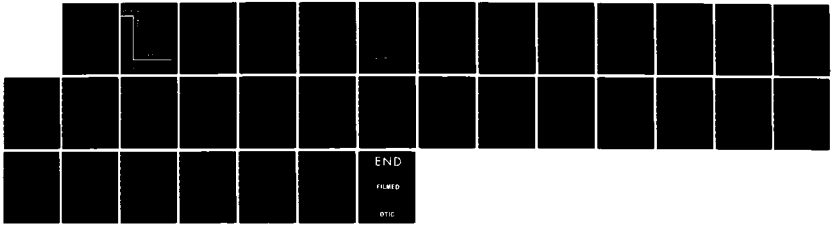
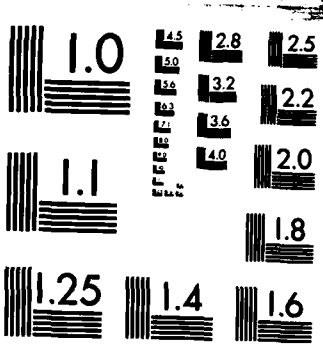
AD-A153 821 THE 1980 YOUTH POPULATION: A VERIFICATION REPORT(U) AIR FORCE HUMAN RESOURCES LAB BROOKS AFB TX M J REE ET AL. FEB 85 AFHRL-TP-84-47 1/1

UNCLASSIFIED F/G 5/11 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

AFHRL-TP-84-47

AIR FORCE

HUMAN RESOURCES

AD-A153 821

THE 1980 YOUTH POPULATION: A VERIFICATION REPORT

By

Malcolm James Ree
Lonnie D. Valentine, Jr.
James A. Earles

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5000

February 1985
Interim Technical Paper for November 1982

Approved for public release; distribution unlimited.

LABORATORY

DTIC FILE COPY

DTIC
ELECTE
MAY 17 1985
S D
B

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5000

NOTICE

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder, or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The Public Affairs Office has reviewed this paper, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This paper has been reviewed and is approved for publication.

WILLIAM E. ALLEY, Technical Director
Manpower and Personnel Division

NANCY GUINN, Chief
Manpower and Personnel Division

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

AD-A153 821

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited.
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFHRL-TP-84-47	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Manpower and Personnel Division Air Force Human Resources Laboratory 6b. OFFICE SYMBOL (If applicable) AFHRL/MOAE	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State and ZIP Code) Brooks Air Force Base, Texas 78235-5000	7b. ADDRESS (City, State and ZIP Code)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Air Force Human Resources Laboratory 8b. OFFICE SYMBOL (If applicable) HQ AFHRL	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State and ZIP Code) Brooks Air Force Base, Texas 78235-5000	10. SOURCE OF FUNDING NOS.

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT NO.
62703F	7719	18	46
62703F	7719	18	19

11. TITLE (Include Security Classification)
The 1980 Youth Population: A Verification Report

12. PERSONAL AUTHOR(S)
Ree, Malcolm James; Valentine, Lonnie D., Jr.; Earles, James A.

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Yr., Mo., Day)	15. PAGE COUNT
Interim	FROM 4 Nov 82 TO 24 Nov 82	February 1985	36

16. SUPPLEMENTARY NOTATION
AFHRL/TS 82-309

17. COSATI CODES

FIELD	GROUP	SUB. GR.
05	09	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
abilities, ASVAB, selector composites, AFQT, equating, 1944 mobilization, aptitude tests, frequency distributions, 1980 youth

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

An investigation was conducted to confirm the results of a report written by the Center for Naval Analyses (CNA) on the proposed adoption of the 1980 Youth Population as a new reference for calibration of the Armed Services Vocational Aptitude Battery (ASVAB). Although deviations were noted in the procedures used by the CNA, the report was found to be essentially correct in its results. Psychometric, policy, and organizational issues involved in the selection of the appropriate reference population were examined and implications of a change from the 1944 Mobilization Base to the 1980 Youth Population sample were discussed.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐	21. ABSTRACT SECURITY CLASSIFICATION

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE NUMBER (Include Area Code)	22c. OFFICE SYMBOL
Nancy A. Perrigo Chief, STINFO Office	(512) 536-3877	AFHRL/TSR

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

AFHRL Technical Paper 84-47 February 1985

THE 1980 YOUTH POPULATION: A VERIFICATION REPORT

By

Malcolm James Ree
Lonnie D. Valentine, Jr.
James A. Earles

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235-5000

Reviewed by

Malcolm James Ree
Chief, Enlisted Selection and Classification Function

Submitted for publication by

Lonnie D. Valentine, Jr.
Chief, Force Acquisition Branch

This publication is primarily a working paper.
It is published solely to document work performed.

SUMMARY

An investigation was conducted to verify the results of a report written by the Center for Naval Analyses (CNA) on the proposed adoption of the 1980 Youth Population as a new norming reference for scores for the Armed Services Vocational Aptitude Battery (ASVAB). This verification was conducted primarily to provide Air Force personnel and manpower planners with information on the general implications of switching to a new normative score scale. The approach used was to replicate the CNA analyses to confirm results relevant to the Air Force and to provide a comparison of the 1980 score scale generated under operational procedures with the 1944 score scale. The data base for the analyses was test scores for 9,173 males and females contained in the 1980 youth sample who were administered Form 8a of the ASVAB. Comparisons were made between the 1980 and 1944 (operational) score scales for all subjects, for males only, and for females only. Comparisons were made for the Armed Forces Qualification Test (AFQT) and the four Air Force selection and classification composite scores. Results indicated that there were numerous implications pertaining to the AFQT. Using the 1980 reference population for establishing AFQT mental category boundaries will have substantial impact on the number of applicants classified as Category I or II and may require changes to operational procedures in the Air Force. Although the use of the 1980 reference population and adjusting cut-off scores will have a negligible effect on three of the four composites, it will have a substantial impact on the Mechanical aptitude composite. Recomputation of the CNA analyses indicated that frequency distributions and percentages were essentially correct although the CNA computations were not based on operational procedures. Other issues addressed in the technical, operational, and organizational realms resulted in a recommendation that other organizations affected by this decision (e.g., Air Training Command, Air Force Manpower and Personnel Center) should be given the opportunity to review and evaluate the impact resulting from the selection of a new reference population.

