

AD A 053628

AD NO.

Ľ



NPRDC TR 78-16

April 1978

PROJECTIONS OF THE U.S. POPULATION OF 18-YEAR-OLD MALES IN THE POST-1993 PERIOD

> J. Borack M. Govindan

Reviewed by J. Silverman

AUGESSION IN		
8715	White Sacttan	>
90C	Butt Section	0
RATHOMOR	3	D
ANTE LATER	ñ	
07	S/ATABABILITT	
en Distriction Biol.	S/ASAHABILITY CO	
er alaisisinsiina Blai,	S/ATAHABILITY O	
er alsisiestie Elas,	S/AFAHABILITY O	••• 14
er ansisiestie Bias. A. I	S/ATAHABILITY O	••

Approved by James J. Regan Technical Director



Navy Personnel Research and Development Center San Diego, California 92152

DISTRIBUTION STATEMENT A

Approved for public release; Distribution Unlimited

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
. REPORT NUMBER 2. GOVT ACCES	SION NO. 3. RECIPIENT'S CATALOG NUMBER
NPRDC-TR -78-16	notes and Indonesian altragave
TITLE (and Subditio) PROJECTIONS OF THE U.S. POPULATION OF 18-YEA	R- CH TYPE OF REPORT & PERIOD COVER
OLD MALES IN THE POST-1993 PERIOD	(Final repton
	6. PERFORMING DREAPORT NUMBE
AUTHORA	. CONTRACT OR GRANT NUMBER(+)
Jules /Borack	
Marshall Govindan	
PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TA AREA & WORKUNIT NUMBERS
Navy Personnel Research and Development Cent San Diego, California 92152 (Code 303)	63707N
San Diego, Galiloinia 52152 (Code 505)	20109-PN.02
· CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE
Navy Personnel Research and Development Cent	er 13. NUMBER OF PAGES
San Diego, California 52152 (Code 505)	32 38 CUBITY CLASS (of this cherry)
MONITORING AGENCY NAME & ADDRESS(IT different from Controlling	UNCLASSIFIED
17 OID 9 PN	
	SCHEDULE
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, 11 dif	ilimited.
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, 11 dif	nlimited.
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, is different entered in Block 20, i	Iterent from Report)
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, 11 dif 8. SUPPLEMENTARY NOTES	ilimited.
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, ii dif 8. SUPPLEMENTARY NOTES	ilimited.
Approved for public release; distribution un D. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, ii dif B. SUPPLEMENTARY NOTES	ilimited.
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the abstract entered in Block 20, ii dif SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse aide if necessary and identify by block	t number)
Approved for public release; distribution un Distribution STATEMENT (of the obstract entered in Block 20, is dis SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse aldo if necessary and identify by block Population Projections Mandower Supply Forecasting	Iterent from Report)
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, ii difference 5. SUPPLEMENTARY NOTES 6. SUPPLEMENTARY NOTES 6. KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend	t number)
Approved for public release; distribution un 7. DISTRIBUTION STATEMENT (of the obstract entered in Block 20, is dis 8. SUPPLEMENTARY NOTES 9. KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend	Iterent from Report)
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, ii difference Supplementary notes KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend	Inimited.
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, is dis SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend MASSTRACT (Continue on reverse side if necessary and identify by block With the advent of the all-volunteer force	nlimited. Norent from Report) k number) k number) e, it is necessary to estimate to
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, ii difference SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend NASSTRACT (Continue on reverse side If necessary and identify by block With the advent of the all-volunteer force long-term supply of individuals available for ability to meet future manpower requirements.	t number) k number) k number) k number to estimate to military service to determine of Planners must be able to forect
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, is dis SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend ASSTRACT (Continue on reverse side if necessary and identify by block With the advent of the all-volunteer force long-term supply of individuals available for bility to meet future manpower requirements. both the size and composition of manpower supp	Interest from Report) (remotor) a, it is necessary to estimate to military service to determine o Planners must be able to forec ply because of the lead time necessary
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract entered in Block 20, is dis- SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse alde if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend MOSTRACT (Continue on reverse alde if necessary and identify by block With the advent of the all-volunteer force ong-term supply of individuals available for bility to meet future manpower requirements. Noth the size and composition of manpower supply ary to take corrective action in areas such a policies, hardware and job design, necessary of the size and top the size	<pre>hlimited. iferent from Report) k number) k number) e, it is necessary to estimate t military service to determine o Planners must be able to forec ply because of the lead time nec as recruitment strategies, train legislation. etc whenever ther </pre>
Approved for public release; distribution un DISTRIBUTION STATEMENT (of the obstract enfored in Block 20, ii difference of the abstract enformed in Block 20, ii difference of the abstract enforced in Block 20, ii difference of the abstract enforce of the Block 20, ii difference of the abstract enforce of the Block 20, ii difference of the allower of the allower of the allower force ong-term supply of individuals available for bility to meet future manpower requirements. Soft the size and composition of manpower supplerence of the size and composition of manpower supplerence of the sign, necessary in the context of the sign, necessary in the size and job design, necessary in the size and solicies, hardware and job design, necessary in the size and solicies between projected supplements.	number) remoter) e, it is necessary to estimate t military service to determine o Planners must be able to forec ply because of the lead time nec as recruitment strategies, train legislation, etc., whenever ther ply and requirements.
Approved for public release; distribution us Distribution STATEMENT (of the obstract entered in Block 20, if dis SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse olds if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend Mith the advent of the all-volunteer force ong-term supply of individuals available for bility to meet future manpower requirements. both the size and composition of manpower supply ary to take corrective action in areas such a bolicies, hardware and job design, necessary in re critical imbalances between projected supply ary to take corrective action in areas such a bolicies, hardware and job design, necessary in a critical imbalances between projected supply a critical imbalances between pr	Interest from Report) (forent from Report) (member) (a, it is necessary to estimate to military service to determine o Planners must be able to forec ply because of the lead time nec as recruitment strategies, train legislation, etc., whenever ther ply and requirements.
Approved for public release; distribution us DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if dis SUPPLEMENTARY NOTES SUPPLEMENTARY NOTES KEY WORDS (Continue on reverse side if necessary and identify by block Population Projections Manpower Supply Forecasting Asymptotic Exponential Trend Mith the advent of the all-volunteer force ong-term supply of individuals available for bility to meet future manpower requirements. Noth the size and composition of manpower supply ary to take corrective action in areas such a solicies, hardware and job design, necessary in recritical imbalances between projected supply Pronm 1473 CONTION OF 1 NOV 65 IS OBSOLETE	A number)
Approved for public release; distribution us DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if differences of the abstract entered in Block 20, if differences and iteration of the abstract of the abstract of the block of the	Internet from Report) (remoter) (a) It is necessary to estimate to military service to determine of Planners must be able to foreco ply because of the lead time necessary to estimate the necessary to estimate the necessary to estimate the necessary to estimate the necessary because of the lead time necessary because of the lead time necessary to estimate the necessary because of the lead time nec

