when the training situation was such that authorization could be obtained from appropriate authorities for the administration of several extra hours of tests.

The Field Research Unit was concerned not only with test development but also in developing adequate criteria of success. It soon became apparent that the measurement of achievement in an air-crew specialty required the professional services of psychologists working in the field. To this end a number of Psychological Research Projects were established to develop objective measures of proficiency in the various air-crew specialties. In January 1944 Psychological Research Project (Navigator) was established at Selman Field, La. This project was moved, along with the Central Instructors School for Navigators, to Ellington Field, Tex., in December 1944. In January 1944 Psychological Research Project (Pilot) was established at Randolph Field, Tex., and Psychological Research Project (Bombardier) at Midland Army Air Field, Midland, Tex. Psychological Research Project (Radar), established to take care of criterion research for a new specialty, radar observer, was inaugurated at Langley Field, Va., in November 1944, while the last of these projects, Psychological Research Project (Flight Engineer), was formally established at Hondo Army

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Air Eicld, Hondo, Tex., in June 1945. Psychological Research Project. (Combat Crew), Lincoln Army Field, Lincoln, Nebr., was established more as a service processing organization than a research project. It did, however, utilize the proficiency measurements which had been accumulated throughout the program and actually performed research on the interrelationships of the various measurements entering into the computation of lead crew stanines.

In accordance with a directive from Headquarters AAF the Field Research Unit published in restricted form several series embodying the results of psychological research in the Training Command. These publications included Research Bulletins, covering results of important studies; Analysis of Duties Bulletins, reporting results of job analysis; Technical Bulletins, covering methodology and statistical techniques; and Research Notes, reporting results of minor studies, research in progress and general news of developments in the psychological program.

Beginning October 1944 the publications work of the Field Research Unit was taken over by a newly organized Publications Unit headed by Maj. Philip H. DuBois. At the same time Lt. Col. Paul Horst was made chief of the Field Research Unit.

THE PSYCHOLOGICAL RESEARCH UNITS AND THE AAF SCHOOL OF AVIATION MEDICINE

Until November 1943, when the Medical and Psychological Examining Units were opened, all air-crew classification testing was accomplished at the three Psychological Research Units. The original functions of these units were to process men who had passed the AAF Qualifying Examination and to conduct research on classification test development. Processing included the administration of the classification battery of printed and apparatus tests, the collection of supplementary data, the computation of stanines, and the making of recommendations for classification. At times aviation psychologists actively participated in the actual classification, but this was unofficial since by directive the function of the Psychological Research Units was simply to provide information to be used by the surgeon at the classification center in making recommendations for classification to Air Forces personnel authorities;

The three units at the classification centers were operating before the Psychological Section at Training Command Headquarters was established so that much of the early supervision of the units came directly from Headquarters Army Air Forces. After the Fort Worth Headquarters was established; directives affecting classification activities came to be transmitted through or originated in Fort Worth.

While the need for uniformity in processing and recommending

procedures was recognized at the outset of the program, many technical difficulties were encountered. For many months apparatus tests were not available in quantities sufficient for the needs of the program. There were delays in procuring personnel, test scoring machines, and test booklets. In some cases the over-all objectives of the program. were not clearly understood by the men working in the field units. At all times there was pressure from post officials for rapid processing and reporting of results The directives from higher headquarters indicated the tests to be used, the weights to be applied in computing the stanines for each specialty and the general methods of processing, but at all units certain improvisations in tests and procedures were found necessary. As the result of conferences and official and unofficial correspondence relative uniformity was gradually achieved, but throughout their history the three psychological research units continued to exercise a considerable degree of autonomy in regard to details. Standing operating procedures for test administration and processing developed independently at each unit, together with processing forms and record systems. Until July 1942, Psychological Research Unit No. 2 computed no stanines, but developed ratings for the air-crew specialties on the basis of psychographs involving certain "critical" tests. These ratings were never validated. Psychological Research Unit No. 3 converted all raw scores into 11-point standard scores prior to the computation of stanines, while the other two units computed stanines from raw scores on the printed tests and standard scores on the psychomotor tests.

When sufficient quantities of all psychomotor tests in the classification battery became available late in 1942, complete uniformity in the tests administered was finally achieved. The Psychological Research Units, however, continued to use their own systems of records and of reporting results to Headquarters Training Command. It was only in the Medical and Psychological Examining Units that uniformity of tests administered, processing procedures and record systems was completely achieved.

In the field of classification test_research, each unit was assigned primary responsibility for one of the four general areas which had been found to be important in the élimination of air-crew trainees. Tests in the field of emotion and temperament were the responsibility of the unit at Maxwell. At San António research centered around the development and application of apparatus tests. The Santa Ana unit was concerned with tests of intellectual functions, while the development of perceptual tests, as explained earlier, was for some time centered at Training Command Headquarters.

Initiative in research activities on the part of the field units was encouraged. However, to prevent duplication of effort and to insure

coverage in the different areas, coordination of research activities was effected by the headquarters organizations. Suggestions for research were transmitted to the units and research proposals originating in the field were transmitted to Fort Worth and Washington for comment and approval. Each unit prepared reports of findings, which were either distributed directly to the other psychological organizations or were reproduced at Headquarters, Army Air Forces or Headquarters, Training Command for circulation. During the course of the war thousands of pages of this material were duplicated and distributed.

Functions of the AAF School of Aviation Medicine in Classification

Late in 1941 it was decided that the facilities of the AAF School of Aviation Medicine, Randolph Field, should be utilized in the classification program, because no headquarters or field unit had adequate facilities for the procurement of apparatus tests and because in the pre-war period the school had carried out extensive research on the problem of selecting pilots. Administratively, the school was directly under Headquarters Army Air Forces and its activities were supervised by the Office of the Air Surgeon. Since the school had no direct part in the actual classification of air crew, it was decided that the development of psychomotor tests and methods of using them would be the joint responsibility of the Department of Psychology of the School and Psychological Research Unit No. 2, Kally Field. Throughout the war Lit. Col. Arthur W. Melton was head of the research section of the Department of Psychology. He reported for duty in January 1942 and gradually built a staff of aviation psychologists, enlisted men and civilians.

A directive from Headquarters Army Air Forces dated 23 March 1922 charged the School of Aviation Medicine with the development and procurement of new psychomotor apparatus for the classification of aviation cadets and authorized communication with the directors of the Psychological Units, through the surgeon of the appropriate Classification Center, in order to make arrangements for the experimental administration and validation of any test developed.

The Department of Psychology redesigned existing apparatus tests which had been chosen for use in the classification program and made contracts with civilian companies for their manufacture or, in some cases, produced the tests at the school. Equipment for the automatic presentation of stimuli and automatic regulation of the duration of test periods was designed and, in collaboration with Psychological Research Unit No. 2, manuals of test instructions, maintenance procedures, and calibration techniques were prepared.

Officers of the school met with the officers of Psychological Research Unit No. 2 as frequently as was required for discussion and decision on technical questions, success: evaluation of new types of psychomotor

tests; design of new psychomotor tests; details regarding the administration of research psychomotor tests, including experimental studies of the tests of methods of administration; statistical procedures to be employed in the analyses of research data; and presentation of final research reports.

From April 1942 until October 1942 the personnel of the department worked almost continuously on the design and production of the 36 units of the initial battery of apparatus tests for use in the three classification centers, and on the design and production of a battery of psychomotor tests for use in the selection of low-altitude bombardiers in the flexible gunnery schools. From November 1942 until June 1943 the energies of the staff were concentrated on the design and construction of research tests and the coordination of validation testing at Psychological Research Unit No. 2. In the summer and fall of 1943 the school concentrated on the Medical and Psychological Examining Units. Later test development included the Pedestal Sight Manipulation Test, CM824, used in the selection of B-29 gunners.

For the tests actually used in classification, the Department gave chief attention to the development of apparatus which could be used for the testing of thousands of candidates for air crew without undue variation from copy to copy or in the same copy from time to time. Since mass apparatus testing was a relatively new development, many technical difficulties had to be solved. While the early models of the apparatus tests showed certain apparatus differences, by the end of the war acceptable homogeneity of apparatus had been achieved through careful construction and systematic calibration. The Department originated the classification models of the Discrimination Reaction Time Test, CP611, and the Aiming Stress Test, CE211, and made many improvements in the Two Hand Coordination Test, CM101, the Complex Coordination Test, CM701, the Rotary Pursuit Test, CM803 and CP410, Rudder Control Test, CM120, and the Two Hand Pursuit Test, CM810. A large part of the experimental test development program was centered around a battery of pursuit tests which were validated at the San Antonio Aviation Cadet Center. Details of the extensive research program of the department are to be found in Report No. 4 of this series.

Psychological Research Unit No. 1

The first of the field units of the Aviation Psychology Program was Psychological Research Unit Ho. 1. The work of the unit dates from 21 September 1941 when Lt. Fol. Laurance F. Shaffer reported for duty at Maxwell Field, Ala., a). I its program was first officially authorized in the letter dated 2 October 1941 quoted in the preceding chapter, from the Chief of the Air Corps. Under various designations

Psychological Research Unit No. 1 existed at Maxwell Field until 7 July 1942, when it was transferred to the Nashville Army Air Field (AAF Classification Center), Nashville, Tenn. Classification testing was completed at Nashville in February 1944 and the following month the unit returned to Maxwell Field, where research activities and some classification testing were carried on until inactivation in December of that year. The organization was reestablished at Maxwell Field on 1 July 1945 as a classification testing unit, this third "incarnation" continuing until December 1945.

Early plans for the Air Corps replacement training centers, where trainces were to report for formal appointment as aviation cadets, processing and 5 weeks of military training included 6 hours of experimental psychological tests. The center at Maxwell Field had been open only 2 weeks when Lieutenant Colonél-Shaffer reported for duty. While no tests were administered to class 42-D, the first pilot class passing through the center, certain printed tests were administered on an experimental basis to 628 aviation cadets in class 42-E, beginning 13 October 1941. The first battery of tests had been procured from the Cooperative Test Service, New York City, and included Quantitative Perception, Numerical Operations, Vocabulary, Comprehension of English, Reasoning and Judgment.

The Psychological Research Section at Maxwell Field was activated by a letter, Research Program for Selection of Aviation Cadets, from the Office of the Chief of the Air Corps, dated 26 November 1941. The director of the section was made responsible to the post surgeon. On 12 February 1942 the Psychological Research Section became Psychological Research Unit No. 1, by an order issued by the Southeast Air Corps Training Center, which also transferred Lieutenant Colonel Shaffer and the other five officers of the Psychological Section to the new organization. This change was in line with directives from Headquarters Army Air Forces, replacing the experimental testing program with the use of psychological tests for classification of air-crew personnel.

Classification activities in the Aviation Psychology Program began on 2 February 1942 when the Maxwell Field Unit administered the first battery for pilots, navigators, and bombardiers. The apparatus tests used on that date included Complex Coordination, CM701A; Steadiness, CM103A; Mechanical Assembly, CM901A; and Visual Spatial Discrimination Reaction Time, CP611C. Throughout the history of Psychological Research Unit No. 1, apparatus tests were administered to all aircrew candidates tested for classification. The printed tests of the first battery were Graph Reading, CP601B; Dial Reading, CP602B; Numerical Operations, CI701A; Table Reading, CP603B; Number Filing CP604B; Mathematics, CI702A; Number

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Size, CP603A; Line Length, CP606A; Point Filterer, CP603A; Line Length, CP608A; Point Filterer, CP608A; Cooperative Vocabulary (Level), Cl605A; Training and Dates Leveling Selections, Cl606A; and Preference Blank, CE501A. The battery was changed from time to time until December 1942 when all three psychological units administered a uniform battery of printed and apparatus tests.

Until 7 July 1942, when Psychological Research Unit No. 1 was transferred to Nashville, nearly 13,000 aviation cadets had been tested with the classification battery. In the 20 months at Nashville approximately 120,000 additional aviation cadets were tested. After the return to Maxwell in March 1944 only occasional candidates were tested, the flow of trainces having been diverted through other processing centers. In the last half of 1945 the flow was limited largely to small numbers of French students who had been eliminated from pilot training and of officer and enlisted returnees from combat. The total number processed by Unit No. 1 through December 1944 was over 133,000.

Lieutenant Colonel Shaffer was director of Psychological Research Unit No. 1 until August 1943 when he was transferred to Headquarters AAF Training Command. He was succeeded by Maj. William M. Lepley who continued as director until the inactivation of the Unit in December 1944. When Psychological Research Unit No. 1 was reopened in July 1945 the new director was Capt. Reuben A. Baer.

By 1 January 1942 the strength of the Unit was 3 officers and 12 enlisted men. Six months later there were 11 officers and 56 enlisted men. As the processing load grew, additional officers and enlisted men were assigned, until a peak strength was reached on 1 July 1943 of 24 officers and 109 enlisted men. When the organization was transferred from Nashville to Maxwell it consisted of 9 officers, 40 enlisted men and 10 civilian employees. Average strength after July 1945 was approximately 3 officers and 18 enlisted men.

As the first of the processing organizations, Psychological Research Unit No. 1 developed many of the processing procedures which were later used in all the testing units.

The original area of research assigned to Psychological Research Unit No. 1 was the development of tests of motivation, interest, personality, and temperament which would be predictive of air-crew success. Among the techniques employed to carry out this objective were the systematic collection of biographical data, the assessment of interests in certain areas by means of objective measures of information, the search for temperamental strengths and weaknesses through the use of personality inventory items and projective techniques, attempts to force significant latent traits and behavior tendencies into

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measurable action by means of social and physical threats and complex and confusing tasks, and attempts to assess personality through various rating and interviewing procedures.

Five tests developed in this research program contributed to the classification battery: Biographical Data Blank, CE602D; Technical Vocabulary Information Test; CE505C; General Information Test, CE505D; Aiming Stress, CE211A; and Rotary Pursuit with Divided Attention, CP410B. The unit also developed the Air-Crew Training Interest Blank, CE501, which was used in all units for making recommendations although it did not enter into the computation of stanines.

Other major research projects carried out by the staff of Psychological Research Unit No. 1 included job descriptions of the pilot, bombardier, and navigator, a study of the causes of failure in navigation, school, a detailed picture of the emotional and learning aspects of pilot training, an extensive study of clinical methods for predicting success and failure in training, and a series of studies on confusion tests and personality inventories. Details of the extensive test development program at Psychological Research Unit No. 1 are to be found in Report No. 4, Apparatus Tests, and Report No. 5, Printed Classification Tests.

Various housing, which involved modifications of available buildings, was used by the unit during its periods of existence at Maxwell Field. At Nashville, where the bulk of its processing wis accomplished, the unit occupied three specially constructed, H-shaped (in Army terminology SB-12) buildings aggregating approximately 28,000 square feet of space, with rooms especially designed for group testing, psychomotor testing, records, research, and administration.

Personnel of the unit were assigned to four sections: administration, including personnel and supply; test operations, including group testing, psychomotor testing, apparatus maintenance, and statistical control; evaluation, including interviews, scoring and stanining, records and reports; and test research, including development, validation, and special projects.

Research findings were published in a series of 22 bulletins, in annual reports, and in a 233-page report of the investigation of clinical techniques.

A detachment of two officers and six enlisted men from the unit was at the AAF Flexible Gunnery School, Panama City, Florida, in the fall of 1942, to test gunnery students for D-8 bombardier training and to make a study of gannery training. Later the officer in charge of this detachment, Maj. R. Nicholas Hobbs, became director of Psychological Research Unit No. 11, concerned with a general program of gunnery research.

The unit also supplied the initial cadres of officer and enlisted per-

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sonnel for Medical and Psychological Examining Unit No. 4 at Greensboro, N. C., and Medical and Psychological Examining Unit No. 6 at Kessler Field, Miss. All the personnel of Aircrew Evaluation and Research Detachment No. 3, which was in the Pacific theatre of war for 3 months, came from the unit. Headed by Major Lepley, this group, on its return from the Pacific, became the nucleus of Psychological Research Project (Combat Crew); Lincoln, Nébr.

Psychological Research Unit No. 2

The work of Psychological Research Unit No. 2 dates from 15 November 1941 when Lt. Col. Robert T. Rock, its first director, reported for duty at Kelly Field, Tex. Before the activation of the unit on 4 February 1942, Lieutenant Colonel Rock, assisted by 2 officers and 10 enlisted men, worked as members of the staff of the surgeon. In December 1941 certain printed tests were administered to aviation cadets on an experimental basis, with the answer sheets sent to Washington for scoring and analysis. The first systematic testing of all cadets passing through the Air Corps Replacement Training Center, Kelly Field, began on 2 February 1942, when a battery of printed tests was administered to class 42–I. Similar tests were administered to all subsequent classes until 5 July 1942, when apparatus tests were added to the battery and stanines were computed at this unit for the first time:

The unit originally occupied testing buildings in the oldest part of Kelly Field with an administrative and psychomotor building in the new preflight section. When that part of Kelly Field which was devoted to preflight training was activated at the San Antonio Aviation Cadet Center on 4 July 1942, all personnel and equipment were transferred to the new command without change in physical location. In September 1942 the unit occupied three specially constructed H-shaped buildings in the AAF Classification Center forming the western half of the San Antonio Aviation Cadet Center. In May 1943 Maj. A. C. Tucker was appointed director of the unit and after cadres left Psychological Research Unit No. 2 in September 1943 to open the Medical and Psychological Examining Units at Miami Beach, Fla., and Jefferson Barracks, Mo., Maj. Meredith P. Crawford was director. Upon the amalgamation of Psychological Research Unit No. 2 and Psychological Research Unit No. 3 to form the Psychological Research Unit, Lt. Col. J. P. Guilford became the director of the combined organization. On 30 June 1945 the Unit was inactivated and staff and equipment transferred to the School of Aviation Medicine to form the Department of Records and Analysis. No change in physical location was involved and the staff continued to work on classification testing projects.

By 1 January 1942, 2 officers and 10 enlisted men had been assigned to the unit. Six months later the strength was 8 officers and 48 enlisted men. Peak strength was approximately 17 officers and 105 enlisted men, except for a brief period when additional men were being trained for service in the Medical and Psychological Examining Units.

The original organization, after classification testing was well under why, included departments for administration of printed tests, apparatus tests, test scoring, records, interviewing and statistics and research. Later a basic records department was established to maintain records no longer used in processing but of value in validation research. This department prepared data for use by the research department, pulling test records of men on whom validation information was available.

During the war the unit administered the aircrew classification battery to approximately 138,000 candidates, a record surpassed by no other organization in the Aviation Psychology Program.

In the program for the selection of D-8 bombardiers from gunnery students, the unit sent a detachment of two officers and six enlisted men to the Harlingen Army Gunnery School. This detachment made a comprehensive report on the training of aerial gunners. Other research detachments went to Ellington Field to administer experimental psychomotor tests to preflight bombardier students, and again to the same station to administer experimental printed tests to preflight navigator students and to 11 elementary pilot schools to administer tests under development to select civilian flying instructors. In the year beginning July 1944 detachments were away from the unit almost continuously to collect data for an analysis of pilot grade slips, for a study of the aptitude requirements of aircrew members of the B-29 and to carry out an intensive research program on flight engineers.

The original research function of Psychological Research Unit No. 2 was to conduct research on the developments of psychomotor tests in collaboration with the School of Aviation Medicine. Between 11 February and 13 July 1942 experimental psychomotor tests from university laboratories and other sources were administered to aviation cadets. Later the unit systematically administered experimental apparatus tests developed by the AAF School of Aviation Medicine or, in some cases, by personnel of the unit. Experimental printed tests were also administered from time to time. At a research conference in Ft. Worth in September 1943 it was proposed that the unit take primary responsibility for research in pilot training. When this responsibility was taken over by Psychological Research Project (Pilot) research on the training of flight engineers was substituted. Upon transfer of the unit to the School of Aviation Medicine, person-

54

nel concerned with flight engineer training was transferred to Hondo Army Air Field to form Psychological Research Project (Flight Engineer). Research of the unit on flight engineers has been incorporated into Report No. 13, Psychological Research on Flight Engineer Training.

Considerable attention was devoted to the development of standardized instructions and conditions for the administration of apparatus tests. In collaboration with the School of Aviation Medicine, the unit developed maintenance procedures and methods of statistical control of psychomotor tests. Procedures such as the administration of apparatus tests to groups of four candidates at a time and the use of cumulative part scores on apparatus tests were worked out. It was found that in certain cases the order of apparatus tests had some influence upon results and, accordingly, a standard order was worked out. Since cadets who saw others taking the tests before they were actually examined had somewhat higher scores the standard procedure became such that the cadets had no opportunity to see the tests in advance. The unit prepared a set of standing operating procedures and forms which were later utilized in preparing standing operating procedures for the Medical and Psychological Examining Units. This phase of the unit's work, together with the results of experimental psychomotor testing, is reported in Report No. 4 of this series, Apparatus Tests.

After amalgamation with the Santa Ana unit, research on printed tests was emphasized, results of which are presented in Report No. 5, *Printed Classification Tests.* Records from all the Psychological Research Units and from the Medical and Psychological Examining Units which had been closed were collected at the San Antonio unit, which assumed responsibility for validation of classification tests in all areas of research: personality and temperament, coordination, intellectual functions, and perception. However, the Department of Psychology, School of Aviation Medicine, continued to have primary responsibility for completing wartime research on apparatus tests, while motion picture tests developed for classification purposes were validated by the Psychological Test Film Unit.

Results of research were published in restricted form in 49 Research Memoranda and 50 Research Bulletins. While no test originated by Psychological Research Unit No. 2 was ever used in the air-crew classification battery, the unit contributed to the refinement of a number of tests and developed certain experimental tests.

Psychological Research Unit No. 3

Psychölogical Research Unit No. 3, at the Santa Ana Army Air Base, Santa Ana, Calif., was formally activated by a letter from the War Department, dated 4 February 1942. Its director, Lt. Col. J. P.
Guilford, reported for duty on 3 March 1942 and testing of candidates began 6 days later. The first test battery consisted of two vocabulary tests (Vocabulary Level, CICO4A, and Vocabulary Speed, CIGO5A); Reading Comprehension, CIGO6A; Mathematics, CI702A; Following Directions, CP402A; and Speed of Identification, CP610A. When Lieutenant Colonel Guilford was assigned to Hq. AAF Training Command on 5 August 1943, Maj. Neil E. Warren was appointed director. Lieutenant Colonel Guilford resumed the directorship on 14 July 1944. On 30 October 1944, 8 officers and 59 enlisted men were transferred to the San Antonio Aviation Cadet Center and Lieutenant Colonel Guilford became director of the Psychological Research Unit, which, as the combination of Units No. 2 and 3, carried on the research activities of both.

Classification testing at Santa Ana continued through 27 April 1944, by which time a total of 109,000 candidates for air crew had been tested. Starting with approximately 2,600 candidates in March 1942, processing reached a peak of 7,100 in July 1943; after which the flow of candidates, gradually decreased.

Classification procedures were similar to those in the other units except that all scores on classification tests were converted into scaled scores, with uniform mean and standard deviation as an intermediate step in deriving stanines.

With the cooperation of Headquarters of the AAF Western Flying Training Command the unit was able to send personnel on detached service to a number of stations where training was being conducted. In this way a number of field studies were carried out. The unit supplied the personnel for the gunnery detachment stationed at Las Vegas, Nev., from 15 September to 21 December 1942, and supplied the initial cadres for three of the Medical and Psychological Examining Units, those at Sheppard Field, Tex.; Buckley Field, Colo.; and Amarillo, Tex. It supplied officer and enlisted personnel to the Air Crew Evaluation and Research Detachments operating in the European Theater of Operations.

The development of printed tests measuring intellectual functions and educational achievement was the particular field of psychological research assigned to the unit. After September 1943 it had additional functions of developing perceptual tests and new forms of the AAF Qualifying Examination.

In its original research program the unit made a break-down of its general research area into nine subareas: (1) information, (2) reasoning, (3) judgment, (4) foresight and planning, (5) memory, (6) comprehension, (7) mathematics, (8) physics, and (9) mechanics. A fundamental premise of its research program was that a systematic exploration and coverage of the subareas would prove more fruitful

in the long run than working on a series of isolated hunches, however brilliant. Lacking full confidence in previous job analyses of aircrew duties as guides to the selection and construction of tests, all possible early validation data were obtained and considered. Special detachments gathered validity data shortly after the students who had been tested with classification and experimental tests were graduated from training.

Factorial methods were employed to test the provisional categories in the assigned areas, to discover the significant variables and to determine which tests in a given subarea were most worth validating.

On the basis of extensive analyses, information about the principal factors measured by classification and experimental tests and their validities for prediction of success in air-crew training became available. A verbal intellectual factor, a reasoning factor, and a numerical factor involving sheer facility with numbers were found to have no validity for pilot but high validity for predicting success in navigator training. Other factors, such as mechanical information, visualization, and motor coordination, were found to have higher validities for pilot training than for navigator success. A perceptual factor had moderate validities for both types of training. Other factors explored included aviation interest, navigator interest, a second observation factor, a second motor factor, as well as various perceptual and memory factors.

In certain of the test areas reasonably good measures were developed which could be used for classification or experimental purposes. In other areas exploration was not complete at the cessation of hostilities.

One psychomotor test, Finger Dexterity, CM116, developed at the unit, was used in the classification battery throughout the war. Another psychomotor test, Rudder Control, CM120, which was originally developed as a training device by an agency outside the Aviation Psychology Program, was first validated at Psychological Research Unit No. 3 and was placed in the classification battery beginning 1 November 1943. Among the printed tests which were developed at the unit and used for classification were various mathematics tests, including Arithmetic Reasoning, CI206; Instrument Comprehension, CI616; Reading Comprehension, CI614; Judgment, CI301; Mechanical Principles, CI903 and Mechanical Information, CI905. No other unit contributed as large a number of tests meeting the standards for inclusion in the classification battery.

At Psychological Research Unit No. 3 test construction involved the development of hypotheses as to the type of material which might be useful, the preparation of large numbers of experimental items and the administration of these items to large groups of men about to

enter training. On the basis of validity data, promising material was revised item by item until a form suitable for inclusion in the classification battery emerged. This involved extensive statistical analyses by a large computing staff. Of the total staff of the unit, which reached a peak of approximately 18 officers, 120 enlisted men, and 55 civilians, 20 percent were engaged in research and special studies in 1943. This proportion increased as processing activities were cut down.

The unit also made a job analysis of the work of the bombardier. It made special studies of the validity of psychological recommendations and classification procedures; the usefulness of nontest data, such as education and age, in predicting flight success; the determiners of average circular error in bombing proficiency; the usefulness of the Aviation Cadet Educational Examination; the validity of aircrew classification tests for predicting success in gunnery training; the determination of the limits of safety in high-altitude flying at various behavior levels; and relation of classification tests scores to accidents. Studies were made of learning to land an airplane, of the validity of items on the AAF Qualifying Examination, of classification tests administered to Chinése cadets, while a series of studies investigated the reliabilities, the correlations, and validities for pilot training of a large battery of psychophysiological measurements.

Results of the psychological research program were published in restricted form in a series of 108 research bulletins, which included studies of specific tests, factorial analyses of test data, and analyses of specific problems in the field of aviation psychology. The bulk of the findings is presented in Report No. 5 of this series, *Printed Classi*fication Tests.

THE MEDICAL AND PSYCHOLOGICAL EXAMINING UNITS

The College Training Program

Early in 1943 a number of changes were made in the handling of candidates for air crew prior to preflight training. The most important of these changes was the establishment of college training detachments in 153 colleges where students who had volunteered for air-crew training were given from 1 to 5 months instruction in mathematics, physics, current history, geography, and English. The announced aim of this program was to eliminate the educational deficiencies among the 100,000 men in civilian life who had been accepted for air-crew training but for whom no training facilities were available. It was stated that college training would be a better preparation for subsequent flying training and that the morale of these men would be greatly improved.

An educational examination (AC20) was prepared by the Psychological Branch, Office of the Air Surgeon, to be used in deciding which of the men were to be sent to the college training detachments and how long they should study. Eventually all men accepted for aircrew training were to spend 5 months in a college prior to preflight school, this decision being prompted more by personnel procurement and housing considerations than by educational motives. Arrangements were also made to give these men flying instruction on light training planes. The choice of participating colleges was, in fact, dictated by flying training facilities already existing at these institutions.

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Prior to being sent to a college training detachment the candidate was to pass through a basic training center to receive 6 weeks of basic military training. A minimum of 35,000 students was to be in the colleges not later than 1 March 1943 and another 35,000 by 1 April 1943.

It became apparent at that time that standards for air-crew training in terms of stanines on the classification tests could and should beraised. It was also apparent that final selection for air crow training should take place prior to college training in order to save the expense of sending rejected candidates to college and in order to: make them available for other assignments in the Air Forces. While the three classification centers at Nashville, San Antonio, and Santa And were close to the flying schools, they were far away from most of the colleges available for air-crew training. At this period in the war demands on the railroads were so heavy that it was believed impractical to send men to the classification centers for the classification tests prior to their assignment to a college training detachment. Accordingly, the decision was reached to inaugurate medical and psychological examining of air-crew candidates in the basic training centers. The Psychological Research Units could not be abandoned because for several months they would continue to handle the processing of men who were in the colleges and who had not received classification tests.

Plans were made to activate Medical and Psychological Examining Units at seven basic training centers: Greensboro, N. C.; Miami Beach, Fla.; Keesler Field, Miss.; Jefferson Barracks, Mo.; Sheppard Field, Tex.; Buckley Field, Colo.; and Amarillo Army Air Field, Tex.

Medical officers who were to head these units and aviation psychologists who were to head the psychological sections met for a conference on 30 July 1943 with the surgeon and chief of the Psychological Section at Headquarters Training Command, Fort Worth. After the general plan for the formation of the new units was explained, teams of one medical and one psychological officer were sent out on temporary duty

to the basic training centers where the new units were to be formed. Two weeks later the officers brought back for approval their plans for building alterations and equipment. Shortly thereafter they were ordered to the basic training centers to establish the new units, which were formally activated by the Adjutant General's Office in September.

Preparation at Training Command Headquarters

Preparations for the opening of the new units by Training Command Headquarters included the formulation of directives to cover operations, procurement of personnel and supplies, and the preparation of a set of standing operating procedures so that psychological processing would be uniform in all the basic training centers. The directives to subordinate headquarters made clear the responsibilities of the units in transmitting aptitude scores and medical findings through the surgeon to post personnel officers for entry on student records. Men disqualified for air crew in the basic training centers were to be reclassified by post classification officers.

A cadre of experienced aviation psychologists and psychological assistants was assigned from one of the Psychological Research Units to each of the new Medical and Psychological Examining Units. Cadres for the units at Greensboro, N. C. and Keesler Field, Miss., came from Psychological Research Unit No. 1 at Nashville. For the units at Miami Beach, Fla., and Jefferson Barracks, Mo., the cadres of psychological personnel came from Psychological Research Unit No. 2, San Antonio Aviation Cadet Center. For the three remaining units at Sheppard Field, Buckley Field and Amarillo Army Air Field the nucleus of psychological personnel came from Psychological Research Unit No. 3, Santa Ana. Additional psychologically trained officers and enlisted personnel were secured by Headquarters AAF Training Command and Headquarters Army Air Forces for assignment to the new units and to replace men lost to the old units by assignment to the cadres. Candidates for air crew who were disqualified physically or psychologically for flying training at one of the classification centers and who had undergraduate courses in psychology were selected and trained as psychomotor examiners, while the largest group of well qualified enlisted personnel who were added to the program consisted of 200 men graduating from the Army Specialized Training Program course in psychology at the University of Chicago, the University of Pennsylvania, and Stanford University. A few enlisted men with psychological training were transferred to the units from other organizations at the basic training centers.

Training Command rosters were combed to find officers with professional training and experience in psychology. Many of these officers considered to be performing less urgent duties, were then assigned to the units. ____ was essential to keep the three Psychological Research

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Units well staffed, since their load would continue without change for several months, testing men who had entered the college-training program without taking the classification battery. After all testing was transferred to the basic training centers, the functions of the Psychological Research Units were to be altered; they were to advise on the final classification of men during preflight training, since final classification was no longer to take place at the time of testing. The units at Santa Ana and San Antonio were already close to the preflight schools but it was necessary to plan for the movement of Psychological Research Unit No. 1 from Nashville back to Maxwell Field. Ala. These units were also to conduct intensive research programs on test development, administering experimental tests in the preflight schools. One advantage of this procedure was that the time lag between experimental testing and the evaluation of training success would be reduced. It would also be possible to administer experimental tests for such specialties as bombardier and navigator exclusively to men who would enter such training. While research on test development and the improvement of testing procedures was to be encouraged in the Medical and Psychological Examining Units, their primary function was classification testing.

Procurement of office furniture, calculating machines, and tables and chairs for group testing was a function of each basic training center, acting on authorizations from Training Command Headquarters: The Psychological Section at Training Command Headquarters provided the required number of test-scoring machines and allied supplies. Approximately 50 new copies of each psychomotor test. together with the control units, were procured by the AAF School of Aviation Medicine for use in the Medical and Psychological Examining Units. . In order to have this apparatus at the new units in time for the scheduled beginning of psychological testing it was necessary to distribute it by air transport, several B-18's and B-34's being made available by Training Command for this purpose. Medical examining for air crew at the basic training centers began in September, but psychological examining was not scheduled to begin until 1 November 1943. By that time all psychological sections were ready to begin operations and since large backlogs of candidates had accumulated, all units were busy immediately.

Medical and Psychological Examining Unit No. 4

Medical and Psychological Examining Unit No. 4 at Basic Training Center No. 10, Greensboro, N. C., examined some 20,000 candidates for air crew prior to 2 May 1944, when its inactivation was directed. The chief of the Psychological Section was Maj. Lewis B. Ward from Psychological Research Unit No. 1.

The primary functions of the Psychological Section, as of the

psychological sections of all the Medical and Psychological Examining Units, were to administer and score printed and apparatus tests to determine the stanines for the different types of air-crew training and to report these stanines to the medical officer in charge of the unit. The stanines, together with the results of physical examination, were to be reported on behalf of the post surgeon to the personnel section of the basic training center. The Psychological Section also prepared rosters of test results and other data accumulated during the processing to the Headquarters at Fort Worth for permanent file and for use in validation studies.

At first, space was available for only one line of psychomotor equipment, consisting of four copies of each test. Psychomotor testing rose as high as 224 a day with the psychomotor line operating with two shifts of examiners. A second line of equipment, together with 21 enlisted men, was sent to Medical and Psychological Examining Unit No. 7, Jefferson Barracks, Mo., to take care of the heavy load at that center. In December a second line of apparatus testing equipment, transferred from Psychological Research Unit No. 2, was installed. Testing was started in wards of the station hospital using improvised tables, but later the unit moved into the remodeled warehouse buildings, which were used until inactivation. The strength of the unit at the peak of processing was 7 officers, 84 enlisted men and 18 civilians.

In experimental classification test development, preliminary work was accomplished on a perceptual size and shape constancy test. Studies were also made on the influence of previous flying training on classification test scores, the relationship between time of day and psychemotor test scores and the relationships between scores on the AAF Qualifying Examination and aptitude scores and recommendations for the various air-crew positions. From these data it was possible to estimate the effect of variations in Qualifying Examination cut-off scores upon the proportion of individuals recommended for the three air-crew positions under various stanine requirements.

Medical and Psychological Examining Unit No. 5

During the 6 months that Medical and Psychological Examining Unit No. 5 at AAF Training Center No. 1, Miami Beach, Fla., was active, nearly 39,000 air-crew candidates were processed. The original cadre for the Psychological Section, including its chief, Mzj. A. C. Tucker, came from Psychological Research Unit No. 2, San Antonio.

The section occupied the White House Hotel, Miami Beach. Three psychomotor lines were set up, since the unit was scheduled to handle 27 percent of the nation-wide flow. This unit processed more men in 1 month (10,194 in December 1943) than any other aviation psychology unit in World War II. It also established the records for testing

in a single day, 528 men given the printed tests on 17 November and 511 psychomotor tested on 18 November. With quarters in a resort hotel, the section had its own swimming pool and private beach. In the spring of 1944 the flow of applicants to Miami was diverted to Keesler Field and the unit was discontinued, effective 30 April 1944.

Of a number of research studies undertaken by the Psychological Section, two were completed and submitted to the Psychological Section, Headquarters Training Command, for publication. These were a preliminary study of the effect of certain population factors on psychomotor scores and a study of the relationship of various classification tests to the officer quality criteria available at the AAF Officer Candidate School, Miami Beach, Fla.

Médical and Psychological Examining Unit No. 6

> Medical and Psychological Examining Unit No. 6 of the AAF Regional Station Hospital, Keesler Field, Miss., processed candidates for air crew from November 1943 throughout the war. By July 1945 it had examined approximately 68,000 candidates for air crew, together with nearly 3,000 candidates for B-29 guinnery. The unit opened with two psychomotor lines, and a third was added during its second month of processing.

> The original chief of the Psychological Section at Keesler was Maj. Frederic Wickert. Other aviation psychologists in charge of psychological activities at Keesler were, successively: Capt. Chester W. Harris, Capt. Walter F. Grether, Capt. Philip I. Sperling, and Capt. Reuben A. Baer. For peak loads the Psychological Section had 11 officers, 137 enlisted men and 20 civilians.

> The section occupied a large gymnasium building, which was used for group testing, psychomotor testing, and administration, together with smaller buildings for the third psychomotor line, scoring, records and supply.

> As the other medical and psychological examining units closed or came to process only potential gunners, the Keesler Unit, at the end of the war, handled all the mass processing of new candidates for air crew.

> During its history a number of research studies were carried out. One of the studies was the development of an air crew index to be used in connection with the adaptability rating for military aeronautics administered as a part of the physical examination by medical officers. This index was in questionnaire form and was designed to differentiate trainces upon whom the interviewers should spend the most time from those who could be readily qualified or disqualified without a detailed psychiatric interview.

> Certain studies were designed to study causes of individual differences in test scores. A study was made of the effective changes in se-

quence of administration on performance on certain group tests. The effect of seating position in the test room on experimental motion picture test scores was studied, results of which are presented in Report No. 7. Other studies included : a study of examiner differences on the Discrimination Reaction Time Test, CP611D; apparatus differences on the Rotary Pursuit Test, CP410B; the question of random ys, stratified sampling in auditing procedures; and the degree to which aircrew classification tests predicted success in airplane mechanics school. A study was made of learning on the Rudder Control Test, CM120. Classification test scores and stanines of Negro applicants for air crew, who were tested at Keesler in considerable numbers, were validated against success in training and a comparison was made of performance of Negroes and whites on psychomotor tests. The Biographical Data Blank, CE602D, was analyzed for Negro examinees and an empirical scoring key for this group was developed. An experimental test, the Evaluation of Significance, was developed and administered to trainces. For the Medical Department, a standar. test was developed on First Aid, Sanitation and Personal Adjustment. Other studies concerned a comparison of examinees with Civil Air Patrol training and those without such training, correlations between the aggregate weighted scores of different batteries, calibration of stylus pressure on the Rotary Pursuit Test, CP410, studies of the reliability of classification tests and experimental tests, and comparisons between original and retest stanines of preaviation cadets.

A special project which began in January 1945 was the administration of the classification battery in French to French trainees who had been eliminated from pilot training in this country. This service was performed at the request of Headquarters Eastern Flying Training Command to assist in the reclassification of these eliminees. The translations used had been prepared in North Africa for use in the French Air Force. Enlisted men from the unit, under the direction of an officer from Headquarters Training Command, administered the psychomotor battery to cadets at the United States Military Academy, West Point.

Medical and Psychological Examining Unit No. 7

In five testing months, o er 18,000 men were examined at Medical and Psychological Examining Unit No. 7, Jefferson Barracks, Mo. Opening as a one psychomotor line unit, it was soon increased to two psychomotor lines in order to handle a flow of candidates larger than originally planned. Maj. Philip H. DuBois was chief of the Psychological Section, personnel of which consisted of approximately 10 officers, 96 enlisted men, and 20 civilians. The section occupied an H-shaped school type building for administration and psychomotor testing, as well as group testing space in the gymnasium and a barracks

64

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building for records and reports. The unit was inactivated in March 1944.

Research included a study of the reliability of the SAM Rotary Pursuit Test with Divided Attention, CP401B; a study of the adequacy of the directions for the Dial and Table Reading Test, CP621-2A; a method for calibrating the Two-Hand Coordination Test; CM101A, by means of adjusting the effective target diameter; examiner differences on psychomotor tests; the relationship between timeof-day and psychomotor scores; the effect of flying experience on classification scores; a statistical study of the Turk Muscular Coordination Test; and the odd-even reliabilities of classification tests and stanines.

Test ideas which were worked on and eventually transferred to other psychological organizations included a directional orientation test with rotated compass points, the work-adder revision of the Rudder Control Test, CM120, a motion picture comprehension test, an objective muscular coordination test and a clock reading test. Special projects included the preparation of complete job descriptions, including duties, qualifications, on-the-job training and performance standards for the positions held by the enlisted personnel of the unit and assistance in developing the standing operating procedures used and published by the Medical Section.

Medical and Psychological Examining Unit No. 8

Medical and Psychological Examining Unit No. 8 at Sheppard Field, Wichita Falls, Tex., continued to test through 1944. After being closed for 2 months, it was reopened in March 1945 for 4 months to handle a flow of candidates which was diverted from Keesler Field and Amarillo because of epidemics. All together some 53,000 air-crew candidates were processed. The original chief of the Psychological Section was Maj. Merrill F. Roff who was succeeded by Capt. Glen Finch. In the spring of 1945 all men at the Sheppard Field unit were on temporary duty from other organizations and were headed by Capt. Reuben A. Baer. Peak strength was 13 officers, 91 enlisted men, and 25 civilians.

Special studies included the relationships between air-crew classification tests and scores on the Army General Classification Test and other tests prepared by the Adjutant General's Department, the AAF Qualifying Examination and the Aviation Cadet Eduational Exami-. nation, AC20B; a factor analysis of the November 1943 battery; the performance of WASP's (Women Auxiliary Service Pilots) on psychological aptitude tests; the validity of the AAF Qualifying Examination for prediction of the graduation or elimination of WASP trainees; the intercorrelations of part scores of the Educational Examination, AC20B, stanines and group tests; and the intercorrelations

of classification tests administered to West Point cadets. A number of experimental tests were administered, including the Self-Pacing Discrimination Reaction Time Test, CP611E. Personnel of the Psychological Section cooperated with medical officers in a study designed to objectify procedures used in determining the adaptability rating for military aeronautics. Items from a number of personality inventories as well as a word association test were correlated against the results of the psychiatric interview in an effort to find a method which would simplify psychiatric interviewing procedures.

Medical and Psychological Examining Unit No. 9

Medical and Psychological Examining Unit No. 9 at Buckley Field, Colo., tested actively through April 1944 after which it was a stand-by unit for several months. With the reduction in processing flow, attention was devoted chiefly to research until inactivation in October. Nearly 14,000 men were processed with the regular classification battery. Activities were resumed in January 1945 to process candidates for B-29 gumery, of whom about 3,000 were tested.

The original chief of the Psychological Section was Maj. Clarence W. Brown who was succeeded, after the bulk of the processing was completed, by Capt. Sidney M. Adams. As a one psychomotor line unit, it had 7 officers, 56 enlisted men and 14 civilians for the heavier processing months. The section was housed in a standard H-type school building with additional space in other buildings as needed.

During the months when little processing was required, attention of psychological personnel was given to a program of test development. Experimental tests constructed included 11 tests to measure ability to change or break mental set; a balancing chair test; a test of the ability to identify stars for celestial navigation; an adaptation of a range estimation trainer; a battery to measure physical fitness; a variable pattern modification of the Finger Dexterity Test, CM116A; and a series of tests designed to predict success in B-29 pregunnery armorer training.

Research work included a study of the Arctic Training Instructors Rating Scale and a study of the personal adjustment of convalescent soldiers. Other studies were made on the reliability of certain motion-picture tests; differences in aptitude related to the status and age of candidates; the accuracy of machine scoring; ability to comprehend and remember psychomotor instructions; average aptitude levels of different types of air-crew candidates; a comparison of test and retest stanines; the effect of time-of-day on performance on psychomotor tests; the relation of the log length to scores on the Rudder Control Test, CM120; the effect of normalizing skewed psychomotor scores upon the classification of candidates for air crew; a study of the reasons for elimination from pregumery armorer training; the

relationship of classification tests and stanines to success in the B-29 prearmorer curriculum; a study of the relationships between combat criteria and classification test scores of decorated and cusualty fighter pilots in the European Theater of Operations; and a statistical analysis of the Pedestal Sight Manipulation Test, CM824A.

Medical and Psychological Examining Unit No. 10

Medical and Psychological Examining Unit No. 10 at Amarillo Army Air Field, Amarillo, Tex., tested nearly 25,000 candidates for air crew and over 2,000 B-29 gunnery candidates prior to its inactivation in October 1945. In its most active period chief of the Psychological Section was Maj. William E. Walton, Capt. Philip I. Sperling becoming chief in January 1945. The section was housed in a building formed by joining six barracks buildings. Several units were air-conditioned. Maximum strength was approximately 8 officers, 61 enlisted men and 20 civilians.

In research chief attention was given to methods of deriving additional scores from existing psychomotor tests including the Complex Coordination Test, CM701A, the Rudder Control Test, CM120B, the Discrimination Reaction Time Test, CP611D, and the Rotary Pursuit Test, CP410B. Other research included a study of the comprehension of psychomotor test instructions; the development of a Pilot Direction Test; a study of a word association test as a predictor of the aptitude rating for military aeronautics; examiner variance in psychomotor tests; the maximum usage possible of printed test booklets; the effect of variation in target diameter on scores on the Two-Hand Coordination Test, CM101A; and the development of various test ideas in the fields of temperament, motor performance, and intellectual functions; printed tests designed to measure functions similar to those measured by psychomotor tests; a performance test for dial reading; a check list performance test and a study of the effect of illumination in the test rooms on psychomotor test scores.

Psychological Research Project (Combat Crew)

Psychological Research Project (Combat Crew) was established in April 1945 at Lincoln Army Air Field, Lincoln, Nebr., with Maj. William M. Lepley as director. Its maximum staff was 5 officers, 22 enlisted men and 12 civilians. The mission of the project was to administer proficiency tests and other evaluative devices to combat-crew personnel; to collate training records; and to compute lead crew stanines which were to be used in making recommendations for the assignment of air-crew personnel to combat crews and in designating potential lead crew material. It was the last of the classification organizations established in the Aviation Psychology Program and the plan for its activities called for the utilization of psychological

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information gathered on individuals all through their training. Approximately 7,000 bombardiers, navigators, pilots, flight engineers, and radar observers were tested at Lincoln while considerable numbers of pilots, flight engineers, and radar observers were tested by detachments and organizations at other stations. Recommendations were made for crew assignments up to the time the project was closed shortly after the end of hostilities with Japan. The project made a study of the intercorrelations among the variables entering into combat-crew stanines. Details of the program of the project are given in chapter 5 of this report.

Relation of Other Psychological Organizations in the Training Command to the Classification Program

Six other psychological organizations in the Training Command had functions which were related to classification but in general performed no classification testing. The function of the Psychological Test Film Unit established at the Santa Ana Army Air Base in October 1943 was to develop motion-picture tests for use in classification and to work on allied problems involved in the psychological use of films. No film test was actually used in the classification battery, although the method appeared to be promising and some of the tests were found to have appreciable validities. There were three Psychological Research Projects established in January 1944; Psychological Research Project (Bombardier) at Midland Army Air Field, Midland, Tex.; Psychological Research Project (Navigator) at Selman Field, La., and later Ellington Field, Tex.; and Psychological Research Project (Pilot) at Randolph Field, Tex. All these projects had as a primary assignment the study of criteria against which classification tests could be validated. Accordingly-chief attention was given to the measurement of air-crew proficiency and to the evaluation of training procodures. Psychological Research Project (Radar), established at Langley Field, Va., in November 1944, and Psychological Research Project (Flight Engineer) at Hondo Army Air Field, Hondo, Tex., established in July 1945, had similar functions. These two projects, however, actually administered proficiency tests to be used in the classification of combat crew. Results of this testing were reported to the Psychological Research Project (Combat Crew) at Lincoln.

Total Numbers Examined

A summary of testing statistics in all Psychological Research Units and Medical and Psychological Examining Units, by months from the beginning of classification testing through June 1945, is presented in table 2.1.

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Year	Month	New Aviation Traincos	Elim- vinces	Student officers	Others	Negroes	B-29 sunnery candi- didates	Total Bum- ber iested
	February		,					2.9
716	March							7.1
	April	********						11,40
	May	********				:		8,01
	June	*********	*******		• <u>.</u>			11,α
	JUIY	********	*****	•••••••	** • • • • • • • • • • • • • • • • • •		•••••	
	Rentember	********			*******	*********	*****	1 산중
r.	October					19	Ŷ	17.5
	November							1 16 1
	December							10
943	January							11.7
	February							14,4
	March							17, 2
	April	********			********			17,7
,	M\$7	•••••						79,9
		*****				••••••	*********	17, 4
	Assessed	20.94				*******	••••	1. 1. 1
:	September	17 24		100	*****		*********	21,0
	October	17, 104	117	1.17		•••••••••	*******	17.7
	November	45. 210	198	1.406	217			m 3
	December	87.164	405	521	. 525			- 18.4
94	January	48, 546	235	. 448	412			. 41.6
· · · · · · · · · · · · · · · · · · ·	February	42,143	: 227	605	729			41.7
	March	23, 608	146	301	344			20, 4
	April	16,078	5 5	107	62			. 14,2
	May	8,914	42	210	48	• • • • • • • • • • • • •	********	8,2
	June	4,300			ZI.			. 4,4
	'July	4,330		24,		341	• • • • • • • • • • •	
,	September	1 144		122		74	••••••••••••••••••••	
	October	1.844		210				
	November	2 110		100	4			2 2
	December	1 524	· .	201	21	77		17
948	January	1,856	20	394	- 35	31	1, 419	5.7
	February	6, 308	· 4	525	14	140.	2,059	- 9, 10
	March.	6, 191	47	364	. 6	-129	2,397	9, 1
	April	7,284		287	4	106	870	1,6
	May	3,783	.10	303	405	55	275	- <u>4</u> 9
	June	1, 349	102	1. 185			P., 847	3,3
Total	l i	376 660	9 744	8.900	1 240	. 071	7 841	`ana +
1 ULM	******		4,330	ຸ່ຈຸດນ	9,600		1,001	. 1 00, 2

TABLE 2.1—Summary of testing statistics. All psychological research units and medical and psychological examining units

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The monthly totals listed for the period from February 1942 through June 1943 give the total number of men tested at PRU 1, PRU 2, and PRU 3. The testing figures for men previously eliminated and for student officers are included in these mouthly totals.

CHAPTER THREE

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The Classification Batteries

All classification testing involved the use of batteries of tests designed to measure the aptitudes required for the different air-crew specialties. The first batteries consisted of printed tests, supplemented in some cases with improvised apparatus tests. The tests used varied somewhat from one testing organization to another until December 1942, when all the apparatus required for the complete psychomotor battery became available.

In this chapter the composition and use of each battery are given, together with statistics on the intercorrelations and validities of the tests. In connection with each battery, considerations entering into its selection are given. Descriptions of each test and detailed validity information are given in Report Nos. 4 and 5 of this series. Identification of tests is by code number.3

- ¹ Each code number involves several places, serving the following function : Place I: A letter to designate general-use. Classification tests had the letter C in Place 1.
 - Place 2: A letter to decignate major, field.
 - Place S: A number to designate specific area within a field.
 - Places | and 5: A number representing an arbitrary identifying designation within a given urea.
 - Place 6: A letter indicating editions or major variations in 'a particular test.

Place 7: Occasionally used to distinguish minor variants of apparatus, instructions, etc. The categories for major fields and areas within fields are as follows;

E. Tests of emotion, temperament, and personality.

- 100. Absence of tenseness.
- 200. Absence of confusion and nerrousness.
- 300. Absence of fear and apprehension.
- 400. Temperament.
- I. Tests of intellectual functions.
- 100. Information.
- 200. Reasoning.
- 300. Judgment.
- 400. Foresight and planning.
- 500. Memory.
- M. Tests of motor performance.
- 100. Gross coordination.
- 200, Fine muscle coordination.
- 300. Appropriateness of controls used.
- 400. Feel of controls.
- P. Perceptual tests.
- 100. Visualization of flight course.
- 200. Estimation of speed and distance.

- 500. Motivation, 600, Personal Information. 700, Projective techniques.
- 300. Fatigue,
- 600. Comprehension.
- 769. Mathematica.
- 800. Physics.
- D00. Mechanical intelligence.

500. Smoothness of control movement.

600. Progress in developing technique.

700. Serial learning.

800. Pursult.

300. Sense of sustentation. 400, Division of attention.

In the presentation of each battery; differences from its predecessor are pointed out. Aspects of each battery not specifically covered in the discussion may be assumed to be identical with those of the battery immediately preceding.

THE CLASSIFICATION BATTERY OF FEBRUARY 1942

The first battery for the classification of aviation cadets in the Army Air Forces was used in Psychological Research Units Nos. 1 and 2, beginning February 1942, but was never prescribed by formal directive. It was discussed in general at a conference of the directors of the Psychological Program held in Washington on 22 January 1942 and was transmitted to the units as technical correspondence, with authorization for its use in the letter dated 2 February 1942 from the Office of the Chief of the Air Corps, quoted in chapter 1 of this report.

Names of tests, together with code numbers, time limits, scoring formulas, and weights are given in table 3.1.² Differences among the units are noted.

The composition of the battery was dictated by the availability of tests, and the degree to which the various tests available would, on the basis of job analyses probably differentiate among bombardiers, navigators; and pilots. At the time the battery was designed, it was believed that only 10 combinations of weights could be used with the aggregate weighting feature of the IBM testing scoring machine. Later in the war a technique was found to avoid this limitation. As with later batteries, it was planned that all scores would be entered on an aggregate weighting sheet which would be scored three times, once for each of the three specialties. Aggregate weighting on this battery was actually used only at Psychological Research Unit No. 1.

Rationale of the Tests Employed

The Vocabulary Test was included in the battery to give some measure of the intelligence of the candidate. It was scored both for speed and for level, with the level score being weighted most heavily for the navigator predictive score, since job analysis had shown that the navigator was not required to react or to make decisions as quickly as the

P. Perpetual tests-Continued 509 Orientation. 700. Auditory discrimination. 600. Speed of decision and reaction. 800, Form perception. O. Physical measures and sensory tests, 100. Size. 400. Depth vision. 200. Weight. 500. Color vision. 300. Night vision. * The key to abbreviations used in the tables giving the classification batteries follows: B=Bombardler. PRU=Psychological Research Unit. N=Navigator. R=Number of Items right. P == Pilot. W=Number of items wrong.

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Test	lode Code	Time 1 (min.)	Fooring ³ formula		eights	2	Ā	RUIT		AA	U 2 and		.Notes
•				A .	Z	A	M	z	A.	A	z		
ried tests: A C Qualifying Fxamination Vocabulary (level) Vocabulary (speed) Reading competension Numerical operations	ACIOB CIGOIA CIGOIA CIGOIA CIGOIA CIGOIA	5585¥	R-W/A R-W/A R-W/A R-W/A R-W/A		0-0-00 0-0-00					s •	t bas t Us		form A at PRU 2. PRU 1 and 2 only. PRU 1 and 3 only. PRU 2 used CI701A and PRU 2 used Form II after Apr. 1, 1942.
Following directions Spatial orientation 1 Spatial orientation 11 Spatial orientation 11 Spatial orientation 111 Graph reading Dial reading	CP 402A CP 702A CP 701A CP 701A CP 701B CP 702B CP 702B	2222 ****	R 4 R-W'5 R-W'5 R-W'5 R-W'5 R-W'5 R-W'5 R-3W	*********		<u>uuu+u+u-</u>		un uuou	nn n×ñ-		RT ja beeu, antite		PRU 1 only. Not available. Do.
Number size. Number size. Line kength. Point distance. Path distance.	CP005A CP005A CP005A CP005A CP005A		R-3W R-3W R-3W R-4W	****	ดดดตุก		*	<u></u>			izion qiazi	<u>, , , , , , , , , , , , , , , , , , , </u>	PRU 3 usid Form B. Do. Do.
paratus tests: Coordination Finger dexterity	CM10 CM10			0.00	00	00	07	00	N-1			•	CMTOLA at PRU-1. CMMLA and B at PRU 1, Form A at PBH 2
Feel of controls Serial reaction time	CN40 CN70			••	04	**	94	00	- 19		N.		CNIIOA at PRU 1. CPSIDA at PRU 1.

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bombardier or pilot. The speed score on the Vocabulary Test was given the most weight for bombardier and pilot.

The giving of most weight on the Reading Comprehension Test to the bombardier and pilot stanines did not imply that the navigator needed less reading comprehension than the bombardier or pilot. This weighting resulted from an effort to fit the weights into one of the weighting combinations and took into consideration the large differential weighting given the navigator on the AAF Qualifying Examination, AC10B. It was also believed that the reading comprehension items would add something to the measurement of the general intellectual level of the candidate.

The Numerical Operations Test, consisting of simple arithmetic items, was weighted most heavily for the navigator, since job analyses had pointed out that he must be extremely accurate in his computations. The work of the bombardier or pilot required so little actual calculation that this test was weighted zero for these specialties. This reasoning had been confirmed by preliminary results from Class 42-E. It also seemed obvious that a relatively high weight on the Mathematics Test, involving simple algebra and trigonometry, should be given to the navigator, but some weight on this test was given to pilot and bombardier since success in bombing and piloting seemed to be related to certain aspects of the physics-mathematics field.

Following Directions, a verbal test, was given a relatively high weight for bombardier since it was hoped that this test would measure the ability of the candidate to learn and follow a series of sequential acts. More than the students in the other specialties, the bombardier student had to learn to do one thing after another in proper order. It was also hoped that this test would measure certain aspects of division of attention. The bombardier's task scemed to demand considerable division of attention since he had to attend to the terrain to pick out his target and, at the same time, check different aspects of the bombsight and other apparatus.

Part I of the Spatial Orientation Test, in which the candidate had to locate aerial photos of the terrain on larger photos, was weighted heavily for bombardiers, because the bombardier usually had to pick out his target after having seen it previously only in a picture. The same type of reasoning was used in giving the navigator's score a high weight for part 11, involving the matching of maps with maps, and in giving the pilot's score a high weight for part 111, involving the matching of maps with aerial pictures. The bombardier's score included a rather heavy weight in Graph Reading because it was known that the bombardier worked extensively with graphs. This test also measured some aspect of speed of perception which was believed to be of considerable importance to the bombardier. This test was weighted

-74

less for the other two specialties in the belief that graph reading was involved, but not to the same degree as for the bombardier.

Dial Reading was given a higher weight for bombardier and pilot than for navigator because bombardiers and pilots did considerable meter and guage reading. However, the speed of perception measured by the test was believed important in all three specialties.

The Table Reading Test was given a high weight for navigator because of the amount of table reading involved in determining navigation variables such as the right ascension, hour angle, and time of transit of heavenly bodies. It was realized that men in other specialties dealt with tables, but not to the same extent as the navigator.

Number Filing and Number Size were included because they were believed to measure a perceptual factor. The weights for bombardier and navigator were higher than for pilot since the pilot did not use numbers as frequently.

The tests of Line Length, Point Distance, and Path Distance were weighted most heavily for bombardier and pilot since they were believed to use more direct observation of distance than the navigator. These tests also appeared to measure resistance to spatial illusions, which was thought to be of special importance to the bombardier and pilot. As a measure of perceptual speed, the Speed of Identification Test, involving the comparison of silhouettes of airplanes, was weighted most heavily for bombardier and pilot. Among the psychomotor tests, the tests of Coordination, Feel of Controls, and Serial Reaction Time were weighted only for pilot. While it might have been desirable to give some weight on these tests to the bombardier's score, this was not done because of the limitation of the weighting combinations. These tests seemed to involve the type of motor coordination demanded of the pilot, and it was hoped that they would measure large muscle coordination and smoothness of response. The Finger Dexterity Test, which involved turning a series of pegs 180°, was given considerable weight for bombardier since job analysis had shown that he had to make fine, coordinate movements in setting the bombsight.

The AAF Qualifying Examination was included in the battery because it was believed to measure the general level of ability better than any other test in the battery. It was weighted most heavily for navigator because of the belief that the navigator had to have considerable ability to reason and to deal with abstract material.

In indicating the relative weight of any test for the different job specialties, the desired raw score weights showed the amount each test would contribute toward differentiating among the job specialties. On the other hand, the relative contributions made by the various tests to a specific predictive score, such as that for pilot, were not shown 1.54

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by the desired weights. Instead, the desired weight divided by the standard deviation of the test would show the actual contribution of a test to the whole battery for any specialty. As the actual standard deviations of all the tests for an aviation cadet population were not known, the assigned weights took into consideration the number of items in each test instead.

It should be noted that in cases where it was desired to weight a particular psychological trait for more than one type of duty, the general principle was followed of weighting this trait for the various types of duty by means of separate tests which were believed to measure a similar but not identical trait. This procedure had the effect of minimizing the spurious agreement between weighted scores for the various duty categories which is introduced by having the errors in scores common to these categories.

The weights for the psychomotor tests were based on the supposition that they would contribute approximately a third of the total variance of the pilot battery and about a fourth of the total variance of the bombardier battery. No weight on these tests was given to navigator.

It was realized that the weights given to the different tests for the three air-crew specialties were to a large degree arbitrary. It was anticipated that the test weights would be changed on the basis of information on the actual variances of the tests and on the basis of judgments of the staffs in the field units regarding their relative importance. Even at the time of the inauguration of the first battery, plans had been made for the eventual use of regression weights in predicting success in the several specialties, but the necessity for immediate classification demanded an a priori system of utilizing the tests that were available.

Scoring Formulas

Scoring formulas for the printed tests were established arbitrarily. In general, highly speeded tests carried heavy penalties for errors, on the theory that accuracy in relatively simple perceptual operations was important in all air-crew positions and in an attempt to equalize differences in relative attention to speed and accuracy. On the power tests, in which the subject matter was more difficult and the time allowed a good proportion of the candidates to attempt all items, the formulas generally involved the conventional correction for guessing.

The Use of Psychomotor Tests

While procurement of copies of the Complex Coordination Test, referred to in the tables as the Serial Reaction Time Test, had been underway for several months, only a few copies were available when classification testing began. For several months it was actually used for classification only at Psychological Research Unit No. 1. The other psychomotor tests used at the Maxwell Unit were largely improvised, including a Mechanical Assembly Test, the conventional Steadiness Test (holding a stylus in a hole, with touches counted) and an improvised Discrimination Reaction Time Test (CP611C).

Classification Procedures

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Classification procedures used with the first battery were similar to those used during the remainder of the war except that no candidates were eliminated from air-crew training on the basis of stanines. Provision was made, however, that cadets assigned to a type of training for which their predicted performance was low, that is, a stanine of 4 or below, would be recommended for training probationally with the request that their performance be observed closely in their initial stages of training with a view to early elimination if they proved unsatisfactory.

In the computation of the pilot stanine two points were added to the scores of those who had obtained a solo pilot certificate, while those who had a solo certificate and 30 or more log hours were given a bonus of three points on the pilot stanine. The maximum "augmented pilot stanine" was, however, 9, as any score, including the bonus, which was greater than 9, was considered 9.

Candidates indicated their preference for the several types of training and a system was established for making recommendations on the basis of preferences and predictive scores. Details of this procedure are given in chapter 1.

Statistical Data

Intercorrelations of the tests of the battery of February 1942, together with biserial validities of the tests for bombardier and pilot training, are presented in table 3.2.

THE CLASSIFICATION BATTERY OF APRIL 1942

A revised battery, based on suggestions from field units and experience in February and March and known as the Classification Battery of April 1942 was sent out directly to the units early in April. It is shown in table 3.3. Like its predecessor, it was not formally prescribed by directive. The major changes were the elimination of most of the highly speeded perceptual tests with short time limits and the introduction of Mechanical Comprehension items and Reasoning and Judgment items from the AAF Qualifying Examination. A new form of the Vocabulary Test was prescribed.

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TABLE 3.2.—Intercorrelations, means and standard deviations of tests of battery of February 1942, together with biscrial validity coefficients for bombardier and elementary pilot training [HII=N]

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TABLE 3.3.—The classification ballery of April 1942. Used from Apr. 21, 1942 to May 10, 1942, at PRU 1; from approximately Apr. 7, 1943 to May 18, 1948 at PRU 2; from Apr. 20, 1942 to May 22, 1948 at PRU 3

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Numerical operations Mathématics. Mechanical comprehension	CIT01A CIT02A CI505B	358	R-3W R-W/4 R-W/4	N40	890	0 H M	410		Tág#` 0J	veight veight			000	Form E at PRU 2: CI701A at PRU 2. ACIOA und at PRU 2: and soured F.
Following directions. Spatial orientation I.	CP402A CP201A	222	R-W/2 R-W/5 R-W/5	٥ <u>٣</u> ٥	0-10	004	0-41-		55-3 		E 9		0-7	ta tre outer. 15-minute test at PRU 1.
Spatial orientation III Gruph reading	CP601B CP601B	5.4 u	R-W/5 R-2W R-2W		080	040	040	12 ~ ~ ~	रु द	ž	g	040	0-0	Boored R-3W at PRU 2.
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 A prilied to raw scores with a mean of 5 and standard deviation of 2.
 A field to standard scores with a mean of 5 and standard deviation, A C10B.
 This test consistent of Parts 2 and 3 of the AAF Qualifying Examination, A C10B.
 This test was part 6 of A C10B.

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Since it had been found that the stanines from the original classification battery were highly correlated, an effort was made to reduce these correlations through changes in the weights. Many tests now carried zero weight for bombardier or navigator. All tests, however, carried a minimum weight of 1 for pilot so that cadets could be told that all tests contributed to the pilot aptitude score. This was believed desirable since the pilot specialty was so popular that it was thought candidates might attempt to pass the tests weighted for pilot and to fail the tests which were weighted for bombardier and navigator. The weights in the February battery varied from 0 to 7 and were to be applied directly to raw scores, while in the April battery they were expressed in percents and were given as desired weights to be applied to standard scores. More was known about the standard deviations of the tests, and this made it possible to provide a parallel set of weights to be applied to the raw scores.

In weighting the Spatial Orientation Test, the logic used in the first battery was followed but to a more extreme degree. Instead of approximately 25 percent, a mathematics test were weighted approximately 50 percent for navigator. Psychomotor tests were to have heavy weight in the computation of the bombardier and pilot stanines.

Since validities and intercorrelations were not yet available, all weighting was on the basis of the professional judgment of the key psychologists in the program. The Army had demanded that a classification job be accomplished even though empirical data were not yet available. In general, the professional judgments appear to have worked out satisfactorily. The heavy weighting of mathematics tests for navigator was completely justified by later empirical results. On the other hand, tests measuring intellectual level never were shown to have appreciable validities for bombardiers or pilots. The removal of the speeded perceptual tests turned out to be an error of judgment since they were later shown to have considerable usefulness, and in somewhat different form were reintroduced into the battery. On the basis of later empirical evidence, Dial and Table Reading came to carry much higher weight for the prediction of success in navigator training. It was recognized that the battery left much to be desired in the coverage of traits required for success in air-crew, but time had not yet been sufficient to develop other tests which had been planned for inclusion. Several of the tests in the battery, including two of the Spatial Orientation Tests, Dial and Table Reading, and Mechanical Comprehension continued to be emphasized throughout all the following batteries.

The intercorrelations of the tests in this battery are presented in table 3.4.

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THE CLASSIFICATION BATTERY OF MAY 1942

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The first classification battery which was prescribed by formal directive issued by Headquarter Army Air Forces and transmitted to the examining units through official military channels was the battery of May 1942.

The directive of 4 May 1942 gave the weights indicated in table 3.5 for the general aptitudes and abilities of cadets who had passed the AAF Qualifying Examination and who were undergoing classification. Tests were to be weighted in accordance with the desired weights given in table 3.5. These weights were to be applied after each test had been reduced to a comparable basis by dividing by its standard deviation. The actual weights used at Psychological Research Units Nos. 1 and 3 are also shown in the table. The weights at Psychological Research Unit No. 1 were those prescribed in a further section of the directive and took into consideration the estimates of the standard deviations available at Headquarters Army Air Forces. In most cases these standard deviations had been obtained through actual experience with the tests at the classification centers.

The weights used at Psychological Research Unit No. 3 also followed the intent of the directive. Instead of entering raw scores on the printed tests and standard scores on the psychomotor tests on the aggregate weighting sheet, the Santa Ana Unit was using scaled scores with a mean of 5 and standard deviation of 2 for all tests. To fit these scores into the aggregate weighting board, the desired weights were reduced by approximately one-third and rounded off. Deviations in scoring formulas were due to the use of a common multiplier. Since there was common scaling, this did not affect the contribution of any test to the stanine. With the use of a common scale, the weights should have been proportional to the "desired weights" of the directives. Deviations from exact correspondence to the desired weights were introduced in order to fit the weights to the aggregate weighting sheet. This method of weighting was continued at Psychological Research Unit No. 3 until 1 November 1943.

For this battery and until July 1942, no aggregate weighting was used and no stanines were computed at Psychological Research Unit No. 2.

For the printed tests, a detailed manual of directions specified time limits and scoring formulas. This 14-page manual was, in effect, the first "standing operating procedures." It outlined the duties of examiners and proctors, gave a standard introductory statement to be read to all cadets prior to taking the examinations, and prescribed exact directions for administration. Similar manuals were prepared for subsequent batteries, gradually becoming more complete and comprehensive.

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TARLE 3.5.—The classification battery of May 1942. Used from May 11, 1942 to June 9, 1942 at PRU 1; from May 13, 1942 to June 15, 1942 at PRU 5 .

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Test	Code	Time (.rime	Scoring formula	Ĭ	ights	Ľ	PRC			80.		PR			Neter
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lied to standard scores with M of 8 and SD of 2. I test consisted of parts 2 and 3 of the AAP qualifying examination, ACMB. I test was part 6 of ACDB.

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The directive specified that functions measured by the psychomotor tests should be uniform in all classification centers. Pending the procurement of sufficient new apparatus, it authorized obtaining psychomotor scores from forms of the tests that were then available, provided that the obtained scores were converted to a common scale of standard scores before performing the prescribed weighting procedure. Additional tests could be administered for purposes of research and development with the approval of Headquarters Army Air Forces, but these tests were not to be used for classification.

The changes from the Battery of April 1942 were relatively minor. The time limits on Parts II and III of the Spatial Orientation Test were increased on the basis of empirical findings. The desired weights were unchanged while the names and code numbers of the psychomotor tests were changed in accordance with the status of plans for their development. Psychological Research Unit No. 1 had a psychomotor test for each one that was prescribed, but the psychomotor battery at Psychological Research Unit No. 3, also makeshift, was incomplete. In general, the directive formalized procedures already in existence. Uniformity of scoring formulas of printed tests was not achieved and there was variation in the form of the mathematics tests used at the different units.

Shortly after this directive was issued, procedures for the selection and classification of air-crew personnel were regularized by a series of official documents. A letter from the Adjutant General's Office, War Department, Washington, dated 12 May 1942, confirmed the authority of the Commanding General, Army Air Forces, to control the selection and classification of military personnel for air-crew duty, including the development of policies; the study and analysis of aptitudes and characteristics required in the various types of air-crew assignments; the development, refinement, and application of practical examination procedures; the determination of appropriate tests to be used for selection and classification purposes; the preparation of directions for administering, scoring, and combining results from these tests; and the recommendation of personnel for suitable assignments. This letter became the basis of AAF Regulation No. 35-24, dated 22 May 1942, and quoted in Chapter 1 of this report, which defined the responsibilities and duties of Headquarters, Army Air, Forces and Headquarters Flying Training Command with regard to the examining of air-crew personnel.

Classification Procedures

Training Command Headquarters issued a plan for the classification of aviation cadets which further specified the details of the classification procedure. The object of classification procedures was not only to classify aviation cadets for the type of duty in which they would be most effective, but also to insure that the cadets realized the importance of having the right man in the right place in the air crew. The cadet was to leave the classification center satisfied that the type of duty to which he was assigned was vital to the success of the Air-Forces and clearly represented the type of service in which he would be able to make the greatest contribution to the war effort.

The first step in the classification procedure was the presentation of air crew functions by means of motion pictures, film strips, pictorial and reading materials, and lectures. This indoctrination was to be presented prior to the expressing of preferences regarding the various types of training and as early as possible after the cadet arrived at the classification center.

The second step for the cadets was to indicate his preference for one of the specific types of training, based on his own analysis of his interest and aptitudes and his judgment as to the service he could give most efficiently. Following the expression of his interest, he was to take the printed and psychomotor tests as prescribed by the directive. Since it was believed that men with actual flying experience who were in pilot training would have better success in that specialty than men without such experience, arrangements for "experience credit" were continued. The allowances of 2 or 3 extra points on the pilot stanine for those with solo certificates or 30 hours beyond solo were based upon analyses of the relative success of individuals with previous flying training.

It was prescribed that the stanines should be distributed approximately as follows:

tanine	Percent
9	4
8	7
7	12
6	17
· · · · · · · · · · · · · · · · · · ·	20
+	17
8	12
2	7
1	4

This distribution would be approximately normal in shape, with a mean of 5 and a standard deviation of 1.96.

At Psychological Research Units Nos. 1 and 3, tables for converting the weighted scores into stanines were made by computing the 4th, 11th, 23rd, etc., centiles and this finally became standard procedure. When, with a later battery, Psychological Research Unit No. 2 began to compute stanines, conversion tables were originally based on computing standard scores so that the stanines would have a mean of 5 and a standard deviation of 2, and with no stanine greater than 9 or less than 1. By this method the shape of the distribution of weighted scores was unchanged from its original form. For the sake of uni-

formity, this practice was subsequently changed to that followed in the other two units.

Definite procedures for making recommendations as to the type of training to which each cadet was to be assigned were established. Cadets with first preference for the type of training in which their aptitude score was the highest were to be recommended for thit type of training. Cadets with a stanine of 6 or better in the ty_i) of training listed as their first preference were also to be recommended for that type of training. Of the cadets remaining unassigned after these steps, those with a staning of 6 or better for their second preference were to be recommended for that type of training. The third preference was to be treated in the same manner for the remaining group. The remainder of the cadets were to be recommended for the type of training in which they made the highest score without regard for preference except in certain special circumstances involving preferences for ground crew training or training in an enlisted status. The classification board was authorized to make such assignments in the group of cadets who could not be classified according to their preferences as were necessary to fill quotas, provided such assignments were reasonable in view of the predictive scores obtained.

Cadets assigned for a type of training for which their predictive score was a stanine of 3 or below were to be recommended for training probationally with a request that their performance would be observed closely in the initial stages of training with a view to early elimination if they proved unsatisfactory. It was believed that less than 10 percent would be given probational assignments.

THE CLASSIFICATION BATTERY OF JUNE 1942

The second directive that was formally issued was for the Battery of June 1942. The changes in tests were few. The Graph Reading Test was taken out of the battery and a new mathematics test with a 25-minute time limit was prescribed. New dial and table reading tests, with longer time limits and a new scoring formula, were available.

On the basis of further professional analyses of the requirements of aircrew, the weighting system was considerably revised. The general changes for pilot included increased emphasis on perceptual skills, comprehension, and coordination. For navigator the weight for mechanical skills was slightly reduced, while comprehension and perceptual speed were further emphasized. Relatively little was changed in the weighting for bombardier except that the importance of finger dexterity was reduced somewhat, while speed of reaction and coordination were emphasized a little more.

The changes in the desired weights for the specific tests are given in table 3.6. Revised directions for administering and scoring the classification tests were issued to the field units.

TABLE 3.6.—The classification ballery of June 1942. Used from June 9, 1942 to Aug. 18, 1942 at PRU 1; from June 15, 1942 to Aug. 1, 1942 at PRU 8 >

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	Tine (Bbc.)		8358835554.30				
	Code		C1300B 4 C1500B 4 C15	CM100A CM113A	CMII6A	CP611D CM701A	
	Test		Printed tests: Reading and judgment. Vocabulary Nurwricio operations. Michanical comprehension Stechanical comprehension Following directions. Spatial orientation II Spatial orientation II Spatial orientation III Spatial orientation III Spatial orientation III Spatial orientation Dial reading.	Apparatus tests: Eteadiness Arm-hand derterity	Finger dexterity	Speed of reaction SAM Complex coordination	

⁵ Applied to raw scores (except on apparatus tests).
⁹ Only 5, 1942, two apparatus tests of the battery were administered at PRU 2 from June 15 to July 5, 1942, two apparatus tests were added. On July 17, threamore apparatus tests were added to the battery. Accurate were main tests of the test was applied to taw scores (except on apparatus tests).
¹⁰ Weights test was part 6 of AC10B.
¹⁰ This test was part 6 of AC10B.