DTIC
ELECTE
MAY 17 1985
S D
B

Accession For
NTIS GRA&I
A-1

DTIC
COPY
INSPECTED
3

PREFACE

This study was completed at the request of the Director of Laboratories (AFSC/DLS). It was accomplished under Project 7719, "Development and Validation of Selection Methodologies" and executed as part of AFHRL's responsibility to provide technical information to aid policy decisions regarding selection and classification.

An effort such as this, although under the direction of an individual, can be accomplished only through cooperating efforts of a group of people. The authors wish to express their appreciation to Col J. P. Amor, Dr. N. Guinn, and Dr. W. Alley for guidance during the editing process. Their contribution enhanced this paper and helped produce a finished product.

A special debt is owed to the Technical Services Division, which put aside all usual practices and most other work to provide rapid computer programming and processing. Instrumental in this effort were Mr. J. Souter and Mr. J. Brazel. Exceptional efforts and results were also produced by AICs Hayes, Hodge, Martin, and Witek. Mr. W. Glasscock and Airman Stieg, as auditors, served to expedite and ensure the quality of the analyses. Without all these people, the effort could not have been accomplished.

Finally, a special thanks is offered to Dr. Milt Maier and Dr. Bill Sims of the Center for Naval Analyses for their assistance. Without their cooperation, replication of the CNA analyses would not have been possible.

NOTE

This document verifies a Center for Naval Analyses report addressing use of 1980 Youth Population data as the normative base for the Armed Services Vocational Aptitude Battery (ASVAB). This verification was conducted primarily to provide Air Force personnel and manpower planners with information on the general implications of switching to a new normative score scale. The results were provided to Air Force in late 1982. Between the completion of this paper and the implementation of the 1980 Score Scale, anomalous performance on the speeded subtests of the ASVAB was detected. The source of the anomaly was traced to the use of non-standard answer sheets during the original norming study. This laboratory corrected the anomaly and provided corrected conversion tables for all Air Force composites and the Armed Forces Qualification Test (AFQT). The correction is reported in The 1980 Youth Population: Correcting the Speeded Subtests (Wegner and Ree, 1984). The tables presented in this paper reflect the results of this initial verification study and they should not be considered final operational tables. The general implications associated with switching score scales for Air Force manpower planners remained unaffected by the answer sheet anomaly.

TABLE OF CONTENTS

	Page
I. Introduction	7
II. Method	7
Subjects	7
The ASVAB	8
Analyses	9
III. Results	10
Verification of Table 1	10
Verification of Table B-1	11
Verification of Table 3	11
Verification of Table 4	13
Verification of Table 7	13
Verification of Table 9	13
Verification of Table 10	14
Verification of Table B-2	14
Verification of Table B-5	15
Verification of Table E-3	18
IV. Implications	18
AFQT	18
Selector Composites	20
V. Conclusions and Recommendations	21
References	22
Appendix A: Tables Referenced but not Reproduced in the Body of the Text	23

LIST OF TABLES

Table		Page
A	ASVAB Subtests	8
B	Air Force Composites	9
C	ASVAB-8a Means and Standard Deviations Used by Maier and Sims to Compute Standard Score for the 1944 Reference Population	10
D	AFQT Mental Category Raw Score Boundaries in the 1980 18- to 23-Year-Old Youth Population by Sex	11
E	Conversion of ASVAB-8a AFQT Raw to Percentile Scores (Based on the 1980 Youth Population)	12
F	Percentage of Weighted 1980 Youth Sample in Each 1944 Scale AFQT Category (By Sex)	13
G	Percent of 1980 Youth Sample Below Particular WWII Score Scale Points on US Air Force Composites	14

LIST OF TABLES (Cont'd)

Table		Page
H	18-23 Year Old 1980 Youth Enlistment Qualification Rate at Various Mental Category Cutoffs.	15
I	Distribution of the Weighted 1980 Youth Sample on the Mechanical AI Under Two Conversion Scales	16
J	Distribution of the Weighted 1980 Youth Sample on the Administrative AI Under Two Conversion Scales	16
K	Distribution of the Weighted 1980 Youth Sample on General AI Under Two Conversion Scales	17
L	Distribution of the Weighted 1980 Youth Sample on the Electronics AI Under Two Conversion Scales	17
M	Percent of 1980 Population Below Selected Aptitude Composite Prerequisite Scores on 1980 Scale Air Force Composite.	19
A-1	Subtest Raw Scores for WWII and 1980 Reference Population	23
A-2	Equivalent Enlistment Standards on WWII and 1980 Scales	23
A-3	Subtest Conversion Tables ASVAB 8/9/10 Conversion of Raw Test Scores to Standard Score	24
A-4	US Air Force Conversion Tables ASVAB 8/9/10 Aptitude Composite Score.	29

THE 1980 YOUTH POPULATION: A VERTIFICATION REPORT

I. INTRODUCTION

Air Force selection and classification tests have until now been tied to the score scale of the 1944 World War II mobilization population. In 1980, the Department of Defense administered the Armed Services Vocational Aptitude Battery (ASVAB) Form-8a to a representative sample of American youth. The data from this administration can be used to construct a new score scale referenced to the aptitudes of the current population of enlistment-age American youth. This paper examines the consequences of changing from the 1944 score scale to a 1980 scale.

In August 1982, the Center for Naval Analyses (CNA) published a memorandum (#82-31183; Maier & Sims, 1982) which investigated the relationship between the 1944 and 1980 scale scores. To provide information for Air Force decision making, portions of the Maier and Sims work have been duplicated in two ways. First, the procedures used by Maier and Sims were replicated to confirm their results which are relevant to the Air Force. Second, operational procedures were also executed to allow comparison of the 1980 score scale generated under operational procedures with the 1944 score scale; this was done because the computations employed by Maier and Sims in their analyses for the memorandum were not identical to operational procedures.

One way that the Maier and Sims effort differs from usual procedures is in what is termed "rounding precision." For example, the computer program used by Maier and Sims reports numbers to two decimal places, so that a cumulative percent of 3.4999 becomes 3.50, as does a cumulative percent of 3.5001. Clearly 3.5001 exceeds 3.5 and should be rounded to 4 when whole numbers are required. However, 3.4999 does not reach 3.5 and should not be rounded up to 4; yet the program used by Maier and Sims reports it as 3.50, which would round to 4 under usual rounding rules when whole numbers are used. In some instances, this created a one-score-point discrepancy in conversion tables.

