The Determinants of Career Decisions of Air Force Pilots

by

RUSSELL THEODORE ROTH

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Signature of Author Signature redacted
Department of Economics
May 15,1981

Certified by Signature redacted
Peter Temin
Thesis Supervisor

Accepted by Signature redacted
Richard S. Eckaus
Chairman, Department Graduate Committee

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on May 15, 1981 in partial fulfillment of the
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in Economics

Abstract

The present study analyses the individual career decisions of Air Force pilots. The inability of the Air Force to retain adequate numbers of qualified pilots in recent years motivated this study. This thesis presents a model of career choice based upon individual utility maximization. The individual is assumed to maximize his utility between continuing as an Air Force pilot and moving to the private sector. Private sector employment may be in either the airline industry or some other segment of the economy. A utility-maximizing choice is made in each discrete time period.

The data used in the estimation of this model comes from officer personnel records for pilots who began service between 1968 and 1972. Their individual characteristics were combined with the appropriate economic factors in each year to model their choices. An error components specification with an equicorrelated correlation matrix was used to estimate a multivariate probit model. Likelihood ratio tests with an independent multivariate probit model conclusively rejected the independent probit model. The results of the estimations are consistent with the theoretical model presented. The rate of airline hires has a negative effect on retention. The real wage level of Air Force pilots and their pay in relation to civilian pilots has a positive effect on the rate of retention and the individual probability of remaining in the Air Force. The rate of unemployment also has a positive effect on the probability of remaining in the Air Force.

The large data set available allowed for predictions in independent samples. The model predicted fairly well in these separate samples. Changes in policy were simulated and compared against these predicted results. Increasing the number of pilots augmented to the Regular Officer Corps would significantly increase retention. A healthy economy in 1980 would have caused continued unacceptable personnel losses, indicating that much still needs to be done to insure proper retention of pilots. Increases in wages to pilots are shown to be cost effective since they increase retention and decrease training costs.

Thesis Supervisor: Peter Temin

Title: Professor of Economics

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There are many people who have contributed to this thesis and my degree. I must now recognize them for their contributions.

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Mr. Bill Manlove of the Draper Laboratory in Cambridge, Mass. was able to loan the use of a portable computer terminal. This allowed me to work at home during the many all night computer sessions and preserve some semblance of a normal home life.

Without question, the work of Capt. Randy Blakelock at the Defense Manpower Data Center was ultimately the most important in meeting my deadlines. He provided the data set which was used for the analysis of the individual decision to separate.

The Officer Retention Group at the Air Force Manpower and Personnel Center, Randolph AFB, Texas and the Future Aviation Professionals of America have also provided considerable data and information.

The statements and conclusions in this thesis are those of the author and do not represent the policies or stated position of the United States Air Force or its agencies.

This thesis would not have been possible without considerable help from my advisors, Professor Peter Temin and Professor Hank Farber. Their technical assistance, friendship and encouragemaent were instrumental in its completion. I cannot thank them enough.

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Biographical Note

Russell Theodore Roth, Ted as he is known by all, was born in Salem, Oregon were he lived for eighteen years. He attended the Salem Public Schools where he graduated from South Salem High School in 1970.

Ted received an appointment to the United States Air Force Academy and left in June of 1970 to begin his training and academic studies. Four years later, he graduated from the U.S. Air Force Academy. He was a Distinguished Graduate and received the award for being the Outstanding Cadet in Economics in the Class of 1974. On this same date, June 5, 1974 he was commissioned a 2nd Lieutenant in the Air Force and married to Louise Ellingson, also from Salem, Oregon.

Following graduation from the U.S. Air Force Academy, the young Lieutenant attended Undedrgraduate Pilot Training at Moody Air Force Base, Georgia. After receiving his wings as a pilot in the Air Force, he was assigned to Sheppard Air Force Base, Texas. He served three years as an instructor pilot, teaching jet flight operations to prospective military pilots.

Under the sponsorship of the Department of Economics, United States Air Force Academy, and the Air Force Institute of Technology, Captain Roth began his studies at the Massachusetts Institute of Technology in September of 1978. After receiving his Ph.D. at MIT, he will return to flying for the Air Force as an aircraft commander in KC-135 Stratotankers (Boeing 707) at Grand Forks Air Force Base, North Dakota. Following this assignment he is scheduled to serve on the Economics Faculty at the U.S. Air Force Academy.

Chapter I

Introduction

The airline transport industry is a very young industry throughout the world. From their modest beginnings, the trunk airlines in this country began to grow during the 1920's and 1930's with the help of government subsidies for airmail contracts. The pilots who made this growth possible came from the large surplus of Army Air Corps pilots available following World War I. The United States trained many pilots to send to the battlefields of Western Europe, but the quick end to the war shortly after America's entrance left them with far more pilots and aircraft than were needed during the peace that followed. The Army sold many of their aircraft and many former military aviators either purchased these aircraft for barnstorming purposes or sought jobs with the fledgling air transport companies. The carefree, adventuresome spirit of these pilots helped the airline industry establish itself.

Following World War II, large numbers of ex-military pilots helped the industry advance from primarily airmail service to passenger service. During World War II, all aircraft production went to produce warplanes. The necessities of war stimulated many technological advances in aircraft and powerplant design and size. When the war was over, the airline companies began to purchase surplus aircraft, or new aircraft which the aircraft producers made available. (1) All of these aircraft were much

---

(1) The Lockheed Constellation was one such aircraft. It was secretly designed and built for Trans World Airlines and enabled that company to make rapid advances in the post war economy.

larger than those available before the war. Thus the former military pilot, with his experience flying state of the art aircraft, with the largest available powerplants, was a valuable asset to an air transport company. In addition, the airlines did not have to pay for the training of these pilots.

This relationship between the civilian trunk airlines and the ex-military pilots still exists. Today's military pilot is much better trained to fly the large and sophisticated aircraft operated by the airline industry than a pilot with General Aviation experience. (1) Pilots without military experience find it very difficult to get the jet or large aircraft experience necessary to fly with the airlines due to the tremendous expense. Out of the many aspiring airline pilots in this country, only a few are able to gain this experience by flying corporate or small commuter aircraft. (2) Historically, approximately 75 percent of the pilots in the airline industry have had military flying experience.

One aspect of the market for pilots is different than it has been in the past. The pool of available pilots is much smaller than it has been. The Armed Forces trained many pilots for World War I, World War II, the Korean War, and Viet Nam. Following each of these wars, the Armed Forces cut back their size considerably, providing sufficient numbers of surplus pilots to the private sector without adversely affecting their own requirements. However, in recent years the airlines have hired many new

(1) All flying not done by the commercial airlines or the military is classified as General Aviation by the Federal Aviation Adminstration.

(2) The exact qualifications of new airline pilots may be seen in Chapter II D.

pilots and will continue to do so into the foreseeable future. (1) During the period, many Air Force pilots have separated from the Air Force in order to seek these new jobs. These personnel losses have alarmed the Air Force because the current retention rates of experienced pilots have dropped far below those necessary to maintain required force levels. The projected hiring rates into the future almost assure that the Armed Forces will continue to face serious retention problems. It is this retention problem which has brought about this thesis research.

Qualified pilots are a vital part of our National Defense and a pilot shortage has a direct impact on the combat readiness of the Air Force. The fact that the Air Force is short of pilots and that experience levels are dropping makes this an urgent problem for the Air Force. While some effort has been made to determine the causes of this situation, there has not been an in depth study into the economic factors which influence pilot decisions. This thesis develops a model to analyse the factors which affect individuals in their career choice decisions.

The Air Force was only retaining 25.7 percent of its pilots through eleven years (2) of service (based on data from September 1979), while their personnel plans required retention of 59 percent of their pilots. The retention statistics have fluctuated considerably over the past few years from a high of 56 percent in 1975 to a low of 25.7 percent in September of 1979. During the recession period of 1980, the rate has increased to 35 percent, still far below that required in Air Force

---

(1) A forecast of future pilot demand may be seen in Table 18 and Figure 9 in Chapter II D.

(2) See Appendix A for a description of how these statistics are determined.

personnel plans. (1) A table and graph of these retention rates may be seen on the next page. The retention rate at each point is based on data from the previous twelve months. The retention rate is determined according to the methodology described in Appendix A.

The Air Force is currently short approximately 2500 pilots. This figure fluctuates from source to source and as total requirements change over time. Hidden in this statistic is the loss of pilots with substantial amounts of experience which cannot readily be replaced. New pilots will require several years to reach the level of experience of those who have departed. The low retention rates for experienced pilots in the 6-11 year range will lead to insufficient numbers of individuals in the middle management areas, in addition to the aforementioned absolute shortage. This will be expanded upon in Chapter 2.

Such a problem requires positive steps by the Air Force to insure that it will be able to meet its requirements. In the past few years it has endured these decreased retention rates through a variety of actions. During the post Viet Nam drawdown, the excess supply of pilots forced many into nonflying positions. By moving these pilots back into flying positions, the Air Force was able to make up for many unplanned losses.

---

(1) The reserve recall program now in effect has altered these statistics. I have recently found out that officers returning to active duty are put back into a year group and are thus effectively counted as an accession to that year group. In FY-79, 133 pilots returned to active duty and 202 in FY-80. percent in FY-80. This will increase the overall retention rate as each recallee cancels out the separation of someone else in that year group. This is only a significant fact for the retention rates for 1979 and 1980. The Air Force Retention Group has assured me that there is no way to determine a retention rate excluding these recallees, in order to determine a statistic for first time separation eligibles. Such a statistic would be a consistent measure with the earlier periods. This contamination has certainly caused a portion of the increase in the 1980 figures. This fact must be considered when discussing the reasons for the 1980 improvement.

Table 1

Air Force Pilot Retention
Statistics, 1975-1980

Date	Retention Statistic	Date	Retention Statistic
Dec 75	56.0%	Sep 78	39.6%
Mar 76	54.0	Dec 78	35.2
Jun 76	52.0	Mar 79	29.2
Sep 76	50.6	Jun 79	26.9
Dec 76	51.4	Sep 79	25.7
Mar 77	52.2	Dec 79	27.5
Jun 77	48.5	Mar 80	28.7
Sep 77	47.9	Jun 80	35.0
Dec 77	47.1	Sep 80	38.6*
Mar 78	46.3	Dec 80	39.2*
Jun 78	44.0		

* The figures for the last two intervals were calculated in a different manner than for earlier quarters. The figures stated are 3% below Air Force figures to attempt to put them on the same basis as all others.

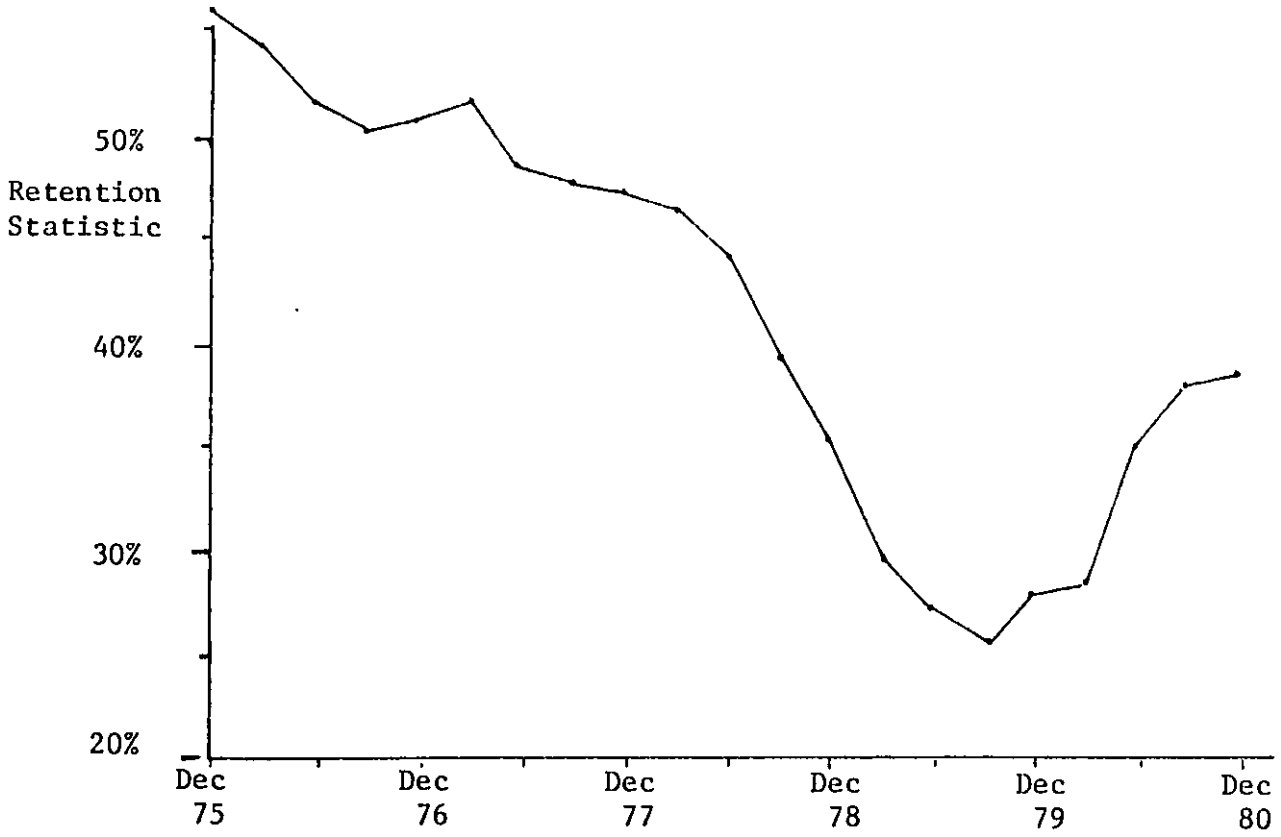


Figure 1

After this supply was exhausted, losses were absorbed mainly by shifting personnel requirements so that fewer non-flying jobs required a rated pilot. Those pilots were then moved out of those jobs and back into the cockpit. (However, this approach could not last forever as the post Viet Nam excess pilot pool was exhausted. Now the Air Force finds itself 2500 pilots short). (1) The Air Force is now trying other measures, such as an officer recall program (to be discussed later) and improved working conditions. The long term effect of these actions is unknown. In particular, the Air Force has not shown resolve at solving this problem during the current recession since retention has improved slightly.

As stated above, the Air Force has made few policy decisions which would significantly alter the retention of pilots. One of the reasons that this is true is that there appears to have been no in depth analysis into the problem. It is hoped that the analysis in this thesis will help illuminate the underlying causes of the current situation. Many have hypothesized that the hiring rates of the airlines and the large salaries in that industry, when compared with military pay have caused many Air Force pilots to separate from the service. Following are a few examples:

> The lull in pilot hiring by the airlines will not change the services' plans to fight for increases in military flight pay. While the services concede that other factors are involved, they blame the recent sharp rise in airlines recruiting for many of their problems. The lines, facing heavy retirements among their older pilots and planning to add new equipment, have turned to the military as the traditional source of trained recruits. Service officials had hoped that raising flight pay rates and adding some bonus money for critically needed pilots might improve matters. Air Force Times, Oct 1, 1979.

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(1) Melvin R. Laird, "People, Not Hardware, the Highest Defense Priority," p.6.

> Top Air Force leaders have made a strong plea for returning military pay to levels comparable with those in the private sector and for adding a full package of benefit improvements next fiscal year. Despite President Carter's recent suggestion that the Pentagon stop talking so much about low pay as a problem in retention, three Air Force officials have called inadequate compensation prime reason for the services' losses. Air Force Times, Apr 7, 1980.

However, there must be much more to this Air Force pilot retention problem than simply the hiring rates and salaries in the airline industry. This thesis will attempt an analysis of the inter-relationship between the airline industry and the retention of Air Force pilots. This will be done by focusing on the individual decision to separate from the Air Force and the effect that the economic environment has on that decision.

From each individual's standpoint, separation is an economic decision which is consciously made. At each point in time the Air Force pilot must weigh the benefits from staying in the service with those to be gained by moving to the private sector. The analysis in this thesis will assume that each individual is a utility maximizer and that his decision to stay in the Air Force or to separate is based on a comparison of his expected utility in each sector. This analysis will then give the Air Force an indication of what they can expect during different levels of economic activity in the private sector and what policy actions will be necessary to assure required levels of retention. The period to be studied will be from 1973 until the end of 1980.

All of this leads to a final statement of the questions to be investigated and answered in this thesis. The first is, what are the economic and personal factors which enter into the individual decision to stay in the Air Force or to separate? The second is on a larger scale and

will deal with the aggregation of all individuals: what are the economic factors involved in the overall retention rates of Air Force pilots?

Chapter II

Military and Civilian Pilot Careers

For the reader to completely understand the subjects in this thesis, it is necessary to present certain background knowledge. This will include information on comparative military and civilian pay, Air Force Personnel Management, a career as an Air Force pilot, career as a civilian airline pilot, and additional reasons for pilot separation decisions.

A. Comparative Military and Civilian Pay

The advent of the All-Volunteer Army has brought many changes to the Air Force and the other branches of service since its inception in 1972. At that time Congress made a commitment to make wages in the military sector comparable with those in the private sector. In the past the Armed Forces had relied upon the draft to provide manpower directly, or through draft induced enlistments. Since 1972, it has been necessary for them to compete in the open market for these people. In order to do that, Congress has done "pay comparability" studies in several years in order to determine the required compensation levels to compete in the labor market.

Despite the results of these studies and the promises made in 1972, Congress apparently has not lived up to its promise to maintain comparability. From 1972 through 1980, the average real military pay for pilots has decreased 13.8 percent with respect to the increases in the Consumer Price Index. The following table illustrates these decreased real earnings with respect to the CPI. As one can see, the increase in October

Table 2

Real Monthly Military
Compensation in 1972 Dollars

Date	Military Pay (without Flight Pay)	Percent Lag	Military Pay (with Flight Pay)	Percent Lag
Dec 72	1308	0.0%	1498	0.0%
Sep 73	1229	6.1	1407	6.1
Oct 73	1285	1.8	1462	2.5
Sep 74	1155	11.7	1361	9.2
Oct 74	1266	3.3	1470	1.9
Sep 75	1185	9.4	1376	8.2
Oct 75	1237	5.5	1426	4.9
Sep 76	1180	9.8	1361	9.2
Oct 76	1232	5.9	1412	5.8
Sep 77	1160	11.4	1330	11.3
Oct 77	1238	5.4	1407	6.1
Sep 78	1147	12.4	1303	13.1
Oct 78	1209	8.3	1355	9.6
Sep 79	1079	17.6	1218	18.7
Oct 79	1145	12.5	1283	14.4
Sep 80	1025	21.7	1149	24.3
Oct 80	1139	13.0	1292	13.8

1980 for all pay excluding Flight Pay, did not keep up with inflation during the same time period. The 25 percent increase in Flight Pay in 1980 did increase the real wages of pilots, but pilots have still had larger decreases over the eight year period than their non-rated counterparts. Most sources claim that the military raise in December of 1972 made military wages comparable with the civilian sector. Melvin Laird, the Secretary of Defense during the establishment of the All-Volunteer Army, had this to say,

> In January 1973, as I left the Pentagon, I was confident that military compensation not only was adequate to provide a decent standard of living for even the lowest ranking enlisted person, but also was reasonably competitive with relevant sectors of the private economy. Today, the situation is dramatically different. Military pay, particularly for enlisted people, is no longer adequate nor is it, by any standard, competitive with those in the private economy with which it must contend. (1)

A recent Defense Department study remarked,

> ...the Department of Defense (DOD) asserted -- and it was generally accepted -- that reasonably competitive pay levels had been achieved. For this reason, 1972 compensation levels serve as an important benchmark against which subsequent gains and/or losses in pay and benefits may be measured. (2)

A case can certainly be made that the makeup of the CPI is not entirely appropriate for military members. However, it is this figure which is published monthly and continually makes the headlines. Therefore, whether the loss in spending power is real or perceived is largely immaterial. The fact remains that Air Force personnel have been bombarded with statements about the erosion of their real spending power since 1972. These statements have come from the national news media as well as publications designed expressly for Air Force personnel. (3)

The use of the CPI is indeed a poor measure of real purchasing power when used with military pay. There are many factors which will alter the

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(1) Melvin R. Laird, "People, Not Hardware, The Highest Defense Priority," p. 8.

(2) Department of Defense Staff Paper "A Balanced Perspective on Pay and Benefits - Executive Summary." 1979.

(3) Primarily the Air Force Times, a weekly newspaper. This newspaper is published by a private firm and is not an official Air Force publication although the Air Force Office of Information provides them with official news releases.

effect that CPI changes have on the purchasing power of individuals. Although pay increases have been less than CPI changes, the housing and subsistence allowances of military compensation are tax free (approximately 20 percent of total income is tax free for an 8-year captain on flying status) which leads to understatement of military pay increases.

In most years, these allowances were increased by the same percentage as basic pay. On the other hand, income tax "bracket creep" may negate this so that real take home earnings are about the same. The weights given to housing and medicine in the CPI might also overestimate the impact of these sectors on military income. Medical care is provided for free and some individuals live in government housing with utilities provided. The CPI weight of 44 percent for housing is clearly higher than the approximately 14 percent of income paid in "rent" for these government quarters. Currently 30 percent of married officers and 21 percent of single officers live on base in government quarters. (1)

As imperfect as the CPI is, it is the most publicized method for determining real income over time. No matter how much of an argument is made that real income of servicemembers cannot be compared to constant real earnings by use of the CPI, other facts do support the contention that real earnings have decreased over time. The first is the results of comparability studies which indicate that military compensation is lagging that in the private sector. As a comparison, aggregate union wages increased 59.7 percent from Dec 72 - Sep 78 while the CPI increased 59.9 percent. (2) Compare this with military wage changes over the same period

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(1) USAF Economic Impact Survey, May 1980.

(2) Economic Report of the President, 1979.

as seen in Table 2. (1) The second comes from recent surveys of Air Force officers which indicate that ever increasing numbers of spouses work (46 percent) and that more military members themselves must find outside work to make ends meet. (2)

One of the great constraints which Congress and the Air Force face is that pay is based entirely on rank and years of service. (3) At any rank there are individuals who perform a wide variety of different jobs. It is very difficult to do a pay comparability study over a wide variety of jobs in the military and civilian sectors. There may be a very large range of earnings for many different jobs in the private sector, but these must be effectively set at one figure in the military pay scale (for one experience level). Promotion rates for all different jobs are approximately the same for all officers, including pilots. Pay for a particular officer is increased only through longevity increases, which does not allow for any discretionary increases based on that individual's value to the Air Force. An 8-year captain is paid the same whether he is a maintenance officer, engineer, supply officer or weatherman. The relevant sections of these pay scales for 1972-1980 are shown on the following five pages in Table 3. (4) The results of a recent survey of Air Force officers showed that 89 percent felt that civilian wages were higher than military wages for the same work.

---

(1) Congress passed a law in 1978 prohibiting unionization within the military, PL 95-610.

(2) USAF Economic Impact Survey, May 1980.

(3) This is not true for doctors and dentists which are under a different system. All other officers, including pilots, are known as line officers.

(4) Current promotion points are 1st Lieutenant (O-2) - two years, Captain (O-3) - Four years, Major (O-4) - eleven years, Lt. Colonel (O-5) - sixteen years. Some officers are promoted ahead or behind this schedule.