UNCLASSIFIED

ECURITY CLASSIFICATION OF THIS PAGE(When Date Entered)

The primary manpower pool for the military is comprised of young men 17-21 years old. This report discusses a forecasting methodology based upon asymptotic exponential regression that may be utilized to obtain projections of this population in the post-1993 period. Specifically, a methodology is presented to obtain projections of the 18-year-old male population. Extension to other age groups is straightforward. Projections obtained by this methodology are compared to Bureau of the Census population projections and actual post-period estimates. The methodology is shown to be an interesting alternative to other projection techniques.

Were the advant of the distance fores, to be consulty to the original the

111

iv

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (Then Date Entered)

FOREWORD

This development was conducted in response to Navy Decision Coordination Paper, Manpower Requirements Development System (NDCP-Z0109.PN) under subproject PN.02, Long-Range Manpower Supply Forecasting. The objective of the subproject is to identify and measure those variables and interrelationships that define the national supply of manpower eligible for Navy recruitment from 5 to 25 years beyond the Five Year Defense Plan. An earlier special report (Govindan, Note 1), entitled <u>Manpower forecasting: Problems</u> in forecasting the long-range supply of military manpower, documented the findings of a literature search and led to the projection model developed herein.

Appreciation is expressed to Professor Sar Levitan and Sheldon Haber of George Washington University and to Stephen Sorensen and William J. Moonan of the Navy Personnel Research and Development Center for their helpful suggestions.

The results of this study are intended for use by hardware and manpower planning offices concerned with the long-range availability of military manpower.

J. J. CLARKIN Commanding Officer

SUMMARY

Problem

With the advent of the all-volunteer force, it is necessary to investigate the long-term supply of qualified young men and women in order to assess our ability to meet future manpower requirements. The United States Bureau of the Census has recently released projections of the number of young men between the ages of 17 and 21, the pool from which most military manpower has been drawn. These projections display substantial uncertainty after 1992; that is, after those <u>not</u> yet born reach the ages of 17-21.

Objective

The objective of this effort was to develop a methodology to provide accurate projections of the overall supply of young men for the period of substantial uncertainty; that is, to project the supply of 18-year-old males for the period 18 years and beyond the date of projection.

Approach

The population projections of future 18-year-olds obtained in this report are based upon the assumption that the yearly fertility rate pattern in the near future will exhibit behavior similar to that observed during the recent past. Specifically, a short-range asymptotic trend model based upon the number of males under 1 year old per 1000 women aged 15 to 44 was developed. This model was then utilized to project the number of males under 1 year of age for a 5- to 6-year period thereafter. Historical survival rates were then applied to these projections to obtain projections of the number of 18-year-old males 18-22 years from the date of projection.

To assess the accuracy of this technique, the parameters of the model were estimated on the basis of data derived during the period 1965-1969 and projections of the number of under 1-year-old males during the period 1970-1975 were obtained. These were compared to both the actual data for this period and to Census Bureau projections made during 1970.

Results

The short-range asymptotic trend model of males under 1 year old per 1000 women aged 15 to 44 was calculated for the years 1965-1969 and 1971-1975. Projections obtained from the 1965-1969 model over the years 1970-1975 yielded results with mean absolute error of 12 percent when compared to actual Census Bureau population estimates. This mean absolute error is smaller than that obtained when using the Census Bureau's 1970 middle (Saries C and Saries D) projections. Series C provided projections whose mean absolute error was 22 percent; and Series D, those whose mean absolute error was 13 percent.

Projections of the population based upon application of the asymptotic regression model to 1971-1975 data yield results indicating that the number of U.S. males will have declined by 27.9 percent as of 1994. This decline is projected to 23 percent in 1998, a more moderate level. These projections are more pessimistic than those offered by the Census Bureau.

Conclusions

Projections of the short-range asymptotic fertility trend model indicate that the size of the U.S. population of 18-year-old males will remain relatively low throughout the period 1994-1998. When compared with Census Bureau projections based upon low, moderate, and high fertility rate assumptions, the short-range asymptotic model yields figures that are somewhat more pessimistic for manpower planners. The difference in the results obtained by the Census Bureau and the asymptotic trend model is due to the difference in the assumptions made by each. Based upon comparisons of projections of the 1970-1975 period with actual post-period estimates, the asymptotic trend method of projection is a reasonable alternative to Bureau of the Census methodology.