A second deviation is an inconsistency in rounding rules: In some cases, values above .5 were rounded up; in others, numbers in the interval .01 through .99 were rounded down.

A third difference is their a priori adjustment of the percentile conversion table for the Armed Forces Qualification Test (AFQT) to provide a raw score conversion to specific percentile points. This is not necessarily wrong, but unadjusted percentiles are provided in this paper.

A fourth deviation is observed in the Maier and Sims memorandum. Their subtest standard scores computed for the 1980 reference population and the 1944 score scale were allowed to assume values outside the range of 20 to 80. Standard scores are constrained to the range of 20 to 80 operationally.

Some parts of the Maier and Sims memorandum are unclear and lack specificity as to exactly what procedures were used. After numerous conversations with the authors, their effort was duplicated as closely as their records and memories allow.

II. METHOD

Subjects

The subjects were 9,173 males and females born between 1957 and 1962. The 1980 youth sample contained a deliberate over-representation of Blacks, Hispanics, and economically disadvantaged

Whites in order to guarantee including their scores in the data base. Data from individuals in these classifications are frequently difficult to obtain, and without such data, the sample could not be representative. Weightings were used for each subject in the sample, in order to compensate for differences in probability of selection from the population into the sample. Application of the weights rendered the sample representative of the population of American youth in 1980.

The ASVAB

The Armed Services Vocational Aptitude Battery is a multiple-aptitude test battery composed of 10 subtests, eight of which are power subtests and two of which are speeded subtests.

Table A[1] shows the ASVAB subtests. The composition of the AFQT and the four Air Force selection and classification composites is shown in Table B.

Table A. ASVAB Subtests

Subtest	No. of Items	Power/Speed
General Science (GS)	25	Power
Arithmetic Reasoning (AR)	30	Power
Word Knowledge (WK)	35	Power
Paragraph Comprehension (PC)	15	Power
Numerical Operations (NO)	50	Speed
Coding Speed (CS)	84	Speed
Auto/Shop Information (AS)	25	Power
Mathematics Knowledge (MK)	25	Power
Mechanical Comprehension (MC)	25	Power
Electronics Information (EI)	20	Power
Verbal (VE)[a]	50	Power

[a]Verbal is the sum of the Word Knowledge and Paragraph Comprehension raw scores; verbal is used in formation of the Air Force Administrative and General composites.

[1]For the sake of clarity, tables in the body of this paper are designated by a capital letter in order to distinguish them from numerically designated tables in the Maier and Sims memorandum.

Table B. Air Force Composites

Composite	Subtests[a]
AFQT	AR+WK+PC+.5NO
M-Mechanical	2AS+MC+GS
A-Administrative	NO+CS+VE
G-General	VE+AR
E-Electronics	AR+MK+EI+GS

[a]Subtests are converted to standard scores; composites are formed from these standard scores. AFQT is an exception; it is formed from the raw scores. Operationally, AFQT is rounded up to integers.

Analyses

Using the 1980 youth population data, several weighted cumulative frequency distributions were computed to form the basis for table verification and for development of tables necessary as a basis for recommendations. Weights employed in generation of the distributions are those contained in the data file for the 1980 youth population sample; each weight indicates the number of persons in the population represented by that particular case. The weighted cumulative frequency distributions were not smoothed or interpolated. Weighted distributions generated include:

1. Raw AFQT composite score (not rounded, Raw AFQT score = WK+PC+AR .5NO; thus, one can obtain half-score-point values in the distribution, which is what Maier and Sims did). Under operational circumstances, half-point scores are rounded upwave, and this was done to the distribution which contains half-point score values in the present analysis.

2. The four Air Force subtest standard score composites (MAGE), where the subtest standard scores were computed from means and standard deviations appropriate to the World War II mobilization population (as was done by Maier and Sims). These computed values are not constrained to the range of 20 to 80.

3. The four Air Force subtest standard score composites (MAGE), with subtest standard scores based on operational conversion tables. These tabled values are constrained to the range of 20 to 80.

4. The four Air Force subtest standard score composites (MAGE), with subtest standard scores computed from means and standard deviations appropriate to the 1980 youth population; these computed values are not constrained to the range of 20 to 80.

5. The four Air Force subtest standard score composites (MAGE), with subtest standard scores based on newly constructed conversion tables; these conversion tables are based on means and standard deviations for the 1980 youth population and are constrained to standard score values in the range of 20 to 80.

Whenever score scales were generated under operational procedures, both the 1980 scale and the 1944 (operational) scale subtest standard score values were constrained to the range of 20 to 80. Scores below 20 were assigned the value of 20 and scores above 80 were assigned the value of 80, as is done in current operational procedures.

The Maier and Sims study used the subtest means and standard deviations from the weighted 1980 youth population to generate 1980 scale scores. They used subtest means and standard deviations from an initial calibration of ASVAB-8a for the 1944 scale (instead of the conversion tables in the operational manual). These means and standard deviations are given in Table C. As in the operational case, Maier and Sims rounded their standard scores to integer form.

Only tables which are of concern to the Air Force have been investigated in this paper. Tables dealing with composites or scores pertaining to the other services have not been verified.

III. RESULTS

Comparisons were made between the 1980 and the 1944 (operational) score scales for all subjects, for males only, and for females only. These comparisons were made for the AFQT and the four Air Force composites. Results were computed using the Maier and Sims method to verify the accuracy of the results reported in their memorandum. Analyses were also conducted using operational procedures. Thus, it is possible (a) to confirm the accuracy of the Maier and Sims analyses given their procedures, (b) to compare the norms for the 1944 mobilization population with norms based on the 1980 youth population as computed by Maier and Sims, and (c) to make this same comparison when norms are computed according to operational procedures for both the 1944 and 1980 reference populations.