Table 3

Effective 15 Dec 72 - 30 Sep 73

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1236	1301	1388	1492	1578	1626
O-4					1065	1112	1188	1255	1312	1369	1407	1407
O-3			894	989	1037	1074	1131	1188	1217			
O-2	652	713	856	884	903							
O-1	556	589	713									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	130	157
O-4	120	145
O-3	105	130
O-2	95	120
O-1	85	110

Basic Allowance for Subsistence, all Officers $47.88

Effective 1 Oct 73 - 30 Sep 74

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1312	1382	1474	1585	1676	1726
O-4					1130	1181	1261	1332	1393	1454	1494	1494
O-3			949	1050	1100	1140	1201	1261	1292			
O-2	692	757	909	939	959							
O-1	600	626	757									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	130	157
O-4	120	145
O-3	105	130
O-2	95	120
O-1	85	110

Basic Allowance for Subsistence, all Officers $47.88

Table 3 - continued

Effective 1 Oct 74 - 30 Sep 75

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1384	1458	1556	1672	1768	1821
O-4					1193	1246	1331	1406	1470	1534	1577	1577
O-3			1001	1108	1161	1203	1268	1331	1363			
O-2	731	798	959	991	1012							
O-1	634	660	798									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	209	252
O-4	189	227
O-3	167	206
O-2	146	185
O-1	115	149

Basic Allowance for Subsistence, all Officers
$50.52

Effective 1 Oct 75 - 30 Sep 76

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1454	1531	1633	1756	1857	1913
O-4					1253	1308	1397	1476	1544	1611	1655	1655
O-3			1052	1164	1219	1263	1331	1397	1431			
O-2	767	838	1007	1040	1062							
O-1	666	693	838									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	220	265
O-4	198	239
O-3	176	217
O-2	154	195
O-1	121	157

Basic Allowance for Subsistence, all Officers
$53.05

Table 3 - continued

Effective 1 Oct 76 - 30 Sep 77

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1506	1586	1692	1820	1924	1982
O-4					1298	1356	1448	1529	1599	1669	1715	1715
O-3			1089	1206	1263	1309	1379	1448	1483			
O-2	795	869	1043	1078	1101							
O-1	690	719	869									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	249	300
O-4	223	269
O-3	197	243
O-2	171	217
O-1	134	174

Basic Allowance for Subsistence, all Officers
$55.61

Effective 1 Oct 77 - 30 Sep 78

Pay Grade	Years of Service: Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1599	1685	1797	1932	2043	2105
O-4					1378	1440	1538	1624	1699	1772	1822	1822
O-3			1157	1280	1342	1390	1465	1538	1575			
O-2	844	922	1108	1145	1169							
O-1	733	763	922									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	281	338
O-4	250	302
O-3	220	271
O-2	191	242
O-1	149	194

Basic Allowance for Subsistence, all Officers
$59.53

Table 3 - continued

Effective 1 Oct 78 - 30 Sep 79

Pay Grade	Years of Service											
	Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1687	1778	1896	2039	2156	2221
O-4					1454	1519	1622	1714	1792	1870	1922	1922
O-3			1221	1351	1415	1467	1545	1622	1662			
O-2	891	973	1169	1208	1233							
O-1	773	805	973									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	296	357
O-4	264	318
O-3	232	286
O-2	201	255
O-1	157	205

Basic Allowance for Subsistence, all Officers
$62.80

Effective 1 Oct 79 - 30 Sep 80

Pay Grade	Years of Service											
	Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							1806	1902	2030	2182	2307	2376
O-4					1556	1625	1736	1834	1917	2001	2057	2057
O-3			1306	1446	1515	1570	1653	1736	1778			
O-2	953	1041	1250	1293	1319							
O-1	827	861	1041									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	317	382
O-4	282	341
O-3	248	306
O-2	215	273
O-1	168	219

Basic Allowance for Subsistence, all Officers
$67.21

Table 3 - continued

Effective 1 Oct 80 -

Pay Grade	Years of Service											
	Under 2	2	3	4	6	8	10	12	14	16	18	20
O-5							2016	2124	2267	2436	2577	2654
O-4					1738	1815	1939	2048	2142	2235	2297	2297
O-3			1459	1615	1692	1753	1847	1939	1987	1987		
O-2	1064	1163	1397	1444.	1474							
O-1	924	962	1163									

Basic Allowance for Quarters	Without Dependents	With Dependents
O-5	354	426
O-4	315	380
O-3	277	342
O-2	240	304
O-1	187	244

Basic Allowance for Subsistence, all Officers
$82.58

(1)

The one job for which Congress has provided added pay is the military pilot. This is in the form of flight crew incentive pay. The pay scales remained unchanged from 1955 until October 1980. The system in effect from 1955 through 1974 is shown in Table 4 and is based on rank and years of service. (2) At the time it was established in 1955, flight pay was approximately 44 percent of base pay (for most officers). By early 1974, flight pay was only 15.8 percent of base pay. (3) In 1974, Congress changed the form of the flight pay schedule and who was eligible but did not change the maximum pay, under the Flight Pay Incentive Act of 1974. (4) Under this Act, a ten year Captain's Flight Pay went from $190 to $245 per month. This latter figure was 20.3 percent of base pay in 1974. This was done for several reasons: 1) to increase flight pay faster so that pilots received the maximum pay during the years when they did the most flying, and 2) to discontinue paying flight pay to those high ranking officers no longer flying or whose jobs were not primarily flying. By 1979, flight pay had dropped to only 14.8 percent of base pay (for a ten year Captain). This was because flight pay was not increased and only base pay was increased by Congress until 1970. The Flight Pay schedule in effect from May 1974-Sep 1980 is shown in Table 5. This lack of change in military flight pay has contributed significantly to the erosion of compensation for military pilots. In October 1980, Congress did increase all flight pay by

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(1) United States Air Force Economic Impact Survey, May 1980.

(2) 37§ 301 U. S. Code.

(3) All figures that follow are for a ten year Captain.

(4) Public Law 93-294, 88 Stat. 177.

Table 4

Flight Crew Incentive Pay
1955-May 1974

Pay Grade	Years of Service						
	Under 2	2	3	4	6	8	10
O-5	190	190	205	205	205	205	210
O-4	170	170	185	185	185	195	205
O-3	145	145	155	165	180	185	185
O-2	115	125	150	150	160	165	165
O-1	100	105	135	135	140	145	160

	12	14	16	18	22
O-5	210	225	230	245	245
O-4	215	220	230	240	240
O-3	200	205	205	205	205
O-2	180	185	185	185	185
O-1	160	170	170	170	170

Table 5

Flight Crew Incentive Pay
May 1974-Oct 1980

Years of Aviation Service	Monthly Flight Pay
Phase I	
Under 2	$100
Over 2	125
Over 3	150
Over 4	165
Over 6	245
Phase II	
Over 18	225
Over 20	205
)ver 22	185
Over 24 but less than 25	165

25 percent over the figures in Table 5. By adjusting this with CPI figures, the new flight pay in real terms is effectively what it was in 1978 and is now 16.5 percent of base pay.

Since 1970, Congress has also begun to increase the housing allowance and subsistence allowance, primarily because these allowances do not enter into retirement compensation. The President has the authority to reallocate up to 25 percent of any pay increase to these allowances. As a result, take-home pay of active duty personnel could be increased without further increases in retirement pay to former members of the Armed Forces. The cumulative savings to the Department of Defense of the 1976/77 reallocation were as follows.

FY77	$83.8 million
FY78	153.8
FY79	240.4
FY80	334.5
FY81	436.2

Further evidence of the inadequacy of military compensation during the late 70's is provided by looking at the housing allowance. The levels of this compensation can be seen by referring to the previous table on military compensation. Note the housing allowance in 1972 and 1973. These amounts did not change until 1974 and had been at the 1973 figures since September of 1962. The government does provide a limited number of quarters for officers and their families on many installations. These individuals effectively pay rent equal to their housing allowance as they receive no allowance if occupying government quarters. For those unable or not wanting to secure government quarters, the added expense of living off base must be borne by the individual. This cost Air Force personnel $240

million in 1979. (1) The Nunn-Warner Amendment (2) provided for a variable housing allowance, VHA, based on the housing costs in each of 324 military housing areas in the country. It would be paid whenever average housing costs in an area exceeded the allowance by more than 15 percent. Over 98 percent of all military personnel and 93 percent of all Air Force officers living off base have received this allowance since October 1980. (3) These figures show the deficiency in current compensation.

This section has described how Congress was committed to maintain the all volunteer force through comparability and how they have failed to maintain that comparability. They are not entirely to blame. The high inflation rates of the 70's have led Presidents Nixon, Ford and Carter to invoke economic policies designed to slow inflation. One of the easiest things to control has been the salaries of federal and military employees. Several times during the decade the President has used the military to set an example for wage guidelines. The most prominent of these was President Carter's voluntary wage guidelines. While these voluntary wage guidelines applied to industry and business, those individuals were often able to negotiate higher wage increases. This was not true for the military. In 1978 and 1979 the President placed a pay "cap" on military pay as an indication of the government's intent to slow inflation. Nevertheless, not many other businesses or labor groups followed this lead and the military personnel suffered under ever increasing inflation rates. It had a major

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(1) 1980 Briefing by Air Force Director of Personnel.

(2) The Nunn-Warner Amendment was a package of several benefits designed to improve compensation to military personnel. This Amendent was part of the Military Manpower Management Act, Public Law 96-343.

(3) Air Force Times, Oct. 27, 1980. p.1.

attitudinal effect on military personnel as they perceived that Congress and the President were not acting in the serviceman's best interest, nor were they living up to the promises of 1972 and the All-Volunteer Army. The military vote certainly contributed to President Carter's defeat in the November, 1980 election.

B. Air Force Personnel Plans

This section will discuss Air Force Personnel Plans and pilot requirements and the changes that have taken place in recent years. The current shortage of Air Force pilots, and the Defense Manpower shortage in general, create serious problems for our Armed Forces. It is difficult to measure whether the National Defense objective is being met when those forces do not have to be employed in an armed conflict. In an effort to best meet this objective, Defense planners attempt to plan for all contingencies and possible scenarios for future conflicts. Within the framework of these potential requirements for certain actions, individual manning requirements for each of the services are determined. As an example, the United States has been committed since World War II to maintaining a standing army in Western Europe against possible Soviet aggression. Other requirements include naval forces sufficient for worldwide operations, strategic nuclear deterrent forces, and the new Rapid Deployment Force (a response to Middle East problems with Iran and the Soviet invasion of Afghanistan). Out of such planning scenarios will come the requirements for the total numbers of Air Force aircraft and personnel.

The manning requirements to meet all contingencies foreseen by defense planners may in fact not be realized. Congress determines the authorized manpower strength by trading off the desires against needs of the armed services against the costs of implementing their requests. Consequently, the armed forces must then attempt to get the most "defense" with the funds allocated to them. It is within this constraint that Air Force personnel planners must then work.

The total authorized strength of the Air Force has changed

dramatically since the height of the Viet Nam War in FY 68. Authorized officer strength has gone from over 133,000 to 92,000 in FY 80, a drop of over 30 percent. These historical trends may be seen in Table 6 and Figure 2. Within the total authorized officer strength one finds the total number of Air Force pilots.

The requirements for pilots are two dimensional. The first is an absolute numbers requirement and the second is the required experience mix within that total number. The absolute number will change with total aircraft in the Air Force inventory, number of crews per aircraft, and as requirements for pilots in non-flying positions change over time. As one can see in Table 7 and Figure 3, total pilot requirements have decreased dramatically since the mid 1950's. As aircraft have become larger, more complex, and more expensive, the Air Force has decreased its total requirement for pilots. This decrease has been steady, with the exception of a buildup during the Viet Nam War, down to what appears to be a steady state requirement of about 23,700 from 1976 through 1985.

Force requirements can change very rapidly as seen in the previous chart. Inventories of available pilots cannot change nearly as rapidly. Production rates can change over time as more assets are moved to the training sector at the expense of manning other frontline combat units. During the Viet Nam years, 1967-1973, pilot production increased significantly. At the same time, many pilots who had entered during World War II or the Korean War were able to retire. One can see that only in 1967 and 1968 did total pilot inventory fall below requirements, a direct result of the rapid buildup of the commitment to Viet Nam. (1) Presumably,

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(1) As more aircraft were built or taken out of storage, a short term increase in Air Force pilot demand occured. This could not immediately be

Table 6

Air Force Officer Strength Levels

Fiscal Year	Total Officer Strength (less Medical and Dental)
1968	133,583
1972	116,085
1973	109,514
1974	105,466
1975	100,249
1976	95,012
1977	91,365
1978	90,543
1979	91,080
1980	92,237

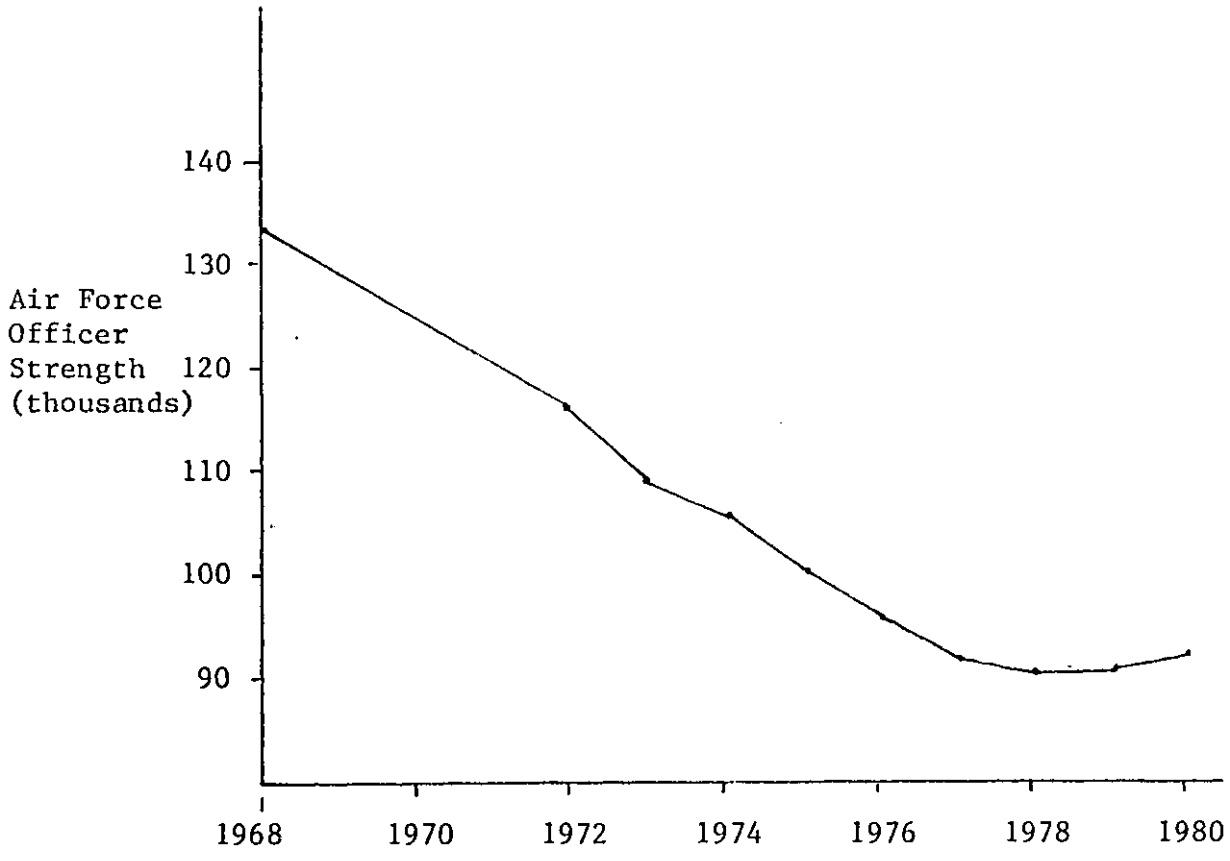


Figure 2

Table 7

Air Force Pilot Production,
Requirements, and Inventory
1950-1985

Fiscal Year	Production	Requirement (1000's)	Inventory (Lt.Col.and below)	Surplus (deficit) (1000's)
1950	1908	23.8	24,220	.42
1951	2006	55.1	41,259	(13.84)
1952	3125	55.8	44,129	(11.67)
1953	5451	53.2	45,789	(7.41)
1954	6401	57.0	46,728	(10.27)
1955	5787	57.1	50,067	(7.03)
1956	5701	57.3	52,427	(4.87)
1957	5333	57.3	54,489	(2.81)
1958	3618	50.0	51,711	1.71
1959	2325	48.5	50,803	2.30
1960	2116	48.0	50,451	2.45
1961	1795	47.8	48,798	1.00
1962	1299	45.7	49,427	3.73
1963	1433	43.9	46,837	2.94
1964	1675	41.8	45,257	3.46
1965	1992	37.4	43,050	5.65
1966	1969	38.2	40,449	2.25
1967	2768	46.2	38,447	(7.75)
1968	3092	43.4	37,632	(5.77)
1969	3216	37.9	36,832	(1.07)
1970	3521	36.1	34,808	(1.29)
1971	3895	35.1	34,782	(.32)
1972	4032	32.4	35,194	2.79
1973	3033	32.0	33,171	1.17
1974	2167	28.5	31,158	2.66
1975	2003	26.4	29,643	3.24
1976	1659	23.9	28,361	4.46
1977	1316	23.3	26,372	3.07
1978	1084	23.0	24,913	1.91
1979	1050	23.8	22,501	(1.3)
1980*	1575	23.4	21,217	(2.21)
1981*	1850	23.7	20,402	(3.27)
1982*	1850	23.6	20,068	(3.55)
1983*	1850	23.7	19,972	(3.70)
1984*	1890	23.7	20,158	(3.55)
1985*	1890	23.7	20,242	(3.49)

* Projections

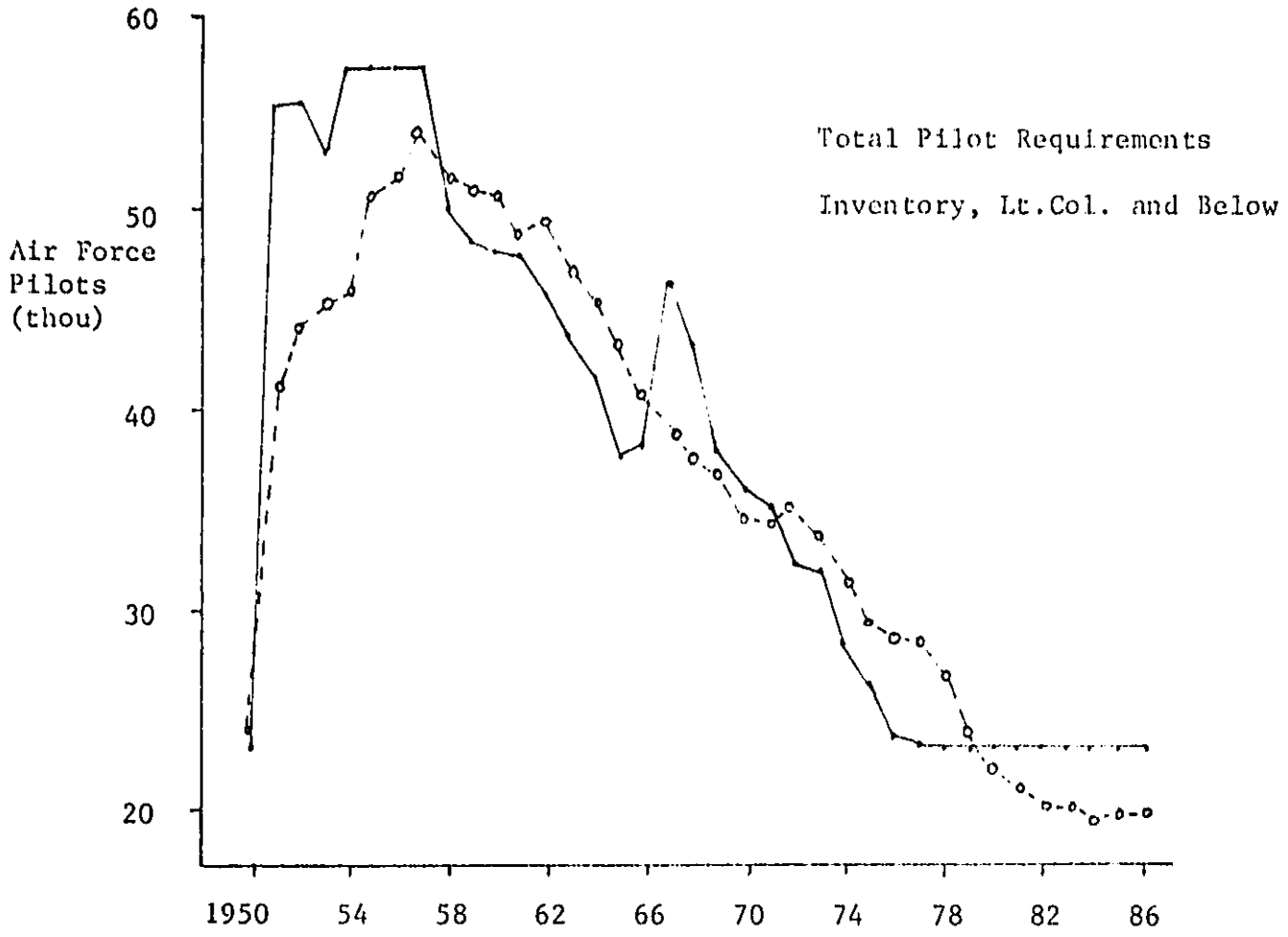


Figure 3

the same type of buildup would be necessary if this country were ever to be involved in another long conflict.

The post Viet Nam drawdown created an excess supply of about 6000 pilots. This led to the aforementioned rated supplement assignments, reductions in force and a variety of programs designed to alleviate the

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met, but required several years of increased pilot production in order to meet this wartime commitment.

overage. Some of these programs were, Early Out, Palace Chase, and Palace Furlough. These programs allowed the individual to either leave with no further obligation (even though the initial commitment may not have been completed) or to complete his commitment in the Air National Guard or Reserve Units. By FY79 the once large surplus had become a deficit, and despite increased production rates, a deficit is programmed through at least FY85.

It is very difficult to manage a large personnel force such as that in the Air Force. Personnel planners must change their plans with changes in the needs and requirements of Air Force commitments. The post Viet Nam drawdown was difficult in that the force had to be reduced by 30 percent in a short period. Simultaneously, it was necessary to continue bringing in new personnel to maintain the proper age distribution for the entire force. These "cycles" have occured following every buildup in the armed forces for World War II, the Korean War, and Viet Nam. As one can see from Figure 3, pilot production rates decreased to very low rates in the last half of the 70's to make up for large production in the previous five years.

Personnel planners formulate their models for the best distribution of the force in terms of rank, year groups and job fields. The whole idea behind such a plan is to have the optimal distribution of individuals necessary at each level to adequately manage (have the required experience) and man all operational units to accomplish their missions. The current model is called Topline 80, which replaced Topline D. (1) Both models required about the same total number of pilots. The most notable change

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(1) There were other Topline plans before Topline D. Topline "C" FY75, Topline "D76" FY76, and Topline "D" FY77-79. These plans have been revised on nearly an annual basis during the post Viet Nam drawdown period.

from Topline D to Topline 80 in the pilot area seems to be a more realistic approach to current retention trends, at the expense of lowering desired experience levels in mid level management. There are more programmed inputs in the new model with higher losses in the six to eleven year range. The comparison of these two models for pilots, navigators and non-rated officers may be seen in Figure 4. The chart shows the number of officers required in each year group of service.

The desired retention objectives for pilots increased from FY75 to FY77 in the earlier Personnel Models. Only after actual retention rates took a plunge did the Air Force revise its desired retention with Topline 80. Did mid-level management requirements change that fast? That is doubtful. It appears that retention rates were revised downward based on the realities of the situation, not on changing requirements. A case can be made that these requirements were changed so that the Air Force could more easily attain the new retention goals. Also, non rated retention has increased in the past few years. Required retention of these individuals was increased in Topline 80 so that overall retention of officers has not changed significantly. But this will increase costs tremendously as more individuals must be trained in their early years, only to be lost at a higher rate. Although Topline 80 may be more realistic, it does so while decreasing experience levels in mid-level management and increasing training costs.