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During the use of this battery, psychomotor apparatus began to be available and the specified models were introduced into the classification battery at Psychological Research Unit No. 2. The other units continued to use whatever tests were available but had the classification models of the Finger Dexterity Test and Complex Coordination Test. Computation of stanines began at Psychological Research Unit No. 2 on 5 July.

THE CLASSIFICATION BATTERY OF AUGUST 1942

Status of Test Development and Procurement

At any given time the status of test development and research was a determining factor in the nature of a new battery. At a conference of directors and chiefs of sections at Fort Worth 13 through 15 July; reports on test development were made by the officers in charge of test development.

The need for psychomotor tests had long been recognized and every effort was being made to introduce a complete psychomotor battery at all three Psychological Research Units. For the SAM Complex Coordination Test 36 copies had been authorized. It was planned to send the first 8 to the San Antonio Unit, then bring the other units up to 8, and finally have 12 copies in each unit. Thirty-six copies of the SAM Two-Hand Coordination Test were in production, together with control units designed by the Department of Psychology, AAF School of Aviation Medicine. These control units would permit simultaneous operation of four copies of the apparatus, at the same time regulating the intervals between trials automatically. Assembly of the SAM Rotary Pursuit Test was in progress, together with control units and special test tables, with delivery to take place to the units by the middle of August. Copies of the SAM Complex Discrimination Reaction Time Test had already been distributed on 1 July, about 6 weeks after the original decision to construct it. More copies were being assembled so that each Psychological Research Unit would have three sets of four units each by 1 September. The Santa Ana model of the Steadiness Test was in use both in San Antonio and Santa Ana, while the Maxwell Field unit was changing its form to the specifications of the Santa Ana model.

Revision of the Classification Battery

A directive covering a new battery had been prepared by the Psychological Section, Hq. Army Air Forces, and was discussed at the conference. The directive from Training Command Headquarters was issued to the training centers on 22 July and the battery went into effect at the units in August.

This battery, shown in table 3.7, reflected the increasing amount of information on test validities obtained in the Aviation Psychology Program.

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¹ Applied to mw scores. ³ Applied to standard scores. ³ Applied to standard scores. ⁴ This test construct of the **AAF** qualifying examination, **AC10D**. ⁴ This test was part 6 of AC10D. ⁵ CM100A and at PRU 1 until Aug. 21, at PRU 2 until Nov. 30, and at PRU 3 until Aug. 28, 1963. ⁶ CM1100A at PRU 1 until Oct. 23, 1962; special model at PRU 3 (no code).

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For the first time, the classification battery was used for selection instead of merely classification, and provision was made for the dis. qualification of two categories of candidates simply on the basis of their aptitude scores. Since cadets with navigator stanines of 4 or below had been found to be unsatisfactory in training, it was directed that no one should be recommended for navigator training without a navigator stanine of 5 or above. A cut-off was also established for cadets who had been eliminated from one type of air-crew training because of lack of aptitude and who were candidates for a new specialty. Such candidates were to be recommended for a second type of training only when their stanine for the new specialty was 6 or better. Among the minor changes at this time were the elimination of the use of the third preference in determining assignments so that a larger proportion of individuals would be assigned to their first choice of training. It was also directed that information to the effect that a particular cadet had made a low predicted score in the type of training for which he was classified should not be given to his elementary flying instructor and should not be available as a basis for elimination from training. The purpose of this provision was to guard against any possible contamination of validity studies by knowledge on the part of instructors of the aptitude ratings of their students. Responsibility for classification was to rest with the faculty board, the decisions of which were to be final.

In the composition of the battery the Reading Comprehension and Mechanical Comprehension Tests from Form AC10B of the AAF Qualifying Examination were replaced with the same parts from a new form, AC10D. The Vocabulary Test (level and speed) was replaced with a Technical Vocabulary Test, which had been developed at Psychological Research Unit No. 1, with differential scoring keys for the three specialties. The Following Directions Test was dropped from the battery because it was not considered promising. Considerable work had been done at Santa Ana on the development of mathematics tests and a Numerical Approximation Test was introduced on the hypothesis that quick estimates of numerical operations were important in aircrew, especially in the work of the navigator. The Two-Hand Coordination Test, which had been found by British and Navy research to have appreciable validity and a classification model of which had been under development for some time, was officially included in the battery for the first time. The new SAM Discrimination Reaction Time Test was given more emphasis for bombardier and pilot. The weights were readjusted on the basis of professional judgment, since validity data were still incomplete and the test intercorrelations were not available. The measurement of coordination was to be effected by both the Complex Coordination Test and the new Two-Hand Coordination Test. Part III of the Spatial Orientation Test

(map on map) which had carried chief weight for navigator was dropped and the other parts were revised. Mechanical Comprehension was assigned small weights for bombardier and navigator but a large weight for pilot, and the Table Reading Test was given increased weight for navigator. The heavy weight which had been assigned to the Finger Dexterity Test for bombardier was reduced. The reading and judgment items from the AAF Qualifying Examination were replaced with a test of reading comprehension taken from the same source. All tests continued to carry a weight of at least 1 for pilot.

In the discussions leading to the formulation of the battery marked differences of opinion were found to exist among the directors as to the value of a test of Steadings Under Pressure which had been developed at Psychological Research Unit No. 1. It was, however, included in the battery.

Test intercorrelations, one of several matrices computed for this battery, together with typical validity data, are shown in table 3.8.

THE CLASSIFICATION BATTERY OF DECEMBER 1942

For the classification battery which was introduced in all three units on 1 December 1942, sufficient apparatus was available so that each cadet could be given the six prescribed psychomotor tests. The battery was formulated at a conference at Fort Worth of the directors and section chiefs on 12 to 16 October, and the covering directive was issued on 30 October by Headquarters Army Air Forces and 2 weeks later by Headquarters Training Command.

Maj. Gen. D. N. W. Grant, the Air Surgeon, addressed the conference and directed that as far as possible the battery be based only on validated tests. He also stated that no changes in the battery which was to be formulated at the conference were to be made until further research showed changes to be highly desirable. This principle was followed for the remainder of the war, with only four general battery changes after that time.

The new battery had more research justification than its predecessors. Validity data on tests administered in April and the complete table of intercorrelations of the August battery were available. All tests in the August battery were discussed critically, as were the tests in advanced stages of development. Each director discussed the tests in his area of responsibility and made specific proposals regarding tests to be included in the battery.

Changes in Tests

The tests and weights prescribed are presented in table 3.9. The changes in the printed tests were largely a reflection of the accomplishments in printed tests development, chiefly at Psychological Research Unit No. 3. New tests of Mechanical Principles, Reading ComprehenTLARS 3.8.—Intercorrelations of classification battery of August 1942, aviation cadels tested at Psychological Research Unit No. 8 and trained in class 43–D

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The signs of all correlation coefficients have been adjusted so that a positive coefficient means that good performance on one test goes with good performance on the other. Stand-and scores with theoretical mean of 30 and 6. D. of 10 used for apparatus tests.

¹ Biserial correlation coefficients between test scores and graduation-elimination in Bombardier classes 43-5, 6 and 7, all schools. For printed tests, blserials computed separately for men tested at the three Psychological Research Units and combined by Fisher's a-Technique. Approximate N's: PRU 1, 552; PRU 3, 300; PRU 3, 460. For apparatus tests, validites are based on approximately 323 cases tested at PRU 2.
¹ Biserial correlation coefficients between tested at PRU 2.
² Biserial correlation coefficients access and graduation-elimination in elementary pilot training. Group identical with that used for intercorrelations.
³ Biserial correlation coefficients dest, numerical and anticipation in elementary pilot training. Group identical with that used for intercorrelations.
TADLE 3.0.—The Classification Battery of December 1942. Adopted Dec. 1, 1942 at all units and used to July 2, 1945 at PRU 1 and to July 1, 1945. •

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sion, Mechanical Information, and Mathematics were available and introduced into the battery. It was agreed that a single score on the Dial and Table Reading Tests should be used in view of the relatively high correlation which had been found between them. For the first time, the SAM Rotary Pursuit Test was introduced into the battery to carry some of the weight assigned to psychomotor coordination.

The most controversial test introduced was the Aiming Stress Test, a modification of the Steadiness Under Pressure Test developed at Psychological Research Unit No. 1 and designed to eliminate as far as possible certain features which had been objected to by psychologists in the program. The test was introduced to investigate the hypothesis that a test involving performance under stress would have validity for air crew. It had already been determined that tests of the steadiness type had practically no validity, and the availability of apparatus dictated the choice of the steadiness test to investigate the stress hypothesis.

A new blank for obtaining the cadets' preferences for various types of ais erew training was introduced. The most important change in the blank was the introduction of 9-point scales on which strength of preference for each type of training was to be indicated. It was believed that the rating scale form of indicating preferences would permit better differentiation in borderline cases.

Classification Procedures

With this battery, procedures at the classification centers took on a selection feature for all specialties in that a minimum stanine of 3 was to be required for bombardier or pilot training. The faculty boards at the classification centers admitted a number of candidates with pilot stanines of 1 or 2 to pilot training contrary to the psychological recommendations, but it was later found that the elimination rate of these specially selected low scoring men was approximately the same as for men in general with stanines of 1 or 2. The requirement introduced earlier of a minimum stanine of 5 for navigator training was continued. A directive from Headquarters Training Command on procedures to be followed by the surgeon in preparing recommendations to the faculty board att the classification center was issued on 28 November 1942. This directive read in part as follows:

2. • • • a. General. Recommendations in each instance will be arrived at after consideration of the following data:

(1) Physical examination results.

(2) Estimated adaptability for aeronautics (ARMA).

(3) Psychological aptitude scores.

(4) Preference ratings.

Supplementary information derived from interview by the Psychological Research Unit and the Physical Examining Unit may also determine in part the recom-

mendation submitted. All these data will be combined by a board consisting of the Senior Flight Surgeon of the Physical Examining Unit and the Director of the Psychological Research Unit, or their representatives, who will prepare recommentations under the surgeon's direction to be presented to the Faculty Board. b. •

e. Psychological Aplitude Scores and Statement of Preference.

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(1) The results of the psychological aptitude tests and the cadet's statement of preferences are to be considered together and, within the limitations imposed by the physical examination results will maximally influence the recommendation io be made to the Faculty Board. Scores of aptitude for the three types of aircrew (stanines) are expressed on a senie from 0 (highest) to 1 (lowest). Preferences as expressed by the Aviation Cadet, in terms of comparative ratings of strength of desire for the seteral aircrew positions (also on 0-point scales), as well as a statement of willingness to welve preferences under certain specified conditions, will be considered.

(2) Psychological Qualification.—A: cadet will be recommended only for the air-crew duties for which he is qualified; Minimum psychological qualification geores are defined as: for pilot, 3; for bombardler, 3; for navigator, 5. A cadet who does not meet these standards for any of the three types of air-crew training will be interviewed by a member of the Psychological Research Unit and will be brought before a board consisting of the senior flight surgeon of the Physical-Examining Unit and the director of the Psychological Research Unit, or their representatives, for final decision as to the surgeon's recommendation. If it is determined that this aviation cadet is unsuited for military aeronauties he will be disposed of as provided in AR 40-110.

(3) Recommendation of Psychologically Qualified Cadets.—Cadets found to be psychologically qualified for air-crew training will be recommended in accordance with the following procedure:

(a) If an aviation cadet expresses in his preference waiver that he desires the type of training for which he has the greatest aptitude, it will be recommended that such training be given him, provided that:

1. His aptitude score for such training is at least 3/points higher than for the type of training given first preference, and,

2. He confirms in an interview the desire to be so recommended.

(b) If a recommendation is not-made under (a) above, the cadet will be recommended for the type of training given first preference, providing his aptitude score for that type of training is δ or above.

(c) If recommendation is not possible under (a) and (b) above, the cadet will be recommended for the type of training for which his aptitude score is highest, provided:

1. If recommended for bombardier or pllot training, his aptitude score is 2 or more points higher for the recommended type of training than for his first preference.

2. If recommended for navigator training, histaptitude score for this type of training is 3 or more points higher than for his first preference.

(d) If a recommendation cannot be made under (a) (b) or (c) above, the cadet will be recommended for the type of training given highest preference of those for which he is qualified.

(c) Each aviation cadet who is to be recommended for a type of training other than that for which he has expressed highest preference will be interviewed by an officer of the Psychological Research Unit. The purpose of the interview will be to verify the cadet's statement of preference waiver, if one has been given, and to explain to him the reasons for recommending training other than that for

which he has expressed highest preference. "High pressure" methods of "selling" the cadet on aparticular type of training will be avoided by all personnel concerned.

(4) Tied Aptitude Scores and Preference Ratings,—Tied aptitude scores will be resolved by reference to preferences; tied preference ratings will be resolved by reference to aptitude scores. In the comparatively few instances in which both aptitude scores and preference ratings are tied, the fact will be reported to the Faculty Board for classification decision.

Statistical Data

In table 3.10 are presented a typical matrix of test intercorrelations, means, standard deviations, and representative validities of this battery.

THE CLASSIFICATION BATTERY OF JULY 1943

The next revision of the classification battery was effective 1 July 1943. New validation data had been accumulated and it appeared desirable to reweight the tests for the different specialties and to introduce certain modifications in the tests. In assigning these weights the primary consideration was, of course, information that had continually accumulated from job analysis and test validation, mainly the latter. A secondary consideration, was the desire to reduce the intercorrelations among the stanines. For the first time since the original classification battery, the battery of February 1942, certain tests carried no weight for pilot, so that candidates could no longer be told that all tests counted in the computation of the pilot score. However, since by now a qualifying stanine was a prerequisite to being assigned to a second form of air-crew training, in the event a cadet were to be eliminated from pilot training, new candidates very generally tried hard on all tests. The cadet who purposely attempted to get a pilot assignment by failing "bombardier and navigator tests" was of very rare occurrence; it would have been a fatal error of foresight to have behaved this way and the fact was well recognized.

Changes in the Battery

The chief new developments in the tests are shown in table 3.11. The General Information Test, scored only for navigator and pilot, replaced the Technical Vocabulary Test scored for all three specialties. This test had shown appreciable validity and appeared to afford an indirect measure of student interest. The Biographical Data Blank, also scored for navigator and pilot, had been developed and was ready for use. It also was known to have appreciable validities and afforded a way of taking students' background into consideration in their assignment. There were also new forms of two mathematics tests, Arithmetic Reasoning and Mathematics. It had been decided to add the Divided Attention feature to the Rotary Pursuit Test since TABLE 3.10.—Intercorrelations of classification battery of December 1942

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TABLE 3.10.—Intercorrelations of classification battery of December 1342 [N=1,096 aviation cadets tested at Psychological Research Unit No. 1]

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TABLE 3.11.—The classification battery of July 1943.

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division of attention had been emphasized in a number of job analyses and it was believed that this feature would not reduce the validity of the test and possibly would improve it. For convenience, scores on the Dial and Table Reading tests were combined into a single score, since the tests had a high correlation and this practice had been authorized for the preceding battery.

Officer Quality Score

Beginning with this battery and continued throughout the war, an Officer Quality Score was computed on the basis of certain of the tests. This was a weighted composite score rather than a singledigit stanine and was to be used as one factor in differentiating between men to be commissioned second lieutenants and those to be appointed flight officers at the conclusion of their training. This score is discussed in more detail in chapter 5 of this report.

Classification Procedures

The method of computing experience credit was made more specific. For 2 points bonus on the pilot stanine, 15 hours or more of pilot instruction, including solo flight, were required; while for 3 points, 30 hours, including 10 hours of solo, were necessary.

Effective 10 July 1943 minimum qualifying scores were as follows: for bombardier training, a bombardier stanine of 4 accompanied by a navigator stanine of 4; for navigator training, a minimum navigator stanine of 6; and for pilot training, a minimum pilot stanine of 3. This step increased the aptitude requirements for two specialtiesbombardier and navigator. Headquarters Army Air Forces had specified a minimum pilot stanine of 4, but Training Command Headquarters had asked for reconsideration. However, 6 weeks later, by directive from Washington, the minimum stanine required for pilot training became a pilot stanine of 4. On 12 August 1943 the requirement for bombardier training became a minimum bombardier stanine of 6, accompanied by a minimum navigator stanine of 4. The principle involved in the navigator stanine requirement for men to be trained as bombardiers was that training plans called for a large production of dual rated men for medium bombardment. This double requirement continued until September 1944. With this battery, cutoffs became automatic and the boards at the classification centers no longer attempted is pick out "promising" naterial from among candidates with low stanines.

Statistical Data

Intercorrelations, means, standard deviations and validities for the Battery of July 1943 are shown in table 3.12.

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TABLE 3.12.—Intercorrelations of tests and stunines of classification battery of July 1945 (Sample 0 1000 Nov Artation Cadets from each Frychological Research Valt. N=3000]

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THE CLASSIFICATION BATTERY OF NOVEMBER 1943

Changes in the classification battery which were to become effective with the opening of the Medical and Psychological Examining Units on 1 November 1943 were considered during a conference on psychological research at Training Command Headquarters on 14 September 1943.

For the first time test weights for all three air-crew aptitude scores were close approximations to multiple regression weights based directly on empirical data. Since some tests were still being revised there were a few points at which it was necessary to supplement data with judgment. The validities used in the regression equations are shown in table 3.13. These coefficients were not corrected for restriction of range and therefore tended to be underestimates of the true validities. The pilot validities of tests of the December 1943 classification battery were computed by combining into weighted composites all data available on those tests, except for the elimination of a few small experimental groups. The validities for tests added to the battery since 1 December 1942 and of new tests proposed for . inclusion in the new battery were those reported from research testing at one of the Psychological Research Units. In most cases these validity data were available only for pilots and the tests were considered for weighting only for pilots.

(Task)	Cada	Bomt	ardler	Navi	gator	Pi	lot
100		r	N	r	N	r	N
Printed tests: Reading comprehension 1	C10140 CP/01B CP/01B CP/01A, 622Å CF/02D CF/02D CF/02D CF/02D CF/02D CF/02D CF/02C C1702E C1702E C1702E C1702B C1615Å C1616Å C160Å C160Å C160Å C160Å C160Å C160Å CM10Å CM10Å CM10Å	0. 12 .07 .12 .13 .05 .01 .01 .01 .01 .01 .01 .12 .13 .11 .11 .13 .14 .14 .15 .27 .27	1, 200 3, 34 3, 34 3, 34 3, 34 3, 34 3, 34 3, 30 3, 30 3	0.32 .33 .33 .33 .33 .33 .33 .33 .13 .13 .13	200 200 200 200 200 200 200 200 200 200		7,400 9,100 3,500 (7) 1,000 4,100 (7) 16,200 16,200 16,200 9,100 9,100 9,100 9,100 9,100 9,100 14,210 14,210 14,210 14,210 14,210 12,410 12,51

TABLE 3.13.—Test validities used in determining weights for November 1943 battery, together with approximate numbers of cases

Battery of July 1943 (nelude) a different form of this test,
 Estimate 1 from data on 7,000 cases to sted with various forms of test, which gave empirical value of 0.3%
 Estimate 1 value for new form; empirical value 0.22 on this form based on 13,709 cases,
 Estimated values. Empirical values 0.34 and 0.33 respectively.

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Three test revisions were included in the new battery. In the case of the new forms of the Mechanical Principles test and the Reading Comprehension test it was assumed that validity would be unchanged, In the case of the General Information test it was assumed that the pilot validity would be raised from 0.22 to 0.30 as the result of the inclusion of new material, especially on flying and automobile driving. It was recognized that the obtained navigator test validities were low because of the marked restriction of range on the basis of the navigator stanine. Men with navigator stanines below 5 had not been admitted to training. Although no systematic correction was made for this curtailment, the validities of Mathematics and Arithmetic Reasoning tests were estimated as 0.50 and 0.45 respectively instead of using the lower figures based on actual data. No analysis was made of the Aiming Stress Test since on the basis of its approximately zero validity it had been decided to drop it from the battery. For tests in the July 1943 battery, the intercorrelations based on 3,000 cases, shown in table 3.12 of this report were used. For the new research tests correlations computed by the developing units were available and were supplemented in certain cases with estimated values. The Instrument Comprehension Test, Part II, developed at Psychological Research Unit No. 3, and which had been found to have a high pilot validity, was introduced into the battery while Part I of the same test, involving predominantly verbal skills, was introduced with a negative weight for pilot. This was the only time during the war that a "suppression variable" was included in the classification battery.

Two printed tests, Speed of Identification involving quick comparison of airplane silhouettes, and Numerical Operations involving simple speeded arithmetic, were dropped from the battery, only to be reinstated several months later. The place of the Aiming Stress Test in the psychomotor battery was taken by the Rudder Control test, originally designed as a training device but found by Psychological Research Unit No. 3 to have a high validity for prediction of success in pilot training.

The regression weights shown from the analysis of the intercorrelation and validities are given in table 3.14. Except for Instrument Comprehension I, no negative weights were used. In the development of the weights for pilot the procedure was adopted of determining the regression weights for the tests already in the classification and determining the multiple correlation for this weighted 'omposite. Then, treating the battery of July 1943 as one variable and the new research tests as additional variables, weights were determined for the research tests considered for inclusion in the new battery. In addition to showing the actual regression weights, table 3.14 shows

Test	Code	Bstt	1543 cr3. ol	July	Batt	ery of 1943	Nov.	Pei	rcenta elghu	E0 .
		n	N	° P	·B	N	P	B	N	1
Printed tests: Reading comprehension	CI6140. CP501B. CP501B. CP501B. CP501B. CP502A. CF502D. CF502D. CF503C. CF503C. CF503C. CF503C. CF503C. CF702B. CF606B. CF616A. CF616A. CF616A. CF616A. CF702B. CF610A. CM503A. CM501A. CM104A. CM101A. CM101A. CM101A. CM101A. CM101A.	0. 05 .06 .05 .02 .03 .03 .03	0.02 .13 .11 .22 .11 ² .11 ² 	0.06 .07 .07 .04 .17 .09 .13	0.06 ⁺	0.02 .13 .11 .22 .11 .11 .22 .15 		8 14 8 12 12 12 19 27 	2 10 9 13 13 13 13 13 13 13 13 13 13 13 14 14 14 14 14 14 14 14 14 14 14 14 14	
Multiple R.		, 295	. 008	. 519	.371	. 678	. 509			

TABLE 3.14.—Regression weights of classification and research tests for dailery of November 1943.

the weights expressed as percentages of the total. Desired weights, raw score weights, standard deviations and effective weights, are given in table 3.15.

On the basis of this statistical analysis it was estimated that the validities of the bombardier and navigator stanines would remain unchanged but that the validity of the pilot stanine would be increased from 0.52 to 0.57.

As a further step toward insuring uniform meaning to aptitude scores computed at all units, tables for converting aggregate weighted scores into stanines were provided the new Medical and Psychological Examining Units.

Classification Procedures

Minimum qualifying stanine for navigator training remained at 6 and for pilot training 4, while for bombardier training minimum requirements were for a bombardier stanine of 5, together with a navigator stanine of 4. These cut-offs were determined by a careful study of the training quotas, of numbers of men available for testing, of the proportions of men expressing first choice for the three aircrew specialties and the percentages of the total group who would be recommended for the different specialties on the basis of varying minimum qualifying scores. On 15 November 1943, after the battery had been in effect for 2 weeks, minimum qualifying stanines were raised as follows: for bombardier training a stanine of 5, accompanied

TABLE 3.15.—The classification battery of November 1943

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	191	Printed tests: Reading comprehension IL Spatial orientation I Final and table reading. Dial and table reading. Nechanical datapilot Horrayhir-al datapilot Horrayhir-al databaw General informatics. Arithmetic reasoning. Instrument comprehension II. Instrument comprehension II. Instrument comprehension II. SAM rotary pursuit with divided attention. First dattetty. SAM discrimination reaction time. SAM two hand coordination.

3 Applied to raw scores on printed tests and standard scores on apparatus terts.

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by a navigator stanine of 5; for navigator training a navigator stanine of 7; and for pilot training a pilot stanine of 5. Standards were raised again on 27 December 1943 by requiring a minimum stanine of 6 for pilot training and a minimum bombardier stanine of 6 accompanied by a navigator stanine of 5 for bombardier training. The minimum stanine for navigator training remained 7. The bonus of 2 or 3 points added to the pilot stanine for previous flying experience was continued.

With the inauguration of testing in the Medical and Psychological Examining Units at the basic training centers, men were accepted for aircrew training on the basis of the psychological tests but were not actually classified for a particular specialty. At the basic training centers stanines were entered on records ("Classification Folders"), which accompanied the candidate through college training or so-called "on-the-line" training prior to preflight. Classification was determined at the preflight school on the basis of recorded stanines and the recommendations of a board which included a representative of a Psychological Reseach Unit. At this time the Psychological Research Units continued to test candidates who had been in a college training detachment, but not previously tested at a basic training center, prior to entrance to preflight.

One further change in the use of this classification battery occurred on 8 May 1944 when it was directed that a bonus of one stanine point should be added to all stanines of candidates with combat crew duty overseas, provided that they had completed the prescribed number of missions in their theater or had been returned to the United States before completion of the prescribed number of missions because of wounds, accidents, or evasion of capture. Such a provision had not been in effect previously because combat returnees had not been available as candidates for flying training. At the same time that this policy was set up it was proposed to make studies to determine whether overseas flying experience increased aptitude ratings.

## **Statistical Data**

Intercorrelations of the tests for a population tested in the Psychological Research Units are shown in table 3.16 and for a population tested in the Medical and Psychological Examining Units in table 3.17.

# THE CLASSIFICATION BATTERY OF SEPTEMBER 1944

Soveral considerations led to new changes in the Classification battery. It appeared to be desirable to make separate predictions for bomber pilot and fighter pilot, since the training for these specialties

TARLE 3.17.—Intercorrelations of all tests of classification buttery of November 1945. Medical and Psychological Examining Units 4 through 10 [0061-N]

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22. Pilot stanine		1	-	5	_		_	_		_	_	_	_	_			-	-	-	-	-	-		

² Based on the scoring formula Rol/4W.

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differed after Basic school and it seemed probab¹ that different aptitudes were required. More and more emphasis was being placed on gunnery training, and the chief source of gunners was men who were disqualified candidates for officer aircrew positions. A large proportion of men who failed to meet stanine requirements for bombardier, na igator, or pilot were now being assigned to one of the several types of gunnery training. In addition, additional evidence had accumulated on the validities of certain experimental tests.

# Introduction of New Stanines

Instead of three stanines it was decided to compute seven: bombardier, navigator, bomb pilot, fighter pilot, aerial gunner, air mechanicgunner and radio operator-gunner. Some data on validities of the classification tests for predicting success in radio operator training, air mechanic training, and gunnery training were available, but relatively little was known about the tests which would best differentiate between potential fighter pilots and potential bomb pilots. Job analyses, however, indicated that the bomber pilot would probably require more of the aptitudes required by the Reading Comprehension Test, Mechanical Principles Test, and the Dial and Table Reading Test than the fighter pilot. On the other hand, the fighter pilot probably required greater speed of perception and faster reaction time.

A new form of the General Information Test was available as well as two new printed tests; a test of judgment, which was weighted only for bomber pilot, and a test of mechanical information which was weighted only for air mechanic-gunner and radio operator-gunner. Two tests which had been dropped from the battery were reinstated; Speed of Identification, used for fighter pilot and the gunnery specialties, and Numerical Operations, weighted for bombardier, navigator and radio operator-gunner. The verbal portion of the Instrument Comprehension Test, which had been used in the preceding battery with negative weight, was dropped out. A new model of the Rudder Control Test, designed by the AAF School of Aviation Medicine, was being constructed and was actually introduced into the battery on 17 November 1944. The composition of the battery is shown in table 3.18.

#### Intercorrelations of Stanines

As one of the statistical procedures incident to the development of the new stanines, the intercorrelations of stanines and the officer quality score were estimated from test intercorrelations, standard deviations and weights. These estimated correlations, together with correlations obtained later on a population of 5,000 aircrew candidates, are shown in

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table 3.19. The close agreement between correlations estimated in advance and the correlations obtained later is evidence that information about the nature of the tests was relatively complete at the time the battery was formulated.

TABLE 3.19.—Intercorrelations of stanines and officer quality score of September 1944 battery

[Correlations estimated at the time the battery was proposed are shown above the diagonal; obtained, correlations ( $N = \delta_1 000$ ) below the diagonalj.

Stanine	- 1	2		-4	8	6	27	
Fighter pilot.     Bomber pilot.     Bomber pilot.     Bomber pilot.     Bomber pilot.     Seado operator-gunner.     Carcer gunner.     Air mechanic-gunner.     Giffeer quality score.	0.90 .64 .50 .63 .53 .53 .54	9, 91 .65 .58 .67 .82 .82 .82	0.65 .65 .88 .87 .53 .75	0.50 .56 .58 .89 .62 .69 .81	0.373 827	0. 56 . 51 . 76 . 56 . 76 . 76 . 76 . 76 . 89 . 67	0.84 .13 .13 .13 .13 .13 .13 .13 .13 .13 .13	0.87 .71 .70 .76 .64 .61

# **Classification Procedures**

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Since studies had shown that men with previous experience in flying airplanes made substantially higher scores on a number of the tests in the classification battery, credit for previous flying experience was eliminated at this time. The policy of giving 1-point credit on each stanine to men with previous combat experience was continued up to 5 April 1945. It was then discontinued because it was shown that men with prior combat experience also tended to have substantially higher scores on classification tests.

For bombardier training, the minimum stanine requirement was a bombardier stanine of 6, the simultaneous requirement of a minimum navigator stanine being eliminated. The minimum stanine for navigator training remained 7, and for either bomber pilot or fighter pilot training, the stanine remained 6. Effective 24 October 1944, all stanine requirements became a minimum stanine of 7 in the specialty in which the individual was to be trained. This was in line with greatly reduced training quotas. In actual practice, the new bomber pilot and fighter pilot stanines were used to differentiate between men assigned to the two types of training, but quotas were so reduced that few men classified with this battery were ever trained. The gunnery stanines were computed on all candidates, but in general were not used.

# Introduction of Single Digit Scores

A radical change in recording procedures was introduced on 1 April 1945 in that before weights were applied raw scores on all printed and psychomotor tests were converted to single digit standard scores ranging from 1 to 9, with a mean of 5 and standard deviation of 2. The purpose of this change was to simplify recording and statistical procedures. Empirical studies performed at Fort Worth had demonstrated that these single digit scores had the same validities and intercorrelations as the two-digit scores when large numbers of cases were used, and that the loss of precision was negligible. The quantities of data which had accumulated at Training Connand Headquarters had proved to be unwieldy to handle even with tabulating machine techniques, but with the use of single digit scores it was possible to have a single card for each man, containing identification, all test scores and stanines, and adequate space for recording training success. Had this step been introduced earlier, it would have considerably facilitated statistical operations.

#### Intercorrelations

Intercorrelations of the tests and stanines of the September 1944 Battery are presented in table 3.20.

# THE CLASSIFICATION BATTERY OF JUNE 1945

The last revision of the classification battery during the war time program was the battery effective 13 June 1945. The three gunnery stanines were replaced by a single aerial gunnery stanine which was actually used in the selection of men to be trained as B-29 gunners. At three of the Medical and Psychological Examining Units large numbers of men who were not candidates for the other aircrew positions were tested to segregate B-29 gunners from other types of gunnery students. The weightings for this specialty were based upon job analyses and one test, the Pedestal Sight Manipulation Test, with high face validity for gunnery, was introduced into the battery, carrying 20 percent of the weight for the specialty. The Two-Hand Coordination Test was replaced with the SAM Two-Hand Pursuit Test. Two new stanines were introduced: flight engineer and radar observer. The weights for these two specialties were based on job analyses and, in the case of radar operator, on validity data accumulated by Aircrew Evaluation and Research Detachment No. 1 in the European Theater of Operations. A Coordinate Reading Test was introduced with a weight only for radar operator. The composition of the battery is given in table 3.21.

When the battery was introduced, a minimum stanine of 7 was required for the original aircrew specialties and for flight engineer. The minimum stanine requirement for flight engineer was reduced to 6 because of stepped-up training program in that specialty. Most of the men being trained as radar operators had already been processed, so the stanine requirement was expressed as a navigator stanine of 8. For B-29 gunners a minimum aerial gunner stanine of 5 was required. These requirements continued until the end of the war.

Variable	Code	1	2	3 '	4	. <b>₿</b> :_`	•	<b>7</b> ° .	.8 /	. •.	
tanines:			3			1.	2 3		; ;		-
1. Bombardler.			0.85	0.04	0.64	0.79	0.83	0.81	0.73	0.11.	0
2. Navigator		0.85			.:0	. 62	. 69	. 89	. 82	.05	1
3. Bomber pllos.		. 66	.58		. 00	.82	.82	. 67	. 43.	. 53	1
4. Fighter pilot		.64	.:0	.90		.81	. 8)	. 63	.35	. 42	1.
5. Aerial gunner.		. 79	.62	. 82	.83		. 55	. 78	17	25	Ľ
6. Mechanic armorer-gunner	i <i>.</i>	.ស	60,	.82	. 80	. 89	•	.83	. 54	1.21	Ι.
7. Radio operator-gunner		, 88	. 89	.67	.63	.78	. 33		.75	1 . 11	
rinted tests:			[					[ ]	2		1
8. Dial and table reading	CP622-621A	.73	.82	. 43	. 33	. 47	. 54	.75		.0[:	
9. Biographical data, pilot	CE602D	.11	.01	, 53	. 42	,25	.25	.11	:01		J.,
10. Biographical data, navigator.	CE002D	.14	.27	.11	.05	.03	.03	. 11	, 15	, 18	
11. Spatial orientation I	GP501B	.56	.50	.35	.34	. 36	. 39	.41	.41	.0)	Ι.
13. Spatial orientation II	CP503B	. 35	. 36	. 51	, 45	.44	. 47	.42	35	.13	1
13. Reading comprehension	CI614H	. 15	.63	. 45	.31	. 46	: 50	.61	.41	.01	1.
14. Instrument comprehension	CI616C	. 49	.45	. 60	.GA	, 50	.51	. 45	.37	. 17	1.
15. Mechanical principles	C1903B	, 40	, 37	.75	<b>.</b> (3)	. 63	.65	. 44	.71	.7	
16. Speed of identification.	CP610A	.40	.35	.31	.41	. 12	. 49	. (4	, 32	.12	1
17. Numerical operations I	C1702B	. 19	60	.12	.11	. 19	.25	. 69	. 53	14	L
18. Numerical operations II.	C1702B	.53	.65	. 20	.17	. 26	.32	. 85	.55	10	Ł
19. Mechanical information	C1905B	.14	.10	.47	.43	. 33	. 51	.23	.02	.15	
20. Cleneral information	CE505F	.25	.21	. (9	. 65	.35	.42	.31	.14	.37	
21. Judgment	CI301C	.37	. 39	. 49	.31	. 35	.38	, 39	.21	1.13	Ł
22. Arithmetic reasoning	CI20/C	. 56	.73	.37	.27	. 37	.42	. 68	. 50	32	
pparatus tests:					1					1	1
23. Rotary pursuit	CP410B	.30	, 16	.45	.41	, 50	.41	.35	.14	1.11	}
24. Rudder control	CM120B	. 20	.02	. 63	.65	.41	.33		.05	.31	-
25. Finger dexterity	CMIIGA	.:0	.24	.23	.25	,32	.45	, 21	.21	.07	Į.
26. Complex coordination	CM701A	. 57	, 35	.62	. 68	.68	263	. 49	.34	. 19	Ł
27. Two hand coordination	CM101A	.44	.21	.44	.54	.67	. 53	.44	. 21	39	1
23. Discrimination reaction time	CP611D	.73	. 55	. 44	ຸ. ສ	. 63	.63	.41	.45	.00	
á											ł
J. Omcer quality score		.75	1.81	. 69	.54	, 67	.70	.79	. 55	. 10	1

# TABLE 3.20 .- Intercorrelations of lests and staning

7 1 1	, Ì ,	10	i n	12	13	14	15	16	17 '	18	19	30	21	22	23	24	23	28	27	23	29	м	<b>9</b> , D
.58 0. .89 .67 .63 .78 .83	73 0.11 82 .06 43 .53 38 .42 47 .25 58 .25 75 .11	0. 14 . 27 . 11 . 05 . 05 . 05 . 14	0.55	0.55 .56 .51 .45 .44 .47 .42	0.55 .63 .53 .53 .55 .61	0. 49 . 45 . 60 . 64 . 51 . 45	0. 40 . 37 . 75 . 63 . 65 . 41	0.40 .35 .32 .41 .42 .43 .44	0.49. .60 .12 .11 .19 .25 .59	0.53 .65 .20 .17 .25 .32 .65	0, 14 , 10 , 47 , 43 , 33 , 51 , 28	0.25 2.29 2.55 2.55 2.55 2.31	0.37 .99 .99 .33 .33 .33	0.573777777	0.30 .16 .45 .41 .50 .41 .36	0.2023244332	0.50 .24 .23 .25 .32 .48 .31	0257 .35 .63 .63 .63 .62 .49	0.44 .28 .44 .54 .57 .53 .41	0, 73 .55 .44 .51 .68 .62 .62	0.73 .81 .69 .51 .67 .70	4,93 5,33 5,10 4,99 5,03 5,03 5,12	1.9 2.0 1.9 1.9 1.9 1.9 1.9 1.9
75 11 14 42 61 44 50 55 53 39 66	01 .01 15 .18 41 .09 35 .13 37 .17 37 .17 32	.15 .15 .07 .03 .12 .03 .13 .13 .13 .11 .08 .07 .12	.41 .09 .07 .39 .18 .25 .15 .45 .24 .21 .01 .16 .14 .17	.35 .13 .39 .35 .40 .35 .11 .18 .19 .24 .29	4: 01 12 18 33 .34 .34 .34 .34 .34 .34 .34 .34 .34	.37 .17 .023 .36 .34 .40 .27 .18 .231 .21 .21 .237 .25 .29	.22 .27 .15 .40 .34 .40 .16 01 .16 .33 .36	.32 .12 .05 .35 .17 .17 .16 .15 .17 .17 .12 .12 .12 .12 .12	.53 14 .13 .24 .11 .29 .18 01 .15 .67 13 .00 .15 .15 .42	. 55 10 .11 .23 .18 .34 .23 .10 .17 .07 05 .21 .51	.02 .35 08 .019 .19 .21 .44 .05 13 05 13 05 .44 .21 .13	.14 .37 .016 .24 .37 .35 .22 .005 .41 .27 .12	A 10 1 X 4 5 3 12 5 7 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	80221288885224533224 1	.14 .14 .55 .15 .07 .21 .21 .01 .01 .01 .01 .19 .02	5325157752553922 	.22 .07 .18 .14 .11 .15 .09 .19 .16 .15 .01 .01 .01		.21 .20 .21 .20 .11 .20 .21 .23 .23 .23 .25 .23 .25 .25 .25 .25 .25 .25 .25 .25 .25 .25	\$0177877788772557 \$0177877887725577		5,77 5,08 5,08 5,08 5,08 5,08 5,08 5,08 5,10 5,10 5,10 5,10 5,10 5,10 5,10 5,10	
.35 .20 .31 .49	14 .14 05 .25 22 .07 34 .19 31 .29	.05 ~.01 .05 .05	.15 .05 .18 .29 .17	.12 .14 .14 .29 .19	.08 .03 .11 .18 .09	.21 .24 .16 .35 .25	.21 .35 .09 .34 .31	.13 .06 .19 .27 .15	.01 07 .16 .14 .04	.01 05 .15 .17 .07	.09 .28 .04 .19 .27	.16 .29 .03 .21 .17	.10 .12 .03 .20 .13	.02 .02 .10 .19 .19	.35 .25 .49 .33	.36 .11 .42 .34	21 21 22 21 22 22	. 40 . 42 . 23	. 71 . 34 . 24 . 18	.33 .55 .25 .25	.14 .14 .17 .33 .22	1.62 1.83 1.70 5.31 1.87	

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	0.1	•3	Scoring		Ľ,	flect	ivə Ý	reigh	ts us	į Ż		
Test	Code		formula	B	N	bP.	ſ₽.	TZ	RO	٨Ċ	0	ə. D.
Printed tests:	•				, .		2		,			
Dial and table reading	CP621A, 622A,	25	R/2-W/2	10	19	4	0	20	10	· · •	-0	2.6
Blographical data, pllot.	CE602D	lat	(R-W+2)	0	0	1.15	5	<b>i O</b>	Q	0	0	1.0
Bicgraphical data, navi-	CE602D	1 ²⁵	N + 20	0	8	. 0	0	0	4	0	0	20
galor.	í	<b>F</b> .		1	1	1 . i						
Spatial orientation I	CP501B	f \$	B-W	10		3	0	. 0	10	0	- •	-1.0
Spatial orientation II	CP:03B	18	R-W+20	10	1.14	5	1	:0	° O	0		2.0
Reading comprehension.	CI614H	30	28-W/2	9	] <i>~</i> 10	1.8	· 0	15	0	ю	41	. 20
Instrument comprehen	CI616C	15	_R-W/4	0	0	7	12	0	10		, <b>e</b>	2.0
sion.	0.000		·				2	2				
Mechanical principles	CINSB	20	R-W/2+20.	2	0	12		11	2	10	1	7.0.
speed of identification	CPGIGA	. •	R-W		0.	Q.	3	9	2	- 500		
Numerical operations,	CITUZB	11		11.	1	· Q.	v	l a	0	6	1 <b>.</b> .	
Iront.	armin .	10	K/2-4W/2	<b>K</b> .		۲ م ^۱		· •			: .	· • •
Numerical operations,:	CINVAB	h I		1.0	1. Y.	2 "				· **:	. •	
DECK.	CIMER'	1	5 W 6			ا م ا						• •
Goural information.	CENSE	14	Diabta				- 18-	2		10		51
Tulemont	C1201C	3	20,218,14			7	10	ă	à		19	
A situatio magoning	Cinco	140	211-211/9	i i	1 56	ľ .		20	10		ii ii	57
Coordinate reading	CP24B	m a	Dishte	ŏ	1.0	l ä	ň	ĩ	20		6	2.4
A marafus festa:		<b>–</b>			<b>1</b>		) <b>•</b> (		а <b>т</b> ,			
SAM rotary purmit	CP410B	15	a	0	0	- 2	0	° 0	' <b>0</b> `	. 0		1.
with divided atten-										á 🐂	· •	
tion.		j .						í í	ľ			
Rudder control	CM120B	1 15		Ó	0	1 8	18	0	. 0	. 0	0	2.0
Finger dexterity.	CM116A	1.15		14	ĪŌ	- Ō'	0	Ó	Ō	10	Ó	2.0
SAM complex coordina-	CM701E	15	Standard )	-6	lē	10	13	ë	20	20	. 0	2.0
tion.			acores .		ľ	( · · · /						<u>^</u>
8AM two hand pursuit.	CM810A	115		8	1	0	1	0	20	20	0	- 29
<b>BAM</b> discrimination re-	CP611D	15		. 18	5	0		P12	. 0	. 0		2.)
action time:	1	ľ	() [	Í	ľ.,			÷	۲ <u>΄</u>	۲. J		
Pedestal sight manip-	CM824A'	1.15		.0	j O	0	- 0	. 0	• • <b>Q</b>	20		-2,0/
ulation.	1		V - 1	1	l	ľ				I. I	Ň	C C

TABLE 3.21.—The classification ballery of June 1945

#### **REEXAMINATION POLICIES AND PRACTICES**

Since an early study showed that there were increments on test scores, particularly on apparatus tests, from test to retest, the general policy adopted in the classification program was to allow no retesting. Certain exceptions to this policy were made beginning in 1943.

In April 1943 it was directed that aircrew candidates who were fully qualified physically for flying duty and who were not assigned to any air-crew training because of low psychological aptitude scores and who had not been through the college training course, were to be returned to a basic training center for military and college training. When these students returned to a classification center they were retested on the classification battery then current. In computing stanines, however, new scores were used on General Information, Mathematics, Reading Comprehension, Numerical Operations and any tests not administered at the time of the original examination, while original scores were used on psychomotor tests and perceptual tests. In October the policy was changed to allow new stanines computed entirely on the basis of the new tests.

In December 1943, a general policy on retesting was adopted which allowed retests only for the following groups: (1) the group described

above, that is, men disqualified from air-crew training on the basis of aptitude scores and then sent to college training detachments; (2) men tested before 4 July 1942 and (3) men who had returned from combat. The reason for allowing retesting of men tested before 4 July 1942 was that prior to this time the classification models of the apparatus tests had not been used in the classification battery and that since that time most of the printed tests had changed. It was believed that the composition of the original batteries was sufficiently different from that of the battery then in use so that the retest effect would be negligible. Returnees from combat were believed to be excellent prospects for aircrew training. The officer group was composed almost exclusively of returned bombardiers and navigators seeking pilot training while the enlisted returnees had flight experience and had passed the AAF Qualifying Examination.

Several studies were made of changes in scores between original and second testing. In table 3.22 are shown original and retest aggregate weighted scores for seven stanines, together with the improvement in terms of the standard deviation obtained from the original testing.

	Original	N=703	Relest 1	N-708	Mr-Mi	_
	M ₁ .	8D.	M	SD1	SD1	<b>F</b>
Bombardler	65. 81	10.08	79. 53	10.20	1.36	0.86
Navigator Bomber pilot Fichter pilot	63.54 58.10	10.79	77.03 71.39	11.75	1.12	. 91
Aerial gunner	84.67 86,39	8.72 8.37	74.10	8.61 8.53	1.77	.98 .90
Radio operator-gunner	60.79	10.99	78.10	11.22	1.39	.9

TABLE 3.22.—Correlations between original and relest raw composite aggregate weighted scores

TAME 3.23.—Means, SD's, and correlations of first and second testing (standars scores used on psychomotor tests). Aircrew candidates retested after college training

	Code	N	Orl	gin <b>ai</b>	Re	tcet	Mr-Mi	1
			Mi	8D1	Mı	8D,	8D1	
Tosta: Mechanical principles	CI903A CI960A CI9402 CI9403 CI4735B CI	231 231 265 368 368 368 368 368 368 368 2368 2368 2	32, 70 32, 34 8, 77 22, 39 14, 29 22, 39 14, 29 35, 99 11, 28 36, 77 1, 79 2, 52 1, 70	15, 10 7, 14 7, 82 5, 09 6, 44 8, 01 7, 45 10, 01 11, 03 1, 23 . 89	46, 94 31, 51 16, 20 25, 64 17, 89 29, 42 55, 65 55, 65 50, 96 14, 00 51, 72 5, 00 4, 35 5, 04	15.36 6.94 8.83 6.22 6.59 8 03 10.13 10.02 9.67 12.20 9.54 1.67 1.31 1.63	0.94 954 954 1.86 1.86 1.86 1.86 1.85 1.85 1.49 3.75	0.06

This study was performed at Medical and Psychological Examining Unit No. 6 on candidates who were retested shortly after the original testing. It is noted that the improvement in all cases is more than one standard deviation.

In table 3.23 are shown test and retest scores for aviation students returned to classification centers after college training. The improvement in stanines, evaluated in terms of mean difference divided by standard deviation of the original testing is in all cases greater than for simple retest.

In table 3.24 are shown original and retest stanines of 314 retested combat returnees, bombardiers and navigators, together with an evaluation of the increase in terms of the standard deviation of the original testing.

<b>R</b> haulan	Orig	inal	Re	læi	Mr-Me
8183100	M ₁	8Di	M1	8Ds	8D1
Bombardier Navigator	5, 34 8, 90	1.00 1.97	1.50 8.51	0.92	1.64
Pilot Fighter pilot	4.63	1.94	7.79 7.92	1.36 1.30	1.00

TABLE 3.24.—Showing means and standard deviations of original and recest stanines of 314 bombardiers and navigators who score releated after tour of combat duly

* Ma was computed by averaging the means of the fighter pilot and bomber pilot stanines,

# CHAPTER FOUR_

# **Results of Validity Studies**

# STANINE VALIDITIES IN PILOT TRAINING

Throughout the war a major research effort of the Aviation Psychology Program was the continuous evaluation of the usefulness oftests, stanines and other data in predicting air-crew success, with the general purpose of improving selection and classification procedures. Much of this validation was accomplished by the Statistical Unit at Training Command Headquarters, where classification data were recorded beginning in August 1942 and where collected records of training success were collated with the classification data. Validities of stanines and nontest data, such as age and education, for various types of training are presented in this chapter, while validities of apparatus tests are given in report No. 4 and of printed tests in report No. 5 of this series.

The criterion of success generally used in studies of the validities of tests and stanines was graduation or elimination from a phase of training. This criterion was selected as the most practical and realistic criterion available from Training Command sources. It was realized that measures of performance in combat were ultimate criteria against which to judge the usefulness of classification procedures, but until relatively late in the war such criteria were not available on men processed with the complete classification battery. Studies of the validation of tests and stanines against combat criteria available in the theatres of war are presented in report No. 17 of this series.

The considerations which led to the selection of graduation-elimination from various phases of training as the general criterion for immediate use are given in report No. 3 of this series, *Research Problems and Techniques*. In the studies represented in this chapter, only categories of elimination which might reasonably be considered as predictable by classification tests were included in the general category of eliminations. These were eliminations for flying deficiency, for fear and at own request. Since flying deficiency was probably a factor in many cases of elimination for fear or at own request, it seemed reasonable to lump these three categories together. In routine validation studies, men who were eliminated from flying training

for physical reasons or for administrative reasons, such as disciplinary action, were excluded. In general, holdovers from previous classes and holdovers to succeeding classes were also eliminated from consideration since in most types of flying training the chief reason for being held over to a succeeding class was absence because of illness or emergency furlough.

In the studies reported in this chapter, all subjects were men in enlisted or cadet status without prior military flight training, unless otherwise identified. Student officers, men previously eliminated from another type of flight training and foreign students were excluded. A few studies of student officers and other special categories are reported separately.

In computing validities against the pass-fail criterion, the biserial coefficient correlation was used routinely, since it appeared that success in a flying school, if measured more precisely than simple plucement in one of two categories, would yield a continuous variable with a normal distribution. The situation, therefore, fitted the assumptions underlying the derivation of the formula for biserial correlation, namely, a continuous variable such as a distribution of stanines or test scores, to be correlated against a distribution upon which a dichotomy had been forced, graduation or elimination from training.

As the war progressed and psychological procedures for selection and classification became more firmly established in the Air Forces, more and more reliance was placed on psychological procedures in deciding who should be admitted to training. At the end of the war, for example, only men with stanines of 7 or better were considered for training in a specialty. This reduction of range of abilities as measured by the tests was, of course, reflected in lower biserial correlations. In order to make results from class to class comparable, it was decided to correct biserials for restriction of range. The details of this problem and the formulas are presented in Report No. 3. In general, the standard deviation of a stanine in the unrestricted range was assumed to be 2.00, except when experience credit had been added to the pilot stanine (to constitute the so-called "augmented" pilot stanine) in which case the standard deviation in the unrestricted range was assumed to be 2.10.

Most of the validity studies were by classes rather than by classification battery or place at which the individual was tested. While it might have been theoretically desirable to validate stanines for different batteries separately, this was done only when detailed studies of the individual batteries were made. Air Force administrative officers made no distinction between batteries, and the pilot stanine which was entered in their records was the augmented pilot stanine. Accordingly, this was used in most validation studies.

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# Prediction of Success in Elementatry Pilot Training

Actual pilot training, in which the students were trained on airplanes, was divided into three phases : elementary or primary training. basic, and advanced. At the successful conclusion of advanced training the student was rated, received his wings, and was either commissioned a second lieutenant or appointed a flight officer. Following graduation, the pilot received "transition" training on specialized. aircraft prior to transfer to the Continental Air Forces for operational training and eventual shipment overseas to combat.

Prior to elementary training, aviation cadets had ground school courses in preflight school. Prior to preflight, candidates for aviation training had basic military training at a classification center or a basictraining center. In addition, many attended a college training dotachment or were assigned duties at an Air Force installation while awaiting assignment to preflight school. Details of the training of pilot students are to be found in Report No. 8 in this series.

The composition of original elementary pilot Classes 43-H through 45-H is shown by augmented pilot staning in table 4.1. The staning included the experience credit of 2 or 3 points for men-who had soloed an aircraft prior to entry into military flight training. The same information by percentages is given in table 4.2.

The table begins with the first class for which test data at Headquarters Training Command were relatively complete. Sufficient information on two prior classes was available for validity studies, but

All	commands	combined.	Holdover	from ;	previous includ	class rd]	es exclu	ded; hol	dovers	to succe	stin <b>g</b> -	classes
			Distributio	n by sta	nine (ex	perlen	ice credli	l include	4)	N pre- vious		
Cl	ass Tota N	1 1	2 2		5	6	1,		•	flying experi-	M _i	8D.

PABLE 4.1.—Composit	ion of original clementary pilot classes, 43–11 through 45–1
All commands combined.	Holdovers from previous classes excluded; holdovers to succeeding classes

			Dist	ributio	n by sta	nine (es	sperleno	e credit	Include	4)	N pre- vious		
Class	Total N	1	2	. 3	4	<b>5</b> .	6	7		•	flying experi- epce	Μ ₄	8D.
43-II         43-J         41-II         41-I         41-I	0.0.1.1.2.2.0.2.5.2.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.2.5.5.2.5.5.2.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5.5	272 1258 224 11 6 6 3 6 4 4 12 0 1 1 6 6 1 1 1 0 0 1 1 1 0	555 3155 557 557 557 557 555 555 155 155 155	1,058 1,058 1,551 1,051 1,051 1,052 1,052 1,052 1,052 1,052 1,052 1,052 1,052 1,052 1,052 1,052 1,054 1,054 1,054 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 1,055 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45-H	663	0	0	•	1 13	28	214	1 133	16	133	1 124	e 23	1.42

	Totel	Fercentage of total class in each stanine (experience credit included)									
	Ň	 1	2	8	4	5	. •	. 7	8.	•	flying expe- rience
5-II	10, 224 10, 479 11, 071 11, 675	2,56 1,31 .52 .22	8,75 3,01 1,49 ,51	10. 74 10. 49 5. 98 8. 44	17.55 14.78 15.70 15.74	19.06 19.71 21.27 20.70	17.39 17.42 17.94 20.25	12,75 13,59 14,96 15,06	8, 89 9, 28 8, 64 9, 55	7. 21 10. 21 10. 50 9. 52	8.1 11.1 12.0 13.1
(-A	12, 532 12, 624 12, 959 13, 255	.21 .09 .05 .03	.(?) .2? .65 .3?	10.80 8.10 6.81 7.86 8.75	17.08 12.94 10.92 14.81	20, 52 20, 00 18, 83 21, 20 21, 46	17.67 18.68 18.70 20.91 21.29	14.31 16.96 18.60 17.10	9.32 11.38 12.82 9.60	9.40 11.56 12.62 8.10 7.51	14.1 14.1 7.1
I-F I-O I-O I-II	10, 633 10, 075 8, 296 8, 622	.04 .04 .14 .00	.13 .15 .29 .02	3. 59 1.03 .37 .08	16.24 15.14 13.85. 10.07	22.25 21.24 20.13 21.23	22, 29 23, 33 21, 22 25, 11	17.04 18.09 18.07 20.43	10.28 11.42 12.56 12.31	7.84 9.57 11.07 10.75	8. 8. 7. 8.
+-J	8,402 7,544 6,756 6,652 2,561	.06 .05 .02 .00	.36 .17 .04 .02 .00	.07 .08 .04 .07 .16	3, 12 1, 13 3, 48 10, 07 3, 90	8.34 5.64 15.99 19.02	23.90 29.07 28.63 23.25 27.41	25, 20 25, 30 23, 79 19, 18 20, 93	12, 42 14, 87 14, 25 10, 45 10, 89	20.96 24.04 20.95 17.69	9. 14. 18. 16. 17.
8-1) 8-K 8-F 8-G	. 1,434 1,420 1,348 692	.00 .07 .07 .00	.14 .35 .00 .00	.14 -1.13 .30 .14	5, 51 3, 94 1, 19 1, 45	15.69 19.16 8.24 7.47	24, 24 32, 32 37, 98 37, 28	20, 57 20, 85 21, 51 21, 10	8.02 8.17 9.27 10.12	21.69 14.01 21.44 22.54	20. 12. 25. 21.

Tanix 4.2.—Composition of original clementary pilot classes, 45-H. through 45-H All commands combined. Holdovers from previous classes excluded; holdovers to succeeding classes included

since the system for collecting all test data at the Fort Worth Headquarters was not established until September 1942, Class 43-H was the first on which relatively complete information was available. Class 45-H was the last class during the war with appreciable numbers of now aviation trainces.

The raising of stanine requirements for entrance into flight training is reflected in the tables. In the first class nearly 3 percent of the group had pilot stanine of 1 and nearly 6 percent, 2's. While men with stanines of 1 and 2 entered many later classes, they were generally either those who had been given a waiver because of exceptional circumstances or who had qualified under earlier requirements but for one reason or another entered late classes. The requirement of a minimum stanine of 4 or better began to be effective in practice with Class 44-F, and of 5 or better with 44-J. The percentage of men entering with a stanine of 5 was appreciably reduced in Classes 44-K and 45-A, but four subsequent classes had large groups of 5's. At the end of the war classes were still being graduated that included some men with stanines below 6.

It will be seen from table 4.2 that the percentage of entering students with previous flying experience reached a peak with Class 44-A, dropped below 10 percent for the succeeding nine classes, and then was relatively high for classes beginning with Class 44-K. The elim-

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705324 O-47 (Fuce p. 116)

Chin	Total N	Percént	Percent E, FD	Percent E, FOR	Percent E, PA	Percent	N+ ²	Percent E, FD, and FOR
43-H 43-J 43-J 44-D 44-D 44-D 44-P 44-F 44-F 44-F 44-F 44-S 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 44-J 45-D 45-D 45-D 45-D 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J 45-J	10, 226 10, 479 11, 071 11, 675 12, 532 12, 524 12, 524 12, 524 13, 253 12, 332 10, 075 8, 200 6, 622 8, 402 7, 544 6, 756 6, 652 8, 402 7, 544 6, 756 8, 255 1, 436 1, 436 1, 430 1, 318 6, 558	88.4 81.8 64.7 67.8 74.7 78.7 78.7 78.9 74.3 78.9 75.9 75.9 75.9 75.8 75.8 75.8 75.8 75.8 75.8 75.8 75.8	31.4 31.0 28.3 31.3 11.7 9.4 10.0 13.2 1 11.1 10.0 13.2 1 12.4 9 24.9 24.5 24.5 24.5 24.5 24.5 24.5 24.5 24.5	23 1.9 1.3 1.3 1.3 1.3 1.3 1.3 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	1.334447.97.99.387.9001146808.177	4.4.8.3.27.7.8.4.9.2.7.7.8.4.0.8.8.3.1. 4.4.8.3.2.7.7.8.4.0.2.7.7.8.4.0.8.8.3.1. 2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.2.	9,817 9,927 19,976 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,705 11,7	7.8 34.8 34.8 34.8 37.4 21.2 27.3 14.2 12.2 14.2 14.2 14.2 14.2 14.2 14.2

TABLE 4.3.—Disposition of original elementary pilot classes 45-II through 45-II, all commands combined, holdovers from previous classes excluded

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*. Totals of graduates and eliminees for flying deficiency and for fear and at own request,

Nors: For each class percent of graduates (percent O); percent of eliminations for flying deficiency (percent E, FD), percent of eliminations for far and at own request (percent E, FOR), percent of eliminations for far and at own request (percent E, FOR), percent of eliminations for far and at own request (percent E, FOR), percent of eliminations for far and at own request (percent E, FOR), percent it IO) are indicated. Also are shown the total numbers of graduates and elimination for flying deficiency and for fear and at own request, together with the percentage of elimination for flying deficiency and for fear and at own request to that base.

ination rate, shown in table 4.3, gradually decreased from approximately 38 percent in Class 43-H to 12 percent in Class 43-H to 12 percent in Class 44-F and then climbed to somewhat over 25 percent. Changes in the elimination rate were in part fixed by Air Force administrative action. The actual elimination rate reflected in part the actual requirements of the service for pilots. When it was realized that excellent pilot material was being sent into training, the elimination rate in primary training went down. Later, flying standards were raised as abundant numbers of trained pilots became available.

It will be seen from table 4.3 that the chief reason for elimination was flying deficiency. The percentages of elimination for fear and at own request, for physical and administrative reasons, and of men held over to another class were fairly constant except that holdovers increased markedly for the three classes in which the elimination rate was the lowest.

Augmented pilot stanines of graduates and eliminees in these classes are shown in table 4.4 while the percents eliminated in each stanine, based on the same data, are given in table 4.5. These results are prosented graphically in figure 4.1. It will be seen that in all classes the

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	322.00000000000000000000000000000000000	21123000-0000000000000000000000000000000		888 2886 2886 2886 2886 2886 2886 2886	28287222884 <b>3</b>	898353318292920-0-0-0000.	<b>1</b> 3%25588945884557408	2553565248552588552488		\$C3343408843368438883484		¥¥zazzakazarazeazzeazzea	<b>1</b> 000000000000000000000000000000000000	£286£222222222888885553888	2812824255555555555555555555555555555555	ੑਫ਼ੑਸ਼ੑਲ਼ੑਫ਼ੑਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼ਫ਼	C.C.S.E.F.F.S.F.S.S.S.S.S.S.S.S.S.S.S.S.S.S	

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percentage of graduates increased directly with the stanine. The climination rate for men with low stanines was always high. The graduation rate of any given stanine varied directly with the over-all class graduation rate, shown by the heavy line in figure 4.1.

Frequency distributions by stanines for every third class are presented in figures 4.2 through 4.9, which show graphically how the composition of the elementary classes changed from an approximately normal form to a sharply truncated form. Relative numbers of graduates and eliminees are indicated by shading.

Percentages eliminated in each stanine group for the same series of classes are shown graphically in figures 4.10 through 4.17, all of which have been drawn on a uniform percentage scale to facilitate comparison. This type of chart was influential in convincing Air Force officers of the utility of psychological classification procedures. An over-all frequency distribution based on 166,507 cases is presented in figure 4.18, and the corresponding percentages eliminated in figure 4.19.

Biserial validity coefficients of the augmented pilot stanine for all the classes previously discussed, together with two prior classes, are shown for the three Flying Training Commands and for all commands combined in tables 4.6 through 4.9. Table 4.9 also shows the biserial validity coefficients for the three commands, as combined by Fisher's z-technique. These coefficients probably present the best over-all summary, since elimination policies varied somewhat from command to command. The data are shown graphically in figure 4.20.

TABLE 4.5.—Percent eliminated in each augmented	pilot stanine group, elementary
pilot classes 43–II through	45-H

[Based on data of table 4.4]

Class	N.	N.	1	2	3	6	5	6	. 7	د <b>ک</b>	· .0
43-II.	8,617	3, 617	83.3	71.5	60.7	49.6	35.6	29.1	. 20.1	15.2	
43-I	9,921	3, 454	77.7	68.7	62.4	82.6	40, 2	21.5	20.8	5 13.6	6.7
43-J	10, 376	3, 375	71.2	72.1	62.5	51.2	39,0	23, 5	20.9	11.1	8.9
43-K	11,010	3, 221	72.7	69.8	60.5	46, 3	34.2	23, 4	10.2	10.1	7.8
41-A	11,705	3, 204	61.5	61.8	64.7	42.2	31.7	31.4	1 14.8	8.9	4.7
44-B	11,59	2, 519	60.0	82.9	52.3	38.1	27.7	18,7	12.1	6.9	1 21
44-0	12, 232	1,902	60.0	49,3	41.5	31.8	21.4	13,6	8.1	8.1	· 23
4f*D	11, 452	1,635	0.0	40,9	37.3	21.1	1.1	11.6	6.4		
11-6	10, 161	1,213	31.3	44.1	31.3	21.0	19.3	9,1	4.4	21	2.4
41-Y	9,371	1,128	- 73.0	30,8	33.3	23.3	15.6	9/3	3.6	3.7	1.3
44-0	9,455	1, 424	25.0	30.0	5.7	29,5	21.9	14	8,1	3.7	2.5
11-11	7,813	1, 323	43.3	47.8	64.0	33.5	21.9	10.4	10.7	7.0	
· · · · · · · · · · · · · · · · · · ·	6,466	1,269		0.0	0.0	44.0	22.6	20,0	12.0	9.6	7.
11-12-0-0-0-0	8, 137	1, 305	54.5	63.2	10,7	37.5	32.4	74.7	1.3	10.1	1 11
11-K	7,213	1,359	83.3	01.0	2.3	23.8	33.9	21.3	14.9	12.2	- <u></u>
13-A	6,523	1, 313	100.0	100.0	44.0	1 1 1	31.0		26.7	13.1	
13-13	014,5	1,499	100.0	100.9	10.0	33.4	1.9	31.8	41.4	56.1	4.3
13-0	2,432	6.55			20.0	51.1	2.4	771	21.0	10.1	1.1
10-17	1,344	275		20.0	••••	1 22.0	31,2		12.9	10.9	
12-5	1,3.9	378	110.0	100.0	41.3	02.4		31.2	12.0	1.4	
····	1, 2.0	321	1 100.0		10.4	13.0		33.3	23.0	10.1	1 15
17-11	UM I	167	•••••	******	<u>, a</u> e	<b>N</b> . 1		47.0		21	
15-11	200	146			• <u>^</u> •	01.9	40-1	ાનાગ	13(\$	- <b>21.</b> 2	لة مِنْنَا



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FREQUENCY DISTRIBUTION BY STANINE

FREQUENCY DISTRIBUTION BY STANINE

GRADUATES AND ELIMINEES FOR FLYING DEFICIENCY, FEAR, AND OWN REQUEST

ELEMENTARY PILOT TRAINING - PILOT CLASS 43-K ALL FLYING TRAINING COMMANDS COMBINED



* *










FREQUENCY DISTRIBUTION BY STANINE

GRADUATES AND ELIMINEES FOR FLYING DEFICIENCY, FEAR, AND OWN REQUEST

ELEMENTARY PILOT TRAINING - PILOT CLASS 45-G ALL FLYING TRAINING CÓMMANDS COMBINED ંઝ્



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20. PER CENT ELIMINATED FROM ELEMENTARY PILOT TRAINING FOR FLYING DEFICIENCY, FEAR, OR OWN REQUEST FOR EACH APTITUDE RATING Pilot class 45-d; all flying training commands commined THE BISENUL COARELATION COEFFICIENT FOR THESE DATA IS JR; COARECTED FOR RESTRICTED RANGE THIS COARELATION IS 50. 21.5% ELIMINATED PILOT CLASS 45-D 298 ELIMINEES 2 there were a class with artifluer rational or 1, 2, or 2 or two 25 0% mer rluminater. PER CENT 1,384 CASES 2 . 2 2 ...... Ĩ • î 246 -121 •٢ 300111d¥ 1071d SNITAR • -Figure 4.16





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FREQUENCY DISTRIBUTION BY STANINE

GRADUATES AND ELIMINEES FOR FLYING DEFICIENCY, FEAR, AND OWN REQUEST

ELEMENTARY PILOT TRAINING - PILOT CLASSES 43-H THROUGH 45-H ALL FLYING TRAINING COMMANDS COMBINED





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Class	N	Po	M,	м.	8D:	7 5 60	1735e l
 ۵-۲	3,924	0, 848	5,73	4. 51	1.50	0.42	0.47
(3-0	3, 228	.582	5.81	4.31	1,97	. 47	. 60
43-11	3,301		3.93	1.41	1.20	- 12	.52
\$j=1	2,107	1012	6 20	3.04	1.23	.01	
53~3+++++++++++++++++++++++++++++++++++	A 017	603	6 16	1,10	1.50		- 03
95°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°°	4 103	7.80	in	4 5.2	1 75	AL .	
//	4.214	. 701	6 47	4 95	1.50	. 49	.54
44-C	4.515	. \$18	6.44	4.37	1.78	. 50	
44-D	3. 527	.787	6.30	4.85	1,70	.49	.57
4-B	2,875	.863	6.27	4.71	1.61	. 62	.62
41-F	2,437	. \$20	6.32	4.97	1.63	. 49	1,54
44-0	3, 312	.796	6.46	8.33	1.83	.42	1, 19
41-II	2, 597	.779	6.61	6.48	1.63	.43	1,50
44-I	2,3%	.757	6.80	8, 54	1.53	.49	3, 57
4+-J	3, 248	.763	6.82	5.88	1.41	. 40	. 85
41-K	2, 335	.778	7.00	6.07	1.34	,43	.00
4)~ A	2,001	.771	7.13	0.32	1.33	.33	.48
43~13	1, 814	.652	6.56	6.47	1.59	- 42	. 63
\$2"L's Seesessessessessessessessessessessessess	507	.701	6,74	0.87	1.48	. 35	
1/-1/	307	614	0.50	0.03	1.02	. 43	. 33
1-12 1-12	397	.023	0.07	0,33 1,00	1.23		.01
14-C3	214	715	6 02	6.02	1 22		. 10
16.11	211	- /10	0.92	0.04	1,34	• 21	

TABLE 4.8.—The validity of the augmented pilot stanine for predicting graduation or elimination from elementary pilot training, classes 33-F through 45-II, East-ern Flying Training Command

¹ Biserial correlation against graduation-elimination corrected for restriction of range to a theoretical standard deviation of 2.10, except as noted. ³ Corrected to a theoretical standard deviation of 1.87. ³ Corrected to a theoretical standard deviation of 1.90.

TABLE 4.7The validity of	the augmented	pilot staning f	or predicting	gradua-
tion or climination from c	lementary pilot	training, classes	1 43-D through	\$5-II.
Central Flying Training (	Command			

Class	N	P.	M.	м.	SD,	<b>F34</b>	o" > 6a \$
43-D	2,919	0.713	6.05	4. 26	2.02	0.51	0.51
43-E	2,296	.734	5.01	4.03	2.03	. 45	. 46
43-P	2,962	.663	6.02	4.22	2,11	. 52	. 52
43-0	3,385	.000	5, 89	4.33	1.91	. 51	. 65
43-11	3,866	.632	5.91	4,13	1.02	. 63	. 57
43-I	3, 515	. 616	6,39	4.74	1.93	. 53	. 67
43-J	3.158	.611	6, 22	4.88	1.77	.47	. 54
43-K	3,923	.03	6, 19	4.92	1.73	.45	. 52
44-A	3. 819	.632	0,23	4.52	1.80	.48	.64
44-B	3,927	.726	6,39	4.87	1.81		. 15
44-0	4.017	. 618	6 52	5.07	1.79	.40	. 53
41-D	4,030	.852	6 34	4.90	1.71	.40	. 51
41-33,	3, 547	. M.J	6.31	4.77	1.76	.47	.61
44-F	3, 518	.88	6.15	5.07	1.61	. 15	1.80
41-0	3,100	.862	6,47	5,31	1.51	. 11	1.45
41-32	2.615	. 831	6, 57	5,43	1.57	.41	1,47
44-I	2,361	, 805	6,63	5.60	1.38	.40	1.51
4 <b>1-</b> J.,	2 687	.818	7.13	6.21	1.33	.33	.ស
4I-K	2.752	.815	7.54	6.65	1.27	.32	. 83
45-A	2.361	. 868	7.61	6.47	1.39	. 48	.63
45-]]	1.84	1 .779	7.26	0.11	1.19	. 41	. 52
45-C	755	.732	7.01	6.11	1.41	.37	.80
45-1}	611	.789	5.89	5.97	1.00	.35	. 47
45-E.	800	.735	7.15	6 03	1.45	. 10	.00
45-F.		.811	7.70	6.29	1.37	. 57	.73
15-0	271	1 .771	7.52	6.31	1.41	. 19	.65
45-II	145	1 .731	7.07	5.77	1.54		.62

¹ Biserial correlation against graduation-elimination corrected for restriction of range to a theoretical standard deviation of 2.10, except as noted. ¹ Corrected to a theoretical standard deviation of 1.87. ³ Corrected to a theoretical standard deviation of 1.90.

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Class	N	p,	м,	М.	SD:	714	o" b fak
43-B	2, 504	0.733	5.72	4.64	2.07	a. 31	0.51
43-C	2,112	.743	5.28	4.07	2.12	.34	23
43-D	2,603	.726	8.78	4.17	2, 16	.44	.43
43-E	2, 123	.752	8.12	4.19	2,18	. 52	.50
43-7	2, 127	.729	5.09	4.63	1.94	45	.48
43-0	2,803	. 695	5,83	4.55	1,85	.42	.47
43-11	2,890	.643	5.75	4.26	2.03	. 45	. 47
4 <b>3-1</b>	2,915	.743	6.03	4.42	1.97	. 49	.51
43-J	2,946	.719	6. 27	4,69	1.93	.49	. 63
43-K	3,054	.777	6.45	4.00	1,79	.50	.55
41-A	3,751	.802	6.18	4. 69	1.89	,48	. 62
44-B	3,739	.850	6.24	4.70	1.73	.47	. 65
44-Q	3, 874	. 907	6.36	4.69	1.76	.49	.64
44°D	3, 925	.927	5.66	4. 81	1.62	.35	.43
44-Z	3,743	. 903	8.53	4.24	1.63	.40	. 49
4f-Y	3,393	.914	5.65	4.81	1.51	.35	1.42
44-0	2,083	. 890	6.05	4.86	1.57	.29	1,45
44-31	2, 273	.892	6.18	4.95	1.63	.39	2.44
<u>المعام المعام المع</u>	1,719	.860	6.21	6,17	1.47	.38	3,47
4{-}	2, 202	.880	6,56	5. 83	1.44	.37	. 51
41-K	2, 181	.834	7.04	5, 18	1.36	.30	.51
45-A	2, 163	.787	7.14	6.25	L 41	.36	.50
40-10	1,718	.729	7.14	0.97	1. 59	.44	.55
	810	.757	7.06	6.24	1,40	.34	.45
10-1/	337	.817	7.16	6.23	L 49	.35	.47
92-27	430	.781	0.91	6.77	1,39	.47	.63
40°F	407	.741	1 7.30	6,12	1.24	.50	.70
5J-13	179	.070	7.20	6.54	1.19	.23	.45
42-11	212	.755	7.19	0.00	[ 1.44	.49	.63

TABLE 4.8.—The validity of the augmented pilot stanine for predicting graduation or elimination from elementary pilot training, classes 45-B through 45-H, Western Flying Training Command

Biserial correlation against graduation-elimination corrected for restriction of range to a theoretical standard deviation of 2.10, except as noted.
 Corrected to a theoretical standard deviation of 1.87.
 Corrected to a theoretical standard deviation of 1.90.