Table C. ASVAB-8a Means and Standard Deviations used by Maier and Sims to Compute Standard Scores for the 1944 Reference Population

Subtest	Mean[a]	Standard Deviation
General Science	16.2	5.09
Arithmetic Reasoning	17.8	7.20
Word Knowledge	25.7	7.66
Paragraph Comprehension	10.5	3.44
Numerical Operations	36.0	10.39
Coding Speed	43.1	16.12
Auto/Shop Information	16.4	5.60
Mathematics Knowledge	12.5	5.95
Mechanical Comprehension	15.5	5.57
Electronics Information	12.5	4.32
Verbal[b]	36.2	10.61

[a]Number of decimal points shown as provided by Sims (Personal Communication, November 1982).

[b]Verbal is the sum of Word Knowledge and Paragraph Comprehension.

Verification of Table 1

The data in Table 1 of the Maier and Sims memorandum have been recomputed and verified to be correct except where noted. These data were computed for the total sample, and for males and females separately. The AFHRL computed values are presented in Table D. Where the Maier and Sims data deviate from these computations, their values are noted in parentheses next to the true values.

Table D[a]. AFQT Mental Category Raw Score Boundaries in the 1980 18- to 23-Year-Old Youth Population by Sex

AFQT Category	Raw Score Boundaries Based on: Males	Females	Total
V	0-38(39)	0-42	0-40
IVC	(40)39-47	43-49(50)	41-48
IVB	48-53	(51)50-55	49-54
IVA	54-63	56-63	55-63
IIIB	64-77	64-75	64-76
IIIA	78-84(85)	76-82	77-83
IIB	(86)85-92	83-91	84-92
IIA	93-98	92-97	93-97
I	99-105	98-105	98-105

[a]Table D is Table 1 in the Maier and Sims memorandum.

Verification of Table B-1

Verification of the ASVAB-8a AFQT raw-to-percentile score conversion table based on the 1980 youth population is presented in Table E. This was Table B-1 in the Maier and Sims memorandum. This is potentially the single most important table in their memorandum, as it is used by all services. Mental categories based on AFQT scores are reported annually to the Congress. A number of minor deviations and typographical errors were found in the Maier and Sims table. The correct version of their Table B-1 is presented in Table E. The Maier and Sims values are presented in parentheses next to the corrected values. Note values in parentheses next to the raw score column; these numbers represent typographical errors in the Maier and Sims table. The deviations in the "Percentile Score" column are one point in magnitude and are of no significant importance.

Verification of Table 3

Table F shows the percentage of the weighted 1980 youth sample within each AFQT mental category, as defined by the 1944 mobilization population. It also presents World War II Mental Category distributions for comparison purposes. This was Table 3 in the Maier and Sims memorandum. Their Table 3 was recomputed and a few deviations were observed. The corrected table is presented below with the disparate values reported by Maier and Sims shown in parentheses.

Table E[a]. Conversion of ASVAB-8a AFQT Raw to Percentile Scores (Based on the 1980 Youth Population)

AFQT Raw Score	Percentile Score	AFQT Raw Score	Percentile Score
0-20	1	63 (62)	30
21	1	64 (63)	31
22	1	65 (64)	32
23	2	66 (65)	34
24	2	67 (66)	36
25	2	68 (67)	37
26	3	69 (68)	38
27	3	70 (69)	40
28	3	71 (70)	42 (41)
29	4	72 (71)	43
30	4	73 (72)	45
31	5 (4)	74 (73)	46
32	5	75 (74)	48
33	5	76 (75)	49
34	6	77 (76)	51 (50)
35	6	78 (77)	53 (52)
36	7	79 (78)	55 (54)
37	7	80	56
38	8	81	59 (58)
39	9	82	61
40	9	83	63
41	10	84	65
42	11	85	67
43	11	86	69
44	12	87	71
45	13	88	73
46	14	89	75
47	14	90	77
48	15	91	79
49	16	92	81
50	16	93	83
51	17	94	85
52	19 (18)	95	87
53	19	96	89
54	20	97	91
55	21	98	93
56 (55)	22	99	94
57 (56)	23	100	96
58 (57)	24	101	97
59 (58)	25	102	98
60 (59)	26	103	99
61 (60)	27	104	99
62 (61)	28 (29)	105	99

[a]Table E is Table B-1 in the Maier and Sims memorandum.

Table F[a]. Percentage of Weighted 1980 Youth Sample in Each 1944 Scale AFQT Category (By Sex)

AFQT Category	Percentile Score Range	1980 Sample Males	1980 Sample Females	1980 Sample Total	WWII Population
I	93-99 (100)	5	4	4	8
II	65-92	35 (34)	31	33	28
III	31-64	29 (30)	34	32	34
IV	10-30	23	25 (24)	24	21
V	1-9	8	6 (7)	7	9
I+II	65-99 (100)	40 (39)	35	37	36
I+II+IIIA	50-99 (100)	54	51	53 (52)	51
IV+V	1-30	31	31	31	30

[a]Table F is Table 3 in the Maier and Sims memorandum.

Verification of Table 4

Table 4 in the Maier and Sims memorandum reports ASVAB-8a subtest means and standard deviations for the World War II population and for the weighted 1980 youth sample. Table 4 used data from a previous study for the columns marked "WWII." These raw data were not available and the values could not be recomputed. The columns marked "1980" have been recomputed and have been found to be accurate. This and other tables in which no discrepancies were noted are contained in Table A-1 in Appendix A.

Verification of Table 7

The Maier and Sims Table 7 (presented as Table G here) has been recomputed by the method they used. The table also has been recomputed using operational procedures, and only minor deviations have been noted. The values recomputed by operational procedures are displayed in Table G; the discrepant Maier and Sims values are displayed in parentheses.

Verification of Table 9

Table 9 in the Maier and Sims memorandum identifies, for weighted 1980 youth sample-based conversions, the AFQT and sum of MAGE values which equate to current Air Force enlistment standards as defined by the World War II (WWII) score scale. The Maier and Sims results have been verified as correct. The table is contained in Appendix A as Table A-2. It suffices here to observe that an AFQT percentile 31 on the 1944 scale equals a percentile 32 on the 1980 scale, and percentile 65 on the 1944 scale equals percentile 65 on the 1980 scale. A MAGE sum of 120 on the 1944 scale equals a MAGE sum of 130 on the 1980 scale.