Although on an unrelated topic, the opposite changes occured in planned retention of non-rated personnel from Topline D to Topline 80 (Figure 4). These changes may also have long run economic effects on the Federal Budget. By raising this retention rate, the number of individuals retiring will also increase, thereby increasing total retirement costs.

Comparison of Air Force Personnel Plans
Topline 80 - Topline D

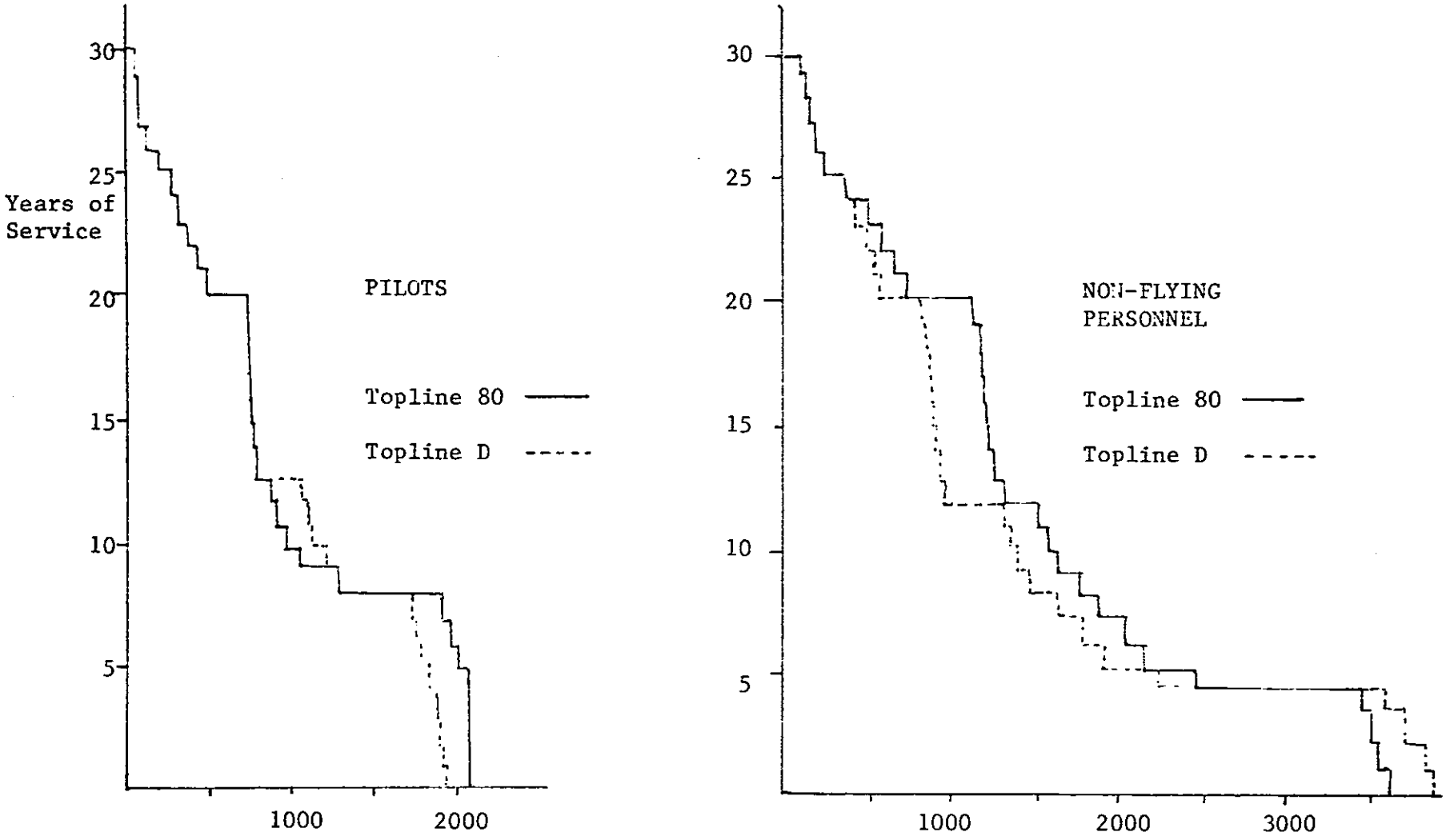


Figure 4

Planned retention of these people has increased over 15 percentage points from FY75 to FY 80. If the personnel plans of the mid 70's were designed properly with an effort to get the proper mix of age, experience and rank distribution, then this change to higher retention rates based on actual increases can only be a bad sign. It makes overall retention rates look better but does not address the serious problem of pilot retention. Many of the non-rated personnel can easily be replaced by younger, less expensive individuals, which also lowers long run costs in that fewer non-rateds are allowed to retire.

The cyclical nature of military manpower management has already been mentioned. What has gone on in the past with that management cannot be changed now. One can see this by comparing current force levels with the current optimum plan, Topline 80 in Figure 5. In FY79, there is an excess of officers in the year groups around twenty five years due to the mid-50's buildup seen in a previous chart. The other area of excess officers is in the 10-15 year groups that entered in the peak Viet Nam years. The dashed line shows where the current force will be in FY 86. The upper portions (above twenty years) of this forecast match the desired officer distribution of Topline 80 fairly well. The Viet Nam peak can be seen around the twenty year point, as well as a serious gap in mid-level management in the 8-15 year group range. Nothing can be done about this now. Also, that gap is based on attaining 43 percent retention. The Air Force has not retained that many pilots for quite some time. Note also that production rates themselves will fall several hundred pilots short of desired production for FY79-FY86.

The current, steady state requirement is for approximately 23,700 pilots. This is the "peacetime" rate for optimal operation and manning of

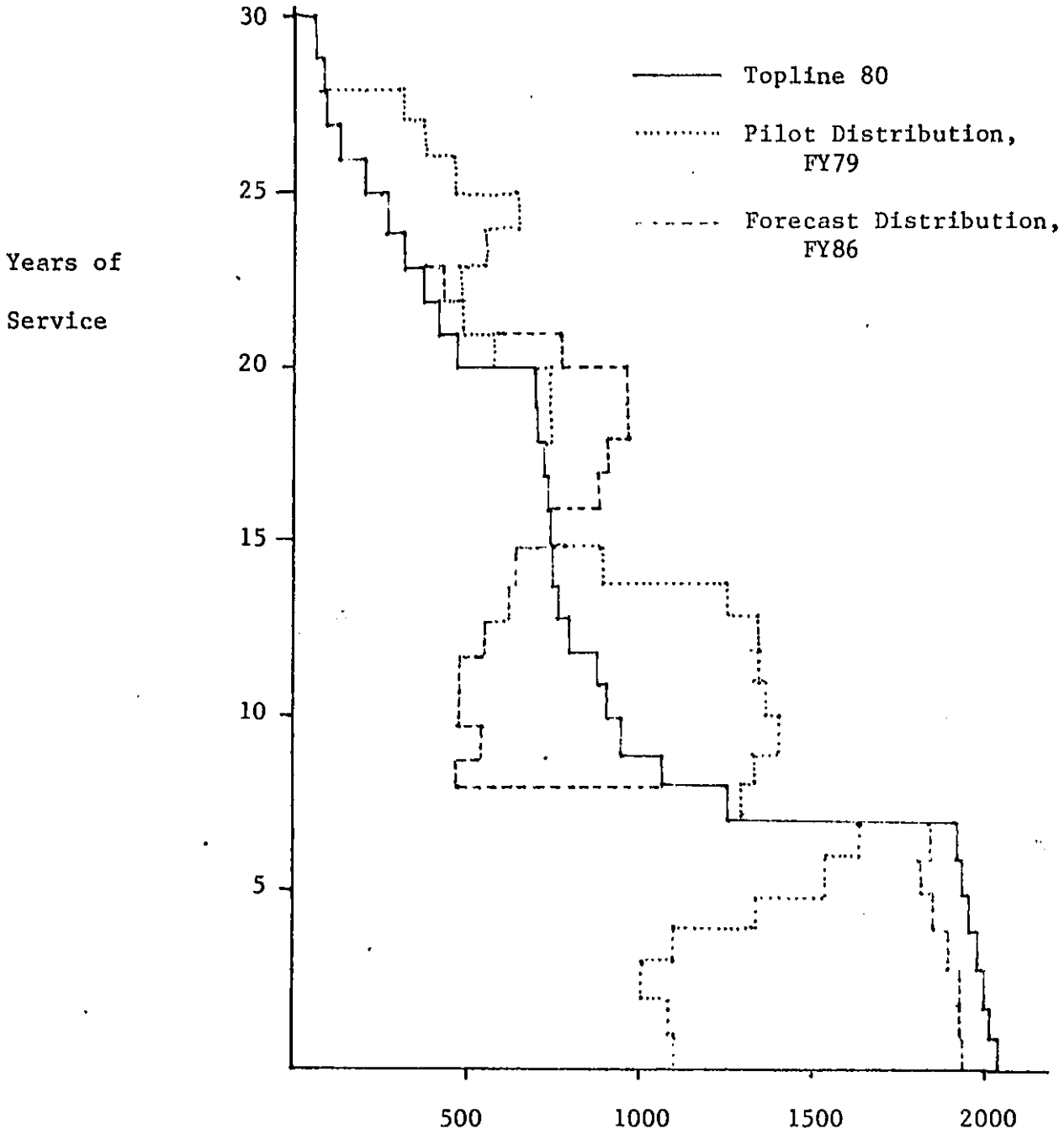

Years of
Service
30
25
20
15
10
5
500
1000
1500
2000
Topline 80
Pilot Distribution, FY79
Forecast Distribution, FY86
Air Force Pilots

Figure 5

the Air Force now, and in future years. What happens to National Defense if this pilot deficit is allowed to continue or if retention rates fall below those planned for in Topline 80?

The second dimension of pilot requirements is that of the experience level. Within each particular weapon system there is a requirement for a certain overall experience level amongst its pilots. Most operational units require between 30 and 50 percent of their pilots to be "experienced" in order for that unit to be operationally ready. The unit will be made up of a distribution of pilots with different amounts of total flying time and time in that particular aircraft. A pilot who has flown fighter aircraft for five years can be assumed to be more competent than a pilot just graduating from pilot training. The amount of flying time required to be classified as experienced varies from aircraft to aircraft, depending on the complexitiies of the aircraft and its mission. Five examples of current front line aircraft and their experience requirements are shown in Table 8.

The actual experience levels of these major weapon systems are also shown in Table 8. This data is from unofficial working papers at the Personnel Center from September 1980. The experience objective is met in all cases with respect to authorized strength for those aircraft listed and in nearly all other cases as well.

The previous paragraphs have described how the Air Force makes its personnel plans to determine the total numbers, experience mix, and proper rank structure for pilots in order to meet their part of the National Defense objective. Given that this objective must be met, it should be done at minimum cost. By varying each of the above three factors, total number of pilots, experience mix and proper rank structure, the total cost

Table 8

Pilot Experience Criteria

Weapon System	Experience Objective	Actual Experience	Definition	Time to Experience in Years
F-15	40.0%	69.5%	500 MSN/or 1000 IP,FP/300 MSN	UPT 3.00 Other 2.00
B-52	32.0	49.2	1300 Rated/300 MSN	UPT 4.26 Other 1.00
KC-135	33.3	52.3	1200 Rated/300 MSN	UPT 4.40 Other 1.29
C-141	33.3	54.4	1300 Rated/500 MSN	UPT 2.87 Other 1.26
T-38	46.4	53.0	600 MSN or 800 Rated/250 MSN	UPT 2.00 Other .80

MSN: Time in that aircraft, FP: Pilot in Command time, IP: Instructor Pilot, UPT: first assignment after pilot training, Rated: Total flying time.

for Air Force pilots will change.

The effect of a change in total pilots is quite obvious. The more pilots required, the higher will be the overall cost of maintaining that force. This figure appears to be fairly constant for the 1976-1985 period. The experience mix for each aircraft is also fairly constant and is a minimum for operational readiness for that type of unit. Units will not be composed entirely of experienced personnel as new people must gain the necessary experience in their new aircraft.

It is the third factor, rank structure, which will truly affect total cost for Air Force pilots. This is where current retention problems have

the most direct impact on total costs. As retention rates decrease, more people must be trained to replace them at additional cost. The December 1979 Retention Newsletter from the Military Airlift Command explained these costs as follows:

> Pilot upgrade requirements in the C-141 best illustrate the training costs involved. Our C-141 flying hour program is driven by the upgrade requirement to keep half our crew members aircraft commander qualified. This currently equates to 526 hours per pilot per year -- or 1008 programmed flying hours over a 23 month period. These numbers do not include all hours flown by the C-141. In FY81, for example, 29,153 additional hours are required for the C-141 fleet beyond co-pilot upgrade requirements. In other words, hauling cargo is largely a by-product of co-pilot aging.
>
> Until the requirement to upgrade so many pilots -- driven by our 80 percent loss rates -- is lowered, we can equate programmed hours directly to our pilot retention problem.

A closer look at a few examples of training costs for several aircraft will give a better idea of how much money has been invested in each experienced pilot. All examples are recent Pilot Training graduates going to their first assignment. These figures come from the December 1979 MAC Retention Newsletter or are derived using their methodology, and Air Force Pamphlet 173-13, USAF Cost and Planning Factors Guide, 31 May 79. These costs do not include: Operational and Maintenance base suppport costs per person per year, Temporary Duty/PCS travel costs for members/dependents or dislocation allowance, mission per diem, local requalifications/upgrades, combat evaluation training, etc, salaries and retirement costs, and the "sunk" costs of bases, facilities, etc. The figure for initial training includes average acquisition costs ($45,790, for Academy, ROTC, or OTS), Undergraduate Pilot Training costs ($238,000) and advanced training in the

assigned aircraft. (1) It is easy to see why many people have said that each time a pilot leaves, several million dollars worth of training walks out the door. Policy recommendations to attack this problem will be presented in Chapter VIII.

Table 9

Pilot Training Investment Costs
Fiscal Year 1980

Aircraft	Initial Training (thousands)	Total Cost to Experience (millions)
T-38 Instructor Pilot	418	.834
F-15	1340*	3.59
B-52	435	5.16
C-141	360	2.22
C-5	448	8.50
KC-135	369	2.48

*From Ashy, "Fighter Pilot Shortfall."

(1) The "Total Cost to Experience" was calculated by multiplying the total hours required from Table 21 by the cost per flying hour for that aircraft from AFP 173-13, except for the C-5 and C-141 which were taken directly from the December 1979 MAC Newsletter. The initial training cost figure for the F-15 comes from Joseph W. Ashy, "The Fighter Pilot Shortfall" 1979, p.9. All of these numbers are crude estimates, but do give some sense of the training costs for these aircraft.

C. Career as a Military Pilot

Each officer in the Air Force must receive a commission to serve as an officer. Prospective officers are given the training and knowledge necessary to become effective military officers in one of three commissioning programs. These are the Air Force Academy (approximately 13.7 percent of each years accessions), (1) Reserve Officer Training Corps (ROTC) at 146 college and university campuses (45.8 percent), and Officer Training School, (OTS) a 90 day officer training program (40.4 percent).

The Air Force Academy provides a four year program of education, military training, and physical training. At the completion of the program, each graduate is commissioned as a 2nd Lieutenant in the Regular Air Force and has a five year commitment. (2) All graduates who are physically qualified are encouraged to go to pilot training. In addition, academy graduates are granted medical waivers for certain vision deficiencies which would normally disqualify potential entrants to pilot training.

The ROTC programs may be either four or two years long. At the completion of this program, distinguished graduates (top 15 percent) receive regular commissions and a five year commitment. All others receive commissions in the Reserve Forces and a four year commitment. (3) Graduates of ROTC must compete for entry into pilot training during low production periods. Normally, there is a larger pool of graduates desiring

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(1) Based on Topline 80, the Air Force Personnel Plan.

(2) Four years for classes before 1969.

(3) Differences between Regular and Reserve officers are discussed in Chapter III.

this training than there are available slots in the pilot training programs. In the mid-70's, when pilot production was cut back after the Viet Nam War, the competition for the few pilot training slots allocated to ROTC graduates was very keen. The large production years of 1968-1972 (the year groups used in this study) allowed many ROTC graduates to become pilots.

Since both the Air Force Academy and ROTC commissioning programs have very long lead times, any quick changes in officer procurement are achieved by changing the inputs to OTS.

The third commissioning program is Officer Training School. The recruitment of individuals for OTS is similar to that for enlisted personnel. They are recruited on college campuses throughout the country in the same manner many companies recruit new employees. They are obligated to serve 4 years after completing their initial training.

Priority for entry into pilot training is based on source of commission. As stated previously, Academy graduates are encouraged to attend and thus have the highest priority. Further openings are filled by ROTC graduates through some type of entry competition. During periods of higher pilot production or rapidly increasing rates of production, OTS graduates will fill the vacancies to insure the necessary output of pilots.

Pilots in this study were trained in a program called Undergraduate Pilot Training which lasted approximately fifty weeks. They were obligated to four or five years of service, depending on their entry date to this training. Pilots who entered training before Jan 1, 1970 were obligated to serve four years. Those entering from Jan 1, 1970 to Jun 14, 1979 had a five year commitment. Anyone entering pilot training after Jun 15, 1979,

now has a six year commitment. (1) After completing pilot training, the individual must go on to advanced training in a specific aircraft. This takes from three to nine months, depending on the type of aircraft. (2) These aircraft are divided into five weapon system groups: trainers, fighters, transport, bombers, and tankers. At the completion of this advanced training, the pilot reports to his operational assignment where he will perform his primary flight crew duties. If he is a trainer or fighter pilot then he is flying as the only qualified pilot in the aircraft and is the pilot in command. New pilots in transports, bombers, and tankers begin as co-pilots and must attend further training in subsequent years to upgrade to aircraft commander in these multi-pilot aircraft.

The Air Force has entered an era where there is little cross training from one of these weapon system groups to another. The one exception is a continual flow into and out of the trainer branch. It is felt that all branches should be represented in the instructor pilot force to give student pilots a varied background in his instructors' operational experience. Approximately 50 percent of the instructor force is made up of pilots with five or more years experience in one of the other weapon system groups. The remainder of the instructor pilot force is made up of recent Pilot Training graduates who will serve approximately three years as instructor pilots and then go to advanced training for their next assignment in fighters, transports, bombers or tankers.

The pilots in this study incurred either a four or five year

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(1) Air Force Regulation 36-51, 31 Oct 75.

(2) Graduates are classified as either aircraft commander qualified (they are deemed qualified to fly fighters or trainers) or they are restriced to the larger aircraft where they will serve as co-pilots. Aircraft commander qualified graduates are not restricted to fighters or trainers only.

commitment from their date of graduation, (1) regardless of any commitment they may have had due to their source of commission. When added to the year already spent in pilot training, these individuals did not have any opportunity to separate prior to the end of their fifth year (year groups 68, 69) or sixth year (year groups 70, 71, 72) of service.

The eleventh year of service is the end point in this study because very few voluntary separations occur after this time. The officer will know by the end of this eleventh year whether he has been promoted to Major. Once promoted to Major, the officer will probably remain in for at least twenty years and retirement. In addition, most of the airlines will not hire pilots after 33 years of age, the approximate age of an officer with eleven years of service. If he is not promoted promoted, or if he does not intend to make the Air Force a career, then in all probability, he will have separated by the end of this eleventh year. Thus most of the voluntary separation decisions of interest to this study will occur in the 5-11 year period.

This explains what the pilot can expect in his first few years in the Air Force, but is not a complete picture of all the opportunities and possible career progression paths which an individual might expect to follow. Three others are the rated supplement, advanced degree programs, and headquarters staff. Only in the past few years have pilots been able to expect to remain in flying positions for their first two assignments. During the drawdown period after the Viet Nam War, it was necessary to continue training pilots but the large surplus created during the latter

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(1) Depending on entry date. Pilots who entered service in 1968 or 1969 were only required to serve four years after completing their initial training. Pilots in the other three year groups in the study, 1970, 1971, and 1972 were all obligated to five years service after their training.

years of that conflict forced many pilots finishing their first assignments into what was called the "rated supplement." These were non-flying jobs in which pilots were to gain "career broadening." Many pilots separated rather than accept these assignments. Others were able to take part in advanced academic degree programs, which are still available on a more limited basis. The other major opportunity open to a mid-career pilot is to work at the staff level. This is a necessary function that must be performed in all units and major Air Force Commands. Also, this staff work is perceived by many as a necessary step in their career for enhancing ones promotional opportunities. Thus the pilot in the period from 1972 until the present was probably engaged in one of the following types of work: operational flying, advanced educational study, staff level work, or in the rated supplement.

That tells what each pilot could expect to do but does not tell how those assignments were made. The assignment process itself continues to be one of the main irritants among pilots. The initial assignment process has changed several times during the 1972-1980 time period. At first, a list of available assignments equal to the number of graduates in a class was given to that class. They then chose their assignments by graduation standing in the class. The less glamourous Commands which flew bombers and tankers complained that they were getting the bottom pilots in the class. Then it was changed to allow the top ten percent in a class to choose their assignment, and the Air Force Personnel Office somehow optimized assignments over the rest of the class to spread the talent to all the Major Commands. This plan did not last long, and in late 1974, the system changed again to where the Training Command got first choice as to who they wanted to retain as instructor pilots (it was felt that a good cadre of

instructors would produce better pilots). This was usually about 20 percent of the class, and the rest were then optimally assigned based on personal preferences, Air Force needs, and on whether the individual was aircraft commander qualified. Most individuals to be considered in this study were able to choose their first assignment as in the system used at the beginning of the period. Subsequent follow-on assignments were made by the Air Force Manpower and Personnel Center, (AFMPC), at Randolph Air Force Base, Texas. These assignments were made by optimizing over individual preferences for assignment and Air Force needs. Each assignment usually lasted from two to four years.

Advanced academic programs have long been recognized by the Air Force as essential to the accomplishment of the Air Force mission. Today's sophisticated weapons require officers with the education necessary to operate, maintain and develop the complex systems used by the Air Force. Officers are chosen for these programs on the basis of undergraduate performance, test scores, availability, past performance, and the needs of the Air Force. Approximately 38.5 percent of Air Force officers currently have Masters Degrees and about 1.7 percent have doctorates. At the completion of an Air Force sponsored program, the officer will have an increased commitment of three years for every year spent in the educational program. (1)

In the preceding paragraphs, the terms commitment and obligation have entered several times. For each training program that the Air Force finances, the individual must "pay back" the Air Force by committing

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(1) This was true for any Air Force sponsored degree program entered before Feb 1, 1980. After that date, maximum limits of four years for a Masters Degree and five for a PhD went into effect.

himself to a certain length of service. The educational programs funded through the Air Force Academy and ROTC programs required five and four year active duty service commitments respectively. As previously mentioned, the initial obligation for pilot training was four or five years from date of completion. Other training programs or actions which would incur a further commitment are advanced training in an aircraft (two to four years) upgrade to aircraft commander (two to four years) advanced educational programs (three years for every year in school) and acceptance of an assignment and a move to a new duty station. These obligations are published and known to the pilot before undertaking these training programs. It is a method whereby the government assures itself of recovering a given return for the training costs expended. A more complete discussion of the costs involved will be presented later. An officer's career is then a series of these commitments, incurred following each formal training program attended. At the completion of this period, he will be free to separate if he has not incurred another obligation from some other training program. The officer will switch back and forth between the state of "no further obligation" and the state of "obligated service" depending on his assignments and career progression.