Recommendations

The methodology explored in this report should be seriously considered by manpower planners and forecasters when developing projections of future qualified military manpower supply and enlistments.

a state of the second secon Second second

and a second second of second s

1.1.1

and the second second

CONTENTS

Page

INTRODUCTION	•		•		•	•	•	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	1	•	•	•	•	•	1.13	L
Problem .	•	•	•	:	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	1	L
Objective Background		:	:	:	•	:	•	•	•	•	•	•	•	•	•	•	:	•	•	•	:	:	•	:	•	•	•	:	:	•	•		
APPROACH					•					•			•		•	•			•	•	•	•			•	•		•		•	•	1.7	7
RESULTS																	1		•	-		•			•	•	•				•	1	1
Comparison Census E Projecti Projection	s l ons	Bet eau s	tl	eer Pos	n /	Asy -Po	ymj er: 4-1		ot: d 1	ic Est M	E: tin	na e	ten 18	ent s, -Y		al nd	Tr 19	ren 970 1	nd D (Pop	Pr Cer		jed 18	Bu	Lor ure	18, Bau			:ue	•1	107 (50 (50) (•)		1:	13
CONCLUSIONS		•		•	•	•	•		•	•		•	•	•	•	•				•		•		•		•		•			•	2	1
RECOMMENDATI	ON	•			•		•	•		•	•		•		•		•	•	•		•	•	•	•		•	•	•	•	•	•	2	1
REFERENCES .		•	•	•				•	•	•	•		•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	2	3
REFERENCE NO	TE	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	3
BIBLIOGRAPHY		•	•	•	•			•		•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	2	5
DISTRIBUTION	L	IS	Г			•				•				•																		2	9

Comparison burners accoul Canons Burens post-meriod antiactes and Careson Barano Carles C Padjeciona, Causas Burness Feriou B Feriactions,

discipations between actual General Surena post-parind satimates and fitted anymprovit expensatial trend corve (1971-1971)

Series II and General Series Series III: Frejections of 18-year-of main population (1984-1988)

LIST OF TABLES

Page

1.	U.S. Census Bureau Post-Period Estimates of Number of Males 1 Year Old and Number of Females Ages 15 to 44 (1970-1975)
2.	U.S. Census Bureau Projections of Number of Males Under 1 Year Old (in Thousands) (1970-1975) 12
3.	U.S. Census Bureau Projections of Number of Males Under 1 Year Old Per 1000 Women of Childbearing Age (1970-1975) 12
4.	Comparison Between Actual Post-Period Estimates, Asymptotic Exponential Trend Projections, and 1970 Census Bureau C and D Projection Series (1970-1975)
5.	Comparison Between Asymptotic Exponential Trend, Census Bureau Series II, and Census Bureau Series III Projections of Male 18-Year-Old Population
	LIST OF FIGURES
1.	Estimates (in thousands) of U.S. male population age 17 to 21, including armed forces overseas, 1975 to 2000 (from U.S. Bureau of the Census, October 1975, Tables 7-9, pp. 41-118)
2.	Actual Census Bureau estimates of number of males under 1 year of age per 1000 women of childbearing age (1965-1969) 8
3.	Comparison between actual Census Bureau post-period estimates and fitted asymptotic exponential trend curve (1965-1969)
4.	Comparison between actual Census Bureau post-period estimates and Census Bureau Series C Projections, Census Bureau Series D Projections, and Asymptotic Exponential Trend Projections (1970-1975) 15
-	

Series II	and	Census	Bureau	Set	ries	I	:11	P	roj	ecti	lon	5 0	f 1	18-	yea	ar-	-01	Ld		
male popul	latio	on (1994	4-1998)																	19

	,	
ł.	í.	

INTRODUCTION

Problem

With the advent of the all-volunteer force, it is increasingly important to be able to estimate the long-term supply of service qualified young men and women in order to assess our ability to meet future manpower requirements. Planners must be able to forecast long-range manpower supply characteristics because of the long lead time necessary for taking corrective action when critical imbalances between manpower supply and manpower needs are projected.

The United States Bureau of the Census has recently released projections of the male population for the period 1975-2050.¹ The Census Bureau projects a decline in the size of the primary military manpower supply pool (young men 17-21 years old) of approximately 27.9 percent until 1993--after which an upturn is projected. However, the Census Bureau projections of this age group display considerable uncertainty after 1992, since they include counts of individuals not yet born as of the date of projection. For example, 1975 projections of the number of 17-year-old males in 1993 include individuals unborn as of 1975.

Objective

The objective of this effort was to develop methodology to provide accurate projections of the overall supply of young men 17-21 years old for the period of substantial uncertainty--that is, beyond the point where the births of these individuals have actually occurred. This methodology will provide a basis for short-range projections into this period of greatest projection uncertainty.

Background

Census Bureau projections of the 17 to 21-year-old population are summarized in Figure 1. Note that the three projection series display substantial uncertainty after 1992; that is, after those not yet born and counted reach the ages 17 to 21. These projections are based upon explicit assumptions regarding mortality, immigration, and fertility. By far the most significant component in population change and the most difficult to predict is fertility (U.S. Bureau of the Census, October 1975, pp. 1-5). Consequently, the variability in the three projection series arises from uncertainty over assumed fertility rates in the next few years. The other two components of population change, mortality and immigration rates, have been historically very stable and are held constant in all three projection series displayed in Figure 1 (U.S. Bureau of the Census, October 1975, p. 25).

As the Census Bureau states, "population projections are 'correct' by definition (except for computational errors) because they indicate the population that would result if the underlying assumptions should turn out to be correct. Thus, without an evaluation of the assumptions, there is no basis for choosing among alternative projections" (U.S. Bureau of the Census, October 1975, p. 14).

¹U.S. Bureau of the Census, Projection of the Population of the United States 1975-2050; Current Population Reports, Series P-25, No. 601, October 1975.



The assumptions underlying the Census Bureau's projection methodology are summarized as follows:

In selecting the ultimate cohort fertility assumption for Series II, two general approaches were considered.

The first approach focuses on the long term and excludes consideration of past trends in fertility. Population growth obviously must cease at some point in the future; the difficult questions concern when this will occur, at what level, and by which path zero growth will be reached. (This does not preclude the possibility of population decline after zero growth occurs.) Although the average level of cohort fertility could differ somewhat from replacement level over an extended period of time, especially when combined with an assumption of substantial net immigration or net emigration, an ultimate assumption of fertility at replacement level appears reasonable; however, the question of when to assume that replacement level fertility is reached remains open.

The second approach focuses on fertility prospects in the near future. In this regard, survey data collected annually from 1971 through 1974 on total births expected by young wives suggest that their completed fertility will be around replacement level. Birth expectations data are subject to error and to change, and the completed fertility of these young wives could be higher or lower than indicated; however, at present, it does not appear that their fertility will differ greatly from replacement level.