Table G[a]. Percent of 1980 Youth Sample Below Particular WWII Score Scale Points on US Air Force Composites

Score on WWII Scale	Cumulative Percent of 1980 Youth Sample			
	Mechanical AI	Administrative AI	General AI	Electronics AI
30	44	32	30	33 (34)
40	57	41 (42)	39	43
50	67	51	47	51
60	76	62	60	62
70	82	72	70	71 (72)
80	89	81	78	80

[a]Table G is Table 7 in the Maier and Sims memorandum.

Verification of Table 10

Table 10 in the Maier and Sims memorandum compares two alternate ways of defining AFQT percentiles and mental categories through use of the 1980 youth population data. All data in this table have been recomputed and verified as correct, except that 100 is listed as the maximum percentile value when it should be 99.

The first way of defining percentiles, labeled "Constant Percentile Score" in Table 10, bases the percentile conversions directly on the weighted 1980 youth sample's distribution without reference to the older standard. It assigns to mental categories the same percentile cut-offs that have always been used (e.g., percentile rank 93 and above constitutes mental category I). This alternative is a clear break from the World War II base.

The second way of defining percentiles and mental categories, labeled "Constant Expected Performance" in the Maier and Sims Table 10, bases the percentiles directly on performance in the weighted 1980 youth sample, but adjusts mental category boundaries to maintain categories linked to the World War II population (e.g., the mental category I boundary would become 97 and above, rather than 93 and above; this would place 4 percent of 1980 youth in category I under both the 1980 and the 1944 percentile categorization).

The difference in enlistment qualification rates among these alternatives and the 1944 scale are summarized in Table H. Note that the WWII Scale and the 1980 Constant Performance columns yield identical cumulative distributions; this is because the 1980 constant performance mental category percentile boundaries are changed to achieve this end.

It can be seen from this table that the only point at which choice among the three conditions makes any appreciable difference is at the boundary between category I and category II.

Verification of Table B-2

Table B-2 in the Maier and Sims memorandum provides the proper raw score to standard score conversion table for ASVAB-8a subtests if conversions are to be based on the weighted 1980 youth sample. Their Table B-2 has been verified and is correct. It should be noted that this table was not used to compute any other values in the memorandum. However, this table is a very crucial one since it is the proper table for conversion of subtest raw scores to standard scores if the 1980 youth population is adopted as the normative reference for the enlistment test battery. This table is contained in Appendix A as Table A-3.

Table H[a]. 18- to 23-Year-Old 1980 Youth Enlistment Qualification Rate at Various Mental Category Cut-Offs

AFQT Mental Category	Cumulative Percent of Weighted 1980 Youth Sample		
	WWII Scale	1980 Constant Percentile	1980 Constant Performance
I	4	9	4
IIA	19	19	19
IIB	37	37	37
IIIA	52	51	52
IIIB	69	70	69
IVA	79	80	79
IVB	85	85	85
IVC	93	91	93
V	100	100	100

[a]Table H is Table 10 in the Maier and Sims memorandum.

Verification of Table B-5

The Maier and Sims Table B-5 provides the basic for conversion of Air Force aptitude composites (computed from subtest standard scores) to their Air Force percentile equivalents based on the weighted 1980 youth sample. Table B-5 contains correct values, but for several *one-point deviations* when computed by the Maier and Sims method. There are also two typographical errors. These occur in the columns for the General and Electronics Aptitude Indexes (AIs). First, for the General AI, the Air Force percentile score 85 is listed twice; the second entry should be 90. For the Electronics AI, in the column "SSS" the values "211-206" should be "211-216." Recomputation of this table by operational procedures resulted in no other changes in the values and the table is contained in Appendix A as Table A-4.

Tables I, J, K, and L display the impact on Air Force Aptitude Indexes of changing from the 1944 mobilization population to the 1980 youth population as the normative reference for ASVAB. For each of the four AIs, these tables (based on equipercentile equatings) provide cumulative distributions of the weighted 1980 youth sample under the (present) 1944 scale and under the (proposed) 1980 scale.

Note that changing to the 1980 youth population as a reference makes very little difference in disqualification rates at frequently used AI cut-offs on the Administrative, General, and Electronics AIs. However, there is a significantly large difference in disqualification rates between the two scales for the Mechanical AI. A percentile 40 on the present Mechanical AI would be approximately equal to a percentile 55 on the 1980 scale, and a 50 on the present scale would be approximately 70 on the 1980 scale. Mechanical AI percentiles 40 and 50 on the present scale are the cut-offs for virtually all mechanical specialties.

Table I. Distribution of the Weighted 1980 Youth Sample on the Mechanical AI Under Two Conversion Scales

Mechanical AI	1980 Youth Cumulative Percentage 1944 Scale	1980 Scale
01	2	4
05	8	9
10	16	14
15	25	19
20	34	24
25	42	29
30	50	34
35	56	39
40	61	44
45	67	49
50	72	54
55	75	59
60	80	64
65	81	69
70	85	74
75	88	79
80	92	84
85	96	89
90	99	94
95	99	99

Table J. Distribution of the Weighted 1980 Youth Sample on the Administrative AI Under Two Conversion Scales

Administrative AI	1980 Youth Cumulative Percentage 1944 Scale	1980 Scale
01	3	4
05	7	9
10	12	14
15	19	19
20	24	24
25	31	29
30	36	34
35	41	39
40	44	44
45	49	49
50	55	54
55	60	59
60	65	64
65	71	69
70	76	74
75	80	79
80	87	84
85	93	89
90	98	94
95	99	99

Table K. Distribution of the Weighted 1980 Youth Sample on the General AI Under Two Conversion Scales

General AI	1980 Youth Cumulative Percentage 1944 Scale	1980 Scale
01	3	4
05	6	9
10	12	14
15	18	19
20	23	24
25	29	29
30	34	34
35	37	39
40	42	44
45	46	49
50	51	54
55	57	59
60	61	64
65	67	69
70	71	74
75	76	79
80	84	84
85	89	89
90	96	94
95	99	99

Table L. Distribution of the Weighted 1980 Youth Sample on the Electronics AI Under Two Conversion Scales

Electronics AI	1980 Youth Cumulative Percentage 1944 Scale	1980 Scale
01	2	4
05	7	9
10	13	14
15	21	19
20	27	24
25	33	29
30	39	34
35	42	39
40	45	44
45	51	49
50	56	54
55	62	59
60	66	64
65	71	69
70	76	74
75	79	79
80	86	84
85	93	89
90	98	94
95	99	99

A large proportion of the Mechanical AI distributional difference between the two scales is attributable to the inclusion of females in the 1980 youth sample. Because males generally achieve lower scores on mechanical measures than females, their inclusion in the reference population altered the Mechanical AI metric. No decrement in scores was found when the distribution of the Mechanical AI was computed for males alone.