The military compensation system or pay system is established by Congress. The pay for officers is made up of pay and allowances which come in four different categories. Basic pay is paid to all officers based on rank and years of service. Flight Crew Incentive Pay is only given to officers on flying status, and is currently based on years of flying experience. The other two forms are allowances, the basic allowance for subsistence, which is the same for all officers, and a housing allowance which is based on rank. Congress and the President are able to change the

level and makeup of each of these forms of pay or allowances. Tables of these pay scales (only for the relevant officer ranks in this study) from 1972 to 1980 were seen in Chapter II A. Figure 6 shows the expected

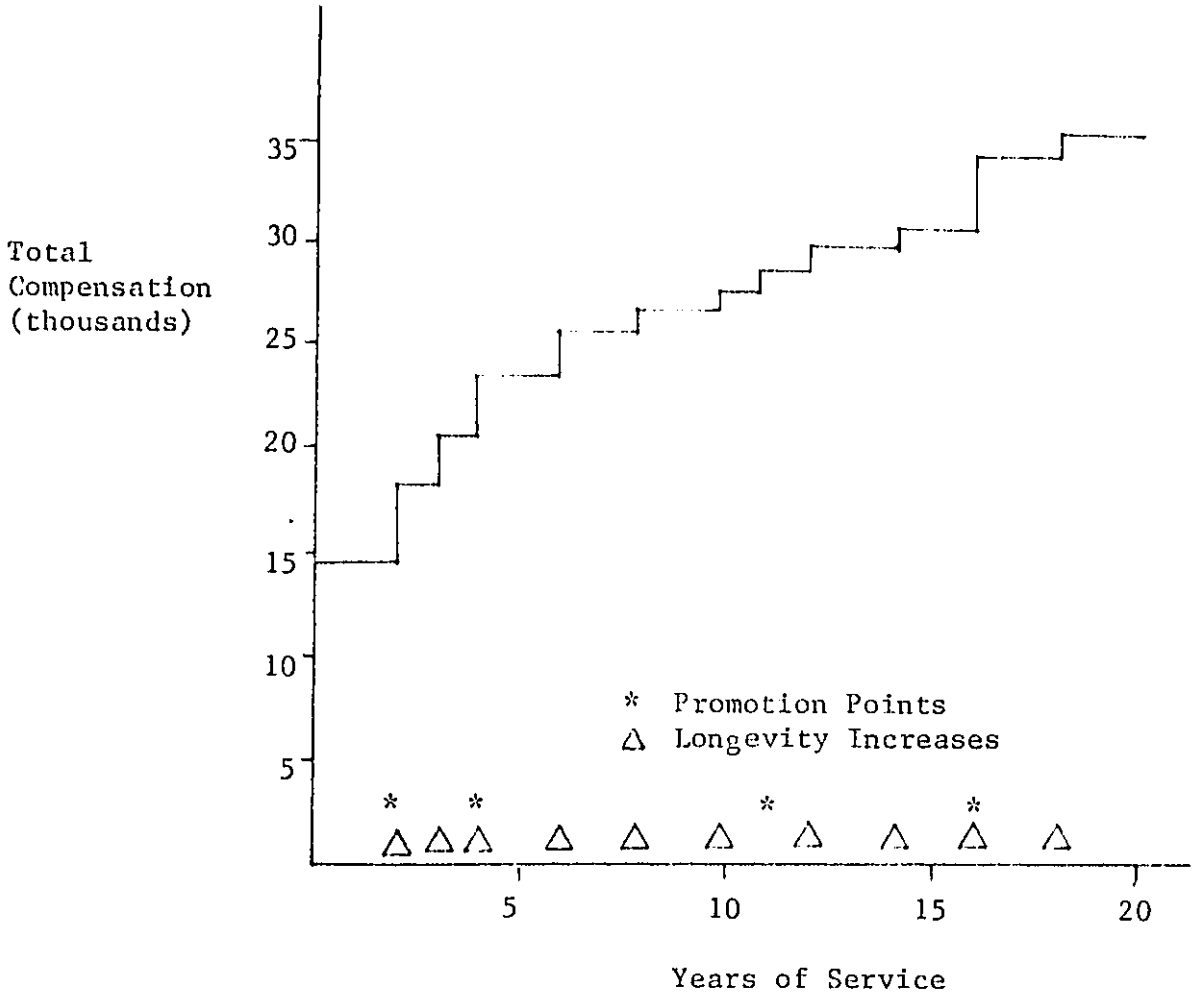


Figure 6

annual earnings for an officer progressing normally through the ranks. It is based on a pilot, with dependents, using the pay scales in effect for Oct 79 - Sep 80.

One important aspect of a pilot career in the Air Force is the different lifestyles one can expect in the different major commands and the

different types of aircraft mentioned previously. Each pilot has an idea of what it is like in each type of assignment and location and these facts may weigh heavily in his decision to stay in or leave the Air Force. Following is a short description of what the pilot can expect in each of the four major commands.

Air Training Command

In this command, most young pilots serve as instructor pilots. They teach student pilots how to fly high performance military aircraft. Most flying is done in the local area during a five day work week. Some weekends are spent away from the home base on navigation missions. The working hours may be long, but the regularity of the lifestyle may compensate for that. The aircraft and the mission are unglamourous, but pilots in this command have been able to gain good flying experience with more flying hours per pilot in recent years than pilots in the other commands. Opportunities for staff level work are not as available as in other commands.

Military Airlift Command

This command flies transport type aircraft. These are the C-5 and the C-141 (four engine jets) the C-130 (four engine prop-jet) and the C-9 (a modified DC-9). Missions will take aircrews all over the world, where they gain valuable experience on international air routes. Missions in the stategic airlift sector may take aircrews away from their home stations for a few days or a few weeks at a time. This allows for travel to interesting places. A set number of days off is given at the end of each mission. At other times, local training sorties may be flown. Those aircrews flying

C-130s in the tactical airlift forces may be deployed during exercises or for temporary periods away from their home station for a few weeks to a few months. It is pilots in this command who fly missions most like those in the civilian airline sector.

Strategic Air Command

This command is in charge of the nuclear deterrent forces. As such, they fly strategic bombers, the B-52 and FB-111, and tankers for inflight refueling, KC-135s. The latter are modified Boeing 707s. Bomber crews stay almost exclusively at their home base. Tanker crews also support tactical fighter forces, so may be deployed anywhere in the world, although primarily in Western Europe or the Far East. These deployments are for approximately one month. At each SAC base, a given number of bomber and tanker crews and their aircraft "sit alert." While on alert, the aircrews stay in special quarters near their aircraft. They do have some freedom of movement around the base, but must be constantly able to rapidly reach their aircraft for a quick launch. Each crew sits alert for one week at a time and does so every three weeks. In between are days off and local training missions and ground training.

Tactical Air Command

This command flies tactical fighters and reconnaisance aircraft such as the F-4, F-15, F-16 and A-10. These aircraft are the most exotic and high performance available. Aircrews are trained in weapons delivery for air-to-air and air-to-ground combat tactics. Each mission is a training mission in peacetime in an effort to assure that each pilot is capable of accomplishing his required tasks in case of an armed conflict. Many

sorties are flown in the local area, but units are often mobilized and deployed to other areas for weeks or months. Such temporary duty may separate the individual from his family. However, many pilots enjoy such travel and the excitement of exercises of simulated combat which are held periodically. The more realistic the training, the better the pilots will be able to perform their duties in time of national emergency.

These descriptions are not meant to be complete descriptions of the lifestyles in the various types of aircraft or commands, but it is hoped that the reader will be able to see the various opportunities available to the Air Force pilot. In general, pilots in the Air Force have fairly long duty hours and average at least a five day work week. The aircraft that they fly are not always the most comfortable or stylish, but that is not a requirement for their mission. The pilots are generally happy when they are flying many hours per month, but the tremendous increases in fuel costs since 1973 have cut average flying hours per pilot considerably as may be seen in Table 10.

A few other aspects of military life should be mentioned. Each officer is authorized thirty days of leave (vacation) each year, but there may be restrictions on when he is able to take that leave due to the mission requirements of his unit. Free medical care for himself and dependents (dental care for dependents not providied), commissary and base exchange privileges, and other lesser valued services are provided.

One of the most well known of all benefits of military service is the twenty year non-disability retirement. This program was begun after World War II and it now appears to be a very expensive program for Congress to fund. However, very few of the legislators who voted it in are still around to pay for the program. Most officers can thus retire at age 42-45

Table 10

Total Fuel Expenditures and
Average Flying Hours 1972-1980*

Year	Total Fuel Expenditure (millions)	Total AF Pilots (thousands)	Total Annual Flying Hrs. (millions)	Avg Monthly Flying Hours per Pilot
1972	700	35.19	5.5	156.2
1973	700	33.17	4.8	144.7
1974	900	31.15	4.0	128.3
1975	1400	29.64	3.5	118.1
1976	1400	28.36	3.1	109.3
1977	1550	26.37	3.2	121.3
1978	1500	24.91	3.1	124.4
1979	1550	23.5	3.2	144.0
1980	2700	21.21	3.2	153.2

* Air Force Magazine, Sep, 1980. The estimate of average flying hours in this chart is very crude. It is simply made by dividing total Air Force programmed flying hours (which includes Reserve and Air National Guard) by the number of pilots on active duty. The actual number is insignificant, but the general trend in flying hours per pilot may be seen. The rise in 1979 and 1980 is caused by the reduction of pilots in the rated supplement. Actual pilots in flying positions and total flying hours have been relatively constant since 1976.

and start a new career. Their pension benefits are fifty percent of base pay at twenty years plus two and one half percent for each additional year above twenty years of service. These retirement payments are adjusted twice annually based on increases in the consumer price index. The value of this retirement, for a few selected years, may be seen in Table 11. The figures are in current dollar amounts as of 1977, with no discounting of future pension payments. Since these figures have been adjusted by the CPI semi-annually, they are now much higher.

The jobs available after retirement are quite varied. Since most officers have had management experience during their service careers, many

enter into management positions. Others may enter vocations which their educational background or rated supplement have prepared them for. Former Air Force officers in general, are able to get fairly good jobs after retirement.

Table 11

Military Lifetime Retirement Pay*

Retired Pay Grade	Years of Service over 20	over 24	over 28	over 30
Brig. Gen.	608,302	651,577	671,244	672,702
Colonel	478,396	543,589	608,996	611,314
Lt. Col.	432,739	480,985	496,937	488,828
Major	394,621	425,697	442,205	445,224

* Dyke. F. Meyer, "1980 Financial Planning Guide for Military Personnel."

D. Civilian Pilot Careers

The previous section of this chapter gave a description of the career of a pilot in the Air Force. This section will describe the career options available to the former military pilot in the civilian sector. (1) This will include the civilian airline industry, other pilot employment, and nonflying jobs in the civilian sector.

The airline industry in this country has changed tremendously in the past twenty-five years since the advent of the large jet transport. This thesis is not a history of the airline industry, but it is necessary to present information about the makeup of the industry in the 1970's, to include the effects of deregulation of the industry in the late 70's.

There have been 30-35 major air carriers in the United States during the past ten years. A major carrier is defined as one flying large, modern aircraft. As of March 1980, there were thirty-three companies which flew regularly scheduled jet operations. The current companies, along with the number of pilots, Revenue-ton miles, Revenue-passenger miles, and equipment flown are shown in Table 12. There have been several mergers, most notably the Pan Am - National and Southern - North Central - Hughes Airwest (now Republic Airlines) mergers, and a few exits and new entrants. These new entrants have come in the regional carriers and the overnight delivery freight companies. The number of trunk airlines has decreased during the decade with the exit of Overseas National and National Airlines. The proposed merger of Continental and Western, currently before the Federal

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(1) Much of the information in this chapter has been taken from publications of the Future Aviation Professionals of America and from discussions with personnel of this firm. I am greatly indebted to these people, especially Mr. Joe Ginanni for their assistance.

Table 12

Major U. S. Air Carriers

Airline	Approx. No. Flight Officers	Rev-Ton Miles (mill)	Rev-Pass Miles (mill)	Equipment Flown
Air California	160	.101	1.009	B-737
Air Florida	159	.056	.57	DC-9,B-737,DC-10
Airlift	207	.117		DC-8
Alaska	190	.098	.847	B-727
Aloha	89	.039	.385	B-737
American	4478	4.1	33.89	B-707,27,47,DC-10
Braniff	2204	1.56	13.68	B-727,747,DC-8
Capitol	90			DC-8
Continental	1743	1.25	9.5	B-727,DC-10
Delta	3733	2.96	26.44	B-727,DC-8,9,L-1011
Eastern	4400	3.21	28.91	B-727,DC-9,L-1011
Evergreen	86			DC-8,9,L-188
Federal Express	421			B-727,737,DC-10
Flying Tiger	732	1.48		DC-8,B-747
Frontier	700	.321	2.98	B-737,CV-580
Hawaiian	192	.96	.49	DC-9,L-188
Hughes Airwest	727	.276	2.62	B-727,DC-9,F-27
Northwest	1742	1.98	13.54	B-727,747,DC-10
Ozark	559	.182	1.7	DC-9,FH-227
Pacific Southwest	480	.286	2.81	B-727
Pan American	3340	3.75	25.08	B-707,27,47,L-1011
Piedmont	595	.208	1.9	B-727,737
Republic	1200	.198	1.8	CV-580,DC-9,B-727
Seaboard	163	.496		DC-8,B-747
Southwest	197	.149	1.49	B-737
Texas Int'l	406	.238	2.2	DC-9
Transamerica	412	.016	.159	L-188,DC-8,10,B-747
Trans World	3962	3.61	31.08	B-707,27,47,L-1011
United	6026	4.47	38.24	B-727,37,47,DC-8,10
U.S. Air	1168	.555	5.16	BAC-111,DC-9,B-727
Western	1658	1.21	10.49	B-727,737,DC-10
Wien	181	.061	.342	B-737
World	197			DC-8,10,B-747

B-Boeing
DC-McDonnell Douglas
L-Lockheed
CV-Convair
F-Fairchild

Trade Commission, and the preliminary merger talks between Eastern and Braniff (1) indicate that there will be a further depletion in the number of companies competing on the long hauls between major markets. This has been one of the effects of deregulation.

The primary emphasis of this thesis is the movement of the former military pilot to this major air carrier industry. As mentioned in the opening chapter, large numbers of former Air Force pilots have been hired by these major carriers in the past few years. Since 1977, approximately 9500 new pilots have been hired by these major carriers, of which about 6840 were former military pilots and 4446 were former Air Force pilots. (2) Why do so many former military pilots leave the Armed Forces and fly with the airlines? This thesis assumes that individuals will maximize their utility. For many this involves getting a job as an airline pilot. We have already looked at the lifestyle and expectations in the military sector. We will now look at the same elements in the career of a pilot with one of these major air carriers.

Entry into the airline industry as a pilot is not a simple process. Timing is of the utmost importance. The airline industry is very cyclical in nature. Expansion, profits and general health in the industry is directly related to the state of the economy. A certain amount of airline travel is discretionary, and is thus a luxury good. In economic downturns, this type of travel falls off while business travel continues, but at a slightly lower rate. All this may leave the airlines with excess capacity, leading to layoffs of flying personnel. Consequently, just getting hired

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(1) "The Odd Couple", Newsweek, Dec 29, 1980, p. 55.

(2) Based on new hire pilot qualifications of new hires in 1979. From FAPA Update Feb 1980, June 1980.

is not all that an individual must concern himself with, but he must also consider the health and future of his company. A pilot hired by TWA in 1978, and now furloughed, may wait a long time to be recalled due to the status of the company.

There was very little hiring in the first half of the 70's due to a move to larger aircraft and the 74-75 recession. Also, 1966 was the largest hiring year ever and any of those pilots who were subsequently laid off had to be rehired before any new pilots could be hired. During the recovery from that recession, many pilots were recalled from furlough status and many new pilots were hired. The period 1976-1979 saw over 12,000 pilots recalled or hired, of which approximately 9500 were new hires. The total number of pilots is now approximately 42,500 with the major carriers. The charts and graphs on the next two pages will give an indication of employment in the airline industry over the past thirty-five years. One can see the effects of the 1980 recessionary period on hiring and furloughs, as well as that of earlier recessions. Both Pan American World Airways and Trans World Airways (TWA) have furloughed pilots hired as early as 1969. They have had problems due to the age of their fleets and the rapidly increasing fuel prices of the 1970's. Their early model Boeing 707's are very inefficient and expensive to operate. Deregulation has also affected the industry as many companies have attempted to expand their route structure. Braniff International has encountered serious problems and has been forced to cut back, necessitating more furloughs and the sale of aircraft. Western and Continental are having difficulties and are attempting to execute a merger which would help both companies. On the other end of the spectrum is Delta, which has continued to expand during the past two years.

Table 13

Airline Pilot Hiring, 1945-1980

Year	Hires	Year	Hires	Year	Hires
1945	652	1957	741	1969	1495
1946	533	1958	256	1970	724
1947	248	1959	527	1971	163
1948	179	1960	287	1972	948
1949	218	1961	326	1973	1452
1950	276	1962	340	1974	244
1951	823	1963	620	1975	113
1952	427	1964	1292	1976	567
1953	560	1965	2337	1977	1446
1954	241	1966	4702	1978	4113
1955	975	1967	2487	1979	3310
1956	1129	1968	1959	1980	815

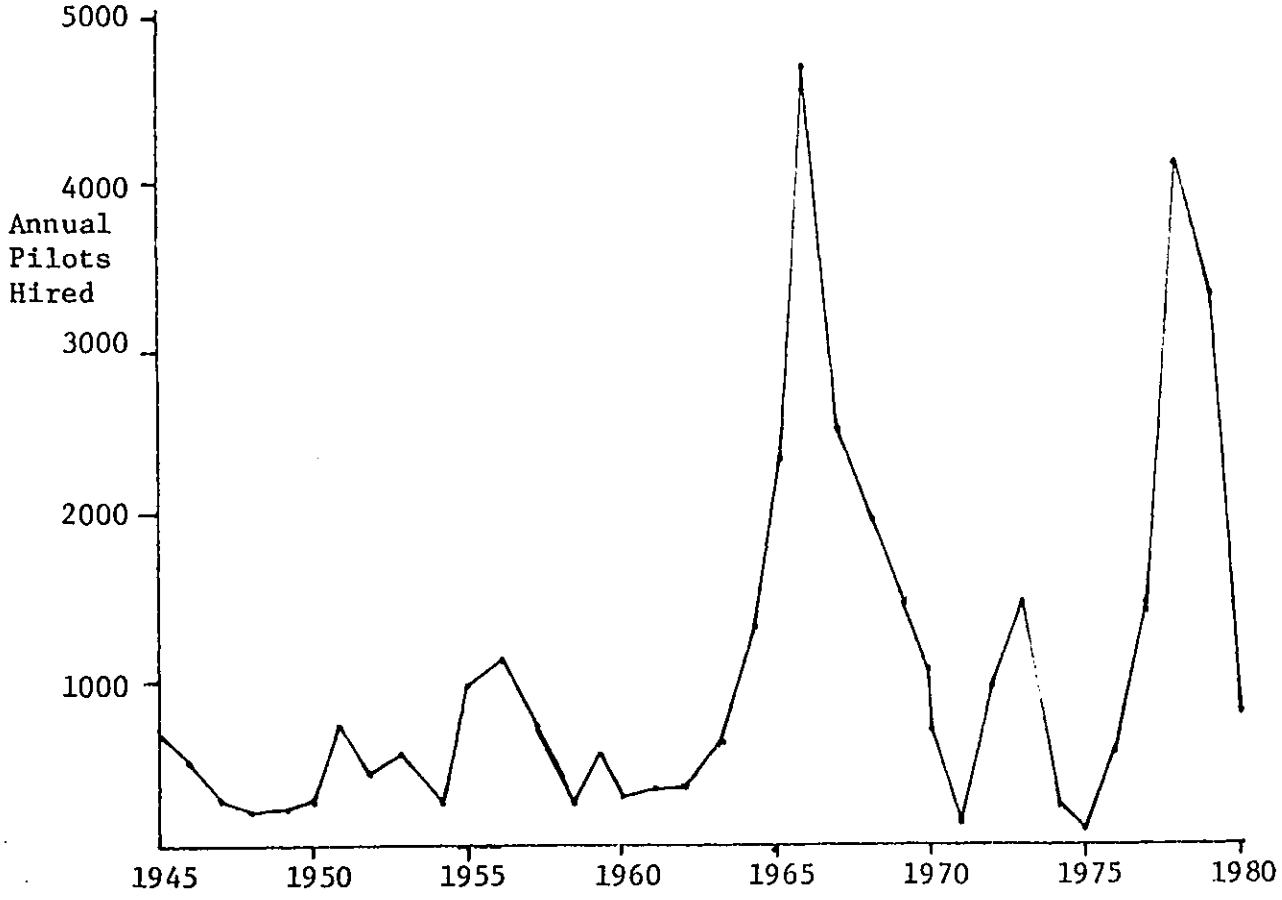


Figure 7

Table 14

Pilot Hiring, Recall and Furlough Activity, 1975-1980

Year	Hires	Recalls	Furloughs at Year End
1975	113	313	2831
1976	567	1086	2349
1977	1446	1185	1063
1978	4113	573	545
1979	3316	249	914
1980	815	372	3396

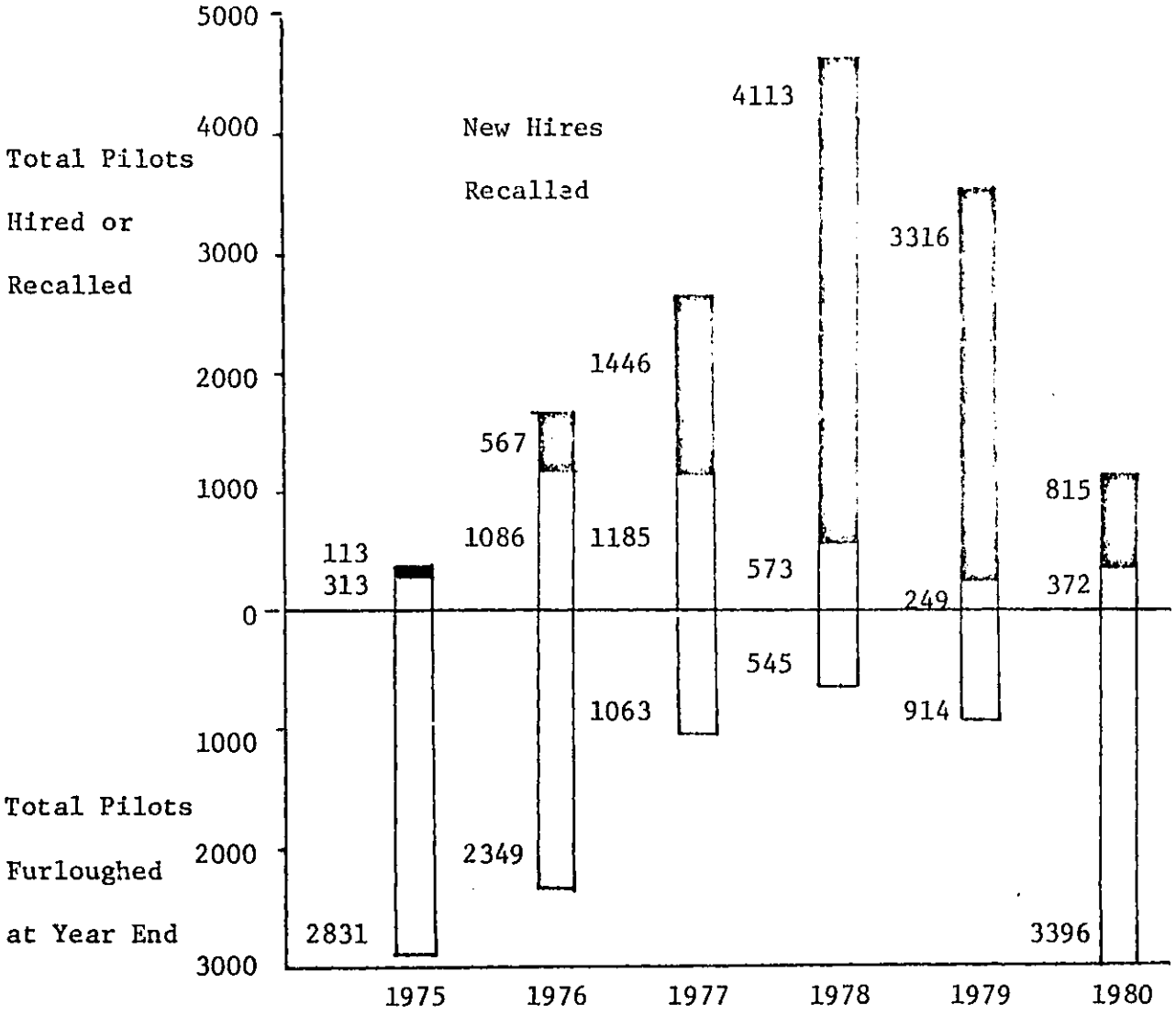


Figure 8

Not only is timing important to getting an airline job, but the hiring process is different with each company. How does an individual go about getting hired by the major airlines? Before 1975, an individual was on his own to apply to each company and find out about each company. Since then, a company currently named Future Aviation Professionals of America, in Las Vegas, Nevada has provided information and counseling services on the hiring practices of each company. By consolidating information on all the airlines, they can provide a one stop service to the prospective airline pilot on each of the major carriers. In 1980, 79 percent of all new hires were FAPA subscribers. This company comes as close as possible to providing "perfect information" to the prospective pilot in search of such a job. At the peak of the recent hiring period, FAPA had over 10,000 subscribers. As of November 1980, there are about 7000 subscribers. This drop was a surprise to the FAPA president as he felt that in downturns furloughed pilots would subscribe to the service to find out what was going on in the industry. There are a couple of reasons for such a drop. 1) Over 7000 new pilots were hired in 1978 and 1979, thus there were fewer people in the supply pool who would need to know the information. 2) Since hiring has slacked off in 1980, prospective pilots, especially military pilots, see no need to follow industry trends if they have little chance of getting hired. Once a hiring period starts again, there may be an increase in subscribers. There are still about 4000 military subscribers on active duty. This is a sufficient number that anyone who wants to know the information is able to get it from those that they work with. Discussions of the monthly <u>FAPA Update</u> are commonplace among military pilots.