In brief, the two approaches suggest that for Series II it is reasonable to assume an ultimate cohort fertility rate at the replacement level figure of 2.1 and cohort fertility around replacement level commencing with women presently in the young childbearing ages. . . The three main projection series assume that fertility rates will move smoothly toward the assumed ultimate levels. It is of course possible that fertility could reach replacement level in cohorts presently in the young childbearing ages and then fluctuate in subsequent cohorts.

The Series I and Series III assumptions reflect an attempt to provide a reasonable range around the Series II assumption. Ideally, this range would reflect a specified statistical confidence interval; however, as this is not possible, . . . the Series I, Series III assumptions can be described as "providing a one-child range that at this time appears likely to include future trends and fluctuations in fertility." The Series I assumption . . . was set further above the Series II assumption than the Series III assumption . . . was set below the Series II assumption. This choice reflects the idea that for average fertility to drop much below 2.0 births per woman, there would have to be a change in the prevailing social norm which favors at least two children per family and/or in the social and economic factors determining adherence to this norm. . . . Ideally the Series II assumption could be described as "most likely"; however, given the uncertainty about future fertility, the Series II assumption is more accurately described as appearing at this time to be a reasonable choice. (U.S. Bureau of the Census, October 1975, pp. 21-22.)

This report will develop an alternative set of assumptions that may be better suited to the short run than those of the Census Bureau and may therefore serve as the basis for more accurate projections of male 17 to 21-yearolds. These new assumptions were fostered by the following questions about the Census Bureau's assumptions.

1. Why should an ultimate assumption of fertility at replacement level in the long-term appear reasonable in the short term?

2. Why should "consideration of past trends . . . be excluded?"

3. Why is it that "population growth obviously must cease at some point in the future?"

4. Why is so much faith put in fertility <u>expectations</u> of surveyed women and none in the past trend of <u>actual</u> fertility behavior?

Govindan (Note 1) included a search of the literature regarding the determinants of fertility, methods for its projection, and data availability. The search indicated that:

1. With regard to the determinants of fertility, we do not as yet have a theory, either economic or sociological, that can explain changes in fertility trend. We do know that:

a. The effect of income on fertility has not been found to be consistently negative nor positive nor of much magnitude in either direction.

b. Major fertility changes do not appear to be influenced by business cycle indicators, but surface deviations from trend do appear to move in the same direction.

c. Increases in the cost of the wife's time tend to reduce fertility.

d. There appears to be a significant inverse relationship between cohort fertility and cohort size. The explanation for this is still conjectural. e. Based on sociological research, there appears to be a relationship between fertility decline and a number of factors, generally described in State III of the "Demographic Transition Theory." These factors include the rise in women's education, and the rise in their labor force participation rates. But these have not been tied together sufficiently to permit accurate, predictive extrapolations.

2. With regard to methods of estimating future fertility, the Census Bureau's surveys of the lifetime fertility expectations of 18 to 24-year-old married women is sometimes a poor predictor of subsequent actual fertility behavior. The survey is also substantially weaker in the short run than in the long run because it does not control for variations in the timing pattern of fertility, but only for completed lifetime fertility of surveyed women. A more appropriate survey would be of the fertility expectations over the next 3 or 4 years.

Due to this lack of an agreeable theoretical technique for forecasting fertility rates, this report derives population projections of 18-year-old males based upon the assumption that trends in fertility will continue in the short run (over the succeeding 5 years) as they have in the recent past. That is, the underlying causal conditions of fertility behavior are assumed to behave in the near future as they have behaved in the recent past. A discussion of the projection methodology used in this report is described in the following section.

in al

APPROACH

This chapter describes a short-range fertility model that was used to derive projections of the 18-year-old male population 18 or more years from the date of projection. The model assumes that recent trends in annual births will continue into the near future.

The number (in thousands) of U.S. males under 1 year old as of 1 July of the years 1965 to 1969 was 1917, 1812, 1757, 1718, and 1742 respectively (see U.S. Bureau of the Census, Series P-25, No. 519, Table 1). The number (in thousands) of women in the U.S. population of child bearing age (15 to 44) for the same years was 39,058, 39,709, 40,392, 41,101, and 41,839 respectively (Ibid). Based on these figures, the number of males under 1 year of age per 1000 women of childbearing age for the same years was 49.08, 45.63, 43.50, 41.80, and 41.64 respectively.

A graph of this data is presented in Figure 2, which indicates that the data for the period 1965-1969 exhibit a pronounced curvilinear downward trend. In order to model this process so that it will both accurately fit this series of past data as well as maintain consistency with Census Bureau assumptions of smooth movement to an ultimate fertility rate (see U.S. Bureau of the Census, Series P-25, No. 601, pp. 2-5), an asymptotic exponential model was chosen. This model is mathematically represented as (see Stevens, W. L., 1951):

$$Y = \alpha + \beta \rho^{X} + e$$

where

- Y = number of males under 1 year of age per 1000 women of childbearing age,
- x = year (1 = 1966, 2 = 1967, etc.),
- a = asymptote of process,
- β , ρ = model parameters, and

e = error term.

Unlike Census Bureau methodology, the procedures used in this section are based entirely upon past trends and not upon a survey of birth expectations. Assuming the model to be appropriate, a bonus derived from this new methodology is an estimate of α , the asymptote, which is an indication of where the process is heading in the long term if recent trends continue.

Fitting the data of Figure 1 to mathematical equation (1) yields the following estimated relationship:

7

$$Y = 40.379 + 14.675(.595)^{*}$$

(2)

(1)





NUMBER OF MALES UNDER 1 YEAR OF AGE

Figure 3 illustrates the closeness of the fit between the 1965-1969 estimated and actual data. The projections of the number of males under 1 year old per 1000 females of childbearing age based upon equation (2) are also presented.

Once the projections of the number of males under 1 year old per 1000 females of childbearing age have been obtained, the projected number of males under 1 year old may be obtained by multiplying this figure by the projected number of females between 15 and 44 years of age for the corresponding year. Such projections are available as part of the Census Bureau's P-25 series and are quite accurate since, for the near term, they do not require the use of fertility rate assumptions as part of the projection methodology.