Verification of Table E-3

Table M (Maier and Sims Table E-3) shows the cumulative percentage of the 1980 sample that scored below a selected set of decile cut-off percentiles based on both the 1980 scale and the 1944 scale. Using the Maier and Sims method, but with greater rounding accuracy, 11 one-point changes were found. Corrected values are reported in the table and deviant Maier and Sims values are presented in parentheses.

IV. IMPLICATIONS

The implications of shifting from the 1944 population base to the 1980 population base for service test calibration are numerous. There are a series of implications pertaining to the AFQT, relatively few for the Air Force A, G, and E composites, but many for the M composite. The issues focus on the technical, operational, and organizational concerns which result from adopting the new population base.

AFQT

The two options concerning the AFQT are either to retain the 1944 population or to adopt the 1980 population as a calibration reference standard (constant percentiles).

1. Option 1. Retaining the 1944 population base means that no changes would be made and the status quo would be maintained. This implies no change in regulations, recruiting, training, and retraining activities since the scores would retain their same meaning. But it further means that since the 1944 population contained no females, they will continue to be unrepresented in determining the meaning of a percentile score. Finally, this option is in opposition to the recommendation of the Defense Advisory Committee on Military Personnel Testing.

2. Option 2. Changing to the 1980 population as the calibration standard requires consideration of the effects on the AFQT mental category boundaries. Mental categories are defined in terms of percentile cut-offs on the distributions of abilities in a population (Category I = top 8%; Category II = next 28%, etc.). Traditionally, the mental category cut-offs have been referenced to the abilities in the WWII population. In those terms, only 4% of the 1980 youth population achieved scores which are designated Category I. Should the mental categories as defined above now be referenced to the distribution of abilities in the 1980 population, this would, by definition, result in 8% of the 1980 population achieving scores designated as Category I-thereby creating an illusion of increased quality to those unaware of the change in reference base for the mental category definition. Due to a perceived doubling in Category I personnel, the increase must be carefully explained to those monitoring the number of military accessions by AFQT category, to avoid misinterpretation. There would also be a compensating decrease in the number of Category II youth with the total numbers of youths in Categories I and II remaining unchanged. The number of youths in all other categories would remain about the same.

Table M[a]. Percent of 1980 Population Below Selected Aptitude Composite Prerequisite Scores on 1980 Scale Air Force Composites

Aptitude Composite	Percent of 1980 population below score of: 20 Scale 1980	20 Scale WWII	30 Scale 1980	30 Scale WWII	40 Scale 1980	40 Scale WWII	50 Scale 1980	50 Scale WWII	60 Scale 1980	60 Scale WWII	70 Scale 1980	70 Scale WWII	80 Scale 1980	80 Scale WWII
Males and Females														
M	19	25	29	43	38	56	50	66	59	75	69	81	80	89
A	20	19	29	30	39	40	49	50	59	61	69	70	79	80
G	19	18	30(29)	28	39	37	49	45(46)	59	59	69	68	80	76(77)
E	19	21	30	33	40	42	50	51	60	61	70	71	80	80
Males														
M	12	15	17	25	22	34	30	44	37	55	47	65	63	78
A	24	23	34	35	44	45	55	55	64	66	74	76	83	84
G	19	18	29(28)	28	36	35	46	42	55	54(55)	65	64	76	73
E	16	17	24	26	32	34	41	42(43)	51	53	61	62(63)	72	72
Females														
M	26	35	41	62	55	79	70	89	83	96	91	98	97	99
A	16	15	25	26	34	35	43	44	53	55	63	65	75	76
G	19	18	31(29)	29	42	39	53	49	63	63	74	73	83	80
E	23	24(25)	36	39(40)	47	50	58	59	69(70)	70	79	80	88	87

[a]Table M is Table E-3 in the Maier and Sims memorandum.

If the 1980 population is adopted as the AFQT calibration reference, other implications are evident. First, all Air Force systems tied to AFQT percentile scores (such as the Person-Job Match (PJM)) would require changes. Historical continuity on service accessions' AFQT performance would be lost (but could be retained if conversion tables are supplied for analytic purposes). Adoption of the 1980 youth population as the test calibration reference would return the mental categories to their original (1944) distribution in terms of the current youth population. There would be an immediate doubling of the available number of Category I youths for enlistment. This doubling might appear suspect to the Congress and certainly has implications for the Recruiting Service. The Air Force could be in a poor position relative to the other services in competition for recruiting resources if too many of Air Force recruits are classified as Category I.

Additionally, the Air Force has historically been accused of "skimming" the high-quality recruits from the enlistment-eligible pool at the expense of the other services. Should the apparent number of Category I recruits double, the Air Force could become vulnerable to a resurgence of this kind of criticism and face unknown consequences in budgetary competition for recruiting resources.

Selector Composites

There are three options concerning adoption of the 1980 youth population as the calibration reference for the Air Force Selector Composites:

1. Retain the 1944 population, with no change in operational procedures.

2. Adopt the 1980 population and adjust M, A, G, and E qualification cut-off scores to retain expected performance relative to the 1944 scores.

3. Adopt the 1980 population, without adjusting M, A, G, and E qualification percentile cut-offs.

1. Option 1. Retaining the 1944 population base means no changes will be made. This implies no changes in regulations, recruiting, training, and retraining, as the scores retain their meaning. It further means that females will continue to be unrepresented in determining the meaning of percentile scores on aptitude indexes. Based on conversations with representatives of other services, it is expected that none of the other services will select the option to retain the 1944 population for their aptitude indexes. If only the Air Force fails to adopt the 1980 population, this policy may be subject to review and criticism. However, retaining the 1944 population as a calibration reference for the AIs is not likely to lead to a disadvantage relative to the other services in acquiring high-quality recruits for technical training.