Traditionally, the major carriers have hired about 75 percent of their pilots with military experience. This varies across airlines with some

having more or less concentration of military pilots. For example, Delta and Eastern are predominately military and Piedmont is predominately civilian. This hiring of former military pilots is due to several aspects of the training and flying experience of the military pilot with respect to his civilian counterpart. The military pilot has had at least two years of formal training in such subjects as aerodynamics, aircraft systems, navigation, weather, instrument flying, and air traffic control procedures, as well as having completed a college degree. They fly jet aircraft, anywhere from high performance fighters to large four engine transports. This type of experience is directly applicable to the civilian airlines.

On the other hand, a strictly civilian pilot who would be hired by the airlines has come up through the ranks. He probably started out working as an instructor at a flight school flying small single engine or twin engine aircraft. He then probably began flying with a charter service. After gaining sufficient experience, the pilot may get a job with a commuter airline or as a corporate pilot. New hire qualifications from FAPA statistics show that almost all pilots hired by the major airlines without military experience come from a corporate job or commuter airline. (1) These are about the only jobs in which a civilian can get jet time or turboprop time which the airlines generally desire. Again the military pilot has a distinct advantage since few of them fly propeller driven aircraft. Table 15 shows new hire qualifications for Nov 77 - Dec 79. (2)

Another limitation on the civilian pilot is the FAA ratings required

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(1) This was done by looking at the surveys of each initial airline training class which are kept by FAPA. Of those pilots with civilian only experience, almost all had flown for corporate or commuter airlines.

(2) 1980 FAPA Pilot Employment Guide, p. 18.

Table 15

New Hire Pilot Qualifications

	Nov 77-Apr 78	May 78-Oct 78	Nov 78-Apr 79	1979
Number of Pilots Hired	1144	1754	2208	3170
Number of Pilots Surveyed	391	777	981	1187
Sample Size (%)	34%	44%	44%	37.4%
Median Age	29	30	30	30
Average Age	28.7	29.6	29.5	29.6
Age Range	22-36	22-48	21-39	21-46
Median Flying Hours	2900	2600	2700	2815
Average Hours	3200	3025	3030	3012
Percent less than 2000 Hrs.	9.6%	15.6%	17.5%	19%
Percent with Jet Time	75%	78.4%	76.5%	77%
Turboprop and No Jet	20%	15.2%	15.6%	17%
Neither TbProp nor Jet	5%	6.4%	7.9%	6%
Four Years College	94%	95.5%	92.1%	90%
Visual Acuity below 20/20	3%	2.6%	5%	6%
Civilian Only	28%	24.5%	31.5%	28%
Civilian/Military	30%	28.3%	24.2%	26%
Military Only	42%	47.2%	44.3%	46%

to get an airline job. These require a minimum of 1500 flying hours. Unless the individual is employed in some type of flying job, there is little chance for him to accumulate this amount of time.

Other entry requirements may vary, depending on the rate of hiring and the availability of pilots. In times of little hiring, the airlines can be very restrictive, hiring only those with the best qualifications. These usually include 20/20 vision and age under thiry-three (for the largest companies, smaller firms may not be as restrictive on age). When large amounts of hiring are going on, these restrictions may become flexible. However, the generally accepted maximum age of thirty-three for hiring will force military pilots to separate prior to their eleventh year of service (assuming college graduation at age 22).

Another influence on hiring is the number of retirements in each year. Congress has legislated a mandatory retirement at age sixty for all commercial pilots. The large buildup in passenger travel after World War II saw many pilots hired. These people are now beginning to retire in large numbers. Even with no growth in the industry these people must be replaced, so there will be steady hiring in the coming years. A return to 1979 flying levels will see the recall of most furloughed pilots to replace those who have retired since that time. Actual retirements for 1977-1980 and future retirements can be seen in Table 16.

The future demand for airline pilots is an educated guess, at best. Future demand will come from two sources, retirements and increased airframes. Based on projections by the FAA of the number of airframes in service during each year of the next decade, and crew ratios for each aircraft, (total pilots per airframe) FAPA has estimated total demand to be over 19,000 new pilots hired by 1990. This analysis may be seen in Table

Table 16

Airline Pilot Retirements
1977-2000

Year		Year		Year	
1977	523	1985	655	1993	1331
1978	667	1986	434	1994	1484
1979	707	1987	481	1995	1550
1980	791	1988	662	1996	1684
1981	956	1989	743	1997	1727
1982	738	1990	941	1998	1971
1983	719	1991	925	1999	2022
1984	773	1992	1227	2000	1974

Table 17

Pilot Demand Forecast

Federal Aviation Administration Aircraft Forecast

Type of Aircraft	Change in Total Airframes, 1979-1989	Crew* Ratio	Change in Pilots
2 Engine Jets	+452	12	5424
3 Engine Jets	+322	18	5796
4 Engine Jets	-123	18	-(2214)
2 Engine Turbo-props	-95	11	-(1045)
4 Engine Turbo-props	-37	16	-(592)
			+7369
Attrition of Pilots (retirements and medical) 1979-1989			11787
		Total Pilot Demand	19,156

*pilots per aircraft

17. Assuming a steady demand for this total number of pilots in the next decade, Figure 9 compares this steady demand with the number of Air Force and Navy pilots eligible to separate. This chart emphasizes that current retention problems, if indeed caused by airline hiring, will continue for quite some time. Within a few years, it may be possible for any former military pilot to get an airline job if he desires one. Note that during the period 1982-1986, airline pilot demand exceeds the total of all military pilots eligible to separate after completing their initial obligation following pilot training.

Pilots for the airlines fly trips from eight long days to as many as seventeen short days per month. This will depend on seniority and the type of aircraft flown. In most cases, pilots are limited to 75-85 hours per month by contract or regulation. This doesn't necessarily mean actual flight hours, but may include credit time. For example, in most cases pilots are awarded one hour of flight time for each two hours on duty when this "credit time" exceeds that duty period's actual flight time. Actual flight time for any month could be as low as fifty-five hours, but with the credit time, the pilot would reach the maximum of seventy-five hours.

The two or three man flight crew (depending on the type of aircraft) will report for duty about one hour before the scheduled takeoff. After a weather briefing and picking up a computer prepared flight plan, they report to their aircraft where the pilot and 1st Officer (co-pilot) begin cockpit duties and the 2nd Officer (flight engineer) gives the aircraft an external pre-flight inspection. At the end of their day's flying, the flight crew has no other duties, unlike the military pilot who may have many additional duties to perform after his flying is completed or on days he does not fly. The airline pilot is hired strictly to fly aircraft. He

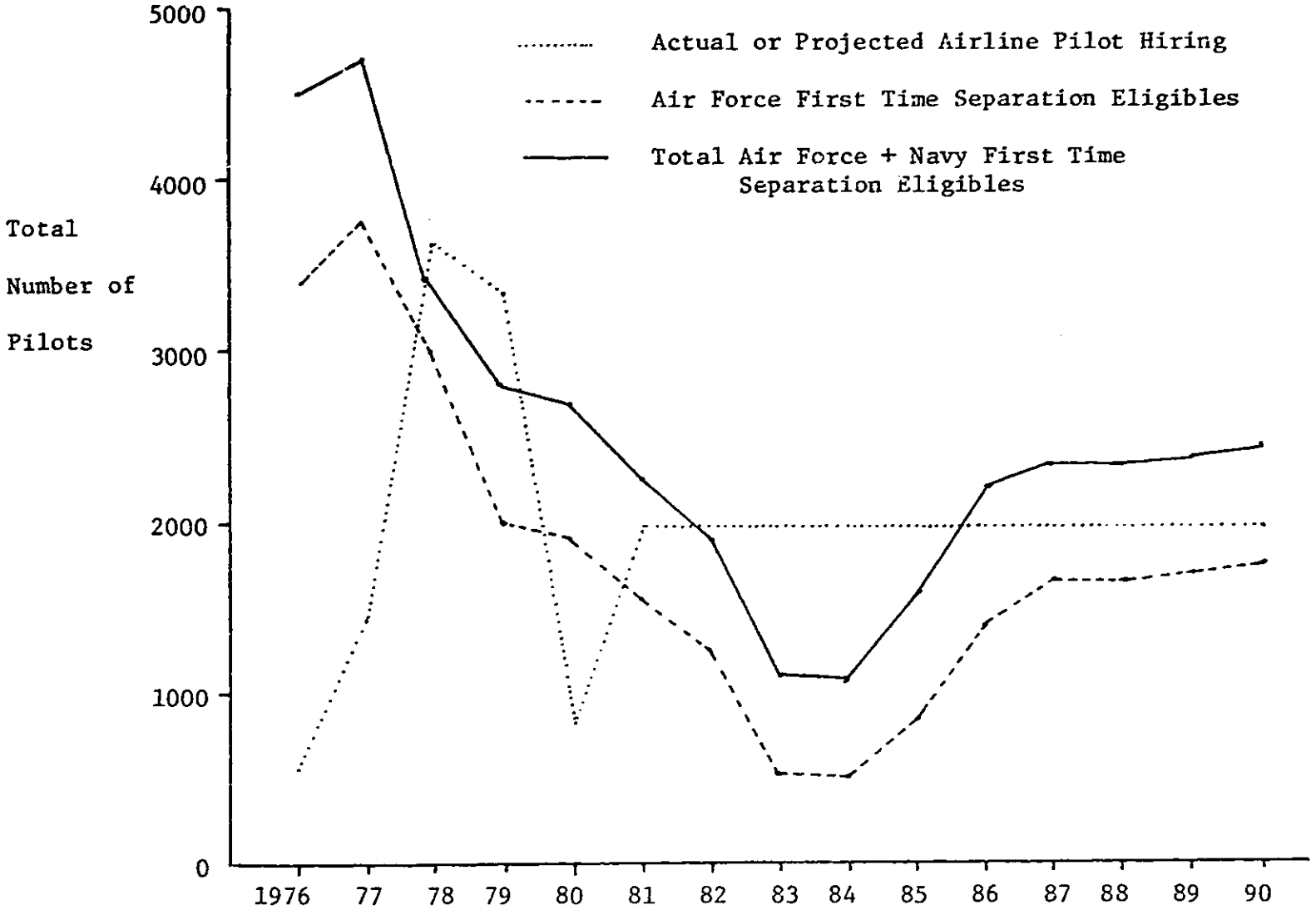

5000
4000
3000
2000
1000
0
Total
Number of
Pilots
Actual or Projected Airline Pilot Hiring
Air Force First Time Separation Eligibles
Total Air Force + Navy First Time
Separation Eligibles
1976
77
78
79
80
81
82
83
84
85
86
87
88
89
90

Figure 9

can only move into management at his own choice. Once hired as an airline pilot, he is assured of that job until retirement (assuming good health and that he survives a twelve month probationary period). Approximately 5 percent are eliminated during this probationary period. Evidence shows that former military pilots are better able to get through this period than pilots without military experience.

In discussions with many airline pilots, they have stated three facets of their job which they really enjoy. These are: 1) no other aspect of their job except flying, 2) many non-working days during each month, and 3) the job security of the seniority system. This seniority system begins the day the new pilot is hired. He is given a seniority number within his company. His position with respect to those around him on the seniority list will remain the same throughout his career. He automatically moves up when someone above him retires or leaves the company. Choices of aircraft, crew position, domicile and monthly flights are all chosen by seniority. Also when layoffs occur, those at the bottom of the list are placed on furlough first. They will then be recalled back to work in order of their seniority. The best trips with more time off and the best layovers usually go to the pilots at the top of the seniority list at each domicile. Those at the bottom may end up on reserve (on call) or flying the less desirable flights. There is a certain amount of apprehension for those at the bottom of the list, but the rules of the seniority system provide long run stability.

The pay and benefits for airline pilots have always been fairly good. Part of this can be attributed to the pilot union, the Airline Pilots Association, ALPA, which represents about 90 percent of the pilots with the major carriers. The pilots with American Airlines are the only major

carrier not represented by ALPA. The mid-30's saw this union gain tremendous power in negotiating with employers. This union has been able to gain pay increases due to productivity increases from new aircraft and to protect its people from inflation very well, but has had difficulty protecting employment as evidenced by furlough statistics. Average

Table 18

Average Salaries of ALPA Members

Year	Average Captain Salaries	Average First Officer Salaries	Average Second Officer Salaries
1971	$38,749	$21,444	$18,113
1972	40,306	23,182	20,349
1973	42,884	26,925	22,685
1974	45,271	28,507	22,030
1975	50,271	32,536	28,564
1976	53,541	35,388	29,033
1977	60,413	40,535	31,919
1978	64,957	42,247	32,100

salaries of ALPA pilots for 1971-1978 may be seen in Table 18. These figures appear to be a bit low when compared with actual contracts. The smaller carriers have brought these figures down. Also, a FAPA projection of possible career earnings can be seen in Table 19. (1)

Just as military pay is made up of several parts, airline pay varies due to different aspects of the particular flights a pilot might take in a month. Pilots receive 1) base pay 2) additional pay based on weight of

(1) Pilot Employment Guide, copyright 1980, Future Aviation Professionals of America. These earnings are from the latest contract which went into effect in Oct 1980. This is a three year contract which calls for semi-annual increases which will total 42 percent over three years.

Table 19

Hypothetical 30 Year Earnings with
Trunk or Regional Carrier

Trunk Carriers			Regional Carriers		
Year	Aircraft/ Position	Annual Salary	Year	Aircraft/ Position	Annual Salary
1	B-727 SO	$17,200	1	B-727 SO	$12,000
2	B-727 SO	36,720	2	B-727 SO	21,732
3	B-727 SO	44,736	3	CV-580 FO	27,963
4	B-707 SO	49,740	4	CV-580 FO	32,950
5	B-707 SO	51,048	5	CV-580 FO	33,641
6	B-707 SO	54,168	6	CV-580 FO	34,336
7	B-727 FO	54,600	7	DC-9 FO	49,393
8	B-707 FO	61,620	8	DC-9 FO	50,312
9	B-707 FO	63,348	9	DC-9 FO	51,237
10	B-707 FO	64,596	10	DC-9 FO	53,812
11	B-707 FO	65,424	11	B-727 FO	53,975
12	B-707 FO	67,848	12	B-727 FO	54,138
13	B-707 FO	67,848	13	B-727 FO	54,138
14	B-707 FO	67,848	14	CV-580 Capt	56,205
15	B-707 FO	67,848	15	CV-580 Capt	56,205
16	DC-10 FO	71,328	16	CV-580 Capt	56,205
17	DC-10 FO	71,328	17	DC-9 Capt	77,205
18	B-727 Capt	86,508	18	DC-9 Capt	77,205
19	B-727 Capt	86,508	19	DC-9 Capt	77,205
20	B-727 Capt	86,508	20	DC-9 Capt	77,205
21	B-707 Capt	94,392	21	DC-9 Capt	77,205
22	B-707 Capt	94,392	22	DC-9 Capt	77,205
23	B-707 Capt	96,768	23	DC-9 Capt	77,205
24	DC-10 Capt	103,032	24	DC-9 Capt	77,205
25	DC-10 Capt	103,032	25	B-727 Capt	80,804
26	DC-10 Capt	103,032	26	B-727 Capt	80,804
27	DC-10 Capt	103,032	27	B-727 Capt	80,804
28	DC-10 Capt	103,032	28	B-727 Capt	80,804
29	B-747 Capt	115,260	29	B-727 Capt	80,804
30	B-747 Capt	115,260	30	B-727 Capt	80,804

aircraft, 3) mileage flown and 4) night flying. As an example, a DC-9 Captain might be paid $50 per hour of flying. In addition, he might be paid three cents per hour for each thousand pounds of gross weight. For a DC-9-30 this is about 108,000 lbs. which comes out to an additional $3.24 per hour. Mileage is computed by incorporating a contract-designated speed such as 550 miles per hour, yielding an additional $16.50 per hour at 3 cents per mile. Usually night flying pays about $3 per hour more than day flying. In all, the grand total would be approximately $70 per hour for a DC-9 Captain. Since normal maximum is about 75 hours per month, a DC-9 Captain could expect to make approximately $5,250 per month. A base pay may also be added to this figure. The pay of 1st and 2nd Officers is based on a percentage of the Captain's salary. (1)

Benefits f airline pilots are also quite good. Most firms provide life insurance, medical programs, disability benefits, and pension plans which are either free to the individual or available at low cost. Other benefits include free or reduced fare airline travel, sick leave, vacations, stock purchase options and unemployment benefits. In general, these benefits are as good or better than those offered to military personnel.

Not every separating Air Force pilot will be able to get an airline job, nor will all desire such a job. As previously mentioned, hiring is very cyclical and furloughed pilots must be recalled by an airline before new pilots are hired. Consequently, there will be a delay in hiring in an economic upturn. The best time to attempt to get an airline job appears to be at the beginning of an upturn. This will improve ones chances of

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(1) Pilot Employment Guide, 1980, Future Aviation Professionals of America. p.23.

getting hired.

If a former military pilot does not get a job with the major airlines, then what other options does he have available? He can attempt to get himself a job as a corporate pilot or with a commuter airline. These small commuters have flourished in the period following deregulation. Normally, these jobs will not pay as much as what the individual was able to earn as an Air Force pilot, but there may be other aspects of the job which make it more desirable. Also, these jobs allow the individual to continue flying, thereby making them more marketable to the airlines in future hiring periods. This corporate and commuter field is certainly an area in which the individual can seek employment for an interim period immediately after separating from the Air Force. The availability of such jobs and the qualifications of the former military pilot make the uncertainties of the civilian labor market a bit less formidable to the individual contemplating separation.

Another area in which the individual can continue flying is with an Air National Guard or Air Force Reserve unit. It is possible for him to make nearly the same salary as on active duty while eliminating many of the undesirable aspects of military life. There have been numerous cases of people who would take one of these jobs to provide current income until an airline job was available.

Alternate employment outside the major airlines, commuters or corporate flying jobs is certainly an option for many former pilots and officers. All officers have college degrees and some also have advanced degrees. These educational qualifications, stable employment background, and managerial experience of the former Air Force officer make him a valued employee in the civilian sector. There are firms which actively recruit

former officers for many corporations in this country. Pay in these firms may be lower in the first few years of employment, but opportunities for advancement are prevalent. Benefits and fringes of many companies are now a large and significant part of overall compensation and are comparable to the benefits offered military personnel. In the past, military benefits were much better in general than those in the private sector, but that gap has narrowed. Many companies now offer better benefits to their employees than the armed forces do to theirs. Mr. Augustine K. Fosu compiled the following statistics for the period 1955-1976. This table shows the compound growth in several benefit areas in the private sector.

Table 20

Pension and Insurance Growth vs.
Changes in the Price Level

Sector	Percentage Change 1955-1976
Pension Growth	303.9%
Insurance Growth	624.4
"Other"Growth in Benefits	505.4
CPI Increase	96.6
Growth of Medical Care Cost	171.6

E. Additional Irritants in Military Careers

Not all of the dissatisfaction with an Air Force career for pilots involves pay. When an individual decides to separate and change careers, he does so for a variety of reasons. As the retention rates among all officers and enlisted men fell in the late 70's, the Air Force became concerned about the reasons for the sudden drop in retention rates. An effort was made to meet with as many pilots as possible to ascertain their greivances.

Also, each separating officer was given a questionaire. This Exit Survey contained among other things, a list of forty-eight possible contributions to their decision to separate. A quarterly report is now published which lists these reasons why officers separate, including an analysis of separating pilots.

The top ten reasons and the percentage of pilots listing each as contributing factors to their decision may be seen below. A short statement about these reasons for separating will follow, using the order of the Jan-Mar 1980 responses. It must be remembered that these responses may not generalize to the entire pilot force since the only respondents are those who have left the service.

More Geographic Stability in Civilian Job (65%)

The trend in the past year has been for this factor to increase in importance. There are several reasons why stability may be becoming more important to the Air Force officer. One of these is the large out of pocket expenses discussed later, which are incurred during a move to a new assignment, and the realization that he will move every three to four

years. Many more wives now work and become attached to their jobs in the community.

Annual Pay Increases Too Small (63%)

This subject was discussed at length in the previous section based on past increases in pay. This historical perspective leads the individual looking to the future to perceive that the longer he stays with the Air Force, the worse off he may become. (1)

Higher Pay in the Civilian Job (over the long term) (62%)

Again the perception of inadequate military compensation in the recent past and the foreseeable future.

Little Say in Future Assignments (62%)

As was previously mentioned, all assignments are made by the Air Force Manpower and Personnel Center. Many pilots have the same desires for particular types of aircraft and the Air Force has requirements to fill many different aircraft assignments in diverse locations. When a pilot doesn't get what he wants, it appears to him that he has little say in where he may go and in what he will fly. The problem is caused by the constraint of Air Force needs.

Unsatisfactory Future Assignments (60%)

The needs of the Air Force often require some individuals to take rather undesirable assignments and not the assignments of their choice. As

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(1) See also, Laird, "People, Not Hardware."

the number of individuals separating increases, the number available for reassignment decreases, which may in turn further increase separations. It must be remembered that many people separate rather than accept a new assignment. Thus this figure may be high due to the large numbers of people who separate when asked to take what to them is an undesirable assignment.

More Job Satisfaction in Civilian Job (55%)

More Freedom and Independence in Decision Making in Civilian Job (48%)

Supervision and Leadership Above Unit/Squadron Level (46%)

These three factors are all about the work environment and management in the two sectors. Approximately half of the separating pilots listed these as contributing factors to their separation decision. It does indicate a general dissatisfaction with the way that the unit missions are carried out. Many people who have been involved with the military have difficulty accepting the military way of doing things.

General Erosion of Benefits (44%)

The largest source of this complaint has already been discussed in terms of monetary compensation. However, the perceived, or actual, erosion of benefits is much more far reaching. Other areas of military life have changed in recent years, tending to reinforce this attitude. One of the primary areas of concern has been the declining quality of health care. The doctor shortage since the end of the draft has seriously limited the health care available at military installations, especially for dependents.