In order to now project the number of 18-year-old males 18 years beyond the date of projection, it is necessary to apply a survival factor to the projected number of under 1-year-old males. Life Tables from the HEW National Center for Health Statistics (see National Center for Health Statistics, Life Tables, 1975) estimate the stationary population of males under 1 year old to be 98,436. The estimated number of 100,000 males born who would reach their 18th birthday is estimated to be 96,774. As this survivorship rate has remained fairly constant historically, it will be assumed that it will stay the same in the near term. Therefore, the ratio of the above figures, 96,774 ÷ 98,436 = .983, is used as the survival factor. Multiplying the projections of under 1-year-old males by this factor yields projections of the number of 18-year-old males 18 years beyond the date of projection. Entirely analogous procedures may be used to project the total number of 17-year-old males, 19-year-old males, etc.

In summary, the methodology utilized to obtain projections of the 18-yearold male population is as follows:

1. Project the number of under 1-year-old males per 1000 females of childbearing age by extrapolation of the asymptotic trend model expressed by (1).

2. Project the number of under 1-year-old males by multiplying the projections obtained in 1 by the projected number of females of childbearing age # 1000, obtained from the Census Bureau's P-25 Series.

3. Project the number of 18-year-old males 18 years beyond this projection date by applying the appropriate survival factor to the above projections.

To assess the accuracy of the above methodology, the projections obtained from equation (2) were compared with actual Census Bureau 1970-1975 post-period population estimates (see U.S. Bureau of the Census, Series P-25, No. 614) and with Census Bureau population projections made during 1970 (see U.S. Bureau of the Census, Series P-25, No. 448). These comparisons are presented in the next section. Additionally, the above steps are followed to determine projections of the 18-year-old male population for the period 1994-1998 on the basis of data obtained during the period 1971-1975. Census Bureau 1975 projections of this age group are also presented (see U.S. Bureau of the Census, Series P-25, No. 601).



.

Figure 3. Comparison between actual Census Bureau post-period estimates and fitted asymptotic exponential trend curve (1965-1969).

RESULTS

This section presents the results obtained when utilizing the projection methodology discussed previously. The first part of this section computes projections based upon data obtained during 1965-1969 and compares them to the actual 1971-1975 post-period Census Bureau estimates and to 1970 Census Bureau projections. The second part computes projections of the 1994-1998 male 18-year-old population based upon data obtained during 1971-1975 and compares the results to corresponding Census Bureau projections.

Comparisons Between Asymptotic Exponential Trend Projections, Actual Census Bureau Post-Period Estimates, and 1970 Census Bureau Projections

Table 1 presents the actual 1970-1975 post-period Census Bureau estimates of the number of males under 1 year old and the number of females of childbearing age (15 to 44) (see U.S. Bureau of the Census, Series P-25, No. 614).

Table 1

U.S. Census Bureau Post-Period Estimates of Number of Males Under 1 Year Old and Number of Females Ages 15 to 44 (1970-1975)

Year	Number of Males Under 1 Year Old (in Thousands)	Number of Females 15 to 44 Years Old (in Thousands)
1970	1788	42,646
1971	1832	43,485
1972	1671	44,399
1973	1574	45,308
1974	1539	46,231
1975	1575	47,165

Post-period estimates of the number of males under 1 year old per 1000 women of childbearing age for the same years, calculated on the basis of the data appearing in Table 1 are 41.93, 42.13, 37.64, 34.74, 33.29, and 33.39 respectively. These data indicate that, during the 1970-1975 period, the fertility variable under study exhibited a pronounced downward decline.

The Census Bureau periodically releases population projections based upon various assumptions regarding fertility, mortality, and net immigration. The four regular series (B, C, D, and E), released in August 1970 (see U.S. Bureau of the Census, Series P-25, No. 448), differ only in the fertility assumptions involved. For these series, it is assumed that, on the average, women will bear 3.10, 2.78, 2.45, and 2.11 children during their lifetime. For purposes of comparison with actual post-period estimates and with asymptotic exponential trend projections, the two middle Census Bureau projection series (Series C and D) are presented in Table 2.

Table 2

	(1970–1975)	
Year	Series C	Series D
1970	1846	1749
1971	1911	1773 '
1972	1975	1816

2039

2105

2174

1859

1901

1943

1973

1974

1975

U.S. Census Bureau Projections of Number of Males Under 1 Year Old (in Thousands) (1970-1975)

When the projections in Table 2 are normalized by the estimated number of females of childbearing age (see page 11), the figures appearing in Table 3 are obtained.

Table 3

U.S. Census Bureau Projections of Number of Males Under 1 Year Old Per 1000 Women of Childbearing Age (1970-1975)

Year	Series C	Series D	
1970	43.3	41.0	
1971	43.9	40.8	
1972	44.5	40.9	
1973	45.0	41.0	
1974	45.6	41.1	
1975	46.1	41.2	

Projections of the number of males under 1 year old per 1000 women of childbearing age for 1970-1975, using the asymptotic exponential trend technique discussed in the previous section, are 41.0, 40.8, 40.6, 40.5, 40.5, and 40.4 respectively. The values x = 6, x = 7, ..., x = 11 are inserted into predictor equation (2), which was computed on the basis of 1965-1969 data in order to obtain projections for the period 1970-1975.

Table 4 compares the actual Census Bureau post-period population estimates, the asymptotic exponential trend projections, and the Census Bureau Series C and D projections. Also listed is the percentage error between the yearly population projections and the corresponding actual post-period estimates. The table indicates that all three projection series generally overestimated the actual results. However, the asymptotic trend and Census Bureau D series both appear to be substantially more accurate than the C series projections. The mean absolute error of the asymptotic trend projections was slightly lower than the Census Bureau D series.

Figure 4 provides a graphical comparison between the actual Census Bureau post-period estimates and the projections appearing in Table 4. Note the relatively steep decline in the actual data appearing during the 1971-1975 period. The actual process appears to have "shifted" downward from the exponential curve described during the 1965-1969 period. The exponential shape of the process, however, appears to be quite similar to the data pattern described during the 1965-1969 period.