2. Option 2. Adopting the 1980 population as a reference and adjusting qualification cut-offs to maintain present expected technical school training performance has numerous implications, due primarily to differences between the 1944 and 1980 scales in the distribution of scores on the Mechanical AI. Differences in score distributions for the A, G, and E composites based on the 1944 population and the 1980 population are minor, and use of present technical training school cut-offs would have negligible effect on the number of qualified individuals. Consequently, changes in qualification cut-offs on these AIs would not be necessary. However, qualification cut-offs for the Mechanical AI will have to be raised by as much as 15 points to remain equivalent to present standards. The new Mechanical AI standards for recruiting will appear to be higher than they presently are when, in fact, they have been changed

only to remain equivalent. AFR 39-1, which states qualification standards, will have to be revised and reissued. The Person-Job Match system will also have to be revised to accommodate the changed score requirements. Other systems requiring use of the Mechanical AI scores may have to be revised or reaccomplished as well. Systems of records will require revision, and when retraining or reenlistment is considered, it could become necessary to retest personnel with ASVAB reenlistment scores given prior to October 1, 1980. Longitudinal investigations may be less accurate because of the necessity of estimating Mechanical AI scores on the 1980 scale for scores derived prior to October 1, 1980. Additionally, this would be the second major change to the score scale in 3 years. However, since it would be accomplished in conjunction with the implementation of a new test, it may be more readily accepted in the Air Force personnel and training community. Adopting Option 2 would also have the following implications. The 1980 population was carefully selected and is more representative of the population of American youth than was the 1944 population. For the first time, females were included in the reference population. Recruiting problems should not increase, since inherent aptitude qualifications would remain unchanged. In fact, management decisions for recruiting could be enhanced by knowledge of the relative standing of recruits in the current enlistment age population. No training problems attributable to the change in test calibration reference population are expected. Choosing Option 2 (i.e., adjusting cut-offs to maintain present performance) does not leave the Air Force at a disadvantage relative to the other services in recruiting high-quality enlistees, regardless of the option chosen by the other services.

Option 3. Accepting Option 3 means adopting the 1980 population but not adjusting qualification scores to keep expected performance constant. This particular option has serious implications for the classification of recruits on the M composite. No changes would be necessary to AFR 39-1, but the meaning of the Mechanical AI percentile scores will have changed drastically. Recruiting Service will be able to qualify more applicants (especially females) in Mechanical areas, but the recruits will be of lower true aptitude. As these recruits move into technical training, it would be expected that the failures and "wash-back" rate would increase relative to those currently experienced. This could lead to increased demands for additional technical training resources or strain existing training resources. A shortage of well-trained individuals in the mechanical field could result. As in Option 2, the systems of score records would require revision to reflect new mechanical scores. Changes in PJM would not be required, but less-qualified individuals would be assigned to mechanical specialties (as discussed above).

V. CONCLUSIONS AND RECOMMENDATIONS

1. Recomputation of the CNA analyses as they apply to Air Force scores and standards indicates that the frequency distributions and percentages are essentially correct, although their computations were not based on operational procedures. Analyses were verified by AFHRL using current operational procedures.

2. The issues from a psychometric, policy, and organizational standpoint involved in the selection of the appropriate reference population were examined, but they should be carefully reviewed prior to finalizing the Air Force position. It is recommended that other organizations affected by this decision be queried for their input (e.g., Air Training Command, Air Force Manpower and Personnel Center, etc.). The impact associated with the use of constant percentiles or constant raw score boundaries with the AFQT has also been addressed.

3. Using the 1980 reference population for establishing AFQT mental category boundaries will have substantial impact on the numbers of applicants classified as Category I or Category II and will require changes to operational procedures in the Air Force.

4. Using the 1980 reference population and adjusting the cut-off scores will have a negligible effect on the A, G, and E composites, but will have a substantial impact on the Mechanical composite, which will require extensive changes to operational procedures in the Air Force.

REFERENCES

Air Force Regulation 39-1. Airman classification regulation. Washington, D.C.: Department of the Air Force, January 1982.

Maier, M. & Sims, W. (1982). Constructing an ASVAB score scale in the 1980 reference population (Memorandum 82-3118/3). Center for Naval Analyses, Alexandria VA.

Wegner, A. G., & Ree, M. J. (1984). The 1980 youth population: Correcting the speeded subtests. Unpublished manuscript, Brooks AFB, TX: Manpower and Personnel Division, Air Force Human Resources Laboratory.

APPENDIX A: TABLES REFERENCED BUT NOT REPRODUCED IN THE BODY OF THE TEXT

Table A-1[a]. Subtest Raw Scores for WWII and 1980 Reference Populations

	Mean		Standard Deviation	
ASVAB Subtest	WWII	1980	WWII	1980
General Science	16.2	16.0	5.09	5.01
Arithmetic Reasoning	17.8	18.0	7.20	7.37
Word Knowledge	25.7	26.3	7.66	7.71
Paragraph Comprehension	10.5	11.0	3.44	3.36
Numerical Operations	36.0	34.5	10.39	10.99
Coding Speed	43.1	46.3	16.12	16.25
Auto/Shop Information	16.4	14.3	5.60	5.55
Mathmatics Knowledge	12.5	13.6	5.95	6.39
Mechanical Comprehension	15.5	14.2	5.57	5.35
Electronics Information	12.5	11.6	4.32	4.24
Verbal[b]	36.2	37.3	10.61	10.60

[a]Table A-1 is Table 4 in the Maier and Sims memorandum.

[b]Verbal is combination of Word Knowledge and Paragraph Comprehension subtests (i.e., 36.2 (WWII) = 25.7 + 10.5).

Table A-2[a]. Equivalent Enlistment Standards on WWII and 1980 Scales

		Enlistment Standards			
		High School Graduate		Not-High School Graduate	
Service	Variable	WW II Scale	1980 Scale	WWII Scale	1980 Scale
Army	AFQT	16	16	31	32
	Aptitude Composite	85	89[b]	85	89
Navy	AFQT	17	17	38	38
Air Force	AFQT	31	32	65	65
	MAGE Composite[c]	120	130	120	130
Marine Corps	AFQT	21	22	31	32
	General Technical Composite	80	81	95	96

[a]Table A-2 is Table 9 in the Maier and Sims memorandum.