TABLE 4.0.—The validity of the augmented pilot stanine for predicting graduation or elimination from elementary pilot training, classes 43-F through 45-H, all commands combined

Class	N	Pr	M,	м,	8D,	8640	arsed	ar 3602	r 3 (4 ⁰	0736ch
43- <b>F</b>	9,013	0.672	5.92	4.44	1.95	0.40	0.49		0.45	0.49
43-0,	9,428	, 622	8.84	4.38	1.91	. 47	. 51		. 47	. 51
43-H	9,617	, 621	8.87	4.27	1.99	, 50	. 52		. 60	. 52
43-I	9,927	.652	6.23	4, 63	1.96	. 60	. 63		. 51	.54
43-J	10, 376	. 675	6.28	4.79	1,85	. 49	. 54		. 49	.54
43-K	11,010	.707	6.26	4,86	1.76	. 48	. 54	0.54	. 47	. 34
44-8	11.705	.728	6.11	4.69	1.82	. 47	. 52		.47	. 63
44-B	11.880	. 738	6.37	4.87	1.78	. 48	. 54	. 54	. 49	. 55
44-C	12, 232	.845	6.44	4.92	1.78	. 47	. 53	1 .60	. 48	. 54
4-D	11, 482	.853	6.08	4.81	1.69	.41	.48	. 46	. 43	. 58
44-F.	10, 161	.878	6.00	4.60	1.71	. 44	. 51	1 . 51	. 46	. 55
14-P	9,371	.850	6.12	4.91	1.00	.40	1.46	. 49	. 42	1,49
4-0	9,455	.849	A 33	<u>5 22</u>	1.55	. 39	1.45	48	. 41	9,47
44-11	7,813	.831	6.46	5.36	1.59	. 39	1.14	47	. 41	9, 47
44-1	6.405	. 804	6.57	8.52	1.47	. 41	1.50	. 54	. 43	1,65
44Y	8 137	.815	6.85	8 92	1.42	.37	. 61		.39	.53
44_K	7. 268	. 603	7.24	6.31	1.34	.39	. 65	. 55	.40	.55
1.1	0 525	.790	7.32	6 37	1.40	.39	. 84	52	. 40	.54
14_12	ALL A	721	7.00	X 80	1 41	. 44	. 63	1.00	. 42	. 83
4.0	2 432	790	6 93	H M	1.45	.36	. 40	19	.35	.45
1C T	1 194	785	6 04	8 01	1 54	39		1	.38	. 49
15-17	1 314	217	6.70	i i i i i i i i i i i i i i i i i i i	1 22	40		1 .61		.53
4x_1*	1 200	751	7 21	A 10	1 34		1 .45	1	. 47	.63
45.0	1 CG1	724	7 25	Å 11	1 15	1		1		. 18
50°U		770	1 4 22	A MA		1	1	1 47		
45-H	003	.739	7.23	6.28	1.43	.40	.54	.47	.41	· ·

Biserial correlation against graduation-elimination in three commands combined corrected by Fearson formula to a theoretical standard deviation of 2.10, except as noted.
Corrected by Tuits formula.
For this column biserials in the three commands were combined by Fisher's s-technique.
Biserials in three commands averaged by Fisher's s-technique corrected by Pearson formula to a theoretical standard deviation of 1.87.
Corrected to a theoretical standard deviation of 1.80.

í

For classes 43-K through 45-H the biserials computed for the three commands combined have been corrected both by the Pearson method and by the method developed at Tufts College in 1945.¹ The rationale of the Tufts method is essentially as follows: The x-variable is categorized and in each category the proportion in the upper and lower y-category is obtained. In each category the proportion is converted to a normal deviate. If the correlation is zero the normal deviate will be equal in all categories except for sampling fluctuations. For positive correlation the proportion in the upper category (i. e., high stanines) will increase as the x-variable increases. The normal deviate of that proportion will vary linearly with the x-variable. Thus, if a straight line is fitted to the normal deviates, by least squares, the slope will be indicative of the correlation. The two methods are discussed in detail in Reports Nos. 3 and 21 of this series. In two studies, performed at Psychological Research Unit No. 3,

Santa Ana, Calif., direct comparison of the validities of the pilot stanine in successive batteries was made, using identical individuals. The groups took the tests in both batteries in order to provide the basis for new forms. The comparative validity coefficients for the December 1942 and July 1943 pilot stanines, with and without the bonus for previous flying experience, are shown in table 4.10.

TABLE 4.10.—Validity coefficients	for December	1942 and	July 1945	pilot stanins,
	class 44-0	Ţ	•	

Stanine	Nı	Pc	M,	M	80,	5	156	ersch
December 1942 with credit July 1943 with credit December 1942 without credit July 1943 without credit.	637 537 537 537	0. 935 . 935 . 935 . 935	6, 14 6, 49 5, 92 6, 27	4, ( 5, ( 6, ( 5, (	59 1.70 58 1.65 59 1.65 59 1.65		0. 40 . 42 . 35 . 38	0. 42 . 47 . 38 . 43
¹ The following unrestricted pilot stanine stand	nrd der	lations w	tere used	to cor	rect the vi	uldit	y coel	licients:
					Flying cr in	edit	Flyin	ng credit out
December 1942 staalne, July 1943 stanine.					1	. 63 . 89		1.79 1.80

The correlation (N=513) between the December 1912 and July 1913 pilot stanines was 0.86.

A similar study compared the validities of the July and November 1943 pilot stanines, using a sample of pilots in classes 44-G, 44-H and 44-I, for whom both stanines were available. These results are given in table 4.21.

¹ Memorandum on Training Methods and Results, 31 May 1045, to The U. S. Navy, Bureau of Aeronautics, Special Devices Division, Capt. Luis de Fiores, from Tufts College (L. Carm'chael, P. Rulon, L. Gillman, H. Goode), "Estimate of Correlation Coefficient of a Bivariate Normal Population When S is Truncated and y is Dichotomised."

							-
Stanine	N,	P:	Me	м,	SD,	P bla	s"\$41
July stanine, credit in November stanine, credit in July stanine, credit out November stanine, credit out	405 495 495 495 495	0. 851 . 851 . 851 . 851	5, 99 5, 97 5, 81 5, 83	4.81 4.32 4.74 4.28	1.52 1.74 1.42 1.63	0. 43 . 52 . 41 . 52	0. 51 . 57 . 50 . 58

TABLE 4.11 .- Validation data for July 1943 and November 1943 pilot stanines

¹ The following unrestricted pilot stanine standard deviations computed from the conversion data were used to correct the validity coefficients:

	Flying credit in	Flying credit out
July stanize November stanine	1.91 2.62	1.80 1.93
The July and November pilot stanines were correlated as follows:		
	N	r
Flying credit in	495 495	0.87 ,83

These data show that in each case the new battery was more valid. The failure to find a rising trend in the validity of the pilot stanine over the period of 2 years is probably not an indication that the selection and classification battery did not improve. There are several possible explanations. The range of ability, as measured by the pilot stanine, was successively curtailed at the lower end and it is possible that the correction for curtailment of range was inadequate. It is also possible that there were qualitative changes in the graduation-elimination criterion. Flying standards undoubtedly varied from command to command, from one elementary school to another and from time to time. When the last classes were graduated, the Air Forces had relatively large numbers of pilots, so that the schools may easily have applied higher and different standards than those previously applied. The effect of training in the detachments in the colleges is also unknown, but men with low aptitude for flying may have eliminated themselves from pilot training during the flight instruction which they received in the colleges. As the war progressed and as a backlog of men physically and mentally qualified for pilot training developed, the time between testing and training increased. This factor may have contributed to lowering the validity of the stanines. There is also reason to believe that in some ways the later groups of new aviation trainces were more heterogeneous, since groups with and without college training were mixed and there was considerable variation in the interval between time of testing and entrance into training.

# Validities of the Bombardier and Navigator Stanines in Elementary Pilot Training

For classes 44-J through 45-H the validities of the bombardier and navigator stanines in elementary pilot training are shown in tables 4.12 and 4.13. None of the biserials has been corrected for restriction of range. It can be seen from the tables that the validities of these stanines are significant but much lower than the validities of the pilot stanine. No trend is noted, except possibly the bombardier stanine is less predictive of pilot success in classes 45-F through 45-H. This may reflect the efforts made to make the stanines more specific for each specialty. The three stanines are, of course, positively correlated and job analyses indicated that the aptitudes required in the positions overlapped. Positive validities of stanines other than pilot for pilot training are not surprising.

### TABLE 4.12.—The validity of the bombardier staning in elementary pilot classes 44-J through 45-II

0	East	ern Fly	ring Ti	raining	Com	bnan	Cen	tral Fiz	ing Tr	alning	Comm	bital
CIASS	N	Pr	Me	м.	SD:	· r 544	<u>м</u>	Pe	Mr	M.	8D4	734
44-J 44-K 45-A 45-B 45-C 45-D 45-P 45-F 45-F 45-F 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R 45-R	3, 218 2, 335 2, 001 1, 844 567 353 397 352 214 203	0.765 .778 .771 .662 .701 .742 .625 .660 .715 .729	6.20 6.27 5.80 5.25 5.82 5.82 5.82 5.82 5.82 5.82 5.82	5.28 5.50 4.07 4.65 5.02 4.51 4.51 4.87 4.87 4.87 5.73	1.85 1.85 1.87 1.87 1.89 1.89 1.89 1.55 1.63	0.29 .21 .20 .32 .29 .25 .32 .32 .32 .13 .09 .18	2, 687 2, 752 2, 361 1, 854 755 614 509 411 271 145	0.818 .815 .808 .779 .732 .735 .811 .771 .731	6.27 6.06 5.89 5.81 5.86 5.55 5.55 5.57 6.34	8. 65 8. 41 8. 17 8. 09 8. 22 8. 19 6. 70 4. 73 8. 14 8. 90	1.77 1.63 1.64 1.81 1.77 1.73 1.72 1.63 1.89 1.43	0.28 .22 .25 .27 .21 .21 .22 .21 .22 .22 .21 .22 .21 .13 .17
	West	tern Fl	ying T	rinin	; Com	mand	All '	Trainin	g Com	mands	Comb	lned
44-J 44-K 45-A 45-A 45-D 45-D 45-D 45-P 45-P 45-P 45-P 45-H	2,202 2,181 2,163 1,718 810 397 430 467 179 212	0,8%6 .531 .757 .729 .757 .817 .781 .781 .741 .670 .755	5 50 5 55 5 80 5 81 5 75 5 61 5 49 5 25 5 64 6 21	4.93 5.03 5.28 5.13 5.11 4.87 4.89 4.83 4.80 5.77	1, 50 1, 64 1, 77 1, 76 1, 71 1, 71 1, 71 1, 71 1, 60 1, 49 1, 55 1, 55	0.25 .15 .19 .23 .22 .25 .21 .17 .31 .17	8, 137 7, 6, 525 5, 116 2, 351 1, 351 1, 356 1, 250 661 550	0.815 7.232 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.7777 7.77777 7.7777 7.7777 7.7777 7.7777 7.77777 7.7777 7.7777 7.7777 7.777777	0.11 5.55 5.55 5.55 5.55 5.55 5.55 5.55	5.27 5.36 5.14 6.62 5.11 1.01 4.52 4.53 5.14 5.14 5.41	1.83 1.71 1.81 1.70 1.70 1.70 1.71 1.67	0.28 .27 .27 .27 .27 .27 .27 .10 .10 .17

[Biserial correlations against graduation-elimination are given for all three flying training commands separately and for the combined commands]

### Validities of Nontest Variables in Pilot Training

Table 4.14 shows the validities of age, education, previous flying experience and strength of interest for the three air-crew positions for predicting success in elementary pilot training. This information is incomplete because the computations were not made routinely. From these data it may be concluded that age has a slight negative validity in the neighborhood of -0.12, while previous flying experience has positive validity. While the three coefficients for education

### TABLE 4.13.—The validity of the navigator stanine in elementary pilot classes 44-J through 45-II

[Biserial correlations against graduation-elimination are viven for all three flying training commands separately and for the combiled commands]

<u>Olar</u>	Eastern Flying Training Command Central Flying Training C									Comm	Command		
Clase	N	p,	M.	м.	SD,	<b>T1</b> 4	N	p,	M.	м.	SD,	714	
i-J. K. 5-A. 5-B. 5-C. 5-C. 5-C. 5-F. 5-F. 5-C. 5-C. 5-H.	3, 248 2, 331 2, 001 1, 814 807 353 397 382 214 203	-,765 .778 .771 .6/52 .701 .742 .625 .660 .715 .729	5.53 5.71 5.53 4.93 4.93 4.53 4.77 4.10 4.77 4.69	4.80 4.92 4.87 4.01 4.35 3.87 4.24 3.78 4.33 4.11	1.76 1.75 1.77 1.65 1.41 1.32 1.27 1.15 1.23 1.46	0.25	2,687 2,752 2,361 1,854 755 614 509 441 271 145	0.818 .815 .803 .770 .732 .735 .811 .771 .731	5.63 6.03 5.95 5.60 4.88 4.82 4.94 4.89 5.11 5.77	4.91 5.36 5.10 4.84 4.31 4.35 3.99 4.47 5.08	$\begin{array}{c} 1.61 \\ 1.63 \\ 1.68 \\ 1.66 \\ 1.40 \\ 1.40 \\ 1.51 \\ 1.55 \\ 1.63 \\ 1.52 \end{array}$	0.22.22.22.22.22.22.22.22.22.22.22.22.22	
	Wes	iern Fl	ying T	raining	g Com	naná	All '	Frainin	ig Com	mands	Comb	Ined	
14-J	2, 202 2, 131 2, 163 1, , 18 810 387 430 467 179 212	0.880 .831 .787 .729 .757 .817 .781 .741 .670 .755	5.08 5.14 5.32 5.29 4.95 4.90 4.73 4.40 4.83 5.41	4.48 4.70 4.00 4.55 4.38 4.45 4.22 4.25 4.27 5.12	1.49 1.50 1.60 1.58 1.54 1.52 1.34 1.18 1.29 1.40	0.21 .14 .20 .28 .22 .19 .22 .08 .28 .13	8, 137 7, 208 6, 525 5, 416 2, 432 1, 381 1, 330 1, 290 664 560	0.815 .809 .700 .723 .729 .785 .717 .751 .720 .739	5.45 5.66 5.70 6.29 4.92 4.79 4.83 4.51 4.94 5.25	4.78 5.04 4.03 4.42 4.35 4.20 4.28 4.00 4.38 4.73	1.65 1.67 1.71 1.66 1.45 1.43 1.39 1.34 1.45 1.52	6. 22 12 12 12 12 12 12 12 12 12 12 12 12	

TAULE 4.14.-Biserial validities of nontest variables in elementary pilot training

P redicting variable	Class	Nı	D1	М,	м.	8D;	734
Ags (in years) Education ¹ Previous flying experience ¹	++++++++++++++++++++++++++++++++++++++	5, 540 9, 908 11, 386 5, 450 9, 874 11, 384 9, 935 8, 45% 2, 516	9. 853 625 857 854 628 873 628 873 628 873 628 . 873	22.87 22.68 21.10 4.43 4.54 4.78 4.82 4.67 4.63	21,45 21,154 21,154 21,154 4,50 4,71 5,78 4,61 4,61	2.15 2.24 2.02 1.34 1.40 1.19 .92 .89 1.95	-0.15 10 12 .02 .03 .03 .03 .03 .03
Etrength of interest for navigator 3 Etrength of interest for pilot 4	43-11 44-C 43-H 44-C 43-H	2, 518 11, 422 2, 514 11, 423	. 630 . 836 . 630 . 835	4.29 5.88 7.13 8.66	4.09 6.13 6.78 8.50	2.43 2.10 3.08 .91	.05 07 .07 .10

¹ Coded as follows: 0, 8th grade or less; 1, 9th grade; 2, 10th grade; 3, 11th grade; 4, 12th grade; 5, 1st year college; 6, 2d year college; 7, 3d year college, 8, college graduate. (Professional school graduates omitted.) ³ Coded as follows: 1, commercial pilot's license; 2, privato pilot's license; 3, student pilot certificate with solo privileges; 4, student pilot certificate; 5, passenger in plane but no formal instruction; 6, nover been passenger in plane. (Men with military flying 'instruction omitted.) ³ On scale of 1 (low) to 9 (high).

Intercorrelations of age, strength of interest and stanines based on a randum sample of about 16 percent from each of the three psychological research units-Elementary pilot class 44-0

[N=1701]

										-
	1	2	¥	4	5	6	7	8	м	SD
Age     Birength of interest, D     Strength of interest, N     Birength of interest, P     Bombardler stanine     Navigator stanine     Pilot stanine     Augmented pilot stanine	-0.03 .01 .00 08 13 02 .02	-0.03 .20 .00 12 14 13 10	0.01 .20 13 .21 .21 .21 .21 .21	0.00 13 03 03 03 03 03	-0.08 12 .21 03 .74 .78 .73	-0. 13 14 .29 13 .74 .82 .47	-0.02 15 .11 .02 .78 .52	0.02 16 .09 .04 .72 .47 .94	21, 20 5, 51 5, 54 8, 66 6, 49 6, 88 6, 10 6, 25	L 89 L 89 2 12 .175 L 69 L 74

Standard error of a zero r is 0.02.



are all positive, the highest is 0.03. Strength of interest for pilot seems to have a slight positive validity. These interest ratings were made on a 9-point scale with 1 indicating little or no interest and 9 indicating extremely high interest. Intercorrelations of age and strength of interest for the three specialties and stanines are also shown in table 4.14.

Values of chi-square for three qualitative variables in the prediction of success in elementary pilot training in classes 43-H and 44-C are shown in table 4.15. First preference, i. e., the type of flying training desired by the student, is significantly related to success. Men who preferred pilot training to bombardier or navigator training were less likely to be eliminated. Preference waiver (the degree to which the student wished his preferences to be taken into consideration in his classification and which is described more fully in Report No. 18 of this series) appears to be significantly related in one class but not in the other. Marital status is significantly related to success in class 43-H and possibly in class 44-C. In both classes married men were more likely to succeed.

TABLE 4.15.—Relationship of Ars	st preference, preference seai er and marital sta-
tus to graduation-climination	in elementary pilot training, classes 43-11 and
44-C, evaluated by chi-square	technique

			Orad	uates	Ellm	inces		Table values of x ²		
Variable	Class	Category	N	Per- cent	N	i'er- œut	x ³	t per- cent lavel	5 per- cent lovel	dl
	{43-H	Bembardler. Navigator Pilot	40 78 4, 535	39.2 47.3 61.9	62 87 2, 788	60.8 52.7 33.1	31.33	9.21	5.99	2
First preference	41-C	Bombardler. Navigator	248 657 8 (9)7	75.6 76.0	80 207 1.405	24.4	65.88	9.21	5.99	2
<b>N A A A A A A A A A A</b>	<b> </b> ⁴3-Ⅱ	(W X Y Z.	1, 664 1, 567 2, 617 395	53.4 62.5 65.4 63.0	1, 340 (69 1, 357 232	11.6 37.5 31.6 37.0	73.74	11.34	7. 53	3
Preference walver * {		W	2, 770 977 8, 453	82.6 81.2 84.1	844 146 1,036	17.4 15.8 15.9	4.44	11.34	7.82	3
<b>N.P. 1 N N N N</b>	[43-II	12 Single Married	316 4, 872 1, 294	82.3 59.9 68.2	63 3,203 602	17.7 40.1 31.8	45.25	6.66	3.84	1
einten status	l++-C	Single	7,810	83.2 85.4	1,679	16.8	\$ 6.63	०अ	3.84	1

¹ Coding for preference waiver was as follows:
¹ W I want to be assigned to the kind of nir-crew training for which I show the greatest ability on the tests.
¹ X I want to be assigned to the kind of nir-crew training for which I show the greatest ability on the tests only if my ability for that kind of raining is m.cd greater than for any other kind.
¹ Y I want to be assigned to the kind of air-crew training in which I aim most interested walkes the tests show that I should probably fail in that kind of training.
² Z I want to be assigned to the kind of air-crew training in which I aim most interested crea if the tests show that I should probably fail in that kind of training.

# Validity of the Vilot Stanine in Basic Pilot Training

Table 4.16 shows the validity of the pilot stanine in classes 43-D through 43-J for the three Flying Training Commands separately, for classes 43-F through 43-J and 44-G through 45-D for all com-

mands combined. It can be seen that all validities are positive and moderately high. Table 4.17 gives the validities of the pilot stanine for graduation or elimination from both elementary and basic flying training. The combined validities do not differ greatly from the validities in elementary training alone. Consequently, the pilot stanine can be regarded as a good predictor of success for pilot training through the basic phase. Validities of nontest data predicting success in basic pilot training are shown in table 4.18. Age is negatively related to success in basic pilot training, while previous flying experience is positively related, but both biserials are low. Preference waiver is possibly related, but the other nontest variables are not associated with success in this phase.

TABLE 4.16 The	validity of the	e augmented p	ilot stanine for	r predicting gradua-
tion from basic	pilot training,	Eastern, Cent	tral, and West	ern Flying Training
Commands sept	rately and in	all commands c	combined	•

#### EASTERN FLYING TRAINING COMMAND

······································						
Class	N	Pe	Mr	м,	8D,	<b>7</b> 34
13-D	435	0.754	8 22	\$ 10	1 78	0.9/
43-P	2020	. 857	5.69	A 00	1 81	u.31 97
43-0	1820	.862	5.94	5.16	1.86	.23
4S-H.	2043	. 206	6.00	80.4	1.87	.3
43-1	2057	.948	6.27	5.00	1.89	.17
43-J	2614	. 937	6.39	ā. 55	1.81	. 21
CENTRAL FL	YING TI	RAINING	COMM	ND		
<u>۶</u> ۰-۵	1591	0.915	6.12	δ. 18	2.00	0.23
43-E	1948	. 891	5.98	<u>6 10</u>	1.91	.21
43-P	2139	.800	6.10	5, 21	1.91	.23
43-01	1920	.819	6.07	5, 15	1.79	.29
43-11	2118	.822	6.03	5.18	1.84	.21
43-1	2048	. 812.	6,65	5.40	1.81	.39
43-J	2002	. 801	6.39	5. 55	1.72	.2
WESTERN FI	LYING T	RAINING	сомм.	AND		
	1890	0.907	6.13	5.38	1.84	0.21
43-0	1941	.875	5.92	6.12	1.80	.21
43-II	1818	,848	5.93	4.87	1.90	.30
43-I	2137	.803	6.17	6.13	1.86	.30
43-3	20/3	.876	6.42	δ. 30	1.82	κ.
ALL C	OMMAN	DS COM	BINED			
44-7	6055	0.574	6.04	\$ 16	1.87	0.2
43-0	5631	.852	6.97	8.14	1.82	.2
43-H	6084	. 859	6.01	8.05	1.87	.2
Q-1	6212	.876	6.35	5.33	1,86	.2
43-7	6616	.878	6.40	8.47	1.78	.2
44-0	7544	.875	6.46	8.00	1.55	( . <b>3</b>
44-II	6095	. 574	0.61	8.67	1.87	1 .2
44-1	5191	.800	6.68	5.00	1. 52	I •3
44-7	5036	.872	7.01	0.31	1.39	.7
44-K	4831	. 826	7.42	6.74	1.29	.3
(J-A	4278	. 505	7.46	6. 69	1.37	1.2
45-B	3658	.847	7.10	0.44	1, 58	.7
45-0	1620	.825	7.00	6.62	1 1.47	1 • 1
45-D	. 975	.812	7.07	8.60	1.63	1 1

TABLE 4.17.—Validity of the augmented pilot stanine for predicting graduation from both elementary and basic training for selected classes in the three flying training commands and for the three commands combined

ť

### EASTERN FLYING TRAINING COMMAND

N	Pe	Me	м,	8D,	836	~24 ³
3065 1069	0.567 .601	8, 89 5, 93	1.63 1.50	1.81 L.72	0. 44 . 41	a 12 . 55
TRAL FI	YINO T	RAINING	COMM.	ND		
2429 2558 2976 968	0, 599 . 679 . 618 . 490	6, 12 5, 00 6, 10 6, 14	4.39 4.34 4.56 5.03	2 11 2.01 2.04 1.62	0.51 .49 .47 .43	0. 51 . 50 . 43 . 51
STERN FI	LYING T	RAINING	сомм	AND		
2534	0.676	6.13 6.09	1.85 1.89	1.19	0.41	0.43
ALL C	OMMAN	DS COM	BINED			
. 8575 . 3016 . 8978 . 7435 . 6502 . 7142 . 6270 . 5651 . 6155 . 2278	0.617 .563 .735 .716 .677 .658 .643 .643 .610 .610 .621	6.01 6.65 6.46 6.61 7.01 7.42 7.40 7.10 7.00	4.66 4.91 5.38 5.47 5.58 6.05 6.47 8.57 5.08 6.22	1.92 1.68 1.50 1.60 1.60 1.42 1.33 1.41 1.63 1.46	0.44 .42 .41 .43 .41 .41 .41 .41 .44 .59 .43 .33	0, 45 .43 .52 .53 .54 .54 .54 .54 .54 .54 .54 .54 .54 .54
	N 3005 1000 7TRAL FI 2429 2553 2976 903 STERN FI 2534 1018 ALL C 2534 1018 ALL C 8575 3016 5978 77435 2016 2017 2018	N         Ps           3065         9.567           1069         .601           TRAL FLYING T           2429         0.599           2553         .679           2976         .618           903         .439           STERN FLYING T         .           .         2534         .679           .         903         .439           STERN FLYING T         .         .           .         2534         0.676           .         903         .439           STERN FLYING T         .         .           .         2534         0.676           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         .           .         .         . <td>N         Ps         Ms           3005         0.567         3.89           1009         .601         3.93           TRAL FLYING TRAINING           2429         0.599         6.12           2533         .679         5.06           2976         .618         6.10           2976         .618         6.10           903         .490         6.14           STERN FLYING TRAINING         .607         6.09            2534         0.676         6.13            2535         0.617         6.09           ALL COMMANDS COMI               3016         .565         6.65                                                    </td> <td>N         p₆         M₆         M.           3005         0.567         5.89         4.63           1000         .601         5.93         4.60           TRAL FLYING TRAINING COMM.           2429         0.599         6.12         4.39           2553         .679         5.94         4.34           203         .490         6.14         4.36           2553         .679         5.94         4.34           2076         .618         6.10         4.56           .903         .490         6.14         4.03           STERN FLYING TRAINING COMM                                                              <td>N         $p_6$         M.         M.         SD.           3005         0.567         3.89         4.63         1.81           1009         .601         3.93         4.50         1.72           TRAL FLYING TRAINING COMMAND           .         2429         0.599         6.12         4.33         2.11           .         2433         .679         5.06         4.34         2.01           .         2976         .618         6.10         4.55         2.04           .         2976         .618         6.10         4.55         2.04           .         903         .490         6.14         3.03         1.67           STERN FLYING TRAINING COMMAND        </td><td>N         $p_6$         M.         M.         $3D_4$ $r_{1L}$           3005         0.567         5.89         4.63         1.81         0.44           1000         .601         5.93         4.63         1.81         0.44           TRAL FLYING TRAINING COMMAND         .41         .41         .41           TRAL FLYING TRAINING COMMAND         .43         2.01         .49           .2353         .679         5.96         4.34         2.01         .49           .2534         .679         5.96         4.34         2.01         .49           .2976         .618         6.10         4.56         2.04         .47           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .607         6.09         4.85         1.49         0.41           .903         .607         6.05         4.91         1.62         &lt;</td></td>	N         Ps         Ms           3005         0.567         3.89           1009         .601         3.93           TRAL FLYING TRAINING           2429         0.599         6.12           2533         .679         5.06           2976         .618         6.10           2976         .618         6.10           903         .490         6.14           STERN FLYING TRAINING         .607         6.09            2534         0.676         6.13            2535         0.617         6.09           ALL COMMANDS COMI               3016         .565         6.65	N         p ₆ M ₆ M.           3005         0.567         5.89         4.63           1000         .601         5.93         4.60           TRAL FLYING TRAINING COMM.           2429         0.599         6.12         4.39           2553         .679         5.94         4.34           203         .490         6.14         4.36           2553         .679         5.94         4.34           2076         .618         6.10         4.56           .903         .490         6.14         4.03           STERN FLYING TRAINING COMM <td>N         $p_6$         M.         M.         SD.           3005         0.567         3.89         4.63         1.81           1009         .601         3.93         4.50         1.72           TRAL FLYING TRAINING COMMAND           .         2429         0.599         6.12         4.33         2.11           .         2433         .679         5.06         4.34         2.01           .         2976         .618         6.10         4.55         2.04           .         2976         .618         6.10         4.55         2.04           .         903         .490         6.14         3.03         1.67           STERN FLYING TRAINING COMMAND        </td> <td>N         $p_6$         M.         M.         $3D_4$ $r_{1L}$           3005         0.567         5.89         4.63         1.81         0.44           1000         .601         5.93         4.63         1.81         0.44           TRAL FLYING TRAINING COMMAND         .41         .41         .41           TRAL FLYING TRAINING COMMAND         .43         2.01         .49           .2353         .679         5.96         4.34         2.01         .49           .2534         .679         5.96         4.34         2.01         .49           .2976         .618         6.10         4.56         2.04         .47           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .607         6.09         4.85         1.49         0.41           .903         .607         6.05         4.91         1.62         &lt;</td>	N $p_6$ M.         M.         SD.           3005         0.567         3.89         4.63         1.81           1009         .601         3.93         4.50         1.72           TRAL FLYING TRAINING COMMAND           .         2429         0.599         6.12         4.33         2.11           .         2433         .679         5.06         4.34         2.01           .         2976         .618         6.10         4.55         2.04           .         2976         .618         6.10         4.55         2.04           .         903         .490         6.14         3.03         1.67           STERN FLYING TRAINING COMMAND	N $p_6$ M.         M. $3D_4$ $r_{1L}$ 3005         0.567         5.89         4.63         1.81         0.44           1000         .601         5.93         4.63         1.81         0.44           TRAL FLYING TRAINING COMMAND         .41         .41         .41           TRAL FLYING TRAINING COMMAND         .43         2.01         .49           .2353         .679         5.96         4.34         2.01         .49           .2534         .679         5.96         4.34         2.01         .49           .2976         .618         6.10         4.56         2.04         .47           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .490         6.14         5.03         1.62         .43           .903         .607         6.09         4.85         1.49         0.41           .903         .607         6.05         4.91         1.62         <

 Biserial validities of quantitative variables

 Predicting variable
 Ne
 Pe
 Me
 Me
 SDe
 Pia

 Age
 6,613
 0.873
 22.44
 22.85
 2.20
 -0.10

 Education
 6,603
 .873
 4.00
 4.63
 1.42
 .01

 Previous flying experience
 6,564
 .873
 4.71
 5.01
 1.10
 .15

Relationship of qualitative variables evaluated by chi-square techniquo

		Gradu	ates	Elin	uinces		Tabled	ed values of chi squared - 5 per- cent level df 4 7.82		
Variable	Category	N	Per- cent	N	Per- cent	X ¹	i per- cent level	5 per- cent level	a	
First preference	(Bombardier Navigator Pilot Other	84 103 5, 611 25	84 57.3 57.4 53.3	15 15 813 8	18 12.7 12.6 16.7	1. 47	11.34	7.83	3	
Prelerence walver 1	W X Y	1, 152 925 3, 197	M3 M2 M3	15 23 15 23	11.7 13.8 11.7	2.12	11.34	7.82	; ;	
Marital status	Single. Marr'ed.	4,414	57 3 57 4	64 512	127	.00	4.65	1.84	1	

¹ For explanation of coding, see table 4.13,

## Validity of the Pilot Stonine in Advanced Pilot Training

Table 4.19 shows the validity of the pilot stanine in nine advanced classes in all commands combined. Except for the last two classes, these validities are slightly lower than those reported in basic training. All biserials are, however, statistically significant. Statistics for the three phases combined (elementary, basic, and advanced) are also shown in table 4.19. It may be concluded from this table that the pilot stanine remained predictive of success through all phases of training.

TABLE 4.19.—The validity of the augmented pilot stanine for classes 44-G i	through
45-D in advanced pilot training in all commands combined	

Class	N	p,	M.	м.	SD,	F34
44-G	6, 572 5, 297 4, 441 4, 872 4, 013 3, 438 3, 081 1, 331 788	0.950 .923 .917 .931 .969 .973 .976 .981 .978	0.50 6.66 6.72 7.05 7.44 7.47 7.11 7.01 7.09	5, 75 5, 99 6, 25 6, 94 7, 14 5, 52 6, 23 6, 24	1. 53 1. 55 1. 60 1. 37 1. 37 1. 37 1. 37 1. 37 1. 35 1. 57 1. 45 1. 53	0.23 .21 .16 .21 .17 .17 .10 .15 .21 .21

The validity of the pilot stanine by classes 44–0 through 45–D in elementary, basic, and advanced pilot training in all commands combined

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Class	м	Pe	Ma	м.	SD,	<b>73</b> 6	et s cr ¹
44-0 44-II 44-I 44-J 44-J 44-J 44-J	8, 947 7, 407 6, 567 7, 101 6, 252	0. 698 . 664 . 620 . 639 . 622	6.50 6.66 6.72 7.05 7.44	5. 42 5. 55 5. 68 6. 10 5. 50	1. 57 1. 60 1. 57 1. 42 1. 33	0.42 .42 .41 .42 .41 .42 .44	0. 82 , 52 . 52 . 56 . 61
45-A 45-B 45-C 45-C	8, 641 5, 140 2, 273 1, 269	. 593 . 585 . 575 . 608	7.47 7.11 7.01 7.09	6. 59 6. 23 6. 17	1.41 1.63 1.46 1.53	.39 .43 .34 .37	. 63 . 52 ! 46 . 45

I Corrected for restriction of range to a standard deviation of 2.10 in the unrestricted range.

### Validity of the Pilot Stanine in Transition Training

In table 4.20 are shown the validities of the pilot stanine in predicting graduation from transition pilot training, after the completion of the three regular phases. Validities are presented by class and by type of aircraft, either 2-engine or 4-engine. With one exception (in which only seven eliminations were involved), all validities are positive.

TABLE 4.20.—Validity of the pilot stanine in predicting graduation from transftion pilot training, by type of aircraft

Class	Aircraft	Nı	Pe	M	м.	8D,	836
43-0		455 338	0.879	6. 19 5. 82	5.66 4.82	1.81	0.18
4 <b>3-</b> H	B-24 B-24 B-17 and B-25 B-17 and B-26	221 977	.812 .952	6.23 5.66 6.29	5.80 4.27 4.55	1.77	. 15 . 77 . 13
43-I	{B-25 and B-26 B-17. B-24	316 1,045 953	.859 .976	6.19 6.03 6.03	5.97 5.00 5.34	1.03 1.62 1.63	.022
43-J and 43-K	····   II-25. B-26.	313 350	.978 .824	5.95 6.20	6. 57 5. 60	1.43 1.65	18 . 31

Figure 4.21 shows the elimination by stanine for the nine classes for each of the three phases. For these data the over-all biserial correlation of augmented pilot stanine with graduation elimination in the three phases is 0.38, which when corrected for restriction of range to a standard deviation of 2.10 becomes 0.49. A frequency distribution for the same classes, showing relative numbers of graduates and eliminees in each stanine group is presented in figure 4.22.



# THE PREDICTION OF SUCCESS IN NAVIGATOR TRAINING

Details of the training of navigators are given in Report No. 10 of this series. Following preflight training, the student followed a course in advanced navigation school, which varied in length from 12 to 30 weeks. The 24-week course, in effect at the end of the war, included approximately 1,000 hours of classroom instruction and 150 hours in flight training missions. As with pilot, the criterion used for the validation of stanines was graduation or elimination from training. In the early study reported in table 4.21 no distinction was made between new aviation cadets who had no prior flight train. ing and men who had been eliminated from pilot training before

TABLE 4.21.—The validity of the navigator stanine for certain navigator classes graduating in 1942⁴

[New	aviation	cadets and	eliminated	pilots	combined]
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	N	Pı	Mg	М.	8D,	566
Classes 42-4 through 42-7 (Coral Gables)	309	0.800	0.46	5.06	2.53	0.48
Classes 42-10 through 42-17 (Monroe)	847	.798	6.59	5.39	1.52	.45
Classes 42-13 through 43-3 (Mather)	869	.883	6.71	5.11	1.70	.50

¹ Elimination for unsatisfactory progress only.

								_	
Class	Personnel category	N	Pe	M,	м.	SD,	TV2	at 3 (4 ¹	a sul
43-12	New aviation cadets Eliminated pilots Combined	781 268 1,052	0.810 .732 .792	7.14 7.14 7.14	5.95 6.79 6.22	1, 34 1, 06 1, 28	0.51 .20 .42	0.68	0.67
43-13	New aviation cadels Eliminated pilots Combined	833 463 1, 290	.815 .829 .820	6.99 7.12 7.04	6.20 8.49 6.30	1.29 1.06 1.21	.35 .33 .34	, 50 , 55	.53 .60
43-14	New aviation endsts Eliminated pilots Combined	663 360 1,028	.789 .758 .788	7.04 7.34 7.15	6.13 6.39 6.22	1.30 1.09 1.24	. 49 . 50 . 43	.56 .73	.54 .75
43-15	New aviation cadets Eliminated pilots Combined	462 539 1,001	.810 .785 .810	6.91 7.08 6.99	5.96 6.69 3.41	1.30 1.02 1.36	.40 .21 .29	. 67 . 39	.51 .36
43-16	New aviation endets Eliminated pilots Combined	461 870 1, 331	.803 .845 .830	6.92 7.01 6.93	0.02 0.30 0.31	1.38 1.04 1.16	.38 .24 .31	.52 .39	44 53
43-17	New aviation cudets Eliminated pilots Combined	658 206 1, 164	.784 .839 .808	7.27 7.08 7.18	6.08 6.36 6.25	1.33 1.07 1.25	.50 .27 .42	.64 .41	.58 .45
43-18	New aviation cadets Eliminated pilots Combined	537 305 842	.750 .744 .743	7.61 6.93 7.30	6.11 6.44 6.23	1.35 1.02 1.26	.00 .28 .53	.79 .46	.78 .03
<b>44-1</b>	New aviation cadets Fliminated pilots Combined	837 350 1, 217	.789 .753 .777	7.40 6.00 7.25	6.42 6.33 6.41	1.31 .98 1.24	.43 .31 .39	. 58 • . 51	.50 .71

TABLE 4.22.—The validity of the navigator stanine for prediction of graduation from navigator training, classes 43-12 through 44-1, for new aviation cadels and climinated pilots separately and combined

Corrected for restriction of range by the Pearsonian formula. Unrestricted standard deviation assumed to be 2.00 unless otherwise indicated.
 Corrected for restriction of range by the Tufts College formula.
 Assumed unrestricted standard deviation = 1.70.

FREQUENCY DISTRIBUTION BY STANINE

GRADUATES AND ELIMINEES FOR FLYING DEFICIENCY, FEAR, AND OWN REQUEST

PILOT CLASSES 44-6 THROUGH 45-D; PRIMARY THROUGH ADVANCED ALL FLYING TRAINING COMMANDS COMBINED



entering navigator training. For these groups the validity of the navigator stanine was approximately that of the pilot stanine in elementary pilot training.

Table 4.22 shows the validity of the navigator stanine in Classes 43-12 through 44-1 for new aviation cadets and eliminated pilots treated separately and combined. In general, the navigator stanine appeared to be somewhat more predictive for new aviation trainees than for eliminated pilots.

The validity of the navigator stanine in classes 44-2 through 44-7 for the two commands where navigator training was given and for the combined commands is shown for new aviation cadets in table 4.23 and for eliminated pilots in table 4.24. Again, the validity of the navigator stanine for new aviation cadets is somewhat higher than for eliminated pilots. It will be noted that in the classes trained beginning with 1943, the range of ability as measured by the navigator stanine was greatly restricted. Instead of a standard deviation of approximately 2, found by definition for all stanines for all cadets screened on the AAF Qualifying Examination, the standard deviation for new aviation trainces was approximately 1.35 and for eliminated

TABLE 4.23.—Validity of navigator stanine for prediction of graduation from navigation training, classes 33-2 through 33-7, by flying training commanda

[New aviation cadets only]

Class	N;	p,	м,	м,	8D,	<b>T14</b>	et die
(1-2	267 90 82 114 299 81	0.853 .911 .979 .979 .979 .571	7, 26 7, 23 7 22 7, 35 7, 36 7, 20	\$.73 \$.63 7.00 \$.18 \$.76 \$.70	1.34 1.28 1.24 1.18 1.14 1.15	0.59 .65 .05 .61 .30 .09	0.63 .77 .12 .67 .45 .84
CENT	RAL FL	YING TI	MINING	COMM	ND		<u> </u>
(1-2. (1-3. 11-4. 11-4. 14-5. 11-6. 11-7. 11-7.	463 425 533 533 206 63	::::: ::::::::::::::::::::::::::::::::	7, 92 8, 21 8, 04 7, 05 7, 04	s 41 6 79 7 6 99 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1 73 1 25 1 11 1 12 1 12 1 12 1 12 1 11	0. 63 - 84 - 80 - 45 - 38 - 41	0.70 .76 .16 .01 .01
TOTAL EASTERN	AND CI	ENTRAL	FLYING	TRAINI	NO COM	MANDS	
44-2 41-3 44-4 44-5 44-5 44-5 44-7 Total.	720 518 518 515 647 705 777 3, 892	0. \$11 . \$77 . \$19 . \$11 . \$19 . \$11 . \$19 . \$11 . \$17 . \$19 . \$11 . \$17 . \$19 . \$19	7.00 8 04 7.91 7 04 7.03 7.59 7.73	6.25 6 1-3 7.03 6.74 7.00 6.74 6.73 6.72	1.40 1.29 1.17 1.13 1.14 1.12 1.22	0.57 .53 .42 .41 .32 .42 .42 .42 .42	0. 6.1 . 71 . 57 . 61 . 47 . 61

EASTERN FLYING TRAINING COMMAND

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-	ini Vallallur	A the naviation	-stanine for	prediction of	graduation from
TABLE	4.24 Vanuary C	-1	rough 11-7.	by flying tra	ining commands
15.00	dation training	, CIUEECS 337~~ +/	11 U HY HY HY H	~ U 1 · U / · U	-

[Eliminated pilots only]

EASTERN FLYING TRAINING COMMAND	
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Class	N,	Pe	М,	м,	8D;	F36
44-3 44-3 44-4 44-4 44-6 44-6 44-6 44-7	278 219 203 179 221 210	0.881 .918 .951 .922 .914 .886	7.36 6.89 7.09 7.20 7.26 7.32	6, 70 6, 55 6, 80 7, 35 6, 74 6, 59	1.07 1.03 1.04 1.09 1.12 1.00	0.32 .16 .13 .06 .37 .36
CENTRAL F	LYINO T	RAINING	COMM.	AND		
4+3 44-3 44-5 45-6 41-7	281 335 139 340 375 84	0.701 .755 .712 .717 .765 .685	7.35 7.28 7.53 7.51 7.44 7.61	6,76 6,67 6,70 0,73 6,70 0,73 6,70 0,83	1.08 1.07 1.03 1.15 1.06 1.15	0.33 .33 .49 .46 .41 .33
TOTAL EASTERN AND	CENTRAL	, FLYIN	O TRAIN	ING COM	IMANDS	 
44-2 44-3 44-4 44-6 44-6 44-7 44-7 44-7	. 559 . 554 . 312 . 525 . 506 . 204	0.791 .819 .854 .787 .820 .845 .814	7.35 7.10 7.24 7.61 7.49 7.35 7.35	8.74 6.65 8.72 6.72 6.70 6.71	1.09 1.06 1.04 1.13 1.09 1.09	0.33 .24 .27 .40 .41 .33

pilots, approximately 1.10. This sharp curtailment reduces the validity coefficients from what would have been obtained in an unrestricted population. The coefficients as corrected for restriction of range indicate that success in selecting navigators was even greater than that in choosing pilots. One reason was probably that the curriculum included a much higher proportion of classroom work, measured by objective classroom tests. Success in the curriculum was therefore highly predictable from psychological aptitude tests. A comparison of the validities of the navigator stanines assigned by the classification batteries of December 1942 and July 1943 is given in table 4.25. For the most comparable set of data, for new aviation cadets in the Central Flying Training Command, the December 1942 battery appears to be slightly more predictive, but the difference is not marked. Comparative validities of the bombardier, navigator and pilot stanines for predicting success in navigator training are shown in table 4.26. The navigator stanine is definitely more predictive in the Battery of December 1942 but not in the battery of July 1943. All stanines appear to be positively associated with success in navigator training although two negative coefficients for the pilot stanine appear in the table.

**TABLE 4.25.**—Comparison of the validities of the navigator stanines of the classification batteries of December 1942 and July 1943 for predicting graduation or climination, from navigator training. Classes 44–2 through 44–7, separately and by direct combination, Eastern and Central Flying Training Commands, and new aviation cadels and climinated pilots treated separately. (No correlations shown for classes with less than 60 cases.)

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	5		I	Sastern F	lying Tn	alning Co	ommand				ပ	entral F	ylog Tr	aluing Co	pururo		
		ż	'n	Me	м.	8D	Z P C	.T34	år. Li Li	N,	p,	м,	M.	a8	546	er 1 ie	514
New aviation cadets, battery-	\$\$ <b>7</b>	SESE2	0.859 901 923 925 925 925 925	21622	29794 88735	*****	9.1.2 22225	33851	r3687	នីទី៥ភូន	0.778 8258 7285 7365 7365 7365 7365 7365 7365 7365 736	222222 2722222	44944 442855	86688	88222	2222	82222 6777
Combined	2-33	162	. 505 . Nov	2.16	5.71 5.95	1.20	5 8	3 3	1.8.1	1.271	- 524 - 708	2		8	2	0	
New aviation cadeds, battery- July 1943.	497 777									~ <u>~</u>	83	80	153	18.	3		25
	***	ន្ត្តន	N.	2.37	7.03	1.00	1,	8.	ត្ត	825	255	228	2283 2743	:=8=	887	3223	
Combined		329	ű.	7.33	1.8	1.10	. 16	2.	87	1, 991	NGS.	7.83	6 3	1.12	2	3.1	19.4
Fiminated pilots, battery—Dec. 1912.	997991 57755	สุรสุรริ	Kirkadi	475878	837853	83382	មុខ=ខុតុះ 1			ន្តន្តន្តន្ត	<u>s</u> rees	177777 8833949	59999 28282	88838	287792		199 <b>1</b> 3
Combined			010	18	8 2	3 8	8			1, 160	8 22.	\$ \$	2 2	3 8	3 8		5
Eliminated pllots, battery-July 1943.		S	383							84500	28322 28322	89 89	44 44	88	<b>\$</b> 3		94 - 92 -
Comblacd		=	520						Ī	ž	22	2.32	0.50	18	ŝ		Į₹
* Cerrected to themetical stan	ndard det	lation of	navicato	r - tanino	M 2 M												

Corrected to theoretical standard deviation of margineer stands of 2.00.
 Converted to standard deviation of 2.074 found for a 50 percent sample of the group tested during Mar., Apr., May, June 1943.
 Converted to the standard deviation of 1.80° four a fort he total group tested July through Oct. 1943.
 Converted to the standard deviation actually found for new aviation cadets in the same class in the same command.

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TABLE 4.29.-Showing validity coefficients for bombardier, navigator, and piloe stanines for navigator classes 44-2 through 44-7, all classes combined, by Fisher's z-technique. Validities for new aviation cadels and climinated pilots reported separately for the batteries of December 1942 and July 1943. Uncorrected hiserial validity coefficients, together with coefficients corrected for restriction of range are shown for Eastern Flying Training Command, Central Flying Training Command, and far both commands combined

	New avi	ation cade and CFTC	S EFTC	Elimin	ated pilots and CFTC	EFTO
	EFTC N=797	CFTC N=1,254	Com- bined N=2,051	EFTC N = 1,353	CFTC N=1,460	Com- bined N=2,\$43
Bombardler stanine—Battery of December 1942: Uncorrected Corrected Navirator stanine—Battery of December	0. 42 1.55	0. 50 1. 65	0.47 1.62	0.20	0.35	0. 27
1917- 1' neorrected Corrected	.46 1.64 9.62	.56 1.72 4.71	.52 1.69 4.68	, 20) 1 . 24	.39 21.47	.30 1.38
Plot stanine—Hattery of December 1912: Uncorrected Corrected	.28	.36 1.49	.33	.11	.20	. 16
Bombardier stanino—Battery o. July 1943:	N = 237	N = 1,988	N = 2,225		N=108	
Uncorrected, Corrected Navience stanine-Baltery of July 1913	· 22 • 28	.52 •.65	.50 1.62		. 51	
Uncorrected.	.14 1.23	43 63.4 8.4	.41 •.59	•••••	.48	
Pilot stanine—Battery of July 1943: Uncorrected	07 03	.37 •.43	.33 .39		<b>1</b> 21	

;

Corrected to a standard deviation of the navigator stanine of 2.076.

N = 1,390. N = 2,773.

Corrected to a standard deviation of the navigator staning of 2.000, Corrected to a standard deviation of the navigator staning of 1.805,

In table 4.27 are shown the validities of the navigator, bombardier, pilot, and augmented pilot stanines for predicting graduation or elimination from navigator training in classes 44-08 through 45-13. Results for different classification test batteries, for the 18- and 24-week curricula and for new aviation trainees and eliminated pilots, are presented separately. It will be seen from the table that the navigator stanine is slightly more predictive of navigator success than the bombardier stanine and definitely more predictive than the pilot stanine. The biserial validities are low because of the sharp curtailment of range on the basis of the navigator stanine. When corrected for the restriction of range, the validity of the navigator stanine continued in these classes to be as high or higher than the validity of the pilot stanine in predicting results of pilot training. Validities appear, however, to be lower in later classes than in earlier classes. This may be partly accounted for by the change in the nature of the curriculum, which was increased in length and which included considerably more

flight training than earlier in the war. It might reasonably be expected that when the criterion of elimination-graduation was determined largely by standing in academic work that it would be more predictable on the tests weighted into the navigator stanine than when more aerial performance, often evaluated subjectively, was involved. Another possible explanation was that the group was further curtailed on the basis of the navigator stanine and that the corrections applied were not adequate.

While the validities, as computed, for eliminated pilots appear to be slightly lower than those for new aviation trainces, curtailment of range was also greater. For these classes the navigator stanine appears to be approximately equally predictive for both groups.

Five bar charts and two histograms, figures 4.23 through 4.29, present stanine validities in navigator training graphically. One chart, figure 4.24, shows the percentages of new aviation trainees and eliminated pilots eliminated from navigator training in each stanine group. These figures show that the higher the navigator stanine, the greater the chance of success in navigator training, with the elimination rate for the men with a stanine of 9 always being less than 6 percent,

	Battery	Length of train- ing in weeks	Group	· Nr	p,	M,	м,	SD,	P \$ 60	•*14
Navigator stanine	July 43 Nov. 43 Nov. 43 Dec. 42 July 43 Nov 43 Nov. 43	18 18 24 18 18 18 21	NAT NAT EP EP EP EP	1,459 4,550 1,235 727 1,231 759 121	0.893 .918 .916 .919 .899 .899 .814	7.36 7.74 7.57 7.50 7.50 7.50 7.68 7.35	6 62 6.02 7.01 6.83 6.04 7.12 6.79	1.03 1.05 1.01 1.00 .87 .93 1.00	0.39 .39 .28 .33 .32 .31 .31	10.83
Bombardier stanine	July 43 Nov. 43 Nov. 43 Dec. 42 July 43 Nov. 43 Nov. 43	18 18 21 18 18 18 18 21	NAT NAT EP FP EP EP	1,489 4,586 1,255 726 1,234 759 121	. 893 1918 1916 1919 1899 1899 1899 1843	6 20 6 95 7, 19 6 19 6 51 6 94 6, 99	5 14 6 05 6 70 5 30 3 58 6 17 7, 20	1 77 1, 64 1 40 1, 45 1, 42 1, 49 1 5	.31 .29 .15 .28 .34 .34 .27 11	1.46 1.(0 1.35
Pilot stanine	July 43 Nov. 43 Nov. 43 Dec. 42 July 43 Nov. 43 Nov 43	18 18 24 18 18 18 18 24	NAT NAT P FP EP EP	1,489 4,580 1,255 727 1,234 759 124	. 893 . 918 . 916 . 919 . 899 . 899 . 899	4.63 5.49 6.90 3.20 5.40 6.93 7.08	3,71 5,49 5,77 4,40 4,90 5,55 7,16	1.94 1.70 1.73 1.48 1.42 1.27 1.25	.24 .15 .07 .13 .20 .16 04	1.31 1.32 1.22
"usmented Pilot stanine	July 43 Nov. 43 Nov. 43 Dec. 42 July 43 Nov. 43 Nov. 43	18 18 24 18 18 18 24	NAT NAT NAT EP EP EP EP	1,493 (,550 1,255 727 1,534 759 121	. 8% 918 . 914 . 919 . 899 . 899 . 899 . 898 . 843	4.69 6.01 5.02 5.52 7.10 7.32	3 81 8 61 8 77 8 03 4 19 0 73 7, 47	1 99 1, 7,3 1 75 1, 55 1, 45 1, 30 1, 31	.23 .14 .07 .11 .19 .15 	1,30

TABLE 4.27.—Validities of stanines for predicting graduation-elimination from navigator training, classes 44-08 through 45-13

1 Corrected for re-triction of range to pavigator stabling standard deviation of 1.73, 7 Corrected for restriction of range to navo, stor stabling standard deviation of 1.80

NAT - New aviation trainces. EP-Eliminated pilots.


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Figure 4.23



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Figure 4.25





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# NEW AVIATION TRAINEES

# GRADUATES AND ELUMINEES FOR UNSATISFACTORY PROGRESS, FEAR, AND OWN REQUEST

NAVIGATOR TRAINING - NAVIGATOR CLASSES 44-8 THROUGH 45-13 ALL FLYNG TRAINING COMMANDS COMBINED



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### Prediction of Navigator Success by Nontest Variables

Table 4.28 shows the validity of certain nontest variables for the prediction of success in navigator training in terms of biserial corre-

TABLE 4.23.—Biscrial coefficients of validity for certain nontest variables for the prediction of graduation-elimination from advanced navigator training, classes 43-2 through 43-15

Predicting variable	N	p,	м,	М.	SD,	7340
Are. Education ¹ . Previous flying experience ¹ . Strongth of interest bomb ¹ . Art night of interest navigation ¹ . Strongth of interest pilot ¹ .	1,951 1,932 1,961 1,953 1,953 1,953	0, 791 , 709 , 769 , 791 , 791 , 791	22, 30 6, 12 5, 25 6, 13 7, 34 7, 59	22.72 4.85 6.27 4.67 6.34 7.59	2.18 1.43 .77 1.92 1.04 1.61	-0.11 02 .05 .18 03

¹ Numbers assigned for computation as follows: 8th grade or less, 0; 9th grade, 1; 10th grade, 2; 11th grade 3; 12th grade, 4; 1st year college, 5; 2d year college, 6; 3d year college, 7; and college graduate, S. Professional school graduates omitted.
¹ Numbers assigned for computation as follows: private pilot's license, 2; student pilot's certificate with solo provideges, 3; student pilot's certificate, 4; passenger in plane with no formal instruction, 5; and never been passenger in plane, 6. Men with milit wy flying instruction conflicted. Sign at correlation reveals so that the negative coefficient indicates that these with less experience are more likely to graduate. This coefficient is not statistically significant.
⁴ On a scale ranging from 1 (low) to 9 (higb).

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· · · · · · · · · · · · · · · · · · ·		Graduates		Eliminees			Tabled [values of x *		
Variable	Category	N	Per- cent	N	Per E.nt	x ¹	l per- cent levél	5 pcr- cent lavel	dr
First preference,	(Bombardier Navigstor Pilot Tics	12 512 711 253 599	63.2 85.3 70.0 78.1	7 8 25 71 2	36.8 14.7 24.0 21.9	22.80	11.34	7.82	3
Preference wälver 1	X	2.0	77.7 80.2	63 -181	22.3 19.8	ģ. 00	11.34	7.82	3
Marital status	Single.	72 1, 214, 296	77.6 81.1	30 359 58	22.4 22.4 15.9	7. 16	6. 64	3.84	· 1

TAME 4.29.—Relationship of first preference, preference waiver, and marital status to graduation-climination in navigator training, classes 43–12 through 43–13 evaluated by chi-square technique

1 For explanation of coding see Table 4.15.

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lations, while table 4.29 shows the relation of certain other nontest variables as evaluated by the chi-square technique. The factors significantly associated (at the 1 percent level) with graduation-elimination are:

Age	Younger men are more likely to succeed.
Marital status	Married men are more likely to succeed.
First Preference	Those whose first preference is for navi- gator training are more likely to suc- ceed.
Strength of interest, navi- gator.	Those who indicate high interest are more likely to succeed.

Education is probably associated with graduation-elimination (those with more education are more likely to succeed), but flying experience, preference waiver, and strength of interest for bombardier or pilot training are not so associated.

As evidenced by the biserial correlation -0.02 in table 4.28, there is no relationship between previous flying experience and success in navigator training.

### THE PREDICTION OF SUCCESS IN BOMBARDIER TRAINING

Following preflight, student bombardiers were trained in a program which in the early part of the war lasted 12 weeks. The length of the course was increased to 18 weeks in the summer of 1943 and to 24 weeks in the summer of 1944. Details of bombardier training are given in Report No. 9 of this series.

**TABLE 4.30.**—Validities of the bombardier, nuligator, and pilot stanings in predicting graduation-elimination from bombardier training in classes 43–5, 6, and 7. New aviation trainces and eliminated pilots combined. Data reported separately for men-tested at three psychologies.⁴ research units

Tested at-	Nr	Ps	Me	M.	·3D4	гън
Bombardler stanine: Psychological Research Unit 1	552	0. 833	3.50	2,61	1.72	0.27
Psychological Research Unit 2 Psychological Research Unit 3 Navicate 3tanine:	330 496	.861 .819	5. 169 5. 70	4.35	1,99 1,85	.36 .31
Psychological Research Unit 1 Psychological Research Unit 2 Unit 2	532 330	. 835	3.50 5.53	2.89 4.91	1.63	.21 ,15
Pilot stanine: Psychological Research Uuit 1	552	. 835	2.62	1.34	1. 57	.27
Psychological Research Unit 2 Psychological Research Unit 3	319 496	.861 .819	3.99 4.93	3, 27 4, 17:	2-52 2.19	.13

In the study reported in table 4.30, the biserial validities of the bombardier, navigator and pilot stanines for predicting graduationelimination from bombardier training in classes 43-5, 6, and 7 are given. New aviation trainces and eliminated pilots are combined, but the data are reported separately for the men tested at the three psychological research units. In general, the validity of the bombardier stanine was higher than that of either the navigator or the pilot stanine. Over-all validity of the bombardier stanine was over 0.30.

Biserial validity coefficients for new aviation trainees and eliminated pilots for classes 43-4 through 44-1 (with two classes omitted) are shown in table 4.31. All validities were positive and, with one exception, statistically significant. It appears that the validity of the bombardier stanine in these classes, for prediction of graduation or elimination from bombardier training, is again in the neighborhood of 0.30. It is to be noted, however, that in comparison with pilot training, the graduation rate was high. Relatively few men were eliminated from bombardier training, partly because of the lack of a valid method of determining which were the good bombardiers and which were not. By the time these classes were trained, it was known that record circular error had relatively low reliability and was not an adequate criterion for judging the success of student bombardiers. Some men were eliminated for lack of progress in ground school work or faulty technique, but approximately 90 percent successfully graduated from training. In view of the uncertain validity and reliability of the elimination criterion in bombardier training, the stanine validities may be considered appreciable.

Stanine distributions for new aviation trainees and eliminated pilots are shown in table 4.32 for 5,710 new aviation trainees and 3,562 eliminated pilots in classes 43-8 through 43–18. It will be noted that chances of success increased with the stanine, but not perfectly

Cláis	Personnel category	Length of course in weeks	N	. <b>De</b>	· M _e	м.	SĎ:	T 3 40 -	•764	o7348
43-4 and 43-5.			859	0.871	5.00	~4.°14`	2.02	0.23		
43-8 through 43-11.	NAT 4. Filminated Pilots.	, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	2,7517 1,771	2784 1844	5.21 6.42	4.44	1.80	. 25 . 21	0.28 .31	0.28
	Combined		4, 522	. 809	8.71	4.91	1.74	. 26	. 30	
43-12	NAT. Eliminated Pilots		485 462	. 593 . 946	4.93 6.45	4.14	1.69	.25 .25	.29 .41	.33
	Combined		917	.919	5. 69	4.69	1.64	• . 30	. 36	
43-13 and 43- 14.	NÁT Eliminated pilots	, ,,	913 572	.821 .895	4.71 6.42	3.97 5.98	°1.73 1.15	· .24 .20	.28 .33	.32 .30
	Combined		1, 515	. 819	5.39	4.50	1.76	.23	.31	
43-15 sing 43- 16,	NAT. Eliminated Pilots	` 	902 783	.864 .912	4.76	3.98 6.28	1.75	.24	.28	.30
	Combined		1, 685	. 886	5, 65	4.80	1.75	. 26	.29	
43-17	NAT	12 12	383 162	.885 .895	5.02 6.15	4:21 5:47	1.90	.23 .30	.24 1,40	. 28
,	Combined	12	545	, 888	\$.36	4.50	1.80	.23		t
	NAT. Eliminated Pflets	18 18	134 350	.851 .854	4.97	3.75	1.84	.36 .22	.39 .34	. 54
	Combined	Ì8	490	. 853	.6.11	5, 47	1.50	.23		
43-18	NAT. Eliminated Pilots	12 12	377 163	.870 .905	\$:73 6.20	4.90 5.73	1.93 1.40	.23 .17	·25 • 20	.35
	Combined	12	.540	.851	5.87	5,09	.1.80	.23		
	NAT. Eliminated Pflots	18	174 405	.908 .884	8.20 6.57	4:38	· 1.85 1.15	· 22 . 17	.24	.33
-	Combined	18	579	.891	6.15	5.73	1. 57	. 14		2
<b>44-1</b>	NAT. Eliminated Pilots		527 488	. 901 . 904	5.16 6.39	3.98 6.36	1.77	.34 .01	.38 1.01	.48 03
	Combined		1,015	. 902	8.75	8.11	1.67	.20		

TXBLE 4.31.—Valldity-of the dombardler staning for predicting graduation-elimi-nation from bombardier training, classes 43-4 through 44-1, new aviation-trainces and eliminated pilots reported separately and in combination

¹ Corrected for restriction of range by the Pearsonian formula. Unrestricted standard deviation assumed to be 2.00 unless otherwise indicated. ¹ Corrected for restriction of range by the Tufts College formula. ¹ Unrestricted standard deviation assumed to be 1.66. ⁴ NAT=New aviation trainees.

TABLE 4.32.—Comparison of the elimination rates, by bombardier stanine for new aviation trainees and eliminated pilots in 12-week bombardier training, classes 43-8 through 43-18

,	New à	viation to	alnees	Eliminated pilots		
Bombardier stanine	Total N	N elimi- nated	Per- cont ellini- nated	Total N:	N elimi- nated	Per- cent elimi- nated
·	180	10	5.6	141	1	1.7
*****	353	38	10.8	373	· 34	9.1
	600	55	9.2	944	- 30	
······································	1.009	137	13.6	1.668	213	12.8
	1.052	184	17.0	215	31	15.3
	955	197	20.0	104	21	20.1
	1.150	252	24.8	68	20	34.1
***************************************	2.6	75	26.2	48	111	77.1
	65		41.5	ii	1	41.4
	1 710	1.001				
101M	0,110	1,000	11.0	3,007	1 127	12.4

Charts showing percentage of elimination by bombardler stanine, classes 44-09 through 45-13, for new aviation trainces and eliminated pilots separately, are presented as figures 4.31 through 4.36.

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regularly. Men with the higher stanines had greater chances of success than those with the lower stanines. Results are presented graphically for four of the classes and for new trainces and climinated pilots together in figure 4.30.

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Figure 4.30

Validities of the bombardier, navigator, pilot and augmented pilot stanines for new aviation trainces in classes 44.09 through 45-13. are shown in tables 4.33 through 1.36. In each table two to five negative validities appear. All stanines are predictive to some degree, with the bombardier and navigator stanines somewhat more predictive than the pilot stanine. It will be noted that the navigator stanine, as evidenced by the z-average correlation of 0.18, is slightly more predictive than the bombardier stanine, with an average biserial of 0.16. For these classes the curriculum included more navigation than formerly, so that the greater validity of the navigator stanine is not surprising. Results are shown graphically in figures 4.31 through 4.35.

TABLE 4.33 Validity of th	e dombardier sta	inine (tatter)	, of Nover	nber 194	3) for
predicting graduation-el	imination from	bombardier	training,	classes	44-09

Class	Ne:	Pe-	Me	м.	₿D₁.:	° 710
11-06	145	0.834	6.65	5.92	1. ĬS'	0.1
14-10	185	. 957	7.02	6.00	1.23	
14-11	473	. 943	6.81	6.26	1.18	2
14-19 N. C. 1 N. C. 1 N.	988	940	6.69	6.41	1.21	1
14-12	1.403	. 940	6.81	6.41	. 98	° .3
14-421	123	.976	- 8. 83	5.67	1.09	a. 1
14-11 · S · · · · · · · · · · · · · · · · ·	357.		6.65	6.45	1.16	
4-44	319	s . 914 i	6.67	6.97	1.01	1
4-45-27	209	952	6, 80	6.20	. 94	
4-44	238	.967	6.86	6.09	1.00	i
<b>14-17</b>	336	.946	6.83	- <u>6. ii</u>	1.07	
14-48 5	319 1	. 871	6.76	6.81	1.02	0
A-APT PL CIM MURIC RECO	193	. 964 1	6.68	6. 57	1.05	0
4-50	296	. 970	6. 67	6.78	1.05	0
4-61	221	.946	6.79	6.25	1.07	
4-52	353	. 895	6.82	6.68	1.08	10
4. Martin and a second s	180	. 967	-6.93	8.83	1.20	
S-01.	274	. 894 :	-6.69	. 6.45	-1.09	
5-02	319	947	6.62	6. 18	1.04	1
5-03	1 173	908	6.92	6.63	1.12	
5-04 °	152	967	6,80	6.00	1.18	
5-08	326	. 929	6.78	6.44	1.18	
15-C6	129	. 899	6.47	6.23	1.11	·
15-07	162	.932	7. Či	6.73	1.27	
<b>IS-08</b>	1 110	. 982 (	6.69	6.50	i i os l	
45-00	295	.955	6. 67	6.21	i ii	1
45-11	28	. 929	6.92	6.00	1.33	(
<b>15-12</b>	131	. 855	6.96	6. 53	1.01:	
45-13	1 103	981	6.68	6.50	1.09	

Average 766 by Fisher's sectochique for all classes=0.16.

TAME 4.34.—Validity) of the navigator stanine (battery of November 1943) for predicting graduation-climination from bombardier training, classes 44–09 through 45–13, new aviation trainces only

	Ni	Pe	Me	M.	8De	· 160
46-00	145	6.834	6.10	-6.'00	1.24	0.0
44-10	185	2.957	5.96	5.75	1.00	
44-11	473	.013	4.01	A 67	1.14	11
44-12	GRR	010	5 94	8 73	1.11	
44-12 5	1 401		6 23	8 77		2
44.491	171	076	4 10	1 17	1 24	
AL. 12 3	447		6 84	5.55	1.00	
41-44	940		8.01	5.00		
***************************************	- 319		9.91	5, 90	• • • • • •	, 0
<b>4-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-</b>	2070		0.04	5.50		,7
**************************************	- 339	1 101	0.13	5.21	1.14	
	. 330	.946	6, 10	. 6, 34	1.13	.3
	. 319	.871	6, 30	8.81	1.19	• 2
38-17	. 193	, 964	8.32	8.29	1.25	, 37
44-00	296	.970	6.15	6.00	1.30	.0
44-51	. 221	.946	6.27	6.33	1.30	
41-52	. 353	. 895	6.22	6.30	1.30	0
44-53	- 150	.907	6.23	8.00	1.35	.31
45-01	274	1 . <u>894</u>	5.93	5.09	1.17	.11
45-02	312	947/	5.88	8.83	1.16	
45-03	173	. OUM	6.01	5.05	1.12	. Ja
45-04	1 152	0.17	R CA	1 50	1 34	
45-45	374	820		6.26	1 24	2
45-66	1 120	600	4.47	6,00		

TABLE 4.34 Y alidily of the nationlor stanine de Con	mtinue	itinue	ntin
------------------------------------------------------	--------	--------	------

	Class		, , , , , , , , , , , , , , , , , , ,	Ne 🕄	Pe	M	'M.	8D,	-2640
5A7				182	.932	5.85	1.46	Ľ 24	
5-08				110	.962	5.66	7.00	1.20	) ÷ <del>.</del>
5-09			iş.,:::	255	956	0.50 5 XI	3.00	J. CL	
5-13	***********		**********	131	.855	5.74	1.47	. 56	
5-13		· · · · · · · · · · · · · · · · · · ·		. 103	981	5.32	4.50		

3.Numbering system for classes changed at this point. Average rac by Fisher's s-tuchnique for all classes=0.18.

11

TABLE 4:35,-Validity of the pilot stanine (battery of November 1943) for predicting graduation-climination from bombardier training, classes 44-09 through 45-13, new avidtiss trainers only.

- 18	Class	Ni pr	<u>ં M</u> .	Me	< 80 ₁ .	124
-09	······································	143: 0.834	4. 95	3.79	1,48	Q. j
-10		473 957	5.32 5.19	5.00	1.57	.0
-12		968 .940	5.00	4.88	1.54	
-18		1,403 .940	5,82	5, 16	1.48	2
-13 1	, , , , , , , , , , , , , , , , , , , ,	123	\$ 88	5, 33	1, 50	. 1
<b>43</b>		307	1.99	5 <b>A 13</b>	1.53	· ·~. 0
48 6 5 2 2		202	5 18	5 UN	1 30	
-48		338 .967	<b>k</b> ii	4.46	1.47	
47		336 .946	6.53	4.75	1.54	
<b>48</b>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	319 .871	1.55		1.70	(
49		193 .964	8.41	5.57	1.67	0
30	<u> </u>	221 2016		<4:43 6 00	1.21	<u>Ş</u>
52		353	5.52	.8 84	1.87	
-68		180 .967	\$ 20	4.33	1.52	,
-01		274 .504	5. 59	4.86	1.16	
-02		319	5.47	4. 47:	1. 🕫 [	
-03		173 . 998	6.05	<b>4.00</b>	1.42	1
-04		106 .007	1 4.05	3,749	1.67	
-06		129 . 600	A KI	4 62	1 47.	-
-07		932	5.52	5.30	1 4 4	
-06	*****	110 .952	8.32	6, 50	1.52	
-09		295 . 936	5, 18	\$.00	1.48	
-11		25 . 929	٥ <u>٩</u> ٨	\$.00	1.34	· .
-12	*******************************	131 .853	6.35	5,00	1.57	1

¹ Numbering system for classes changed at this point. Average rate by Fisher's reconfigue for all classes=16.

TABLE 436.—Validity of the augmented pilot stanine (battery of November 1943) for predicting graduation-climination from bombardler training, classes 44-09 through 45-13, new aviation trainces only

Class	Ne :	Pe	M	M.	.8Di	734
l <b>(-09</b>	145	0.831	4.89	3.92	1.52	6 2
14-10.	185	. 957	5.33	5.00	1.58	
4-11	473	.913	5. 21/	4. 11	1.53	. 2
14-12	958	. 910	5.03.	4.88	1.55	្ត្រី
H-18	1:403	. 910	5.84	6.18	1.35	2
14-121	123	976	5.97	5 33	1:55	
11-43	357	.911	5.00	5.15	1.55	6
14-44	349	. 914	5:24	5.07	1.4	
14-45	20	. 952	6.18	Δ 00	3.30	
14-46	338	967	5.36	4.46	1.54	2
11-17	336	. 916	5.64	4.78	1.54	
11-15	319	. 871	A 36	5.37	1 70	
11-19.	193	.961	-5.42	8.57	1.63	0
14-50.	2.6	. 970	8 22	4.33	1. 12	2
14-51	221	.916	5.57	<b>5 (ii)</b>	1.62	ំរំ
14-52	353	. 895	A 65	5.84	1.61	- 6
14-53	150	. 967	.5.26	4.33	1.59	2
15-01	274	. 894	5.60	4.56	1.56	
13-02	319	917	\$ 40	4.65	1.53	
15-03	1 173	. 908	.6.10	5.00	1.51	: Ja
13-01	152	. 967	5.64	1.80	1.64	
15-05	3:54	929	57	4:53	1.64	21
NS-08	129	. 510	4.81	4.62	1.47	. d
45-07	162	. 932	\$ 52	A 36	l ï.44	
13-0 <b>1</b>	1 110	. 162	5.33	6.50	i i i i i i i i i i i i i i i i i i i	
15-09.	245	. 656	K 21	5.00	1.51	្រុំតំ
45-11	1 28	1123	5.12	6.00	1.37	Ĭ
66-12.	131	.855	. 5 39	5.00	2.59	
45-13	1 103	6.031	1 3.00	3.50	1 48	

. *

Average run by Fisher's stechnique for all classes=,14.

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### Prediction of Bombardier Success by Nontest Variables

The validities of certain nontest variables, reported in table 4.37, are all low. However, strength of interest for bombardier training has a consistently positive validity, and previous flying experience has a biserial correlation for the 18-week curriculum of over 0.10. Age is negatively correlated with success in bombardier training; that is, the older students tended to have a higher elimination rate.

TABLE 4.37Biscrial correlations of a	e, education; previous Aying experience,
and strength of interest for different	types of Aying training with graduation-
elimination in bombardier training	

· · · · · · · · · · · · · · · · · · ·	Ne	Pı	M.,	.M.	, 8Dí.	8340
New aviation trainces, 12-week curriculum:		, ,	· .		с. ,	
Are	1. 1. 728	0.855	21.64	21.95	2.29	0.07
Education	1 1,724	.85	4,64	4. 52	1.24	. 05
Strength of interest; bombardier	1,706	. 183	6.92	6.83	2.03	. 02
Strength of interest, navigator	1,706	. 583 '	5.09	5. 19	2.34	.03.
Strength of interest, pilot	1,706	. 653	7.68	7.70	1.81	~.01
Are	852	. 924	22.87	<b>⊴23.03</b> /	2.29	03
Education	845	. 927	4.63	4.76	1.30	05
Strength of interest, bombardler	633	.921	5.57	5.46	2.00	.03
Strength of interest, navigator	633	. 921	5 43	8.34	2.14	.02
Strength of interest pilot	617	122	8 40	8 62	1.33	
New aviation trainees. 18 week curriculum:			~			
	455		21.69	21.07	2.18	07
Founding	451	815	4 65	4 53	1.32	.05
Flying evention	1: 440	842	5 18	1.31	62	12
Strongth of interest hombardies		1	7.00	A 87	2 01	
Strongth of Interest posilentor	1.00	- 211.	6 35	.4 04	2 14	
Strength of Interest pilot			7 60	7.50	1.2	- 07
The last all all and the second and a second		.011			1.00	
Emminated phots, 10-week currentum;	1 104	410	20 47	22 01		
AKU		1 . 201	22.00	14.11	1 1 1 1	07
EQUCATION.	- 222	.855	<b>1.30</b>	1.01	1.23	
Flying experience.	189	.800		9,23		
Strength of interest, Dombardier	1 010	1 . 807	0.03	E 1. 74	1. 1.13.	.09
Surengin of interest, navigator	- 016	.857	1.87	4:55	2.02	.05
Strength of interest, pilot	.į 513.	j.856.	L 87 02	8.72	[ .vo	05

Age measures in years. Education coded from 0, eighth grade or less to 8, college graduate. Strength of 'sterest rated by candidate on 9-point scale.

Relations of certain other nontest variables to success in bombardier training are shown in table 4.38. No significant relationships appear for preference for type of training, marital status, or preference waiver.

Correlations between stanines and record circular error for classes 44-09 through 44-13 are presented in table 4.39. Record circular error was the average distance by which bombs dropped in training missed the target. Practice bombs were not counted in computing record circular error. Stanines from the July 1943 battery and November 1943 battery are reported separately. Except for the eliminated pilots, all correlations are positive and most of them are statistically significant.

# TABLE 4.33.—Values of chi square for qualitative variables in the prediction of bombardier success.⁴

N=1729; New Aylation Cadets (12-week course) Classes 43-15 through 44-1

	Ţ	df .	Tabled values of x *		
	ľ X ¹		x'ı	t df	5 percent lovel
First preference. Prefurence walver. Marital status.		5.79 1.65 3.71	4 3 2	9,49, 7,82 5,99	13, 28 11, 34 9, 21
First recommendation		4.30	2	5,99	9,21

N=862; Eliminated Pilots (12-week course) Classes 43-15 through 44-1

First preference	3.60 1.89 .89 .89	• 4 4 3 2 5	9, 49, 9, 49 7, 82 5, 93	13, 28 13, 28 11, 34 9, 21 15, 09
Education. First recommendation	4.59	5.2	11:07 5.59	15.09 9.21

N=155; New Aviation Cadets (18-week course) Classes 43-14 through 43-18

v	, ,	1 7			
First preference		3.31	l. 3'	7.82	11.34
Preference walver		\$ 10.35	3	7.82	11, 34
Marital status		1.15	( i	3,84	6.64
Education		1.92	5	11.07	15,09
Flying experience.		3.42	1 3	7.82	11.34

N=524; Eliminated Pilots (18-week course) Classes 43-14 through 43-18

		-		1
First preference.	2.92	3	7.82	- 11:34
Preference walver.	2,09	3	7.83	11.34
Marital status.	.09	1	3,84	6,64
Education	6, 23	5	11.07	15.09
Flying experience	4.03	. 3	7.82	11.34
				i

1

¹ In each case the hypothesis tested by chi square was that in the tables 'giving percent eliminated for each category of the qualitative variables the percentages differ from the percentages that would be expected on the basis of the marginal totals only as much as would be expected due to sampling. ³ Of doubtful significance. All other values of chi square not significant.