Projections of the 1994-1998 Male 18-Year-Old Population

Projections of the 1994-1998 male 18-year-old population were made using the asymptotic exponential trend technique. The model described by (1) was fitted to the 1971-1975 period data provided on page 12, yielding the following estimated relationship:

$$Y = 32.41092 + 19.28587(.50752)^{x}$$
.

The closeness of the fit between the 1971-1975 actual data points and the estimates obtained by (3) is presented in Figure 5.

The projections of the number of males under 1 year of age per 1000 females of childbearing age for the period 1976-1980 obtained from the asymptotic exponential trend equation are 32.74; 32.58; 32.50; 32.45; and 32.43 respectively. These results are obtained by substituting the values x = 6, x = 7, ..., x = 10into predictor equation (3).

The projected number of women aged 15-44 for the years 1976-1980 (see U.S. Bureau of the Census, P-25, No. 601) are 48,131, 49,132, 50,082, 51,027, and 51,872 respectively.

Multiplying the corresponding yearly projections listed above yields the projected number of males under 1 year old; that is, 1,575,809; 1,600,721; 1,627,665; 1,655,826; and 1,682,209 for the years 1976-1980 respectively.

(3)

Table 4

Comparison Between Actual Post-Period Estimates, Asymptotic Exponential Trend Projections, and 1970 Census Bureau C and D Projection Series (1970-1975)

Year

Series	1970	1971	1972	1973	1974	1975	Average Absolute Error
Actual	41.9	42.1	37.6	34.7	33.3	33.4	
Asymptotic Trend	41.0	40.8	40.6	40.5	40.5	40.4	12%
(Percentage Error)	(-2 X)	(-3 X)	(+8Z)	(+16 Z)	(+21%)	(+21 X)	
Census Bureau - C Series	43.3	43.9	44.5	45.0	45.6	46.1	22%
(Percentage Error)	(+3 x)	(+4 X)	(+18Z)	(+30Z)	(+37 Z)	(+38 2)	
Census Bureau - D Series	41.0	40.8	40.9	41.0	41.1	41.2	137
(Percentage Error)	(-2 7)	(-3 z)	(7 6+)	(+18 Z)	(+23 X)	(+23 X)	

14

Merristan the coreary and in







Applying the survival factor .983 discussed in the previous section to the above projections yields the following asymptotic exponential trend projections of the number of 18-year-olds for the years 1994-1998: 1,549,020; 1,573,509; 1,599,995; 1,627,677; and 1,653,611 respectively.

The number of males 18 years of age in 1975 was estimated by the Census Bureau to be 2,148,000. Therefore, the asymptotic exponential trend projections appearing above indicate the number of 18-year-olds is likely to remain well below 1975 levels during the 1994-1998 period.

Table 5 presents a comparison between these asymptotic exponential trend projections and the Series II and Series III projections of the 1994-1998 male 18-year-old population made by the Census Bureau in 1975 (see U.S. Bureau of the Census, Series P-25, No. 601). Census Bureau Series II (middle series) assumes an average cohort fertility rate of 2.1 lifetime births, while Series III (low series) assumes an average cohort fertility rate of 1.7 lifetime births. The corresponding percentage declines from the 1975 level of male 18-year-olds are also indicated. The table shows the asymptotic exponential trend projections to be much closer to Series III than to Series II Census Bureau projections. From 1996 onward, the asymptotic exponential trend projections are somewhat lower than the Census Bureau Series III. A graphical comparison appears in Figure 6.

Table 5

Comparison Between Asymptotic Exponential Trend, Census Bureau Series II, and Census Bureau Series III Projections of Male 18-Year-Old Population

	•		Year		
Series	1994	1995	1996	1997	1998
Asymptotic Trend	1,549,020	1,573,509	1,599,995	1,627,677	1,653,611
(Percentage Decline from 1975)	(-27.9%)	(-26.7%)	(-25.5%)	(-24.2X)	(-23.0 %)
Census Bureau - Series II	1,704,000	1,775,000	1,850,000	1,923,000	1,996,000
(Percentage Decline from 1975)	(-20.7%)	(-17.4%)	(-13.92)	(-10.5 2)	(-7.1 X)
Census Bureau - Series III	1,533,000	1,540,000	1,607,000	1,673,000	1,723,000
(Percentage Decline from 1975)	(-28.6 2)	(-28.3 %)	(-25.2%)	(-22.1%)	(-19.8 2)





19 Q.S.

Joald

CONCLUSIONS

The short-range asymptotic exponential fertility trend model discussed in this report projects the size of the U.S. population of 18-year-old males to remain relatively low throughout the 1994-1998 period. The model forecasts a decline from 1975 levels of approximately 27.9 percent in 1994, moderating to a decline of approximately 23 percent by 1998. These results signal a significantly lower military manpower pool than Census Bureau projections based upon high and moderate fertility assumptions.

Based upon comparisons between 1970-1975 population projections and actual post-period population estimates, the asymptotic trend method of projection appears to be a reasonable alternative to U.S. Bureau of the Census methodology.

RECOMMENDATION

The methodology (or suitable modifications thereof) explored in this report should be seriously considered by military manpower planners when developing projections of future qualified military manpower supply and enlistments.

Marchd

2.2

CEDING PAGE BLANK-NOT FILMED

REFERENCES

Stevens, W. L. Asymptotic regression. <u>Biometrics</u>, September 1951, 7(3).

- U.S. Bureau of the Census, Projections of the population of the U.S. 1970-2020, <u>Current Population Reports</u>, Series P-25, No. 448, August 1970.____
- U.S. Bureau of the Census. Estimates of the population of the U.S. by age, sex, and race: April 1, 1960 to July 1, 1973. <u>Current Population Reports</u>, Series P-25, No. 519, April 1974.
- U.S. Bureau of the Census. Projections of the population of the United States: 1975-2050. <u>Current Population Reports</u>, Series P-25, No. 601, October 1975.
- U.S. Bureau of the Census. Estimates of the population of the U.S. by age, sex, and race: 1970-1975. <u>Current Population Reports</u>, Series P-25, No. 614, November 1975.
- U.S. Department of Health, Education, and Welfare, National Center for Health Statistics. <u>Vital statistics of the United States, Vol. II, Mortality,</u> <u>1961, 1971, 1972, 1973, 1974</u>. Published by U.S. GPO 1963, 1973, March 20, 1975, July 30, 1975, and May 5, 1976.