A civilian health care program known by the acronymn CHAMPUS, has led to increased out of pocket costs for Air Force families. Also, areas of CHAMPUS coverage have decreased and reimbursements may fall significantly short of expenses in some areas.

Although not a large concern to officers who are all college graduates, the loss of the GI Bill educational benefits has contributed to the general erosion of benefits attitude. The current contributory program has been able to enroll only 4.6 percent of all eligible individuals. Reimbursements for flight training as a vocation have been reduced from the original 90 percent to only 60 percent. There is little doubt among experts that today's recruiting problems have been exacerbated by the loss of G.I. Bill benefits. (1)

Many other factors which have contributed to the general erosion of benefits attitude come from the actions of Congress. Although Congress has not actually taken away benefits in most instances, the fact that they continually threaten to cannot be, and is not, ignored by military personnel. Some of the proposals brought before Congress in recent years which are seen as threatening to servicemembers are 1) Commissary subsidy threatened, 2) GI Bill replaced by contributory VEAP program (passed), 3) Appropriated fund support for Morale, Welfare and Recreation curtailed (passed), 4) removal of the 1 percent "kicker" to retirement pay (passed), 5) change indexing of retired pay to once a year instead of semi-annually, 6) seven retirement modernization proposals in past eight years (all proposals recommended substantial retired pay reductions for 20 year careerists), 7) $47,500 "cap" imposed on dual compensation (retirees

(1) Senator William Armstrong of Colorado, and others are attempting to reinstate some form of the old GI Bill in the 96th and 97th Congress.

working in federal jobs, passed), (1) 8) retirement pay based on average of last three years pay instead of last years pay (passed, all officers currently on active duty will be covered by the old system) and 9) DOPMA, Defense Officer Personnel Management Act, a bill which would significantly reallign the officer strength in the Armed Forces and would have the immediate effect of decreasing the promotional opportunities for most officers. In addition, Congress supported the pay caps in the 1970's, and has passed into law the compensation schedules shown earlier.

In all fairness to Congress, it must be stated that some benefits have been increased in recent years, primarily for very junior members. The negative aspects however, tend to be more strongly remembered, which has led to the widespread attitude that benefits have steadily eroded in the 70's. The actual balance between increases and decreases in benefits is impossible to determine and would depend on rank and individual tastes. A survey done in 1976 by Richard Eisenman and Robert Goldich (2) found that 84 percent of the respondents agree or strongly agree that there had been an erosion of benefits in recent years. Only 5 percent disagreed with this statement (11 percent neutral).

During this same period, employees in the civilian sector made great strides at improving their non-wage income. Table 20 at the end of the last section shows how various aspects of total compensation have improved in the recent past.

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(1) This also limits the pay of high ranking officers. All General Officers above the rank of Brigadier General are limited by this pay cap.

(2) Richard Eisenman and Robert Goldich. "What's Happened to Military Pay and Benefits Through the Past Decade." Dec 30, 1977. p.18. cited in Lt. Col. Charles Ackerman, "Erosion of Military Benefits and Compensation: An Assessment" Feb, 1979.

Unable to Fly During Entire Career (43%)

This is a common complaint made by many Air Force pilots today. The number of flying hours has decreased dramatically since the early 70's and the days of cheap jet fuel. The price of fuel alone has jumped tenfold from 1973 to 1980. This has seriously limited flying hours available. This was seen in Table 10. Also, since many pilots must serve in staff positions or the rated supplement (especially in the mid 70's) they may not actually fly for three or four year periods. A recent study by two Air Force officers from the Psychology Department at the United States Air Force Academy, finds that when the psychological flying needs of the pilot are not met, then his job satisfaction level decreases substantially. Their study found that pilots with the civilian airlines were much better able to satisfy those needs. (1) A pilot thus sees that a steady job with the airlines will allow him to fly without the interruptions necessitated by the needs of the Air Force.

This section has been an effort to express some of the other factors which have led many Air Force pilots to make the decision to separate from the Air Force. Some are strictly monetary in nature, while others are less tangible but just as influential at affecting the individual's perceived view of a continued Air Force career.

Chapter II A has presented information concerning the general erosion or perceived erosion of the four components of the Air Force pilot's pay and allowances. These are not the only areas in which service members have found compensation to be inadequate. Some of the others will be discussed

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(1) Lt. Col. Bill Rosenbach, Maj. Bob Nordeman and Maj Bob Gregory. "Similarities and Differences: How Airline and USAF Pilots View Their Jobs." 1980.

below.

Inadequate Compensation for Moving.

The individual in the military must move periodically to fulfill the personnel and manning requirements of the Air Force. As the expense to the Air Force of transporting individuals and household goods has increased rapidly during the 70's, the Air Force has been moving people steadily less

Table 21

Permanent Changes of Station
1970-1980

Fiscal Year	Total Number of Permanent Change of Station Moves (thousands)	Average Months on Station
1970	449	18.6
1971	406	19.1
1972	318	23.7
1973	283	24.9
1974	282	23.7
1975	205	31.1
1976	180	33.3
1977	147	39.8
1978	124	47.0
1979	125	45.2
1980	122	45.2

frequently. Table 21 indicates how this has changed. The expenses to the individual have also increased, but compensation for these moving expenses has not increased proportionately. It has been estimated that Air Force personnel spent one billion dollars in out of pocket expenses in 1979, in

excess of compensation. (1) Many individuals have separated rather than incur the expense of another move. The October 1980 benefits package provided an increase in compensation for Permanent Change of Station moves but these entitlements are much less than other federal employees or persons with other companies receive.

Temporary Duty Expenses (TDY)

Inherent in the job of the military pilot is the fact that the pilot may spend a significant amount of time away from the home base. Like many businesses, the government does provide compensation in the form of per diem for people away from home while performing military duties. These TDY funds always seem to be in short supply, which may eliminate some trips or cause pilots to forego compensation in order to gain necessary training. Also, some areas are more expensive to live in on a temporary basis than others. All of this leads to undercompensation for some military personnel when away from the home station. The recent USAF Economic Impact Survey results showed that 70 percent of the officers who had been TDY in the past year stated that their actual expenses had been greater than reimbursements. This is probably not a large financial problem for pilots, but continual emphasis on lack of funds and the required out of pocket expenses are a nuisance. It then becomes an irritation to the individual. Again, the level of these reimbursements was increased in October 1980, but the effect that this will have on total funds available or pilot morale is uncertain.

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(1) 1979 Department of Defense study cited in Laird, "People, Not Hardware," and Air Force Times, Jan 19, 1981.

Chapter III

The Model of Individual Career Decisions

The previous chapter has given a description of the various possible career paths for an individual who begins his working life as an Air Force pilot. These included a twenty year Air Force career, or switching to the private sector for employment with the major airlines or some other line of business. In addition, the constraints placed upon the Air Force by Congress in the form of the All-Volunteer Army and the Air Force's own manning and experience requirements have been discussed. The individual career decision and the constraints under which the Air Force must operate have led to the current problem of pilot retention in the Air Force. This chapter will develop a model incorporating the economic and personal factors which have led to this problem of retaining qualified numbers of experienced pilots.

Throughout an individual's life, he is faced constantly with the decision of whether to stay in his present profession or to change careers. Many people stay in the same field throughout their lives although they may change jobs or locations while staying in that career field. Others may decide after a time in one career that they are dissatisfied with that profession, for any number of reasons, and may embark on a new career. Such a career change may involve further education or training prior to entry into a new profession or, simply a transfer of previously acquired skills. This thesis will specifically look at the individual's decision to change careers from being a professional military pilot to working in the private sector, either as an airline pilot or in some other job in the

private sector.

Whereas most people could decide upon a career change at virtually any time, the military pilot is faced with a restricted set of opportunities for such a change. His opportunity to separate from the Air Force is dictated by his Active Duty Service Commitment date. An officer's career is a series of obligations to government service. Each of these obligations is incurred at the completion of any formal training program, as mentioned in Chapter II. Once an individual's obligation or commitment is finished, he is faced with the decision whether to stay in the Air Force or to move to the private sector. His continued career in the Air Force is known with relative certainty. He is already familiar with what to expect in the way of job satisfaction and remuneration and what his future income and job opportunities will be.

Although the pilot may not know exactly what he would be doing or where he might be assigned during his continued military service, he does know with relative certainty what to expect in terms of lifestyle and income. A career change to the civilian sector for the officer with six to eleven years of service is entirely different. He will leave the relative security of the Air Force with its known policies, pay scales, and promotion opportunities for a world of uncertainty. For many pilots, the private sector offers high salaries and benefits by flying for the trunk airlines or other major carriers. For others, it is the opportunity to get away from the military lifestyle and pursue careers in a variety of fields. The job opportunities available, and the wages offered in the private sector may be affected by general economic trends. This added element of uncertainty makes the decision even more difficult. In its most simple terms, one can see the tradeoffs involved between continuing ones career in

the Air Force and seeking a job in the private sector.

Each individual must decide whether he is better off staying in the Air Force or getting out. It is assumed that the individual makes the choice which maximizes his expected utility between continuing in the Air Force and moving to the private sector. This rational economic agent is commonly used in models using individual utility. (1) The utility of military service comes from such things as the wage, total compensation, security, work intensity and benefits. As previously mentioned, this is known with relative certainty and will be designated as U_{mil}. If the individual gets out of the Air Force, he has utility U_{civ}. This utility has much more uncertainty, since the wage and other variables of the individual's utility may be unknown at the time of his separation. It can be assumed that individuals are risk averse and that this will enter into the determination of U_{civ} by adding a negative term. Thus the expected U^{e}_{civ} will come from a distribution of utilities, which may or may not be greater than the utility of staying in the service. This distribution of available civilian utilities will shift as the state of the economy shifts, primarily due to the health of the airline industry. The individual will compare his expected utilities in the two sectors and choose the sector with the greatest expected utility for himself.

Now consider at the decision as it is made by a typical individual. In making that decision, he must consider not only himself, but his family as well, if he has one. Since he is eligible to separate at any time that he has no further commitment, the utility comparisons in the two sectors

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(1) See, for example, Jerry A. Hausman and David A. Wise, "A Conditional Probit Model for Qualitative Choice: Discrete Decisions Recognizing Interdependence and Heterogeneous Preferences." Econometrica, Vol.46,No.2, March 1978.

will be an ongoing process. To maximize his expected utility, he must look at the distribution of future values of the variables which enter into his utility function such as wages, benefits, promotions, job security, assignments, or job opportunities, and the associated probabilities of those variables. (1) Many of the variables which will be realized if he stays in the Air Force will be determined by the moods of society and especially Congress. At present, there is a general feeling that benefits of military personnel are being eroded, as explained in Chapter II. Such a feeling is an example of how the expectation of the variables will enter the utility function.

More specifically, the pay scale and other benefits are known to the individual. Longevity increases occur every two years and the phase points for promotions are known. This typical progression using the Oct 79 - Sep 80 pay scales was shown in Figure 6. In recent years, cost of living raises have been made annually by Congress. The general trend since the introduction of the All Volunteer Army has been for these increases to be less that changes in the Consumer Price Index. (2) This downward trend itself may have a significant effect on individual utilities.

When looking at the civilian sector, the military pilot considers many things. If he is thinking of leaving the Air Force, it is probably for one of two reasons, either general dissatisfaction with the Air Force or a desire to get a job with the airlines. In considering leaving for either

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(1) An Air Force officer in the Comptroller's office, Lt. Col. Charles Ackerman, has written a paper in which he lists and then attempts to quantify each officer's benefits. By quantifying all benefits, he asserts that total military compensation is quite good. It is possible that such a listing of the value of all benefits may be sent to all military personnel.

(2) See Chapter II A and Table 2.

of these two reasons, the individual will look at his job opportunities in the private sector. There is little sense in leaving a reasonably well paying job if the job opportunities in the private sector are not available. The individual must assess his own qualifications and his chances at selling himself in the private sector. His educational background and performance, the quality of his education, and how readily he can adapt to the civilian environment are all factors which he must consider. He has spent his most recent years not using his education, but in doing a highly technically oriented task, flying high performance aircraft. Thus he must determine his ability to move from the cockpit to a job in the private sector if he is unable to get a job with the airlines. Consequently, the probabilities associated with various realizations of the wage distribution will play an important part in the determination of the expected utility in the civilian sector.

In making the career change decision based upon this economic model of utility maximization, it can be seen that the individual must consider many aspects of his own personal characteristics along with the environment in which he must make that choice. We will now take this theoretical model of job choice and attempt to derive a mathematical model which will take those personal and economic variables and give us results about the individual decision to change careers.

An individual in the five to eleven year group range in the Air Force can be in one of the two states mentioned earlier. These are the state of voluntarily staying in the Air Force and the state of having separated from the Air Force. While the individual is in the Air Force, he must continually make a decision as whether to stay in the Air Force or separate. It is these voluntary decisions and transition probabilities

that will be modeled in this chapter.

The basic decision that the individual makes is assumed to be based upon utility maximization over his expected utility in the two states mentioned. Let U^e_{1j} be the expected utility of remaining in the Air Force in period j, and U^e_{0j} be the expected utility of separating and moving to the private sector in period j. W_{1j} and W_{0j} are functions which represent the deterministic factors of each person's expected utility. The e_{ij} account for the unmeasured components of expected utility. This expected utility is a function of individual characteristics and economic variables. Define U^e_{1j}, U^e_{0j} and V^e_j as follows:

$$U^e_{1j} = W_{1j} + e_{1j} \qquad 3.1$$

$$U^e_{0j} = W_{0j} + e_{0j} \qquad 3.2$$

$$V_j = U^e_{1j} - U^e_{0j} = W_{1j} + e_{1j} - W_{0j} - e_{0j} \qquad 3.3$$

In each discrete time interval, the individual will compare his expected utility in both sectors and stay in the Air Force if $V_j > 0$ and separate if $V_j < 0$. The probability that the individual will stay in the Air Force is equal to

$$\text{Prob}[V_j > 0] = \text{Prob}[e_{1j} - e_{0j} > W_{0j} - W_{1j}] \qquad 3.4$$

and the probability that the individual will separate is:

$$\text{Prob}[V_j < 0] = \text{Prob}[e_{1j} - e_{0j} < W_{0j} - W_{1j}] \qquad 3.5$$

The model now predicts the probability of leaving or staying in each period, j. This theoretical model must be translated into one which can be

estimated. The utility maximization by each individual will be approximated by a linear combination of individual characteristics, Q_t, and economic variables, Z_t, which affect his decision-making process in each time interval. (1) Equations 3.4 and 3.5 then become:

$$\text{Prob}[V_j>0] = \text{Prob}[k_j > X_jB] \qquad 3.4a$$

$$\text{Prob}[V_j<0] = \text{Prob}[k_j < X_jB] \qquad 3.5a$$

where $X_jB = Q_j\delta+Z_j\gamma$ and $k_j = e_{1j} - e_{0j}$

As often happens in economic science, the theoretical model based on the economic decisions of individuals and the model that is actually estimated, are very different. Many of the factors which an individual might take into account in his decision-making process are not available as data for an analysis of each individual choice. (2)

The data used in this thesis included the following individual characteristics which did not vary over time: 1) year of entry into the Air Force, 2) age at the beginning of the sample period, 3) source of commission, 4) ethnic background, and 5) state from which accessed into the Air Force. Each individual also had a set or data for each year that they were in the sample. This included, 6) did they have a Masters Degree, 7) were they married, 8) number of dependents, 9) were they serving in a non-flying position, 10) were they a Reserve or Regular officer, and 11) whether they remained in the Air Force or separated during that year.

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(1) Each of these variables will be discussed in more detail below.

(2) This subject will be discussed and modeled in Chapter IV.

These individual characteristics were combined with macro variables which also contributed to the individual's utility function. In general terms, these variables describe the airline industry, the overall state of the economy, and wages. The data available for these macro variables included: 1) hiring in the airline industry, 2) furloughs in the airline industry, 3) retirements of airline pilots, 4) recalls of furloughed pilots, 5) economy-wide unemployment rates (white collar, overall, males 25-54, and professional and management), 6) real Gross National Product Growth, 7) military pay, 8) promotion rates to major, and 9) the wage differential between the military and civilian pilot sectors. Not all of these macro variables were used in the final estimation process, as will be discussed later.

The actual estimated model of individual utility maximization approximated by a linear combination of individual characteristics and macro variables included the following variables:

1) Year of entry into Air Force
2) Age at entry
3) Source of Commission
4) Southern States Dummy
5) Years of Service
6) Did the individual hold a Masters Degree
7) Was the individual married
8) Total number of dependents
9) Was the individual serving in a non-flying position
10) Component, Regular or Reserve
11) Hiring by the Airlines

12) Military pay wrt the CPI

13) Wage differential between two pilot sectors

14) Overall unemployment rate

The individual decision making process is partially determined by the individual's characteristics. Many of these characteristics are described by dummy variables. They take on the value of one if the individual has that characteristic, and zero if he does not. (1) The interaction of these individual characteristics with the economic environment over time will be explored. The possession of certain characteristics may affect the probability that that individual would separate from the Air Force. By looking at the cross-sectional data on individuals, one should have some idea as to the explanatory power of each of the variables on the separation decision as well as the effect that the changing economic environment has on certain types of individuals. Each of these variables is discussed below, in more detail.

Age

The age at entry of pilots is between twenty-one and twenty-seven years of age. The pilots in this study served at least five years (four years if before 1970) after pilot training before becoming eligible to separate. They are then age 27-33 in a particular year group. The period when most separations occur is between six and eleven years of service. These individuals will then be between age 32-38 at eleven years. In any

(1) The Southern States dummy took on the value of one if the individual was accessed from one of the following states: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia.

year there will be this age distribution within the particular year group. The effect of age could be hypothesized to be similar to other models of leaving a job. Younger individuals might be more willing to separate and start a new career than older, more established individuals.

Marital Status

The expected sign of this variable's coefficient is uncertain. There are two influences, either of which could dominate. Recent studies appear to show that many wives are dissatisfied with service life. Long family separations, constant TDY (temporary duty away from home) and geographic instability are among the list of detractions. In addition, the number of military wives now working has increased dramatically in recent years due to two effects, 1) increased labor force participation rates by all women and 2) decreased real earnings of military salaries which have forced many wives to work to supplement incomes. All of these factors would lead one to hypothesize that being married would increase the probability of the individual separating from the Air Force. Also, one might hypothesize that bachelors would be less risk averse and would be more willing to risk the uncertainties of civilian employment, contributing to more separations (and having an opposite effect on the coefficient in this regression).

Number of Dependents

An individual with more dependents is more likely to stay in the Air Force, since the security provided by the Air Force guarantees income for his family. An individual with fewer dependents would be less risk averse and thus more likely to separate. In addition, the benefits provided by military service, such as free medical care and commissary privileges, are

more valuable with more dependents.

Source of Commission

Officers enter commissioned service from three main sources. Depending on the current demand for accessions, the percentage from each source will vary. ROTC provides inputs with a minimum time of two years training and maximum of four years. The Air Force Academy provides (or is supposed to provide) the backbone of the officer corps with about 800-900 new Regular 2nd Lieutenants each year. Again the training takes four years. Officer Training School (OTS) can take up the slack during periods of fluctuating demand. The lead time is only ninety days for this program. The Air Force has evidence that the "quality" (as they measure it through various aptitude tests) is lower for this latter group than the two other groups. During the period 1974-1979, very few OTS graduates entered pilot training. During Viet Nam and the past year however, this quicker pipeline was used to get more people into pilot training. Many of the pilots in this study entered from this source during the 1968-1972 time period. (1)

What differences are there between individuals entering from different commissioning sources when it comes to the decision to separate? One would like to think that the Academy graduates would be more motivated to stay in (if not, its hard to justify the existence and cost of Service Academies) than the college graduate who signs up for OTS to get a job. If he were really interested in the Air Force he probably would have been in ROTC. This argument says that OTS graduates would have a higher probability of separating.

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(1) See Chapter V and Appendix B for further demographic information on the sample.

Is there an argument for the coefficient being of opposite sign? The so called quality difference may affect the separation decision. There is much security in the Air Force. Therefore, those individuals with lower abilities might be less likely to leave that security and try for a job in the civilian sector. Also, there are job placement companies which actively recruit Service Academy graduates for private corporations. These two influences would counteract the motivational factors expressed above.

Years of Service

The inclusion of this variable in the estimation makes it possible to estimate different probabilities of separating in different years. One would expect that the longer that the individual stays, the more likely he is to remain in the Air Force.

Masters Degree

Many Air Force officers work to get their Masters Degree. Classes are often given by accredited universities at many bases so that Air Force personnel may work on advanced degrees on weekends. Also, the Air Force sponsors certain individuals to get their degrees in residency at various institutions around the country. Promotional boards consider advanced educational degrees when analysing an individual's record. People who have earned this advanced degree then have a higher probability of being promoted, therefore a higher probability of staying in the Air Force.

Type of Commission

There are two components of the active duty force in the United States. There are Regular Officers and Reserve Officers. The Reserve

Officer can be Riffed (reduction in force) at any time whereas the Regular Officer is assured of his job. Promotion opportunities may be better for the Regular Officer. The Reserve Officer must retire at twenty years while the Regular Officer need not. When passed over for promotion, the Regular Officer has many better opportunities to stay in than the Reserve Officer. The Reserve Officer is forced out after two passovers to major (eleven years of service). Academy graduates automatically receive Regular Commissions, as do distinguished graduates of ROTC. All others receive Reserve Commissions and compete throughout their careers to be augmented to the Regular Officer Corps. There are Regular Commission boards at the three, five and seven year points. These boards will give some indication to the individual regarding his potential in the Air Force. With this in mind, one would expect higher separations among Reserve Officers in the 6-11 year groups than among Regular Officers.

Rated Supplement

The effect of a person being in the rated supplement in this sample may have an unexpected effect. Since pilots like to fly, one would assume that those assigned to non-flying jobs would have a higher probability of separating. As has been explained previously, many Officers were given these jobs in non-flying positions when they would have preferred to be flying. Officers who were given such assignments often separated rather than accept the new assignment. These people would show up in the sample as separating from a flying position. Those individuls in the sample who show up as being in the rated supplement will then be those pilots who stayed in the Air Force despite being in a non-flying position. Consequently, the fact that an individual was in the rated supplement may

actually increase the probability that the individual will stay in the Air Force.

Real Military Wage

This entire subject was discussed at length in Chapter II A. The effect of inflation on military earnings over the sample period has been very significant. A declining real wage will increase the probability that an individual will separate from the Air Force. The Air Force itself has made claims in early 1981 that the fairly substantial increase in military pay has caused retention rates to increase in late 1980.

Wage Differential

This variable has been suggested by many people as a strong force in causing pilots to leave the Air Force. The wage available with the trunk airlines is much higher than what the Air Force pays its pilots. Although the new airline pilot will take a cut in pay during his first year, in a very short time he is earning twice what he did in the Air Force, with a much less demanding schedule. Following are two different possibilities to be used as the wage differential variable. 1) Air Force officers are in the 6-11 year groups in retention data. Thus the income for an eight or ten year captain on flying status could be used as the military wage. 2) Alternatively, and probably better from a utility maximization decision, would be to use the expected lifetime earnings. For the civilian input to the wage differential 1) the average income of an aircrew member with, for example, ten years experience could be combined with the ten year captain wage from the military sector. Or, 2) expected lifetime earnings for the civilian pilot (or lifetime earnings in the civilian sector) could be

combined with the Air Force lifetime earnings.

Any way that the wage differential is measured, it has increased in favor of the civilian sector in recent years. One would expect this to increase the rate of separations.