TABLE 4.39.—Product`moment correlations of stanines with record circular error, classes 44-09 through 45-13

New Aviation Trainces, 60 Record Bombs; November 1043 Battery. N=6192; Number of School Classes with 3 or More Students=65

1	Stanine	м	8D -	r
Rombardler. Navigator Pilot. Augmented pilot. Record circular error		6, 76 6, 09 5, 41 5, 43 171, 40 ft,	1.09 1.13 1.51 1.53 20.71 (t.	0.06 .04 .05 .05

New Aviation Trainces, 60 Record Bomis; July 1943 Battery. N=1600; Number of School Classes with 3 or More Students=41

Stanine	м	8D	1
Nombardler Navigator. Pilot Augmented pilot Record circular error.	6.81 0.46 5.35 5.37 180.45 (t.	1, 14 1, 32 1, 56 1, 58 20, 71 ft,	0.09 .05 .07

<u>ت</u>ت

TABLE 4.39—Product moment correlations of stanines with record circular error, classes 44-09 through 45-13-Continued

ĩ y

New Aviation Trainces, 100 Record Bombs; November 1943 Battery. N=1449; Number of School Classes with 3 or More Students=12

		Stanine		<i>ci</i> o	* .* *	T,	M	* <b>\$</b> D *	<b>P</b> *
Rambardier		**			<del></del>	-	<b>6</b> 7Ŝ	1 13	
Navigator			********	••••••••			5.75	i, ii 1, 50	.0
Augmented pilot	error				•••••••••••••	17	8.33 1.01 N.1	1, 54 14, 28 ft.	.0
							···· ; • ;• ;• ;• ;• ;• ;• ;• ;• ;• ;• ;• ;•		

Eliminated Pilots, 60 Record Bomba; July 1943 Battery. N=559; Number of School Classes with a

			<u> </u>		`
· · · · · ·	Stanine	4 - A A	M	8D	
Bombardier		,	7. 26 8. 26	° 0.77 1.11	°0.06 01
Pilot. Augmented pilot Record circular error	······	· · · · · · · · · · · · · · · · · · ·	6, 22 6, 25 174, 08 ft.	1, 28 1, 31 21, 13 ft,	07 ⇒.08

Bigns of correlation coefficients have been reversed so that a positive coefficient means that a low record circular error goes with a high stanine.

### VALIDITIES OF STANINES FOR PREDICTING SUCCESS OF COMBAT RETURNEES IN ELEMENTARY PILOT TRAINING

A study was made of the validities of the stanines of the November 1943 and September 1944 batteries for men in classes 45-A through 45-F, who had returned from combat. The returnee officers were rated bombardiers or navigators, most of whom had been tested previously; that is, prior to entry into bombardier or navigator training. The two groups were not separated because the samples were too smallto discriminate reliably between possibly differing validities. The enlisted men were combat crew returnees who had been tested previously.

Validities of the battery of November 1943 for both officer and enlisted returnees are shown in table 4.40. Of the 126 officers, 79 were graduated from elementary training and 47 were eliminated, the proportion of graduates being 0.627. Of the 202 returnee enlisted men,

TABLE 4.40	-Showing th	he primary p	ilot validitic	s of staning	es of the ball	cry of
November	19.13 for of	leer and entit	sted returnee	a in classes	45-A through	1 45-F
combined.	For officer	s, N=126, an	d pe=0.627.	For collisic	d men, N=20.	2, and
ps=0.629						

0		Officer n	eturnces		Enlisted returners				
Stanine	М,	м.	8D,	734	M,	м,	8D,	t bla	
Bombardler. Navigator. Pilot Augmented pilot.	6.34 6.37 7.13 7.20	5, 70 5, 98 5, 57 5, 60	1.59 1.91 1.88 1.91	0. 25 . 13 . 51 . 52	5.26 1.70 6.81 6.91	4.69 4.32 5.83 5.83	1.54 1.45 1.48 1.60	0.23	

127 were graduated and 75 were eliminated, the proportion of graduates being 0.629. The greater variability in the stanines of the officers, as evidenced by the larger standard deviations, may partly account for the generally higher coefficients for this group.

Stanine validities of the battery of September 1944 for officer returnées in clementary pilot classes 45-D, 45-E, and 45-F are shown in table 4.41, together with average biserials for the three classes combined by Fisher's z-technique. Validities of age, education, and previous flying experience are also shown. For the variable previous flying experience, men with military flying instruction were omitted. For class 45-D, 25 cases were considered, of which 13 graduated; for class 45-E, 81 cases of which graduated; and for class 45-F, 128 cases, of which 89 graduated.

For 155 returnee officers original test records were available either on the battery of July 1942 or the battery of December 1942. Of the 113 men tested on the battery of December 1942, 79 were graduated, the proportion of graduates being 0.699. Of the 42 men tested on the battery of July 1942, 26 were graduated, the proportion of graduates being 0.619. Results for the original testing are shown in table 4.42,

	N	P.	.M.	M.	8,01	· 756	rsiit
Class 45-D:		,			· · · · ·		
<u>Age</u>	- 35	0. 553	23, 86	24.29	1.78	-0,15	
Education	38	. 553	4. /6	5.06	1.17	16	
Previous flying experience	25	. 520	4.85	5.00	. 39	25	
Bombardler stanine	38	, 553	8,29	8, 12	1.15	.09	[
Navigator stanine	38	. 553	8,48	8.41	. 99	.04	
Bomber pilot stanine	38	. 553	7.91	7.35	1.26	.27	
Fighter pilot stanine	38	. 553	7.76	6.82	1.11	.53	
Aerial günner stanine	38	. 553	7.43	6. 82	1.29	.29	
MAO stanine	38	, 553	7.29	7.00	1.44	.12	
ROO stanine	38	. 553	8,10	8.06	1.24	.02	
Class 45-E:							
Are	102	. 824	21.45	24.33	1.76	28	
Education.	102	.824	4.65	5.39	1.16	36	
Previous flying experience.	81	.827	4,90	Å 00 Å		· 11	
Bombardier stanine.	102	.824	8.54	8.06	.89	.30	
Navigator stanine	102	. 524	8.00	7.89	1.03	1 11	
Bomber pilot stanine	102	.821	8 27	7 61	1 13	33	
Fighter pilot stanine	102	. 824	8.01	7.06	1.25	43	
Acrial sunner stanine	102	824	8 02	7.33	1 25	1 1	
MAG stanine	102	.824	8 05	7 04	1 34	1.1	[·····
RO(I stanine	102	824	1.54	7 67	1 10		} <u>-</u>
Class 45-F:	•••		~~1	11.61	4.10	•••	
Are	151	.715	23 57	23.34	1	- 21	-0 21
Education	151	715	A 77	6 07	1 22		2
Provious fixing experience	124	605	1 84	4 02		1 2 6	1 211
Bombardier stanine	151	715	8 35	1 15	- 04		- 13
Navientor stanine.	151	715	9. AN	9 47	1 1 1		1 1
Bomber pilot station	15	718	8 14	7 57		1	
Flubtor tillot staufna	101	716	2.01	7 51	1.13	1 .2	1 177
Acelal entiner stanine	151	714	8.03	7 84	1 1 21	10	
MAG stanina	151	715	0.20	7 01	1.20		
416 - 3 - 7 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6 - 6	101	1 113	0,10	1.30	1,24	1 .11	, 24

TABLE 4.41.—Biscrial validities of stanines and nontest variables in baltery of September 1944 for officer returnees in elementary pilot classes 45–D, 45–E, and 45–F

A verage rate for three classes by Fisher's stechnique.

while retest validities are given in table 4.43: The men and scores for the battery of September 1944 were included in the results reported in table 4.42.

Stanine	Origini	l test, ba N=42, j	ttery of ps=.019		Origina	l test, ba N=113,	tiery of I ps=.699	2ee 1912
· · · · · · · ·	Me	<b>M.</b>	8D.	This	М,	.M.	* 8De.	710
Eombardier	5, 12 5, 15	8.08 8.81	1.90 2.23	0.02	4.71 6.44	8.08 6.03	1,96	0.20
Pilot.	4.63	4.13	1.97	.15	A II	<b>4.00</b>	1.95	.36

TABLE 4.42.—Primary pilot validities of stanines for returned officers based on original testing with the battery of July 1942 or December 1948:

TABLE 4.43.—Primary pilot validities of stanines of battery of September 1944 for returnee officers who had been previously tested with battery of July 1948 or December 1942, group identical with that reported in sable 4.48

Stanine	м,		8De	716
Bombardier Navirator Bomber pilot Fighter pilot Actial gunoer Mechanic armorer gunner Radio operator gunner	8.62 8.50 8.29 8.20 8.42 8.31 8.60	8.44 8.54 7.62 7.36 7.86 7.78 8.66	0.79 .84 1.11 1.14 1.12 1.24 .86	Q.14 .01 .24 .44 .32 .31

[N=155; ps=.677]

Correlations between original and retest stanines for 61 returnee officers originally tested on the batteries of July and December 1942 and retested on the battery of November 1943 are shown below.

Stanine ,	N	M	SD	M	8D	*
Bornbardier Navigntor	61 61 61	5, 61 6, 31 5, 13	1.94 1.98 2.11	8.72 8:80 8.26	0.63 .51 1.05	0.58 .44 .66

These correlations are low, partly because of the restricted range of the retest stanines, which were largely 8's and 9's.

In this study the validity of the pilot staning for returnee officers for all classes combined was approximately 0.50 and for returnee enlisted men approximately 0.40, with no correction for restriction in range applied.

In cases with data available on both original testing prior to bombardier and navigator training and retest prior to pilot training, the second stanine obtained appeared to be slightly more predictive than the first stanine.

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### VALIDITY OF STANINES FOR PREDICTION OF SUCCESS OF NEGRO PILOT TRAINEES

Negro candidates for air-crew training were examined with the class sification battery at Medical and Psychological Examining Unit No. 6, Keesler Field, Miss., and trained at the Tuskegee Army Air Field, Ala. Table 4.44 shows the validities of the stanines of the November 1943 battery for 298 Negro candidates in classes 44-J through 45-C. The validity of the pilot stanine is higher than that of the bombardier or navigator stanines, but definitely lower than for the white trainees in the same classes.

1 7 7	1		•	
M,	<b>M</b> ,	8D,	Thia	d 540
4.41 3.74 5.24	4.28 3.62 3.05	1.68 1.39 1.24	0.13 .15 .28	0.21 .20 .33
	M 4.41 8 4.41 8 3.74 8 5.24	M ₀ M ₀ M ₁ M ₂ M ₃ M ₄ M ₅ M	M ₆ M ₆ SD1 8 4.41 4.28 1.68 8 3.74 3.62 1.39 8 5.24 8.05 1.24	M ₆ M ₄ SD1     F16       8     4.41     4.22     1.68     0.13       8     3.74     3.62     1.39     .15       8     5.24     0.06     1.24     .26

TABLE 4.44.—Validifies of stanines for Negro air-crew trainees, battery of November 1943, Tuskegee elementary pilot classes 44-J, 44-K, 45-A, 45-B, and 45-O

Because of the difficulty in filling quotas, it was necessary to use lower stanine cut-offs for Negroes than for white candidates, thus qualifying a larger proportion of Negro examinees. Detailed analysis showed that the pattern of intercorrelations of the classification tests was also different and that a number of tests differed significantly in validity in predicting training success. These intercorrelations and validities are shown in table 4.45. By reweighting the tests in the battery, it was found that a multiple correlation of 0.42 could be obtained for this particular sample. However, because of the small size of the group, it can be anticipated that this value would show an appreciable amount of shrinkage in a new group.

### TESTING OF CHINESE STUDENTS WITH CHINESE TRANS-LATION OF THE CLASSIFICATION BATTERY

Beginning in December 1943, experimental testing of Chinese aviation students was conducted at Psychological Research Unit No. 3, Santa Ann, Calif. The translation of the classification battery into Chinese was made under the direction of Capt. T. N. Sang of the Chinese Air Force. In time, the complete battery of classification tests became available in the Chinese editions, using pictorial material from the American battery. Apparatus test instructions were translated and standardized, and the general procedures were made parallel to those in use for the classification of American cadets.

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The biserial validity coefficient reported in table 4:46 is for graduation or elimination in advance training for the 8th Chinese Detachment, For this group there was practically no elimination in elementary training. Correlations of the pilot stanine with primary and advanced school criteria are also shown. From this table it appears that the Chinese adaptation of the battery was definitely successful in predicting flying success:

TABLE 4.48.—Validity: of pilot staning for predicting graduation-elimination of Chinese students in pilot training

Group	Phase	Ni.	· Pe	M	. M.,	8D,	7140 0 0 0 0
8th Chinese Detachment	Advanced	64	0.706	4.71	2.67	1. 78	0.34

Correlations of pilot staning with primary and advanced school criteria for Chinese training Detachment.

		Advi	hood
	Primary (N=89)	Fighter pilot (N-28)	Bomber pilot (N-21)
Plying rating. Ground school average.	0.40	6. 18 . 17	*0.11 .20

### RESULTS WITH CADETS OF UNITED STATES MILITARY ACADEMY

At the request of the United States Military Academy, West Point, N. Y., printed tests of the classification battery were administered to cadets of the class of 1946 in September 1944, and the apparatus tests were administered 2 months later. Intercorrelations of classification test scores, stanines, academic grades and physical proficiency measurements are shown in table 4.47. A total of 356 of these men were trained in pilot class 45-8. Stanine validities are shown in table 4.48.

LABLE -	4.48.—Validitics	of stanincs	in prediction	of gra	duation-climination	of
	West Point of	cadets in elen	nentary pilot t	raining	, class 45–H	•

Stanine	N.	Pe	м,	М.	8D,	Y blo
Bombardier. Navigator Bomber pilot. Fighter pilot. Aerial gunner. Mechaule armorer-gunner. Radio operator-gunner.	358 358 358 358 358 358 358 358	0.711 .711 .711 .711 .711 .711 .711 .713	7.76 8.31 7.70 6.89 7.21 7.41 8.13	6.98 7.00 6.46 5.38 6.02 6.17 7.63	1.38 1.09 1.59 1.80 1.73 1.71 1.71	0.34 .21 .47 .50 .45 .45 .44

Although the group was restricted in the sense that their average stanines were higher than those found for men processed in the basic training centers, validities were comparable. For elementary pilot Dedi ANNA TARAA . 18 2 58888 53863 58888 Represent the second stated for the second states and the second se SEXES 1 58285 (82288) 82882 ,##XX#. , **Faux vavs**e szere zabie: seise szere öszse sases *N#88 85#8# 58885 58883 frake faxer zenen nyen NANSA NASA8 ***** sarra 'sasaa wheya wat u uuura .upuut 'sasaa' sasaa .saraa saas saas ayaa ayaa 2 <u>พยุพหล่ะ พระธรร พนุรหัญ 2 262 พยุมพล 1861 มีจะหม่อ: สุดจุษม พยุธยัญ สีลัขตุจ ธยุรริม กลังจะ</u> Ĕ 0,52250,235557,525628 8 '<u>s</u> ' HRAY & WESAN WE REN'N SUBARY SUBARY SUBARY SUBARY WERE SUBARY WERE SUBARY SUBARY SUBARY SUBARY SUBARY SUBARY SU ÌΩ, a prista urstan is an utaten sausa isses nutat uses ikutat utase utase sisse tesse UNHAN NANAN & WUN HANN STREE BESTE BESTE NESTER NESTER STREES SEPERE 2 aunes salaey herri asses, sever tesses apart drass anted correct costations Namuz 2822 - 20085 - 20085 - 20083 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 - 2005 2 under in the second of the second .28238 8==== 1282 RA 28 BUUNDER UNDER APANA NASUR NEEDE UNE UNERS UNDER UNDER SERER SABA Nors dust author during andre assure ansure assure assure assure CEACED CITAGE CITAGE CITAGE CITAGE CITAGE CLINSC CPG22-21A. CP501B CP501B CP501B CP502B CEMASE Clease Clease Clease CPSIA CPAMB CM101A CM101A CM100B CM100B unner Stanine er Stanine ............ 4 Gruphic liah. tary Topography and Graphia ding comprehension. 8 ;;; Verlable fillimetic reasoning iai and table reasoning patial orientation I...... patial orientation II...... ographical data, mavigati Mathematics English Attuary Topography and G Attuary Physical Endered reaction General Information.... Instrument comprehena Mechanical principias... Mechanical Information... Speed of identification... Fluger Dexterity. Bombardier Stanine... Navigutor Stanine. Bomber Pilot Stanine. Fighter Pilot Stanine. chanic Armune dio Operator Gur fort Quality Been Total Propertional Officer Average Rese Average Ra et Average Ra d Composite R rutes Rotary pursuit Two-hand scordin Complex scordine Rudder scortol Distimination re al operation at home for CERP Cadet Aven Final Comp Increal and Arts Necha Official Carlo 51.200 inizizi ี้สุทธรร แห่ยุมุม สุทุสมุม แห่ยุมุม มีกุมมุม วุกกุมกุ QÇÇŞŞŞ สรีสสร้

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TABUE 4.47.—Intercorrelations, meāns, and standard deviations of elassificationstetis, stanines, and West PC

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۶ [	\$977 <u>8</u>	811834	¥883¥		19555	48832	88 <u>3</u> 3	r=888	*\$\$\$\$\$	82328	27288	នង់ខ្មន់ន
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training, the fighter pilot stanine had the highest validity, 0.50, followed closely by the bomber pilot stanine. The bombardier stanine was less predictive of pilot success, while the validity of the navigator stanine was 0.22.

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### VALIDITY OF THE PILOT STANINE IN WASP TRAINING

At the request of representatives of the Women's Auxiliary Service Pilots (WASP) arrangements were made in March 1944 for the administration of the classification test battery to members of the WASP's in training. The group was tested at Avenger Field, Sweetwater, Tex., by members of the staff of Medical and Psychological Examining Unit No. 8: As shown in table 4.49; the pilot stanine had a validity of over 0.50 for two classes of women trainees. Further testing of members of the WASP organization was precluded when the organization was dissolved in December 1944.

TABLE 4.49.—Validity of the pilot-staning in WASP training, battery of Novêmber 1943

Class	N ₁	Po	М,	М,	SD, ≥	Žšu
44-W-7. 44-W-8.	87 104	0. 839 . 610	5.47- 4.84	3.73 3.22	1.81	0. 63

### VALIDITY OF PILOT STANINE, CLASS 42-X

In September 1942 trainces for a special pilot class were selected at Psychological Research Unit No. 2. The purpose of this class was to

TABLE 4.50.—Validity of the pilot staning for pilot class 42-X

<i>"</i>	Nı	Pr	Me.	M.	SD1	£14
With previous training	180	0. 872	6, 45	5,01	1.72	0.44
	205	. 532	6, 75	0,59	1.82	.03

Damber .	Men wi fiying	th previous experience	Men without previ- ous flying experience		
Stanjne	Ń	Percent climinated	N	Percent eliminated	
	25 14 46 38 30 19 7 3	0.0 8.7 13.9 23.3 15.8 42.9 33.3	21 23 55 73 29	38, 1 52, 0 43, 6 45, 3 55, 6	

Distributions of the pilot stanine in class 42-X

TABLE 4.511	The validity of stanines o	l the December 1942 cla	sificatio	s battery	for vari	ous lype	e of tech	nical Irai	ning	
Type of training	School	Criterion	N	x	8. D.	Stanine	Ж	S. D.	<b>.</b>	<b>R</b> 1
Armaneut	Lowry Field	Averaço grade.	32L	78.67	20	<u> </u>	444	567	ទទួន	
Armsment	Lovery Ekild	Final grade	376	7.4	61	<u>e%a</u>	७७।- हर्लल	000	<u></u>	8.
Air mechanle	Sbeppard Fkld	Finel grade	8	87.78	2.35	exe			સંલંક	.05
Radio oprator-mechanic	Šætt Fkld	Final grade	152	8.11.6	30.5	<u>éza</u>	+ * * + + + +	003	\$V8	2
Radio operator-mechanic	Scott Field	Frequency of hold-over	នរ	1.1	£.1	EZA,	4 4 4 4 4 4		979	
Type of training	School	Criterion	Stanine	N	pe	<b>У</b> .	.W.	S. D.	74	Ā
Hadio operator mochanie	South Fkeld	Pars-Fail.	A AZ A V A V A	និនិនិនិ	0.607 607 607	รัฐรัฐ	**** \$888	8523	822 <u>1</u>	3

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² Based upon regression weights for the satire battery.

178

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train pilot instructors, who were greatly needed at that time, without the usual?long course of cadet training. Flying training was greatly accelerated. In selecting members of this class, men with previous flying training were given first preference, but in order to meet the quota it was necessary to add others without previous flying experience. However, no candidate without previous flying experience was qualified for the class whose pilot stanine was below 5.

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Biserial validities of the pilot stanine for the two groups in the class, together with distributions by stanine and percent of elimination in each stanine, are shown in table 4.50. For the men with previous flying experience, the validity coefficient of 0.44 compares favorably to that found for other groups. For the men without prior flight training, the validity of the stanine was low. Almost half of this group was eliminated and the special circumstances under which the group yas trained probably were a factor in the low validity.

### VALIDITIES OF STANINES IN TECHNICAL TRAINING

Since a very large proportion of the enlisted men who were trained in the Air Forces Technical Schools were originally procured as prospective air-crew trainees and were tested with the classification battery, it was possible to determine the effectiveness of the classification tests and the stanines for predicting success in various types of technical training. Stanine validities and multiple correlation coefficients for several samples of technical trainees are presented in table 4.51.

The versatility of the stanines is further illustrated in a study at Medical and Psychological Examining Unit No. 9, Buckley Field, Colo., in which the stanines of the September 1944 battery were correlated with pistol and carbine firing scores. The population was 350 air-crew candidates tested in late 1944 at Medical and Psychological Examining Unit No. 8, Sheppard Field, Tex. The correlations are shown in table 4.52. Pistol scores have somewhat higher correlations with stanines than carbine scores, although all coefficients are significant at the 1 percent/level.

TABLE 4.52.—Correlations of stanines of September 1955 battery, with small arms performance [N=320]

Stanlaë	м	ED	Platol	Carbine
fighter pilot. Bonber pilot. Navigator Dombardier. Arthi gunner. Machanic armorer-gunner. Ratio operator-gunner.	5,03 4,10 4,60 4,51 4,96 4,94 4,94	2.31 2.22 1.98 1.91 2.16 2.16 2.15	0.38 .40 .25 .32 .39 .40 .31	0.31 .31 .32 .30 .27 .30 .27 .37
M			62, 84 14, 51	132,21 17.60

179

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## CHAPTER FIVE____

# The Experimental Group

### INTRODUCTION

The present chapter reports results in training for a group of approximately 1,300 men who were sent into pilot training with no prerequisites as to aptitude or temperament.

As indicated earlier in this report, the Army Air Forces initiated in January 1942 a program of selecting men for air-crew training in terms of performance on objective aptitude tests. The program of selection and classification involved screening at two successive stages. In the first place a minimum qualifying score was established on the AAF Qualifying Examination in terms of which a substantial fraction of applicants was disqualified. This proportion ranged at different times from as low as 25 to as high as 50 percent. In the second place, an additional screening took place at the time of administering classification tests to determine for which air-crew specialty each man should be recommended. Originally the classification tests were used only to determine for which air-crew specialty a man should be recommended, but starting in December 1942 a minimum qualifying stanine was set for all air-crew duties. The stanine requirements were progressively raised, so that by the end of 1944 some 70 percent of all new air-crew trainees who took the classification tests were being disqualified from air-crew training on that basis. These procedures, through which aptitude test scores were used to see that men most likely to succeed were sent into each type of training, made it impossible to get data on the performance in training of a group which had not been screened in terms of aptitude. It was impossible to get records of performance in training for the type of individual who had already been eliminated by the tests.

It seemed desirable on several counts to get empirical data on the performance in training of a group which was completely unselected so far as test performance was concerned and to validate tests and aptitude scores for such a group. Though statistical procedures have been developed to correct for curtailment of the group, it was considered desirable to supplement statistically derived values with empirical results. In the first place, actual data on what did happen to

certain individuals carry much more conviction, particularly to the lay. man, than calculations as to what would have happened on the basis of certain statistical assumptions. In the second place, the statistician should check empirically the correctness of the assumptions which he must make in calculating corrections to take account of the curtail, ment in the available group. In the third place, some of the statistical problems of corrections for several successive curtailments of a group and of correcting biserial correlation coefficients for curtailment seem not to have been entirely solved. In view of the above considerations, it seemed well worth while to send one group of men into training without curtailment and see what actually happened to the men who would have been eliminated by the normal selection procedures. Accordingly, the experiment was initiated.

A memorandum was prepared by the Chief of the Psychological Branch from the Air Surgeon to the Chief of the Air Staff, dated 6 May 1943, Subject: "Study of Eligibility Requirements For Aviation Cadets," outlining the proposed research study. Discussions of this memorandum led to its approval and the preparation of a letter to the Adjutant General, dated 21 June 1943, same subject as above, specifying the procedures for selecting personnel to constitute the experimental group. This was implemented by a letter from the Adjutant General to the several Service Commands, dated 10 July 1943, transmitting instructions on the necessary procedures. Actual recruiting of the group took place during August, September, and October of 1943, and shipments of men into training took place during September, October, and November, with a few cases delayed until still later.

### ADMINISTRATIVE AND TECHNICAL PROCEDURES

### Selecting the Group

In selecting a group of subjects for this experiment, the purpose was to assemble a sample which would be representative of the total group of applicants for air-crew training and to send them directly into pilot training with a minimum of delay. The letter of 21 June 1943 referred to above gave authorization to waive all mental requirements for entrance into pilot training for a group of 1,450 men. Approximately 40 Aviation Cadet Examining Boards were selected from which the subjects were to be obtained. These were distributed overthe country, and included boards in cities as well as at army posts. Quotas were allotted to the different boards so as to obtain numbers from each service command proportional to previous flow from that service command. An officer from the Psychological Branch, Research Division, Office of the Air Surgeon, visited each board which had been assigned a quota for the experimental group and explained procedures in detail to the officers in charge of that board.

Beginning in August 1943 applicants for aviation cadet training at each of these boards were given special instructions as follows:

Some of you men who can qualify may wish to by pass or omit the pre-avlation cadet college training program. Omitting the college training program willmean that you will have an opportunity to become an avlation cadet and enter dying training that much sooner. There are many advantages of becoming an avlation cadet as soon as possible. For example, as an avlation cadet you receive \$75 per month, but while you are in college you receive the pay of a private, which is \$50 per month. As an avlation cadet, you are issued special clothing. Most important of all, the sooner you enter flying school, the sooner you will have the opportunity of earning your wings and becoming an officer.

If you are between the ages of 18 and 27, and if you want to go into pilot training, you are eligible to volunteer to omit the college training program and to go into flying training as soon as practicable. A form will now be distributed to you. Read it, but do not fill in any of the spaces until you are told to do so.

Examining Boards were instructed to inform those men who signed the waiver, and who passed the physical examination for flying, that they had been accepted for pilot training. Men were to be accepted, no matter how poorly they had done on the AAF Qualifying Examination, until the quota for the board had been filled. Rosters of men who had been accepted for the experimental group were transmitted from the examining boards to the Office of the Air Surgeon. That office initiated requests for the shipment of groups of men into basic training centers. Men who applied as civilians were given 60 days of basic military training at basic training centers after which they were transferred to classification centers and given the battery of aircrew classification tests. Men already in military service were sent from basic training centers to a classification center for testing without further military training. As indicated above, those men waived college training; so they were to be sent to Preflight training directly from classification centers.

As might be expected in an experiment involving as large a group of subjects as this and as many different cooperating agencies, a certain number of mix-ups and delays occurred. In all, 239 men received classification tests at Medical and Psychological Examining Units at basic training centers instead of at Psychological Research Units at classification centers as planned. Although it had originally been hoped that all men in the group would enter training at very nearly the same time, delays of one sort and another resulted in a spread of seven classes between the entry into flying training of the first and last man of the group.

### Testing

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Testing of the experimental group followed the standard procedures in use in the aircrew psychological program at the time. The AAF

Qualifying Examination, Form AC12I, was administered to the menby the examining boards. This form of the Qualifying Examination had only recently been introduced, and it presented some new administrative problems to the boards since it required careful and accurate timing of speeded parts of the test. However, each of the boards was visited by an officer from the Office of the Air Surgeon, so that the boards were adequately instructed in the new procedures. The tests were scored by the boards, but the answer sheets were transmitted to the Office of the Air Surgeon, where the scoring was checked. Subsequently, part scores for seven sections of the test were computed by personnel of the Aviation Psychology Program in the AAF Training Command.

The men in the experimental group took the battery of classification tests together with applicants for air-crew training who had entered air-crew training in the usual way, and the standard procedures were followed in testing, scoring, and combining test scores into weighted aptitude scores. The first of these men was tested on 25 September 1943, and the bulk of the testing took place during the next 3 months. Practically all men were tested after 1 November 1943 with the battery introduced on that date. However, some men were delayed, and the testing of the group was not completed until May 1944.

### **Records and Reports**

In order to carry out this experiment, a number of special provisions had to be made for maintaining records and controlling flow of personnel. These will be described at this time.

Initial responsibility for assigning men to the experimental group fell upon the group of selected examining boards. As indicated above, these boards selected men to fill their assigned quota on the basis that the man was 18 to 27 years of age, signed the waiver form indicating acceptance of immediate assignment to flying training, and passed the physical examination. The only other authorized basis for exclusion was a criminal record. The Board Proceedings for these men were identified by an attached waiver form and the statement under remarks

Found mentally qualified in accordance with Special Procedures authorized by The Adjutant General, dated 10 July 1943.

The records of men identified as above were segregated in the headquarters of each service command, and held pending further instructions for calling the men to active duty and shipment to a basic training center.

At the same time that a request was initiated for orders shipping a group into basic training centers, the roster of men indicating the stations to which they were to be sent was transmitted to AAF Train-
ing Command Headquarters. Training Command Headquarters informed the stations involved of the expected shipments, and provided instructions for processing men through basic training centers. Men already in the Army, who had already had basic training, were merely given a physical examination and shipped to a classification center. Men who had been recruited for the group from civilian life were in addition given 60 days of basic training before shipment to a classification center. In making shipments from basic training centers to classification centers, an effort was made to keep the experimental group together and make a small number of large shipments. Rosters of each shipment were sent to the classification center.

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From the basic training centers, men were shipped to classification centers, where they were given the complete physical examination for aircrew ("64 examination") and were given classification tests by the Psychological Research Unit. Special rosters for this group were prepared at the Psychological Research Units and forwarded to the Headquarters AAF Training Command as each shipment was tested.

A complète cumulative card file on all men in the experimental group was maintained in the Office of the Air Surgeon. This file recorded name, Army serial number and other identifying information, qualifying examination score, and facts about shipment orders. This file provided a final check upon the members of the group. Certain individuals who were not identified on special rosters at the time of classification testing were subsequently located for inclusion in analyses by reference to this basic file.

In general, every effort was made to minimize the special attention paid to members of this group, and to avoid marking them off as in any way special or unusual. Some basis of identification and follow-up had to be provided, but the use of this and the number of people who were aware of it were kept to a minimum. In setting up procedures at basic training centers and classification centers, specific instructions were issued that the experimental project was to be kept confidential, and that only those individuals were to be informed of it whose duties required such information. Provisions were made that there should be no segregation of these individuals from the regular flow of trainces either at the time of testing or in subsequent training. The members of this group were differentiated from the group of trainces acquired through standard procedures only by the omission of stanines from the service record and the addition of the notation:

Qualified for pilot training under authority AGO Letter, File AG 221, 10 July 1943.

The fact that stanines were not available on the service records of these men made it impossible for personnel in training schools to have any information as to the aptitude scores of individual men. The members of the group were, of course, aware that they were a special group receiving special treatment, but there is no indication that they were aware of the bases upon which the group had been differentiated other than the omission of college training.

The Flying Training Commands were instructed that as members of the group, identified as above, were eliminated from training, Training Command Headquarters was to be notified. This notification was required in order that information could be provided as to the eligibility of the individual in question for some other air-crew assignment. This procedure also served the purpose of providing preliminary criterion information for part of the group. In determining the final disposition made of each man in the group, the records just mentioned were supplemented by a systematic examination of the academic reports in the Surgeon's Office, Headquarters Training Command. Cases not found in these records were reported to the Office of the Air Surgeon, and a search was carried out in the 201 files at Headquarters Army Air Forces and in the Office of The Adjutant General.

Test records and records of composite aptitude scores were punched on IBM cards as they were received, and were filed in the routine manner in the complete testing files at the Office of the Air Surgeon, Headquarters AAF Training Command. These test results were subsequently collated with criterion data for the statistical analyses which are reported in the following sections.

# CHARACTERISTICS OF EXPERIMENTAL GROUP

In all, 1,311 individuals were finally recruited for the experimental group. A summary statement of what happened to these men is presented in table 5.1 and shown graphically in figure 5.1.

Two features of table 5.1 seem to warrant further comment. The first is the small percentage of this group of individuals who managed to complete advanced flying training and obtain their wings. Only 20 percent of the total group graduated. Some further comment should also be made on the 159 men who did not get into pilot training. Table 5.1 gives some indication as to what happened to these men, but for many men the information is rather incomplete. A substantial group of men (42), for example, were eliminated at a classification center and no further record was found. It is assumed that the cause of elimination for most of these men was a physical defect not found in the early physical examination but found at the time of examination in classification center. However, there is no definite



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information that this was the case. Other individuals were probably lost to the group through administrative mix-up, in that they were sent to basic training centers in small groups or as isolated individuals and were not recognized as members of the experimental group. Though little is known about the actual basis upon which these menwere lost to the group, there is no indication that the selection was such as to bias the data on classification or selection tests.

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Certain background characteristics of the group are presented in table 5.2.

Table 5.3 shows the distribution of AAF Qualifying Examination scores for this group. It should be noted that the passing mark for this form of the AAF Qualifying Examination was 180. This means that 41.9 percent of the group failed to achieve passing scores on this examination.

Disposition	N	Percent
Did not get into pilot training	159	12,1
Disqualified A RMA, ¹ physical examination or both. Assigned other than flight training, did not reach preflight. Assigned other than flight training after entering preflight. Eliminated classification center, no further record. Graduate bombardier or navigator training; no pilot training. Pool. Records sent to demobilized personnel records. Passed physical examination; no further record.	41 55 42 42 43 7 3	
Eliminated in preflight	189	14.4
A cadémic deficiency Own request Administrative (including physical).	99 27 63	
Eliminated in primary pilot training	581	
Flying deficiency. Fear, own request. Administrative (including physical)	504 36 43	
Manhaaret in Distegrate training		
Form denotency. Form, own request. Administrative (including physical).	69 4 10	
Eliminated in advanced pilot training	24	I. 8
Flying deficiency Administrative (including physical)	18 0	
In Primary Flying School (held over for eight classes) Gradu ded from advanced training Dispesition not known Removed from study (CDD), ² previously tested, etc.).	1 265 3 6	0.1 20.2 0.3 0.5
Total	1,311	

TABLE 5.1.—Disposition of personnel entered in experimental group

Adaptability Rating for Milliary Aeronautics, a psychiatric interview which was part of the physical examination.
 ¹ Di charged for reasons of physical disability.

187

	N	Percent
Aze:		
20-8	130	10,0
24-5	176	13.6
22-3.	240	18.5
20-1	354	27.5
28-19	397	30, 6
Unknown	8	
Education:		
Professional-scuool graduate	3	0.1
College graduate	20	2.0
Third year, college	20	1.0
Second year, college	88	61
First year, college	92	7.:
Twellih grade	736	57.
Eleventh grade	153	12
Tenth grade	96	7.4
Ninth grade	40	3.1
Elalith spale of less	17	1.:
Unknown	31	
Praylous flying experience:		
Commercial lleepse	2	0.:
Private license	11	. 0.9
Student outificate, sola privileres	45	3.
Student ortificate	33	20
Pessences no instruction	740	58.)
Never been passenger	421	33.0
Military Instruction	22	1.
Unknown	31	1
Recultad from:		
	652	] · SO.
Civilian status	646	{ 49.4
Karita ataine		1
Blingla	936	73.
Ning Ni Contra State Sta	322	25.
Willowed diversel energied	15	1.
The second structure and second	32	

TABLE 5.3.—AAF Qualifying Examination scores of experimental group

Šcore .	N	Percent	Score	N	Percent
320-339 300-319 240-200 260-279 240-229 240-229 230-219 200-219 200-219 200-219	3 7 21 57 97 131 170 252	0.2 .6 1.7 4.5 7.6 10.3 13.4 19.8	100-179. 140-159. 120-139. 100-119. 80-99. Total	247 155 32 38 10 532	19.4 12.2 6.5 3.0 .3 41.8
Total	738	68.1			
Total		1 270	I Maan soure	<u></u>	191.06

Unknown.

In table 5.4 are presented distributions of stanines for the experimental group. These may be compared with the percentages for the different stanine values normally expected among men who has passed the qualifying examination, which are also shown in the table.

Finally, table 5.5 shows the mean and standard deviation of the experimental group for each of the classification tests. For comparison purposes, means and standard deviations are shown for a sample of 1,920 cadets processed at medical and psychological examining units in the normal manner who were tested at approximately the same time.

	Bomt	Bombardies Navi			Pliot		Theoret
Stanine score	Number	Percent	Number	Percent	Number	Percent	leal percent
	42 64 107 153	13 5.0 8.4 12.0	31 48 68 114	2.4 2.8 3.3 8.9	22 46 118 142	1,7/ 3,6 9,3 11,1/	4713
h	195- 207 181 139 187	15.3 16.2 14.2 10.9 14.7	182 262 251 183 136	.14, 3 20, 8 19, 7 14, 4 10, 7	181 - 256 179 164 167	16.3 20.1 14.0 12.9 12.1	
Total. Unknown	i, 275 30 4. 21 2. 21		1, 275 30 3.95 1.96		1,275 30 4.08 2,06		

TABLE 5.4.—Staning distributions of experimental group

TABLE 5.5.—Mcans and standard deviations of raw scores for all tests and of stanines

		Exper	imental (	roup	Com	partson g	quor
Test	Code	N	м	, 8D	N	M,	8D
Riographical data, navigator Biographical data, pilot Spatial orientation I	CEG02D CEG02D CP201B CP201B CIG14H CP622-21A CIG15B CIG15B CIG15B CIG15B CIG15B CIG16B CF205B CF205B CF205B CF210B CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A 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CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A		22, 29, 29, 20, 20, 20, 20, 20, 20, 20, 20, 20, 20	3.01 3.07 5.752 5.130 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 5.08 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51.25 51.25 51.25 51.25 51.25 51.25 51.25 51	3.63 6.47 5.61 11.86 9.85 3.36 10.71 13.56 6.73 8.91 9.66 10.34 10.08 10.44 2.181 1.76
AAFQE—Judgment. AAFQE—flying information AAFQE—mechanical comp	AC12I-V AC12I-VI AC12I-VII	1,727 1,228 1,228	14,94 21,06 30,66	3.62 5.68 10.12	•••••		· · · · 4. · · · · · ·

Scoring formula R-36 W.

### VALIDITY OF TESTS AND STANINES

Biserial correlations were computed between classification test scores, stanines, part scores, and total scores for the AAF Qualifying Examination, Army General Classification Test ("G. C. T."), and various background measures and the criterion of pass-fail in training. Correlations were computed for each stage of training separately, and for cumulative eliminations through each stage of train-

ing. Correlations were also computed for complete flying training, excluding eliminations in preflight. Correlations were computed both including and excluding physical and administrative eliminees and both including and excluding cases with flying experience credit.

Table 5.6 shows validity statistics for complete training for: (a) all cases entering preflight; (b) all cases excluding physical and administrative eliminees; and (c) all cases excluding both physical and administrative eliminees and individuals receiving a stanine bonus for previous flying experience. The differences among the three groups are small. In general, the tests weighted for pilot give somewhat higher validities if the physical and administrative eliminees are excluded, and somewhat lower validities if flying experience credit cases are excluded.

Table 5.7 presents a more detailed statement of validities for the group including only flying deficiency and fear and own-request eliminces (the second group of table 5.6 above). Data are presented for each phase of training separately and for several combinations of phases of training.

Biographical data, navigator.       CE602D       0.11       0.10       0.09         Biographical data, pilot.       CE602D       31       33       33       33         Sputial orientation I       CP501B       34       34       34       32         Spatial orientation I       CP503B       38       40       39       38       40       39         Reading comprehension.       C1614H       31       32       28       38       40       39         Mechanical principles       CP6022-21A       40       40       31       32       28         Instrument comprehension I       CP603B       42       43       42       43       42         Instrument comprehension I       C1616B       37       39       36       36       37       39       36         Instrument comprehension II       C1616B       37       39       36       37       39       36         Instrument comprehension II       C1603B       42       43       45       45       45         Instrument comprehension II       C160B       37       39       36       30       30       30       30       30       30       30       30       30	Variable	Code	All cases	All cases ex- cept physical and adminis- trative eliminees	Physical and administrative eliminees and flying ex- perience cases excluded
AA FQE totalAC12I505030AA FQEcircuitsAC12I-II232525AA FQEbidden figuresAC12I-II313029AA FQEbidden figuresAC12I-II161515AA FQEbidden figuresAC12I-III161513AA FQEbidginentAC12I-V191919AA FQEbig ing informationAC12I-V323233AA FQEbidging formationAC12I-VI343533AA FQEbidging formationAC12I-VI343534AA FQEbidging formationAC12I-VI343534AA FQEbidging formationAC12I-VII343534AA FQEbidging formationAC12I-VII343536AA FQEbidging formationAC12I-VII343536AA FQEbidging formationAC12I-VII343536AA FQEbidging comprehensionAC12I-VII343536AA FQEbidging comprehensionAC12I-VII464740ArgooodoodoodoodoodStrength of interest, bombardleroodoodoodoodStrength of interest, pilotoodoodoodoodStrength of interest, pilotoodoodoodoodStrength of interest, pilotoodoodoodoodStrength of interest, pilotood	Biographical data, navigator.         Biographical data, pilot.         Spatial orientation II.         Spatial orientation II.         Biographical data, pilot.         Spatial orientation II.         Spatial orientation II.         Rechanical principles .         Instrument comprehension I.         Instrument comprehension II.         Orneral information.         Mathematics A         Mathematics B.         Rotary pursuit.         Two-hand coordination.         Rudder control.         Discrimination reaction time.         Finger desterity .         Bombardler stanine .         Aviguetor stanine .         Aution e .         A FQEcircuits .         A FQEluclue ength	C E(021) C E(021) C E(021) C P(20113 C P	0.11 .31 .33 .34 .42 .35 .42 .34 .42 .35 .35 .42 .30 .31 .35 .35 .42 .30 .31 .35 .35 .42 .30 .31 .35 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .42 .30 .31 .35 .35 .42 .35 .35 .35 .42 .35 .35 .35 .35 .35 .35 .35 .35 .35 .35	0.10 .33 .34 .40 .32 .43 .43 .51 .50 .29 .31 .41 .40 .42 .55 .56 .52 .50 .52 .52 .52 .52 .52 .52 .52 .52 .52 .52	0.09 33 32 33 34 35 42 37 42 37 42 37 42 37 42 37 45 45 47 31 34 34 54 54 54 54 54 54 54 54 54 5

TABLE 5.6.—Validities based on experimental group for complete training

Test         Code $\frac{1}{24}$						1	Com	plete th	róugh	-ing
Biotraphical data, N.       CE (202)       0.11       0.10       0.01       0.01       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10       0.10	Test	Code	I'realght	Primary	Basic	Advanced	Primary	Basic	Advanced	All fying el
Number climinated	Biographical data, N Biographical data, P Spatial orientation I Spatial orientation I Reading comprehension Dial and table reading. Machanical principles. Instrument comprehension I Instrument comprehension I General information. Mathematics A Mathematics B Rotary pursuit Two-hand coordination Complex coordination Complex coordination Complex coordination Complex coordination Rudder control. Discrimination reaction time. Finger dexterity Bombardler stanine. Navigator stanine. Navigator stanine. Mathematics tanine. AAFQE total. AAFQE total. AAFQE bilden figures. AAFQE bilden figures. AAFQ	CE602D CE602D CF602D CP203B C1014H C10022-21A C1003B C1615B C1616B C1616B C1616B C1616B C1616B C1616B C1616B C1616B C1616B C1616B C1702F C1206C C1702F C1206C C1701A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM101A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A CM10A	0	0.30328242242222223434342444262544244442444423444423445352223	$\begin{array}{c} 0.01\\ 0.02\\ .100\\ .15\\ .22\\ .24\\ .24\\ .24\\ .24\\ .24\\ .24\\ .24$		0.4333316445446374854442444545654243451282528451454454454454454444544445444545444544	0.33333343424234244213455527374411733475278325235252525	0.33:422444445288234444153855682359110225475572910102225	0.231323311355255555555555555555555555555

TABLE 5.7.—Experimental group, summary of validity statistics, climinees for academic or flying deficiency, fear, and own request

Probably the most significant data in table 5.7 are those showing validity for complete training from entrance into preflight to completion of advanced flying training and receipt of wings as a receiv officer. For this complete training, the validity of the pilot starme used for classification in the battery of November 1943 is 0.660 with out the credit for previous flying experience and 0.662 with the credit. The validity of the Qualifying Examinations is 0.503 and of G. C. T. 0.313. The outstanding single tests are General Information (0.506), Instrument Comprehension II (0.178), Mechanical Principles (0.426), Discrimination Reaction Time (0.422), Complex Coordination (0.415), Rudder Control (0.404), Dial and Table Reading (0.401), and Spatial Orientation II (0.400). There are only three classification tests with pilot validity below 0.30 for this group, and these tests were not weighted for pilot. The relative validities of tests for preflight and for flying training are also of interest. It is clear that the tests giving the best prediction of preflight success are quite

different from those giving the best prediction of success in flying training. Preflight success is predicted best by G. C. T. (0.473), Dial and Table Reading (0.467), Education (0.404), Qualifying Examination (0.372), and Reading Comprehension (0.348). The best prediction of success in flying training is obtained from General In, formation (0.501), Qualifying Examination (0.473), Instrument Comprehension II (0.454), and Rudder Control (0.424).

The validity statistics are illustrated by a number of charts, shown at the end of this chapter as figures 5.2 through 5:60. These show the validity data in various ways and make possible a number of cross comparisons.

The validities in tables 5.6 and 5.7 are for all men in the experimental group. Validities are also available based upon only those men who received a passing mark on the AAF Qualifying Examination. A comparison of these values with the validities for the complete group is of considerable interest, since it provides direct empirical evidence of the effect which curtailment of the cadet population from the use of the qualifying examination had upon test and stanine validities. Table 5.8 shows the validity for the complete group and for those who passed the qualifying examination, and shows in addition the correlation of test scores with qualifying examination score in the total group. This table shows clearly the general reduction in test validity resulting

TARLE, 5.8.—Experimental-group test validities in total group and in group passing AAF qualifying examination

		0		
Test	Code	Total group validity	Qualifying passers validity:	Test VS, Qualifying
Blogmubical data navigator	CE602D	0, 11	0.11	0.'08
Normuhical data, pilot	CE602D	.34	.32	.31
Spatial orientation L.	CP501B	.32	.28	• .41
Spatial orientation If	CP503B	. 39	.32	.53
Reading comprehension	CI61411	.31	.24	. 52
Dial and table reading	CP622-621A	.38	.29	.51
Mechanical principles	C1003B	.44	.33	.59
Instrument comprehension 1.	CI615B	.34	.23	
Instrument comprehension II	C1616B	.45	.42	. 54
Cleneral Information	CE505P	.46	.35	.63
Mathematics A	-C1702F	.30	.23	.40
Mathematics B	CI206C	.27	.19	.45
Rotary pursuit	CP410B	.28	.30	,20
Two-hand coordination	CM101A	.34		.34
Complex coordination	C M701A	. 40	.34	9.0
Rudder control.	CM1208	, 10	.40	.73
Discrimination reaction time	CP611D	, 40	, 37	
Fluger devlerity	CM116A	.18	.13	.13
Hombardier stanine			. 46	. 59
Navigator stanine		.51	.45	.05
Pilot stanine			. 59	.00
Officer quality score		.50	1 .12	.70
AAFQE, wial	1	.10	. 53	
AAFQE-circuits	AC121-1.	.71	.12	
AAFQE-hadden ngures	AC121-11	.30		1 .2
AAFUE-line length		1 15	.03	1 .3
AAFQE-point distance		1 .18	1 .1	1 4
AAFQE-magment	AC121-V	.32	1 .22	
AAFQE-Hying information		1 .30	1 .19	- 21
AAFQE-mechanical comprehension.	A 121-VIL	.42	1 .38	1
General classification test		i .31	1 .17	1 .19

Eliminees in preflight and primary for flying deficiency, fear, and own request.

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LABLE 5.9 --- Intercorrelations of classification lests, stanines and other incasures of experimental group i *[N=1,112]

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from cartailment of the group. It is also clear that in general, with minor exceptions which may be due to sampling fluctuation, the higher the correlation with the variable in terms of which the group was curtailed, the greater the reduction in validity.

Correlations among all scores available for the experimental group were computed, for use in-analyses of multiple correlations from various groups of tests. The complete table of correlations is given in table 5.9.

# FURTHER ANALYSES OF VALIDITY STATISTICS

The validity statistics per<u>mit of a number of further special analyses</u>. These are presented in the following sections.

A comparison was made of the correlation with pass-fail obtained from the pilot stanines of November 1943 and the multiple correlation obtained from the optimum weighting of tests based upon the validity and intercorrelation statistics of the experimental group population. These comparisons were made using validities for eliminees at all stages, including preflight and also using the validities based upon eliminees from flying training only. The results are as follows:

	All eliminees, including preflight	Eliminées from flight train- ing
Stanine correlation.	0. 600	Q. 653
Multiple correlation.	. 693	. 609

The possible improvement upon the stanine by reweighting the tests is seen to be quite small, 0.033 for all eliminees and 0.016 for eliminees from flying training only. When it is remembered that the multiple correlations are based on this specific limited sample and would show some shrinkage in another sample, it can be seen that the stanine in use in the November 1943 battery gave very nearly the maximum prediction which could be extracted from this group of tests. This is the case even for the experimental group, which has not been screened on the Qualifying Examination, and for which different relative weights would therefore be expected than for the groups processed by the standard routine.

A further analysis was made to determine the maximum prediction which could be obtained from the paper-and-pencil tests alone and the psychomoter tests alone. These results are as follows:

	All eliminees	Flying training eliminees only
Complete battery	0.69	0.67
Paper-and-pencif only. Psychomotor only.	. 64 . 53	.61

It can be seen that a very substantial prediction can be obtained fromeither the paper-and-pencil or the psychomoter tests, omitting the other group. However, neither paper-and-pencil or psychomoter alone can equal the predictive efficiency of the complete battery.

It is also of interest to see what level of prediction can be obtained from two, three, four, or five tests from the complete battery. The multiple correlations obtainable from certain abbreviated batteries are shown below.

	All eliminees	Flying training climinees only
General information.	0,506	0. 501
General information and instrument comprehension II.	,584	. 562
General information, instrument comprehension II, and rudder control	,620	. 616
General comprehension II, rudder control, and dial and table reading	,645	. 632

It can be seen that for this specific sample a fair approximation to the validity of the total battery can be obtained from a selected group of four or five tests. However, it must be recognized that these results would be subject to even more shrinkage as applied to another sample than would the multiple correlation based on all tests. In selecting a particular few tests from a large battery to be used in a subsequent testing program, one capitalizes upon chance variation not only in the weights which are assigned but also in the tests which one picks to receive weights. Thus, if a large enough assortment of tests is used, it will always be possible to find a few which will, in combination, give a good prediction in the original sample, even though the predictive value may shrink to zero in a new sample. No analytical statement of the expected shrinkage is known for this case, but it would clearly be a direct function of the number of tests from among which selection was made and an inverse function of the number of tests selected and of the number of individuals upon which the correlations were based.

The validity data for the AAF qualifying examination and the G. C. T. were analyzed in relation to the validity of the pilot stanine, in order to see what, if anything, these tests would add to the prediction made on the basis of stanine alone. The results are as follows:

	All elimina- tions	Flying elimi- nations only
Pflot stanine alone	0.660 .665 .667	0, 633 , 655 , 655

It can be seen that the pilot stanine covers essentially all of the valid variance in the Qualifying Examination and in the G. C. T., so that these make no novel or separate contribution. The value of the Qualifying Examination lay in its function as a practical preliminary screen for widespread administration, rather than in any content separate and distinct from that of the stanine.

As a basis for evaluating the composition of the Qualifying Examination, an analysis was made of the regression weights and multiple correlation for the Qualifying Examination part scores. In table 5.10 which follows, the regression weights of parts of the Qualifying Examination are given, both for complete training and for flying training only. For comparison, the obtained standard deviations of part scores for the experimental group are shown.

An examination of the part score weights in table 5.10 suggests, first, that there were several parts of form 121 of the AAF qualifying examination which could have been omitted with little or no detriment to the total examination. Part III, line lengths, and part I, circuits, could almost certainly have been eliminated, and were in fact dropped in later editions of the examination. Part IV, point distance, and part V, judgment, appear of doubtful value and might be dispensed with. Actually, however, the gain to be expected from a re-weighting of the parts is not great. For all stages of training including preflight, the validity of the unweighted total score was 0.503 whereas the multiple correlation from weighted part scores was 0.510. For eliminees in flying training only the corresponding figures are 0.473 and 0.481. It appears that here again the obtained validities approximate the maximum which could be obtained from these materials.

TABLE	5.10Regression	1ccights	and	mulliple	correlations,	AAF	Qualifying
		Examin	nation	i, form A	012 <b>I</b>		

	Regressio	(m)	
Part	All eliminees	Flying climi- nees only	SD—experi- mental group
I. Circuits. II. Hidden figures. III. Line length IV. Point distance. V. Judgment. VI. Flying information. VII. Mechanical comprehension. Multiple correlation.	0.02 .11 .00 .05 .05 .15 .30 .510	0.02 .10 .01 .02 .03 .14 .30 .491	7, 77 6, 29 4, 47 4, 91 4 3, 62 4 3, 63 4 10, 12

⁴ These parts weighted double in computing total score, so effective SD's become 7.24, 11.35, and 20.24, respectively.

### DETAILED CASE STUDIES

When criterion data for the experimental group were received it was found that there were a small number of men with high pilot stanines (15 men with stanines of 8 or 9) who had been eliminated from training and a small number with low stanines (16 men with  $\cdot$ stanines of 2 or 3) who had been graduated. In view of the special interest in the experimental group and of the extensive records which

were already available for it, it seemed worth while to try to follow up this small group of individuals for whom the stanine had failed to predict outcome of training, in order to try to get some light on the reasons for this failure. Plaus were made, therefore, for an individual follow-up study of these men.

The follow-up of all the low stanine graduates and high stanine eliminees (15 eliminees and 16 graduates) was carried out by one officer who devoted full time for about 3 months to the project. This officer visited the schools at which the men in the group had been trained and obtained all available data from the school records. In some instances he interviewed instructors and supervisory personnel, but this phase of the study was not very rewarding because shifts in personnel made it difficult to find many individuals who had worked with the students in question and those who were found generally had at best only a hazy recollection of the students. The officer also interviewed each of the students personally and gathered from him information about his training experiences and his personal and family background. Students also provided reasons (or possibly rationalizations) for their success or failure in training. Data were assembled for each man covering in training such factors as ground school grades, records of sickness, evidences of cadet leadership, records of hours of dual and solo flying time, trainee's statement about flying conditions and instructors at that particular school, excerpts from records of progress checks, elimination check rides and elimination board procedings; personal information concerning family, home, education, work history, sports, hobbies, previous contact with planes and aviation; interviewer's impression of general appearance and manner. A detailed case report was prepared for each of the students, presenting and summarizing all the data which were still available in the records and which were obtained from the interview.

Interpretation of the results from these case reports is, of course, subject to the usual limitations of material which places a considerable premium upon synthesis and interpretation by the research worker. Certain objective records may be presented for each case, but any interpretation of these and particularly any summarization of the results for a number of cases involves interpretation and subjective evaluation. The factors which appeared of critical importance to one observer might seem relatively minor to another and vice versa. This caution must be borne in mind in interpreting the following paragraphs of summary and evaluation.

It is obviously impossible to present the complete materials in this report because they fill several hundred typewritten pages. It is proposed to present a summary table of certain objective records on each man, some general comment on the evaluation of the results by the

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officer conducting the study, and then two illustrative case records given in nearly complete detail.

Various facts about the 31 men in the group which could be determined objectively from records and stated categorically are presented in table 5:11. An examination of this table provides some suggestions as to ways in which the two groups differed. Other than the test scores, etc., which enter in as a part of the definition of the groups, the striking differences are in age and marital status. Among the 16 lowstanine graduates, only 2 are over 22 years old, whereas 12 of the 15 high-stanine eliminees are 23 or over. Only 2 of the graduates are or have been married; whereas 8 of the eliminees have. These results are suggestive, but only that, and examination of the larger intermediate stanine groups fails to confirm the importance of these factors.

### TABLE 5.11.—Summary of clinical follow-up

#### CODE

Unless otherwise indicated, data are presented in the form of single-digit scores on a scale from 1 to 9. For tests and stanines, these represent normalized standard scores. For interest, they are the responses of the candidates recorded on a 1 to 9 scale. Units and coding for other scores are represented below. A dash indicates data not available. A question mark indicates data ambiguous.

Flying Experience: Standard Training Command Code, as follows:

1-has commercial pilot's license.

2-have private pilot's license.

3-have held student pilot certificate with solo privileges.

4-have held student pilot certificate.

5-have been passenger in plane but have had no formal instruction,

6-have never been passenger in plane.

7-have had military flying instruction.

Hospitalization: Number of days spent in hospital.

Primary Hours Dual to Solo: Hours and minutes of dual instruction prior to solo.

Final Flying Grade:

S—Satisfactory.

A. B, C, D, E, F-Grades, with A being superior, D minimum satisfactory, and E and F failing grades.

Demerits: Reported nun / of demerits. Tours walked are not included.

Cadet Office: Yes Indicates some cadet office held, from temporary corporal to temporary group commander.

No indicates no cadet office held.

Education: Reported as years completed.

Age: Reported in years to last birthday.

Martial Status: M-married.

S---single.

D-divorced.

Height: Reported in feet and inches.

Weight: Reported in pounds.

ARMA: G-predicted graduation.

F-predicted failure.

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TABLE 5.11—Summary of clinical follow-up—Continued

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TABLE 5.11-Summary of clinical follow-up-Continued

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The general factors which appear as plausible explanations of the training performance of these men may be subdivided into individual factors and situational factors. The individual factors, which recurred most frequently in evaluation of the case description were motivation and emotional maturity. Very high motivation and determination to persist in spite of obstacles and difficulties appeared almost uniformly in the reports about low stanine graduates. Some degree of lack of motivation is reported for about half of the high staning climinees. Presence of emotional stability and maturity in the case of graduates and lack of emotional maturity and stability in the case of eliminees is reported almost equally often. Attractiveness of personality or the reverse is referred to in a smaller number of cases. Factors of individual aptitude in terms such as memory or judgment seem to provide explanations of success or failure in only isolated instances. Within the field of individual factors the dominant role appears to be played by emotional and motivational factors, which, it must be admitted, were not adequately represented in the aircrew classification battery.

In addition to the individual factors just discussed there appeared to be a number of factors having to do with the circumstances encountered by the students in their training which provided some explanation of the failure of the pilot stanine to predict training outcomes. The item most frequently referred to is quality of instruction. Poor or unsympathetic instructors are reported to have been a factor in the case of perhaps a third of those who were eliminated, and good or particularly considerate instructors are indicated to have been a factor for two-thirds of the low aptitude men who were graduated. A number of other unfavorable situational factors were referred to in the case of a few eliminees. Two or three seemed to have encountered instructors whose personalities were incompatible with their owr. Two or three experienced quite traumatic personal experiences at the time of their training. These included such things as death of a brother, desertion by wife, etc. Other factors which were mentioned in isolated instances were a protracted spell of bad weather just before a critical check flight and the temporary elimination policy at a school emphasizing maximum reduction in the student load.

Two illustrative case records are presented as appendix C. These provide a picture of the type of information which was gathered and of the type of interpretation which was made.

#### SUMMARY AND CONCLUSIONS

In order to evaluate psychological selection procedures in a group which had not been selected on the basis of aptitude measures, an experimental group of about 1,300 men was admitted to pilot training

without any requirements as to either aptitude or personality. This group was tested in the standard way with the AAF Qualifying Examination and the AAF Air-crew Classification Battery, but all men were entered into training no matter how low their scores on these tests. In the same way, the men were given a careful interview by a medical officer to determine their Adaptability Rating for Military Aeronautics, but no men were disqualified on the basis of the interview.

These men were entered directly into pilot preflight training, and from there followed the usual course through primary, basic, and advanced training. They were spread through many classes and schools and were given training in the usual way mixed in with trainees who had been screened by the standard procedures. Test and training records were maintained for this group and were analysed after they had completed training.

For the group unscreened by aptitude tests, the pilot validity of the AAF Qualifying Examination was about 0.50 and that of the pilot stanine was about 0.66. The multiple correlation resulting from reweighting the classification tests was 0.69. Since this is based upon the particular sample and would be subject to some shrinkage in a new sample, it may be said that the stanine in use approached closely the maximum prediction which could be obtained from these tests.

The value of the qualifying examination as a preliminary screen is shown by the fact that only 45 out of 520 men who failed the examination were graduated from training, whereas the yield among those passing the examination was 211 out of 751. The effectiveness of the stanine for purposes of prediction is shown by the fact that of 150 men with pilot stanines of 1, not a single individual was graduated from advanced flying training. Only 16 out of 201 men with stanines of 2 or 3 were graduated. In contrast, of 98 men with augmented pilot stanines of 8 or 9 only 15 were eliminated for testable reasons (flying deficiency, fear, and own request).

Clinical follow-up of the 31 cases mentioned in the previous paragraph in which the stanine failed to predict outcome of training indicated that these failures to predict were due in part to individual qualities not well represented in the test battery, in part to variations in adequacy of instruction and other factors encountered by the individual in his training.





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## Figure 5.18

*Adaptability Rating for Military Aeronautics. **Credit for flying experience included. On top of each block is shown the total of the graduates and flying deficiency eliminees in each category. This number is the base used for percentage eliminated, shown on the side of each block.

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Figure 6.10

On top of each block is shown the total of the graduates and fying deficiency eliminees in each category. This number is the base used for percentage eliminated, shown on the side of each block.



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*Credit for flying experience included. On top of each block is shown the total of the graduates and flying deficiency eliminees in each category. This number is the base used for percentage eliminated, shown on the side of each block.

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13 ELIMINATION RATE OF EXPERIMENTAL GROUP BIOGRAPHICAL DATA BLANK - PILOT PREFLIGHT THROUGH ADVANCED ELIMINATION FOR FLYING DEFICIENCY, FEAR, OR OWN REQUEST. IOIT CASES 755 ELIMINEES 74.2% ELMINATES 1 ŧ 68.9 ( 18 | - Y . 65.2 , 184 4 S 18 6 2 234 55 79.7 ÷ 1 86 6 I 48 I .... . 3 ν.  $\hat{\mathbf{T}} \neq \hat{\mathbf{I}}$ 8 30 ٠. i i 97.8 . . . 1 * As of 31 way 1945. Figure 5.23 221 * .... 1







Figure 5.26

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Figure 5.32

S. ELIMINATION RATE OF EXPERIMENTAL GROUP MATHEMATICS TEST B -PREFLIGHT THROUGH ADVANCED ELIMINATION FOR FLYING DEFICIENCY, FRAR OR OWN REQUEST. IOI7 CASES 755 ELMINEES 74.2% ELINANATED 25. * SA.3 - - 31 (4 1.791 , 10.5 j ٠. 65.6 2 188 } .: • 2 د بر می _; i 80.8 177. 392 ÷., 1531 00,5 c i iii . . . · • • • 3 . .... 111 * As of 31 May 1945. * Figure 5.33 231 1.2







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Figure 5.54

		ELIMINATION RATE OF EXPERIMENTAL GROUP
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Figure 5.58





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Figure 5.60

# CHAPTER SIX_

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# Special Activities Related to Selection and Classification

#### THE OFFICER QUALITY SCORE

By the Flight Officer Act of 1942, Congress created the rank of flight officer (equivalent to warrant officer, junior grade) and provided that upon graduation from flight training, superior aviation cadets would be commissioned second lieutenants, while others would be appointed flight officers. AAF Regulation 35-9, 12 November 1942, and AAF Regulation 35-9A, 5 March 1943, directed that each cadet be rated during each phase of training on "leadership, judgment, responsibility, military bearing, initiative, self-confidence, force of character, alertness, comprehension, cooperativeness, attention to duty, and professional proficiency" by officers responsible for ground and flight training, and that these ratings would be combined into a flight officer composite score, which would be used to make the differentiation. The Commanding General, Flying Training Command, was to set a critical score for each graduating class, based upon the available allotments for commissioned officers and upon the distribution of composite scores.

Table 6.1 lists the items making up the composite score and their weights (applied after conversion into standard form).

	l'ilots	Bombardlers and navigators
AAF Qualifying Examination. Preflight school rating.	Percent 10 10	Percent 10 25
Radie school rating Basie school rating Advanced school rating Flight officer final examination	25 21 15	(0 15

TABLE 6.1.—Composition of the flight officer composite score

The AAF Qualifying Examination, a full discussion of which is presented in Report No. 6 of this series, was the initial screening device used for selection of air-crew candidates, and these scores were taken

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from the cadets' permanent records. The ratings from the several stages of training were over-all estimates of proficiency made by instructors and recorded on the individual's proficiency card. The flight officer final examination, which was administered about 1 month prior to graduation, was a 60-item test of judgment, reading comprehension, and arithmetic reasoning, and was originally constructed in the Psychological Section, Office of the Air Surgeon, Headquarters Army Air Forces. Responsibility for the construction and development of this examination was in September 1943 transferred from Headquarters Army Air Forces to Headquarters AAF Training Command.

Soon after the initiation of the flight officer composite score, the personnel authorities administering the Flight Officer Act reported that incomplete records made it impossible to obtain AAF Qualifying Examination scores for all cadets, and it was proposed that the Aviation Psychology Program develop a substitute score from the selection and classification battery. At a conference of aviation psychologists in Fort Worth in January 1943, a group of tests was selected and a set of weights devised for this purpose, the score to be known as the Officer Quality Score. However, it was not until July 1943, when a new testing battery was introduced, that the routine computation of the Officer Quality Score for all candidates was begun.

Table 6.2 lists the tests entering into the Officer Quality Score in successive batteries and their weights, which were applied after the raw scores were reduced to standard form.

			July 1943	3	No-	Sep-	June	
Test	Code	PRU 1 PRU 2 PRU		PRU 3	vem- ber 1943	ber 1944	1945	
Ocneral information, navigator	CE:05D CE:05D CE:05D CI:002F CI:0140 CI:003A CI:003A CF:01A CF:01A CF:01A CE:05E CI:01A CE:05E CI:01A CE:05E CI:01A CE:05E CI:01A CE:05F CI:01C	7 5 12 7 20 9 9 7 7	7 8 18 7 20 9 7 7 5 9	7 5 118 7 20 9 7 9 4 9	20 11 6 	4 20 6 10 18 3 20	15 4 8 15 15	

TABLE 6.2.—Tesis comprising the officer quality score and their weights in successive batterics

+ Original weight of 12 was changed to 18 on 15 July 1943.

Although after July 1943 the Officer Quality Score was computed routinely for all candidates tested, it did not supplant the AAF Qualifying Examination as a factor in the flight officer composite score until December 1944, since only then were men with Officer Quality Scores from their classification testing being graduated in large numbers. The Statistical Unit at Fort Worth developed regression procedures for properly weighting the remaining items in the composite score when one or more were missing in individual cases, prepared instructions to officers making ratings of cadets to insure that the ratings were assigned in a standardized manner, and also assisted in the development of forms B and C of the flight officer final examination by supervising experimental administration and scoring of the test and by performing item analyses.

#### THE USE OF THE EDUCATIONAL EXAMINATION, AC20

When the AAF College Training Program was initiated in March 1943, aviation cadets who successfully passed the initial screening procedures were sent to college training detachments at various colleges and universities for 5 months of study before final classification and preflight training. The college training program served several purposes. First, it compensated in some measure for the dropping of all formal educational requirements for air-crew trainces. Whereas, before the war aviation cadets had been required to have 2 years of college, or its equivalent, under the system introduced in January 1942 many candidates had no college training whatever, and many others had been out of school for some time. The second purpose of the college training program was to provide intensive courses of study in such subjects as physics and mathematics in order to prepare the cadets for aeronautical training in the preflight schools and in later training. In addition, the college training detachments served as convenient reservoirs for the large numbers of air-crew candidates who were being recruited by the Air Forces at a greater rate than they could be absorbed into the training program.

The curriculum for aviation cadets at the colleges included five basic courses: mathematics, physics, history, English, and geography, with the provision that cadets would be required to take any of the five in which they were deficient, but could substitute approved elective courses for those in which they could demonstrate satisfactory proficiency. It was also provided that the length of stay at the colleges would depend to some extent upon the cadets' need for such training. Within the limitations of requirements for training schedules, the best prepared cadets would be returned to the air-crew training program first, while the less well prepared cadets would be retained in the college. training detachments for the full 5-months course.

To insure the efficient and objective administration of these provisions, the Aviation Cadet Educational Examination (AC20) was developed by the Psychological Section, Office of the Air Surgeon, Headquarters Army Air Forces. This test contained 150 five-choice items

divided among five subject-matter fields corresponding to the five basic courses of instruction at the colleges, and was administered at basic training centers by classification officers. The arrangement of the test is shown in table 6.3. In September 1943 responsibility for the development of the test was transferred to Headquarters AAF Training Command and assigned to Psychological Research Unit No. 3. The test is described in fulled detail in Report No. 6 in this series.

TABLE 6.3.—The arrangement of the Aviation Cadet Educational Examination, AC20

Part	• Subject	Number of items
I II III IV	Mathematics Physics History Geography English	45 45 20 20 20

Two separate uses were made of the Aviation Cadet Educational ! Examination in connection with the college training program:

(1) To determine those academic subjects in which deficiencies existed, a critical score was set for each part of the test. Cadets scoring below that point were considered to be deficient in the subject and were required to study the course, while cadets who scored above the critical point were permitted to take the course or, at their option, to substitute an approved elective. The critical scores were set so that one-fourth to one-third of the cadets made satisfactory marks on any one part.

(2) To determine the length of stay at the colleges, cadets were divided into fifths on the basis of their total scores on the Aviation Cadet Educational Examination. Then when the college training detachments received orders to return given numbers of cadets to the air-crew training program, men would be drawn from the highest fifth until it was exhausted, and the remaining numbers would be drawn from successive fifths, so that the men with lower scores would remain at the colleges for the longest period of time.

Correlations of part scores and total scores on the Aviation Cadet Educational Examination, Form AC20B, with stanines and with certain tests in the classification battery of November 1943 are given in table 6.4. The population consisted of 500 air-crew candidates tested at Medical and Psychological Examining Unit No. 8 in February 1944.

In addition to their use in the college training program, Aviation Cadet Educational Examination scores were employed by the Aviation Psychology Program in a number of research studies which required differentiation among the subjects in educational attainment. With

Test	Code	м	SD	Total	Part L	Part` 11	Part III	l'art IV	Pret
Biographical data, navigator Biographical data, pilot Spatial orientation I Reading comprehension Dial and table reading Mathematics A Mathematics B Mathematics B Mathematics B Instrument comprehension I i Instrument comprehension I i General information Bombardier stanine Navigator stanine Filot stanine SD	CE602D CE602D CP501B CP503B C1604H C16021-622A C1702F C1206C C1900B C1616B C1616B CE505E	21. 5 21. 5 21. 6 18. 2 11. 4 30. 8 3. 6 12. 7 20. 3 37. 3 4. 3 5. 1	3.34 5.89 11.1 10.6 6.0 9.0 9.2 10.8 13.7 1.8 1.9	0. 27 . 01 . 22 . 47 . 47 . 45 . 9 . 23 . 33 . 34 6 . 64 . 27 . 33 . 4 13. 8	0.19 01 21 33 33 23 23 23 23 23 23	0.013 116 116 116 116 116 116 116 116 116 1	0.33 22 .07 .15 .57 .57 .57 .57 .57 .57 .57 .57 .57 .5	49	0. 19 . 11 . 14 . 15 . 10 . 19 . 15 . 10 . 14 . 15 . 15 . 16 . 14 . 15 . 15

TARLE 6.4.—Correlations of classification test scores and stanines with the Aviation Cadet Educational Examination, AC20B. N=500 candidates tested at Medical and Psychological Examining Unit No. 8 in February 1944

I Signs of coefficients reversed to indicate positive association of "go.d" scores.

the termination of the college training program, administration of the Aviation Cadet Educational Examination was discontinued in May 1944.

#### THE D-8 BOMBARDIER SELECTION PROGRAM

In September 1942 a program for the training of enlisted graduates of the AAF Flexible Gunnery Schools as low altitude bombardiers was initiated. From each class of approximately 200 students, 35 were to be selected and sent to Carlsbad Army Air Field, N. Mex., for the lowaltitude bombing course, which included 4 weeks of training in pilotage and dead-reckoning navigation and in the use of the D-8 bombsight.

It was decided to recommend candidates for this course on the basis of their preferences and their performance on a battery of selection tests. Colonel Geldard and Lt. Colonel Melton spent several days at Midland Army Air Field, Tex., where they received instruction in the D-8 bombsight and made analyses of the skills involved in low-altitude bombing. From their findings and from research studies of bombardier and navigator selection and training a group of tests was assembled to be used as the D-8 bombardier selection battery. Research detachments, each consisting of two officers and six enlisted men from the Psychological Research Units, were placed on temporary duty at the AAF Gunnery Schools at Tyndall Field, Fla.; Harlingen, Tex.; and Las Vegas, Nev., to administer the tests, to make recommendations for selection, and to make validation studies.

The tests comprising the D-8 bombardier selection battery and their a priori weights (applied after the raw scores were converted to standard scores) are listed in table 6.5, together with validity coefficients with respect to graduation-dimination, academic average, and average circular error in low-altitude bombing. Validity coefficients of the composite score (the sum of the weighted separate scores) are also shown. The validity data were obtained after the conclusion of testing and were not available at the time any of the assignments were being made.  $T^{1}$  population included trainees in Classes D-8-1 through D-8-7 and was drawn about equally from those tested at each of the three gunnery schools. Because of incompleteness in the data, the numbers involved in the correlations varied, but none was less than 574, the maximum being 675. These coefficients have not been corrected for any restriction in the range of the test scores or the composite scores.

The relationship between the composite score and graduationelimination is more fully shown in table 6.6, which presents the composite score distributions of graduates and eliminees for the population discussed above.

TABLE	<b>8.5.</b> —Correlations	of D8	scicction	battery	with	1010	altitude	bombardicr
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[N=at least 574]

Test	Code	Weight	м	SD	Oradua- tion-clim- ination (rsa)	Academic average (r)	A verage circular error 1 (r)
Mechanical principles. Numerical operations. Speed of Elentification Mathematics (part IV of AC10A) Numerical approximations. Technical vocabulary. Spatial orientation I. Disc. reaction time. Ywo-handi coordination. Visual coinchience reaction time Composite score.	C1003 A C1702B C1610A CF505E CF501B CP611D CM101A CP613A	10 5 10 10 10 15 10 15 10	27.7 17.0 31.3 13.6 9.1 24.0 53.7 111.0 54.3 394.8	9.3 5.8 7.9 5.8 5.1 13.4 10.8 12.8 9.4 8.8 540.1	0.25 .39 .14 .40 .34 .30 .09 .17 .11 .11 07 .46	6.30 .32 .10 .48 .31 .33 .33 .33 .19 .14 03 .44	0.03 .07 .04 .07 02 .00 .00 .04 .12 .11

¹ Signs changed to indicate positive association of high score and low error.