REFERENCE NOTE

 Govindan, M. <u>Manpower forecasting: Problems in determining the long-range</u> supply of military manpower (NPRDC Spec. Rep. 77-8). San Diego: Navy Personnel Research and Development Center, April 1977.

CEDING PAGE BLAN

NOT FILMED

BIBLIOGRAPHY

- Adelman, Irma. An economic analysis of population growth. <u>American Economic</u> <u>Review</u>, June 1963, <u>53</u>.
- Altman, S., & Fechter, A. Military manpower procurement: The supply of military personnel in the absence of a draft. <u>American Economic Review</u>, May 1967.
- Becker, Gary. An economic analysis of fertility. <u>Demographic and economic</u> <u>change in developed countries</u>. Special conference series. Universities -National Bureau of Economic Research, Princeton: Princeton University Press, 1960, pp. 209-231.
- Becker, Gary. A theory of allocation of time. <u>Economic Journal</u>, September 1965, <u>75</u>.
- Binkin, Martin, & Johnston, John D. <u>All volunteer Armed Forces: Progress,</u> problems, and prospects. Washington, DC: U.S. Senate Armed Services Committee, 1973.
- Blake, Judith. Can we believe recent data on birth expectation? <u>Demography</u>, February 1974, <u>11(1)</u>.
- Bowen, W. G., & Finegan, T. A. <u>The economics of labor force participation</u>. Princeton: Princeton University Press, 1969.
- Bumpass, L., & Westoff, C. <u>The later years of childbearing</u>. Princeton: Princeton University Press, 1970.
- Cain, Glen G. <u>Married women in the labor force</u>. Chicago: University of Chicago Press, 1966.
- Center for Family Planning Program Development, The Technical Assistance Division of Planned Parenthood. <u>Need for subsidized family planning</u> services: U.S., each state, and county, 1971. New York, 1972.
- Chu, David S. <u>Physical standards and the supply of enlisted volunteers</u>. Santa Monica, CA: Rand Corporation, 1974.
- Directorate for Manpower Research, Office of the Assistant Secretary for Defense (M&RA). <u>Trends in the geographic distribution of male nonprior</u> <u>service enlistees:</u> July and August, 1971, 1972, 1973 (Manpower Research Note 73-12). September 1973.
- Duesenberry, James. <u>Comment: Demographic and economic change in developed</u> <u>countries</u>. Special conference series. Princeton: Princeton University Press, 1960, pp. 231-234.
- Easterlin, R. A. <u>Population</u>, labor force, and the long swings in economic growth. New York: National Bureau of Economic Research, 1968.

- Easterlin, R. A. Relative economic status and American fertility swings. In Eleanor B. Sheldon (Ed.), <u>Family economic behavior</u>. Philadelphia: Lippincott Company, 1973, pp. 170-223.
- Fechter, A., & Grissmer, D. The supply of enlisted volunteers in the post draft environment. McLean, VA: General Research Corporation, 1975:
- Fisher, Anthony C. The cost of the draft and the cost of ending the draft. American Economic Review, June 1969.
- Friedlander, S., & Silver, M. A quantitative study of the determinants of fertility behavior. <u>Demography</u>, 1967, <u>4</u>(1).
- Glick, Paul, & Norton, Arthur. Perspectives on the recent upturn in divorce and remarriage. <u>Demography</u>, August 1973, <u>10</u>(3).
- Goldberg, Lawrence. An econometric model of the supply of enlistments: Estimates and applications. McLean, VA: General Research Corporation, 1975.
- Grissmer, D. W., Amey, D. M., Arms, R. L., Huck, D. F., Imperial, J. F., Koenig, L. D., Moore, W. F., Sica, G. P., & Szymanski, R. <u>An econometric</u> analysis of volunteer enlistments by service and cost effectiveness compari-<u>son of service incentive programs</u>. McLean, VA: General Research Corporation, 1974.
- Howthorn, G. <u>The sociology of fertility</u>. London: Collier-Macmillian Ltd., 1970.

Johnston, J. Econometric methods. New York: McGraw Hill, 1972.

- Kirk, Dudley. The influence of the business cycle on marriage and birth rates. <u>Demographic and economic change in developed countries</u>. Special Conference Series. Universities - National Bureau of Economic Research. Princeton: Princeton University Press, 1960, pp. 241-261.
- Lee, Donald. The formal dynamics of the echo, the boom, and the bust. <u>Demography</u>, November 1974, <u>11</u>(4).
- Leibenstein, H. An interpretation of the economic theory of fertility. <u>Journal</u> of <u>Economic Literature</u>, June 1974, <u>12(2)</u>.

Manpower Research and Data Analysis Center, Survey Research Division. <u>Results</u> of AFEES Survey, May 1975; and printouts for September 1974 and April-December 1973 surveys. Alexandria, VA, 1976.

Merrill, W. C., & Fox, K. <u>Economic statistics</u>. New York: John Wiley & Sons, Inc., 1970.