[b]Average equivalent score on Army composite.

[c]Sum of four composites (Mechanical, Administrative, General, Electronics).

Table A-3[a]. Subtest Conversion Tables ASVAB 8/9/10 Conversion of Raw Test Scores to Standard Scores

RAW	GS	AR	WR	PC	NO	CS	RAW
0	20	26	20	20	20	22	0
1	20	27	20	20	20	22	1
2	22	28	20	23	20	23	2
3	24	30	20	26	21	23	3
4	26	31	21	29	22	24	4
5	28	32	22	32	23	25	5
6	30	34	24	35	24	25	6
7	32	35	25	38	25	26	7
8	34	36	26	41	26	26	8
9	36	38	28	44	27	27	9
10	38	39	29	47	28	28	10
11	40	40	30	50	29	28	11
12	42	42	31	53	30	29	12
13	44	43	33	56	30	30	13
14	46	45	34	59	31	30	14
15	48	46	35	62	32	31	15
16	50	47	37		33	31	16
17	52	49	38		34	32	17
18	54	50	39		35	33	18
19	56	51	41		36	33	19
20	58	53	42		37	34	20
21	60	54	43		38	34	21
22	62	55	44		39	35	22
23	64	57	46		40	36	23
24	66	58	47		40	36	24
25	68	59	48		41	37	25
26	61	50			42	38	26
27		62	51		43	38	27
28		64	52		44	39	28
29		65	54		45	39	29
30		66	55		46	40	30
31			56		47	41	31
32			57		48	41	32
33			59		49	42	33
34			60		50	42	34

[a]Table A-3 is Table B-2 in the Maier and Sims memorandum.

Table A-3[a] (continued)

RAW	GS	AR	WR	PC	NO	CS	RAW
35			61		50	43	35
36					51	44	36
37					52	44	37
38					53	45	38
39					54	46	39
40					55	46	40
41					56	47	41
42					57	47	42
43					58	48	43
44					59	49	44
45					60	49	45
46					60	50	46
47					61	50	47
48					62	51	48
49					63	52	49
50					64	52	50
51						53	51
52						54	52
53						54	53
54						55	54
55						55	55
56						56	56
57						57	57
58						57	58
59						58	59
60						58	60
61						59	61
62						60	62
63						60	63
64						61	64
65						62	65
66						62	66
67						63	67
68						63	68
69						64	69

[a]Table A-3 is Table B-2 in the Maier and Sims memorandum.

Table A-3[a] (continued)

RAW	GS	AR	WR	PC	NO	CS	RAW
70						65	70
71						65	71
72						66	72
73						66	73
74						67	74
75						68	75
76						68	76
77						69	77
78						70	78
79						70	79
80						71	80
81						71	81
82						72	82
83						73	83
84						73	84

[a]Table A-3 is Table B-2 in the Maier and Sims memorandum.

Table A-3[a] (continued)

RAW	AS	MR	MC	EI	VE	RAW
0	24	29	24	23	20	0
1	26	30	25	25	20	1
2	28	32	27	27	20	2
3	30	33	29	30	20	3
4	31	35	31	32	20	4
5	33	37	33	34	20	5
6	35	38	35	37	20	6
7	37	40	37	39	21	7
8	39	41	38	42	22	8
9	40	43	40	44	23	9
10	42	44	42	46	24	10
11	44	46	44	49	25	11
12	46	48	46	51	26	12
13	48	49	48	53	27	13
14	49	51	50	56	28	14
15	51	52	52	58	29	15
16	53	54	53	60	30	16
17	55	55	55	63	31	17
18	57	57	57	65	32	18
19	58	58	59	68	33	19
20	60	60	61	70	34	20
21	62	62	63		35	21
22	64	63	65		36	22
23	66	65	67		37	23
24	67	66	68		37	24
25	69	68	70		38	25
26					39	26
27					40	27
28					41	28
29					44	29
30					43	30
31					44	31
32					45	32
33					46	33
34					47	34

[a]Table A-3 is Table B-2 in the Maier and Sims memorandum.

Table A-3[a] (concluded)

RAW	AS	MR	MC	EI	VE	RAW
35					48	35
36					49	36
37					50	37
38					51	38
39					52	39
40					53	40
41					54	41
42					54	42
43					55	43
44					56	44
45					57	45
46					58	46
47					59	47
48					60	48
49					61	49
50					62	50

[a]Table A-3 is Table B-2 in the Maier and Sims memorandum.

Table A-4[a]. U.S. Air Force Conversion Tables ASVAB 8/9/10
Aptitude Composite Scores

Mechanical Aptitude Index		Administrative Aptitude Index		General Aptitude Index		Electronic Aptitude Index	
SSS	AI	SSS	AI	SSS	AI	SSS	AI
90-140	1	56- 97	1	41-65	1	96-142	1
141-151	5	98-111	5	66-71	5	143-151	5
152-159	10	112-121	10	72-77	10	152-158	10
160-165	15	122-129	15	78-81	15	159-165	15
166-171	20	130-134	20	82-86	20	166-171	20
172-177	25	135-139	25	87-90(89)	25	172-177	25
178-183	30	140-143	30	(90)91-93	30	178-183	30
184-187	35	144-147	35	94-96	35	184-188	35
188-193	40	148-150	40	97-99	40	189-193	40
194-198	45	151-153	45	100-102	45	194-199	45
199-203	50	154-156	50	103-105(104)	50	200-204	50
204-209	55	157-159	55	(105)106-107	55	205-210	55
210-214	60	160-162	60	108-109	60	211-216(206)	60
215-220	65	163-165	65	110-112	65	217-222	65
221-228(227)	70	166-168	70	113-114	70	223-228(227)	70
(228)229-234(233)	75	169-171	75	115-117	75	(228)229-234	75
(232)233-240	80	172-175	80	118-119	80	235-240	80
241-248	85	176-179	85	120-122	85	241-247	85
249-258	90	180-184	90	123-124	90(85)	248-255	90
259-276	95	185-199	95	125-128	95	256-272	95

[a]Table A-4 is Table B-5 in the Maier and Sims memorandum. Correct values are tabled; values enclosed in parentheses were in error in the original.

END

FILMED

6-85

DTIC