 
 TABLE 6.6.—Relation between composite test score and graduation-elimination in D-8 bombardier training, classes D-8-1 through D-8-7

(34-0.16)

Boore	N	N,	N.	Percent eliminated
500 and above	8 10 43 80 149 178 178 178 178 17	8 10 45 77 137 152 92 37 12	0 0 3 12 28 32 30 3 30 3	0 (         
Total	675	567	109	16.1

The findings presented in the above tables demonstrate that the D-S hombardier selection battery predicted graduation-elimination effectively. This is due largely to its appreciable correlation with academic-grades and to the fact that academic failure was responsible for approximately 93 percent of the eliminations. The battery was not so successful, however, in predicting average circular error in lowaltitude bombing, although the composite score correlation of 0.11 is significantly different from zero at the 1 percent level. The low reliability of the circular error criterion (estimated to be 0.40 for one class and 0.68 for another) may account in part for this low validity. The fact that the composite score does not predict graduation-elimination or academic average any more effectively than does a single test, mathematics, indicates that other methods of weighting the tests would probably have resulted in considerably higher efficiency of prediction. A similar conclusion may be made with respect to the average circular error criterion, since its correlation with Visual Coincidence Reaction Time is higher than its correlation with the composite score. The early termination of the D-8 by mbardier training program, however, precluded more exhaustive investigation of the selection battery, and multiple correlation studies to devise more appropriate weights . were never performed.

The D-8 bombardier selection program lasted for almost 3 months, ending in January 1943. Table 6.7 lists the number of candidates tested at each of the psychological detachments together with the number and percent selected for D-8 training.

Detachment	Number	Number	Percent
	tested	selected	selected
No. 1. Tyndall Field	2, 303	245	10.6
No. 2. Harlingen	1, 247	210	16.5
No. 3. Las Vezas	2, 891	239	8.3
Total	6, 111	691	10.5

TABLE 6.7.—Number tested with D-8 selection battery and number and percent selected for D-8 training by each psychological detachment

In addition to their work on the selection of D-8 bombardiers the research detachments undertook preliminary studies in the selection and training of flexible gunners. This work culminated in the establishment of Psychological Research Unit No. 11, the activities of which are recorded in Report No. 11 of this series.

### SELECTION OF BOMBARDIERS FOR NAVIGATOR TRAINING

Toward the end of 1942 a need arose for men trained both as bombardiers and as navigators for use in medium bombers which could not carry the large crews of the heavy bombers. Because of quota de-

mands and lack of training facilities, a special program was set up whereby certain numbers of graduate bombardiers highly qualified in terms of navigator aptitude scores would be selected for training in precision navigation. The mission of obtaining and supplying to the bombardier schools the names of graduates qualified for this additional training was assigned to the Psychological Section of Headquarters Training Command and was undertaken by the Field Studies Unit.

For class 43-1 navigator stanines were obtained from data available at Headquarters AAF Training Command and for classes 43-2 through 43-7 rosters containing bombardier and navigator stanines were obtained from the Psychological Research Units at the classification centers. After distributions of the stanines had been prepared, the Psychological Section at Fort Worth was able to inform the training authorities of the approximate number of graduates of each school who would be eligible for navigation training. Lists of names of bombardier cadets having navigator stanines of 5 or above were supplied to the schools with a directive providing that cadets with stanines of 6 or more be sent into this training but that cadets with stanines of 5 be used only when necessary to fill quotas. Beginning with class 43-8 the Statistical Unit began to provide most of these data, as the records of stanines for all men tested were available from the psychological units.

After approximately 3,000 students had been selected by this method, the assignment of graduate bombardiers for training in dead reckoning navigation was discontinued in the spring of 1943, when the regular bombardier course was lengthened from 12 to 18 weeks by the addition of a 6-week course in navigation.

#### THE SELECTION OF RADAR OBSERVERS

One of the new air-crew specialties which was developed during World War II was that of the individual who operated the radar equipment of bombing planes. The present discussion concerns psychological activities in the selection of candidates for Radar Observer (bombardment) Training. For a more complete account of the history, objectives, techniques, and accomplishments of psychological research in the selection and training of radar observers, Report No. 12 in this series should be consulted.

In the spring and summer of 1944, Aircrew Evaluation and Research Detachment No. 1 administered to radar students at the 8th Air Force Pathfinder School several selection tests which had been devised by the National Defense Research Committee's Radar Project at Camp Murphy, Fla., and several experimental tests developed by the detachment. These, together with certain tests from the selection and classification battery, were validated against achievement measures in the Pathfinder School. The more successful of these tests were Coordinate Reading (NDRC), Oscilloscope Interpretation (NDRC), Pattern Orientation (AERD), Spatial Orientation I (CP501B), Complex Coordination (CM701A), and Two-Hand Coordination (CM101A). Details of this testing are given in report No. 17 in this series.

Before these results had been reported, however, the need for radar students in the Training Command demanded a tentative selection procedure; and in July 1944 Psychological Research Project (Navigator) selected three tests from the battery developed at Camp Murphy and undertook the administration of these tests to navigation trainees. The NDRC's Polar Grid Coordinate Test, Scale Reading Test, and Oscilloscope Interpretation Test were chosen and were administered at the four Training Command Navigation Schools at Selman Field, Hondo Army Air Field, San Marcos Army Air Field and Ellington Field, beginning on 28 July 1944 and continuing until air-borne testing teams took over in November 1944. Rosters of each graduating class were prepared, listing candidates in rank order of their aptitude for radar training as indicated by the sum of the raw scores on Scale Reading and Oscilloscope Interpretation plus one-half the raw score on Polar Grid Coordinate Reading Test. A navigator stanine of 8 or higher and graduation in the upper third of the class 'were required for eligibility.

In September and October 1944, in anticipation of the rapid expansion of the radar training program, six airborne testing teams, organized by Training Command Headquarters, visited stations in the Training Command administering selection tests to rated pilots. Each team consisted of two officers (one an aviation psychologist and one a combat returnee) and two enlisted men (both psychological assistants). The selection tests used were Coordinate Reading, Oscilloscope Interpretation, Pattern Orientation, and Spatial Orientation I, which were among those validated by Air Crew Evaluation and Research Detachment No. 1. Only one test, Oscilloscope Interpretation, was in both the battery administered by the testing teams and the battery used by Psychological Research Project (navigator). In November the screening of pilots for radar training was discontinued after 700 had been assigned to radar training, of whom 585 were subsequently removed from training because of low morale, lack of motivation, and inadequate preparation; and the screening of rated bombardiers and navigators was begun. After 1 January 1945 only two testing teams were in operation. One, based at Ellington Field, screened navigators; the other, based at Midland Army Air Field, tested bombardiers. In August 1945 the screening of navigators and bombardiers for radar training was discontinued.

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The bombardiers and navigators who were screened for radar training were drawn from three sources: returned combat personnel, experienced noncombat personnel (chiefly instructors), and recent advanced school graduates who had not yet received assignments. Table C.8 shows the numbers of navigators and bombardiers in each of the three experience categories who were screened by the testing teams.

TABLE 6.S.—Bombardiers and navigators screened by airborne testing teams, 10 November 1944 to 1 August 1945

Experience category	Bombar- diers	Navigators	Total
Combat returnees Experienced personnel	1, 625 545 5, 466	1, 613 371 5, 537	3, 235 916 11, 003
Total	7, 638	7, 521	15, 157

¹ Includes personnel still in air-crew training on 1 August 1945 and certain noncombat personnel returned to the Training Command from the Continental Air Forces.

A radar aptitude composite score was obtained for each individual by adding the raw scores of the four tests. This composite score was then converted into a radar aptitude score or "radar stanine"¹ which ranged from 1 to 9, with 9 indicating the greatest aptitude and 1 the least. In addition to taking the aptitude tests, the bombardiers and navigators indicated the degree of their interest in radar training on a 9-point scale, ranging from "little or no interest" (1) to "exceptionally strong interest" (9). Rosters containing the names, ranks, test scores, preferences, and other data were forwarded to Headquarters Central Flying Training Command, Randolph Field, Tex., where a representative of the Psychological Program reviewed the qualifications and made recommendations for assignment to radar training. Quotas for training classes were filled from among those who had radar aptitude scores of 5 or higher and who had indicated an interest of 5 or higher. In the case of bombardiers, individuals in the above group were assigned in the order of their scores on a navigation proficiency test² which was administered in the same testing session as were the four selection tests. Navigators were assigned in the order of their aptitude scores. Table 6.9 lists the number and percent of those recommended for radar training in each of the several experience categories.

⁴ Not to be confused with the Radar Observer Stanine, which was computed routinely from the classification battery after 1 June 1945.

^{*} Navigation Proficiency Test, Form P-5B, constructed at Psychological Research Project (radar) was used until June 1944, when it was replaced by the Navigation Supplement, Form DN, of the Bombardler Proficiency Test prepared by Psychological Research Project (bombardler).

TABLE	0.9Bomoaraicra	ana _i navigatora training	гссоттскаса 1	for	raaar	003 <u>C</u> TTCT	

·Fundaires estaran	Bomb	ardlers	Navl	Total			
Expendice category	N	Percent	Ń	Percent	N	Percent	
Combat returnees	114 166 2, 139	4.7 7.6 87.7	67 89 2, 117	3.0 3.9 93.1	181 275 4,256	3.9 3.8 90.3	
Total	2, 439	100.0	2, 273	100.0	4,712	.100.0	

There were several factors which operated to restrict the complete application of the recommendation procedure. Combat returnees had to volunteer in writing for another overseas tour in order to be eligible for radar training; and, after 1 May 1945, experienced noncombat personnel were withdrawn from consideration because of the need for such individuals for very heavy bombardment (B-29) assignments in their rated specialties. After 6 April 1945 recently graduated personnel who stood in the upper 15 percent of their class were also withdrawn from consideration because they were considered more qualified for very heavy bombardment. Occasionally it was necessary to include some individuals with aptitude scores of 4 in order to fill quotas.

Beginning with the battery of 1 June 1945 a radar observer stanine was computed from the classification battery by weighting the tests listed in table 6.10, which were selected largely on the basis of the validation findings reported by Aircrew Evaluation and Research Detachment No. 1.

Test	Code	Weight
Complex coordination. Two-hand pursuit. Instrument comprehension. Spatial orientation I. Coordinate reading. Dial and table reading. Arithmetic reasoning.	CM 701 E CM 701 A CI 616C. CI 201B CI 201B CI 2021A-22A CI 205C	Percent 20 20 10 10 20 10

TABLE 6.10.-Composition of the radar observer stanine, buttery of June 1945

During the latter part of the period covered in this report, Psychological Research Project (1 adar) at Langley Field, Va., was engaged in the development of achievement criteria in radar school against which to validate the tests listed above and other tests. An experimental selection battery was being administered to students in radar school, including tests from the classification battery, tests adapted from the NDRC project, and tests developed at Langley Field. Report No. 12 in this series contains accounts of this research.

#### THE SELECTION OF FLIGHT ENGINEERS

When the B-29 training program was initiated, enlisted men were trained as flight engineers. Selection standards varied from time to time, but in general it was required that the individual be a ground crew chief, a B-17 or B-24 aerial engineer, or an airplane mechanic (or higher specialist in the same job family) who had finished in the upper 20 percent of his class in the Technical Training Command School.

In September 1944, Headquarters Army Air Forces instituted the policy of assigning commissioned rated personnel to this position and directed that the Training Command assign excess single and twinengine pilots to flight engineer training. The Psychological Section at Headquarters AAF Training Command organized traveling testing teams to screen surplus pilots for these assignments on the basis of their preferences and their scores on three printed tests, Mechanical Information, Mechanical Principles, and Reading Comprehension. These traveling teams were the same teams that tested men for radar observer training. After about 4,000 pilots had been screened, however, the assigning of pilots to flight engineer training was discontinued, and only a few of the pilots so screened were admitted to training.

Subsequent sources of personnel for flight engineer training were individuals who had qualified for air-crew training under the requirements then in force of at least 1 stanine of 7 or above and who were on-the-line trainces or who had already entered preflight school, aircraft maintenance officers who were graduates of the Technical Training Command Engineering School at Yale University, and enlisted men trained as airplane mechanics who met current standards on the AAF Qualifying Examination and other requirements relating to age and education. Successful completion of the flight engineer training course led to a commission as second lieutenant or an appointment as flight officer.

Beginning 1 June 1945 there was computed for each candidate taking the selection and classification battery a flight engineer stanine. The tests which were used for this purpose are listed in table 6.11, together with their effective weights.

TABLE 0.11.—Composition of flight engineer stanine, dattery of June 19.55

Test	Code	Weight
Arithmetic reasoning	C1206C	20
Reading comprehension.	C1614U	15
Mechanical principles.	C1003B	17
Mechanical information.	C1605B	20
Dial and table reading.	CP021A-22A	20
Discrimination reaction time.	CP011D	11

Upon the establishment of the flight engineer stanine the requirement was established that aviation students and enlisted men assigned to flight engineer training have a flight engineer stanine of 7 or above or, if tested before 1 June 1945, a navigator stanine of 6 or above.

#### COMBAT CREW ASSEMBLY

The general problem of combat crew assembly was that of selecting air-crew members, on the basis of proficiency and personality, to be formed into bomber crews in such a way that maximum effectiveness in combat would be the outcome. Within this general problem was a more specific problem, the selection and assembly of "lead crews." In a combat operation every bomber formation was directed by a "lead airplane," the responsibility of whose crew it was to guide the formation to the target area, locate the target, and return the formation to its base. The crews of the other planes followed the lead ship and usually released their bombs at its signal, although they had to be prepared at any time to act individually in an emergency. It was early recognized that the higher order of proficiency required of lead crews demanded special care in the selection of individuals for such assignments and the assembling of those individuals into crews.

Research in combat crew assembly in the Psychological Program began early in 1944 after Colonel John C. Flanagan, of Headquarters Army Air Forces, visited operational bombardment organizations in the European Theatre of Operations. It was learned that operational commanders considered the selection of lead crews one of their most important and most difficult personnel problems and that they would welcome the development of instruments and techniques which would enable them to improve and standardize their selections. It was also learned that personality factors such as leadership, morale, and temperament were believed to be of importance to combat crew performance, but no research studies had been made to evaluate properly the influence of these variables.

Under the program in effect until the spring of 1945, prospective bomber crew members received training in their individual specialties in the Training Command. Upon the completion of this training they were assigned to one of the Continental Air Forces (1st, 2d, 3d or 4th Air Force), where the individuals were formed into crews and trained as bomber teams. After combat crew training had begun, every effort was made to preserve crew integrity, since it was felt that the teamwork developed in training was extremely valuable for success. Changes in crew personnel after combat crew training were rare, except as the result of emergencies.

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During 1944 preliminary research toward a program of crew selection was undertaken by Air-crew Evaluation and Research Detach-

ments overseas, by psychological sections of the Continental Air Forces, and by the Psychological Research Projects in the Training Command. The overseas Air-crew Evaluation and Research Detachments surveyed the current procedures for selecting and training lead crews in the theatres, made pioneering attempts at proficiency measure. ment in combat, studied lead crew duties and requirements, and investigated the validity of tests in the classification battery for lead crew selection and performance. The Psychological Sections in the Continental Air Forces conducted studies of crew proficiency and developed procedures for matching crews for congeniality or the basis of such factors as rank, age, education, geographical origin, and interests. The Psychological Research Projects in the Training Command developed written proficiency tests and other objective measures of the individual's skill in his specialty. The culmination of these researches, full accounts of which will be found in other reports in this series, was the establishment of Psychological Research Project (combat crew), whose mission it was to utilize proficiency measures, classification test data, and applicable research findings in the selection of potential lead crew members.

#### **Psychological Research Project (Combat Crew)**

In March 1945 there was established, under the jurisdiction of the Training Command, the Combat Crew Processing and Distribution Center at Lincoln Army Air Field, Lincoln, Nebr., to which all combat aircrew personnel were sent for assignment to combat crew training. At the same time, the Training Command assumed responsibility for the assembling of bomber crews at Lincoln, a function which had previously been the responsibility of the Continental Air Forces, which continued, however, to administer the combat crew training.

Psychological Research Project (combat crew) was activated on 16 April 1945 at Lincoln Army Air Field. Its mission, as defined by directive from Headquarters AAF Training Command, was:

a. The administration of proficiency tests and other evaluative devices to combat crew personnel and the collating of training records leading to recommendations for the assignment of combat crews and the designation of lead crew members.

b. To conduct research leading to the use of improved devices and procedures for making recommendations in the assembly of combat crews.

c. To conduct research studies on other psychological problems to be directed by this headquarters.

d. To furnish the Assignment Section of Lincoln Army Air Field with recommendations for combat crew assembly. These recommendations will be followed insofar as quota demands and commitments permit.

The initial personnel of the project were four officers, headed by Maj. William M. Lepley, and seven enlisted men, originally members of Psychological Research Unit No. 1 at Nashville, Tenn., and Max-

well Field, Ala., who had just returned from temporary duty in the Pacific Theatre as Air-Crew Evaluation and Research Detachment No. 3.

Plans for the work of the project were further developed at a conference of aviation psychologists at Lincoln, 7 to 10 May 1945. Representatives were present from the Office of the Surgeon, Headquarters Army Air Forces; the Office of the Surgeon, Headquarters Training Command; the several Psychological Research Units and Projects; the School of Aviation Medicine, the AAF Personnel Distribution Command, the psychological sections of the several Continental Air Forces; and the Research Division of the Central School for Flexible Gunnery. Reports of the work of the overseas Air-Crew Evaluation and Research Detachments were presented, methods of matching crews in the Continental Air Forces were discussed, and procedures to be used in carmarking potential lead crews in the Training Command were developed.

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Army Air Forces Letter 50-117, dated 7 June 1945, subject "Screening of Combat Crew Personnel," formally authorized lead crew selection at Lincoln and directed that a "lead crew aptitude score" be computed for each officer air-crew member. This score was to be a "weighted average of evaluations of aerial training and experience, written proficiency examinations in appropriate specialties, and original air-crew aptitude test scores." More detailed instructions were contained in a directive from Headquarters Army Air Forces Training Command, 16 June 1945, subject "Screening of Combat Crew Personnel at Lincoln Army Air Field." This latter document prescribed the variables and weights to be used in the computation of the lead crew aptitude scores for pilots, bombardiers, navigators, radar observers, and (B-29) flight engineers. These variables are listed below:

Pilots (including co-pilots);	Weight
a Training Command Flight Grades	10
h. Flying Experience and Instruction	40
e Pilot Information Test	30
d Pilot Staning	
Navigators (including medium bombardment bombardier-navigator	אכ):
n Navigator Proficiency Test	40
h Andomia Grade in Navigation School	10
e Flight Grade in Navigation School	
d. Navigator Stanine	30
. Bombardlers:	
a. Bombardler Proficiency Test	20
h. Bombardier School Grades	
C Average Circular Error in Bombardier School	
d Dhase Checky in Rembardier School	
e. Spatial Orientation I	15

3.	Bombardiers—Continued	11	dşt
	f. Discrimination Reaction Time	-	20
	g. Dial and Table Reading		10
4.	Radar Observers:		•
	a. Percentile Rank in Radar School		100
	b. Navigator Stanine (used when radar school standing not available).		
5.	Flight Engineers:		
	a. Cruise Control Grade	50	35
	b. Final Grade in Flight Engineer School1	35	25
	c. Transition School Ranking	15	10
	d. Flight Engineer Proficiency Test		20
	e. Navigator Stanine (used if one or more of the above variables was not available).		

¹These weights were used until the Flight Engineer Proficiency Test was available in August 1945.

The next several paragraphs contain a brief discussion of the nature and origin of each of the variables listed above.

1. Pilots.—a. The Training Command flight grades were summary ratings of "superior," "excellent," "very satisfactory," or "unsatisfactory," based upon a large number of separate ratings of various flying skills at each phase of pilot training. In the computation of the lead crew aptitude score the rating for the most recent stage of training was used whenever available. For most pilots, this was the two-engine or four-engine transition school, where the pilots received instruction and training in the planes they were expected to fly in combat. These grades were taken from the pilots' Individual Training Records in the personnel files at Lincoln Army Air Field.

b. The flying experience and instruction variable was a weighted combination of the numbers of hours of flying time the individual had accumulated since graduation from advanced school. Time in combat flying, time as an instructor, and time in multi-engine airplanes were weighted relatively more than student time or time in single-engine planes. The number of flying hours in each of the several categories was reported by the pilot on a General Information Blank, which was filled in during the testing session.

c. The Pilot Information Test (multiengine) was a written examination of information concerning flying and concerning the particular skills required of pilots of multi-engine aircraft. Topics such as aerodynamics, aero-equipment, weather, navigation, and principles of instrument flying were included. This test was administered at Lincoln. A comprehensive discussion of the nature and development of this test is presented in Report No. 8 of this series.

d. The pilot stanine was the aptitude score for pilot training derived from the battery of classification tests. Microfilm rosters of classification-testing data, supplied by the Statistical Unit, Headquarters Training Command, were used by Psychological Research Project (combat crew) in obtaining pilot stanines. 2. Navigators.—a. The Navigator Proficiency Test was a 3-hour objective examination devised by Psychological Research Project (navigator). The first published form of this test, known as "Navigator Proficiency Test (form A)," was administered at Lincoln until 1 July 1945, when it was replaced by a revised version, Navigator Proficiency Test (form B). Form A of the test contained items on air plo⁴ and dead reckoning, the use of the navigation computer (E-6B), maps and charts, pilotage, weather, instruments, radio techniques, and celestial navigation. Form B contained in addition a section on loran, an advanced radio aid. Report No. 10 in this series contains a discussion of these tests.

b. The academic grade was a combination of the examination average and the average ground mission grade in the advanced navigation school. The examination average was the mean of scores on a series of objective and fairly well standardized achievement tests administered at regular intervals during the navigation course. The ground missions were simulated "flights" performed in the classroom, with the instructor providing the sort of data that would appear in the aircraft instruments during actual flight and the cadets "navigating" by solving the problems involved. Rosters of these grades were transmitted to Psychological Research Project (combat crew) directly by the navigation schools for all classes graduating after 1 January 1945.

c. The flight grade was a grade assigned by navigation instructors upon inspection of the cadets' logs after an aerial training mission. The rosters mentioned above in connection with the academic grades also contained the average of the individual's flight grades. This average flight grade was used by Psychological Research Project (combat crew) in computing the lead crew aptitude score.

3. Bombardiers—a. The Bombardier Proficiency Test was a 3-hour objective examination constructed at Psychological Research Project (bombardier). Form C of this test was administered by Psychological Research Project (combat crew) until 21 June 1915 when it was replaced by form DB. The Navigation Supplement, form CN, was used with both forms of the test. Items concerning bombsight operation; altitude computation; theory of bombing; the C-1 autopilot; weather; bombs, racks and fuses; and navigation were included. A full discussion of the Bombardier Proficiency Test is presented in Report No. 9 in this series.

b. The bombardier school grades were the final academic marks at the advanced bombardier school and were submitted on class rosters for classes graduating after 1 January 1915, directly from the bombardier schools, together with the average circular error and the phase check scores.

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c. The average circular error in bombardier school was the mean distance, measured in feet, by which the cadet missed the target in a series of practice bombing missions. These data were furnished Psychological Research Project (combat crew) by the bombardier schools on the class rosters mentioned above.

d. The phase check was a standardized check list by means of which each step in the conduct of a practice mission was objectively scored. Details of the construction and use of the phase check, which was developed at Psychological Research Project (bombardier) will be found in Report No. 9 in this series. Phase check scores were transmitted to Psychological Research Project (combat crew) on the same rosters as were the circular error scores and the school grades discussed above.

e., f., and g. Spatial Orientation I (CP501A or CP501B), Discrimination Reaction Time (CP611C or CP611D), and Dial and Table Reading (CP621A and CP622A) were three tests from the selection and classification battery selected for the bombardier lead crew aptitude score because of promising validation reports from combat research. These tests were not administered at Lincoln. Scores from the original administration at classification centers and examining units were taken from the microfilm rosters of classification testing data.

4. Radar observers.—a. The percentile rank in radar school was supplied on class rosters which contained the percentile standing of each student within the class. These percentiles were transformed at Lincoln into normalized scores for purposes of conversion.

b. The navigator stanine, which was used when the radar school standing was not available, was found in the micro-film rosters.

5. Flight engineers.—a. The cruise control examination grade, which was furnished by the flight engineer schools at Lowry Field, Colo., and Hondo Army Air Field, Tex., was the score on an objective "cruise control problem" involving the scudent's planning and execution of a flight mission in terms of maximum power plant performance with minimum fuel consumption.

b. The final examination grade was transmitted to Lincoln for each graduating class by the flight engineer schools along with the cruise control grades.

6. The transition school ranking was obtained from the rank order standings supplied for each class at the B-29 transition schools at Maxwell Field, Ala. Randolph Field, Tex., Roswell Army Air Field, N. Mex., and Lowry Field, Colo., where flight engineers were assigned for training with pilots and copalots upon graduation from the flight engineer schools. These rank orders had to be converted, on the basis of the individual's standing in the class and the total number in the class, into comparable values and normalized for combining with the other variables.

d. The Flight Engineer Proficiency Test was an objective examination prepared by Psychological Research Project (flight engineer). The structure and operation of various parts of the B-29 airplane, engine operation, cruise control, emergency procedures, and inspections were treated. Report No. 13 in this series discusses the development and use of this examination. The Flight Engineer Proficiency Test was not originally a part of the flight engineer lead crew aptitude battery, but was added late in the summer when B-29 flight engineer lead crew aptitude scores were computed at Psychological Research Project (flight engineer) before the flight engineers were sent to the transition schools for training with pilots and copilots.

e. The navigator stanine, which was found in the microfilm rosters for those flight engineers who had taken the selection and classification battery, was employed only when one or more of the other components was missing. It could, therefore, replace one, two, three, or even all four.

Each variable was transformed into standard form based upon a mean of 100 and a standard deviation of 20. Scores thus transformed were then multiplied by the specified weight and added to form a composite score. The directive provided that when a score was missing, the mean of that person's other standard scores would be substituted except in the case of radar observers or flight engineers, where navigator stanines would be used if available. Another provision was that maximum weight for Training Command grades for pilots, maximum weight for academic and flight grades for navigators, and maximum weight for school grades for bombardiers would be allowed in the case of combat returnees who, during their tour of duty overseas, had flown five or more missions as a lead crew member in the same crew position as that to which they were being assigned at Lincoln.

The composite score, which was the sum of the weighted standard scores, was transformed into the lead-crew aptitude score, which had a range of 4 to 9, with a score of 9 indicating the most promising leadcrew material and 4 the least promising. The conversion tables used for this purpose were so constructed as to yield approximately 7 percent 9's and 4's, 16 percent 8's and 5's, and 27 percent 7's and 6's. A lead-crew aptitude score of 9, 8, or 7 was required for designation as a potential lead crew member.

The selection of 4 to 9 as the range of the lead crew aptitude score was governed by several considerations. Commanding officers in training and in combat had become accustomed to the stanine, with its range of 1 to 9. The meaning of a lead crew aptitude score of 7, 8 or 9, which identified potential lead crew members, was therefore ap-

parent through analogy with the stanine. Since it was desired that roughly one-third or one-half of the crews leaving the Training Command should be ear-marked as potential lead crews, fine differentiations in proficiency were not considered necessary. Since relatively few men in the group had stanines from the classification battery below 4, it did not appear desirable to use the entire range of 1 to 9, and a 6-point scale was considered adequate.

Beyond recommending potential lead crew members by means of the lead crew aptitude score, Psychological Research Project (combat crew) had no part in the assembling of crews. The Classification and Assignment Section of the Combat Crew Processing and Distribution Center, which was an activity entirely distinct from Psychological Research Project (combat crew), received the recommendations and made the actual crew assignments in compliance with the Training Command directive quoted above, which stated that ". . . insofar as possible, potential lead crews will be made up of crew members, all of whom have lead crew aptitude scores of 9, all of whom have lead crew aptitude scores of 8, or all of whom have lead crew aptitude scores of 7... Effort should be made to assemble crews in such a manner that the airplane commander is not out-ranked by a member of his crew, and, where possible, consideration should be given to matching crews on the basis of compatibility." Crews whose officer component included only individuals with lead crew aptitude scores of 9, 8 or 7 were designated "potential lead crews". All other crews were designated "combat crews."

Only the officer members of bomber crews were assigned lead crew aptitude scores. The gunners, radiomen, and other enlisted men were assigned to crews in much the same manner as they had been assigned in the matching systems used by the Continental Air Forces, i. e., by considerations of rank, age, education, etc. Whenever practicable, special requests by airplane commanders for the assignment of an individual, officer or enlisted, accompanied by a like request from the individual concerned, were honored. Other factors which influenced crew assignments and the assembling of potential lead crews included the order of arrivals at Lincoln and hence the order of processing, the exigencies of shipping schedules and quota demands, and last-minute vacancies because of illnesses and emergencies.

At the time each crew was assembled there was initiated a Combat Crew Record Form, which was designed to accompany the crew throughout its later training and into the overseas theatre of operations. This form, which listed all the crew members, both officer and enlisted, contained spaces for the recording of any changes in crew personnel with the reasons for such changes, measures of crew proficiency such as the average circular error in combat crew training, and appropriate remarks by training officers. Upon the completion of combat crew training the original designation of the crew as a "potential lead crew" or a "combat crew" was to be confirmed or qualified, appropriate notations being made on the Combat Crew Record Form.

Several unusual problems and difficulties were encountered by Psychological Research Project (combat crew) in the assembling and collating of records necessary for the computation of the lead crew aptitude score. These problems will be better understood through a recapitulation of the various classes of basic data according to their sources.

1. Data gathered by Psychological Research Project (combat crew).—The pilot, navigator, and bombardier proficiency tests were administered at Lincoln. Also administered at Lincoln were the General Information Blanks, which furnished: (1) Data used in the leadcrew aptitude score (such as flying experience for pilots and combat experience for all classes of personnel); (2) information necessary for the identification and interpretation of the training and classification data listed in the two following paragraphs (such as date of classification, school, class, etc.); and (3) biographical and miscellaneous data for future research purposes. The collection and collating of this class of data involved no unusual problems.

2. Data originating in the training schools.—Measures of progress and achievement in training for all personnel except pilots were taken by Psychological Research Project (combat crew) from class rosters transmitted directly to Lincoln by the various schools for all classes graduating after 1 January 1945. Academic and examination grades of various kinds, circular error and phase check scores for bombardiers, flight mission grades for navigators, and cruise control marks for B-29 flight engineers were received in this manner. Positive identification of training grades for a given individual required the knowledge of his full name, rank, and serial number, the name of the school he attended, the numerical designation of his graduating class, and, in some cases, his former enlisted or cadet serial number. This information was supplied, not always with complete accuracy, by the General Information Blank mentioned above.

3. Data obtained from microfilm rosters.—Rosters of classification testing data produced by machine record equipment and printed on reels of microfilm were supplied to Psychological Research Project (combat crew) by the Statistical Unit at Fort Worth. These rosters, which included several sets of records of more than 500,000 individuals, provided pilot and navigator stanines and the three classification test scores used in computing the bombardier lead crew aptitude scores. Identification and interpretation of these data required some or all of the following information: the individual's full name, rank, officer and enlisted serial numbers, the psychological unit at which he was tested with the classification battery, the approximate date of his classification testing (in order to identify the battery used so that variant norms and scoring formulae could be accounted for), and the numerical designation of the class to which he was assigned for training. These microfilm rosters were so arranged that it was frequently necessary to examine several sets of reels before the information required for a particular individual was found.

4. Data obtained from the officer personnel files at Lincoln Army Air Field.—The Training Command grade for pilots (the over-all rating from the latest stage of training) was taken from the Individual Training Record, which was a part of the officer's "201" or personal data file. In a few cases, where other sources failed, pilot stanines were found among these records.

A principal problem encountered by Psychological Research Project (combat crew) was that of incomplete data. The population of aircrew members undergoing processing at Lincoln at a given time was extremely heterogeneous with respect to time of original classification and time of graduation from training in the various specialties, ranging from those who had completed training only several weeks previously to those who had completed training as early as 1941 and who had never taken the classification battery. For a substantial number, no training school records were available, since such records were received only for classes graduating after 1 January 1945. Incomplete training records in the pilots' files and inadequacies and illegibilities in the microfilm records were found. In all such cases Psychological Research Project (combat crew) computed the lead-crew aptitude score by substituting for a missing score the mean of that person's other standard scores or by substituting the navigator stanine, as provided in the directive, but a considerable amount of clerical energy had to be expended in order to discover and verify the fact that not one of several dozen files and rosters with a total of more than a million entrics did not contain the desired score.

Another series of problems was encountered in connection with the interpretation and conversion of data. Scores on the three classification tests used in the bombardier lead crew aptitude score had to be reduced to comparable form by adjusting them according to the version of the test in use at the time the individual took the classification battery and according to variant scoring formulae and variant methods of recording scores from one battery to another and from one psychological unit to another. Distributions of the training measures were extremely irregular, particularly the ratings of pilot proficiency and the flying experience scores. In extreme cases, conversion tables were constructed by completely normalizing the distributions of the first several hundred cases accumulated at Lincoln. For other variables, conversion was accomplished by linear transformations.

Validities and reliabilities of the various grades and ratings were not a primary concern of Psychological Research Project (combat crew), but some mention of the problem may well be made here. The lengths, curricula, and grading standards of air-crew training courses changed considerably from time to time, as did the methods of reporting and recording grades and ratings. These changes were such that there was no assurance that, for example, a random Lincoln sample of navigators' flight mission scores were all measures of the same thing, since the group of navigators may have represented several schools and a dozen classes spread out over 2 years or more. In several cases, Psychological Research Project (combat crew) found significant differences in grades among schools and classes, indicating possible differences in standards. Reliabilities of some of the scores, particularly the pilot ratings and measures of the work-sample type (such as circular error for bombardiers and the navigators' flight mission grades) were questionable. The reports of psychological research in the various air-crew specialties should be consulted for information concerning the reliabilities and validities of the several training measures.

In the case of pilots, a difficult assignment problem arose out of the fact that lead-crew aptitude scores for airplane commanders or first pilots and those for copilots were computed in the same manner and by using the same variables. Individuals who came to Lincoln classified and trained as airplane commanders were generally older men and men with longer experience as pilots than were those designated as copilots. The latter, however, made higher scores on the Pilot Information Test, probably because their training was more recent and covered more adequately the material represented in the test. The greater amount of flying experience and the higher frequency of combat experience among the airplane commanders, however, resulted in higher lead crew aptitude scores, which meant that the number of crews designated as potential lead crews was limited by the number of copilots who were potential lead-crew copilots.

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In August 1945 an accelerated program for the training of very heavy bombardment (B-29) crews was instituted. This program necessitated changes in the B-29 crew assembly procedure, since airplane commanders, copilots, and flight engineers were to receive training together as partial crews at B-29 transition schools in the Training Command and were to proceed directly to combat-crew training schools without passing through the Combat-Crew Processing and Distribution Center at Lincoln. At the combat-crew training schools they were to be joined by the navigators, bombardiers, and enlisted

crewmen, who were to be processed through Lincoln as before. At the staging areas, after combat-crew training, the crew was to be completed by the addition of the radar observer.

In order that there would be no variation in the basic procedures established, psychological processing detachments, each consisting of one officer and four enlisted men, were placed on temporary duty at the B-29 transition schools to determine the lead crew aptitude scores for the pilots and copilots and to advise the assignment sections at those stations in assembling pilots, copilots, and flight engineers into partial crews. Arrangements were made for the radar observers to be tested at the radar schools by detachments from Psychological Research Project (radar). Also, provisions were made for the evaluation of B-29 flight engineers by Psychological Research Project (flight engineer) at Hondo, Tex. All B-29 bombardiers and navigators continued to flow through Psychological Research Project (combat crew) at Lincoln.

On 13 September 1945, combat-crew processing at Lincoln was discontinued, after a total of 8,862 individuals had been screened for potential lead-crew material, although processing of B-29 flight engineers at Psychological Research Project (flight engineer) at Hondo continued until 11 November. Table 6.12 presents the distributions of lead-crew aptitude scores assigned by Psychological Research Project (combat crew) during the period 12 June 1945 (the first day of testing) to 13 September 1945, and by Psychological Research Project (flight engineer) from 12 August to 11 November 1945.

TABLE 6.12.—Distribution of lead crew aptitude scores, 12 June through 11November 1945 .

Scote	Pilots i		Navigators		Bombardlers I		Radar observers		B-29 flight engineers i	
	N	Percent	N	Percent	N	Percent	N	Percent	N	Percent
	192 536 1,022 1,022 015 182	5.3 15.0 28.6 28.6 17.2 5.1	115 277 305 353 171 53	8.6 20.8 27.4 26.5 12.8 4.0	00 276 507 528 341 149	5.2 14.5 26.7 27.8 17.9 7.8	28 39 43 67 22 18	12.9 18.0 19.8 30,9 10.1 8.3	160 324 502 546 290 115	8.2 16.7 21.8 28.1 15.2 5.9
Total	3, 669		1,334		1,900		217		1, 943	

1 Includes 488 pilots tested by psychological detachments at the B-29 transition schools. 1 Includes 1,222 flight engineers tested by Psychological Research Project (flight engineer) and 721 tested by Psychological Research Project (combat crow).

Elaborate plans were made for research in combat crew selection by Psychological Research Project (combat crew) and by the psychological sections in the Continental Air Forces. Validation studies of the lead-crew aptitude score in combat-crew training and in overseas operations, further research in the measurement of crew proficiency, the investigation of congeniality and personality factors in crew performance, and the possible extension of assembly procedures to the enlisted air-crew members were contemplated. The cessation of hostilities in August and the subsequent discontinuance of the combat crew selection program precluded the completion of these studies. The only research study which was sufficiently advanced to deserve mention was the computation of the intercorrelations of the variables entering into the lead-crew aptitude scores. Intercorrelations for substantial populations of pilots and navigators were completed and are listed with related statistics in tables 6.13 and 6.14. The pilot group, which included both airplane commanders and copilots of very heavy, heavy, and medium bombers, consisted of 800 cases processed at Lincoln during the period 12 June through 17 July 1945. The navigator group consisted of 671 cases tested during the period 9 July through 11 August 1945 and included navigators for very heavy, heavy, and medium bombers; a considerable portion of the latter group being dual-rated (bombardier-navigator) personnel. Because there were a number of cases with one or more missing variables, the numbers involved in the correlations and the means and standard deviations of the variables are not constant. The tables therefore list the number, the merns, and the standard deviations for each correlation. Converted scores with a theoretical mean of 100 and standard deviation of 20 were used in computing the correlations rather than raw scores.

TABLE 6.13,—Intercorrelations of variables entering into the pilot lead crew aptitude score

x	Y	N	Mr	SDr	Mr	8Dr	127	SDrar
Flying experience 1 Flying experience	Pilot stanine Pilot informa- tion test.	514 800	91, 71 100, 21	15.80 19.68	100.21 100.02	20, 01 19, 99	-0. 16 . 21	0.04
Flying experience	Training com-	480	03.00	18, 19	97.73	16.59	.36	.03
Pilot stanine	Pilot informa-	514	100.22	20.01	99.74	19.69	. 32	.04
Filot stanine	tion test. Training com-	318	99.63	20.42	94.95	16, 18	01	.05
Pilot Information test	Training com- mand grade.	450	101.76	18, 00	97.73	10, 59	. 10	.05

⁴ The negative correlation of flying experience and pilot stanine is largely a reflection of the fact that jukats with longer experience were admitted to training at an early period, when stanine requirements were to batively low.

TABLE 8.14.—Intercorrelations of variables employed in determining the navigator lead crew aplitude score

					A DESCRIPTION OF A DESC	Statement of the local division of the local	The local division of	
x	Y	N	Mx	8D <b>x</b>	Mr	SDr	tsr	SUFIT
Navigator proficiency test,	Navigator sta-	<b>č</b> 81	104.14	19.70	102, 14	19.35	0.36	0.41
form B. Navigator proficiency test,	nine. Academic grade.	319	101.13	19.03	W. 50	21. 28	.54	
form B. Navigator proficiency test,	Flight grade	319	101.63	10, 93	103, 20	14.71	.3	.63
form B. Navigator stanine Navigator stanine Academic grade	Academic grade Flight grade Flight grade	317 317 349	101-54 101, 81 95-90	19-61 19,61 21,26	97 07 194 29 104 20	21.35 11.75 11.71	.43 .12 .29	.05 .03 .03

## DEVELOPMENT OF THE FRENCH CLASSIFICATION BATTERY

#### **Mission to North Africa**

After the Allied invasion of North Africa, the French Air Force (L'Armée de l'Air Française) was reactivated with the assistance of Great Britain and the United States. A Joint Air Commission, composed of representatives of the United States Army Air Forces, the Royal Air Force, and L'Armée de l'Air Française, was established to arrange for matériel and personnel. The training of men who had been partially trained prior to the 1940 armistice and the retraining of former flying personnel who had seen active service before the armistice were undertaken in North Africa. While some untrained volunteers were trained by the British, others were sent to the United States for training similar to that being given to American cadets. Originally the selection of these French candidates was based primarily upon physical and educational standards. In lieu of formal education roughly equivalent to American high school graduation, an examination in such subjects as mathematics, geography, history, and science was given, but aptitude tests such as those used in the selection and classification battery for American candidates were not used.

Early in 1944 the Joint Air Commission received reports indicating that the elimination rate of French students in flying training in the United States was higher than had been anticipated. When Colonel Flanagan visited the theatre, members of the Joint Air Commission saw in his presentation of the results of aptitude testing of American air-crew candidates a method which offered considerable promise for use in the selection and classification of French personnel. Accordingly, a request was made that American psychological personnel visit the theatre in order to aid the French authorities in setting up appropriate screening procedures in North Africa.

Maj. Philip II. DuBois and two assistants ' were selected for this mission because of their familiarity with the French language and their experience in classification testing. In preparation for the mission, Major DuBois visited several stations in Alabama where French pilot trainees were undergoing instruction. Interviews were held with commanding officers, flight surgeons, supervisors of ground and flight instruction, and a number of instructors and students. It was reported that the French trainees were highly motivated and appeared to be the equal of American students in general intelligence, but that their elimination rate was somewhat higher than that of American students in comparable stages of training. Language difficulty was suggested as contributing to this lack of progress (much of the in-

^{*} Technical Sgt. John L. Droste and Staff Sgt. Arthur Z. Cerf.
struction was carried on through interpreters), although more important reasons appeared to be the lack of certain aptitudes, particularly those associated with mechanical comprehension and with coordination. It was recommended that a screening procedure similar to that in use with American air-crew candidates, with special emphasis upon measures of coordination and mechanical abilities, be developed for the French.

The detachment was furnished with French translations of the American classification battery and proceeded overseas, reporting in Algiers, Algeria to the Commanding General of the North African Theatre on 26 April 1944. It was attached to the Joint Air Commission for duty. Conferences with members of the Joint Air Commission and staff personnel of the French Air Forces led to the establishment of Centre de Selection Psycho-Physiologique de l'Aviation Française. The head of the Centre, Cmt. Jean Malmejac, a trained physiologist and flight surgeon, was well acquainted with the American testing program and had previously proposed that the French employ a similar procedure. Under his direction, considerable progress had already been made in developing selection tests based upon tests devised in Europe and in the United States.

Upon the organization of the Selection Center at the University of Algiers, the preliminary translations of the printed tests were made available to the French staff and further adaptations were made, Items in the General Information Test having to do with American sports and American aviation terminology had to be replaced by equivalent French items, with the aid of French experts in these fields. The difficulties of constructing a usable translation of the Reading Comprehension Test were considerable, since no equivalent material was found in French sources and since the complexity of certain passages made translation difficult. For the Biographical Data Blank, many adjustments had to be made in order to develop items which would adequately represent the French educational system and French customs. For most of the other printed tests, no unusual problems aroso in the preparation of the French versions. Instructions for the psychomotor tests were rewritten entirely, special care being taken to make all directions as clear as possible since the French candidates had not been screened by an instrument such as the AAF Qualifying Examination.

The American detachment set up a systematic training program for the French staff, many of whom were members of the Forces Feminines de l'Air, or French WAC's. Instruction was given in the theory and practice of aptitude testing, psychomotor examining, and statistical computation. Visits were made to French combat units operating in North Africa, Sardinia, and Corsica, and it was learned that combat requirements in the French Air Forces were not greatly different from those in the American Air Forces and that the traits and abilities regarded as important for success were generally the same.

Preparations for the first testing were completed by July, when the psychomotor equipment arrived at Casablanca, Morocco, from the United States. It was decided to examine a maximum of 18 candidates a day 6 days a week, with the French staff in charge of all operations, assistance being given when necessary by the Americans. The order of group test administration, together with code numbers, time limits, and scoring formulæ, is given in table 6.15. In parentheses after the name of each test is the title of the corresponding American American test except that the initial letter "C" was replaced by "F."

TABLE 6.15Printed	l testa in	the French	classification	battery
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Code	T	Time	Scoring formula
F E 505E F1016B.: F101B-503B F1702B F1702B F100A P PC22A F PC21A F1003B F1205O F1205O F E 502B	Informatios (Iénéraie (Teneral Information) Interprétation des Instruments de Burd (Instrument Comprehen- sion II). Compréhension de la Lecture (Reading Comprehension) Orientation Spatiale (Spatial Orientation I+1D) Opérations Numériques (Numerical Operations) Vitesse d'Identification (Speed of Identification) Lecture des Cadrans (Dial Reading) Lecture des Cadrans (Dial Reading) Principes Mécaniques (Mechanical Principles) Raisonnement d'Arithmetique (Arithmetic Reasoning). Données Biographiques (Biographical Data Blank)	Minutes 36 13 30 23 10 4 9 15 20 33 33 33	R+0/3 R+0/5 R+0/5 R+0/5 R-3W R-W R+0/5 R+0/3 R+0/3 R+0/3 R+0/3 R-W

With the exception of Operations Numeriques, Vitesse d'Identification, and Données Biographiques, scoring was accomplished by marking all questions omitted with the "A" response, and then scoring with the rights key. This procedure was designed to get scores that would correlate highly with scores obtained by the usual American formulæ. For a series of 5-choice items, and on the assumption that "A" responses are correct in 1/5 of the omitted items, the effective scoring formula for a test scored R+0/5 is R-W/4. The French edition of the Numerical Operations Test was scored by the usual formula R-3W, while the American formula R-W was also used with the French versions of the Speed of Identification Test and the Biographical Data Blank.

The psychomotor tests were administered in the usual linear order as listed in table 6.16.

TABLE 0.16.—Psychomotor tests in the French classification battery

Code Dolgts (Finger Dexterity).

FM110A EP.110B	Poursuite Circulaire	avec Diffusion	de l'Attention	(Rotary	Pursuit
T. F. JEAN	with Divided Atte	ntion).	-		

- Temps de Reaction avec Discrimination (Discrimination Reaction FP011D Time).
- Coordination Bimanuelle (Two-Hand Coordination). Coordination Complexe (Complex Coordination). FM101A

FM701A

FM120B Contrôle du Palonnier (Rudder Control).

Two psychomotor tests were lengthened over the American practice. Eight trials instead of five trials were given on the Finger Dexterity Test while with the Rotary Pursuit Test, a fourth trial was given without Divided Attention after the second and third trials with Divided Attention. By considering each pair of trials on the Finger Dexterity Test as a single part score, a uniform number of four part scores were obtained on each psychomotor test. It was found possible to maintain the usual 15-minute over-all time allowance. This system of a uniform number of part scores on all psychomotor tests was adopted as a means of facilitating later statistical computation on the results. On the Discrimination Reaction Time Test, the final accumulated score was subtracted from 400 so that the final score used in classification would be positive.

It was decided to compute stanines for five specialties, bombardier, mechanic, gunner, navigator, and pilot. In the computation of stanines, weights for bombardier were based upon those used in the November 1943 American classification battery. Weights for mechanic, navigator, and pilot were based upon results of research on American students conducted at Headquarters Training Command, while weights for gunner were originally worked out at Headquarters Army Air Forces. Some adjustments in all weights were made in conference in the Office of the Air Surgeon, Headquarters Army Air Forces, prior to the departure of the mission, and final weights were agreed upon by the French authorities. These weights, applied after the test scores were reduced to standard form, are listed in table 6.17.

<b>T</b>			Weights		
161	В	M	0	N	P
General information	2 2 14 7 16 32 27 12	13 8 8 6 6 6 20 14 14 16 7 7 10	10 5 10 20 5 12 20	12 5 31 12 33 12 12 12 3 12 3 7 4	4 7 2 10 10 10 5 8 10 10 10 10 10 10

TABLE 6.17.-Weights used in North African testiny of French air-crew candidates

From aggregate weighted scores (the sums of the weighted standard scores) stanine conversion tables were determined in the usual fashion, i. e., by allowing approximately 4 percent 9's and 1's, 7 percent 8's and 2's, 12 percent 7's and 3's, 17 percent 6's and 4's, and 20 percent 5's. By definition, therefore, French candidates had the same distribution of stanines as candidates in the United States.

Means and standard deviations of the printed tests and the apparatus tests are listed in table 6.18.

. Code	American title	N -	M	8D
E.6058	General information	654	43, 15	10.90
'I616B	Instrument comprehension II	694	27.67	1.04
'I614H	Reading comprehension	694	11.78	5 18
P501 B	Spatial orientation I	695	29.87	7 ii
P6038	Sustial orientation II	693	21.42	7.47
17020	Numerical operations	601	69.65	27 13
P610A	Streed of identification	680	31.02	10 6
P6224 - 21 A	Dial and table reading	680	80 64	10.04
Tana R	Machanical principles	ARE	16 26	10.0
12040	A rithmatio reconing	890	10 87	2.94
YAN2R	Ringranhim data saginator	894	14 /22	O
TANOL	Bianaphian data alla	400	20.00	2.9
	Rinner destation	404	30. 99	3.1
DAIAD	Determented	401	160 60	
P1100	Nowry pursuit	001	109.00	73.8
P0110	[ I/Iscrimination renotion tune	081	200, 27	47.0
M 101 A	Two-band coordination	681	403.70	98. 8
M120B	Kudder control	681	334.98	132.71
M701A	Complex coordination	681 j	36, 45	30.0

TABLE	8.18Meane	and.	<b>sland</b> ar(	d devia	lions -	of tests	administered	to	French
		air-a	creió can	ididates	in No	orth Afr	ica		

In evaluating the means and standard deviations of the printed tests, it should be remembered that directions were rewritten, extensive changes were made in the content of the General Information Test and the Reading Comprehension Test and that the scoring formulae differ considerably from those used with American candidates. With the psychomotor tests, the score on the Finger Dexterity Test is the number of pegs turned in eight trials of 35 seconds each. The score used for the Rotary Pursuit Test was time of contact in hundredths of seconds for four parts, each consisting of five 20-second trials, and with Parts II and III given with the Divided Attention feature. The score on the Discrimination Reaction Time Test was the time for reacting to 70 stimulus patterns in hundredths of seconds, subtracted from 400. On the Two-Hand Coordination Test, the score was the time of contact in hundredths of seconds. After the second, fourth, and sixth trials, a 20-second rest period was used, there being eight trials in all. The score on the Complex Coordination Test was the number of matchings in 8 minutes, while for the Rudder Control Test the score was in hundredths of seconds for four groups of three 30-second trials.

On 25 August 1944 the American personnel departed for the United States. It was believed that the French had quickly grasped the essentials of psychological processing and were fully prepared to carry on further development of the Center.

#### Use of the French Battery in the United States

Late in 1944 it was decided to administer the classification battery to French eliminees from pilot training in the United States in order to furnish information for use in their reclassification as bombardiers, navigators, or gunners. Testing was inaugurated on 2 January 1945 at Medical and Psychological Examining Unit No. 6, Keesler Field, Miss., after Headquarters Army Air Forces had secured from the French authorities in Washington permission to use the translations of the classification tests developed in connection with the mission to North Africa. Major DuBois and Staff Sergeant Cerf, who had been members of the North African detachment, visited Keesler Field and trained personnel there in the administration of the French battery.

In July the testing of French pilot eliminees was transferred to the newly reopened Psychological Research Unit No. 1 at Maxwell Field, Ala. This change was made in order to avoid unnecessary transportation, since Maxwell Field was the site of one of the largest training centers for French students.

In developing methods for testing French pilot climinees, efforts were made a make all procedures as nearly equivalent as possible to the procedures used in handling American trainces. Special norming techniques were devised that took into account the differences in difficulty of the American and French versions of the tests. In cases where scores were available from the testing of a French student in North Africa, the original scores were used as far as possible in determining the stanines, as no stanines from French sources were available.

From 2 January 1945 through 6 November 1945, a total of 269 French pilot eliminees were examined with the classification battery, 168 at Medical and Psychological Examining Unit No. 6 and 101 at Psychological Research Unit No. 1.

## PSYCHOLOGICAL MISSION TO THE PHILIPPINES

In the early spring of 1945, after Manila had been retaken and Far Eastern Air Forces Headquarters had established itself at nearby Fort McKinley, plans were laid for the utilization of Filipino pilots in the continuing air war against Japan. It was planned to retrain certain of those who, before the war, had flown in the United States Army Air Corps but whose skills had necessarily declined during the years of guerilla warfare in the Philippines. In addition, plans were initiated for a Philippine Air Force with training of new pilots to be undertaken, initially at least, in the United States.

Selection of personnel for such training became the responsibility of the Surgeon of Far Eastern Air Forces, Col. Keith Simpson. He

decided to utilize, in all essentials, the system of aircrew selection in use in the States. Facilities available in the Philippines permitted the administration of the necessary physical examinations but there were on hand neither the equipment nor the specialized personnel required to administer and interpret the results of psychological aptitude tests. Accordingly, Col. Simpson, in April 1945, proposed to the Office of the Air Surgeon that aviation psychologists be sent to the Philippines to remedy the deficiency.

Uncertainties surrounding the formation of the Philippine Air Force, together with the somewhat reduced priority assigned the project as a result of the greatly stepped up tempo of the air war in the Pacific, resulted in inevitable delays. It was not until 2 July 1945, that a concrete proposal could be formulated. On that date a letter, "Selection of Filipinos for Pilot Training," was sent from Washington to General MacArthur's Headquarters in Manila. This letter offered the services of 3 officers and 12 enlisted men, together with testing equipment, and stated that they would be sent to the Philippines on request.

On 27 July a radio reply asked that personnel and equipment be sent to Manila "without delay." It authorized air transport for personnel and 1000 lbs. of test materials. Psychomotor equipment was to be sent "by earliest water shipment."

Circumstances connected with the arrival of V-J Day, rapidly changing policies with respect to release of men from the Army, and especially dislocations of transportation facilities occasioned by the post-surrender invasion of Japan all militated against a prompt response to the Manila request. However, after some uncertainty during August concerning the issuance of orders, there was assembled a party of 3 officers and 11 enlisted men, chosen largely for its eagerness to undertake the venture and representing a good range of skills for the task at hand. The group reported at Hamilton Field, Cal., on 9 September, processed and ready for overseas shipment. The party consisted of: Col. Frank A. Geldard, Commanding; Capt. Chester W. Harris; Lt. Franklin Bacon, Jr.; Technical Sgt. George N. Bollinger; Technical Sgt. William H. Fitts; Technical Sgt. Austin J. Jernigan; Staff Sgt. Wayne D. Schall; Sgt. William A. Crowdis, Jr.; Sgt. Homer G. Perkins; Cpl. William T. Crozier; Cpl. George R. Welch; Cpl. Robert C. Zwahlen; Pfc. Charles V. Crump; and Pfc. George W. Smith.

While personnel was being brought together, work was under way at the School of Aviation Medicine, assembling and preparing for shipment a complete "line" of psychomotor apparatus, together with necessary "spares" and replacement parts. There was also prepared, at the Training Command Headquarters, Fort Worth, Tex., an adequate stock of test booklets, answer sheets, and similar supplies, to accompany the party. While at Hamilton Field, negotiations were entered into with Pacific Overseas Air Technical Service Command, Cakland, Cal., relative to the possibility of getting the psychomotor equipment sent to Manila by air transport. West-bound freight had greatly diminished since the initial occupation of Japan and ATSC agreed to effect the change if the theatre authorities would approve. Such approval was requested by radio and was given. All equipment, 5½ tons of it, was flown to Manila, arriving at the Air Depot at Nielson Field just 1 month to the day after it had been packed in San Antonio, Tex. This-circumstance had much to do with the success of the mission. In fact, had the apparatus been sent by water, as originally planned, it is quite certain that several accomplishments could not have been realized in the allotted time.

The group left Hamilton Field in a C-54 airplane on 15 September and arrived 2 days later at Nichols Field, Manila, brief stops having been made enroute at Oahu, Johnston Island, Kwajalein, and Guam. It reported to the Headquarters of Far Eastern Air Forces, Fort Mc-Kinley (7 miles southeast of Manila) the same day. Quarters were obtained there and the Psychological Mission to the Philippines (as it had come to call itself) was assigned to the Surgeon for duty. Throughout the next 3 months all work was to center on the Fort-McKinley Headquarters where adequate facilities were made available—suitable living quarters for both officers and men, "office" space (a woven bamboo hut but suited to the climate), transportation (two "jeeps" and a weapons carrier), messing arrangements, and various miscellaneous base services.

It was a matter of seme surprise to learn, on arrival, that Colonel Simpson had been forced by a serious chronic illness to return to the States just the previous week. However, continuity of planning had been well preserved in the appointment of his successor, Col. Duran H. Summers, who gave never-failing and whole-hearted support to the mission on all occasions.

It was only a few days, so promptly do such things get done in an active theatre of operations, before the Psychological Mission to the Philippines could be said to have "gotten its roots down," had assessed the local situation, and was in a position to make concrete plans for the accomplishment of its work. Preliminary discussions with Col. John P. Ryan, Acting Chief of the Philippine Air Force, lead to the decision to establish necessary testing facilities at Camp Murphy, the chief encampment of the Philippine Army, situated some 5 miles northeast of Fort McKinley and a similar distance from Manila. Many of the immediately available applicants for the Philippine Air Force were already stationed there, in replacement battalions, and in

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any case no site superior to Camp Murphy suggested itself. There was some discussion of the possibility of setting up the testing facilities at Lipa Air Strip, 40 miles south of Manila, where it was thought future expansion might provide a central pilot training station for the archipelago, but plans for this development were not sufficiently well advanced at the time, nor have they progressed notably since.

Whereas Camp Murphy was considered to be well situated for the establishment of a testing center, an examination of its facilities did not provide high encouragement. In their retreat from Manila the Japs had demolished nearly all buildings as, indeed, they had done at Fort McKinley and in large areas of Manila. The consequence was that the reorganized Philippine Army was living in a vast tent city, mired down following the frequent tropical rains and otherwise choking in the clouds of dust thrown up by an unbroken stream of Army vehicles pounding past its gates.

However, survey of the camp area revealed there to be available a plot of high ground having good drainage and situated well away from the busier highways. Moreover, it was learned that there could be constructed, in a minimum of time and mainly from prefabricated materials on hand, suitable buildings for an examining center. The Chief of Staff of the Philippine Army, Major General Valdes, upon having the needs outlined to him, directed that the construction should be begun promptly by the 3d Engineering Construction Battalion of the Philippine Army, that it should follow faithfully a ground plan designed by PMP, and that the buildings should be completed in a 20-day period, weather permitting. The schedule was very closely approximated. Buildozers levelled the site, construction began on October 11, and the center was ready for occupancy about November 1.

A description of the buildings and their equipment will be given later in this account. While construction was in progress, and while awaiting the arirval of psychomotor apparatus, PMP did not remain idle. It had set several goals for itself: (1) to administer the written tests in the AAF battery to representative Filipino populations with a view to determining whether the contents were entirely applicable in this new situation. It was judged that certain of the tests might encounter difficulties of language, despite the use of English in the school system of the Philippines. Moreover, it was known that one test, the Biographical Data Blank, contained items entirely inapplicable to the Filipino scene; (2) to determine whether conditions of test administration needed to be varied from those obtaining in the States. The question of time limits was thought to be an especially important matter; (3) to contact responsible persons, either in the military or civilian populations, who could be trained to administer and interpret the tests. Since the stay of PMP was to be limited to 3 months it was

important that permanence of the effort be guaranteed in this way. (4) to take advantage of the possibly ready availability of combat records in the Air Forces operating under Far Eastern Air Forces Headquarters and to further the general progam of the psychological work in the AAF by performing studies on the effectiveness of classification test scores in predicting combat performance;

All aims were kept constantly in view and, through suitable assignment of duties and responsibilities within the group, all projects were worked on nearly simultaneously.

#### **Experimental Administration of Tests**

Four groups of experimental subjects, representing a considerable range of backgrounds and potential capacities, were given the written tests. The groups were:

(1) Students enrolled in the University of the Philippines.—This was a natural group to select for an initial tryout. Age range and academic and cultural backgrounds were about what would be expected of applicants for the new Philippine Air Force. Indeed, the University contained a number of actual applicants, young men who had volunteered early, who had already survived the physical screening and who were awaiting the official administration of the aptitude tests before their applications could be processed finally. Those falling in this category were, of course, avoided in the initial experimental testing of University students. They were later to take the tests "for keeps." The experimental group at the University consisted of 74 men. Approximately three-quarters of them were enrolled in the College of Engineering; the remainder came from the College of Liberal Arts. Members of this group ranged in age from 18 to 24.

(2) Students from a city high school.—Through the cooperation of the Philippine Department of Instruction it was arranged to test 94 boys from the Mapa (East Manila) High School. This group ranged in age from 15 to 23. The subjects were approximately equally divided between third- and fourth-year students. The Mapa School draws its students from a densely populated area of Manila, an area judged to be made up largely of "middle-class" families.

(3) Students enrolled in a provincial high school.—There were selected as representatives 92 boys from the Rizal High School in Pasig, the capital of Rizal Province. Students in this school are drawn from a population made up largely of artisans, laborers, and farmers. Ages ranged from 17 to 24. The students tested were about equally divided between the third and fourth high school years.

(4) Students having some formal training in mechanics.—A group of 49 young men enrolled in the Philippine Arts and Trade School, Manila, were tested. In normal times a key institution in the vocational educational system of the archipelage, this school had

physical existence, just after the war, only in the shops of the Ordnance Department of the United States Army. Filipino boys, carefully screened by competitive examinations, were assigned as apprentices to work in shops repairing automotive engines, small arms, artillery, etc. All students acquired some skill in the operation of power machinery, hand tools, and in the use of blueprints. The group tested ranged in age from 17 to 34 and in formal education from primary school to second-year college.

The first three groups consisted exclusively of volunteers and all signs pointed to their motivation as being extremely high. They had been informed, at the time of volunteering, of the experimental nature of the testing and of the intention to keep the test scores on file in Philippine Army Headquarters, to be used if needed in the event of subsequent application for flying training. The fourth group, the mechanics apprentices, was not composed of volunteers in the same sense. Since they were receiving a daily wage which they could not forego it had to be arranged to release them from work, with pay, for a day of testing. Their only reward thus consisted in relief from the daily shop routine. However, their desire to do well on the tests was plainly evident, especially since the importance of the testing to the Philippine Air Force was carefully explained.

Distribution statistics for the four Filipino groups and a United States comparison group, consisting of 712 air-crew candidates tested at Medical and Psychological Examining Unit No. 6, are given in table 6.19. The tests administered to Filipinos inclue all the paperand-pencil tests of the Aviation Cadet Classification Esttery of June 1945 with the exception of Coordinate Reading (CP224B), Biographical Data Blank (CE602D), and General Information (CE505F).

Test	Code	Tru Sch N=	de oci 49	Rizal Sch N=	High ool 92	Mapa Sch N=	High ool 94	Univ Ph N=	7. ot 11. •74	U: 8. pl N=	8am- 0 712
1		м	8D	м	8D	M	8D	M	8D	<u>M</u>	8D ·
Mechanical principles Arithmetic reasoning Dial and table reading Flying information ¹ Mechanical information. Speed of identification Reading comprehension. Numerical operations(F). Numerical operations(F). Spatial orientation 1 Practical judgment Instrument comprehen- sion.	C1003B C1206C C1206C C1521-2A CF511A-B C1005B C1005B C161411 C1702B C1702B C1702B C1702B C1702B C1503B C1503B C1501C C1616C C1616C	20. 9 .3 18. 6 3. 5 23. 5 23. 5 23. 5 24 9. 6 26. 6 19. 9 2. 5 13. 5	5.68 8.24.9 8.5.37 10.7,7 8.5 8.5 9.8 10.7,7 8 10.7,7	20.4 3.0 20.0 9.2 27.2 6.8 12.6 8.0 24.7 21.7 2.0 18.0	5.6 8.1 10.2 3.7 4 5.2 6.2 7.3 12.1 7.3 12.1 7.3	21.9 6.3 25.7 7.92 31.9 8.4 13.9 11.8 27.8 23.9 6.1 20.8	7.09 9.86 3.00 8.3 7.5 8.7 8.9 10.6 7.8 9.6	24.6 12.6 31.2 5.6 1.7 18.6 14.4 27.9 29.0 9.8 23.5	7.2 8.8 9.1 3.8 7.6 11.2 7.1 10.2 8.4 10.1	28.3 11.4 29.6 13.7 34.9 17.1 17.4 15.0 28.4 32.6 20.7 28.3	8.9 9.8 3.8 7.3 7.5 13.0 5.0 8.0 8.8 8.4 11.4

TABLE 6.10.—Means and standard deviations of printed classification tests for four Filipino groups and one United States sample

+ Form PESIIA was given to the Trade School group. The U.S. Sample for this test was 137 air-crew mandklates examined at PRU No. 1.

Coordinate Reading was not used since it was not planned to derive radar operator stanines; it had been weighted only for this specialty in the June 1945 battery. Biographical Data Blank was judged to be in need of revision before being administered to Filipinos. The content of General Information had been judged to be somewhat inappropriate; it was decided to substitute Flying Information (CE511A-B) for it.

In Table 6.19 it will be observed that, for many of the tests, the four experimental groups arrange themselves in the order, from high to low: University of the Philippines, Mapa High School, Rizal High School, and Trade School. Important exceptions are the results on Flying Information and Mechanical Information. On the Mechanical Information test the Trade School group is superior to each of the other groups. It was anticipated that this would be the case since the Trade School students were currently receiving instruction in various aspects of mechanics. Form PE511A of the Flying Information test, a revision prepared for use in the Philippines, was given to the Trade School group; consequently no comparison of the Trade School with the other groups can be made for this test. For the other experimental groups the order of "goodness" of performance on Flying Information is reversed from that observed for the majority of the tests.

The differences in mean scores among the groups were evaluated by computing critical ratios. These are presented in table 6.20. The Filipino groups, it was found, have significantly lower means than the United States sample on most of the tests, an outstanding exception being Spatial Orientation I, for which there are no significant differences among the groups. The university students made higher scores than the other Filipino groups on most of the tests, a result

Test	Code	2-2	1-3,	1-4	1-5	2-3	2-4	2-5	3-4	3-5	4-6
Mechanical principles Arithmetic reasoning Flying information Speed of identification Reading comprehension. Numerical operations (F). Numerical operations (B). Spatial orientation I Spatial orientation I	CI003B CI206C CI206C CF62I-2A CF610A CI603B CI614H CI702B CI702B CI702B CI702B CI702B CI501B CP501B CI506C CI616C	6.1 -1.1 -1.6 13.2 9.0 3.1 -1.3 • 2.9 10.6	8.0 5.8 3.6 11.5 17.1 3.1 3.4 5.4 5.2 (8 5.1	11.7 9.2 8.3 9.2 18.0 7.5 10.1 6.0 9.2 1.9 8.3 21.6 7.8	9.0 14.8 8.2 5.7 8.6 16.0 9.2 10.9 1.3 8.0 16.3 10.7	24 4.8 3.7 -2.3 2.8 4.0 2.1 • • 9 3.0	4.1 7.2 7.4 4.0 3.7 5.1 5.8 1.0 4.3 6.1 4.9	3.3 10.0 7.6 -22 5.8 6.7 7.4 7.3 • 4.8 5.0 7.4	1.6 2.5 2.5 1.3 1.3 1.3 3.4 3.6 2.0	• 5.4 - 4.8 5.29 4. • 4.27 4.9	• 2.3 - 1.9 2.4 1.7 2.7 1.7 • • • • • • • •

TABLE 6.20Critical ratios of differences in m	ncans of printed tests among four
Filipino groups and one United	d States sample ³

¹ A negative sign indicates that the difference is in favor of the group identified second. A dash in the table indicates that no comparison was made, since the groups took different forms of the tests. An asterisk indicates a critical ratio less than 1.0.

which was expected since the university groups were highly selected with respect to academic aptitude. The only test in which the Trade School students were superior was Mechanical Information; this result was anticipated, since the Trade School students were receiving instruction in mechanical work. The tests on which the University of the Philippines group differs significantly from the United States group are, for the most part, tests that demand mechanical experience and information and flying experience and information.

#### The Question of Time Limits

Because it was surmised that speed of reading English might be a factor limiting the performance of Filipinos, despite the formal use of English in the schools of the Philippines (native dialects, chiefly Tagalog, are used in nearly all other relations), an investigation was made of the effect of increased time limits on the performance of Filipino students on certain tests of the Aviation Cadet Classification Battery. In particular, the investigation was planned for the following tests: Mechanical Principles (CI903B), Mechanical Information (CI905B), Flying Information (CE511A-B), Reading Comprehension (CI614H), and Practical Judgment (CI301C). The essential question to be answered was: Are the time limits utilized in the United States, on tests that are judged to have a large verbal component, adequate to permit Filipinos to make optimum scores!

The samples used in this study were: (1) 49 university students, and (2) 49 students of the Mapa (East Manila) High School. The technique generally used was to administer the test with standard time limits, to have each examinee circle the number of the last item he had answered, and then to permit an extended working period in which the examinees completed as many more items as possible. Instructions were given not to change any answers already recorded and not to go back and do items previously omitted. Proctors were alert to enforce these instructions.

The results, for each test in question, are presented below :

Mechanical principles (C1903B).—The effect of allowing an extended period was primarily to increase the standard deviation. For neither sample was the mean increased. It was concluded that the standard time of administration was suitable and desirable.

Mechanical information (C1905B).—The giving of additional time, sufficient to permit the examinces to complete all items, did not increase the mean score when the test was scored according to the formula: R-W/3. The low mean on the test pointed to the necessity of examining it with a view to appropriateness of content for Filipinos. This was done and a revision (P1905B) was subsequently made.

Flying information (CE511A-B).—During the administration of form A to the university sample it was noted that the examinees worked very rapidly. At the conclusion of the standard 10-minute working time a survey was made and it was found that 80 percent had completed the test. The plan to extend the time limit was therefore abandoned though, like Mechanical Information, the test was subsequently revised because of certain inappropriate contents. The Filipino form (PE511A) required 15 minutes.

Reading comprehension (71614H).—The effect of allowing examinees an extended working period on this test was to increase the mean, but only slightly. The increment was so small that the consumption of 10 additional minutes was not considered warranted. The original time limits were subsequently used.

Practical judgment (C1301C).—It was found that nearly all examinees had finished at the end of the allowed 30-minute period. No adjustment was therefore necessary.

Thus, somewhat to the surprise of all personnel of PMP concerned, the initial assumption that language difficulties would militate against maximal performance was not confirmed by the experimental testing. The results dictated that United States time limits be preserved and this was done in all subsequent testing.

#### Arrangements for Permanence

Contacts were made early to insure that the efforts of PMP to establish a selection and classification service for the Philippine Air Force would result in a permanent gain. Through the cooperation of President Gonzales of the University of the Philippines suitable arrangements were made for Professor Isidoro Panlasigui, Chairman of the Department of Psychology, to serve as director of the psychological work at the Medical and Psychological Examining Center when it should become necessary for PMP to take its departure. It was arranged, through Philippine Army Headquarters, for Professor Panlasigui to be appointed Special Consultant to the Philippine Air Force. Also by the time the buildings at Camp Murphy were finished and testing could be undertaken, there had been located suitable supervisory personnel who were on hand throughout the period of testing Filipino aircrew candidates and who, then and later, underwent an extensive course of training in procedures used in testing, scoring, and evaluating results. Notable among this group was Capt. Daniel Limbo, a former student of Professor Panlasigui and man of broad educational experience. He became the first military director of the Camp Murphy unit upon the termination of PMP's work. By the time the latter event occurred arrangements for an orderly transfer of responsibility had been effected. The Headquarters of the Philippine Army had published an authorization for a permanent

297

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psychological processing unit at Camp Murphy. The Table of Organization and Equipment, dated 26 Nov 45, called for 3 officers and 15 men: 1 major (Chief of the Unit); 1 captain (Chief of the Group Test Section); 1 1st lieutenant (Chief of the Psychomotor Test Section); 3 technical sergeants; 2 staff sergeants; 4 sergeants; 6 corporals. The Table of Equipment included two jeeps and a weapons carrier and various items of shop, laboratory and office equipment. The unit was formally activated within the Philippine Army under General Orders No. 239, Philippine Army Headquarters, dated 3 December 1945.

During the last 3 weeks of PMP's stay in the Philippines the chief duty was considered to be that of providing the Filipino condidates for assignment to the unit with intensive training in the operation of a psychological examining unit. Though the number of trainees responding to the call for men to staff the unit never came to table strength, those reporting and taking the course of training were apt and, by the end of the 3-week period, a sufficiently large and welltrained group of Filipino examiners was on hand to insure that the Camp Murphy unit need not fail in its assigned task for want of proficiency in testing techniques. The only disquietude felt by the members of PMP concerned the probability that rapidly shifting policies within the Philippine Army might cause withdrawal of personnel from the unit or that the vicissitudes of petty politics to which, unhappily, many agencies in the archipelago are subject, might work to the misfortune of the work so auspiciously begun.

#### Combat Records

PMP arrived on the scene too late to perform as effective a study on combat records as it would have liked to have undertaken. However, quite complete records on the 307th Bomb Group of the 13th Air Force were available at Clark Field, about 60 miles north of Manila, and these data were procured. They will not be described here since they are presented in Report No. 17, "Psychological Research in the Theatres of War." A journey to Samar, Headquarters of the 5th Bomb Group of the 13th Air Force, revealed this organization to have so far broken up as to make practically all records unavailable. Other organizations under Far Eastern Air Forces, the 5th Air Force and the 7th Air Force, were in Korea and Okinawa respectively, and were inaccessible. In any event, by the time PMP arrived in the theatre, most bombing-error data had either been forwarded to Washington or, if it appeared inconsequential, had already been destroyed.

#### Selection of Weather Observers

One of the service functions that the Psychological Mission to the Philippines was called upon to perform was that of screening a group of Filipinos of the Philippine Army for training as weather observers. Certain paper and pencil tests of the Aviation Cadet Classification Battery were used for this purpose. Scores on these tests, weighted in the manner described below, were then used to derive a composito score that was used in ranking men in the order of their probable competence to pursue such a course satisfactorily.

Lacking any empirical data as a guide, the tests to be used and the weights to be assigned to each of these tests were determined in the following manner. First the syllabus of the weather observers course was examined to secure suggestions regarding the abilities demanded of students in such a course. The ability to read-technical material in English, such as that found in Army technical manuals; the ability to make simple numerical calculations rapidly and accurately; the ability to read weather instruments, such as barometers, and temperature charts, maps, tables, etc.; and the ability to understand and to operate such instruments as the theodolite, appeared to be the important abilities demanded by the course of instruction. Second, a conference was held with the United States Army officers who were responsible for training these Filipinos as weather observers to secure from them their concepts of the relative importance of these abilities in pursuing such a course successfully. Following this, there were selected from the available tests those to be used and these were assigned tentative weights. This selection of tests and set of weights was then proposed to and approved by the officers responsible for the instruction.

The tests selected and the weights assigned were as indicated in Table 6.21:

Test	SD	Desired weight	Actual weight	Test	`8D	Desired weight	Actual weight
Reading comprehen- sion Coordinate reading Dial and table Mechanical principles	8 18 10 6	35 10 15 10	4 1/4 1/4 1/4	Numerical operations, front	7 7 8	7.5 7.5 15	1 1 2

TABLE 6.21.-Tests in the Filipino Weather Observer Battery

The actual weight given in the right-hand column above was used as the multiplier of the formula score of each test, and the resulting products were summed to secure a composite score.

Distribution static fields of these composite scores for the 42 Filipinos who were candidates for the weather observer course are as follows: Range, 10-305; Mean, 120.5; SD, 61.2.

On the basis of a roster of men tested, arranged from high to low in composite score, there were selected the highest standing to take the course. Possible validation data had not been made available by the time PMP left the Philippines.