Rate of Hiring

The number of new pilots hired by the major airlines fluctuates wildly over time. This is due to the dependence of the airline industry on the state of the economy. A good portion of airline traffic is a luxury good and decreases during recessionary periods. In growth periods many pilots are hired and in downturns pilots may be layed off. This will slow hiring in the next upturn as layed off pilots are recalled before new pilots are hired. The number of hires is a good indicator to the Air Force officer of the probability of getting an airline job. There are several current indications that this has a great effect on retention as fewer Air Force pilots are separating during this current recession. In addition, a new Air Force program allowing previously separated officers to return to active duty has shown some popularity. However, the overall quality of these individuals is not known. It is possible that they are simply the ones who cannot compete and win in the civilian environment.

In conclusion, the rate of hiring is expected to have a negative effect on the rate of retention.

Unemployment Rate

Since the separating officer probably does not have a job when he leaves, the state of the economy will greatly affect his chances of getting an airline job as well as affecting what other jobs are available. The

unemployment rate is certainly one indicator of the state of the economy. A better indicator might be the unemployment levels for professionals or college graduates. The unemployment rate will have a positive effect on the rate of retention.

The results of this analysis will give an indication of the impact of various personal characteristics and economic variables on the individual decision to separate. This will then lead to policy implications for the Air Force designed to maintain an adequate force of experienced pilots.

Omitted Variables

As previously mentioned, not all of the variables which enter into each individual's decision-making process are available as data. Some are non-quantifiable while others do not happen to be a part of the data set available for this thesis. Still others have not been kept for a long enough period of time. (1) These omitted variables will be discussed below, with a brief description of their effect on the individual decision to stay in the Air Force or to separate.

Wife's Occupation or, Does Wife Work

There is no data available on Air Force pilots as to whether their wife works or in what occupation they may work. General surveys of employment of Air Force wives have been done in the past. These surveys are anonymous and the results usually only give summary statistics of how

(1) See Appendix B.

many wives work. As more wives begin to work and establish their own careers, the effect of the wive's working, or her occupation, will increase in the overall utility maximizing framework for each pilot. The effect of different types of occupations on the Air Force pilot's decision may depend on how easy it is for the wife to transfer her skills to a new job in a new locality. Those wive's whose occupation is linked to the current local economy may decrease the probability that their husbands will stay in the Air Force.

Number of Permanent Change of Station Moves

This information was not available for each individual. Since geographic instability is a significant factor in people's decisions to separate from the Air Force, the number of times that the individual must move during his career may affect whether he stays. A measure of moves per year, computed for each sample year, would help to test the relevance of this variable to the individual decision to remain in the Air Force or to separate.

Education Variables

All officers in the sample are college graduates. In addition, data is available on whether the individual has a Masters Degree or a PhD. This information has been included in the actual estimation. There are other measures of academic performance and achievement which are not measured by this variable which might enter into the individual utility maximization decision.

1) Graduate Degree Study Method. Officers earning graduate degrees do so either by independent study or in Air Force sponsored programs. Those

individuals who are in Air Force programs incur a further Active Duty Service Commitment while those earning their degrees on their own do not. Thus, the individuals who earn their degrees on their own will find it much easier to separate from the Air Force.

2) Academic Major. Information on Academic major would further help to determine individual behavior. Certain skills are much more marketable in the private sector than others. An individual analysing his own potential in the civilian market might very well consider his academic major and its effect on the probability of his getting a job.

3) Quality of Education. Efforts to determine the effect of quality of education on earnings in the past have not been very conclusive. It would be interesting, however, to see if this fact entered the individual's decision-making process. It can enter in one of two ways, either as one's own performance in schooling or as the reputation of the university attended. Individuals graduating from "better quality" institutions or having good performance records might be more likely to leave the Air Force, while those from other schools or with not particularly outstanding backgrounds might be more content to remain with the security of the Air Force.

Promotion Opportunities in the Air Force

Not everyone is promoted to Major in the Air Force. The percentage has varied between 80 and 90 percent in recent years. The figures for pilots are very similar to the above percentages. The promotion opportunity, which is the percentage of that particular year group which will be promoted, is generally published before the promotion board takes place. An officer in the six to eleven year range is thus able to see

general trends in the promotion probabilities before he is actually eligible for promotion. This promotion is one of the main uncertainities facing the career minded officer. Being promoted to Major is an indication of good performance and will allow the officer to continue on to retirement. Reserve Officers passed over twice for this promotion are forced out of the Air Force by law. Regular Officers may continue for several more years before losing their commissions. If this happens, they may then serve until retirement in the enlsited ranks. (1) As the percentage promoted increases, one would expect a higher rate of retention.

Monthly Flying Hours

This data is kept on all pilots in the Air Force, but by a separate agency from the Department of Defense Agency which provided the data for this thesis. This fact, combined with limitations imposed by the Privacy Act, made it impossible to include this data in the list of individual characteristics. It could be hypothesized that such a variable would be an indication of job satisfaction. The more hours per month, the higher the probability that the individual would stay in the Air Force.

Airline Industry

There are many factors about the airline industry that the individual may look at when determining his probability of gaining an airline job.

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(1) Starting in 1979, a "selective continuation" program was begun whereby these officers could stay on active duty at the rank of Captain. This was done primarily to fill vacancies in career fields with shortages such as pilots. Very few of the pilots in this study would fall into this category as few have reached twelve years of service by 1980 where this second passover would take place.

The pilot employment statistics published by FAPA which include a breakdown of monthly hiring rates, total pilots on furlough, and number of airline pilots retiring are all generally available to all interested pilots. As a prospective airline pilot, the individual is primarily interested in activity within the hiring market. Thus, hiring and furloughs will indicate this activity, hiring by showing the increases in employment by airlines with no pilots on furlough and total furloughs showing the activity of firms with pilots laid off. Hirings and furloughs are highly correlated, thus hirings was the only variable included for the airline industry. There is little further information to be gained by including retirements or recalls, so they were omitted.

State of the Economy

The individual contemplating leaving the security of his job with the Air Force must look at the overall state of the economy when determining his utility in the two sectors. The simplest, and most publicized measure of the economy is the unemployment rate. The Bureau of Labor Statistics prepares these rates on a wide variety of different groups. The pilots in this study fall into several subgroups for which these unemployment statistics are kept. Which unemployment rate is appropriate? Most officers separating from the Air Force would seek employment in the professional and management area. An individual would look at this segment of the economy prior to separation to ascertain his chances of getting a job. However, a simple correlation between 1) overall unemployment, 2) Male (age 25-54), 3) white collar unemployment, and 4) professional and management unemployment shows a correlation coefficient above .9 between overall unemployment and the other three. Since the former is much more

publicized and available to individuals, and due to the high correlation with all segments in which the individuals in this study would be interested, the overall unemployment rate for the economy was used for this variable. All other measures of the state of the economy were omitted.

Another measure of the state of the economy is the growth rate in Gross National Product. While the overall unemployment rate is a measure of health in the economy, it may not totally depict the true state of the economy as people move in and out of the labor force. The real growth rate in GNP gives an indication of growth or recession. This too is a much publicized figure in the media. This fact could affect individual decisions.

General Omitted Variables

There is no data available on individual tastes for military life. This, and other non-quantifiable or unmeasured variables which enter the individual utility maximization and decision-making process are part of the error term in the estimated equation. This subject will be discussed further in the following chapter.

Chapter IV

Econometric Specification of the Individual Decision Model

This chapter will present the mathematical model to estimate the model presented in Chapter III. The methodology for obtaining maximum likelihood estimates will be presented. (1)

From Equations 3.4a and 3.5a, it can be seen that the probability of staying or leaving in each period depends on whether $e_{1j} - e_{0j}$ is greater than or less than $Q_j\delta + Z_j\gamma$. (2) The variation in the probability across individuals comes from several sources; 1) the deterministic effect of each individual's characteristics and the economic variables contained in $Q_j\delta + Z_j\gamma$; 2) purely random factors that arise independently in each time period and are independent of all other random factors in other time periods; and 3) random factors, including unobservable variables, that are correlated across time periods. For simplicity, let

$$e_{1j} - e_{0j} = k_j$$

Each individual will have a value of k_t for each period that they remain in the sample. They will remain in the sample as long as $k_t > Q_t\delta + Z_t\gamma$. The probability of an individual separating in the jth period is:

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(1) The derivation of this model will follow the model in J.J. Heckman and R.J. Willis, "Estimation of a Stochastic Model of Reproduction: An Econometric Approach."

(2) The subscripts for individuals have been suppressed except where necessary for clarity.

$$\text{Prob}[J] = \text{Prob}\,[k_1 > X_1B, \ \ldots\ k_{j-1} > X_{j-1}B, \ k_j < X_jB] \qquad 4.1$$

and the probability of staying throughout the sample period is:

$$\text{Prob}[S] = \text{Prob}[k_1 > X_1B, \ \ldots\ k_p > X_pB] \qquad 4.1a$$

where p is the total number of time periods in the sample.

If the k_t were assumed to be independently and identically distributed, then these probabilties for all individuals could be written as:

$$\text{Prob}[J] = \left[\prod_{t=1}^{j-1}(\text{Prob}(k_t > X_tB))\right] \text{Prob}(k_j < X_jB) \qquad 4.2$$

$$\text{Prob}[S] = \prod_{t=1}^{P} \text{Prob}\,(k_t > X_tB) \qquad 4.2a$$

The estimation of the parameters for such a model will depend upon the specification of the distribution of the k_t's. The normal distribution and the logistic distribution are often used in models of this type. The use of these distributions leads to the probit and logit models respectively. Throughout this thesis, the normal distri'ution will be used. Equations 4.2 and 4.2a can be written as:

$$\text{Prob}[J] = \left[\prod_{t=1}^{j-1} \int_{\frac{X_tB}{\sigma}}^{\infty} \phi(k_t)dk_t\ \right] \int_{-\infty}^{\frac{X_jB}{\sigma}} \phi(k_j)dk_j \qquad 4.3$$

$$\text{Prob}[S] = \prod_{t=1}^{P} \int_{\frac{X_t B}{\sigma}}^{\infty} \phi(k_t)\,dk_t \qquad 4.3a$$

where ϕ is the normal density function. The independence assumption allows the separation of the probability for each period, and therefore computation of a single integral for each period. This is because the joint density has a diagonal covariance matrix with σ_k^2 on the diagonal.

If the k_t for each pilot are generated by the same random process, then it is possible to derive maximum likelihood estimates for each of the parameters in the combined model of Equations 4.3 and 4.3a. A simple probit model will generate these estimates for the parameter vector. The log of the likelihood function for this probit model may be written as:

$$L = \sum_{s=1}^{M} \sum_{t=1}^{T} \int_{\frac{X_{st}B}{\sigma}}^{\infty} \phi(k_{st})\,dk_{st} + \sum_{r=1}^{N} \left[\sum_{i=1}^{j-1} \int_{\frac{X_{ri}B}{\sigma}}^{\infty} \phi(k_{ri})\,dk_{ri} \right] + \sum_{r=1}^{N} \int_{-\infty}^{\frac{X_{rj}B}{\sigma}} \phi(k_{rj})\,dk_{rj}$$

M = Number of pilots who stayed throughout sample period

T = Total years in sample

N = Number of pilots who separated throughout sample period

J = Number of years in the sample when separated

The use of such a probit model relies on the assumption that the k_t are independent across time periods. This assumption does not allow for serial correlation in the time path of each individual's decisions. Any persistent, omitted factor would require that a serial correlation coefficient be part of the model. The inclusion of such a parameter is

common in many models which use panel data. (1) (The value of this parameter is usually in the range .4 - .9). (2) Such a model is called a random effects model. (3)

A further modification of the error term is necessary to take into account the omitted variables such as taste for military service which was mentioned in Chapter III. We will assume that the error, k_t, is made up of two components which are both normally distributed and independent with mean zero. The first component, α_i, is drawn from a distribution for each individual, i, and does not vary over time. This "random effect" takes into account any persistence over time in an individual's decisions. It includes all omitted variables which may persist over time for each individual. The second component, u_{it}, is drawn from an independent distribution and varies across both time and individuals. This is the standard error term upon which most econometric theory is based. These assumptions about the error term k_t, may be summarized as follows:

$$E(u_{it})=0$$

$$E(\alpha_i)=0$$

$$\text{cov}(\alpha_i,\alpha_q)=\sigma_\alpha^2 \qquad i=q$$

$$=0 \qquad \text{otherwise}$$

$$\text{cov}(u_{it},u_{qs})=\sigma_u^2 \qquad i=q,\ t=s$$

$$=0 \qquad \text{otherwise}$$

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(1) See J.J. Heckman and Robert J. Willis, "Estimation of a Stochastic Model of Reproduction: An Econometric Approach" or J.A. Hausman and D.A. Wise, "Social Experimentation, Truncated Distributions and Efficient Estimation."

(2) Hausman and Wise, "Social Experimentation."

(3) The discussion follows that in G. S. Maddala, Econometrics. p 325.

$$\text{cov}(\alpha_i, u_{qt}) = 0 \qquad \text{for all } i,\ q,\ t$$

The residual k_t and its covariance terms may now be written as follows:

$$k_t = \alpha_i + u_{it}$$

$$\text{cov}(k_{it}, k_{is}) = \sigma_\alpha^2 + \sigma_u^2 \qquad \text{for } t=s$$

$$= \sigma_\alpha^2 \qquad t \neq s$$

$$\text{cov}(k_{it}, k_{qs}) = 0 \qquad \text{for all } i \neq q$$

and the correlation matrix Λ, is in the following form, commonly called equicorrelated since the correlation is constant between any two time periods. Normally, it is impossible to estimate such a multivariate probit model. The equicorrelated model described here, allows for estimation

$$\Lambda = \begin{bmatrix} 1 & \rho & \rho & \rho & \rho & \rho & \rho \\ \rho & 1 & \rho & \rho & \rho & \rho & \rho \\ \rho & \rho & 1 & \rho & \rho & \rho & \rho \\ \rho & \rho & \rho & 1 & \rho & \rho & \rho \\ \rho & \rho & \rho & \rho & 1 & \rho & \rho \\ \rho & \rho & \rho & \rho & \rho & 1 & \rho \\ \rho & \rho & \rho & \rho & \rho & \rho & 1 \end{bmatrix}$$

using numerical integration.

The correlation coefficient ρ, between any two time periods, may thus be defined as:

$$\rho = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_u^2}$$

If such an effect is a true part of the model, that there are persistent, unobserved variables which are correlated across time, then the

independent probabilities model of Equation 4.3 is not valid. That model, allowed the separation of the probability of leaving in each period into an integral for each period. After evaluating those integrals for each time period, the contribution to the likelihood function for that individual could be calculated by taking the product of each of these sample period probabilities. This is no longer true in the random effects model proposed above and a model must be derived to take this into account. (1)

The model is now a multivariate probit with a constant correlation between any two time periods. The probability of separating in any period for each pilot now depends on the value of this error term, α_i, the random effect. This changes Equation 4.1 to the following for a person leaving in the jth year.

$$\text{Prob}[J] = \text{Prob}[k_1 > X_1B | \alpha \, , \, \ldots \, k_{j-1} > X_{j-1}B | \alpha \, , \, k_j < X_jB | \alpha \,] \qquad 4.4$$

A person staying throughout the sample interval has the following probability of that event based on his persistant effect, α.

$$\text{Prob}[S] = \text{Prob}[k_1 > X_1B | \alpha \, , \, \ldots \, k_p > X_pB | \alpha \,] \qquad 4.4a$$

where p is the number of years that this year group was in the sample range. To solve Equations 4.4 and 4.4a, we must now integrate over the entire possible range of the random effect α. Equations 4.5 and 4.5a follow:

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(1) Hypothesis tests comparing these two models will be presented in Chapter VI.

$$\text{Prob}[J]=\int_{-\infty}^{\infty}\text{Prob}[k_1 > X_1B, \ \ldots \ k_{j-1} > X_{j-1}B, \ k_j < X_jB]\ h(\alpha)\ d\alpha \qquad 4.6$$

$$\text{Prob}[S]=\int_{-\infty}^{\infty}\text{Prob}[k_1 > X_1B, \ \ldots \ k_p > X_pB]\ h(\alpha)\ d\alpha \qquad 4.5a$$

where $h(\alpha)$ is the marginal density of α. Substituting Equation 4.3, which gave the probability of leaving in each period into Equations 4.5 and 4.5a, gives the following form. These equations are the contributions to the likelihood function for an individual separating from the Air Force in period j, Equation 4.6, or staying throughout the sample period, Equation 4.6a.

$$\text{let} \quad \frac{X_tB-\alpha}{\sigma} = \xi$$

$$\text{Prob}[J]=\int_{-\infty}^{\infty}\left[\int_{\xi_1}^{\infty}\cdots\int_{\xi_{j-1}}^{\infty}\int_{-\infty}^{\xi_j}\phi(u_1, \ \ldots \ u_j,\Sigma)\,du_1,..du_j\right]h(\alpha)\,d\alpha \qquad 4.6$$

$$\text{Prob}[S]=\int_{-\infty}^{\infty}\left[\int_{\xi_1}^{\infty}\cdots\cdots\int_{\xi_p}^{\infty}\phi(u_1, \ \ldots \ u_p,\Sigma)\,du_1,..du_p\right]h(\alpha)\,d\alpha \qquad 4.6a$$

where ϕ is the density function for u and Σ the covariance matrix for u. (1)

As previously mentioned, it will be assumed that the errors, k_t, are normally distributed. This implies that α and u_t are also distributed normally. Substituting the normal density function into Equations 4.6 and

(1) This covariance matrix is diagonal since the u_{it} are independently and identically distributed.

4.6a leads to the final form used for estimation.

$$\text{Prob}[J]=\int_{-\infty}^{\infty}\phi(\alpha)\left[\int_{\xi_1}^{\infty}\cdots\int_{\xi_{j-1}}^{\infty}\int_{-\infty}^{\xi_j}\phi(u_1,\ldots u_j,\Sigma)\,du_1,\ldots du_j\right]d\alpha \qquad 4.7$$

The formula for this equicorrelated correlation matrix was taken from Johnson and Kotz, Distributions in Statistics: Continuous Multivariate Distributions, and may be seen below in Equation 4.8. This integral must be estimated by numerical integration and requires extensive computional time. (1)

$$\text{Prob}[S] = \int_{\infty}^{\infty}\phi(\alpha)\prod_{t=1}^{p}\Phi\left(\frac{X_t B - \sqrt{\rho}\,\alpha}{\sqrt{1-\rho}}\right)d\alpha \qquad 4.8$$

It has been necessary to make one important assumption. This assumption involves the treatment of those individuals in the sample who have passed their initial commitment at the five or six year point (depending on entry year) but have incurred a further commitment for some other training. By accepting that training, and further commitment, the individual has shown a voluntary decision to stay in the Air Force, thus he will enter the likelihood function as one who makes a decision to stay during during each year in that interval, even though he may have been unable to actually make a decision in that particular year.

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(1) Special thanks to Prof Hank Farber and Paul Ruud for programming assistance for this model. The computation of this model took approximately ten hours of CPU time for each year group and twenty hours for the combined model where nineteen percent of the pilots were used from each year group.

Chapter V

The Data

The data for this thesis has come from a wide variety of sources. This chapter will give a description of where that data has come from and how it was chosen.

The individual career decision model of Air Force pilots has been derived in Chapter III. To estimate such a model, it was necessary to obtain individual data on a group of Air Force pilots. The data consisted of all pilots who entered the Air Force between 1968 and 1972. Each year group consists of the pilots who entered during that year. It was not possible to use all of the individuals in each year group in the estimation process. A random number generator was used to extract approximately 1000 individuals to estimate the individual year group models. This set of people was used for both the probit estimation and the random effects model. The combined model used a different subset of approximately nineteen percent of each year group. Likelihood comparisons of these different models cannot be made.

The data on individual characteristics was obtained from individual officer personnel records. Each officer has a file in which is kept data and records on his Air Force career. In addition to these individual characteristics, officer performance reports are maintained. A master file for each officer is maintained at his base, plus a computer record at the Air Force Manpower and Personnel Center in San Antonio, Texas. Periodically, this master file of all officers is copied onto computer tape and saved for historical purposes. These historical tapes have been

maintained back to 1972. The data for the pilots in this study was extracted from these historical tapes from 1972 to 1980. Another reason for looking at the period after 1972 is to avoid the effects of the Viet Nam War.

The personnel data which was finally used in the actual estimation did not come from the Air Force Personnel Office in San Antonio. Each year, extracts are made from the Officer Records and sent to the Defense Manpower Data Center, a Department of Defense Agency in Monterey, California. This agency standardizes its files for all the services, so some information which is in the officer record maintained by the Air Force is not contained in the Department of Defense data. I was unable to get the more complete personal characteristics and background maintained in those master files. This has led to some of the omitted variables discussed in Chapter III.

Captain Randy Blakelock of the Defense Manpower Data Center compiled the data set of personal records. Each individual record contained the non-changing characteristics plus an annual update for each year that the individual was in the sample period. The 1968 year group included all pilots who entered the Air Force during that year. The sample period for this year group covered the period 1973-1979. This was the five to eleven year range for this group. Summary statistics of each of these year groups may be seen on the following five pages in Tables 22-26. The same statistics are shown in Appendix B for the sub-samples used in the estimation of the various models.

The tables are organized as follows. Most of the individual characteristic variables are dummy variables (takes the value of one if the individual has that characteristic and zero in he does not). Thus the proportion of the sample with that characteristic is of interest. The mean

or proportion for each variable is shown for each of the periods for the particular year group. Age, Source of Commission and the Southern States Dummy do not change over time, although the proportion of the surviving sample with any one of those characteristics does change. All other personal characteristics were updated annually. As time goes on, one can see how the characteristics of the surviving sample change. The last variable, Retention Rate, shows the proportion of that year group sample surviving to the end of the period. First year retention rates of the last three year groups will be much higher than the other two due to the change in commitment. (1) Comparisons after this first year should be fairly similar across year groups. Standard deviations are shown in parentheses under the mean values.

The macro variables are listed below the individual characteristics and Retention Rates. The sample is different for each year group. The means and standard deviations for the appropriate time period are shown.

(1) Some individuals were able to separate in the fifth year despite a six year commitment by trading accumulated leave for an earlier separation date.