- Mincer, Jacob. Labor force participation of married women. In H. Gregg Lewis (Ed.), <u>Aspects of labor economics</u>. Universities National Bureau of Economic Research Conference Series 14. Princeton: Princeton University Press, 1962.
- Mincer, Jacob. Market prices, opportunity costs, and income effects. In C. Christ (Ed.), <u>Measurement in economics: Studies in mathematical economics</u> and econometrics. Palo Alto, CA: Stanford University Press, 1963.
- Nerlove, M., & Schultz, T. P. Love and life between the census: A model of family decision making in Puerto Rico, 1950-1960 (RM 6322 AID). Santa Monica, CA: Rand Corporation, 1970.
- Neter, John, & Wasserman, William. Fundamental statistics for business and economics. Boston: Allyn and Bacon, Inc., 1966.
- Nie, N., Hull, C. H., Jenkins, J. G., Steinbrenner, K. S., & Bent, D. H. <u>Statistical package for the social sciences</u> (2nd Edition). New York: <u>McGraw-Hill</u>, Inc., 1975.
- 01, Walter. The economic cost of the draft. <u>American Economic Review</u>, May 1967, pp. 39-51.
- Phillips, L., Votey, H., & Maxwell, D. E. A synthesis of the economic and demographic models of fertility: An econometric test. <u>The Review of</u> <u>Economics and Statistics</u>, August 1969, pp. 258-308.
- Ryder, Norman. A critique of the national fertility study. <u>Demography</u>, November 1973, <u>10</u>(4).
- Schultz, T. P. An economic model of family planning. <u>Journal of Political</u> <u>Economy</u>, March/April 1969, 77(2).
- United Nations Department of Economics and Social Affairs. The determinants of consequences of population trends. New York, 1953, ST/SOA Series A/17, 53 X111.3.
- U.S. Bureau of the Census. Preliminary projections of the population of states: 1970-1990. <u>Current Population Reports</u>, Series P-20, No. 274, December 1974.
- U.S. Bureau of the Census. Educational attainment in the United States: March 1973 and 1974. <u>Current Population Reports</u>, Series P-20, No. 274, December 1974.
- U.S. Bureau of the Census. Estimates of the population of states by age; July 1, 1971 and 1972. <u>Current Population Reports</u>, Series P-25, No. 500, May 1973.
- U.S. Bureau of the Census. Fertility expectations of American women: June 1974. <u>Current Population Reports</u>, Series P-20, No. 277, February 1975.

- U.S. Bureau of the Census. Marital status and living arrangements: March 1975. <u>Current Population Reports</u>, Series P-20, No. 288, January 1976.
- U.S. Bureau of the Census. Fertility history and prospects of American women: June 1975. <u>Current Population Reports</u>, Series P-20, No. 288, January 1976.
- U.S. Bureau of the Census. Education attainment in the United States: March 1975. Current Population Reports, Series P-20, No. 295, June 1976.
- U.S. Department of Health, Education, and Welfare, Public Health Service, Center for Disease Control. <u>Abortion Surveillance 1974</u>. Atlanta, GA, April 1976.
- U.S. Department of Health, Education, and Welfare, National Center for Health Statistics, Family Planning Statistics Branch. <u>Provisional data from the</u> <u>National Reporting System, January 1972-December 1972, January 1973-December</u> <u>1973, January 1974-December 1974, January 1975-December 1975, National</u> <u>Level</u>, 1973, 1974, 1975, 1976.
- U.S. Department of Health, Education, and Welfare, National Center for Health Statistics. <u>Vital Statistics of the United States, Vol. I, Natality, 1956,</u> <u>1961, and 1971</u>; and Advance Report: <u>Final Natality Statistics, 1974</u>. Published 1963, 1973, and February 13, 1976.
- U.S. Department of Health, Education, and Welfare, National Center for Health Statistics. <u>Vital Statistics of the United States, Vol. III, Marriage and</u> <u>Divorce, 1961, 1971; and Monthly Vital Statistics Reports: Final Marriage</u> <u>Statistics, 1972, 1973, 1974</u>. Published by U.S. GPO 1963, 1973, March 20, 1975, July 30, 1975, and May 5, 1976.
- U.S. Department of Labor, Bureau of Labor Statistics. <u>Employment and Earnings</u>, every month from 1953 to 1974 (264 volumes).
- U.S. Department of Labor, Bureau of Labor Statistics. <u>Handbook of Labor</u> Statistics - 1975, Reference Edition. U.S. GPO, 1976.
- Urban Institute. The economic and labor market environment of military manpower. <u>A proposal submitted to Office of Naval Research</u>. Washington, D.C., November 13, 1975.
- Wharton Econometric Forecasting Associates, Inc. <u>Manpower research studies:</u> <u>A proposal to the Office of Naval Research, November 10, 1975</u>. Philadelphia.

Willis, Robert J. A new approach to the economic theory of fertility behavior. Journal of Political Economy, March/April 1973, 81(2), Part II.

DISTRIBUTION LIST

Assistant Secretary of the Navy (Manpower, Reserve Affairs, and Logistics) Principal Deputy Assistant Secretary of the Navy (Manpower and Reserve Affairs) Chief of Naval Operations (OP-O1CR), (OP-987H), (OP-991B) Chief of Naval Personnel (Pers-10c), (Pers-2B) Chief of Naval Research (Code 450) (4) Chief of Information (01-2252) Director of Navy Laboratories Commandant of the Marine Corps (Code MPI-20) Chief of Naval Education and Training (N-5), (OOA) Chief of Naval Technical Training (Code 016) Chief of Naval Education and Training Support Chief of Naval Education and Training Support (OIA) Commander, Navy Recruiting Command Commander Training Command, U.S. Atlantic Fleet (Code N3A) Commanding Officer, Fleet Combat Training Center, Pacific (Code 00E) Director, Training Analysis and Evaluation Group (TAEG) Master Chief Petty Officer of the Force, U.S. Atlantic Fleet Master Chief Petty Officer of the Force, U.S. Pacific Fleet Master Chief Petty Officer of the Force, Naval Material Command (NMAT 00C) Master Chief Petty Officer of the Force, Naval Education and Training Command (Code 003) Personnel Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base Occupational and Manpower Research Division, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base Technical Library, Air Force Human Resources Laboratory (AFSC), Brooks Air Force Base Flying Training Division, Air Force Human Resources Laboratory, Williams Air Force Base Technical Training Division, Air Force Human Resources Laboratory, Lowry Air Force Base Advanced Systems Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base Program Manager, Life Sciences Directorate, Air Force Office of Scientific Research (AFSC) Army Research Institute for the Behavioral and Social Sciences Military Assistant for Training and Personnel Technology, Office of the Under Secretary of Defense for Research and Engineering Director for Acquisition Planning, OASD (MRASL) Library Operations Section, Library of Congress Bureau of the Census Defense Documentation Center (12)