#### Testing Facilities and Procedures Used at Camp Murphy

It was stated earlier that the construction of testing buildings at Camp Murphy followed a plan laid down by PMP. The physical arrangements should be described briefly.

Three buildings, one for psychomotor testing, one for group test. ing, and one for scoring, analysis, and storage of records were origi. nally contemplated and the construction of all three was undertaken nearly simultaneously. The buildings were arranged in a U-shaped manner, the central recessed one being designed for psychomotor testing. The group test building and the scoring and records build. ing were identical in outside dimensions, 54 feet by 20 feet, while the psychomotor building was considerably larger, 54 feet by 42 feet. Essentially the same type of construction was used in all buildings: cement floors (Jap cement, we were delighted to see), corrugated iron siding and roofing, partitions consisting of double layers of heavy burlap stretched on either side of framing lumber supports. Partitions were kept to 8 feet in height and a 6-inch space beneath each permitted free circulation of air. The siding was kept as low as possible and still provide weather protection. Screened areas under the eaves permitted good ventilation. Condemned nylon cargo parachutes were draped from the rafters as partial insulation against the tropical heat. Fluorescent lights were used throughout.

The psychomotor building contained wide corridors and 9 individual rooms: a reception room, a commodious shop  $(27' \ge 11')$ , a storage room, and 6 testing rooms. The latter had dimensions as follows: Finger Dexterity, 15 feet by 11 feet; Rotary Pursuit, Discrimination Reaction Time, and Two-Hand Coordination, each 15 feet by 10 feet; Complex Coordinator and Rudder Control, each 20 feet by 10 feet. The arrangement of corridors and rooms was such that a group of examinees could be led from the reception room through all six testing rooms, in the order named, and leave the building without at any time retracting steps or conflicting with another group following.

The group test building contained, in addition to a large group test room, 40 feet by 20 feet, two offices. Tables with upright partitions, forming a series of cubicles, were constructed for the group test room. Full use of the scoring and records building was not realized during the stay of PMP since there had, of course, developed no large need for record storage. In any case, security of records was more readily preserved at Fort McKinley, where both officers and men were living.

The buildings having been completed on schedule and all equipment having been installed and calibrated, it was decided to make something of the occasion of opening the unit. Accordingly, a ceremony was arranged for the morning of Sunday, 4 November 1945. The main address was made by Maj. Gen. Basilio-J. Väldes, Chiefof Staff of the Philippine Army, to a group of approximately 80 people-officers of both the United States and Philippine Armiés, officials of the Philippine Government, members of PMP, and various Manila friends interested in the project. General Valdes expressed the appreciation of the Philippine Commonwealth for the work of PMP and pledged the support of the Army to the future work of the Examining Center. A demonstration of psychomotor test equipment followed the dedication ceremony.

On the following day the first of the candidates for air-crew training appeared at Camp Murphy and testing continued steadily through 13 November. A total of 204 Filipinos were given the complete battery. Two kinds of raw aggregate scores were computed for each examinee, one for single-engine training ("fighter pilot"), one for multi-engine training ("bomber pilot"). For the former the scores ranged from 693 to 164, for the latter 685 to 165. The qualifying score for both forms of training was set, after an analysis of the distributions, at 475, the lower limit of the 5-stanine interval. This cut-off point was somewhat arbitrary but represented reasonable selectivity and was in line with the prevailing views of the economics of training.

The general testing procedures established for the Medical and Psychological Examining Center followed very closely those in use in the medical and psychological examining units in the United States, as specified in the Standing Operating Procedures issued for their guidance. A 2-day testing program was established, with group tests being administered the first day and psychomotor tests the second day. On the first day, an opening statement, prepared specifically for use with the Filipino groups being examined, was followed by the administration of the paper and pencil tests in the order given below and with the time limits specified:

Code	Test	Time Iimits
C 1903B C 1200C C 1962LA-622A	Mechanical principles Arithmetic reasoning Dial and table reading Flying information Nicehanical information Speed of identification Reading comprehension Numerical operations Spatial orientation Practical judgment Instrument comprehension Biographical data blank.	Minutes 20 33 24 15 12 4 30 30 30 31 23 25

The time limits given represent actual working time on the test proper, and are exclusive of time for giving instructions, working sample problems, etc.



During the first day, a number of forms used in identifying the applicant and securing census data about him were also filled out. One of these forms was used as an appointment card for the psychomotor testing session on the second day. Men reported for psychomotor testing in small groups, were given an orientation statement similar to that used in the United States, and then took the following tests in the order indicated:

1,

Cude	Test
CM116A	Pinger dexterity.
CP410B	Rotary pursuit with divided attention.
CP611D	Discrimination reaction time.
CM810A	Two-hand pursuit.
CM7018	Complex coordination.
CM120B	Rúdder control.

Time limits for these tests, which are governed by the controls that are integral parts of the test apparatus itself, did not differ from those in use in the States. Care was taken, in establishing the psychomotor line, to secure a power supply that delivered alternating current of 60 cycles with a constant voltage of approximately 115.

For scoring the paper and pencil tests, the scoring formulas used in the United States were specified as the ones to be employed. For Flying Information Test (PE511A) the formula, rights only, was adopted.

The techniques utilized in arriving at a composite aptitude rating (stantine) include the conversion of scores of each of the tests to a standard score on a 9-point scale with a mean of 5 and a standard deviation of 2. The statistical advantage of using such conversion tables prior to weighing tests by the technique of beta weights is evident. United States conversion tables were adopted for those tests for which they were available and applicable. In this practice is implicit the policy of using United States norms for the Medical and Psychological Examining Center (Philippine Islands), rather than developing norms based on the performance of Filipinos. For two of the paper-and-pencil tests-Flying Information (PE511A) and Mechanical Information (PI905B)—new conversion tables were built. The modifications made in Biographical Data Blank (PE602D) were judged to be minor enough to permit the use of the United States conversion table for form CE602D. In building conversion tables for PE511A and PI905B, an attempt was made to approximate the table that would have been derived from the performance of United States applicants for flying training on these forms of the tests.

Three additional conversion tables were built because the appropriate United States conversion tables were not available. These tables are for Two-Hand Pursuit, Complex Coordination, and Rudder Control. In building these tables, the scores actually made by Filipino applicants tested at the Medical and Psychological Examining Centerwere used, together with their means and standard deviations, to determine the distribution. This practice was not in keeping with the policy of utilizing United States norms; it was dictated by necessity.

#### Termination of the Project

As has been stated, the primary aim of PMP was to provide the Philippine Air Force with the best available techniques for the selection of personnel for air-crew training. All the efforts of the organization, from the original planning to the completion of the training of a Filipino Unit to carry on the work, were directed very closely to this end. The mission was felt by all those engaged in it to have been discharged with unqualified success.

Once routine testing of air-crew applicants was well under way at Camp Murphy it became possible for the officers of the group to turn to another matter of some urgency. This concerned the study, at first hand, of the methods used by the Japanese during the war for the selection and classification of their air crew. Accordingly, on 12 November 1945 Colonel Geldard and Captain Harris departed Fort McKinley for Tokyo. Lieutenant Bacon joined them in Tokyo on 25 November. A full report of the Japanese findings has been made elsewhere.⁴ The work in Japan was completed late in November and on 1 December the officers returned to Manila. Training of Filipino assistants had, meanwhile, gone on apace. There remained only a final collating of records and certain items of business connected with transfer of property in the custody of PMP. Arrangements were made to leave Manila on 7 December, and, after traversing the same route as that taken on the western voyage, the entire group arrived at Hamilton Field, Calif., on 9 December 1945.

⁴Geldard, F. A. and Harris, C. H. Selection and Classification of Air Crew by the Japanese. Amer. Psychol., 1946, 1, 205-217.

### CHAPTER SEVEN.

1 .

## Summary

In World War II a psychological program for the selection and classification of air crew was established in the Army Air Forces. General direction of psychological activities was from the Office of the Air Surgeon, Headquarters Army Air Forces, where Col. John C. Flanagan was chief of the Psychological Branch. At Headquarters AAF Training Command, Col. Frank A. Geldard, chief of the Psychological Section of the Office of the Surgeon, was in charge of psychological activities.

At the outbreak of war decision was made to use a screening test, the AAF Qualifying Examination, for preliminary selection of men to be trained for air crew. This examination was administered by aviation cadet examining boards throughout the United States and in the overseas theatres. Men selected took classification tests at one of the three Psychological Research Units which were established at the classification centers at Nashville, Tennessee; San Antonio, Texas; and Santa Ana, California. On the basis of a battery of printed and apparatus tests, requiring approximately eight hours for administration, weighted predictive scores were determined for the three aircrew specialities: Pilot, bombardier, and navigator.

Throughout the war an extensive program of research on the problems of the selection and classification of air crew was carried out by the staff of aviation psychologists and psychological assistants in the headquarters organizations and in the processing units. Stanines, as the weighted single-digit predictive scores were called, and classification and experimental tests were validated against success in training and in combat.

The classification program changed considerably during the course of the war. As the battery was shown to be remarkably predictive of later success, it came to be used for selection of air erew as well as for classification, without replacing the AAF Qualifying Examination. Minimum qualifying standards, in terms of standards were adopted for each air-crew speciality and were changed from time to time in accordance with the requirements of training and combat organizations. Throughout the war, in class after class, the pilot stanine predicted graduation-elimination from elementary pilot training efficiently, the average biserial correlation coefficient being slightly above .50. In earlier classes the navigator stanine predicted graduation-elimination from navigator training even more effectively, although the validity of this stanine dropped somewhat when the amount of aerial training for navigator students was increased. The bombardier stanine predicted success in bombardier training significantly, but success in bombardier training proved to be more difficult to predict than success in the other two original air-crew specialities.

In general the stanine developed for a particular specialty was more predictive for success in that specialty than the other stanines. This probably resulted from the fact that classification batteries were carefully devised and weighted on the basis of available job information and validity data on specific tests. Elaborate arrangements were made at Training Command Headquarters to gather test data and other pertinent information on each of the 600,000 men examined for air crew at Training Command stations and to correlate this information with data on subsequent success in training.

The introduction of the college training program in 1943 called for a reorganization of classification activities. Responsibility for the detailed supervision of psychological activities in this field was delegated by Headquarters Army Air Forces to Headquarters AAF Training Command while the number of examining units was increased temporarily from three to ten, with seven Medical and Psychological Examining Units being established in the basic training centers. In this way it became efficient to examine men for air crew prior to the college training which preceded preflight school.

The classification battery gradually developed from a collection of printed tests about which relatively little was known to a group of well-validated, printed and apparatus tests scientifically selected from the large number of devices available for use. The battery was used for the selection of men to be trained for new specialities: Radar observer, flight engineer, and B-29 gunner.

The classification battery proved to be predictive for special groups, such as WASP, Negroes, and Chinese. Adaptations of the battery were made for use with French cadets and Filipinos. The tests included in the battery proved to be predictive of training success in the technical specialties, such as air mechanic, and radio-operator mechanic.

During 1943 the number of air-crew candidates completely tested at Training Command installations was 285,634, while the estimated cost of the ps. hological research and testing program was \$1,309,821.¹

³ The monetary saving to the Government and the accompanying gain in the number of well-qualified air-crew members resulting from the use of an efficient selection procedure is unknown.

The estimated cost per candidate was thus \$4.59. The estimated cost included salaries of military and civilian personnel, allowance for the use of buildings, the cost of equipment and supplies, travel of personnel and over \$100,000 for transportation of equipment, since in that year the Medical and Psychological Examining Units were established and, in order to meet the deadline for this opening, bulky psychomotor equipment was distributed by air.

¥ •,

The most striking test of the usefulness of psychological procedures applied to selection of air crew was obtained from the study of the experimental group described in chapter 5 of this report. Approximately 1,300 men were admitted to pilot training without any requirements as to aptitude or personality. The pilot validity of the AAF Qualifying Examination for this group was about .50 and that of the pilot stanine was about .66. Of the 150 men with pilot stanines of 1, not a single individual was graduated from advanced-flying training, while only 16 out of the 290 men with pilot stanine with 2 or 3 were graduated. On the other hand, of the 98 men with augmented pilot stanines of 8 or 9 only 15 were eliminated for testable reasons, that is, flying deficiency, fear, or own request.

At the end of the war, the psychological program was extended to the formation of combat crews. On the basis of aptitude measures, training records, and proficiency measurements, certain crews were designated as potential lead crews. All crews, lead and nonlead, were assembled by taking rank, age, education and personal requests into consideration. The end of hostilities prevented systematic investigation of the effectiveness of the crewing procedures.

## APPENDIX A_

# **Processing Statistics**

#### INDEX TO TABLES

Table No	o, Tille	Page	
I. Numbe	rs Tested by Months:		
Å.1	February 1942-June 1943	312	
A.2	New aviation candidates, July 1913-June 1945	313	
A.3	Eliminees, July 1943–June 1945	313	
А.4	Student officers, July 1943-June 1945	314	
A.5	Others, July 1913–June 1945	314	
A.6	Negroes, July 1944–June 1945	315	
A.7	B-29 gunnery candidates, January 1945-June 1945-	315	
A.8	Operations at PRP (CC), June 1945-September 1945	315	
A.9	Supplementary testing and processing statistics	315	
II. Distrii	butions of Stanines by Batterics:		
A.10	Batteries of February, August, and December 1942	316	
A.11	Battery of July 1943	317	
A.12	Bombardier Stanine, battery of November 1943	318	
A.13	Navigator Stanine, battery of November 1943	318	
A.14	Pilot Stanine (with experience credit), battery of November		
	1943	319	
A.15	Pilot Stanine (without experience credit), battery of November		
	1943	319	
A.16	Bombardier Stanines, battery of September 1044	320	
Å.17	Navigator Stanines, battery of September 1944	320	
A.18	Bomber pilot Stanines, battery of September 1944	321	
Á.19	Fighter pilot Stanines, battery of September 1944	321	
Α.20	Aerial gunner Stanines, battery of September 1914	322	
A.21	Mechanic-armorer-gunner Stanines, battery of September 1914.	322	
A.22	Radio operator-gunner Stanines, battery of September 1914	323	
A.23	Bombardier Stanines, battery of April 1915	323	
A.24	Navigator Stanines, battery of April 1915	324	
А,25	Bomber pilot Stanines, battery of April 1945	324	
A.26	Fighter pilot Stanines, battery of April 1945	323	
λ.27	Aerial gunner Stauines, battery of April 1915	323	
A.28	Mechanic-armorer-gunner Stanines, battery of April 1945	020	
А.29	Radio operator-gunner Stanines, battery of April 1915	320	
A.30	Bombardier, navigator, bomber pilot, and nghter pilot Stanines, batfery of June 1945	327	
A.31	Aerial gunner, flight engineer, and radar observer Stanlnes, battery of June 1945.	328	
А.32	Aerial gunner, mechanic-arimorer-gunner, and radio operator, gunner Stanines for B-29 gunnery candidates, battery of	200	
	September 1944	460	
*:	309		

INDEX	TO	TABLES
-------	----	--------

	Table N	o. Tuls	D.1.
II.	Distrib	outions of Stanines by Batteries—Continued	2.036
	A.33	Aerial gunner, mechanic-armorer-gunner, and radio operator-	
		gunner Stanines, for B-29 gunnery candidates, battery of	
		April 1045	329
	A.34	Flight engineer, radar observer, and aerial gunner Stanines for	
		B-29 gunnery candidates, battery of June 1945	329
Ш	. Triva	riate Distributions:	
	Λ. 35	Pilot, bombardier, and navigator stanines for cadet tested	
		in February 1943	330
	<b>A.</b> 36	Pilot, bombardier, and navigator stanines for air-crew appli-	
		cants tested in February 1944	331
	A. 37	Bombardier, navigator, bomber pilot, and fighter pilot	
	<b></b>	stanines for air-crew applicants tested in September 1944	332
17.	Distril	outions of Preferences, Preference Waivers, Previous Flying	
	Exp	erience, Age, and Education;	
	A. 38	First preferences	335
	A. 39	Freierence waivers	336
	<b>A.</b> 40	Previous nying experience for Fico 1, Fico 2, and Fico 3,	220
	A 41	Percent of new eviction candidates measuring credit for nro-	030
	N. 31	vious fiving experience. November 1943-September 1944	337
	A. 42	Age of aviation candidates tested in September 1942	337
	A. 43	Age of aviation candidates tested in October 1942	337
	A. 44	Age of aviation candidates tested in March 1943	338
	A. 45	Means and standard deviation of age, fiscal year 1944, by	
		quarters	338
	A. 46	Means and standard deviation of education, fiscal year 1944,	
		by quarters.	338
V.	Distrib	utions of Qualifications:	
	<b>A.</b> 47	New aviation candidates tested prior to battery of 1 Septem-	
		ber 1044	339
	A. 48	Eliminees tested prior to battery of 1 September 1944	339
	A. 49	Student officers tested prior to battery of 1 September 1944.	339
	A. 50	Others tested prior to battery of 1 September 1944	340
	A. 51	Negroes tested prior to battery of I September 1944	340
	A, 52	New aviation candidates tested after battery of 1 September	010
	A 50	1944	ふなU 2.41
	A E4	continues tested after battery of 1 September 1944	231
	A 55	Others tested after battery of 1 September 1944	341
	A. 50	Normony toytoxi after bat ary of 1 Soutember 1944	342
	A 57	R-20 munner condidered	342
VI	Distril	D-20 guinery cannuaces services Positions.	01-
	A. 58	Period of February 1942–July 1942, and period of September	
		1942-November 1942	342
	A. 59	Battery of December 1942	343
	A. 60	Battery of July 1943	343
	A. 61	Battery of November 1943	343
	A. 62	Battery of November 1943 (continued)	344
	A. 63	Battery of September 1944	344
	A. 64	Battery of September 1944 (continued)	344
	A. 65	Battery of April 1945	344

#### INDEX TO TABLES

	Table No.	Thie
ΫĪ.	Distrib	utions of Recommendations for Aircrew Positions—Continued
	A. 66	Battery of June 1945
	А. 67	Supplementary recommendation statistics.
	A. 68	Number interviewed and recommendations of interviewing
		officers
VII	. Group	Test Mean Scores:
	A. 69	Men processed May 1944
	À. 70	Men processed June 1944
	A. 71	Men processed July 1944
	λ. 72	Men processed August 1944
	A. 73	Men processed September 1944 on battery November 1943.
	A. 74	Men processed September 1944 on battery September 1944
	Å. 75	Men processed October 1944
	A. 76	Men processed November 1944
	A. 77	Men processed December 1944
	A. 78	Men processed January 1945
	Λ. 79	Men processed February 1945
	A. 80	Men processed March 1945
	A. 81	Men processed April 1945
	A. S2	Men processed April 1945 (normalized scores)
	A. 83	Men processed May 1945
	A. 84	Men processed June 1945

#### INTRODUCTION

This appendix presents tabulated information from the operation of the classification program. Data for the tables were obtained from three primary sources: (1) annual reports, (2) monthly activity reports, and (3) weekly activity reports all prepared by the processing units. Additional data were secured from reports on file in the Psychological Section, Headquarters AAF Training Command. Figures are presented for the period from February 1942 when classification testing was initiated through 30 June 1945, the final date covered by the war-time annual reports. Instances where data are incomplete are indicated by footnotes. Inclusive dates are listed for each table.

These tables have been organized into sections to make the data more meaningful. The data listed under the section Number Tested by Month have been subdivided into the following categories: (1) New Aviation Candidates, (2) Eliminees, (3) Student Officers, (4) Negroes, (5) Others, and (6) B-29 Gunnery Candidates. These same categories, when available, have also been used in the sections giving Distributions of Qualifications and Distributions of Recommendations.

Data in the sections on Distributions of Stanines and Distributions of Recommendations have been subdivided into periods covre ponding to classification battery changes. Data compiled for Distributions of Qualifications have been divided into two periods: (1) Qualifications Prior to Battery of 1 September 1944 and (2) Qualifications After the Battery of 1 September 1944. This division was required for the

new qualification categories, e. g., bP (bomber Pilot), fP (fighter Pilot), etc., which were included in the battery initiated 1 September 1944.

The following abbreviations are used:

<b>B</b>	Bombardier.
BbP	Bombardier and bomber pilot.
BbPfP	Bombardler, bomber pilot, and fighter pilot.
BIP	Bombardler and fighter pilot.
BN	Bombardier and navigator.
BNbP	Bombardler, navigator and bomber pilot.
BNIP	Bombardier, navigator and fighter pilot.
BNbP/P	Bombardler, navigator, bomber pilot, and fighter pilot.
BNP	Bombardier, navigator, and pilot.
bP	Bomber pilot.
BP	Bombardler and pilot.
fP	Fighter pilot.
MPEU	Medical and Psychological Examining Unit,
N	Navigator.
NAC	New Aviation Candidate.
NbP	Navigator and bomber pllot.
N(P	Navigator and fighter pilot.
P	Pilot
SD	Standard Deviation.

Insofar as possible the sections of this appendix follow the normal processing routine; i. c., tables listing the number processed at the separate units are listed first in the appendix and the number of candidates who were recommended for each air-crew position are listed in the final section. The statistics for each processing unit are listed separately within each general section.

#### I. NUMBERS TESTED BY MONTHS

TABLE A.1.-Monthly testing statistics,¹ Feb. 1942-June 1943

Year	Month	PRU 1	PRU 21	PRU 33	Total
1942	. February March	1,389	1.535	2.681	2,924 7,100
	Aptil. May	3,381 2,889	2,469 2,352	5, 550 2, 829	11, 403 8, 070
	July.	3, 115 2, 404 3, 748	3,508 3,607 7,800	4,017	11,000 8,039 15,245
	September October	8,751 7,705	5,472 5,072	4,330	18,553 17,241
A 19	November December	4, 193 3, 141	3, 733 3, 524	5,379 2,399	14,107 9,064
	February	4, 285 7, 547 8, 198	7,435 4,555 4,057	2,020	13, 740 15, 473 17, 266
	April. May	7,613 7,694	5,957 7,857	4,220	17, 790 20, 861
	June	6,261	6, 181	4, 265	17, 510

85 't380,65760,562220,3521 The figures listest for each PRU give the total number of candidates tested for each month. The testingfigures for candidates proviously eliminated and for student officers are included in the monthly total of each unit.The figures for PRU 2 are taken from the following sources covering the period Feb. 1912-June 1912 in-clusive: From 2 Feb. 1912-12 May 1912 the figures are taken from the number of candidates taking the Quanti-tative Perception Tests I and 11 1,100 BS77 and 1,100 BS75 from 13 May 1942-13 June 1912 from the numbertaking the Orapit Reading. Dial Reading Tests, CP401B, CP402B and from 15 June 1912-11 July 1912 thenumber of candidates taking the Dial Reading Test C14521.The furthers for the period from March 1912-January 1943 inclusive represent those who were group-testedduring this period.

#### TABLE A.2.-Monthly testing statistics NEW AVIATION CANDED

EW AVIATION CANDIDATES	
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Contraction of the local sector of the local s										1 1 1 1	
Year and month	PRU 1	PRU ž.	PRU 3	MPEU 4	MPEU 5	MPEU 6	MPEU 7	MUEUS	MPEUC	MPEU-10	Tete
1913							· · ·		Ì,	-	
Inly	5.958	4.502	7.151								37.641
August	A 535	6.728	6.982								20.245
August	6 636	5 353	1 000	******	******	******	•••••	******			17. 255
Schtenori	\$ 700	4 071	6 375	******	******						17 100
OCIODET	4,100	0,001	3, 313		<b>*</b> 600				1 1 1 1 1 1		44 716
November	5,200	1,011	1,001	3,001	1,022	6,100	9.144	0,000	3, 143	2,070	
December	5,454	5,205	4,213	3, 222	1 1, 102	1.24	0.354	0,003	3,352	3,800	91,100
1844			ا مد ا					1	ا شده م		
January	3, 307	4,667	4,033	3,017	8,754	8,22	5,018	4,693	3,240	3, 55	43, 549
>February	6, 162	4,478	j 3,761 .	3,677	6, 778	6,040	1,611	4,621	2:467	2,618	42, 143
March.	0	5,507	5.277	2,857	4, 419	5,429	706	2,639	\$20	1 1054	23,605
Auril	26	2 691	1.653	1.054	71	4.002		4.213	407	1, 128	16,075
May	39	9	- 68			1 224		1128	6	2.110	8,934
Tuna	i	ì	30			1.652	1	1.419	1 4	1.219	4.300
Tulor	1 11		22			1 ITA		1.1 201		1.318	4.355
JUIY	12 14					2 1174		2 014		1 040	6 023
AUCUM	1 1	1 7	1 14	·····		6,048	{	2,000		721	370
September	1 1		2	[******			[	1,011		121	7 51
October	1 1	0	0	******		13		1,830		1 10	1,017
November	0	1 1				1,315		790			2,110
December	0	0	1			3,457		37		. 0	. 4, 526
. 19 <b>18</b>	[		1			I	i		1		
January		91		1		3,749		0		16	3,854
February.		282		1	1	4.952	1	1	1	1,074	6,006
March		322				4, 119		1.334		409	6, 191
Aneil		252	1			90	1	6 892		1 20	7.24
Mar		1				404		3.329	1	10	2.783
314y		10				1 1 200	l	AL '	1	ie I	1.819
JUD5		1	<u> </u>			1					
Total	45.100	151.251	45.352	19,408	37,820	66,014	17,901	52,755	113,729	21, 213	376, 609

¹ The figures for MPEU 4, MPEU 5, MPEU 6, MPEU 7, and MPEU 9 represent those who were group-tested during this period. The figures for MPEU 8 and MPEU 10 represent those who were group-tested in the period November 1943-June 1914, inclusive; and represent those who were completely tested July 1914 and following. ³ 4 candidates of this number were Aviation Candidates carmarked for Flight Engineer Training.

#### TABLE A.3.—Monthly testing statistics

#### ELIMINEES!

Year and month	PRU 1	PRU 2	PRU 3	MPEU 4	MPEU &	MPEU 6	MPEU 7	MPEU 4	SUFEU 9	MPEUJO	Total
1943 July	12 13 23 35 51 40 20 63 4 57 6 7	8 19 35 45 42 47 35 30 35 29 0 0 0 0 0	18 22 37 34 49 42 33 49 42 33 92 0 10 0	21 21 24 14 20 0	34 100 21 10 1 0	125 20 30 33 42 6 5 2 1	37 37 3 2 0	172 B2 334 01 10	82 8 10 8 0 0	21 21 33 12 0 30 12 0 30 12 0 30 12 0 0 12 0 0 0 0 0 0 0 0 0	203 203 203 203 203 203 204 203 203 204 203 203 204 203 203 204 203 204 203 203 204 203 203 204 205 205 205 205 205 205 205 205 205 205
September. Oriober. November. 1048 January. February. March. April. May. June.		0 0 0 42 46 42 5 0	0 0 					0 0 0 0 0 1 0		0 0 0 137 14 143	30 44 47 79 10 165
Total	331	1 400	302	1 163	168	3.0	1 47	1 114	<u> </u>	1 *13	

¹ The term eliminees refers to men previously eliminated from ris-rew training. The fruins for MPEU 4. MPEU 5. MPEU 0. MPEU 7, and MPEU 9 represent those who were 1 superiod quing this period. The figures for MPEU 5 and MPEU 10 reprisent those who were group-tested in the period. November 1013-June 1014 and represent those who were completely tested July 1014 and following. ¹ All men tested were Aviation Cadets carmarked for Flight Engineer Training.

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313

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TABLE A.4.—Monthly testing statistics

8TU	DENT	OFF	<b>ICER</b>	ç s
	and the second s	_		_

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Year and month .	PRU 1	rru 2	PRU 3	APEU 4	MPEUS	MPEUA	MPEU'1	MPEU 8	MPEUO	MFEU 10	Totel
1945 July August September October November December	225 332 309 242 750 169	210 374 267 285 618 266	12 10 6 10 5 10		 0	0 0				: 	477 716 562 537 1,405 521
1044 January February March April May Juno Juno Juno Juno Juno Juno Juno Juno Juno Juno September October November December	200 200 0000000000000000000000000000000	216 225 159 83 39 3 3 3 3 1 48 24 0 0	9 6 1 0 2 6 18 28	23 84 101 9	0 23 43 4 	0 0 5 55 39 5 40 27 8 0 200	0 9 	0 0 59 22 12 13 14 151 109 1		0 0 4 57 20 16 16 20 0	418 605 303 107 210 59 23 76 125 210 109 291
1845 January Febriary March April May June Total	 	391 825 304 287 303 160 4, 911	125			3 0 0 0 0 378	 	0 0 0 0 381		0 0 0 25 146	394 525 364 287 303 185 8, 800

¹ The figures for MPEU 4, MPEU 5, MPEU 6, MPEU 7, and MPEU 9 represent those who were group-tested during this period. The figures for MPEU 8 and MPEU 10 represent those who were group-tested in the period November 1943-June 1944, inclusive; and represent those who were completely tested July 1944 and following.

## TABLE A.5.—Monthly testing statistics OTHERS:

Year and month         PRU 2         MPEU 4         MPEU 5         MPEU 6         MPEU 7         MPEU 8         MPEU 7         MPEU 7         MPEU 7         MPEU 8         MPEU 7         MPEU 7         MPEU 7         MPEU 7         MPEU 7         MPEU 7         MPEU 7         MPEU 7         MPEU 7				OTHE	KS1					
1943       27       70       52       7       51         December       112       117       257       0       33         1944       383       233       47       19       1       6         April       9       209       22       3       0       1         April       9       209       22       3       0       1         June       2       7       0       3       0       1         June       2       3       0       3       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <t< th=""><th>Year and month</th><th>PRU 2</th><th>MPEU 4</th><th>MPEU 8</th><th>MPEU 6</th><th>MPEU 7</th><th>MEPU 8</th><th>MPEU 9</th><th>MPEU 10</th><th>Total</th></t<>	Year and month	PRU 2	MPEU 4	MPEU 8	MPEU 6	MPEU 7	MEPU 8	MPEU 9	MPEU 10	Total
1944     84     143     192     1     22       sinuary	1943 November December			27 112	70 117	52 257	70	51 38	10 4	217 528
1946 January 35	1944 s inuary	••••••	389 9 1	84 253 209 2	143 47 22 7 0 2 6 3 5 1 4 21	192 19 8	1 1 0 3 3 3 0 0 0 0 0 0		0 10 50 48 16 7 8 31 0 0	442 729 314 63 21 16 11 8 2 16 11 2 4 2 1
February         14           March         6           April         6           May         464           June         773           O         0	1946 January February March April May	464 273			55 14 6 4 1 0		0 0 0 0		000000	235 14 6 4 465 2773

¹ Others include can ikiates from the following categories: WTS, enlisted pilots and bombardiers, glider pilots, provious Navy pilots, naval pilot eliuinces, RCAF pilots and men from Navy lighter-than-air training. The figures for MPEU 4, MPEU 5, MPEU 6, MPEU 7, and MPEU 0 represent those who were group-tested during this period. The figures for MPEU 8 and MPEU 10 represent those who were group-tested in the period November 1943-June 1944, inclusive, and represent those who were completely tested july 1 4 and following. ² Flight engineers who were tested in order to obtain officer quality score.

#### TABLE A.C.—Monthly testing statistics NEGROES!

LUKULS

Year and month	MPEU 6	MPEU.S	Total	Year and month	MPEU 6	MPEU 8	Total
1944 July	22 161 75 60 30 27		21 161 75 39 77	î946) Januáry February March April May June Total	31, 140 129 108 58 38 38	44	31 140 129 108 58 82 921

* Negroes tested for B-29 training are listed under B-29 candidates. * This total includes 15 student officers.

#### 

B-29 GUNNERY CANDIDATES

		MPI	eu•	MPR	ປ <b>.</b> 10	(Paka)	
Ytar and month	MPE0 6	White	Negro	White	Negro		
1948 January February March April	267 205 1,101 493 136	732 1,012 666 . 218 96		391 803 612 157 47	21 41/ 18 2 0	1, 419 2, 069 2, 397 870 279	
Jubit	2,831	2,911	0 16	2,011	82	7,851	

1 The figures for MPEU 6 represent those who were group-tested during this period.

TABLE A.S.—Testing operations of psychological research project (combat crew) Lincoln Army Air Field

Week	Bombard- iers	Navigators	Pilots	Flight engineers	Radar observers	Total
1945         10 June-16 June.         17 June-23 June.         24 June-30 June.         13 July-7 July.         8 July-7 July.         29 July-23 July.         29 July-24 July.         29 July-24 July.         29 July-25 July.         29 July-24 August.         29 July-25 July.         29 July-26 July.         29 July-27 August.         20 July-28 July.         29 July-29 July.         29 July-29 July.         29 July-29 July.         29 July-29 July.         29 July.         29 July.         29 July.         20 July.         20 July.         20 July.         20 July.         20 July.         20 July.         21 August.         21 August.         22 August.         23 August.         25 August.         25 September.         25 September.	195 138 8 171 124 34 192 276 350 150 150 150 154 154 154 154 154 154 154 154 154 154	10 2 0 47 153 126 195 220 325 140 157 5 2	2172 2122 2131 2152 2153 2153 2153 2153 215	0 28 71 91 1 0 0 0 27 216 8 1% 27 216 8 27 216 27 216 27 216 27 216 27 216 27 27 216 27 27 27 27 27 27 27 27 27 27 27 27 27	47 33 78 33 19 0 M M M D 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	276 273 367 497 375 274 679 771 679 771 679 771 876 213 33
Total	1,894	1, 412	2,870	670	219	7,058

Figures obtained from the weekly reports.

TABLE A.9,-Supplementary testing and processing statistics

#### PRU 2. Mexican trainees.

On 16 February 1945, 15 Mexican trainees were given the psychomotor tests.

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#### PRU 2. Chinese student officers and aviation students.

On 19 February 1945, 20 Chinese student officers and 50 aviation students were tested on Chinese classification battery No. 7 (based on November 1943 classification battery), using group tests prepared in Chinese and Chinese-speaking examiners.

#### PRU 3. Chinese aviation cadets.

Group tests and psychomotor tests were given on an experimental basis to Chinese aviation cadets in August 1944 and October 1944. A total of 155 were tested.

#### MPEU 6 and MPEU 8. Testing at United States Military Academy.

On 26 August 1944, four enlisted men left for the United States Military Academy, West Point, N. Y., to administer the group test battery. Testing was supervised by officer personnel from the Psychological Program. Enlisted men were from MPEU 8.

On 29 October 1944, a group of 10 enlisted men was sent to the United States Military Academy, West Point, N. Y., to administer the apparatus tests of the air-crew classification battery to cadets of the Military Academy. Approximately 900 cadets in the second year were tested.

Arrangements for continuing this testing the following years were made.

#### MPEU 6. French eliminees from pilot training.

Testing of French trainees was begun in January 1945. From the beginning of January to the end of June 1945, 168 French trainees wore tested.

#### MPEU 8. Wasps.

In February and March, 1944, testing was carried out at Avenger Field, Sweetwater, Tex. Data were obtained on 480 WASPS.

#### **II. DISTRIBUTIONS OF STANINES BY BATTERIES**

#### TABLE A.10

Distribution of stanines, period of Feb- Distribution of stanines, battery of As ruary 1942-July 1942* gust 1942-November 1942*

Stanine	PRU 3 bombar- dier	PRU 3 naviga- tor	PRU 3 pilot	Stanine .	PRU 3 bombar- dler	PRU 3 naviga- tor	PRU3 pilot
	116 193 344 540 660 521 426 258 194	91 186 211 469 879 634 410 271 241	305 305 408 407 472 303 229 193	9 8 6 8 4 2 1	646 1, 032 1, 526 2, 130 2, 005 1, 971 1, 379 749 473	609 1, 191 1, 320 1, 003 2, 514 1, 970 1, 3%0 508 536	766 1,088 1,654 2,402 2,405 1,793 1,793 1,278 745 396
Total	3, 142	3, 142	3, 142	Total	12, 531	12, 831	12, 531

¹ Figures are for July 1912 only. Figures are not available for PRU 1 and PRU 2. ³ No distribution is included for August because of change of battery during the month. Figures not available for PRU 1 and PRU 2.

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#### TABLE A.10-Continued

#### Distribution of stanines, battery of December 1942-June 1945.

Stanine	PRU 24 bombardler	PRU 3 bombardler	PRU 24 navigator	PRU 3 navigator	PRU 24 pilot	PRU 3 pilot
*****	956 1, 616	1, 898	1, 491 1, 859	2,452	828 1,082	1, 371
••••••••••••••••••••••••••••••••••••••	1,878 2,082 2,083	1,472 4,478 5,212	2,016 1,913	2,769	2, 103 2, 061 2, 532	3,718 4,312 4,312
······	1,698 1,112	3,600 2,340	1,363 785	3, 2×8 2, 143	1,672 1,291	2,634
éselesetesetesetesetesetesetesetesetesete	343	718	\$39	3, 215	325	617

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* Figures not available for PRU 1. * Figures for PRU 2 represent cases reported in April 1943 and May 1943. Distribution of pilot staning does not include experience credit.

#### TABLE A.11

Distribution of bombardier stanines, Distribution of navigator stanine, dat-battery of July 1943-October 1943 tery of July 1943-October 1943

Stanine	PRU 1	PRU 2	PRU 1	Stanine	PRU 1	PRU 2	PRU 3
	1, 448 2, 583 3, 129 6, 568 4, 671 2, 518 2, 518 2, 319 818 331	2, 141 2, 743 3, 013 4, 662 4, 302 2, 959 1, 675 915 414	1,408 2,051 3,463 4,619 6,195 3,401 2,198 1,221 918	9 8 6 4 1	1, 141 1, 555 5, 873 4, 559 4, 559 1, 615 1, 103 397	1,814 2,650 2,474 4,617 3,855 1,605 249	1, 067 2, 016 3, 466 5, 009 6, 075 3, 306 3, 306 3, 619 574 236
Total	21, 385	22,754	25, 482	Total	24, 385	22,754	23, 481

Distribution of pilot stanines (without experience credit), battery of July 1943-October 1943 Distribution of pilot stanines (with experience credit), battery of July 1943-October 1943

Stanine	PRU 1	PRU 2	PRU 3	Stanine	PRU 1	PRU 2	PRU 3
8 8 7 6 8 8 8 8 8 8 8 8 8 8 8 8 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 7 8 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	1, 311 2, 610 3, 228 5, 782 5, 471 2, 979 1, 713 (28 333	1,468 2,321 3,953 4,750 4,760 4,601 2,555 1,857 931 284	819 1, 125 3, 634 4, 630 4, 935 5, 751 2, 763 1, 319 716	9 8 7 6 5 4 3 1	1, 871 2, GN 3, 110 5, 723 6, 257 2, 859 1, 675 915 332	2, 144 2, 315 3, 778 4, 856 4, 451 2, 516 1, 813 504 279	1, 122 1, 223 3, 630 4, 503 4, 704 5, 839 2, 664 1, 365 703
Total	24, 385	22, 751	25, 452	Total	24, 385	22, 754	25, 482

¹ The maximum staning recorded was 9, even though experience credit and staning on tests added to more than 9,

TANI	A:12,-Distribution of	bombardier	stanines,	battery	of	November	19.\3_
		Aunust	1944				

Stanine	PRU	PRU	PRU Si	MPEU 4ª	MPEU \$3	MPEU 84	MPEU 84 (negro)	MPEŬ 71	MPEU 8-	MPEU	MPEU 101
	1, 535 1, 533 2, 585 3, 748 3, 781 2, 882 2, 010 1, 003 767	1,706 2,423 3,992 5,377 5,277 3,784 2,537 1,175 825	1, 579 2, 232 3, 650 4, 796 4, 801 3, 793 2, 366 1, 150 829	947 1,356 2,340 3,242 3,547 3,129 2,463 1,484 1,274	2, 100 2, 892 4, 895 6, 362 6, 735 5, 892 4, 659 2, 691 2, 164	1, 570 2, 421 4, 746 7, 245 3, 742 7, 872 6, 060 3, 431 2, 980	8 6 15 26 28 30 32 21 21 25	1,439 1,554 2,373 2,930 3,011 2,619 1,977 1,977 1,087	1, 559 2, 424 4, 357 6, 406 7, 318 6, 223 4, 643 2, 572 2, 011	714 1,018 1,716 2,315 2,507 2,241 1,637 874 735	1,045 1,447 2,644 3,853 4,287 3,612 2,817 1,545 1,220
Total	20, 544	27, 176	25, 196	19,782	28, 479	45, 163	186	17,910	37, 513	13,755	22,508

Includes 7 cases from September distribution who were tested on battery of November 1943-August 1944-¹ Includes cases from September 1944 distributions (1 case for PRU 2, 20 cases for PRU 3) of men tested prior to the introduction of September 1944 battery.
³ Figures are included from September 1944 and October 1944 distributions of men who began testing prior to the introduction of September 1944 battery.
⁴ Figures for November 1945-March 1944.
⁴ Figures for November 1943-June 1944.
⁵ Figures are included from September 1944, October 1944, and November 1944 distributions of men who began testing prior to the introduction of September 1944, and November 1944 distributions of men who

TABLE A.13.-Distribution of navigator stanines, battery of November 1943-August 1944

								and the second se			and the state of the
Stanine	PRU 11	PRU 21	PRU 31	MPEU 41	MPEU 5 ³	MPEU 64	MPEU 64 (Negro)	MPEU 7	MPEU 8	MPEŬ 9+	MPEU 10'
9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	1, 519 1, 550 2, 676 3, 283 4, 328 3, 748 2, 225 882 327	2, 632 2, 508 3, 933 4, 809 5, 515 4, 280 2, 325 848 200	1, 786 1, 936 3, 200 4, 454 5, 513 4, 521 2, 515 929 342	889 900 1, 531 2, 291 3, 508 4, 085 3, 447 2, 010 1, 031	1, 533 1, 743 3, 317 4, 036 7, 880 8, 408 6, 277 3, 057 1, 328	1, 588 1, 850 3, 426 5, 357 8, 445 9, 851 7, 903 4, 339 2, 314	\$ 8 6 15 25 35 35 35 24	1, 182 1, 004 1, 664 2, 350 3, 512 3, 748 2, 699 1, 244 607	1, 361 1, 700 3, 301 4, 983 7, 322 7, 887 6, 149 3, 263 1, 551	506 628 1,160 1,703 2,771 3,288 2,162 1,002 475	972 1, 113 2, 053 3, 315 4, 772 4, 871 3, 313 1, 507 587
Total	20, 544	27, 176	23, 196	19,782	38, 479	45, 163	180	17,910	37, 513	13,755	22, 503

Includes 7 cases from September 1944 distribution who were tested on battery of November 1943-August

Includes 7 cases from September 1914 distributions (1 case from PRU 2, 20 cases from PRU 3) of men tested
Includes cases from September 1914 battery.
Figures of November 1913-April 1914.
Figures are included from September 1914 and October 1914 distributions of men who began testing
Prior to introduction of September 1914 battery.
Figures for November 1913-March 1914.
Figures for November 1913-March 1914.
Figures for November 1913-June 1914.
Figures are included from September 1914.

TABLE A.14.—Distribution of pilot stanines (with experience credit), baliery of November 1943-August 1944

Staninə	PRU 11	PRU 2 ³	PŔU 34	MPEU 4 ¹	MPEU 34	MPEU 61	MPEU 64 (Negro)	MPEU 7*	MPEU 8	MPEU 97	MPEU 10
	1, 257 1, 752 3, 464 4, 060 3, 761 3, 158 1, 542 783 464	2, 987 2, 800 4, 703 5, 259 4, 510 3, 627 1, 815 867 408	2, 164 2, 232 4, 101 4, 889 4, 771 3, 709 1, 901 870 659	1, 292 922 1, 917 2, 763 3, 469 3, 856 2, 746 1, 687 1, 100	1. 894 1. 923 4. 223 5. 878 7. 162 7. 913 4. 924 2. 835 1, 752	1,083 2,111 4,500 6,786 8,547 9,013 6,172 3,675 2,378	11 9 8 25 29 34 31 31 30 15	1,003 919 1,967 2,630 3,291 3,640 2,201 1,291 848	2 309 1.834 4.035 7.108 7.108 7.255 4.742 2.537 1.547	817 782 1.755 2.533 2.533 1.514 743 498	1, 220 1, 308 2, 470 3, 718 4, 467 4, 254 2, 676 1, 474 816
Total	20, 544	27, 168	25, 198	19, 782	38, 475	45, 103	186	17, 910	37, 513	13, 755	22, 303

¹ Includes 7 cases from September distribution who were tested on battery of November 1913-August 1914. Cases in distributions above 9 stanine are totaled with 9 stanine. Figures are for period November 1917-June 1944.
³ No distribution available for pilot stanine (with experience credit) of 8 men under July 1944, August 1944; and September 1914 distributions.
⁴ Includes 2) cases from September 1914 distribution who began testing prior to the introduction of September 1944 battery.
⁴ Figures for period November 1943-April 1046.
⁴ Figures for November 1943-April 1046.
⁴ Figures for November 1943-March 1944 battery.
⁶ Figures for November 1943-March 1944.
⁶ Figures for November 1943-June 1944.
⁶ Figures for November 1943-June 1944.
⁶ Figures for November 1943-June 1944.
⁶ Figures are included from September 1944, October 1944 and November 1944 distributions of men who began testing began testing prior to the introduction of September 1944.

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TABLE A.15.—Distribution	of	pilot stan	inca i	(icithout	experience	orcdil),	ballery
0	ſŇ	ocember 1	)\$ <b>5-</b> A	uyust 19	44		

Stanine	PRU 11	PRU 2 ³	PRU 31	MPEU 41	MPEU 5 ¹	MPEU 64	MPEU 6+ (Negro)	MPEU 74	MPEU 8	MPEU 91	MPEU 107
9 8 5 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	1, 031 1, 770 3, 010 4, 225 3, 880 3, 214 1, 557 787 404	1,046 2,730 5,030 5,030 5,564 5,002 3,709 1,847 877 471	1, 345 2, 300 4, 318 5, 110 4, 920 3, 789 1, 931 8\S 862	717 1,017 2,090 2,903 3,594 3,007 2,762 1,691 1,101	1, 241 1, 951 4, 440 6, 067 7, 254 7, 951 4, 947 2, 810 1, 755	1, 322 2, 168 4, 681 6, 995 8, 657 9, 072 6, 198 3, 684 2, 388	6 9 24 32 35 35 35 20 15	619 967 2,059 2,766 3,361 3,681 2,275 1,291 813	1, 354 2, 003 4, 330 6, 273 7, 372 7, 323 4, 763 2, 516 1, 850	514 798 1.840 2.354 2.545 2.545 1.618 750 501	752 1, 372 2, 632 3, 590 4, 556 4, 323 2, 701 1, 490 817
Total	20, 544	27, 178	25, 196	19, 782	38, 479	45, 103	186	17, 910	37, 513	13, 758	22, 503

Includes 7 cases from September 1914 distribution who were tested on battery of November 1913-August

Includes 7 cases from September 1914 distribution who were tested on Eattery of November 1913-August 1914.
Includes cases from September 1914 distributions (1 case for PRU 2, 20 cases for PRU 3) of men tested prior to Introduction of September 1914 battery.
Figures for November 1913-April 1914.
Figures are included from September 1914 and October 1914 distributions of men who began testing prior to the introduction of September 1914.
Figures for November 1913-March 1914.
Figures for November 1913-March 1914.
Figures for November 1913-June 1914.
Figures for November 1913-June 1914.
Figures are included from September 1914, October 1914, and November 1914 distributions of men who began testing prior to introduction of September 1914, Detaber 1914, and November 1914 distributions of men who began testing prior to introduction of September 1914, Detaber 1914, Battery.

		PRU 2 (returnees)				Ę	-		
Stanloe	PRU 1— new aviation	New av	New aviation candidates		Student officers		MPEU 6-	MPEU	MPEU 10-new aviation
	candi- dates	Not previ- ously tested 1	Previ- ously tested	Not previ- ously tested	Previ- ously tested 3	- <b>0</b> -	Negro		candi. dates
	000000000000000000000000000000000000000	57 78 118 123 85 63 31 21 0	39 36 21 15 11 3 0 0 0	92 51 23 13 9 0 1 0	874 141 75 36 9 3 0 0 0 0	448 925 1,913 2,908 3,717 3,412 2,420 1,405 1,030	0 1 13 32 60 89 95 85	188 256 495 724 838 761 513 292 200	64 110 229 239 359 262 163 78 64
Total	1	575	123	216	1,138	18, 178	468	4,257	1,630

TABLE A.16.—Distribution of bombardier stanines, buttery of September 1933_ March 1945

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Includes 2 nonreturnees.
Includes 2 cases from the April 1915 distribution who received one-point bonus for overseas returnees.
Includes 75 cases from the April 1945 distribution who received ene-point bonus for overseas returnees.

TABLE	A.17Distribution	of	navigator	stanines,	ballery	of	September	1944
		•	March	1945				

		F	PRU 2 (	returnees	)				
Stanine	PRU 1—new aviation	New aviation candidates		Student officers		MPEU	MPEU 6 Negro	MPEU	MPEU 10-now aviation
	cindi- dates Not Provi- previ- ously tested i	Not previ- ously tested?	Previ- ously tested ³			candi- dates			
	000000000000000000000000000000000000000	63 77 101 129 101 64 29 11 0	37 25 20 13 20 13 0 0 0	111 48 21 14 13 5 1 0 0	801 143 (5 23 9 1 1 0 0	819 1,051 1,020 2,723 3,521 3,357 2,538 1,417 832	1 5 22 27 67 77 113 75 81	251 285 451 738 783 783 735 537 301 173	99 131 223 233 324 214 159 70 47
Total	1	875	123	216	1, 138	18, 178	468	4,257	1,630

Includes 2 nonreturnecs.
 Includes 2 ens. 2 from the April 1915 distribution who received 1 point bonus for overseas returnees.
 Includes 75 cases from the April 1915 distribution who received 1 point bonus for overseas returnees.

TABLE A.18.—Distribution of	bomber-pilot	stanincs,	buttery	01	September	1944-
	March 1	945		-		

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		F	NU 2 (1	returnees	)				
Starine	PRU 1-New aviation	New aviation candidates		Student officers		MPEU	MPEU 6-	MPEU	MPEU 10-New aviation
•	candi- dates	Not previ- ously tested ¹	Provi- ously tested	Not previ- ously tested 2	Previ- outly tested i	0	Netto		dates
5	0 0 0 0 0 0 0 0 0	57 2 8 10 15 R 11 0	32733 232 232 232 232 200 0	107 37 35 18 11 6 3 0 0	577 199 180 111 200 111 200 111 11 1 0	872 1,052 1,745 1,465 1,465 1,372 1,465 1,455 1,455 1,455	0 4 14 24 55 102 91 57	378 343 437 587 749 709 325 312 203	113 134 235 230 239 176 83 33
Total	1	574	123	216	1, 122	18,17	468	4, 257	1,630

Includes 1 nonreturnes.
 Includes 2 cases from the April 1945 distribution who received 1 point bonus for aversess returnees.
 Includes 75 cases from the April 1945 distribution who received 1 point bonus for oversess returnees.

TABLE A.19.—Distribution of	fighter-pilot sta	anines, ballery	oſ	September	1944-
	March 1945	5			

Stanice		P	RU 2 (1	eturnees	)				
	PRU 1New aviation candi- dates	New aviation cupdidates		Student officers		MPEU	MPEU 6-	MPEU	MPEU 10- New
		Not previ- ously tested	Previ- ously tested	Not provi- ously tested 2	Previ- ously tested #		Negro		candl- dates
9 8 6 5 1	0 0 0 0 1 0 0 0 0 0	70 78 101 107 88 67 35 25 0	20 24 20 29 3 3 0 0	81 42 45 18 20 6 3 1 0	421 223 212 149 33 36 7 2 0	<b>K13</b> <b>500</b> <b>1,645</b> <b>2,631</b> <b>3,235</b> <b>3,203</b> <b>2,639</b> <b>1,719</b> <b>1,471</b>	1 9 19 68 73 82 07 113	401 344 826 891 742 652 470 283 208	83 124 190 229 311 224 143 95 64
Total	1	574	123	216	1, 133	18,178	468	4, 257	1,630

Includes 1 nonreturnee.
 Includes 2 cases from the April 1915 distribution who received 1 point bonus for overseas returnees.
 Includes 75 cases from the April 1915 distribution who received 1 point bonus for overseas returnees.

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,		F	PRU 2 (	reiurnees	)				
Stanine	PRU 1—New aviation	New av candi	clation dates	Student officers		MPEU	MPEU	MPEU	MPEU 10
	candi- dates	Not previ- ously tested ¹	Previ- ously tested	Not previ- ously tested *	Previ- ously tested 3	Ű	Negto	• •	candj- dates
8 7	0 0 0 0 0 0 1 0 0	75 77 93 88 77 93 25 0	58 29 24 17 9 3 2 1 0	62 46 40 24 18 12 4 3 0	627 218 137 84 41 222 8 1 0	709 1,027 1,878 2,690 3,335 3,108 2,447 1,502 1,392	1 5 12 39 60 94 77 80 100	318 374 509 659 741 603 497 301 197	84 119 159 293 319 272 175 95 84
Total	<u>,</u> 1	574	123	215	1, 138	18, 178	468	4, 257	1,630

# TABLE A.20.—Distribution of aerial-gunner stanines, buttery of September 1945-March 1945

Includes 1 nonreturnee.
 Includes 2 cases from the April 1945 distribution who received 1 point bonus for overseas returnees.
 Includes 75 cases from the April 1945 distribution who received 1 point bonus for overseas returnees.

TABLE A.21.—Distribution of mechanic armorer gunner stanines, battery of Sep-tember 1944-March 1945

		P	RU 2 (1	eturnees	)				
Staalne	PRU 1—new aviation	New av condi	viation dates	Sludent	officers	MPEU	MPEU	MPEU	MPEU 10-new aviation
	candl- dates	Not previ- ously tested 1	Provision ously tested	Not previ- ously tested	Previ- ously tested i	Ū	Negro	U	candi- dates
	0 0 0 0 0 0 0 0 1 0	82 72 83 10 83 10 83 10 9 10 9 10 9 10 9 10 9	36 34 22 12 20 0	80 41 40 29 15 7 22 0	613 234 150 91 35 - 13 1 0 0	642 1,025 1,707 2,564 3,327 3,201 2,648 1,637 1,287	3 4 4 29 54 82 105 82 104	342 342 502 673 731 668 635 238 178	102 147 217 295 309 252 154 78 66
Total.	1	574	123	216	1, 138	18, 178	468	4, 257	1,630.

Includes 1 nonreturnce.
 Includes 2 cases from the April 1915 distribution who received 1 point bonus for overseas returnces.
 Includes 75 cases from the April 1945 distribution who received 1 point bonus for overseas returnces.

		F	PRU 2 (	returnees	)	<u>`</u>			
Stanine	PRU 1—new aviation	New a candi	viation dates	Student	offeers	Mpeu	MPEU A-	MPEU	MPEU 10-new aviation
	eandi- dates	Not previ- ously tested 1	Previ- ously tested	Not previ- ousiy tested 3	Previ- ously tested a		'Negro	-	candl- dates
9 8	, 0 0 0 0 0 0 0 0	65 63 102 118 100 63 40 18 0	37 24 30 18 8 6 0 0	98 335 25 23 13 7 1 1 0	530 126 87 41 18 5 1 0 0	763 1,058 1,844 2,703 3,420 3,297 2,535 1,526 1,030	1 7 8 31 59 84 95 81 99	279 332 536 6/5 807 707 490 254 167	84 102 201 277 301 296 178 114 75
Total.,	1	574	123	216	1, 138	18, 178	473	4, 257	1,630

# TABLE A.22.—Distribution of radio operator gunner stanines, battery of September 1945–March 1945

Total.

887

0543

Includes 1 nonreturnee.
 Includes 2 cases from the April 1945 distribution who received one point bonus for overseas returnees.
 Includes 75 cases from the April 1945 distribution who received 1 point bonus for overseas returnees.

TABLE A.23.—Distribution of bombardier stanines, battery of April 1945-May 1945 PRU 2 (returnces) MPEU 81-New avia-tion candi-dates New aviation candidates Student officers MPEU 61 MPEU 61 Negro MPEU 84-Negro **Stanine** Not previ-ously tested Not Previ-ously tested Previprevi-ously tested ously tested 13 13 258 105 65 29 11 7 0 0 381 47 68 118 140 150 161 112 63 50 11 10 19 21 18 7 1 3 1 736 1,350 2,021 2,116 1,913 1,481 849 872 17 36 39 51 39 26 12 7 C 4 10 6 - 7 11 1 230 000 5 ..................... 172 11, 454 41 29

Includes 8 cases from June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 1 case from June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 150 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All cases are from June 1945 distribution. Candidates were tested on battery of April 1945-May 1945.

35

478

924

220

91

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	I	PRU 2 (r	eturnces)	)		MPEU			
Stanine	New av candl	riation dates	Student	oMocra	MPEU		MPEU 8 ¹ New avia-	MPEU 8'	MPEU- 10 New avia-
	Not previ- ously tested	Previously tested	Not previ- ously tested	Previ- ously usted	Ū.	Negro	tion candi- dates	Negro	tion candi- dates
9 8	6 12 41 45 49 31 X13 4	10 7 16 18 19 15 2 2	13 5 5 2 4 2 0 2 0 2 0	299 94 54 23 7 1 0 0 0	73 78 112 145 153 127 127 127 62 47	3 4 8 17 22 34 34 23 23	693 1,002 1,618 1,943 1,944 1,811 1,216 736 411	0 2 6 3 4 11 8 5 2	4 3 2 10 2 4 4 0 0
Total	230	91	35	478	924	172	11, 454	41	29

TABLE A.24.-Distribution of navigator stanines, battery of April 1945-May 1945

Includes 8 cases from June 1915 distribution who began testing prior to introduction of June 1945 battery.
 Includes 1 case from June 1915 distribution who began testing prior to introduction of June 1945 battery.
 Includes 156 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All cases are from June 1945 distribution. Candidates were tested on battery of April 1945-May 1945.

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1

	3	PRU 2 (r	eturne <del>es</del> )	)					
Stanine	New a candl	viation dates	Student	Student officers		MPEU 61-	MPEU 81- New nyla-	MPEU 84	MPEU 10- New ayia-
	Not previ- ously tested	Previ- ously tested	Not previ- ously tested	Previ- ously tested		Negro	candi- dates	Negro	tion candi- dates
9 8 	10 24 41 42 50 33 14 11 5	7 11 25 27 8 9 1 3 0		155 89 101 63 43 15 4 0 0	67 68 101 132 183 144 137 54 48	0 2 5 10 19 35 41 35 25	569 850 1,391 1,830 2,146 2,071 1,452 766 373	0 0 2 5 6 12 11 5	2 1 4 5 9 5 2 1 0
Total	230	91	35	478	021	172	11, 454	41	29

TABLE A.25.-Distribution of bomber pilot stanines, battery of April 1945-May 1945 .

Includes 8 cases from June 1915 distribution who began testing prior to introduction of June 1915 battery.
Includes 1 case from June 1915 distribution who began testing prior to introduction of June 1915 battery.
Includes 156 cases from June 1915 distribution who were tested on battery of April 1915-May 1915.
All cases are from June 1915 distribution. Candidates were tested on battery of April 1915-May 1945.

	I	'RU 2 (r	eturnees)		,		Ň		-
Stanine	New av candi	riation dates	Student	en so Mo	MPEU	MPEU 62	MPEU SL Now	MPEU 84-	MPEU 10 New avia-
	Not previ- ously tested	Previ- ously tested	Not previ- ously tested	Previ- ously tested	ដូរ	Negro	tion camil- dates	Negro	tion candl- dates
9 	7 22 33 42 43 35 22 11 8	7 13 23 21 10 7 4 2	9 7 6 8 4 1 0 9 0	109 85 96 85 21 7 4	48 87 102 140 172 158 124 68 68	0 2 4 10 19 21 35 37 44	452 778 1,343 1,876 2,173 2,015 1,447 861 409	0 0 1 1 7 4 9 10 9	0 1 4 3 8 3 1 0
Total	230	91.	35	478	924	172	11, 454	41	29

TABLE A.20.—Distribution of fighter pilot stanines, battery of April 1935-May 1935

Includes 8 cases from June 1945 distribution who began testing prior to introduction of June 1945 battery,
 Includes 1 case from June 1945 distribution who began testing prior to introduction of June 1945 battery,
 Includes 156 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All cases are from June 1945 distribution. Candidates were leated on battery of April 1945-May 1945.

TABLE	A.27Distribution	01	acrial	gunner	stanincs,	battery	of	April	1945-
		-	316	ay 1945					

	P	RU 2 (r	eturnees)			MPEU 61- Norio			١
Stanine	New av candie	lation lates	Student	officers	Mpeu		MPEU New avia-	MPEI.	MPEU 10- New syla-
•	Not previ- ously tested	Previ- ously tested	Not previ- ously tested	Previ- ously lested		Negro	tion candi- dates	Negro	tion candi- dates
9 8	8 18 21 42 51 37 21 20 7	9 24 13 21 12 5 4 2 1	7 6 2 11 3 5 1 0 0	114 (US 160 76 39 15 6 2 2	36 59 134 145 135 62 61	0 4 7 10 22 41 22 41 22 33	476 819 1,413 1,035 2,118 1,950 1,476 810 425	0 1 3 6 33 9 7 2	1 2 4 0 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Total	230	91	35	478	924	172	11, 456	41	22

Includes 8 cases from June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 1 case from June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 156 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All cases are from June 1945 distribution. Candidates were tested on battery of April 1945-May 1945.

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703324-47-22

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*	1	PRU 2 (1	returneer	١					
Stanipe	New a cand	viation dates	Student	officers	MPEU	MPEU 61-	MPEU 81- New avia-	MPEU 84-	MPEU 10- New avis-
	Not previ- ously tested	Previ- ously tested	Not previsously tested	Previously tested		Negro	tion candi- dates	Negro	tion candi- dates
8 8	10 19 40 37 52 34 20 12 6	14 11 22 16 15 9 2 2 0	10 8 5 4 4 4 4 0 0 0 0	163 83 104 72 35 12 3 1 0	42 63 102 140 163 137 122 77 58	0 1 6 12 23 27 41 24 38	523 791 1,437 1,850 2,229 1,920 1,352 817 505	0 0 3 3 8 15 3 9	1 1 5 5 10 8 1 1 0
Total	230	91	35	478	926	172	11, 454	41	29

## "TABLE A.28.—Distribution of mechanic-armorer-gunner stanines, battery of April 1945–May 1945

Includes 8 enses from June 1945 distribution who began testing prior to introduction of June 1946 battery,
 Includes 1 ense from June 1945 distribution who began testing prior to introduction of June 1945 battery,
 Includes 156 enses from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All enses are from June 1945 distribution. Candidates were tested on battery of April 1945-May 1945.

TABLE A.29.—Distribution of radio operator-gunner stanine, dattery of April 1945-May 1945

	1	PRU 2 (r	cturnees)	)		MPEU	MPEU 8 ¹ New avia-	•	
Stanine	New a candi	viation dates	Student	officers	MPEU			MPEU 8'-	MPEU 10 New ayla-
•	Not previ- ously tested	Previ- ously tested	Not previ- ously tested	Previ- ously tested		Negro	tion candi- dates	Negro	tion candi- dates
9 8 6 6 8 8 2 2 1 2 1	4 15 36 53 45 33 20 18 4	12 11 17 20 15 8 4 4 4 0	11 7 5 1 5 1 0 0	253 102 75 20- 19 2 1 0 0	56 80 114 132 150 133 156 63 55	1 3 6 10 21 38 33 31 21 39	586 929 1,443 1,583 2,133 1,774 1,318 795 603	0 1 5 8 2 12 7 4	2, 4 2 9 5 4 0 1
Total	230	91	35	478	924	172	11, 454	41	29

Includes 8 cases of June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 1 case from June 1945 distribution who began testing prior to introduction of June 1945 battery.
 Includes 150 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.
 All cases are from June 1945 distribution. Candidates were tested on battery of April 1945-May 1945.

#### TABLE A.30

			•	,					
	PRU	2 (retur	ncés)			PRU	2 (retur	nccs)	
1	New	Student	officers			New	Student	officers	
Stanine	tion candi- dates not previ- ously tested	Not previ- ously tested	Previ-, ously tested	MPEU 6	Stanine	tion candi- dates not previ- ously tested	Net previ- ously tested	Previ- ously tested	MPEU 6
9 8 8 1 4 8 4 2 1		0 1 2 1 1 0 0 0	85 34 18 11 6 1 0 0 0	32 75 120 176 224 166 126 70 58	9 8 6 4 3 3 1	0 1 0 0 0 1 0 0	1 2 1 1 0 0 0 0 0	93 32 18 3 3 18 3 0 0 0 0 0	49 111 157 192 172 168 117 61 35
Total	2	6	154	1,062	Total	2	1	154	1,002

#### Distribution of bombardier stanines, Distribution of navigator stanines, batbattery of June 1945 tery of June 1945

Distribution of bomber pilot stanines, Distribution of fighter pilot stanines, battery of June 1945

PRU 2 (returnces)		nces)	ļ		PRU	nees)			
	New	Student	officers			New avia-	Student	officers	•
Stapine	tion candi- dates not previ- ously tested	Not previ- ously tested	Previ- ously tested	MPEU \$	Sianine	tion candi- dates not previ- ously tested	Not previ- ously tested	Previ- ously tested	MPEU
9 8 6 8 8 8 8 1	0 0 1 0 0 1 0 0 0 0		50 28 36 19 35 6 2 0 0	42 65 122 157 150 150 155 156 156 55	9 8 6 8 4 3 1	0 1 0 0 0 0 1 0		37 23 35 25 18 7 2 1 0	33 33 117 164 199 163 163 163 163 163 163 163 163 163 163
Total	2	6	154	1,062	Total	2	6	161	1,061

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#### TAULE A.31

#### Distribution of acrial gunner stanines, ballery of June 1945 Distribution of flight engineer stanines, ballery of June 1945

	PRU	3 2 (retur	necs)		-	PRI	l 2 (retur	nces)	
	New avia-	Studen	l cíficers			New avis-	Studen	officers	
Stanine 	tion candi- dates not previ- ously tested	Not previ- ously tested	Previ- óusly tested	5 PEU 6	Stanine	tion candi- dates not previ- ously tested	Not previ- ously tested	Previ- ously tested	MPEU 6
9 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	0 1 0 0 0 1 0 0	d		76 69 128 149 170 176 139 89 60	9 8 6 5 4 3 2 1	0 0 1 0 1 0 1 0	0 4 0 1 0 1 0 0 0	68 27 22 9 3 0 0 0	56. 92 141 184 190 149 133 73 44
Total	2	8	154	1,062	Total	2	6	°154	1,062

Distribution of radar observer stanines, battery of June 1945

	PI	U 2 (returne	·cs)	
Stanine	New avia- tion candi-	Student	officers	MPEU 6
	dates not previously tested	Not previ- ously tested	Previously tested	
P	0	02	72 33	27 52
7 6 8	0	2 0 1	20 16 10	93 159 228-
y			2	184 179- 71 41
'Total	2	0	154	1, 962

#### TABLE A.32.—B-29 gunnery candidates

DISTRIBUTION OF AERIAL GUNNER STANINES BATTERY OF SEPTEMBER 1944-MARCH 1945

Stanine	MPEU 6	MPEU	MPEU 10	MPEU 10- Negro	Stanine	MPEU 6	MPEU 9	MPEU 10	MPEU 10- Negro
9. 8. 7.	64 86 125	95 112 190	79 88 138	0 0 1	3 2 1	182 199 279	329 340 385	269 227 341	9 14 33
\$	209 221	31/2	210 213	4 15	Total	1, 558	2, 425	1, 809	77
DISTRIBUTIO	N OF	MECH.	ANIC-AL TEM	IS RMOREI BER 194	R-OUNNER STA 1-March 1945	NINES	BATT	ERY O	p sei

9	72 87 140	113 122 185 207	97 110 156 215	0 1 0	3	109 168 250	338 330 319	237 203 • 279	21 9 33
8 9	213 213	377	254 258	8	Total	1, 558	2, 426	1,809	π

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TABLE A.32.-B-29 gunnery candidates-Continued

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DISTRIBUTION OF RADIO OPERATOR-GUNNER STANINES BATTERY OF SEPTEM-BER 1941-MARCH 1945

Stanine	MPEU 9	MPEŲ 9	MPEU 10	MPEU 10- Negro	Stanine	MPEU 6	MPEU 9	мрк <b>u</b> 10	MPEU 10- Negro
9 8 7 6 5 4	70 63 93 133 231 237	117 119 173 292 325 412	76 91 125 150 253 273	1 0 2 1 10	3 2 1 Total	215 197 305	324 315 319 2, 423	261. 222 335 1,509	19 9 35 77

TABLE A.33.—B-29 gunnery candidates

DISTRIBUTION OF AERIAL GUNNER STANINES BATTERY OF APRIL 1913-MAY 1918

Stanine	MPEU 61	91 91	MPEU 10	MPEU 10 Negro	Stanine	MPEU 61	PEU .93	MPEU 10	MPEU 10 Negro
	17 28 52 54 82 83	14 19 35 37 63 83	10 14 21 18 29 27	0 0 0 0 0 0	3 2 1 Total	-93 91 134 632	44 35 20 325	31 23 40 219	0 1 1 2

DISTRIBUTION OF MECHANIC-ARMORER-GUNNER STANINES BATTERY OF APRIL 1915-MAY 1945

9 8 6 4	22 35 62 85 85	15 24 39 47 61 54	8 12 18 28 20 32	000000000000000000000000000000000000000	\$ 2 1 Total	76 80 127 632	45 18 22 323	33 28 40 219	0 1 1 2
DISTRIBUTION	I OF	RADIO	OPERA'	TOR-01 1915-M.	UNNER STANI AY 1943	NES B.	ATTER	Y OF	APRIL
9 8 7	25 24 50	13 30 33	3 12 17	000	3 2 1	77 10 151	47 21 20	37 23 53	101

23 24 50 62 79 81 3 12 17 19 20 29 30 33 45 50 0 0 0 0 4..... Includes 4 cases from June 1945 distribution who were tested prior to introduction of 1 June 1945 battery.
 Includes 11 cases from June 1945 distribution who were tested on battery of April 1945-May 1945.

Total....

632

325

#### TABLE A.34.—B-29 gunnery candidates

DISTRIBUTION OF FLIGHT ENGINEER STANINES, BATTERY OF JUNE 1945

Stanine	MPEU 6	PEU 9	MPEU 10	Stanine	MPEU 6	PEU 9	MPEU 10
9 8 7	11 13 21	9 6 15	0 0 0	3	39 NJ 171	35 15 19	0000
6 3 4	47 48 67	27 22 25	0 0 0	Total	522	176	¢
DISTRIBUT	ION OF	RADAR	OBSERVE	R STANINES, BA	PTERY C	of June	1915
9 8 7	3 5 12	3 7 10	000	S 2 1	81 57 204	27 21 30	000000000000000000000000000000000000000
6 5 ŧ	33 41 57	នតន	0000	Total	5.12	* 171	0

329

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TABLE A.34.—B-29 gunnery candidates—Continued DISTRIBUTION OF AERIAL GUNNER STANINES, BATTERY OF JUNE 1945

Stanine MPEU PEU MPEU Stanine MPEU MPEU MPEU

	6	9	10	Otwinte	6 .	8	10
9 8	11 12 26 26 42 58	12 6 20 23 31	_0 0 0 3 0	3 2 1 Total	58 62 227 522	21 11 29 176	0 0 0 0 0

15 cases are excluded of men who were tested with April 1945-May 1945 battery.

#### **III. TRIVARIATE DISTRIBUTIONS**

TABLE A.35.—Trivariate distribution of pilot, bombardier, and navigation stanines, in each pilot stanine group plotted separately. Navigator stanine on x-axis, bombardier stanine on y-axis

[N=3,000 cadets tested in February and early March 1943. 1,000 cadets from each Classification Center.]

*	<u> </u>		Pilo	t stai	nine	= 1				c				Pilc	et sta	nine	-2				
N	1	2	3	4	5	0	7	8	9	T	N	1	2	3	4	5	6	7	8	0	T
B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B B.		   	   1 11			333	1			38 20 45	B 9 8 6 5 4 1			3 10 21 15	220 S	2 11 11 11 11 11 11	388			1	1 6 31 63 87 48
Т	22	15	16	14	ð	8	2	• • •		82	т	35	18	55	34	31	22	6	2	1	204
			Pilo	ot sta	nine	-1								Pilo	ot sta	nine					
N	1	2	3	4	5	6	7	8	9	т	N	1	2	3	4	5	6	7	8	9	т
B9 8 7 6 3 1 T	3 5 10 7 23	3 7 9 4 23	2 11 35 8 2 68	 5 19 22 6  52	 2 17 27 19 5 1 71	2 10 12 12 12 13 37	4 10 7 2 23		1	1 11 45 83 102 39 14 205	B 9 8 6 6 4 3 1 T	····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ····· ······	······································	 2 18 42 25 7 1 95	4 24 45 37 4 1 115	7 44 38 17 1 1 103	4 18 39 35 10 	1 2 18 22 12 12 1 1 	2 10 3 2		3 7 53 157 100 121 27 8 571
		_	Pll	ot st	anina	<b>)</b> ∞\$					,		_	Pil	ot st	ania	e <b>-6</b>				
N	1	2	3	4	5	6	7	8	0	Т	N	1	2	3	4	5	6	7	8	9	T
B 9 8 8 8 9 8 9 8 9 8 9 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9.		2 5 14 11 6	80	1 12 37 29 10 3	3 22 49 32 7 1	12 27 49 11 3 	8 11 24 20 3	48821		2 13 39 103 180 132 535	B § 8 1 T		10822	3 0 18 8 4 1	1722233	1 14 38 52 10 3	3 35 20 33 5 1	1 6 24 30 12	1 9 23 6 4 1	2 5 3	4 25 109 141 155 58 14 511

			P	llot s	tani	ne = 7	,						<u>.</u>	P	llot st	anir	k=8				
N	1	2	3	4	5	ũ	7	8	5	т	N	1	2	3	4.	5	6	7	3	9	т
B 9 8 6 5 4 3 1 T		···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ···· ····· ····· ····· ····· ····· ····· ······	4 9 1 1 1 16	1 3 11 12 9 2 1  39	1 18 24 17 5 1 2 1 2 5 1 2 63	1 5 27 22 14 4  73	78	5 20 17 5 1  48	7 19 6  32	15 (2) 99 58 57 21 8 57 21 8 57 21 359	B 9 8 5 4 1 T	1		1 1 1 1 1 1 1	2242	1 2 9 8 7 5  32	12 12 12 12 13 12 13 12 12 13 12 12 12 12 12 12 12 12 12 12 12 12 12	······································	6 1; 6 1 2 : 29	20 13 2 	315 47 59 37 214 14 3  215
								P	llot	stanin	······					<u> </u>				·	
	N			1	L	2		2		4	5		6		7		8		9	·	r
B9 9 7 6 6 4 3 2 1				·····	1		1		1 2 1 1				1	8 8 9 2 4 2		5 5			27 5 2 1 1		87 39 53 35 30 9 1
т	•••	••••	••••		1		2		5	11	3.5		4	12	4	7	37		36		234

### TABLE A.35.--Trivariate distribution of pliot, bombardier, etc.--Continued

TABLE A.36.—Trivariate distribution of pilot, bombardier, and navigator sta-nines, in each pilot stanine group piloted separately. Navigator stanine on x-axis, bombardier stanine on y-axis

	Pilot stanine=1												Pilo	t star	ine-	-2					
N	1	2	3	4	5	6	7	8	9	т	N	1	2	3	4	5	6	7	8	9	T
B 9 3 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 9 8 8 8 9 8 9 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	2 2 3 3 3 5 45	  1 5 14 18 33	1 7 10 9 5 32		1 7 3 	2233		2			B 9 8 7 8 8 8 8.	2 5000 1	8 847 con: : : :	2 o 52 4 2 4		2]:	112021		1 1		11 42 52 53 53 47 45 255
	•	<u>'</u>	Pilo	star	ine=	• 3		1	<u></u>	L			·	Pilo	t stai	nine	- 6				
N	1	2	3	4	5	6	7	8	0	T	N	1	2	3	4	8	6	7	8	9	т
B											-										

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[N=3000 alr-crew applicants tested in February and March 1914 in MPEU's, sampled in proportion to number tested at each MPEU during February]

331

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			Pi	îot s	tani	nd =	5									Þ	ilot s	tani	ne-t	5				
N	1	2	3	4	5	6	7		8	9	т		N	1	2	3	4	5	6	7	T	8	9	T
B 8 6 4 2 T		30 20 20 20 30	4 10 31 21 11 3 89		14 32 48 35 8 1 135				2 2 7 10 2 23	3 5 2 1 15	5 17 61 117 145 26 21 535	1198.7.6.5.43.21. T			1 7 3	13 13 13 9 2 1 38	1 5 21 44 30 12 1 1 	2 13 26 31 79 8	9 19 43 20 4			1 4 10 3 4 1	71063	9 32 72 116 121 76 29 1 2 461
			P	llot a	tani	ne=	7			يى المنصرة						P	ilot s	tanl	ne-t	3				
, N	1	2	3	4	8	6	7	8		9	T	~	N	1	2	3	1	5	6	7		8	9	T
B9 9 3 6 4 3 1 T	2	31		1 5 13 18 9 2 48	1 6 10 19 27 4 2 	* * * * * * * * * * * * * *	2 7 18 12 4 1 1 1 1 5		11100511	4 8 9 1 1 23	8 41 71 83 65 22 12 2 1 305	11 9. 8. 7. 6. 5. 4. 3. 2. 1 1 1	N			1 1 2 1  5	2 1 2 1 2 2 1 2 2 10	2 8 7 6 1 1 1 25	6 13 11 2  32			3543	11 7 4 2	17 28 42 34 12 4 4 3 12 4 11 4
		<u> </u>				<u> </u>				P	lot st	an	ino-9	<u> </u>	<u> </u>	<u> </u>			<u> </u>	<u> </u>				
<b>-</b>	х			Γ	1		2		3	T	4		5	1	6		7		8	T	9			T
B9 8 7 6 4 1 T							1 2 1 1 5			1						1 4 15 3 3	1	892251 1		9 9 8 1 1 		18 9 3 2 32		33 33 40 27 13 4 2 1 1 1 1 57
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<del></del>	Bomber pilot stanine=1											1		au	n	omt	×r p	llot s	tank	ne	2	~ <u></u>		
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TABLE A.36.—Trivariate distribution of pilot, bombardier, etc.—Continued

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		Bon	iber J	vilot 1	Ianl	ne=:	3						Bon	iber	pilot	#tai	nlne		*****		
N	1	2	3	•	5	6	7	8	9	т	N	1	2	3	6	5	8	7	. 8	9	T
B 9 5 5 4 2 T	1 6 11 18 36	6 25 19 10 60	1 27 15 16 4 93	2 17 28 25 7 2 111	\$ 44 33 8 93	2 11 21 7 41		···· 3 1 ···· 7	····	E 2252380-:	B 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8			35 35 47 24 6 117	2 34 34 31 14 133	 13 63 47 1 131	201			1.32.1	2 7 733 755 115 152 152 152 152 152 152 152 152 1
<u></u>		1		1105 2	1	10-1	э 		<u> </u>				Lion	nber	pilot	stat	nine I	8	-1	<del>.</del>	
N 	1	2	3	4	<u>.</u>	<u> </u>	7	8	8	т 	N 	1	2	3	4	3	6	] -	8	9	T
B 9 8 6 5 4 1 T	  3 1 	     	1 10 19 20 7 1 61	2 43 55 24 2 125	5 26 55 27 4	1 14 58 41 12	3 18 25 6	10	: 5 5 : : : : : : : : : : : : : : : :	5 1933 11 55 15 63 7 P	B 8 6 5 3 1 T	1122	····		S   watte	3 29 51 13 1 97	17 53 24 3				8 21 23 110 117 34 393
<b></b>		Bon	iber 1	llot :	stant	20 m'	7		,				Bon	nber	pliot	stat	lne	-8			
N	1	2 3	4	3	6	7		8	9	T	N	1	2	3	4	s	8	7	8	•	T
B9 8 7 6 5 7	••••					10	•	i	4		n								••••	11 7	11 37 64
2 1 T	· · · · · · · · · · · ·		20 10 2  37	21 30 5 1 (3	19 41 10 1  71	20 13  43		24	5 3 13	25626271	8 7 δ 1 T			1 2 1 		3 2 .	11 21 5 	2 : : : : : : : : : : : : : : : : : : :	10 12 1 	21	43 26 8 1 195
2 1 T	····	1 1 1 Bon	20 10 2  37	21 30 5 1 63	19 41 10 1 71 71	20 13  43 ne	9	24	3 13	25 25 20 27 7 1 233	8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		Fig	1 2 1 	1 1 3 4 11 11 11	3 6 13 2	11 21 5 	173° 1 2 3 7	10 12 1	21	43 26 8 1 1 95
2 1 T N	1	1 1 1 1 Bon 2	20 10 2  37 ber 1	21 30 5 1 (3 63	19 41 10 1 71 71 stani	20 13  43 ne 7	9	3 1 24 8	6 3 13 9	25 C2 E2 C2 27 1 253	8 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9		Fig 2	1 1 2 1 1 	1 3 4 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3 16 13 2 	11 21 3 30 30 6	-1 7	10 32 1 	21	195

TABLE A.37.-Trivariate distribution of bombardier, navigator, etc.-Continued

		Fig	hter	pilot	stan	lne=	2					·	FI	ghte	r pik	ot ste	nine	;3			
N	1	2	3	4	5	8	7	8	8	·T	N	1	2	3	1	8	6	7	8	6	т
B 8 6 6 8 6 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	1 30 37	4 10 24 18 53	11 32 20 7 70	2 24 20 8 2 50	3 7 15 7 	2 9 9 9		231		28832814 in 15832838	B 9 8 5 5 4 2 1 T	10 16 20	20	20		32		3		···· 1 3 ···· ···· 4	1 11 30 84 113 103 67 27 412
	<u> </u>	Fig	hter	l pllot	i stan	ine~	! 	<u> </u>					<u>ן</u> דו	zhte	r pilo						
N	1	2	3	1	5	0	7	8	9	T	N	1	2	3	4	5	6	7	8	9	т
B9 8 7 6 4 2 T	5 11 8 24	8 13 17 2 40	3 36 49 15 4 107	3 30 68 29 5 135	1 9 56 40 2	3 26 38 9  76	1 9 21 5 1  37	3 12 3 	37 1  11	1128833353341 8	B 9 7. 6. 5. 4. 2. 1. T.	11143	8 18 8 	1 8 30 39 8	2 36 52 22 4	3 21 65 27 3	13 49 36 9	2 22 18 5	10 12 2 10 12 2	6 2 6	6 14 55 93 130 127 83 24 2 554
	<u> </u>	Fig	hter	pilot	stan	ine-	6	<u>·</u>				<u> </u>	F	ghte	r pik	ot sta	anina	-7	<u> </u>		
N	1	2	3	4	5	0	7	8	9	т	N	1	2	3	4	5	6	7	8	9	т
B 9 8 6 4 2 1 T	···· ··· ··· ··· ··· ···	195	1 7 11 6 25	3 43 25 4 1 70	4 32 57 11 1 ,	22 57 28 2 	······································	10 11 3	4 5 1	4 22 54 120 135 70 20 5 1 421	B 9 8 δ 3 1 T			3 10 1 1 15		4 27 30 1 	1 15 43 6 1  66	12 38 11 2	2 12 11	21	il 34 71 86 63 26 3 1 
		Fli	ter	pllo	t star	11110-	-8					<u> </u>	F	ighte	e pll	at st	anin	0-9			
N	1	2	3	•	5	6	<u>_</u>	8	9	T	N	1	2	3	4	5	6	7	8	9	т
B9 8 6 8 8 4 1 1 T			1 3 1		6   19   13   2		1000	10 10 1	14	15 31 62 51 24 6 1	B 8 6 3 1 T		· · · · · · · · · · · · · · · · · · ·	1	2111	4 7 6  17	3 9 8  20	11 12 3 1 	2 16 3  21	22 3   25	24 33 30 19 9  115

TABLE A.37.—Trivariate distribution of bombardier, navigator, etc.—Continued

#### TABLE A.37.-Trivariate distribution of bombarduer, navigator, ctc.-Continued Fighter pilot stanine

		1	3	3	4	5	3	7	8	9	T
Nomber pilot stanine.	9 8 7 6 5 4 3 1 T.	13 54 140 207	2 25 92 115 55 270	2 27 124 184 92 13 442	1 21 133 243 138 24 24 2 24 2	4 20 102 236 163 23 23 23 25 25 4	2 21 77 171 119 27 3 1 421	12 63 103 78 35 1 4. 4. 295	38 77 59 16  100	82 2N 3 2  2  115	134 195 263 392 653 355 455 255 210 3,076

#### IV. DISTRIBUTIONS OF PREFERENCES, PREFERENCE WAIV-ERS, PREVIOUS FLYING EXPERIENCE, AGE, AND, EDUCA-TION

TABLE A.39.-Distribution of first preferences

		N (on		Percent	of total	
Unit	Date	which percent- ages are based)	Bombar- dkr	Navi- gator	Filot	Other
PRU 1 ¹ PRU 1 ⁴ PRU 2 ⁴ PRU 3 ⁴ PRU 3 ⁴ PRU 3 ⁴ PRU 3 ⁴ MPEU 4 MPEU 4 MPEU 6 ⁴ MPEU 6 (Negro) MPEU 6 (Negro) MPEU 8 MPEU 8 MPEU 8 MPEU 9 MPEU 10	July 1942-December 1943 January 1941-June 1944 July 1942-November 1912 July 1942-June 1913. July 1942-June 1913. July 1943-April 1944 November 1943-April 1944 November 1943-April 1944 November 1943-June 1944 June 1044-May 1945 July 1944-June 1945 November 1943-March 1944 November 1942-December 1944. March 1945-May 1945 November 1943-May 1944 November 1943-May 1944	109,453 1,573 25,531 12,000 5,079 1,010 2,325 4,321 4,170 22,972 8,79 3,317 41,592 1,354 1,505 1,354 1,505 1,505 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,515 1,51	4.69 9.00 3.09 5.40 10.86 % 00 10.86 % 00 3.65 8.21 2.33 3.33 3.33 3.33 3.63 6.07 2.67 7.03	8,78 13,54 4,10 6,70 11,23 9,71 2,5,85 4,18 8,65 7,50 8,65 7,50 4,18 5,85 4,18 5,85 4,18 5,85 4,18 5,85 4,18 5,85 4,10 5,76 5,76 5,76 5,76 5,76 5,76 5,76 5,76	54, 55 76, 56 92, 81 95, 82 97, 59 94, 43 94, 58 91, 60 91, 60 91, 60 91, 60 91, 60 91, 60	1.20 1.20 1.20 1.43 .35 1.20 1.20 1.20 1.20

i00-percent samples are given.
i Figures are based on 10-percent samples. Figures for the months April, May, and June 1014 which are included in these figures contain for the most part redeclarations of preferences as specified in AAF Training Command Memorandum No. 35-17, 14 Apr. 1044.
i Figures for first preference available only for July 1942-November 1942.
i Figures are based on a total of samples of 1,000 cases for each month.
i Figures for first preference available of a 10-percent flow of men through the unit.
i Figures for first testers processed at PitU 3. From a random sample of a 10-percent flow of men through the unit.
i Figures for student oilleers. Figures represent a random sample of a 10-percent flow of men through the unit.

I Figures for student oncers. Figures represent a function complete of the term of the total number the unit.
 I Figures are based on a random sample, which represents something over 10 percent of the total number tested.
 I Figures represent a 10-percent sample. Figures are taken from the preference blank of every tenth new aviation traines.
 IF Figures are based on a sampling of 600 enses for each month.
 IF Figures are based on a random selection of a 10-percent sample of new aviation trainees.

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		N (on which		Percent	of total	
Unit	Ferlod	percent- ages are based)	w	x	Y	z
PRU 14 PRU 24 PRU 24 PRU 24 PRU 24 PRU 24 PRU 34 PRU 34 PRU 34 PRU 34 MPEU 44 MPEU 64 MPEU 64 MPEU 64 MPEU 64 MPEU 64 MPEU 64 MPEU 84 MPEU 84 MPEU 84 MPEU 84 MPEU 94	August 1942-June 1944 July 1943-May 1944 July 1944-May 1945 November 1943 May 1944-May 1945 July 1944-June 1944 July 1943-April 1944 November 1943-April 1944 November 1943-April 1944 November 1943-April 1944 July 1944-June 1945 July 1944-June 1945 July 1944-June 1945 July 1944-June 1945 November 1943-May 1944 November 1943-May 1945	109, 369 4, 653 1, 174 1, 570 921 - 12, 000 3, 639 1, 010 2, 325 4, 381 4, 170 22, 972 839 3, 317 40, 951 1, 500 1, 350	25, 02 29, 00 17, 38 1, 34 21, 40 36, 92 30, 48 15, 71 27, 31 27, 31 27, 31 27, 31 27, 31 27, 31 27, 31 27, 28 31, 80 41, 11 29, 20 31, 25 32, 25 33, 62	14. 12 8. 62 8. 52 3. 26 14. 10 12. 74 8. 37 9. 29 11. 83 11. 93 12. 76 11. 24 16. 69 10. 85 11. 49 10. 93 11. 76	51, 04 56, 42 54, 63 21, 59 58, 00 49, 10 49, 32 59, 46 60, 00 49, 85 49, 31 46, 60 39, 41 40, 65 55, 50 46, 82 62, 74 51, 01	7. 52 5. 45 19. 42 71. 60 6. 50 2. 50 1. 95 2. 69 11. 01 9. 40 8. 80 8. 24 10. 12 12. 43 5. 73 4. 83

TABLE A.39.—Distribution of preference waivers

1

¹ These figures contain cases tested by other sections and units. Figures for April, May, and June 1914 which are included in the N contain for the most part relectantions of preference waivers as specified in AA F Training Command Memorandum No 35-17, 14 Apr 1914.
³ Figures for November 1913 are not included. November figures appear below. Figures represent a 10-percent sample.
⁴ Figures include men previously eliminated.
⁴ Figures represent a 20-percent sample.
⁴ Figures represent a 20-percent sample.
⁴ Figures represent a a notion of samples of 1,000 cases for each month.
⁴ Figures represent a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are based on a total of samples of 1,000 cases for each month.
⁴ Figures for basic training center testees processed at PRU 3. From a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are for student officers. Figures represent a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are for student officers. Figures represent a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are for student officers. Figures represent a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are for student officers. Figures represent a random sample of 10 percent of the flow of men through the unit.
⁴ Figures are based on a 10-percent sample of new aviation trainees only.
⁴ Figures the represent a 10-percent sample of new aviation trainees.
⁴ Figures hased on a sampling of 500 eases for each month.
⁴ Figures meshed on a sampling of 500 eases for each month.
⁴ Figures are based on a 10-percent sample of new aviation trainees.
⁴ Figures hased on a random sample of new aviation trainees.
⁴ Figures hased on a random sample of new aviation trainees.


Coding for preference waiver was as follows: W-I want to be assigned to the kind of in-crew training for which I show the greatest ability on the tests. X-I want to be assigned to the kind of in-crew training for which I show the greatest ability on the tests only if my ability for that kind of training is much greater than for any other kind. Y-I want to be assigned to the kind of air-crew training in which I am most interested unless the tests show that I should probably fail in that kind of ir-crew training in which I am most interested unless the tests show that I should probably fail in that kind of ir-crew training in which I am most interested even if the tests show that I should probably fail in that kind of training.

TABLE A.40.-Previous flying experience of 15,000 aviation candidates from report submitted 29 October 1942

Category 1	PR	Ul	PR	U 2	PR	U 3	To	tal
	Num- ber 9 639 411 175 2,954 718 64	Per- cent 0.18 12.78 8.22 3.60 59.63 14.34 1.28	Num- ber 300 262 300 3,298 826 1	Per- cent 0, 14 6, 12 5, 24 6, 00 (5, 06 16, 52 .02	Num- ber 501 494 205 2, 910 781 97	Per- cent 0.10 10.08 9.88 4.12 53.20 16.63 1.94	Num- ber 1,419 1,167 0,192 2,323 162	Pcr- cent 0.14 9.68 7.78 4.54 61.28 15.57 1.05
Total	5,000	100.00	5,000	100.00	5,000	100.00	15,000	100.00

Categories were as follows:

 Have commercial pilot's license.
 Have private pilot's license.
 Have held student pilot certificate with solo privilege.
 Have held student pilot certificate.
 Have been passenger in plane but have had no formal instruction.
 Have held previous military flying instruction.

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TABLE	A.41Percent	of	neio	arlation	candidates	receiving	credit	for previous
				flying ca	perience ¹			

Year and month	PRU 1	PRU 2	PRU J	MPEU 4	MPEU 5	MPEU 6	MPEU 7	MPEU 8	9 Mi-ea	MPEU 10
1943 November December		******		3.1 4.3	4.4 2.6	5,1 2,2	2.5 5.7	3, 2 4, 3	4. 2 3, 8	4.1 2.4
1944 January February March April May Juno Juno July	4.3	5.3 1.4 1.7	7.2 5.6 7.0	5.0 1.9 2.7 2.2	2.2 1.7 1.3. 6.7	1.9 2.3 3.1 0.2 3.0 4.1 2.7	2.7 3.3 6.0	4.0 3.2 5.5 5.0 4.1 4.4 2.8	3.9 4.8 4.7 1.5	3.3 4.2 1.7 4.6 3.4 1.6 3.3
August. September		••••••				.9 2.0		1.4 2.7		2.1 t.1

¹ The percentages are based on data obtained from 20-percent samples and 25-10-percent samples of the month's testing. Where the number tested was small, 100-percent samples have been used.

	PR	បរ	PR	U 3	PR	U 3	То	tal
Age	Number	Percent	Number	Percent	Number	Percent	Number	Percent
28 27	0 85 107 138 138 117 145 72 72 47 3	0.0 3.3 10.5 13.6 11.5 15.3 14.5 14.3 14.3 7.1 4.6 .3	0 77 121 123 176 195 160 133 150 133 151 133	0.0 6,8 10,7 11.2 15,6 17.3 14.2 11,8 7,8 4,5 ,1	6 (3) 123 1157 211 213 213 111 50 55 11 0	0.6 8.8 11.6 14.8 19.9 20.1 10.5 7.5 5.2 1.0 .0	6 255 751 201 201 201 201 205 205 205 205 205 205 205 205 205 205	0.2 8.0 11.0 13.1 15.7 17.6 13.0 11.2 4.7 3.4
Total	1,017	100.0	1,128	100.0	1,000	100.0	2, 205	100.0

TABLE A.42.—Distribution of age of aviation candidates tested in September 1942*

¹ Candidates who were tested during the latter part of September. Average are of aviation candidates tested in September 1942: PRU 1, 23 years 2 months; PRU 2, 23 years 2 months; PRU 3, 23 years 9 months; total, 23 years 5 months.

	PR	U 1	PR	U 2	PR	U 3	To	: <b>h</b>
Age	Number	Percent	Number	Percent	Number	Percent	Number	Percent
28	4 415 459 805 811 1,109 1,099 1,094 319 319 319	0.1 0.9 7.6 9.9 9.8 13.4 19.2 18.2 18.2 18.2 5.7 .5	8 43% 517 640 653 810 1,016 871 479 270 16	0.1 7.7 9.0 11.2 11.4 14.3 17.8 15.2 8.4 4.7 .3	12 255 505 710 762 844 744 744 661 310 158 8	0.2 7.5 9.8 13.8 14.9 16.4 14.5 12.0 3.1 .2	21 1,215 1,215 1,915 2,455 2,455 2,569 1,314 1,777 35	0. 7. 11. 11. 11. 11. 11. 11. 11. 11. 11.
Total	6,031	100.0	5,718	100.0	5, 135	100.0	14, 807	100,

TABLE A.43.—Distribution of aye of aviation candidates tested in Oclober 1912

Average are of aviation candidates tested in October 1942: PRU 1, 22 years 9 months; PRU 2, 23 years 0 months; PRU 3, 23 years 4 months; total, 23 years 0 months.

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TABLE A.44.—Distribution of age of aviation candidates tested in March 1943

¢	PR	U 1	PR	Ũ 2	PR	U 3	Te Number 418 192 202 213 3405 946 1, 207 543 205 21 4, 500	tal
A 86	Number	Percent	Number	Percent	Number	Percent	Number	Percent
27	178 87 61 112 2235 403 192 120 8	11. 9 4. 5 4. 3 4. 1 7. 5 19. 6 20. 8 12. 8 8. 0 . 5	64 65 73 79 140 3% 441 183 84 5	4.3 4.3 4.9 5.3 9.7 21.0 29.4 12.2 6.6 .3	205 67 123 133 147 201 333 128 62 8	13.8 4.5. 8.3 6.9 9.8 19.4 24.2 8.5 4.1 .5	418 199 202 213 405 946 1, 207 503 269 21	10.6 4.4 5.8 5.4 9.0 21.0 20.8 11.2 5.9 .5
Total	1, 500	100.0	1, 500	103.0	1, 500	109.0	4, 500	100.0

Average are of aviation candidates tested in March 1943: PRU 1, 22 years 3 months; PRU 2, 22 years 0 months; PRU 3, 22 years 10 months; total, 22 years 4 months.

TABLE A.45.—Mcan and standard deviation of age for PRU's and MPEU's by quarter for fiscal year 1943-44

	Jul: Se	y throu ptemb	igh cr	October th Decemb		ough er	January through March		April through June		h June	
	N	м	8D	N	м	8D	N	м	SD	N	м	SD
PRU 1 2 3 MPEU 4 5 6 7 8 9 10	3, 629 3, 003 3, 657	21.07 21.20 21.35	2.06 2.09 2.20	4,795 4,493 4,216 2,724 5,406 3,815 3,815 3,815 3,810 2,090 1,812	21. 09 21. 13 21. 10 20. 90 20. 87 21. 50 20. 93 21. 16 21. 27 21. 27	2,41 2,46 2,43 2,50 2,73 2,69 2,69 2,67 2,67 2,67 2,01	2, 100 3, 370 3, 200 2, 991 5, 2%4 6, 023 2, 223 3, 602 1, 866 2, 153	21.25 21.30 21.25 21.32 21.21 21.20 20.92 21.27 21.41 21.54	2.51 2.37 2.35 2.85 2.73 2.81 2.73 2.81 2.73 2.73 2.73 2.73 2.73	339 1, 515 2, 646 124 1, 710	20. 20 19. 95 20. 45 21. 76 20. 51	2.52 2.83 3.04 2.83 3.03

[20-percent sample of new aviation trainces at PRU's. 30-percent sample of all men tested at MPEU's]

TABLE A.46Mcans and standard	deviations of education in terms of a code for
PRU's and MPEU's by	quarter for the fiscal year 1943–44

#### 20% Sample of new aviation trainces at PRU's. 30% Sample of all men tested at MPEU's.

6		Jul Sc	y throu ptemb	igh er	October through December		January through March			April through June			
		N	м	81)	N	м	8D	N	м	8D	N	м	81)
PRU MPEU	1 2 3 4 6 7 8 9 0	3, 261 2, 959 3, 616	4.62 4.56 4.45	1. 29 1. 25 1. 25 1. 23	4, 792 4, 403 4, 185 2, 714 5, 350 3, 785 3, 275 3, 275 3, 802 2, 600 1, 805	4.17828348488	1. 19 1. 11 1. 10 1. 22 1. 24 1. 29 1. 21 1. 32 1. 32 1. 30	2,091 3,372 3,253 2,557 5,278 6,017 2,217 3,597 1,857 2,143	4. 12 4.09 4.00 3.81 3.83 3.54 3.52 3.55 3.55 3.55	1. 17 1. 10 1. 19 1. 32 1. 31 1. 23 1. 24 1. 24 1. 30	338 1, 513 2, 647 122 1, 703	4.15 3.84 3.90 3.90 3.90	1. 13 1. 13 1. 18 1. 09 1. 30 1. 11

Education coded as follows: 0, eighth grade or less; 1, ninth grade; 2, tenth grade; 3, eleventh grade; 4, tweitth grade; 5, first-year college; 6, second-year college; 7, third-year college; 8, college graduate. Protessional school graduates omitted from computations.

### **V. DISTRIBUTIONS OF QUALIFICATIONS**

TABLE A.47.—Qualifications of new aviation candidates. Candidates tested prior to buttery of 1 September 1933

Qualification	PRU	PRU	MPEU	MPEU	MPEU	MPEU	MPEU	MPEU	MPEU
	13	24	4	5	6	7	8	9	10
BNP	1, 845	2, 128	2,023	4, 634	4, 703	2,938	3,972	1.772	2,501
BP	916	1, 307	2,172	5, 271	4; 931	572	4,618	2,103	2,557
NP	160	37	69	191	255	3,256	173	63	169
BN	191	171	769	1, 207	1, 510	43	1,074	335	639
B.	123	141	1,191	2, 544	2, 453	1,173	2,000	756	1,254
N	144	29	180	229	431	66	286	52	219
P	1,050	865	2,503	5, 296	6, 601	2,818	5,009	2,271	2,813
Total qualified	4, 459	4,680	9, 207	19, 452	20, 857	10,910	17, 804	7.337	10,144
Total disqualified	867	1,002	10, 153	18, 419	21, 429	7,112	18, 339	6,253	11,082
Orand total	5,333	5,652	19,345	37,871	45, 316	18,023	36, 143	13,612.	22, 126

¹ There are no qualification figures available prior to July 1943. No qualification figures are available for PRU 3. ³ The period covered is July 1943-June 1944 only. This period is represented by a total of the 10 percent random samples for each month. The figures include all categories—new aviation trainces, student officers, eliminees and others. ⁴ Figures are based on a total of samples for each month, slightly in excess of 10 percent,

TABLE A.48.—Qualifications of eliminces. Candidates tested prior to buttery of I September 1944

Qualification	MPEU 4	MPEU 5	MPEU 6	MPEU 7	MPEU 8	MPEU 9	MPEU 10
NP NP NP N B N	0 0 31 26 7 0	0302584	49 37 4 10 12 5	0 40 0 29 8	0 1 0 41 24 21	12 7 2 9 3 2	2 8 0 17 10 7
Total qualified Total disqualified	64 58	121 114	239 110	70 68		39 {0	44
Grand total	122	235	349	135	193	<b>6</b> 7	96

1 No qualification figures for eliminees are available for PRU 1, PRU 2, and PRU 3,

TABLE A.49.—Qualifications of student officers. Candidates tested prior to battery of 1 September 1944³

Qualification	MPEU 4	MPEU 5	MPEUG	MPEU 7	MPEUS	MPEU 9	MPEU 10
BNP BP NP SN B N. P.	73 33 4 17 10 3 44	19 11 4 5 5 4 5	84 23 9 15 6 7 17	0 0 0 0 0 0 0 0	32 20 11 0 2 40	0 0 0 0 0 0	38 12 6 7 0 5 14
Total qualified Total disqualified	184 80	54 17	161 44	000	105 8	0	87 21
Grand total	274	71	205	0	111	0	103

1 No qualification figures for student officers are available for PRU 1, PRU 2, and PRU 3.

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Qualification	MPEU 4	MPEU 5	MPEU 6	MPEU 7	MPEU 8	MPEU 9	MPEU 10			
BNP. BP. NF. BN. B. N. P.	118 82 7 1 2 0 119	192 164 13 16 31 11 179	84 121 6 9 10 2 120	168 37 163 2 36 5 81	0 0 0 0 0 0 0 0	20 12 2 8 5 2 10	123 325 15 3 6 1 120			
Total qualified	329 64	605 181	352 82	492 150	03	59 36	393 52			

TABLE A.50.—Qualifications of others.¹ Candidates iested prior to battery of 1 September 1945² ·

¹ Others refers to any enlisted man with previous military gir-crew training. It likeludes individuals eliminated from Navy or War training service flying training. Individuals are usually former glider-pilot trainces, former enlisted bombardiers, or former foreign air-force pilots. ³ No qualification figures are available for PRU 1, PRU 2, and PRU 3.

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TABLE A.51.—Qualification of Negro candidates tested prior to dattery of 1 September 1944

Qualification	MPEU 6
RNP	32
вр мр	0
BN	-12
n	0
Total qualified.	83
Polal disqualified	103

Stanlae qualifications for air crew training for Negroes have differed from those for white preaviation cadets. At the beginning of the annual report year (1 July 1914) the requirements for Negroes were as follows: For pilot training a pilot stanine of 5 or better; for bombardier (or navigetor) training, a bombardier traine of 5 or better pilot a navigator stanine of 5 or better.

TAME A.52—Qualification of new aviation candidates. Candidates tested after battery of 1 September 1944*

	PRU 2 (i	returnces)			
Qualifications	Not prev- loasly tested	Previously tested	MPEU 6	MPEU 8	MPEU 10
BNbPYP BNbP BNVP BNYP BNYP NbYP RN NbP NP NP NP NP B NP B N P Total qualified Total qualified.	161 31 7 40 9 43 1 8 1 8 1 1 3 33 29 9 25 15 660 340	78 15 17 12 13 2 13 2 13 2 13 1 0 12 14 4 4 8 8 107 15	2, 154 330 83 276 142 789 31 64 109 21 833 218 632 218 632 337 315 5, 431 13, 671	1, 473 242 141 413 197 752 27 68 106 24 973 194 752 277 336 6, 033 9, 510	172 34 7 30 92 8 12 12 12 13 87 87 19 61 62 47 667 973
Orand total	800	213	19, 102	18,005	1,639

1 No figures are available for the few men tested at PRU 1 and PRU 3 after September 1944.

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Grand total.....

L	Schicmas	r 1935 -			
	PŘÚ 2 (1	eturnees)			
Qualifications	Not prev- lously tested	Previously Tested	MPEU 6	MPEU 8	MPEU 10
ANDPIP. UNDP. BNIP. BNIP.	.0 0 0	0 0 7	921	0 0 7 2	0 9 0
NDP1P PN RbP MP NP 	0 -1 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0 -0	1 77 3 0 0	0 1 0 0	0 4 0 0 0	0 5 0 0
N(P	01	0 0 14 8	0 0 0	010000000000000000000000000000000000000	0 0 1 6
P. Total qualized.	0.	113 113	15	<u> </u>	0
Total disqualigoj		17	22		38

TANKE A.53.-Qualifications of climinees. Candidates tested after ballery of

I No figures are available for the few men teste 1 at PRU 1 after 1 Sept 1944.

TABLE A.54.—Qualification of student officers. Candidates lested after ballery of 1 September 1944

	PRU 2 (1	rtuínees)			
Qualifications	Not pre- viously tested	Previously tested	MPEU 6	MPEU 8	MPEU 19
BNbPfP. BNbP. BNP. BNP.	17.4 17 8	1, 158 165 38	154 12	213 15 0	10 0 0
HOPTP	7 14 0 0	10 214 2 2	3 19 1 0	8 22 0 2	0 2 0
NbP NP bP/P B	4 0 15	15 0 3 8	21	0 0 5 0	000000000000000000000000000000000000000
N bP (P	8 3 1		0	22	
Total qualified Total disqualified	217 19	1,709	210	371	
Grand total.	2:6	1,761	213	312	16

1 No figures are available for the few men tested at PRU 3 after 1 September 1914.

TARE A.55.—Qualifications of others, September 1935–June 1935. Candidates tested after battery of 1 September 1933

Qualifications	MPEU 6	MPEU 8	MPEU 10	Qualifications MPEU MP		MPEU 8	MPEU 10
NNbP/P. BNbP. BN/P. Bb/f/P. NbP/P. BN BN. BN BN. KP. NfP.	35 1 6 4 3 0 2 1 2	0 0 0 0 0 0 0 0 0 0 0 0 0	200000000000000000000000000000000000000	bP(P B bP Total qualified Total disqualified Grand total			0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0

Others refer to any colleted man with previous military alrearess training. It includes helividuals climheated from Navy or war training service ily ing training. In Hydrads are usually former glider pilot trainers, former enlisted bombardlers, or former foreign air force pilots.

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	MPE	.U.81		
Qualification	New avia- tion condi- datas	findent afficers	Others	MPEU 8
BNbP/P. BNbP. BNfP. BbP/P. BbP/P. BbP. BbP. BbP. BfP. BfP. BfP. BfP. BfP. BfP. BfP. Bf	11 	3. 10000 1000 1000 20	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	
Total qualified	201 439	86	20	13 23

#### TABLE A.56.—Qualification of Negro condidates tested after battery of 1 Sep. lember 1944

¹ With the introduction of the 1 September 1944 battery no provision was made for qualification standards for Nerrors. The situation was not charined until 5 January 1945, when the following requirements were established: For pliot training, either a fighter pliot or bomber pliot stanine of 5 or better; for bombardier, a bombardier stanine of 5 or better; qualifications for navigator training were discontinued. Effective 23 March and retroactive for all Negroes still at Kersler Field, the requirements for pliot training were reduced to a stanine of 4 for either fighter pliot or bomber pliot, and qualifications for bombardier training were discontinued.

TABLE A.57.—Qualifications of B-29 gunnery candidates

	мг	EUGI	MPEU 9	MPEU 10 white	MPEU 10- Negro
Total qualified	0	888 1, 302	763 862	922 1, 102	7 72
Grand total		2, 190	1,625	2,024	79

¹ For men who began testing prior to introduction of 1 June 1945 battery.

#### VI. DISTRIBUTIONS OF RECOMMENDATIONS FOR AIRCREW POSITIONS

TABLE A.58.—Distribution of recommendations

Recommendation	Period of	February-	July 1942	Peried of September-Novem- ber 19421			
	PRU 12	PRU 21	PRU 34	PRU 1*	PRU 24	PRU 31	
Bombardler	1, 882 2, 161 8, 420	6(72 497 2, 162	2, 340 2, 599 12, 077	3, 167 2, 948 14, 691	. 895 175 12,944	1,044 1,276 9,373	
Total	12, 463	3, 101	17,016	20, 708	14,014	11, 593	

No figures are given for August 1942. Battery was changed during the month.
Recommendations made by a board through June 1942. Recommendations for July made by PRU.
There were no recommendations during February 1912. Recommendations for July made by PRU.
Figures obtained from weekly distributions. Includes month of July 1942 only. Recommendations were made by PRU 2.
Training recommended by PRU. Figures include recommendations made March-July 1942.
Recommended by Office of Classification Reports.
Figures for September 1942 and October 1942 represent cases recommended by PRU. Recommendations (262 recommended for B, 263 recommended for P).

#### TABLE A.59.—Distribution of recommendations

Recommendation	Battery o	Battery of December 1942-June 1943				
	PRU 11	PRU 21	rru3‡			
Bombardier Navigator	2,081 6,474 29,323	2,014 4,957 27,510	1,560 3,004 15,750			
Total	37, 778	35, 411	31, 318			

¹ Recommended by the surgeon.
 ² Recommendations made by Office of Classification Reports through week ending 9 Jan. 1912. Recommendations from week ending 16 Jan. 1912-39 June 1542 made by Surgeon's Board.
 ³ Training recommended by the surgeon. Includes student officers for May 1913 and June 1943.

TABLE A.CO Distribution	0/	recommendations
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	Battery of July 1943-October 1943											
	PRU1:				PRU 2	-	PRU 3 +					
Recommendation	New avia- tion candi- dates	Elimi- necs	Student officers	New avis- tion candi- dates	Elimi- nccs	Student officers	New avia- tion candi- dates	Elimi- nces	Student officers			
Bombardler Navigator Pilot	1, 141 2, 674 19, 356	21 32 0	15 82 931	1,401 3,393 15,775	5 24 55	47 63 813	1, 427 2, 712 16, 005	14 31 5	10 19 819			
Total	23, 171	60	1,029	20, 569	87	925	20, 144	50	545			

¹ Recommendations made by the unit for the surgeon. Candidates tested by other units and sections but finally recommended by PRU 1 are included. Candidates previously recommended at Nashville and reprocessed in later months at Maxwell Field are not included in the statistics for the months during which the unit was located at Maxwell Field. ¹ Recommendations made by the Surgeon's Board. ² Recommendations of the surgeon.

#### TABLE A.61.—Distribution of recommendations

				Batte	ry of No	ovemb	er 1913-	August	1914				
	PRU 11			,	PRU 21			PRU 31			PRU \$4		
Recommendation	New avia- tion candi- dates	Elim- inces	Stu- dent offi- cers	New avis- tion candi- dates	Elim- inecs	Stu- dent oill- cers	New avia- tion candi- dates	Elim- inces	Stu- dent ofil- cera	New Avia- tion candi- dates	Elim- Inces	Stu- dent offi- cera	
Bombardler Navigator Filot	3, 205 4, 355 30, 440	78 152 0	125 185 1,030	4,079 3,0)7 23,577	104 107 11	155 145 912	2, 537 2, 574 12, 078	35 36 9	221 137 628	1, 370 613 8, 231	27 21 19	07 4	
Total	23,000	230	1, 330	31,623	2.2	1,212	17, 159	80	951	7,234	67	4	

¹ Recommendations were made by the unit for the surgeon. Candidates tested by other units and sections but finally recommendations by PRU 1 are included. Figures for candidates recommended under provisions of TC Memo V-17 are included. Figures include candidates tested at medical and psycholog-³ Recommendations made by the surgeon. Figures are for candidates tested at medical and psycholog-ical examinant states are do by the surgeon. Figures are for candidates tested at PRU 3. ⁴ Recommendations made by the surgeon. Figures are for candidates tested at PRU 3. ⁴ Recommendations of the figures are for candidates tested at MPRU 3.

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PABLE A.62Distribution	of	'recommendations
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	Battery of November 1943-August 1944-(continued)										
Recommendation	MPEU	MPEU 4	MPEUS	MPEU 6 (Negro)	MPEU7	MPEU 83	MPEU 9	MPEU 101			
Bombardler Navigator Pilot	1, 515 1, 011 7, 291	3, 498 1, 822 14, 912	3, 160 2, 146 15, 785	8 7 70	1, 487 814 8, 579	2, 424 1, 485 13, 773	954 503 5, 693	1, 700 1, 053 7, 938			
Total	9,817	20, 200	21,051	83	10,910	17, 683	7, 153	10, 001			

Includes 7 cases from the September and October 1911 distributions of candidates who began testing prior to the introduction of September 1914 battery.
 Includes 153 cases previously tested.
 Includes 532 cases from the September, October, and November, 1914, distributions of candidates who began testing prior to the introduction of the September 1914 battery.

	Battery of September 1941-March 1945										
	PRUII			PRU 21			PRU 21				
Recommendation	New avia- tion candi- dates	Elimi- nees	Stu- dent officers	New avia- tion candi- dates	Elimi- necs	Stu- dent officers	New avia- tion candi- dates	Elimi- nees	Stu- dent officers		
Bombardler Navigator Pilot	242 231 1,350	8 11 0	4 1 85	48 87 299	30 31 4	38 106 1,085	1, 427 708 3, 657	20 17 4	9 32 473		
Total	1, 823	19	90	425	GS	1, 229	5,822	41	513		

¹ Surgeon's recommendations. Includes candidates tested at MPEU's. Figures for candidates recom mended under provisions of TC Memo 35-17 are included. ² Surgeon's recommendations for candidates tested at PRU 2, ³ Surgeon's recommendations for candidates tested at MPEU's.

#### TABLE A.64.—Distribution of recommendations

	Battery of September 1944-March 1915-continued									
<b>W</b>		PRU 3								
recommendation	New avia- tion can- didates	Eliminees	Student MPEU 6 MPEU 6 MPEU 6 M	MPEU 81						
Bombardier Navigator Pilot	0 0 3	0 0 0	0 0 4	504 1, 410 3, 521	27 1 114	2,'8 2/3 2,023				
Tots]	3	0	4	5, 435	142	254				

"Includes 3 candidates proviously tested. Includes 42 PFI's qualified by TC Memorandum 37-3.

TABLE A.65.—Distribution of recommendations

<u> </u>		Batter	y of Apri	1 1945-M	ay 1945	•				
		PRU 21		PRU 23					•	
Recommendation	New aviation enndi- dates	Ellm- laces	Student officers	New aviation candi- dates	Ellin- inces	Student officers	MPEU 67	MPEU 6 (Negro)	MPEU 8	MPEU 10
Navigator Pilot	27) 38 142	19 20 2	42 N3 422	3×0 362 1,271	5 3 10	0 0 2	31 79 188	0 0 03	200 1,319 2,545	7 20 17
Total.	309	11	317	2,013	27	2	298	(C)	4, 194	41

¹ Surgeon's recommendations for candidates tested at PRU 2. ¹ Surgeon's recommendations for candidates tested at MPEU's. ¹ Includes 4 cases from June 1945 distribution of candidates who began testing prior to the introduction of June 1945 battery.

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### TABLE A.60, -Distribution of recommendations

Recommendation		PRU 21			PRU 21	· · · · · · · · · · · · · · · · · · ·	MPETTA
	New ariation candi- dates	Elimi- nces	Student officers	New aviation cutili- dates	Elimi- Devž	Student	(Negto)
Bombardice Navigator Pilot	1 0 1	0 0 0	7 20 125	2 4 13	1 0 1	C 0 0	0 0 13
Total	2	C	155	12	2	0	3

Surgeon's recommendations for candidates tested at PRU 2.
 Surgeon's recommendations for candidates tested at MPEU's.

#### TABLE A.07.—Supplementary recommendation statistics

PRU 2.--Recommendations by surgeon under provisions of TC Memo 35-17 (class 45-B), May and June 1944: AIRCREW CANDIDATES TESTED AT MPEU'S

Recommendation	New avia- tion candidates	Eliminees	Student officers
Bombardier Navigator Pilot	372 255 1, 536 2, 463	7 9 0 15	0 1 68 65

#### AIRCREW CANDIDATES TESTED AT PRU 2 AND RE-RECOMMENDED

Bombardier	163	0	000000000000000000000000000000000000000
Navigator	191	0	
Pilot	978	0	
Total	1, 329	0	0

PRU 3.-Distribution of recommendations of basic training center candidates: 1. The Faculty Board classified 266 air-crew students processed and recommended for air-crew training at basic training centers to the type indicated;

Field	Bombardier	Navigator	Pilot
Sheppard Field, Tex Buckley Field, Colo Jetterson Barracks, Mo. Keesler Field, Miss Amarillo Field, Tex Miami Beach, Fla Undetermined.	8600 874	82 51 10 10 2	68 33 7 42 2 21
Totab	31	43	177

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The Faculty Board reinstated 93 air-crew students on the basis of relaxed physical standards: 12 bombardiers, 20 navigators.
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 physical grounds.
 The Faculty Board eliminated 186 air-crew students processed and recommended for air-crew training at basic training onlyrs in accordance with authority contained in letter Hig. A.A.F.W.F.f.C., dashed 30 March 1944, subject. "Withdrawal of A.O.F., A.S.F., and V.F.T. personnel from air-crew training.

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بيديد بيديد ويستعد والمنازية بين مترجة التعاد														
a	Num	hae				Re	comm	endatio	ons				*	
Month	intervi	ewed	Bomb	ardler	Navi	gator	Pl	lot	Gro	und	Gro (cho	and blce)	ndation J 8	
4°5U1164	PRU 3	MPEU 10	ru 3	MPEU 10	PRU 3	MPEU 10	PRU 3	M.PEU 10	PRU3	MPEU 10	PRU3	MPEU 10	No recommo	
1542														
April. May. June. July August September. Getoker November. December.	247 347 329 301 344 651 579 793 436		40 50 76 70 49 118 53 50 91		35 27 34 40 35 55 86 80	· · · · · · · · · · · · · · · · · · ·	156 177 203 166 192 393 382 478 184		16 63 1 0 44 62 70 156 100		0 0 13 9 23 11 23 6		0 9 0 11 0 0 0 0	
1943														
January February March June June July Auzust Eeptember October November December	527 482 1, 143 809 772 753 1, 164 1, 233 1, 164 1, 233 1, 164 1, 233 1, 164 1, 650 640 458	  	98 97 155 155 155 24 25 951 257	· · · · · · · · · · · · · · · · · · ·	103 78 263 167 329 314 376 313 255 255 93 63	······	192 235 150 200 192 257 242 257 258 140		134 99 218 269 75 65 233 422 548 11 14 27		0 1 5 2 14 20 30 30 18 13 6 5		00000000000000000000000000000000000000	
January February March Aptil May Juno Juno July Aurust September November December 1843	524 486 649 189 276 147 401 63	614 255 200 111 253 103 83 132 120 5 2 0	235 101 200 78 143 91 210 30	28 74 53 1 1 0	127 218 216 59 30 200 61 5	43 43 43 41 1 <i>ú</i> 0	147 151 163 43 90 35 124 27	12 15 26 3 0 0	15 16 29 9 12 1 6 1	0 0 0 0 0 0	0 1 0 1 1 0 0		0 0 0 0 0 0 0 0 0	
Jeauary February March April May Juno Total	10, 014	0 41 73 10 2 C 2, 606	 	0 11 23 2 0 196	3, 791	0 19 35 6 0 0 183	6, 053	11 15 3 0 0 85	2, 743	0 0 0 0 0 0	214	0 0 0 0 0 0 0 0 0 0	20	`

TABLE A.68.—Numbers interviewed and recommendations made by interviewing officers

¹ No recommendation was a category utilized by the first interviewing psychologist on the early records of PHU 3. ³ BTC squadrons starting 10 May 1944.

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### VII. GROUP TEST MEAN SCORES

TABLE A.69.—Group test mean scores and mean stanines, May 1944

	Code	MPEU No. 6	MPRU No. 8	MPEU No 10
<ol> <li>Biographical data navigator.</li> <li>Biographical data pilot.</li> <li>Spatial orientation I.</li> <li>Spatial orientation I.</li> <li>Reading comprehension.</li> <li>Dial and table reading.</li> <li>Mechanical principles.</li> <li>Instrument comprehension I.</li> <li>Instrument comprehension I.</li> <li>General information.</li> <li>Mathematics B.</li> <li>Bombardier stanine.</li> <li>Pilot stanine.</li> <li>Augmented pilot stanine.</li> </ol>	CE02D CE02D CE02B CE04B CE44B CE44B CE44B CE44B CE45B CE503B CE503B CE503B CE503B CE503B CE503C	1.5.5.8.8.7.8.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.2.5.7.7.5.7.7.7.7	1755 555 555 555 555 555 555 555 555 555	121333991620 12333991620 1333120 1333120 103555 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 103555 10355 103555 103555 10355 103555 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10355 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 10055 100555 100555 100555 100555 100555 100
N ,		600	560	500

TABLE A.70.—Group test mean scores, men processed June 1944

	Code	MPEU No. 6	MPEU No. 8	MPEU No 10
Biographical data navigator	CE072D CE072D CP/01B CP/01B CP/021-21A CI614H CP022-21A CI016B CF005B CE005B CE005B CE005B CE005B CE005B CE005C	21.63 25.85 27.64 19.59 14.44 28.18 29.21 11.14 28.18 29.21 11.14 28.18 29.21 11.14 28.18 20.12 4.44 4.51 4.49 4.54	21.277 22.277 23.277 24.01 23.279 24.01 23.279 24.01 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.277 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.2777 25.27777 25.27777 25.27777 25.27777 25.27777 25.27777 25.277777 25.2777777 25.27777777777	22.91 75.72 20.24 21.28 12.83 12.83 20.87 11.71 57.13 3.575 9.57 4.33 4.33 4.55 4.55 4.55 4.55 4.55 4.55 4.55 5.57 5.55 5.57 5.55 5.57 5.55 5.57 5.55 5.57 5.55 5.57 5.55 5.57 5.55 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.57 5.
N Total processed during month		500 1,811	1, 230	200 1, 211

	Code	MPEU No. 6	MPEU No. 8	MPEU No 10
Biographical data navigator.     Biographical data pilot.     Spatial orientation II.     Reading comprehension.     Dial and table reading.     Mechanical principles     Instrument comprehension I.     Instrument comprehension II.     Mathematics A.      Mathematics B.      Sombardier stanine.	CE692D CE692D CE692D CP203B CP203B CP622-21A CP622-21A CP622-21A CP625-21A CP625-21A CP625-21A CP625-21A CF616B CE616B CE616B CE705E C1702F C1206C	21 77 5. 60 25. 31 19. 67 13. 15 28, 12 28, 13 11, 57 27, 45 37, 31 6, 95 9, 39 6, 41 4, 54	21.79 31.79 31.10 37.84 12.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112.15 112	72.79 77.79 72.01 71.45 112.67 112.17 11.18 11.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.85 14.8
15. Pliot stanine		5 81 (0)	4.13	4. W
N. Total processed during month.	*** *****************************	(ca 1,310	200 1,4%	

TABLE A.71.—Group test mean scores, men completely processed during July 1944

1 Negative scores appeared on this test. This mean is based on the actual negative scores. 2 Negative scores were treated as zeros.

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5	in the second	، «جمعله می در در مشکله گراه می شاند و در می

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	Code	MPEU No. 6	MPEU No. 8	MPEU No. 10
I. Biographical data navigator     Biographical data pilot.     Spatial orientation I     Spatial orientation II.     Batial orientation II.     Batial orientation II.     Beading comprehension.     Dial and table reading.     Mechanical principles.     Instrument comprehension I.     Bestrument comprehension I.     General information.     It.     Mathematics A.     Mathematics B.     Isombardier stanine.	CE672D. CE602D. CP501B. CP503B. CP503B. CP503B. CP622-21A CP622-21A CP622-21A C1615B. C1702F. C1702F. C1702F. C1702F. C1702F. C1702F. C1702F. C1705B. C1702F. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705B. C1705F.	21. 84 25. 72 28. 80 30. 41 13. 54 28. 11 27. 55 11. 72 25. 89 30. 90 7. 73 9. 41 4. 64	21.86 24.36 27.42 1 30.11 1 2.17 1 12.17 1 12.17 1 2.59 1 28.64 28.76 1 2.69 1 4.69 1 5.51 1 5.51 1 5.57 1 5.51 1 5.57 1 5.57 5.57 1 5.57 1 5.	23,02 25,91 25,91 22,11 13,75 14,92 32,31 30,95 31,44 28,10 35,75 16,61 16,61 16,61 19,92 19,92 4,79
14. Navi;ator stanine		4.64	4, 60	5.05
15. Pilot stanine		4.61	4, 77	5.12
16. Augmentod pilot stanine		4.63	4, 80	5.18
N		500	500	500
Total processed during month		1,799	1, 329	1,773

TABLE A.72.—Group lest mean scores, men completely processed during August 1944

1 Negative scores appeared on this test. This mean is based on the actual negative scores. 2 Negative scores were treated as zeroes.

TABLE A.73.—Group test mean scores, men completely processed during Sep-tember 1943, tested on battery of November 1943

**************************************				
	Code	MPEU No. 6	MPEU No. 8	MPEU No. 10
1. Biographical data navigator 2. Biographical data pilot 3. Spatial orientation 1	C E (02 D C E (02 D C P 501 B	22.07 28.12 27.48	21, 43 25, 55 27, 65	22.93 27.25 1 23.29 1 24.29
<ul> <li>4. Spatial orientation II</li> <li>5. Reading comprehension</li> </ul>	CP503B CI614II	19. 20 15. 36	19, 64 11, 69 12, 03	21.74 12.33 12.83
6. Dial and table reading	CP622-21A	27.58	123.79	32.03
7. Mechanical principles. 8. Instrument comprehension I 9. Instrument comprehension II	C19031B. C1615B. C1616B.	27. 23 12. 23 25. 83	23, 49 13, 08 23, 25	30 86 11 71 27. 87
10. General Information 11. Mathematics A	C E 505E C1702F	32.08 8.29	32.58 15.73 15.94	)15 63 1 A 16 7 6 25
12. Mathematics B	CI206C	9. 69	18.46	19 40
13. Bombardler stanine		4. 53 6. 53 4. 73 4. 76	4.49 4.41 4.68 4.72	4.13 4.13 4.12 8.11 5.17
N Total processed during month		359 413	519 670	458 1,094

Negative scores appeared on this test. This mean is based on the actual negative scores.
 Negative scores were treated as zeros.

	Coir	MPEU No. 6	MPEU No. 8	MPEU No. 10
L. Biographical data navigator.	CE602D	21, 78	21 75	23, 38
2. Disgraphical data phot	CE462D	21.02	25,49	21 42
4. Instrument comprehension.	CloieC	21.83	122.5	22.51
5 A rithmetic reasoning	Clock	10.02	123,88	
0. 1111111113511C 1123991311gn==================================		14.55	10.03	111.12
6. Speed of identification.	CP610A	31, 33	32.01	35.44
7. Spatial orientation If	CP330	32.93	131.51	30.02
8. Spetial orientation 1	C Prain.	28.15	27 37	28.03
9. Reading comprehension	Cl614H	14.32	1 12 73	1 11. 27
10 Tudament t			1 13 13	1 16.33
10. and Ement	CI.901C	19, 60	1 19,73	21.30
11. Mechanical principles	CI900B	27.85	28,34	30 91
12. Mechanical information.	C1903B	8, 18	18,73	13 25
13. Dial and table mading	CP621-22A	23.07	120.04	32.40
			1 29, 94	
14. Numerical operations I	C1702B	15.97	116,03	114.81
15. Numerical operations II	CITOPR	13.39	1 110,90	112.61
			114.00	112.90
16, Bombardier stanine		1.42	1, 62	5.13
17. Naviguor Stanine	•••••	4.53	4.61	5.39
19. Fighter pilot stanine.		4.24	1.65	5.32
20. Aerial gunner stanine		4.30	1.73	1 A 11
21. Atechanic-armorer-gunner stanina	*****	4.20	1.00	4.51
wet winder Alexand, Emmer Stimmerstererererererer			·····	
N		450	1 411	121
Total processed during month	[	1 0:00	1 925	

TABLE A.74.—Group test mean scores, men completely processed during Sep-tember 1943, tested on battery of September 1943

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¹ Negative scores appeared on this test. This mean is based on the actual negative scores. ² Negative scores were treated as zeros.

 TABLE A.75.—Group test mean scores, men completely processed during October 19.55, tested on battery of September 19.55

	Cole	MPEU No. 8
1. Biographical data navigator. 2. Biographical data pilot. 3. General information 4. Instrument comprehension.	C E(02D) C E(02D) C E(02D) C E(04SF C 1616C	22, 21 27, 57 54, 23 1 27, 14 1 27, 13
5. Arithmetic reasoning.	C1309C	19,28
6. Speed of Londification 7. Spatial orientation II	C PAIDA C PAIDB	M 54 1 31, 04 1 33, 76
8. Epstial orientation 1 9. Reading congradient to a	Cistali Cistali	23.30 113.39 113.65
10. Judgment	C1301C	120.56
11. Mechanical principles 12. Mechanical information	C1:03B. C1:05B	30.65 1 10.31
13. Dial and table reading.	CP622-31A	1 31.23
14. Numerical operations I	C1702B	1 15, 83
15. Numerical operations II	C1702B	112.85
16. Pombardier stanine		
18. Boml er jalot stanne		8.17 8.18 3.18
21. Mechande-armon r-gunn r stanine	****	5.15 1.56
N. Total processed during month		630 1,753

Negative scores apprared on this test. This mean is based on the actual negative scores.
 Negative scores were treated as zeroes.

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	Code	MPEU No. 6	MPEU No. 5
1. Restaphical data navigator. 2. Riscraphical data pilot 3. General information 4. Instrument comprehension.	CE(02D CE(02D CE(02D) CE505F CI6160	22, 13 21, 00 51, 63 23, 18	21 20 24,03 55,85 1 26,81
S. Arithmetic reasoning	C1206C	10.85	3 25, 52 4 11, 15
& Speed of identification	CP010A	32.55	34.53
7. Spatial orientation IL	CP:03B	32.71	1 32. 57
S. Spatial orientation I 9. Reading, comprehension	CP501B. CI014H	23.47 16.30	27.63
10. Judgment	C1301C	19.65	19.58
11. Mechanical principles	CI003B CI005B	29.10 7.67	29 75 1 9.00
13. Dial and table reading.	CP622-21A	27.35	1 30.59
14. Numerical operations I	CI702B	10. 57	1 17.03
15. Numerical operations II	C1702B	13.87	1 14.45
16. Bombar lier stadne 17. Navisaty staning		4.36 4.52	4.88
19. Fighter jukt staning.		4.25	5.03
20. Aeras punter staning. 21. Michaphearmorer-gunner staning. 22. Radio operator sunner staning.	• • • • • • • • • • • • • • • • • • •	4. 13 4. 33	5. 05 5. 22
N Total processed during month		688 799	676 958

TAME A.78.--Group test mean scores, men completely processed during November 1944, tested on battery of September 1944

Negative scores appeared on this test. This mean is based on the actual negative scores.
 Negative scores were treated as zeroes.

TAME 2.77.—Group test mean scores, men completely processed during December 1944, tested on battery of September 1944

	Code	MFEU No. 6
Bichraphical data navigator.     Bichraphical data navigator.     Bichraphical data pilot.     General information     Listrument comprehension.     Arithmetic reasoning.     Justrument.     Mechanical information.     Justruent.     Mechanical information.     Arithmetic reasoning.     Arithmetic reasoning reasoning.     Arithmetic reasoning reasoning reasoning.     Arithmetic reasoning reasoning reasoning.     Arithmetic reasoning r	C E CO2D C E CO2D C E COS F C I G10C C PAIDA C PAIDA	21.84 22.13 64.70 23.24 11.85 34.62 33.39 20.04 20.85 29.97 23.31 16.04 20.85 29.97 23.31 16.421 4.77 4.81 4.81 4.80 4.80 4.80
N Total processed during month		543 3, 180

``	Coie	MPEU No.6
Biographical data navigator.     Biographical data pilot     General information     Instrument comprehension.     Arithmetic reasoning.     Syacd of identification.     Spatial orientation II.     Spatial orientation II.     Bending comprehension.     Judgment.     Mechanical information.     Dial and table reading.     Numerical operations II.     Numerical operations II.     Numerical operations II.     Navigator stanine.     Bomber pilot stanine.     Ariah gunner stanine.     Ariah gunner stanine.     Ariah gunner stanine.     Ariah gunner stanine.	C E 6 2 D C E 6 2 D C E 6 2 D C E 6 2 A F C E 6 2 A F	21 77 22 70 23 33 34 55 11 10 32 9 15 32 9 15 32 9 15 32 9 15 30 36 31 10 30 36 31 10 30 36 31 10 30 36 31 10 30 36 31 10 30 36 31 10 30 36 31 10 31 10 30 36 31 10 30 36 31 10 31 1
N Total processed during month		601 3, 732

# TABLE A.78.—Group test mean scores, nen completely processed during January 1945, tested on battery of September 1944

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TABLE A.79.—Mcans and standard deviations of group tests and stanines for December 1944, January and February 1945

		-							
	Code	MPEU Decem	' No. 6 per 1914	MPEU Januai	/ No. 8 19 1915	MPEU Februa	I No. 6 17 1913	MPEU Februar	No. 19 7 1945
		М	SD	м	8D	м	8D	<u>M</u>	8D
1. Blographical data pav-	CE002D	21.84	2.01	21.77	2.82	21.94	3.CÍ	23, 14	3, 13
2. Biographical data pilot. 3. General information	CE(02D CE(05F	26.13 54.70 26.24	6.76 12.33 11.39	27.00	6. A3 12. 30 11. 23	20,43 51,24 26,53	7.13	27.14 57.27 77.98	6.69 12.05 11.44
<ol> <li>Instrument Complete hension.</li> <li>Arithmetic reasoning</li> </ol>	CI:06C	11.68	9.04	11.17	8.62	11. 49	9.71	1 10. 94 1 11. 32	19.78
6. Speed of identification. 7. Spatial orientation II	CP610A CP503B CP501B	34,52 33,39 29,09	7.33 9.19 6.27	33,66 32,06 28,38	7.92 8.86 5.97	33.97 32.00 23.15	7.73 9.10 5.87	35,62 33,23 1 2),32	7.47 8.43 16.33
9. Reading comprehen- sion.	CI014II	16.04	12.32	15.50	12.07	16.45	12.38	110.30	113.49
10. Judgment	CI301C	20.50	8.63	30.35	8.24 9.14	20.55	9,21	1 21.64	18.39 9.12
12. Mechanical informa- tion.	C1905B	9.27	7.09	10.65	7.95 9.03	29.17	9,30	11.84	9, 41
13. Dial and those reading. 14. Numerical operations I.	C1702B	16.02	0.50	16.79	6.51 A 16	17.20	0.65	1 16.40 1 16.42 1 13.96	10.05
15. Numerical operations 11. 16. Bombardier staning	CG03B	4.77	1.95	4.70	1.87	1.73	1.57	11,01	1.67
17. Navigator stanine 18. Bomber pilot stanine		4.91	1.V3 2.12 2.07	4.98	1.04	100	206	& 31 & 14	2.01
20. Aeris) punner stanine 21. Mechanic-armorer-		4, 50	2.07	4.84	2.03	1.77	2.01	A.34	20
22. Radio operator-gunner stanine.		4.88	2.01	4.83	2.01		1 2.00	4.0d	T.04
N Total processed during month.		3,	613 180	3,	601 738	4	646 641	e e	x7 30

3 Negative scores appeared on this test. This mean and standard deviation are based on the actual nega-tive scores. 3 Negative scores were treated as zeros.

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TABLE A. 80.—Group lest means and standard deviations, men completely processed during March 1946. Tested on battery of September 1944

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	ţ	PRU 0000	No. 2	<b>FRU</b> enlisted	No. 2 1 men	MPEU	No. 6	MPEU	No. 8	MPEU	No. 10
	, ,	X	ßD	, W	8D	ж	ßD	N	SD	×	SD
1. Blocrathical dats nevicator	CE602D	2.57	5 8 8	8 8	56	212 212	2.85	ដន ដន	85	52 17	i n
2. Blographical data pilot 3. General information 4. Instrument comprehension	CEMPD CEMP CIBIOC	232	10.75	27.52 27.62	36.19	424 88	444 844	২ন ড গণ্ড ম	52	3839	
s. Arithmetic reasoning	C1206C.	27.24	11.17	11.60	8.21	11.10	8.61	12.94	8.3	22	
6. Speed of identification	CP610A CP63B	36.85 46.43	2.28	35.15 36.91	6.65 9.16	32.5	2.39	888	3% 5%	1025	1919 19 14 2 2 1
8. Spatial orientation I	CP501B	33.75	6.46	20.82	£.83	22.42	G. 16	CI 75	£. 07	195	44
9. Reading comprehension	CIGI4II	39.13	13.98	19.06	12.44	10.57	12.50	18.17	11.47	2011	221
16. Judgment	CI301C	23.03	8.02	22.65	8.30	19.82	0.06	8.8	8.35	1	22
11. Mechanical principles	CI903B CI905B	33.45 12.66	9.64	31.91	9.10 8.18	X× XX	8.97	23.2	8.87 6.25 6.25	187	380 221
<ol> <li>Dial and table reading.</li> <li>Numerical operations 1.</li> </ol>	CP62-21A CI702B	43.10 21.64	8.88 6.21	24 24 24 24 24 24 24 24 24 24 24 24 24 2	81 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	20.23	0.2 <del>1</del> 6.77	16.22	8.4 X 2	22	2.00 2.00 
15. Numerical operations II.	CI702B	21.53	6.10	15.31	6.21	14.63	6.47	14.63	6.13		194
16. Bombardict stanine. 17. Navizator stanine		8.55 12.55 25.55	88	99 99 99	1.3	28 77	88	5.03 5.13	293	17 17 17 17 17 17 17 17 17 17 17 17 17 1	23:
18. Bomker pilot stanlno. 19. Fighter pilot stanlno.		557	838	363	283 2 2 2 2	393	383		530	197	
20. Aerial gunner stanino. 21. Mcchanic-armoter-gunner stanino. 22. Radio-operator-gunner stanino.		585 Xaa	886	499 822 222	33.1 3.1 3.1	388		288	22	2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	ાલન અગ્ર
N. Total processed during month.		ਲਲ	99	মম	88	ਤਕੋ	08	, aa		23	

t Negative scores appeared on this test. This mean and standard deviation are based on the actual negative scores. * Negative scores were treated as zeros.

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	Fada	MPEL	7 No. 6	MPEL	7 No. 8
		м	\$D	M	8D
Biographical data navigator	C FrogD C FrogD C From C From	naxxixxexiexnxxxsii Naxxiixxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	2707 1244 11.41 10.77822 14.50 14.51 10.77822 14.50 14.51 10.77210 2014 2014 2014 2014 2014 2014 2014 2	2253223223225225225252525252252252252252	2580087780870887088708870 11.47.9.37808708870 2.12.11.47.9.3780870 2.12.11.11.11.11.11.11.11.11.11.11.11.11
N		2.3	23 >0	50 1, 1	)0 115

 
 TABLE A.81.—Group test means and standard deviations, men completely processed during April 1945. Tested on battery of September 1944

TABLE A.S2.—Group test means and standard deviations (single-digit normalized scores), men completely processed during April 1945. Tested on battery of September 1944

	Code	PRU offic	No. 2 Nos	PRU enliste	No. 2 1 men	MPEU	No. 5
		м	8D	м	8D	м	80
Biographical data navigator     Biographical data pilot     General information     Instrument comprehension     Arithmetic reasoning     Speci of identification     Spatial orientation 11     Spatial orientation 11     Beding comprehension     Judgment     Mechanical principles     Dial and table tending     Numerical operations 11     Revisition stanine     Surfat estanine     Mechanical principles     Mechanical principles     Mechanical principles     Mechanical principles     Mechanical principles     Mechanical principles     Mumerical operations 11     Sumerical operations 11     Surfator stanine     Mechanication stanine     Artisl cunner stanine     Mechanic-armon r-sunner stanine     Hadio operator-gunner stanine	CE402D CE402D CE405F CloseC CP400A CP40B CP40B Clot11 Clot11 Clot11 Clot11 Clot5B CP42-21A Clo2B Clo2B Clo2B Clo2B	444597476766497456177736997798 44467747768877461717361977788 7457748774877887498	2 12 2 13 1 20 1 17 1 20 1 17 1 20 1 17 1 20 1 17 2 20 1 1 2 20 1 2 2 20 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	4.82.54443454555555555555555555555555555555	20724 1.81, 2075 58, 75, 54, 54, 55, 57, 57, 57, 57, 57, 57, 57, 57, 57	407 407 407 407 407 407 407 407	1 09 1.87 2.01 1.97 1.95 2.01 1.95 2.05 1.95 2.05 1.95 2.05 1.95 2.15 1.95 2.15 1.95 2.05 1.95 2.05 1.95 2.05 1.95 2.05 2.05 2.05 2.05 2.05 2.05 2.05 2.0
N Total processed during month		21 22	2	1: K	2	5 4,4	00 73

TABLE A.83.—Group test means and standard deviations (single-digit normalized scores), men completely processed during May 1945. Tested on battery of September 1945

	Code	Mpel	5 No. 8	PLU offi	No. 2 cers	PRU enliste	No. 2 d mcn
	Code C E602D C E602D C E602D C E602D C E605F C 1206C C P600A C P203B C P20	м	SD	м	SD	м	SD
Biographical data navigator     Biographical data pilot     General information     Arithmetic reasoning     Speci of Identification     Spatial orientation I     Beauing comprehension     Judgment     Mechanical principles     Mechanical information     Dual and table reading     Numerical operations I     Numerical operations I     Numerical operations I     Navicator stanine     Bomber pilot stanine     Arith guiner stanine     Arithmetic armorer-gunner stanine.     Mechanical carmorer-gunner stanine.     Mechanical carmorer-gunner stanine.	C E(02D C E(02D C E(02D C E(02F C E(016C C P(010A C P(010A C P(010A C P(010B C E(014H C E(014H) C E(014H C E(014H) C E(014H)) C E(014H) C E(014H)) C E(014H))) C E(014H))) C E(014H))) C E(014H))) C	4.97 5.117 5.08 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 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 TABLE A.81.—Group test means and standard deviations (single-digit normalized scores), men completely processed during June 1945

		PI en	tU No. gincer	, 2, Fli studer	zht its	MF	EU	ME	ะรุบ
	Code	No pr flying rlei	evious expe- nce	Prev flying rici	lous expe- ace	Non seas h	9V07- SAT'S	Non scas N	over IAT's
		М	\$D	М	SD	М	8D	М	SD.
Illographical dais navigator     Biographical dais navigator     Biographical data pilot     General information     Arithmetic rewoning     Dial an itable rewing     Numerical operations I     Navizator stanine     Aerial gunner stanine     Aerial gunner stanine     Media operator gunner stanine     Media operator stanine     Media operator stanine	C Ef02D C E602D C E503P C 1616C C 1206C C P501B C P501B C 1501B C 1501B C 1501B C 1502B C 1502B C 1502B C 1702B C 1702	3.840 5.673 5.673 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.720 5.550 5.720 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 5.550 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## APPENDIX B_

# Chronology of Selection and Classification Activities in the Aviation Psychology Program

#### 1941

14 June.—Proposal for the establishment of a Psychological Research Agency in the Medical Division, Office of the Chief of the Air Corps, approved.

16 July.—Col. John C. Flanagan reported for duty as director of psychological activities in the Medical Division, Office of the Chief of the Air Corps.

15 August.—Arrangements made with Training Division, Office of the Chief of the Air Corps, for experimental administration of psychological tests in Air Corps Replacement Training Centers.

21 September.—Psychological Section at Maxwell Field, Ala. (later Psychological Research Unit No. 1), began operations, Lt. Col. Laurance F. Shaffer, director.

13 October.-Experimental testing begun at Maxwell Field.

15 November.—Psychological Research Unit No. 2 began operations at Kelly Field, Tex., Lt. Col. Robert T. Rock, Jr., director.

28 November.—Conference regarding division of selection and classification responsibilities among Medical Division, Military Personnel Division, and Training Division of the Oflice of the Chief of the Air Corps. It was recommended that the Medical Division assume responsibility for research in the selection of navigators and bombardiers, in addition to pilots.

7 December.-War between the United States and Japan.

18 December.-Medical Division, Office of the Chief of the Air Corps, assumed responsibility for psychological research in selection and classification of navigators and bombardiers.

19 December.-Experimental testing begun at Kelly Field.

#### 1942

15 January.—AAF Qualifying Examination (Aviation Cadet Qualifying Examination) released for use in screening air-crew applicants; educational requirements removed.

23 January.—AAF Flying Training Command officially activated in Washington.

23 January.—Procedure established by the Chief of the Air Corps whereby Aviation Cadets to be assigned to pilot, bombardier, or navigator training by Classification Boards on the basis of aptitude tests, physical examinations, and preferences.

2 February.—Original testing battery introduced at Psychological Research Unit No. 1 and Psychological Research Unit No. 2.

11 February.—Experimental psychomotor testing begun at Psychological Research Unit No. 2.

3 March.—Psychological Research Unit No. 3, Santa Ana Army Air Base, Santa Ana, Calif., began operations, Lt. Col. J. P. Guilford, director.

23 March.—Procurement and development of psychomotor apparatus assigned to School of Aviation Medicine.

1 April.—First tests given at Psychological Research Unit No. 3.

7 April.-New classification battery introduced at Psychological Research Unit No. 2 (adopted 20 April at PRU 3 and 21 April at PRU 1).

21 April.—Psychological Section established in Office of Surgeon, Headquarters AAF Flying Training Command, Col. F. A. Geldard, Chief.

9 May.—Systematic research program announced for the development and refinement of classification tests. Assignment to PRU 1 of research in measures of personality and temperament; to PRU 2 and the Department of Psychology, School of Aviation Medicine, measures of coordination; to PRU 3 measures of intelligence, judgment, and scholastic achievement; to the Psychological Section, Headquarters AAF Training Command, measures of alertness and observation; and to Psychological Branch, Office of the Air Surgeon, Headquarters AAF, the AAF Qualifying Examination and general supervision of the research program.

11 May.-New classification battery introduced at Psychological Research Unit No. 1 (adopted 13 May at PRU 2 and 22 May at PRU 3).

12 Mny.--Responsibility of the Commanding General, Army Air Forces, for the selection and classification of military presonnel for air-crew duty confirmed by directive from the Secretary of War.

22 May.—AAF Regulation 35–24 assigning responsibilities for the development of tests and the classification of aviation trainces to Headquarters AAF and Headquarters AAF Training Command. 9 June.-New testing battery introduced at PRU 1 (adopted 11 June at PRU 3 and 15 June at PRU 2).

1 July.--Hq AAF Flying Training Command moved from Washington, D. C., to Fort Worth, Tex.

4 July.—San Antonio Aviation Cadet Center activated; PRU 2 formally transferred from Kelly Field to S. A. A. C. C.

7 July.—PRU 1 transferred from Maxwell Field, Ala., to Nashvilla Army Air Center (Army Air Forces Classification Center), Nashville, Tenn.

13-15 July.—Conference at Fort Worth. Discussion of new testing directive, progress in test development, plans, and policies for field studies, and the establishing of system for flow of records from the classification centers to Fort Worth.

27 July.—First stanine requirements established: 5 for navigator training. For men previously eliminated from a type of training, a minimum stanine of 6 for the new specialty was required.

2 August.-New battery introduced at PRU 2 (adopted 17 August at PRU 3 and 20 August at PRU 1).

15 September.—Research decachments from the PRU's sent to AAF Gunnery Schools at Las Vegas, Harlingen, and Panama City to select D-8 bombardier candidates.

12-16 October.—Conference at Fort Worth; D-8 bombardier selection discussed; research program in flexible gunnery proposed; new test battery approved; personnel, supply, public relations, and other miscellaneous matters discussed.

12 November. -- AAF Reg. 35-9 providing for Flight Officer selection.

1 December.—Minimum stanine requirements: 3 for bombardier, 5 for navigator, 3 for pilot.

1 December .-- New testing battery introduced at all PRU's.

#### 1943

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11-13 January.--Conference at Fort Worth. Dual classification and training of bombardiers and navigators, research in Central Instructors Schools, publication policies, Officer Quality Score, test de velopment and validation discussed.

17 February.-Psychological Research Detachment (gumery) established at Fort Myers, Fla., Maj. Nicholas Hobbs, commanding officer.

1 March.—College training program for cadets initiated. Aviation Cadet Educational Examination developed for the college program.

25 March.—Lt. Col. Ro-k relieved of assignment as director PRU 2 to become director Classification Center at S. A. A. C. C.
20 April.—Decision that revision of the test battery would be considered only at 4-month intervals.

25 May.-Maj. A. C. Tucker director PRU 2, succeeding Lt. Col. Rock.

25-26 May.—Conference at Fort Worth. Testing, recording, and reporting matters discussed; policies established with regard to psychological detachments at training schools.

14-16 June.—Conference on psychomotor testing at PRU 2 and School of Aviation Medicine. Development of standard testing, norming, reporting, and calibrating procedures.

1 July.-New testing battery introduced at PRU 2 and PRU 3 (adopted 2 July at PRU 1); Officer Quality Score introduced.

7 July.—AAF Flying Training Command and AAF Technical Training Command merged into AAF Training Command with Headquarters at Fort Worth.

10 July.-Minimum stanine requirements: Bombardier 4 (plus navigator stanine of 4); navigator 6; pilot 3.

21 July.—Minimum stanine requirements: Bombardier 4 (plus navigator stanine of 4); navigator 6; pilot 4.

30 July.—Conference at Fort Worth; plans for reorganization of Aviation Psychology Program; opening of new units at basic training centers.

13 August.—Maj. Frederic Wickert succeeded Lt. Col. Laurance F. Shaffer as director of PRU 1; Maj. Neil D. Warren succeeded Lt. Col. J. P. Guilford as director of PRU 3.

15 August.—Minimum stanine requirements: Bombardier 6 (plus navigator stanine of 4); navigator 6; pilot 4.

1 September.—Responsibility for the development of the AAF Qualifying Examination, Aviation Cadet Educational Examination, and Flight Officer Final Examination transferred to AAF Training Command.

1 September.—Maj. William M. Lepley succeeded Maj. Frederic Wickert as director of PRU 1.

1 September.---Medical and Psychological Examining Unit No. 6, Keesler Field, Miss., activated, Maj. Frederic Wickert chief of Psychological Section.

13-15 September.--Conference at Fort Worth. Discussion of current research, further plans for training research, proposals for new battery.

14 September.—Maj. Meredith P. Crawford, director of PRU 2, succeeding Maj. A. C. Tucker.

18 September.—Activation of MPEU 10, Amarillo Army Air Field, Amarillo, Tex., Maj. William E. Walton, chief of Psychological Section.

18 September.—Activation of MPEU 9, Buckley Field, Colo., Maj. Clarence W. Brown, chief of Psychological Section.

21 September.—Activation of MPEU 4, Basic Training Center No. 10, Greensboro, N. C., Maj. Lewis B. Ward, chief of Psychological Section.

21 September.—Activation of MPEU 5, Basic Training Center No. 1, Miami Beach, Fla., Maj. A. C. Tucker, chief of Psychological Section.

22 September — Activation of MPEU 7, Jefferson Barracks, Mo., Maj. Philip H. DuBois, chief of Psychological Section.

28 September.—Activation of MPEU 8, Sheppard Field, Wichita Falls, Tex., Maj. Merrill F. Roff, chief of Psychological Section.

1 October.—Activation of Psychological Research Unit No. 11, Fort Myers, Fla., Maj. Nicholas Hobbs, director.

9 October.—Activation of Psychological Test Film Unit, Santa Ana, Calif., Maj. James J. Gibson, director.

1 November.-New testing battery introduced at all units.

1 November.-Testing begun at MPEU's.

1 November.—Minimum stanine requirements: Bombardier 5 (plus navigator stanine of 4); navigator 6; pilot 4.

15 November.--Minimum stanine requirements: Bombardier 5 (plus navigator stanine of 5); navigator 7; pilot 5.

22 November.—Col. Flanagan departed for European Theater of Operations to visit operational units of 8th, 9th, 12th, and 15th Air Forces.

21 December.—Minimum qualifying stanine for Negro trainces set at: Bombardier 4; navigator 6; pilot 4.

#### 1944

5 January.—Activation of Psychological Research Project (bombardier), Midland Army Air Field, Tex., Maj. Edward II. Kemp, director.

5 January.—Activation of Psychological Research Project (navigator), Selman Field, La., Capt. Launor F. Carter, director.

5 January.—Activation of Psychological Research Project (pilot), . Randolph Field, Tex., Maj. Neal E. Miller, director.

6-8 March.—Conference at Fort Worth. Achievements and plans for training research discussed, reports of test development.

7 March .-- MPEU 7, Jefferson Barracks, Mo., inactivated.

15 March.—PRU 1 moved from Nashville, Tenn., to Maxwell Field, Ala.

25 March.—WASP's tested with Classification Battery at Avenger Field.

26-27 March .-- Conference of directors of PRP's.

3 April.—Minimum qualifying stanines for Negro trainees: Bombardier 5 (plus navigator stanine of 5); pilot.5.

23 April.—Detachment headed by Maj. Philip H. DuBols departed for North Africa to assist French authorities in setting up classification program.

23 April.—Capt. Chester W. Harris, chief of Psychological Section, MPEU 6, succeeding Maj. Frederic Wickert.

25 April.-MPEU 4, Greensboro, N. C., inactivated:

30 April.-MPEU 5 Miami Beach, Fla., inactivated.

5 May.-PRU 11 absorbed into Research Division Central Instructors School for Flexible Gunnery.

May.-A. E. R. D. No. 1 arrived in European Theater of Operations, Lt. Col. Paul Horst commanding.

22-25 May.—Conference at Fort Worth to discuss implications for the Psychological Program of Col. Flanagan's overseas findings.

26 May.—Instructions from AAF Training Command Headquarters to subordinate commands that no officers or enlisted men in the Psychological Program to be transferred or reassigned without specific permission by name from Fort Worth.

27 May.—Conference of aviation psychologists at School of Aviation Medicine.

29-30 May.—Conference at Randolph Field on instructor selection. 14 June.—Lt. Col. J. P. Guilford succeeded Maj. Neil D. Warren as director of PRU 3.

27 July-3 August.—Conference at San Francisco on psychological research in the continental and overseas Air Forces.

15 August.—Procedure established for the selection of navigation students for radar training.

16 August.—Psychological organizations set up in the 1st, 2d, 3d, and 4th Air Forces.

1 September.--New testing battery. Bombardier, navigator, bomber pilot, fighter pilot, radio operator-gunner, aerial gunner, and mechanic-armorer-gunner stanines.

1 September.—First testing of cadets at United States Military Academy at West Point with Classification Battery.

13 October.—Medical and Psychological Examining Unit No. 9, Buckley Field, Colo., inactivated.

26 October.---A. E. R. D. No. 2, headed by Maj. Neil D. Warren, arrived in Italy.

1 November .-- PRU 3, Santa Ana, Calif., inactivated.

1 November.—Lt. Col. J. P. Guilford, director of PRU 2, succeeding Maj. Meredith P. Crawford.

29 November.—A. E. R. D. No. 3 departed Maxwell Field for duty in Pacific Theater, Maj. William M. Lepley, commanding officer.

2 December.—Psychological Research Project (navigator) moved from Selman Field, La., to Ellington Field, Tex.

13 December .- PRU 1, Maxwell Field, Ala., inactivated.

26 December.—Procedure established for testing and classification of potential B-29 gunners.

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1 January .--- MPEU 9, Buckley Field, Colo., reopened to test potential B-29 gunners, Capt. Sidney M. Adams, chief.

2 January.—Capt. Walter F. Grether succeeded Capt. Chester W. Harris as chief of Psychological Section, MPEU 6, Keesler Field.

2 January.—Classification testing of French pilot eliminees begun at Keesler Field, MPEU 6.

5 January.—Minimum qualifying pilot stanine for Negro trainces: 5 (Negroes eligible for pilot training only).

8 January.—Conference on psychological research in radar training. 12 January.—Inactivation of MPEU-8, Sheppard Field.

17 January.—Conférênce on objective measurement of flying proficiency.

22 January.—Capt. Philip I. Sperling chief of Psychological Section, MPEU 10, Amarillo, succeeding Maj. William E. Walton.

7-10 March.—Conference at School of Aviation Medicine, Randolph Field, regarding test development and weights for new stanines.

8 March.—MPEU 8, Sheppard Field, reopened temporarily to test candidates diverted from Keesler Field because of epidemic. Capt. Reuben A. Baer, chief of Psychological Section.

15 March .-- Minimum pilot stanine for Negro trainces: 4.

1 April.—Single digit scores introduced for the recording of all psychological tests.

12 April.—Psychological Research Project (combat crew) activated at Lincoln Army Air Field, Lincoln, Nebr.; Maj. William M. Lepley, director.

7-10 May.—Conference at Lincoln; plans for combat-crew assembly procedures.

8 May .--- VE-day.

1 June.—New testing battery. Addition of flight engineer and radar observer stanines. Discontinuance of radio operator-gunner and armorer-air mechanic-gunner stanines.

7 June.—AAF Letter 50–117 "Screening of Combat-Crew Personnel," setting up procedure for lead crew selection.

22 June.—Inactivation of MPEU 8, Sheppard Field, which had been temporarily reopened in March.

27 June.—PRU No. 1 reopened at Maxwell Field, Ala., Capt. Reuben A. Baer, director.

1 July.-Establishment of Psychological Research Project (flight engineer) at Hondo Army Air Field, Hondo, Tex., Maj. Neil D. Warren, director.

3-4 August.--Conference at San Antonio on preparation of final, comprehensive reports of the Aviation Psychology Program.

8 August .-- Minimum pilot stanine for Negro trainees: 7.

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13 September .-- PRP (CC) inactivated.

15 September.—Capt. John T. Dailey director of PRP (FE), succeeding Maj. Neil D. Warren.

21 September.-MPEU 9, Buckley Field inactivated.

APPENDIX C_

# Illustrative Case Studies of Individuals in the Experimental Group

In connection with the study of the experimental group, Maj. William E. Walton made case studies of 15 high stanine men who were eliminated and 16 low stanine men who learned to fly. An illustrative case history has been chosen to represent each of the two types. Names and serial numbers have been changed in order to guard the identity of the subjects.

## A HIGH STANINE MAN WHO WAS ELIMINATED

## L. Training Record

A. Preliminary remarks.—A/C John W. Roe, ASN 16021543, now Flight Officer, T-134615, probably failed to learn to fly because of poor instruction and because of an elimination policy set up at Ocala, Fla., during the summer of 1944. There is some evidence that Roe was not as emotionally mature as the situation at that field in the summer of 1944 would require. See further comments under section VI, Summary. Roe entered the Army at Newburgh, N. Y., and since that time has visited the fields listed below. Stations, where training pertinent to this study was taken, are so marked.

Newburgh, N. Y.	Primary	Lakeland, Fis.
Greensboro, N. C.	-	Ocala, Fin.
Nashville. Tenn.		Moody Field, Ga.
Bainbridge, Ga.	Gunnery	Tyndall Field, Fia.
Maxwell, Ala.		Moody Field, Ga.
Greenville, Miss.	Bombardier	San Angelo AAF, Tex.
	Radar	Yuma, Arix

A/C Roe took his psychological tests at Nashville, Tenn., on 16 December 1943. He says, "The mental tests seemed a little difficult for me because I had been out of school for 8 years. On the other hand, the psychomotor tests were fairly easy."

B. Testing data:

1. Testing No. 178306 ARMA 1.

2. Stanines: B-8, N-7, P-9, pilot credit, 0; ACQ, 227; GCT, 4.

3. Strength of interest: B-8, N-6, P-9.

C. Test scores:

CE505E	G	CE616B	8	CM701A	9
CE602D-N	7	CI702F	5	<b>CP410B</b>	6
CE602D-P	9	CI903B	7	Ċ <b>P</b> 501 <b>B</b>	9
CI206C	5	CM101A	9	<b>CP503B</b>	5
CI614H	-4	CM116A	8	CP611D -	7
CI615B	6	CM120B	8	CP621,2A	8

# II. Preflight Training

A. Field.—Maxwell Field, Montgomery, Ala. Section I, Sqd. B, Group 4. (Another report gives Sec. M, Sqd. B, Flight I, as the organization.) Date reported, 1 May 1944.

B. Grades:

<ol> <li>Naval vessels, identifi- cation and tactical functions.</li> <li>Mathematics</li> </ol>	90. 3 96. 7	<ul> <li>4. Maps, charts, and aerial photographs</li> <li>5. Physics</li> <li>6. Radio code in WPM</li> </ul>	92.5 91.7 6
3. Aircraft, identification and tactical func- tions	83. 8	7. Visual codesin WPM	5

C. Record of military training.--WD Publications 100; Safeguarding Military Information 85; Chemical Warfare Defense 98; Firse and 95; Ground Forces 70. (The passing grade in all of these courses is 70.

D. *Health.*—Cadet Roe went on sick call 3 times because of a minor foot ailment. No hospital admissions were recorded.

E. Leadership.—The trainee held the temporary rank of corporal. One official report shows 7 demerits while another shows 30. According to the trainee he received 30 demerits at this field.

#### **III.** Primary Training

A. Field.-Ocala, Florida. Date reported, 6 June 1944.

B. Ground school grades:

Course	Nours_	Qinde
1. Aircraft identification. 2. Navigation. 3. Meteropology.	9 10 12	8 85 94
<ol> <li>Engines.</li> <li>Theories of flight.</li> <li>General average.</li> </ol>	32 18	- 90 91 92

C. *Health*.—Roe went on sick call twice during his stay at Ocala, Fla., but was not admitted to the hospital at any time.

D. Leadership.—The trainee held the temporary rank of flight lieutenant. No information is available concerning the total number of demerits given at this field.

#### E. Flying performed.

1.	Dual time	23:16	4.	Final flying grade F.
2.	Solo	18:55	5.	Link trainer time 2:00
3.	Dual before solo	10:10	6.	Link trainer grade S:

No grades are shown on the official records for Cadet Roe. H. B. Black, a civilian, was Roe's first instructor. He was followed by S. Orzeck, another civilian. H. C. Canfield, civilian assistant director of flying; J. A. McPhillips, probably the civilian group commander; and Capt. Robert D. Morgan, military check pilot, are mentioned in the reports.

#### F. Traince's statement:

Ocala was a file school, set up nicely in such a way that the individual was given a good deal. I didn't like the way the teaching was set up, however. From the time we got there until the time I left, there were many rumors concerning the pilot trainces. One rumor came in about the time I arrived to the effect that pilot trainces would be washed out right and left. My instructor, Black, had five students and washed out every one of them. In his previous class, he failed 2 out of the 3 being trained.

Black never did say much, never hollered at you; in fact, didn't do anything. He sat there on his —— and didn't do anything. I felt badly when I was eliminated. It was my first failure. I usually can do what I set out to do. For example, I was sick during my first 4 hours of flying, but I got over it simply because I was determined to get over it.

I didn't think I had the proper introduction to the course because I don't think flying is too difficult. I wanted to learn to fly the worst way. If I had been taught properly I think I could have learned to fly all right. Black didn't spend any time with us after class. We noticed that other instructors would spend considerable time with their students, explaining the errors they had made, and how they could correct them. We were given to feel that we didn't dure change instructors because the others would turn against you. Finally, Black was released from the service and I was transferred to Orzeck. This was a little over 2 weeks from the time I was eliminated. I believed that Orzeck could have taught me to learn to fly. He said it was a shame that he had not gotten mo sooner, but I guess it was too late for him to do anything because they were already beginning to check ride me.

I wish there were more men in the Army like you to study these things. When we wanted to —— about anything there wasn't anyone we could talk to. We lived under high pressure and the threat that we would wash out. Most of the fellows in my outfit felt that it was merely a matter of time. One check ride officer flunked 12 out of 13 men in 1 day. When a man was washed out, a good story was prepared to cover the records and the officers seemed to make the most of the slightest thing.

G. Progress checks and final statements.—When the grade slips were examined for this man only 2 ank grade slips indicating a failure were found in 45. This included the grade slips for half of his training. The following weekly summaries, progress checks, and final statements are shown after that date.

Weekly summary: July 7, 1944.-Due to poor weather, the above

student has had only two flights this week. He is excitable and overcontrols considerably, but fundamentals and general progress are satisfactory for his time. He is eager to learn, and attention to instruction is fair.

## (s) H. BLACK.

Weekly summary: July 14, 1944.—During the past week, the above student has shown a minimum satisfactory progress, technique, coordination, and air judgment. Student is excitable and becomes ill after a few stalls and spins. He is very rough and tight on the controls. His fundamentals are fair and for time, but he is careless of details and forgets procedures.

#### (s) H. BLACK.

Weekly summary: July 28, 1944.—During the past week, the above student has shown a minimum satisfactory progress, technique, coordination, and air judgment. His progress has been erratic—he is excitable and has been very tense and rough since starting take-offs and landings. His technique is very rough and he overcontrols considerably—he is careless of details. His coordination is mechanical, and his air judgment is inconsistent.

## (s) H. BLACK.

Weekly summary: July 28, 1944.—During the past week, the above student has shown a minimum satisfactory progress, technique, coordination, and air judgment. His progress has been very erratic—his air work is mechanical, and rough. His air judgment is fair. Student is very excitable and overcontrols considerably.

#### (s) H. B. BLACK.

Final statements: August 4, 1944.—I have instructed the above student for the past 17 hours, and have found his technique, progress, coordination, and air judgment to be generally satisfactory. He has been very erratic and inconsistent, but rate of progress has been steadily improving.

#### (s) H. BLACK.

Change of instructors: August 6, 1944.—This student is being transferred from instructor Black, H. B. to instructor Orzeck, S. Reason: Instructor Black has been released.

## (s) J. A. McPhillips.

Weekly summary: August 11, 1944.—Progress for the past week has been satisfactory. Student tends to hurry his maneuvers. Planning, coordination, and air judgment are weak but passing. Technique lacks precision and smoothness. Stalls are faulty but have shown improvement.

(s) S. Orzeck.

Progress check: August 11, 1944.—This student has been checked on maneuvers consistent with his flying time. His basic fundamentals of flight are minimum satisfactory. His control technique is rough in all work. He does not look around sufficiently. This student has a tendency to hold rudder in turns, and in glides. He doesn't uso rudder when rolling in and out of turns. His torque correction is weak in all work. Additional dual instruction is recommended in all stalls. Continued instruction with emphasis on the above-listed weaknesses is recommended.

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# (s) ROBERT R. GUNN.

Weekly summary: August 18, 1944.—Progress for the past week has been slow but passing. Planning, coordination, and air judgment are faulty and lack precision. Second-phase maneuvers are weak and lack precision. Technique is mechanical and he hurries his maneuvers.

# (s) S. Orzeck.

Progress check: (40 hour) August 19, 1944.—This student has been checked on maneuvers consistent with his amount of flying time 40 hours, and I find his progress technique, coordination, and air judgment to be failing. All of this student's flying is mechanical to the point that he is dangerous, student's coordination is erratic, torque correction is failing, and he is unable to do any second-phase maneuvers even minimum satisfactory, spin technique is indefinite and all of his flying lacks planning and precision. Throttle technique and altitude control is failing. Fundamentals of flight are unsatisfactory due to erratic air speed, poor coordination, and no precision. Continuea instruction is considered useless; reclassification is recommended.

# (s) J. A. McPhillips.

Elimination ride: August 21, 1044.—This student was this day checked on all maneuvers consistent with his flying time. Approximate time 40 hours. The basic fundamentals are unsatisfactory. Altitude control and glides are erratic. Stalls are very mechanical. Spin technique indefinite. All intermediate-phase maneuvers are unsatisfactory. His flying lacks feel and precision. Attention to detail is poor due to poor division of attention. This student is very mechanical. Coordination is failing. Student holds excessive rudder in gliding turns. Dangerous on forced landings. Reclassification is recommended.

## (s) H. K. CANFIELD.

Progress check: August 24, 1944.—This student has been checked on maneuvers consistent with his flying time. Student displays failing progress in fundamentals of flight. Coordination is erratic and me-

chanical. Student has failed to develop the proper feel of the airplane. Control use is mechanical. He is unable to recognize a stall. Second-phase maneuvers are unsatisfactory. Gliding turns and forced landings are dangerous because of control technique. Student uses excessive rudder and holds rudder in gliding turns. He is unable to divide his attention properly. Because of lack of progress and aptitude further pilot training is considered useless and reclassification is recommended.

#### (s) ROBERT D. MORGAN.

# **IV.** Personal History

# A. Family:

- 1. Nationality-Father, American; mother, American.
- 2. Education—father, high-school graduate; mother, high-school graduate.
- 3. Siblings—one older brother and one younger sister.
- 4. Father's occupational history, Assistant Director, New York Telephone Company, city in New York (retired).

#### B. Home:

Address	· P	opulation		Dates	
1. City in New York		40.000	Birth-1940, June 1941-Decem December 1942-p		iber 1942. present.
C. Education:	••••••••••••••••••••••••••••••••••••••				
	Sch	xol		Years com	oleted
, High school			4 yes (Ent	rs. Incering con refrigeration	urse 2 years ).
Decring, and therefore, entered trade school rathe educational or vocational plans. D. Work history jobs:	r than going	g on to col	Date	lie has ma	Pay
1. Pipo fitter		August 1 June 1941 February	940-34  -Decc /1943	arch 1941 mber 1942 . August 1943 .	Per month \$170. \$400. \$250.
E. Sports:					
8port		Amou particij	nt of ation	- Qu	ality
Baseball		Yea	r# 4	Noncomp	titive.

F.	Hobbies:	f partie ipelina nears
	Photography	3
	Models, motor ice boats, etc	1

## G. Previous contact with planes and aviation

F/O Roe has had some flying which included 20 hours of Piper Cub instruction and solo flights. He does not hold a permit.

#### V. Appearance and Manner

Flight Officer John W. Roe is a very pleasant, courteous, and considerate chap. His height is 5 feet 61/2 inches and he weighs 150 pounds. He has dark brown eyes. His voice and speech are normal. He has no peculiar mannerisms and is an attractive individual in every way.

### VI. Summary

While F/O John W. Roe says he was very anxious to learn to fly, it is possible that he was not as strongly motivated as he should have been in order to learn to fly at Ocala. On the other hand, many Ocala trainees have reported that a campaign was on at the time to eliminate as many men as possible. With the poor instruction which Roe claims to have had, and the change of instructors in the midst of his training, it is not hard to understand why he was among those being eliminated. Of the last 8 students which instructor Black had, only one had passed the course. It seems that in Roe's case fewer check rides and more instruction might have produced very different results. Furthermore, the fact that Roe has made splendid records since his elimination at Ocala, graduating in bombardiering and being among the few assigned to radar looks favorable for the man. With an instructor like Black, who is anxious to eliminate as many as possible, and where an instructor refuses to instruct, and where eliminations are the rule of the day, it is not surprising that a man of average motivation was eliminated. Apparently the knowledge that it was only a matter of time, and the knowledge that no one was really giving him any instruction, was sufficient to cause A/C Roe to give up during the last several weeks at Ocala.

#### VII. Additional Training Records

A/C John W. Roe was eliminated on 29 August '44 at Ocala, Fla., shipped to Lakeland, Fla., for 1 week awaiting orders, then to gunnery pool at Moody, Fla., and finally to gunnery training at Tyndall Field, Fla. Once again he was sent to the pool at Moody Field to await orders

and from there to bombardier training at San Angelo AAF, Tex. The following is a record of his training in bombardier school:

	Weight	Grade
	. 15 . 05 . 05 . 10 . 10 . 10 . 05 . 15 . 15 . 05	\$5 90 87 84 92 73 100 87 88 83 38
3. Code and blinker. Final average.	(i) 8	87.0

i Satisfactory.

Roe says that his final grade of bombardier was 87.6 as mentioned by Roe to keep the record straight. He graduated in bombardiering on 6 July 1945 and was shipped to Yuma, Ariz., where at the time of the interview he was making a splendid record in radar training.

#### A LOW STANINE MAN WHO LEARNED TO FLY

## I. Training Record

A. Preliminary remarks.—A/C Richard W. Doe, ASN 19389076, now flight officer, ASN T-32645 probably learned to fly because of strong motivation, emotional balance, and good instruction. He was inducted into the Army at Portland, Maine, and has visited the fields listed below. Stations where training pertinent to this study was taken are so marked.

	Portland, Maine	Basic	Bush Field. Ga.
	Greensboro, N. C.	Advanced	Moody Field, Ga.
	Nashville, Tenn.	Copilot	Tyndall Field, Fla.
•	Maxwell Field, Ala.	Combat-crew training	Westover Field, Mas
Primary	Orangeburg, S. C.	Combat-crew training	Euphrata AAF, Wash

Doe took the psychological test at Nashville on 29 Oct. 1943. He says of these tests that "I was excited and quite anxious to pass the test but I never found out how well I did on them. They told me that I passed and that satisfied me. I was worried because I had been out of school since 1939. I don't think I made any more than average on the tests. I felt fine the day I took them."

B. Test data:

- 1. Testing Station: Nashville, Tenn. Date, 29 Oct. 48.
- 2. Stanines: B-3, N-2, P-3, pilot credit, 0; ACQ, 176; GCT, 7.

3. Strength of interest: B-5, N-3, P-9.

4. Testing number, 166174; ARMA 1.

C. Test scores:

CE505E	5	<b>ČE616B</b>	4	CM701A	4
CE602D-N	5	CI702F	4	CP410B	4
CE602D-P	4	CI903B	6	<b>CP501B</b>	5
CI206C	-4	CM101A	2	<b>CP503B</b>	8
ĈI614H	3	CM116A	5	<b>CP611D</b>	4
<b>CI615B</b>	7	CM120B	3	CP621,2A	8

#### II. Preflight Training

A. Field.-Maxwell Field, Montgomery, Ala. Date reported, 4 Dec. 43. Section 7, Squadron "D", Group I. Class 44H and I.

B; Grades:	Hours	Grade 1	B. Grades: Rours	Grside
1. Naval vessels, and tactical	identification, functions	95	4. Maps, charts, and aerial photographs	84. 5.
2. Mathematics		70	5. Physics	90
3. Aircraft, Iden tactical' func	tincation and tions 30	84. 8	7. Visual code in WPM	10. 8.

C. Record of Military Training.—Satisfactory in all twelve branches.

D. *Health.*—A/C Doe was not on sick call or admitted to the hospital during preflight training.

E. Leadership.—The traince did not hold any temporary rank and received only two (2) demerits in preflight training. (For further leadership ratings see sect. V. D. where the ratings from preflight, primary, basic, and advanced are presented.)

## III. Primary Training

A. Field.-Orangeburg, S. C. Date reported, 25 Mar. 44.

B. Ground-school grades:

	Gr	ede	l	•	Grede	
1.	Aircraft identification	80	4.	Engines	03.	
2.	Navigation	93	5.	Theories of flight	84	
3.	Meteorology (weather)	88	<b>G</b> .	General average		

C. *Health.*—The trainee was not on sick call or admitted to the hospital while in primary training.

D. Leadership.—Doe did not hold a temporary rank at Orangeburg. He did not receive any demerits.

E. Flying performed:

2. Solo 81:25 5. Link trainer time 6:0	0
	-

A/C Doe's first instructor in primary was Frank Long, civilian. His second instructor was II. D. Harmon, civilian, who gave him a final grade of C. First Lt. J. R. Hayworth, check pilot, gave him a final grade of D in the course. Doe made 176 landings flying a PT-17.

F. Traince's statement.—"Long was the fellow who really got me started to flying. He was really a fine instructor—one of the finest I ever knew. I still get letters from him. Five of us started our training with him and only two finished. He always figured I would make a pilot. He thought that our eagerness (referring to the two trainees who finished) and our cockiness, at least on the part of the other trainee, got us through. He was a quiet fellow—wouldn't chew us out. He really carried us along in our training and was good on explanations. My advanced instructor was Harmon. He was about the same sort of fellow; quiet and helpful in giving explanations of the difficulties we had in primary training.

## IV. Basic Training

A. Field.-Bush Field, Augusta, Ga. Date reported, 27 May 44.

#### B. Ground-school grades:

, Hours Grade			Houre	Hours Grade		
l. Aircraft identification	100	5. A	Maintenance 9 Radio codo 12	97		
3. Meteorology (wenther) 34 1. Instruments 10	87 93	0. 7.	Radio communications 10	85		

#### ¹ Satisfactory.

C. *Health.*—Doe was not on sick call or admitted to the hospital while in basic training.

D. Leadership.—The trainee held the rank of squadron corporal and did not receive any demerits at Bush Field (See sect. V D for efficiency ratings).

## E. Flying Performed:

1.	Dual time	43:33	4.	Final flying grade	(1)
2.	Solo	42:19	5.	Link trainer time	10:00
3.	Dual before solo	4:38	6.	Link trainer grade	(1)
	¹ Satisfactory,		-		

Doe's instructor in basic training was Mr. Hughes, a civilian. His second basic instructor was Wm. G. Feagin, civilian. He and the squadron commander, a civilian named Manning, gave grades of satisfactory for the flying training in basic. The school was under civilian contract. BT-13's and 15's were used as training ships.

### F. Traince's Statement:

Hughes was a good instructor but excitable and seemed to get wild when he got into the back seat. I still say he was a good instructor and, no matter what happened, I don't blame him. He would yell at us, slap the stick and in general was unpleasant. My grades were lower under him but he was a fine instructor. When we went to instruments Feagin taught me. He was somewhat like my primary instructor, Long. He taiked you through various airplane maneuvers. He never raised his voice and was pleasant to his students. My grades were bet-

ter under him. I probably should have changed instructors when I had Hughes, but it seemed to be a poor thing to do but I worked all the harder and got through, although I did not like Hughes' methods of teaching.

## V. Advanced Training

A. Field: Moody Field, Valdosta, Ga. Date reported, 9 August. 1944.

### B. Ground-school grades:

Hours Gre	ide [		Hours Gr	adč
1. Aircraft and naval vessel recognition14	<b>63</b> 5	. Engines		
2. Navigation	88 6	. General average		87
8, Méteorology (weather) 26	84			
·		Hours	Grado	
Aero-equipment			82	
Altitude procedures			87	
Instrument flight		······································	.88	
Medical training		7	34	
Flight planning			93	
Army Air Forces			88	
Squadron dutles			88	
Aural and visual code			SAŤ	

C. Health.—Doe was not on sick call or admitted to the hospital at any time during his advanced-flying training.

D. Leadership.—The trainee did not hold any temporary rank and did not receive any demerits at Moody Field.

	Prefight	Primary	Dasio	Advanced
1. Leadership	\$	4 8 9 9 9 9 9 8 8 8 8 8 8 8 8 8 8 8 8 8	4 4 4 4 5 4 4 4 4 4 4 4 4 4 4 4 4	
12. Protessional produciency	•	•	•	1

E. Flying performed:

1, Dual time: AT-1026:33 Co-pilot TB 23J2:40	2. Solo AT-10 (dsy)
29:15 Dusl time AT-10	4. Link trainer time
(Bight)	•

Doe's first advanced instructor was Lieutenant McCann. His second advanced instructor was Lieutenant Mannengold. Doe made. 113 landings in an AT-10 and 61 landing in a TB 25-J.

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F. Trainec's Statement.-"McCann was my instructor for 50 hours in advanced training. He was a little rash but a fine instructor. He was an optimistic fellow and we liked him, except that we could never figure out just how we were doing. His methods of teaching were very good, but we never knew just where we stood. After a flight he didn't discuss anything with us. He was very mild in chewing us out while in flight. Mannengold was also a fine instructor but more quiet than McCann. He was my instructor in B-25's and taught me quite a , little bit about instruments. He was a kind of buddy to his men."

#### VI. Personal History

#### A. Family:

- 1. Nationality-father, American-born (Irish-English); mother, Americanborn (English).
- Education-father, 2 years high school; mother, grammar school. Siblings-one older sister. 2.

4. Father's occupational history-laborer, electric truck driver.

#### B. Home:

		Address	Population	Dates
.1.	City in Maine.		800	Birth, 1923.
2.	City in Maine_		2,000	1933-34.
3.	City in Maine.		1, 200	1934-presènt.

#### C. Education:

School, years completed

1. High school, graduated.

2.

College, none. Other, trade school (night), 5 weeks. 3. 4. Reaction to education, at times I wanted to go on but I couldn't afford it.

Doe wanted to go on to college but couldn't afford it. He did not have any future education or vocational plans.

#### D. Work history joba:

Dales	month
Cannery July 1939 to October 1939	\$100
Shoe factory October 1939 to December 1941	100
Shipyards February 1941 to May 1943	300

E. Military history: Portland, Maine; Greensboro, N. C.; Nashville, Tenn.

## F. Sports:

	Amount of par- ticipation, years	Quality
Baseball Swimming, hunting, fishing	- 4 - 10	Team. Noncompetitive.
G. Hobbies:		

Amount of per

				•	licipation, years
Model	planes.		********	 	5
Vegeta	able gan	den		 	5

H. Previous contact with planes and aviation: None.

2	7	1	L
Q	4	ч	5

#### VII: Appearance and Manner

Richard W. Doe is 6 feet tall, weighs 180 pounds and is well proportioned. He has dark brown hair and blue eyes. He has a typical New England accent and reminds one of Calvin Coolidge as he speaks. He speaks with a husky voice and is rather reserved. He spoke freely about his training and about his instructors. He does not have any unusual mannerisms and altogether is a rather pleasant individual.

## VIII

A/C Doe probably learned to fly because he was strongly motivated. He says "I think I learned to fly because I wanted to so badly. It wasn't because I was any better than anyone else. I just think if anyone wants to fly he can. I think if I had some of the instructors that the other fellows had I might have had more difficulty." From Doe's own statement (Sec. III F, IV F, and V F), however, it is clear that his instructors were not too easy with him. In all probability it was because Doe had a good emotional balance, that he was able to put up with several of his instructors and learn under them in spite of their teaching methods. It is also apparent that in other instances he had excellent instructors. This should be held as one factor in favor of his léarning to fly.

#### IX. Summary—Additional Training Records

After graduation from Moody Field on 20 November 1944 Doe was sent to Tyndall Field, reporting there on 2 December 1944 for copilot training on B-24's. While there he was rated average to good. He was then sent to Westover Field for the formation of combat crews and from there to Euphrata AAF, Washington, for assignment to a combat crew. His performance at the latter field was excellent.



APPENDIX D.

# Military Personnel Assigned to the Aviation Psychology Program in the AAF Training Command

# INTRODUCTION

This appendix lists as completely as possible all military personnel who have served with the Aviation Psychology Program in the AAF Training Command for at least 2 months prior to February 1946. Information concerning men who were on duty with the program after 1 October 1942 has been obtained from individual personnel reports and monthly personnel rosters.

The personnel listed in this appendix have been divided into four categories: Officers, enlisted men, WAC's and on-the-line trainees. Enlisted men who were commissioned and were retained in the Training Command program are shown as officers. On-the-line trainees assigned to the Aviation Psychology Program were enlisted men who had qualified for air-crew training. While awaiting assignment to preflight school, 100 of these men were trained at Medical and Psychological Examining Unit No. 6, Keesler Field, during March and April 1945, to administer psychological tests and perform routine administrative duties. A few additional men were trained at other units.

One man, Cpl. Harry H. Davis, was killed in an airplane crash at Buckingham Army Air Field, Fort Myers, Fla. Corporal Davis was 1 of 10 enlisted men on detached service with the AAF School of Aviation Medicine to assist in gathering criterion data for the validation of selection tests for B-29 Flexible Gunners. At the time of his death, Corporal Davis was acting as an observer during a gun camera mission aboard a B-24.

## **OFFICERS**

Abrams, Jack B. Adams, Sidney M. Alchian, Armen A. Bacon, Franklin, Jr. Baer, Reuben A. Ben-Avl, Avrum H. Bentz, Vernon J. Berwick, Leonard Beyers, Otto J. Bijou, Sidney W. Boring, Frank H. Brick, Jay R. Broom, Mybert H. Brown, Clarence W. Brown, James C. Brown, Marion H. Burns, Zed H. Carpenter, Lewis G., Jr. Carter, Launor F. Cheney, Robert B. Christensen, Julien M. Cook, Stuart W. Cowles, John T. Crannell, Clarke W. Crawford, Meredith P. Dailey, John T. Davis, Frederick B. Dawson, James W. Deemer, Walter L., Jr. Deigh, Maurice. DeMott, John Jacques, Jr. Dickinson, Malcolm G. DuBols, Phillp H. Dudek, Frank J. Dunkell, Samuel Ehrenreich, Gerald A. Eisenberg, Ralph M. Ellison, Harry O. Ericksen, Stanford O. Feuerburgh, Joseph N. Finch, Glen Fisher, Raymond H. Fisher, Vivian E. French, John E. Friedman, Seymour T. Gagne, Robert M. Galt, William E. Geldard, Frank A. Ghiselli, Edwin E. Gibson, James J. Gilbert, Gustavo M. Gilmer, B. von Haller

Gregory, Wilbur S. Grether, Walter F. Grings, William W. Grochola, Chester W. Guilford, Joy Paul Hadley, Howard D., Jr. Hagin, William V. Hagy, Harold H. Haire, Mason J. Harless, Byron B. Harris, Chester W. Harris, Frank J. Heathers, Glen L. Henderson, Kenneth B. . Henneman, Richard H. Heyns, Roger W. Hildreth, Glenn W. Hobbs, R. Nicholas Hollinshead, Merrill T. Holloman, Garland H. Holt, David O. Horst, Paul Humphreys, Lloyd G. Jenness, Arthur F. Jensen, Alfred O. Johnson, Albert P. Johnston, Orval R. Kemp, Edward H. Killian, Frank, Jr. King, Joseph E. King, Wilbur R. Klamon, Richard Klein, George S. Kleinsasser, Alvin J. Kraffert, Benjamin F., Jr. Lacey, John I. Latham, Albert J. Lehner, George F. J. Lepley, William M. Lleberman, Solomon S. Long, William F. Lottier, Stuart Lucio, William H. McClelland, William A. McIntosh, Vergil M. McMahon, Rodney J. McQuitty, John V. Michael, Ruby E. Michel, Norman E. Miller, Neal E. Mitchell, Philip H. Mollenkopf, William G.

#### OFFICERS-Continued

Morton, Sheldon I. Moser, George C. Munson, Charles B. Murphy, Robert E. Nogee, Philip. Oflesh, Gabriel D. Oswalt, Jay H. Ozburn, James. Payne, R. Bryan Perrish, Albert. Pomeroy, Donald 8. Raines, Lester O. Ray, Esten W. Rock, Robert T., Jr. Roff, Merrill F. Rohles, Fred H. Roshal, Sol M. Rothney, John W. M. Royce, Joseph R. Russell, Roger W. Sander, Herman J. Schrader, William A. B. Shaffer, Laurance F. Sherman, Arthur W., Jr. Showalter, Ralph E. Simon, George B. Smith, Monerieff H., Jr. Sollenberger, Richard T. Sperling, Philip I. Stein, Seymour P.

Stevens, William C. Stevens, Wilmer E. Stolurow, Lawrence M. Strakn, John H. Super, Donald E. Swenson, Stanley F. Thatcher, John S. Thibaut, John W. Thomas, Francis H. Thorndike, Robert L. Tucker, Anthony C. Valentine, John A., Jr. Vallance, Theodore R. Van Saun, Horace R. Van Scoyk, Randolph L. Wagner, Ralph F. Wallace, S. Rains, Jr. Walton, William Z. Ward, Lewis B. Warren, Nell D. Warrick, Melvin J. Webb, Wilse B. Weltz, Joseph. Weston, Jullen V: Wickert, Frederic Williams, Malcolm J. Winlarz, Francis A. Wolfe, Evan L Youtz, Richard P. Zielonka, William A.

#### ENLISTED MEN

Aborn, Murray Adams, Jack D. Adams, Walter 8. Agruss, Mitchell B. A'Hearn, Norman B. Ahner, Charles W. Alke, Robert H. Allenstein, Morton B. Allison, Norman Allyn, Dwight M. Ames, Thomas W. Amick, Robert L. Amundsen, Earl H. Anderson, Carl L Anderson, Clifford L. Anderson, Donald F. Anderson, Evans L Anderson, Gilbert K. Anderson, Roy C. Anderson, Russell H. Anderson, Thomas H., Jr. Andriolo, Marlo Angoff, William H. Antonelli, Emanuele W. Appleton, John J. Applezweig, Mortimer H. April, Alfred A. Armitage, Stewart G. Armstrong, Robert S. Arnott, Alfred S. Arnold, Donald O. Ashbrook, Howard J. Atkinson, Norman Austin, Donald W. Awad, Phillp P. Ax, Albert F. Axelrod, Joseph. Bainbridge, Robert G. Baker, John A. Baker, John W.

Ballstrere, Frank Ball, Fred J. Balogh, Marray L Bannerman, Edward M. Bardsley, Roger E. Barenholtz, Joseph. Barker, William S. Barkley, Billy H. Barnett, Lester E. Barnette, Warren L., Jr. Baron, Martin R. Barrows, Gordon A. Basile, Frank. Bates, Edson E., Jr. Bates, Jerome EL Bath, John A. Bato, Andrew G. Bean, Walter W. Beck, John B. Beck, Maurice P. Begley, Joseph T. Benson, Arthur L. Berfield, Frank H. Berg, Carl A. Berger, Emanuel M. Berkowitz, Melvia Berliner, Nathan H. Bernard, Jack Berne, Allan L. Bernstein, Martin M. Bernstein, Robert S. Berrey, Hillard K., Jr. Bessent, Trent E. Bimonte, Richard L Birch, Jack W., Birkett, Arthur H., Jr. Birmingham, Henry P. Bishop, Calvin R. Bishop, Philip O. Bitzer, John A. Bjork, Alton J. Blake, Robert B. Blake, Tommy Blenkinsop, Robert Blood, John W. Bloom, Irwin M. Blount, William G. Blum, Gerald S. Blumberg, Stanley Boinc, Arthur E. Bolen, Roy A. Bollinger, George N.

Bond, Edwin L. Bonin, Joseph D. Boory, John F. Borin, Leighton H. Bornemeler, Russell W. Bottorff, Donald F. Bourke, Desmond J. Bourque, Ellsworth J. Bowen, James T. Bowles, J. W., Jr. Boxer, Nathan Braden, Joseph D. Brallier, Clarence S. Branman, Irving Brant, Cloyde Bray, Douglas W. Breeding, Clarence H. Breen, Robert E. Brent, Allan R. Brice, Norman B. Briggs, Billy D. Brill, Robert S. Britt, Eugene M. Brizzolara, John J. Brock, Robert L. Brockwell, John J. Brokaw, Leland D. Brondsema, John S. Bronfenbrenner, Urie Prookman, Alvin Brooks, Edward O. Brooks, Ralph S., Sr. Bross, John R. Brower, Daniel Brown, Gilbert O. Brown, Philip K. Brown, Robert S. Brown, Walter T. Brown, William C. Bruns, Ralph W. Brunson, Joseph T. Bryan, Robert O. Buck, Raymond E. Buckner, William E. Bullock, Harrison Burack, Benjamin Burdman, Milton Burke, James M. Burke, Paul P. Burnett, Robert L. Burns, Claude H. Burns, Robert O.

Burrier, Clayton B. Burson, Kenneth D. Bushell, Hugh G. Butler, John M. Byers, John W., Jr. Byrne, Arthur J. Cahill, James J. Canfield, Albert A., Jr. Cannon, William A., Jr. Capper, James A. Carellas, Peter P. Carey, Lee A. Carlstrand, Robert W. Carpenter, Harry C. Carter, Fendol P. Carver, William T. Cass, William A., Jr. Casselman, Francis A. Castle, William P. Cerf, Arthur Z. Chaplin, James P. Charley, William Charner, Hillar D. Chase, Julian C., Jr. Cheney, Frederick H. Cherry, Jimmie D. Chester, William T. Chlozza, Joseph P. Choper, Melvin N. Christensen, Arden H. Christensen, Quenton E. Christenson, James A., Jr. Chucnin, Walter. Clancy, Philip M. Clark, Grover O. Clark, Irving I. Clark, Jerry H. Clark, Philip. Clark, William K. Clay, John E. Clecker, Waylon B. Cleland, Robert L., Jr. Clouse, James P. Cobb, Bart B., Jr. Cohen, Seymour A. Cohen, Walter. Cole, James M. Cole, Joseph C. Cole, Roger K. Collins, Dwane R. Colquett, Donald F. Coman, Edward F.

Comarow, Aaron A. Conklin, Edmund II. Conley, Lew M. Connery, Maurice F. Cook, Edward H. Cook, Francis Cook, John O., Jr. Cook, Raymond F. Corbin, Horace H. Corwin, Thomas E. Costin, Frank. Cotter, Thomas P. Coulson, Leo Clarence Vincent Cowan, Warren J. Cox, Robert H. Cozad, Lyman H. Cramm, Wellmert C. Cramp, Allen R. Crandell, Richard P. Crawford, Charles H. Croasmun, Robert L. Crowdis, William A., Jr. Crozler, William T. Crum, Richard Y. Crumbaugh, James Crump, Charles V. Culp, Courtland C. Culp, George E. Currle, John B. Cutler, Harold M. Cunningham, William R. Dahlin, Bernard C. Damon, Michael F. David, Henry P. Davidson, Ell E. Davis, Charles II. Davis, Don R. Davis, Harry H. Davis, Paul C. Davis, Robert B: Davis, Stanley R. Davis, Vernon E. Davis, Winifred S. Delay, James C. Delbex, Alfred O. Delman, Louis, Denyse, Robert A. DePalma, Nicholas Derthick, Charles H. Desenberg, Bernard N. Deutsch, Morton Deutscher, Max

Dewaters, Frank G., Jr. Dewhirst, Morton H. Dexter, Richard O. Diamond, Nathan M. Dice, Robert F. Dietsch, Robert W. Diment, Veldon J. Dixon, Harvard W. Dixon, Robert E. Dingacz, Jason Dobin, Albert M. Dodd, Benjamin E. Dodds, William H., Jr. Doherty, John J. Dorfler, Irving Doukas, John M. Dover, Edward A. Dowling, Luke F. Doxsee, James D. Dreikurs, Eric Dreyfuss, Martin S. Droste, John Louis Druitt, William F. Drummond, James F. DuBois, Donald B. Duerr, Howard J. Duff, Robert K. Duncan, Lawrence R. Duncan, Raymond E. Duncan, Robert L Dutton, Winfred E. Dyer, Donald K. Dysart, Max L. Eady, William V. Edgington, Jean R. Edwards, Forrest 8. Edwards, John M., Jr. Edwards, Joseph W. Egbert, William M. Egger, William Ö. Elimann, Gerhard E. Elkin, Albert Elkin, Victor B. Ellingson, Robert J. Ellis, Edward 8. Eilison, Hugh Breckenridge Emeson, Walter A. Engel, Arthur L England, Arthur O. Epp, Walter H. Erickson, Nels V. Erickson, Patrick J.

Ernst, John Errett, Wade, Jr. Erskine, Charles R. Erskine, Ernest, Jr. Ervin, John R. Estes, William K. Ethridge, Lawrence E., Jr. Etkin, Jacob G. Ewing, Thomas N. Fake, Clyde F. Farber, Isadore E. Farberow, Norman L Farrell, Francis M. Faust, Lloyd M. Favour, Paul G. Fears, Roy E., Jr. Feifel, Herman Feiner, Arthur H. Feingold, Sol N. Feinstein, Norlie H. Feldman, Abraham S. Felker, Verner W., Jr. Fenger, Fred T. Ferguson, Charles K. Ferguson, David L Ferguson, James B. Feuer, Bernard Files, James A., Jr. Fink, Clayton A. Finkel, Sidney W. Finney, Ben C. Finston, Arthur H. Fischer, Eugene W. Fisher, Burton R. Fisher, Kenneth A. Fitts, William H. Fitzgerald, Don C. Fleming, Strother C., Jr. Fletcher, Everett H. Flora, Wesley Forbis, Harold N. Forstenzer, Hyman M. Fortune, George J. Foster, Lester I. Fotos, George Fouquet, Donald F. Fox, Richard Fox, Robert Francis, Lewis T., Jr. Frank, Harry M. Frank, William S. Frankel, Ellot.

Frederick, James E. Fredrickson, Roy C. Freeburne, Cecil M. Freedman, Abraham Freedman, Morris Freeman, Paul M. Freidman, Herschel French, Benjamin I., Jr. French, Charles O., Jr. Friedman, Sidney Froehlich, Clifford .P. Fruchter, Benjamin Fudeman, Irving Funk, Marvin H. Futransky, David L. Gage, Nathaniel L. Galkin, Bernard Gallagher, Thomas P. Galvin, Bertrand J. Gammer, Morton Gannam, Michael Ganter, William D. Garber, William F. Gardiner, John L. Gardner, Wayne C. Garrett, Gene A. Garrett, William H. Garshinsky, Irving A. Gasner, George E. Geimer, Vincent D. Gellman, Martin S. Genn, George Gentry, Oakley, Jr. George, Edgar D. Gershenson, Charles P. Getchell, Ellsworth W. Gibbs, William T. Gillman, Robert D. Gladstein, Jacob H. Glaser, Carl Glaser, Ezra Glaser, Nathan M. Glaser, Robert Glass, Julius Glasson, Roger Earl Gleason, John F. Gleason, John G. Globe, Arthur Glusker, Philip F. Goettel, Philip O. Goheen, Howard W. Goldberg, Bernard

Goldberg, Gerald Goldblum, Norman Goldman: Bernard Goldscheid, Eugene Goodman, Alan C. Goodman, Bernard M. Goodman, Ervin Goodman, John K. Goodman, Rudolph Goodrich, Joseph W. Goodrich, Leroy Ashbel, Jr. Goodwin, Phillip A. Goodwin, William P. Gordon, Abe L. Gordon, Arthur D. Gordon, David C. Gordon, Myron H. Gordon, Philip L. Gorin, Thomas-IL Gossett, Raymond M. Gough, Harrison G. Grace, Harry M. Gracey, George R., Jr. Graff, Norman Graff, Smith Stewart Graham, Asbury M. Graham, Jean L. Graichen, George. Grant, Vernon W. Grappe, Ludrew B: Graves, Mentor Eugene Gray, John Michael, Jr. Green, Charles T., Jr. Green, Lewis P. Green, Manly R. Green, Michael Greenbaum, Sheldon L. Greenberg, Alexander Greenberg, Alexander. Greer, Norman J., Jr. Gresham, William W., Jr. Grice, George R. Grier, Daniel J. Griffin, Samuel Blair, Jr. Grigg, Austin E. Grosslight, Stewart R. Grossman, David Grossman, Searles A. Guichard, Charles P. Gutsche, Lyle D. Haberman, Rex Stanley Hackbarth, Edward A.

Hackett, Richard B. Hadley, Samuel T. Hagen, Clayton H. Hahn, Dale D: Hales, Howard J. Hall, Charles A. Hall, Charles W. Hall, Ellsworth L. Hall, Forrest 1. Hall, Harvey. Hall, Wilbur J. Halpert, Dexter Hamborsky, Dwight K. Hamby, Jesse L. Hamilton, Charles E. Hammond, Ephraim W. Hammond, Lee C. Hamrick, Wayne D. Hand, Wilson B. Hanson, Robert E. Hardcastle, Henry K. Harding, John S. Hardtke, Eldred E. Harper, Robert S. Harris, Burdette F. Harris, David Harris, Dwight R. Harris, Robert E. Harris, William B. Harsh, Joseph R. Harter, Aubrey B. Hartman, William J. Hartsig, Joseph G. Hartstein, Edward J. Háss, Melvin H., Jr. Hassett, James P. Hastorf, Albert H., III Hatfield, Newton II. Hathaway, William N. Hausman, Howard J. Hawthorne, Judson, Jr. Hazen, Edward G. Hearn, Garry J. Heartsill, Walter C. Heath, John H. · Hebbard, Arthur T. Helfman, Monasch Heller, Hyman Heller, William Hellman, Leon I. Helimer, Leo A. Hellwig, Norris

Helmick, John S. Hemphill, John K. Henderson, Horace W. Hennessy, John V. Hepburn, David N. Herrick, James W. Herring, William P. Herrmann, Donald J. Hester, Charles H. Heston, James 8. Henser, Herman L. Hickman, Norman W. Hicks, Earl E. Hicks, Samuel M. Hill, Claude Q. Hirsch, Morris Hlasnicek, Stanislaus E. Hoban, Albert E. Hobden, Frank E. Hodish, Moses Hyman Hofstetter, William S. Holden, Harvey K. Holladay, Charles E. Holland, John L. Holley, Robertlee L Hollzer, Herbert M. Holmberg, David M. L. Holmes, William W. Holston, Robert P. Hooper, Herbert E. Hope, John M. R. Hopfan, Herbert A. Horvath, Joseph F. Houck, Howard R. How, Hoiger O. Howard, Herbert S. Howard, Jerome S. Howe, John W., Jr. Hudson, George R. Hufstader, William H. Humphries, Charles H. Hurley, David J., Jr. Hurvitz, Nathan Hutchinson, Linn Hustler, Austin B Ingraham, Phoent: Irion, Arthur L. Ismael, Walter W. Jackson, Leland Jackson, Robert M. Jacobson, Martin Jacobson, Richard Harry

Jaffe, Morton G. Janis, Henry C. Jenkins, David H. Jenkins, Ernest A. Jensen, Elmo A. Jernigan, Austin J. Jerome, Eldon K. Jerrells, Herbert E. Jeweit, Milton R. Johns, William, Jr. Johnson, George O. Johnson, Lennart C. Johnson, Robert H. Johnson, Vincent A. Johnson, Wallace R. Johnston, Joseph J. Johnston, Roland E., Jr. Jolley, Calvin B. Jones, Burritt Jones, Charles Ollie Jones, James P. Joseph, Rebert T. Junger, LeRoy W., Jr. Kahlert, John M. Kaitz, Hyman B. Kamman, James F. Kana, George Kandel, Alan D. Kaplan, Seymour Kart, Gilbert Kaslofsky, Abe Katz, Barney Katz, Leon Kaufman, Benjamin Kass, Bernard Kehoe, John A. Keil, Jack P. Keller, Robert J. Kelley, Harold H. Kelly, Robert M. Kennedy, Albert T. Kennedy, Lowell B. Kertz, John V. Ketchersid, Ernest B. King, Francis E., Jr. King, John P. King, Lawrence J. King, William C. Kirk, Marquis A. Kisciras, Ted P. Kitterman, Robert R. Klapper, Joseph T.

Klebanóff, Seymour G. Klein, Arthur Klinkhamer, George E. Kingman, Samuel F. Knicely, Robert S. Knight, Norton B. Knippel, William R. Knoderer, William H., Jr. Koch, Robert H. Keehler, Earl H. Kogan, William S. Kopp, Raymond Kornreich, Jerome S. Korsh, Sidney Kossoff, Jerome W. Kounin, Jacob S. Kowalsky, Leonard Knippel, William R. Krasnow, Robert H. Kravetz, Nathan Kremer, Frederick J. Kreuzmann, Alvin B. Kriedt, Philip H. Krise, Edward M. Krueger, Frederick W. Kruger, Charles Krugman, Herbert E. Kuhfal, Herbert Q. Kunsman, Harold F. Kurtz, Harmon O. Lacke, Joseph P. Lake, Richard A. Lambert, Robert E. Lamkin, Hibbard. Land, Howard M., Jr. Landau, Milton M. Landy, Jack O. Lane, Robert C. Lunier, Julian A. Larimer, Verne L. Larson, Robert J. Lashley, John R. Lassman, Frank M. Laurence, James O. Laurito, Augelo F. LaVine, Harvey B. Lawrence, Douglas H. Lawrence, James F. Lawrence, Marvin J. Lawrence, Milton M. Lawrence, Warren R. Leavitt, Jack

Lecznar, William B. Leder, George B. Lee, Charles A. Leely, John L. Leeper, Zane H. Loff, Ira S. Lehman, Albert. Ichman, Thomas R. Íæníhan, Noel J. Lerner, Joseph S. Levan, Kenneth B. Levi, Benjamin L. Levin, Morton Levine, Abraham S. Levine, Alexander N. Levine, Robert Levine, Solomon Levinson, Gerald 8. Litbenberg, Maurice. Lieberman, Miltón G. Lieberthal, Jerome I. Lillywhite, Joel P. Lind, Robert V. Linn, Leslie W. Lints, Warren O. Lipman, Eli A. Lipscomb, John R. Lit, Alfred Little, Robert L Little, William H., Jr. Locke, Allen E. Loeper, Carl F. LoMaglio, Samuel C. Long, Rees C. Lopatto, Stanley R. Lottmann, Harry G. Lubin, Ardle Luft, Joseph Lyerly, Samuel B. Lyerly, Walker, Jr. Lynde, Glyndon L Lyster, Harold W. Lyon, Wolcott N., Jr. MacConnell, Charles, Jr. MacGahan, John A. MacNaughton, John F. Madden, Howard L. Madden, James G. Madeira, John P. Maguire, Dennis F. Maguire, William P. Mahl, George F.

Maness, Dee M. Mangan, William J. March, Richard P. Marion, Arthur J. Marlowe, Lloyd D. Marquis, Benjamin Marsh, Harold C., Jr. Marsh, Stewart H. Marteeny, John D. Martens, Carl H. Martin, Benjamin M. Martin, Franklin T. Martin, Glenn C. Martin, Leslie L Martinucci, Gilbert J. Masia, Bertram B. Mason, George E. Matheny, William G. Matthews, Jack Mathis, John H. Mayer, Robert J. Mayme, Richard T. Maynard, Ralph J. McAllister, Charles E. MeBath, James H. McCarthy, Harold E. McCauley, Edwin R. McCollom, Jack L. McCombs, Kenneth S. McCreery, Robert E. McCullough, Norman G. McDowell, Frank K. McGrane, Clement F. McGrath, William, Jr. McHugh, Joseph A. McIlvaine, Harold R. MeInturff, Frank McKay, Bruce W. McKee, Henry H. McKibben, James T. McLanathan, Frank L McPeek, George A., Jr. McReynolds, Paul W. MeVitty, Lawrence F. Meiners, Eugene E. Melse, Frederick H. Meissner, James H. Mendell, Ira A. Menozzi, John Merrell, James Merriam, James T. Merrill, Roger, Jr.

386

۰.

~~ ***** ~~ ~~ *****

Metcalfe, Bernard J. Metrinko, William Myerson, Norman Middleton, Milton D. Milbourn, Jack Vann Miles, Julian R. Miller, Earl L. Miller, Harold W. Miller, John Carl Miller, Robert B. Millette, Eugene A. Mills, Gary L Mills, William B. Misciagno, Stephen J. Mitchell, George D. Mitchell, Richard T. Mock, Sanford J. Mogin, Bert. Moline, Del B, Moll, Aaron J. Monfredo, Dominic J. Mooney, Joseph E. Moore, William T., Jr. Morford, Samuel D. Moriarty, Francis M. Morrill, Harold EL Morris, Edwin T. Most, Milton L. Mount, George K. Muller, Henry J. Munger, Allyn F. Munger, Owen R. Munter, William H. Murphy, William J. Murray, James R. Myers, John L., Jr. Nagge, William W. Nall, Nelson R. Nasgovitz, John W. Nash, Daniel A. Natkins, Mortimer J. Nearing, Cary Neece, Robert W. Nelligan, Gilbert J. Nelson, Charles W. Nelson, Elmer A. Nelson, Paul T. Nelson, Philip 8. Nerby, Sheldon H. Neuman, Gerald G. Nevard, Carlisle, Newman, Emanuel H.

1 4

Never, Joseph Nichaus, Stanley W. Nimberg, Ernest S. Nogee, Phillip, North, Robert D. Nygard, John W. O'Hara, John G: Oliver, Bernard M. Olsen, Raymond Olson, Arnold K. Olson, James B. Olson, Ray P. Oman, Herbert T. A. O'Neill, John P. Oppenheimer, Alex M. Orbach, Charles E. Örensteen, Allan C. Orenstein, Joseph M. Ortof, Murray Orvis, Clay H. Ouellette, Leo L. Overholt, William A: Oveross, Mardon J. Owen, David W. Owen, Frank E. Owens, Edward H. Owens, Forrest A. Paisley, Robert M. Palluotto, Amileare O. Paper, Fred P. Parry, Joseph Pascal, Gerald R. Pasco, Robert O. Patterson, Cecil H. Patterson, Robert J. Paulson, Leonard, E. Payne, Riner O. Pearlstein, Lco Pearson, Charles C. Pearson, Richard Peitier, Thomas B. Pepltone, Albert Perkins, Homer G. Perkins, Phillip H. Perlman, Abe. Perlo, Maurice Perry, George W. Perry, Gilbert W. Peters, Donald E. Peters, John C. Peterson, Cecil IL Peterson, George W.

Peterson, Gustave EL Peterson, Karl O. Pettee, Thornton Pfuff, Robert E. Phelps, Alfred E. Phillips, Charles L. Phillips, Ewing L Pickman, Milton E. Plerce, Robert C. Pierson, R. M.' Pittman, William G. Platt, Joseph EL Poinc, Arthur E. Polard, Robert J. Pollard, Richard F. Pollock, Bernard Porter, Robert B. Posner, Arthur V. Potter, Bugene J. Potter, Homer H. Pratt, William K. Preston, Harley O. Preston, Leonard L. Price, Bruce P. Price, Eugene L. Price, Hubert B. Prinz, Gerard R. Proshansky, Harold M. Pruiett, Ralph B. Puller, Gordon L Punke, Harold H. Radtke, William A. Raglin, Francis E. Rahm, Hayden H. Ramsey, Glenn V. Rand, Morris J. Range, Albert B. Rash, William E. Rattner, Jeseph H. Raush, Harold L Raylesberg, Daniel D. Raymond, John J. Rechnitz, Burton Redlener, Joe Reeves, Stanley B. Rels, Walter J. Reneau, Willard P. Reps, John W. Ressner, Joseph E. Rhea, Ernest O. Rhodes, Marshall O. Rich, Robert W.

38

ا≹

Richards, George H. Richardson, Carroll H. Richtig, Valentine L. Riecken, Henry W., Jr. Riedel, John P. Rieman, Glenn. Rinaker, Samuel M., Jr. Riopelle, Arthur J. Rivera, William J. Robbins, Irving Roberts, Andrew D. Roberts, Harris W. Roberts, Wade H. Robinson, Harvey A. Robinson, Herbert Robinson, James O. Robinson, Preston K. Robinson, Richard G. Rochlin, Isaiah Rodgers, Jack P. Roffman, Bernard Rogosin, Hyman Rohrs, John R. Rokeach, Milton Romano, Frank E. Roney, James G., Jr. Rooney, Robert O. Rose, Emerson W. Rose, Glenn I. Rose, Nicholas Rosemark, Edward M. Rosen, Edwin D. Rosenberg, George L Rosenberg, Harry Rosenberg, Louis M. Rosenbush, Monroe Rosenthal, Louis Rosenwald, Alan K. Rosevear, William H. Rosser, Bernard S. Rossignol, William A. Roth, Harold I. Roth, Ollver R. Routhier, Francis X. Rowan, Paul K. Ruddon, John F. Russell, Robert L. Russell, Robert W. Rust, Ralph M. Ryan, Harold W. Salisbury, Robert H. Salus, Sydney G.

Sanger, Sanford H. Santimouro, Michael J. Sappenfield, Bert R. Savoie, Leonard M., Jr. Sawyer, Everett G. Saxe, Carl H. Scalise, Joseph P. Schafer, Alfred H. Schaffer, Marvin Schall, Wayne D. Schaller, William F. H. Schapiro, Jack M. Schechtman, Philip Scherer, Wallace B. Schmierer, Hyman Schmitt, Anthony J. Schmonsees, Herman F. Schoenrich, Carlos O. Schofield, William Schrader, Everett N. Schroeter, Raymond J. Schureman, Robert .Y. Schwartz, Stanley Schwars, John J. Schwarz, Ralph H. hwotzer, Wilbert H. Scott, Charles B. Scott, Vernon 8. Scrivner, Robert L. Seaman, Everett P. Seimetz, John J. Sellers, Raymond L. Senderowitz, Robert Sendroff, Ira L. Settlage, Paul H. Shafer, Byron H. Shankman, Jerome F. Shaver, Robert H. Shaw, Francis H. Shea, Daniel J. Sheets, Henry J. Shepherd, Clarence E. Shimberg, Benjamin Shirley, Gerald H. Shllen, John M. Shneidman, Edwin S. Shooll, Paul W. Shrader, John O. Shue, William A. Sible, Robert W. Slegel, Saul M. Silberman, Morton B. Silver, Stanley H. Silverman, Harold Simklu, James 8. Sincoff, Philip L. Singer, Harold H. Singer, Martin Sinko, Amil J. Skahen, John R. Sklar, Philip. Slater, Garuld M. Slater-Hammel, Arthur T. Slaven, Edward J. Slawson, Robert M. Sniestad, Clifford E. Smith, Alwood Smith, Earl W. Smith, George W. Smith, Gerald F., Jr. Smith, Harley B. Smith, Herbert A. Smith, Kenneth C. Smith, Mahlon B. Smith, Raymond B. Smith, Robert M. Smith, Thomas W. Smoak, William W. Sofer, Hyman Solomon, Carlene Solomon, Louis Sonnenfeld, Morton L. Sontich, Joseph P. Southworth, Richard V. Spatz, Norman Spector, Samuel Spellman, Arthur L Spelta, Victor F. Spence, David B. Spencer, Charles M. Spencer, Frank H. Spink, Frank H., Jr. Spivak, Daniel C. Spraggon, Leslie A. Sprecher, Harris A. Sprow, Allen J. Srole, Leo Stackhouse, Francis D., Jr. Stackpole, Stephen H. Stafurik, George C. Stalman, Martin G. Standish, William A. Starr, Robert E. Stauffer, Nell P.

389

9.3 . . .

Stausfer, Russell G. Steinert, John C. Steinhardt, Charles S. Steinicke, Andrew V. Steinzor, Bernard Steitz, Nelson P. Stellar, Ellot Stember, Richard S. Steneroden, Ernest H. Stern, Gerald Stern, Marray J. Sternfeld, Philip M. Stevens, Evan R., Jr. Stewart, Donald F. Stewart, Noel W. Stewart, Robert J. Stirling, George S., Jr. Stokes, James W. Stone, Gideon B. Stone, Leon N. Stover, Francis W. Strait, John H. Stratton, James W. Strauss, Harold R. Strobel, David W. Stubblefield, Eben M. Stuart, Earl K. Studna, Irving H. Stumphy, Dee M. Suhumskie, Maurice E. Sullivan, Bernard C. Sullivan, Cornelius D. Sullivan, Edward J. Sullivan, Gerald J. Sumby, William H. Summers, Edward E. Summers, Oliver H. Suren, Stephen M. Sussman, Henry L. Swift, Frederic W. Talt, James F. Tanberg, Merritt O. Tarr, John W. Tarwater, Jesse W. Tate, Edward R. Taylor, Alan Taylor, Everett Taylor, Jack E. Terry, Gilbert H. Thomas, Garth J. Thomas, Gordon L. Thomas, Harry E.

Thompson, Billy C. Thompson, Charles E. Thompson, Vincent P. Thurlow, Willard R. Thuman, Dean R. Tice, Frederick G. Titus, Joe M. Tkachenko, William V. Traeger, Carl Trent, John B. Tunison, John L. Turner, Ralph H. Twist, John R., Jr. Uhlaner, Julius E. Unger, Robert W. Urdang, Laurence J. Utter, Robert F. Valentine, John A., Jr. Valin, Sigmund Varone, Alfred F. Vedder, Palmer W. Veith, Donald P. Verhusen, Ben Lee Vernallis, Francis F. Vinson, David B., Jr. Vinter, Robert D., Jr. Vittetow, Francis H. Vittucci, Matthew M. Vrettos, Nick N. Waeltermann, John J. Waggoner, Robert E. Wagner, Jerome Wainhouse, Edward R. Wald, Malvin D. Walden, Bernard H. Waldman, Marvin Walker, James A. Walker, John M. Wallace, Gerald C., Jr. Wallen, John L. Waller, Harry Belt Wallin, Paul Walton, Keith B. Warden, Clyde R. Warren, Edward 20. Warren, Julius L. Warren, Todd J. Warriner, John E. Waterman, David J., Jr. Weatherford, William B. Webb, David J. Webb, John A.

Weel, Gordon J. Weinberg, Edward H. Weiner, Samuel S. Welss, Aaron Weitzner, Morris Weksler, Harold Welch, George R. Welch, James W., Jr. Wepman, Joseph M. West, William E. Weston, Edward T. Wexler, Gerald Wexler, Louis Wheeler, William M. White, Benjamin W. Whitesell, Jack C. Whitten, Donald S. Whittier, William C. Wicker, Richard E. Wiegand, Edward O. Wienbarg, Jack L. Wiener, Daniel N. Wiley, Charles W. Wiley, John H. Wiley, Llewellyn N. Willcox, Henry H., Jr. Willerman, Benjamin Willey, Clarence F. Williams, Malcolm J. Williams, Meyer. Williams, Wilbur F. Williamson, Dale C. Williamson, Robert C. Willman, William P. Willmann, John M. Wilson, Dale K.

Askew, Annabelle L. Austin, Dorothy B. Babcock, Arline E. Boyd, Gladys M. Brott, Nettle M. Buckley, Loretta K. Erwin, Maude M. Forster, Catherine G. Giddings, Virginia. Glasgow, Ruby J. Gold, Lenore Guth, Helen R. Hatfield, Emma Wilson, Everett E. Wilson, Lawrence T. Winebarger, Richard L. Wines, Charles Winfield, Don L. Winkler, Rudolph Winne, John F. Winnick, Hyman Wisch, Richard Wischner, George J. Wisely, Harold M. Wittenstein, Ansel A. Wolffe, Joseph F. Wood, Homer George Woodhouse, Robert G. Woodruff, Joseph L. Worth, Stephen W. Worthington, Netter R. Woywod, William J. Wright, Beldon A. Wright, Henry W. Nanthaky, Nicholas Yates, Keith E. Yeagley, Henry L. Yellin, Herbert C. Young, Frederick H. Young, John B. Zahren, Scott H. Zettelmoyer, Karl A. Zimmerman, Don R. Zimmerman, Herbert M. Zimmerman, Louis R. Zimmerman, Wayne S. Zucker, Herbert J. Zwahlen, Robert C.

# W. A. C.'s

Kesselman, Sadie Lombardi, Celia T. Loomis, Mary E. McGowen, Virginia A. Mollica, Helea Pasiewicz, Irene M. Rubin, Florence P. Salk, Betty J. Scanlon, Beatrice B. Shappee, Agnes E. Wetherby, Dorothea E. Wismer, Elaino M.

## ON-THE-LINE TRAINEES

Amble, Henry A., Jr. Anderson, James H. Antilla, Alfred D. Barber, John T. Behinke, Martin H. Bennett, Donald C. Bickhart, Benjamin H., Jr. Blount, Robert J. Bohling, John E. Borrus, Bernard Boss, James F. Burkhalter, Lynwood C. Carlson, John A. Carney, William F., Jr. Cecil, Eugene F. Comes, Richard N. Cook, William E. Cooley, John E. Crepeau, Robert J. Davy, Elvin B., Jr. Doyle, Robert G. Duncan, Joha B. Elliot, Billy S. Fulk, Alvin L Lamon, Donald M. Landstrom, Thomas H. Layne, Edward G. Lehman, Raymond W. Lerner, Paul Lewis, Quentin A. Lubin, Melvin Lyons, Edmund W. Maatta, Andrew A. Macchi, Eugene E. Maltenfort, Martin S. Marks, James R. Massle, Sam F. Maurer, Charles D., Jr. McCardell, Archie R. McClure, James C., Jr. McCrimlisk, Gerard J. McCutcheon, James W. Miller, Clarence K. Miller, Harry W. Miller, Irving E. Miller, Robert E., Jr. Mitchell, Kenneth M., Jr. Morecombe, Donald J. Morgan, Thomas B. Moss, Lindy G. Murray, James O. S., Jr. Murrell, Roger L. Nieder, Leonard. Ninneman, Lawrence D. Nolan, James R. O'Brien, Frank R. O'Connell, Daniel J. Parker, George K. Pope, Henry T. Press, Elliott H. Rich, John R., Jr. Roberts, Edward Roberts, Guy J. Robinson, William H. Roitbiat, Alvin. Romig, David W. Rudolf, John J., Jr. Savage, James B. Schaeffer, Ephraim A. Shaner, David G. Shauer, George A. Singer, Irvin Sirany, Dallas R. Skowronski, James E. Slocum, Robert G. Smith, Norman J. Smith, Richard W. Smith, Robert W. Stuckman, William D. Swanson, Albert M. Swartwout, Donald G., Jr. Taylor, Richard S. Tibbetts, Palmer G. Tirrell, John E. Treite, Paul L Van Nostrand, Maurice A. Von Wrangell, Charles Walker, Stuart B. Walters, Kenneth E. Ward, Orville E. Watson, Guy H. Wellerson, Theodore Whittemore, Wayne G. Whyte, Donald E. Wiberley, John A. Wiesenberg, William H. Williams, Glen E. Wilson, Sylvan D. Wodstrehill, Ronald J. Wright, Robert H. Wurst, Ralph, Jr. Wyman, Charles B.

D

ì

45,444

# INDEX OF NAMES

Adams, S. M. 08. Bacon, F. 290, 304. Baer, R. A. 51, 63, 65. Bechtoldt, D. 30. Bechtoldt, I). 30. Brown, C. W. 66. Crawford, M. P. 53. D Davis, F. B. 30. Deemer, W. L. 38. DuBols, P. H. 46, 64, 284, 289. Faubion, R. W. 15, Finch, G. 65. Fitts, P. M. 30. Flanagan, J. C. 8, 24, 29, 30, 271, 284, G Geldard, F. A. 10, 22, 38, 290, 1304. Ghiselli, E. E. 41, 43. Gibson, J. J. 38, 40. Glenn, C. R. 4. Grether, W. F. 63. Guilford, J. P. 10, 21, 44, 53, 56. Harris, C. W. 30, 03, 200, 304. Hobbs, R. N. 52. Horst, P. 30, 46. Jenkins, W. O. 30. K Kendler, T. S. 30. Lepley, W. M. 51, 53, 67, 272. Limbo, D. 297.

ŕţ

McCabe, W. J. 30. Malmejac, J. 285, Mashburn, N. C. 4, Melton, A. W. 10, 10, 15, 34, 48, Mollenkopf, W. G, 30, O'Rourke, L. J. 5. Panlasigul, I. 297. R Rock, R. T. 9, 53. Roff, M. F. 65. Ryan, J. P. 201. Scashore, R. H. 15, Shaffer, L. F. 9, 11, 43, 49, 50, 51, Shefield, V. F. 30, Simpson, K. 200. Sperling, P. I. 63. Summers, D. H. 2 291. Thorndike, R. L. 30. Thorne, F. H. Tucker, A. C. 30, 53, 62. Valdes, B. J. 292. Wallace, S. R. 41. Walton, W. E. 67. Ward, L. B. 61. Warren, N. E. 56. Wickert, F. 63. Willis, M. B. 30.

M

## SUBJECT INDEX

AAF Qualifying Examination. 34. Aviation Psychologists, official specifications for. 30. Aviation Psychology Program: early organization of. 29-38. establishment of. 7. expansion in 1943. 58-61. Battery, Classification: battery of Feb 1942. 72. battery of Apr 1942. 77. battery of May 1942, 82, battery of Jun 1942. 86. battery of Aug 1942, 88, battery of Dec 1942. 91. battery of July 1943, 96, battery of Nov 1943, 99, battery of Sep 1944. 103. battery of Jun 1945. 108. early experimental battery. 15. French classification battery. 284-289. Philippine classification battery. 289-304 Sec also "Tests", "Validity."

Bombardiers: D-8, selection program. 203-265. responsibility for selection research. 15. selection and classification. 3. selection of, for navigation training. 265. Classification: procedure. 17-20. psychological problem. 2, 24-28. Combat Crew Assembly. 272-283. D-S Bombardiers: selection program 263-265. Directives: selection and classifica-tion. 10, 11, 17, 22, 94. Educational Examination: aviation cadet. 201-203. Experimental Group: 181-258, case studies, 105-200. characteristics. 186-189. purpose. 181. selection and testing. 182-184. validity, tests and stanines. 189-195. Flight Engineers, selection of. 270. Headquarters Army Air Forces. 7, 29.

Lead Crew Aptitude Score. 27 Lead Crew Selection. 271-283. 273.

:, :)

Medical and Psychological Examining

- Center; Philippine Army. 297. Medical and Psychological Examining Unit No. 4: history and functions. 61.
- Medical and Psychological Examining Unit No. 5: history and functions. æ
- Medical and Psychological Examining Unit No. 6: history and functions. 63.
- Medical and Psychological Examining Unit No. 7: history and functions. 64
- Medical and Psychological Examining Unit No. 8: history and functions. 65.
- Medical and Psychological Examining Unit No. 9: history and functions.
- Medical and Psychological Examining Unit No. 10: history and functions. 87.

Navigator:

early selection and classification. 3. responsibility for selection research. 16.

Officer Quality Score. 259.

Personnel Consultant, Assistant, offcial specifications for. 31.

Personnel:

- psychological. 9, 14, 18. early procurement of. 31-33.
- Psychological Research Project (Bom-bardier) : establishment of. 45, 68.
- Psychological Research Project (Combat Crew): establishment of. 46, 53, 67.

- history and functions. 272. Psychological Research Project (Flight Engineer): establishment of. 45, 68.
- Psychological Research Project (Nav-
- igator) : establishment of. 45, 68. Psychological Research Project (Pilot) : establishment of. 45, 68.
- Psychological Research Project (Ra-dar) ; establishment of. 45, 68.
- Psychological Research Unit No. 1: establishment of. 10.
- history and functions. 49-53.

Psychological Research Unit No. 3: history and functions. 55-58. Psychological Research Unit No. 11: establishment of. 52. **Psychological Section:** activation at Training Comd. Hq. 12. organization: 38-46. field research unit. 44. 41 field studies unit. perceptual research unit. 40. publications unit. statistical unit. 38. test operations unit. Psychological Test Film Unit. 41, 68. Radar Observers: selection of. 266-269. Reexamination : policies and practices. 109. Research Areas: responsibility for. 47. Research Policy. 36-38. School of Aviation Medicine, Dept. of Psychology: history and functions. 48. Selection: pilot, pre-war: 1. psychological problem of. 2, 24-28. aviation cadet examining boards. 17. research program authorized. 11. Stanine: definition and origin. 21. prescribed distribution of. 85. computation of (See "Battery' validity of (See "Validity"). Tests: aptitude, prewar : 4. early experimental battery. 15, early development of. 35, rationale of. 72. traits to be measured by. 14. use authorized. 12. Sec also "Battery". Validity, Stanines: 113-179. bombardler training. 158–171. navigator training. 146–158. navigator training. 146 pilot training: 113–145, Chinese pilot trainces. 174. combat returnees. 171 experimental group. 181-258 Negro trainees. 174. Pilot Class 42-X. 177. W. A. S. P. training. 177. West Point cadets. 176.

-y

technical training. 178.

Ο

Psychological Research Unit No. 2: history and functions. 53-55.