Table 22

1968 Year Group Sample
2869 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.86 (1.08)	26.82 (1.07)	26.85 (1.06)	26.86 (1.06)	26.87 (1.06)	26.87 (1.05)	26.88 (1.06)
Academy Graduate	.108	.141	.158	.157	.156	.159	.163
ROTC Graduate	.427	.422	.454	.457	.456	.458	.452
OTS Graduate	.464	.436	.386	.386	.388	.383	.386
Southern State Dummy	.336	.358	.376	.382	.384	.385	.389
Masters Degree	.037	.050	.086	.166	.306	.435	.534
Married	.779	.834	.871	.896	.921	.926	.931
Number of Dependents	1.42 (1.04)	1.68 (1.10)	1.98 (1.17)	2.15 (1.14)	2.37 (1.14)	2.48 (1.15)	2.59 (1.14)
Rated Supplement	.018	.069	.161	.212	.298	.325	.326
Regular Officer	.234	.581	.673	.687	.719	.727	.734
Retention Rate	.615	.521	.488	.459	.431	.401	.367

	Mean	Standard Deviation
Airline Hiring Rate	1610	1555.776
Real Military Wage	.911	.045
Wage Differential	.653	.059
Unemployment Rate	6.5	1.278
Sample Period	1973-1979	

Table 23

1969 Year Group Sample
2874 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.89 (1.02)	26.82 (1.02)	26.87 (1.02)	26.88 (1.03)	26.89 (1.03)	26.90 (1.03)	26.92 (1.04)
Academy Graduate	.115	.134	.142	.147	.149	.157	.161
ROTC Graduate	.339	.335	.348	.359	.364	.357	.355
OTS Graduate	.540	.522	.501	.486	.480	.481	.479
Southern State Dummy	.367	.385	.388	.390	.393	.390	.385
Masters Degree	.047	.079	.128	.249	.351	.441	.531
Married	.803	.855	.886	.916	.932	.937	.939
Number of Dependents	1.48 (1.05)	.1.79 (1.14)	2.01 (1.19)	2.24 (1.17)	2.39 (1.14)	2.51 (1.15)	2.62 (1.16)
Rated Supplement	.021	.069	.130	.216	.251	.272	.276
Regular Officer	.292	.516	.578	.616	.631	.677	.784
Retention Rate	.681	.594	.541	.496	.431	.375	.363

	Mean	Standard Deviation
Airline Hiring Rate	1524	1582.315
Real Military Wage	.889	.034
Wage Differential	.622	.083
Unemployment Rate	6.8	1.073
Sample Period	1974-1980	

Table 24

1970 Year Group Sample
2232 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.94 (.983)	26.89 (.964)	26.91 (.973)	26.92 (.968)	26.96 (.984)	26.95 (.977)	
Academy Graduate	.164	.189	.204	.204	.211	.220	
ROTC Graduate	.455	.449	.454	.452	.444	.437	
OTS Graduate	.378	.360	.340	.342	.342	.340	
Southern State Dummy	.369	.380	.392	.403	.411	.409	
Masters Degree	.095	.123	.204	.304	.391	.487	
Married	.796	.842	.875	.891	.900	.051	
Number of Dependents	1.46 (1.07)	1.75 (1.15)	1.99 (1.16)	2.15 (1.17)	2.31 (1.19)	2.40 (1.18)	
Rated Supplement	.023	.067	.144	.187	.229	.243	
Regular Officer	.388	.554	.620	.643	.809	.856	
Retention Rate	.786	.637	.557	.466	.386	.364	

	Mean	Standard Deviation
Airline Hiring Rate	1738	1619.259
Real Military Wage	.882	.031
Wage Differential	.601	.070
Unemployment Rate	7.01	1.018
Sample Period	1975-1980	

Table 25

1971 Year Group Sample
2815 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.95 (1.03)	26.92 (1.04)	26.91 (1.03)	26.96 (1.06)	26.97 (1.08)		
Academy Graduate	.130	.146	.154	.153	.152		
ROTC Graduate	.383	.372	.362	.376	.374		
OTS Graduate	.487	.481	.482	.469	.471		
Southern State Dummy	.380	.379	.384	.398	.408		
Masters Degree	.088	.161	.227	.302	.389		
Married	.801	.847	.860	.877	.897		
Number of Dependents	1.51 (1.12)	1.77 (1.18)	1.92 (1.21)	2.12 (1.22)	2.29 (1.24)		
Rated Supplement	.024	.074	.109	.146	.168		
Regular Officer	.267	.463	.571	.640	.877		
Retention Rate	.823	.697	.542	.447	.410		

	Mean	Standard Deviation
Airline Hiring Rate	2063	1576.591
Real Military Wage	.876	.032
Wage Differential	.585	.065
Unemployment Rate	6.72	.798
Sample Period	1976-1980	

Table 26

1972 Year Group Sample
2023 Individuals

Variable	Year in Sample Period 1	2	3	4	5	6	7
Age	26.88 (1.23)	26.88 (1.26)	26.89 (1.31)	26.89 (1.25)			
Academy Graduate	.195	.203	.220	.218			
ROTC Graduate	.536	.526	.477	.495			
OTS Graduate	.269	.270	.302	.286			
Southern State Dummy	.410	.410	.419	.423			
Masters Degree	.121	.181	.229	.291			
Married	.786	.819	.851	.874			
Number of Dependents	1.45 (1.11)	1.62 (1.17)	1.83 (1.24)	2.03 (1.27)			
Rated Supplement	.024	.042	.067	.088			
Regular Officer	.390	.440	.662	.778			
Retention Rate	.899	.699	.549	.488			

	Mean	Standard Deviation
Airline Hiring Rate	2437	1543.430
Real Military Wage	.869	.032
Wage Differential	.567	.060
Unemployment Rate	6.48	.670
Sample Period	1977-1980	

Chapter VI

Results of the Individual Decision Model

Chapter IV presented two different statistical models to evaluate the probability of a pilot separating from the Air Force in any period, j. The first model, the probit model, assumes independent probabilities in each period. The second, the random effects model (or equicorrelated) allowed for persistent effects across time periods for each individual. If there is serial correlation in the model and the probit model is used, the results will be biased. The direction of the bias is unknown. (1)

It is possible to test whether the independent probit model is appropriate by use of the likelihood ratio test. Twice the difference between the log likelihood of the restricted and unrestricted models is distributed distributed χ^2.

$$-2 \mid L_{ur} - L_{res} \mid \sim \chi^2_k$$

where k is the number of constrained parameters. In this case, the equicorrelated model is the unrestricted model. The probit is restricted, and has one less parameter, in that the correlation coefficient ρ is constrained to be zero.

The model derived in this thesis for the individual decision to separate was based upon individual characteristics and macroeconomic variables. These macro variables were hypothesized to affect this decision by indicating to the individual; 1) the probability of getting an airline

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(1) See Heckman and Willis, "Stochastic Model of Reproduction."

job, 2) the comparative wage levels in the two sectors, and 3) the general state of the economy. The variables used in the estimation were as follows;

Constant - a vector of ones

Age - the individual's age at the beginning of sample (divided by ten)

Academy Dummy - was the individual a Service Academy graduate

ROTC Dummy - was the individual an ROTC graduate

South Dummy - was the individual from a Southern State

Seniority - years of service

Master's Dummy - did the individual hold a Master's Degree

Marital Dummy - was the individual married

Number of Dependents

Rated Supplement Dummy - was the individual serving in a non-flying position

Regular Officer Dummy - was the individual a Regular Officer

Number of Airline Hires - total number of pilots hired in that year

Real Military Wage - Real Wage as a percentage of 1972 year end Real Wage

Wage Differential - ratio of military and civilian pilot wages

Unemployment Rate - overall unemployment rate, divided by ten

The dependent variable is the probability of remaining in the Air Force. Thus, positive coefficients increase this probability and negative coefficients decrease this probability of staying. The base group are those pilots with the following characteristics (the dummy variables are zero): 1) unmarried, 2) Source of Commission - Officer Training School, 3) Reserve Officer, 4) Bachelors Degree, and 5) serving in a flying position.

The parameter values for all dummy variables show the change in the limits of integration which change the probability of staying in the Air Force when compared with this base group.

The inclusion of four macro variables, plus a constant term and the Seniority variable gave a total of six variables which were constant across individuals in each period. The pilot groups in this study were analysed according to the following schedule:

Year Group	Sample Period	Years in Sample
1968	1973-1979	7
1969	1974-1980	7
1970	1975-1980	6
1971	1976-1980	5
1972	1977-1980	4

The short sample periods for the later year groups creates estimation problems for the model. The constant and macro variables are explaining the economic environment in each year. This is fine as long as the number of periods is greater than the number of explanatory variables used. The 1970-1972 year groups are overspecified with all six of these variables included. This leads to incorrect signs in the 1970 model for this specification. It is statistically impossible to estimate such a model for the 1971 and 1972 year groups. Thus the theoretical model cannot be estimated for the last three year groups separately.

One could begin by estimating each year group separately with the independent probit model. This can only be done with the first two year groups due to the above mentioned statistical problems. One way to control for the probit problems mentioned at the beginning of the chapter, is to use an error components model, such as was presented in Chapter IV.

Likelihood ratio tests comparing the 1968 and 1969 independent probit results against the equicorrelated model are shown below. These models were estimated with a random sample of approximately 1000 individuals. The critical value at the 95 percent confidence level is 3.84. In both cases, the likelihood ratio statistic exceeded this value, thus rejecting the restricted independent probit model with ρ constrained to be zero. The value of ρ and its t-statistic are also presented. (1)

Year	Probit Log Likelihood	Eqcorr Log Likelihood	$2\|L_{ur} - L_{res}\|$	Correlation Coefficient (t-stat)
1968	-1494.34	-1486.84	15.00	.448 (73.7)
1969	-1572.07	-1553.27	37.60	.580 (14.9)

The equicorrelated results for these two year groups are shown in Tables 27 and 28. Probit results for all models are contained in Appendix C. The probit results for the 1970-1972 Year Groups are estimated with only two macro variables, Airline Hires and the Wage Differential, to avoid the aforementioned specification problems. (2) A restricted form of the theoretical model could be estimated for each year group with only Airline Hires and the Wage Differential, but estimates for the 1968 and 1969 models show that all four macro variables are significant in one or more models.

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(1) A t-statistic is used to test the hypothesis that the value of the parameter is equal to zero (null hypothesis). A high t-statistic leads us to reject this hypothesis. For example, a t-statistic of 1.96 indicates that we can reject the null hypothesis (parameter equals zero) with 95 percent confidence.

(2) Airline hires is negatively correlated with unemployment and the real military wage is positively correlated with the wage differential.

A likelihood ratio test of this two macro variable model against the four macro variable model rejects the two variable model.

Table 27

Equicorrelated Results for
1968 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-11.463	6.352	-1.805
Age (divided by ten)	.391	.302	1.297
Academy Dummy	-.026	.125	-.208
ROTC Dummy	.006	.066	.090
South Dummy	.128	.061	2.109
Seniority	.187	.141	1.330
Masters Dummy	.219	.087	2.527
Wife Dummy	.092	.097	.954
Number of Dependents	.093	.032	2.902
Rated Supplement Dummy	.063	.076	.827
Regular Officer Dummy	.672	.075	9.003
Number of Airline Pilots Hired (thou)	-.031	.053	-.579
Real Military Wage	5.446	4.147	1.313
Wage Differential	4.475	2.304	1.942
Unemployment Rate (percentage divided by ten)	1.747	.425	4.113
Correlation Coefficient	.448	.006	73.706

Number of Individuals 1055

Log Likelihood Value = -1486.84

Table 28

Equicorrelated Results for
1969 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-12.136	8.997	-1.348
Age (divided by ten)	.004	.318	.012
Academy Dummy	-.195	.128	-1.525
ROTC Dummy	.002	.074	.031
South Dummy	.164	.069	2.369
Seniority	.257	.268	.959
Masters Dummy	.092	.076	1.220
Wife Dummy	-.187	.102	-1.838
Number of Dependents	.109	.034	3.192
Rated Supplement Dummy	.204	.088	2.311
Regular Officer Dummy	1.089	.077	14.004
Number of Airline Pilots Hired (thou)	-.159	.064	-2.484
Real Military Wage	7.694	4.382	1.756
Wage Differential	4.667	4.834	.966
Unemployment Rate (percentage divided by ten)	.745	.455	1.636
Correlation Coefficient	.580	.039	14.926

Number of Individuals 1024

Log Likelihood Value = -1553.27

There are good reasons for estimating individual year groups separately. This allows for differences in the make up of different year groups over time. Changing attitudes and characteristics of the officer population would lead one to expect different responses to the same environment in different time periods. There are difficulties presented by such an estimation method however. One of these has already been mentioned. The theoretical model presented here, and the short time interval over which the sample is estimated, make it impossible to estimate individual year groups over less than seven sample periods.

There is a second limitation on using the individual year group estimated models for policy analysis. This is caused by the effect of the first sample year macro variables on the estimated parameters for that particular year group. The normal retention curve for any Year Group shows much larger percentage losses during the first year that that group is eligible to separate. It would be incorrect to eliminate those who separate in the first year from the analysis, for two reasons. First, there are those individuals who make a marginal decision in the first year and secondly, it is possible to get more reliable estimates for the parameters of the individual characteristics. In fact, the parameter estimates are fairly consistent across different year groups and combinations. (1) Thus, exceptional economic factors in the first separation eligible year may have large effects on estimated parameters for the entire sample period. This can be seen in the case of the 1970 Year Group. The first year that this group could separate was 1975. The economy was in recession, airline hires were at an alltime low and

(1) The use of a dummy variable for the first year of separation eligibility was insignificant.

unemployment was high. Real Military Wages were still nearly comparable with those in the civilian sector. These facts combined with the normal losses in the first year to give unexpected signs to several parameter estimates in the 1970 Year Group model. The opposite effect could also happen in an individual year group model.

Both these problems are eliminated when using a combined model of several year groups. The first separation eligible year for each year group (a different calendar year) is now the first year in the combined model. This effectively averages the first year effect over the number of year groups and allows sufficient degrees of freedom for the estimation of the macro parameters.

By adding the 1970 Year Group to the 1968 and 1969 Year Groups, we have a model which is made up of individuals who have served at least ten years by the end of 1980. The likelihood ratio test between the probit model and the equicorrelated model again rejects the probit model at a very high level of significance.

Year	Probit Log Likelihood	Eqcorr Log Likelihood	$2\|L_{ur} - L_{res}\|$	Correlation Coefficient (t-stat)
1968-1970 combined	-2282.06	-2261.60	40.92	.528 (9.79)

The results of this model are presented on the following page in Table 29. This three year combined model has used a different random sample of approximately nineteen percent of the individuals from each year group.

Table 29

Equicorrelated Results for
1968-1970 Combined Model

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-5.813	1.903	-3.054
Age (divided by ten)	.471	.246	1.918
Academy Dummy	.055	.096	.570
ROTC Dummy	.083	.054	1.537
South Dummy	.128	.054	2.360
Seniority	.060	.047	1.278
Masters Dummy	.139	.066	2.109
Wife Dummy	-.237	.081	-2.909
Number of Dependents	.152	.029	5.314
Rated Supplement Dummy	.062	.067	.918
Regular Officer Dummy	.846	.064	13.285
Number of Airline Pilots Hired (thou)	-.067	.022	-2.982
Real Military Wage	2.653	1.153	2.300
Wage Differential	1.738	.749	2.318
Unemployment Rate (percentage divided by ten)	1.077	.249	4.328
Correlation Coefficient	.528	.054	9.799

Number of Individuals 1518

Log Likelihood Value = -2261.60

The results of this three year model are very consistent with the individual year group models. Data was also available on the 1971 and 1972 year groups. The addition of these groups to the combined model would make it possible to analyse a larger segment of the pilot population. There are other year groups, both earlier and later than the ones used here, that were also eligible to separate during the 1973-1980 timeframe. The inclusion of all five available year groups in a combined model further moderates the first year effects. In addition, it is more representative of the overall characteristics of the pilots in the separation interval of primary concern. In the future, it will be possible to include all appropriate year groups in such analysis as more data becomes available. The likelihood ratio test of the probit model against this five year combined model is again conclusive in the rejection of the independent probit specification. The results of this five year combined model are presented in Table 30. This model again uses a random sample of nineteen percent of the individuals from each year group. The individuals from the 1968-1970 year groups are the same as in the three year combined model.

Year	Probit Log Likelihood	Eqcorr Log Likelihood	$2\|L_{ur} - L_{res}\|$	Correlation Coefficient (t-stat)
1968-1972	-3648.15	-3625.70	44.90	.449 (32.18)

Table 30

Equicorrelated Results for
Combined Model of 1968-1972 Year Groups

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-2.356	.949	-2.48
Age (divided by ten)	.253	.196	1.287
Academy Dummy	-.116	.076	-1.528
ROTC Dummy	-.037	.043	-.866
South Dummy	.099	.041	2.434
Seniority	-.059	.018	-3.335
Masters Dummy	.147	.052	2.822
Wife Dummy	-.190	.064	-2.947
Number of Dependents	.141	.022	6.404
Rated Supplement Dummy	.101	.057	1.777
Regular Officer Dummy	.800	.050	15.981
Number of Airline Pilots Hired (thou)	-.019	.015	-1.239
Real Military Wage	1.770	.718	2.466
Wage Differential	-.519	.442	-1.175
Unemployment Rate (percentage divided by ten)	1.587	.196	8.085
Correlation Coefficient	.449	.014	32.183

Number of Individuals 2427

Log Likelihood Value = -3625.70

Analysis of Results

The five year combined model is the most appropriate for the individual decision behavior of Air Force pilots. This section will analyse the results of that model. The models estimated for the 1968, 1969 and three year combined model will be mentioned when they are different than the five year combined model. This model combines all five year groups in the sample, 1968-1972. (1) Following is a discussion of the parameter estimates for each variable from these models.

The appropriate t-test statistic to determine whether a parameter is significant depends on whether we are doing a one tailed test or two tailed test. For those coefficients which, a priori, are assumed to be of a particular sign, a one tailed test is appropriate and the test statistic is 1.64 at the 95 percent confidence level. At the 90 percent confidence level, the test statistic is 1.28. For those variables of unknown expected sign, a two tailed test is used, with a test statistic of 1.96 at the 95 percent confidence level. Positive coefficients increase the probability of remaining in the Air Force and negative coefficients increase the probability of separating from the Air Force.

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(1) There were some additional constraints which were placed on these models. The equicorrelated model takes extensive amounts of computer time to estimate (approximately twenty hours of CPU (central processing unit) time for the large, combined model). This led to individual year group models which did not use all of the available data. Approximately 1000 individuals were used in these three models. The combined models were limited by the capacity constraints of the computer. This limited any one model to about 2500 individuals, or about 500 from each year group. These nineteen percent samples may not give a totally accurate indication of the personal characteristics of the entire combined sample of 12,817 military pilots in the 1968-1972 year groups.

Individual Characteristics

Constant

This term is negative and significant in the combined model. It is negative in all other models and significant in all except the three year combined model where it is significant at the 90 percent level.

Age

The individual's age at the beginning of the sample period had a positive effect on the pilot staying in the Air Force and was significant at the 90 percent level. The age distribution of the pilots in any model is fairly small, approximately five years. It still appears that the older individuals are more stable and thus more likely to remain in the Air Force. The same general results were seen in the other estimated models.

Source of Commission

There is no conclusive evidence in these models to indicate that there is any significant difference in retention by source of commission. The signs on the parameters for Academy and ROTC Graduates are inconsistent across models. In the five year combined model, (for the particular sample estimated) both of these parameters are negative. Part of this is offset by the Regular or Reserve Component variable to be discussed later. (1)

South Dummy

Preliminary tests were done to ascertain the effect of region of

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(1) See Chapter III.

accession on the probability of staying in the Air Force. All regions, except the Southern States, were insignificant. The Southern Dummy in these four models is always positive, and significant, thus showing that pilots from the Southern States are more likely to remain in the Air Force.

Seniority

This variable entered each individual's utility specification as their years of service. One would expect this parameter to be positive, indicating that the more years of service, the less likely is the individual to separate from the Air Force. The sign of this coefficient is not consistent across models and tends to overstate the effect of first year separations. Although the inclusion of a first year dummy is insignificant, it will change the value of this seniority variable. Such a model was estimated for the 1968 Year Group. The coefficient on Seniority doubled in value (at the same level of significance) and the constant term became more negative. While this is an inconclusive test as to whether the sign would shift from negative to positive in the five year combined model, it does indicate that removal of the first year effect from Seniority should make that parameter positive.

The subject of seniority or survival in the sample is an interesting problem which cannot easily be solved. The heterogeneity of individuals may actually change the makeup of the group characteristics over time. It is not possible to distinguish between a time trend and this group heterogeneity in samples of this type. (1)

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(1) The reader is encouraged to read T. Lancaster and S. Nickell, "The Analysis of Re-Employment Probabilities for the Unemployed." Journal of the Royal Statistical Society, Series A, Vol. 143, Part 2, 1980, pp.141-165.

Masters Degree

As expected, the officers who have earned a Masters Degree are more likely to remain in the Air Force. This parameter was positive in each model and significant in all models except the 1969 Year Group. In this model, it is significant at nearly the 90 percent level. This positive effect may be due to several different effects dicussed in Chapter III, under omitted variables. The degree study method is also important in separating the reasons that this Masters coefficient is positive. If the individual is more likely to stay due to an increased commitment from the Air Force sending him to school, then it is incorrect to attribute the positive sign on this coefficient to increased promotional probabilities. In the estimated models, the positive and significant coefficients are most likely due to a combination of the two effects.

Marital Status and Number of Dependents

These two parameters are very consistent across all models. The presence of a wife increases the probability of separation in all models except the 1968 Year Group. This is the only model in which this coefficient is not significant. The Number of Dependents has a positive and significant effect in all models. The wife as a dependent has not been separated from the Number of Dependents. In order to get a composite effect of the presence of a wife only, one must add the marital status and number of dependents parameters. This can be done since both variables are linear. In the four models where both coefficients are significant, the combined effect of being married with no children is slightly negative. The crossover point to a net positive effect of the two combined variables occurs between .3 and 1.6 children in the four models. This low value of

the number of children required to create a positive effect on the probability of remaining in the Air Force indicates how the number of dependents has a stabilizing effect on career change decisions.

Rated Supplement

The inclusion of a Rated Supplement dummy variable for those pilots serving in non-flying positions was designed to show the effect of such assignments on the probability of remaining in the Air Force. In general, this parameter was positive and insignificant. This does not indicate that those officers currently serving in a non-flying position were slightly more likely to remain in the Air Force. Instead, it shows that of those officers receiving these non-flying assignments, the ones serving in these positions were more likely to stay. Remember that many officers separated rather than accept these non-flying jobs.

Component

There are two components of the active duty Armed Forces in this country. They are called Regular and Reserve forces. The Regular component is made up of career officers. (1) This variable had the most constant effect across all models. The parameter was always positive and highly significant. The base group in the sample was composed of Reserve Officers. This variable took on the value of one if the pilot was a Regular Officer. The positive value, and a large positive value when compared with all other individual characteristics, shows the much higher probability of remaining in the Air Force for Regular Officers. Since all

(1) See Chapter II C for a discussion of this distinction.

Academy Graduates are Regular Officers, they are more likely to remain in the Air Force than the entire officer population as a whole. (1) The tables in Chapter V indicate that the proportions of the surviving population from Service Academies do increase over time.

Macro Economic Variables

The macro variables have fairly consistent effects across all models. The only unexpected parameter value occured in the five year combined model with the wage differential having a negative effect. It was not significant at conventional levels of testing. As in most econometric models, these variables are not orthogonal to each other over the sample period. Consequently, changes in one variable are associated with changes in the other variables. Thus the negative Wage Differential effect is more than offset by the positive and significant coefficient on the Real Military Wage. The combined effect of these wage variables in the combined model was also of the expected sign. The same combined effect is true for the Airline Hiring Rate and the Unemployment Rate. They are fairly highly negatively correlated, thus the effects of the two variables must be considered together. Both are included in the model to pick up the economic effects in different portions of the civilian sector. Chapter 6 will present an analysis of the predictive values of these models and simulations of changes in the macro variables. Following is a discussion of the parameter estimates for the macro variables on all four models. The

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(1) The Academy and Regular effects could not be separated due to estimation difficulties, to determine a separate effect for non-Academy graduates becoming Regular Officers.

reader must also remember the qualifications on the macro parameters of the individual year groups due to the first year effects previously mentioned.

Airline Hiring Rates

This parameter was negative and significant at the 90 percent level in the five year combined model. The parameter estimate for the Unemployment Rate is positive and highly significant. Together, these two variables indicate the effect that the state of the economy has on the individual decision. A longer time period, or the inclusion of more year groups in the model would better separate these two effects.

The estimated coefficient for this variable is negative, as expected, in the other three models and highly significant in the 1969 and three year combined models. The evidence in these models supports the hypothesis that the rate of airline hires does seriously affect the separation decisions of Air Force pilots.

Real Military Wage

The parameter estimates for this variable are positive, as expected, in each model and significant at the 95 percent level in all models except the 1968 model where it is significant at the 90 percent level. The declining Real Military Wages from 1972 to 1980 have thus had a significant effect on retention. These declining wages have led more pilots to separate.

Wage Differential

While the Real Military Wage declined during the 70's, the wages of airline pilots actually increased in real terms. The Airline Pilots

Association was able to bargain effectively to gain wage increases for its members. The signs of the parameters for this variable are positive, as expected, in all models except the five year combined model. In this model, the coefficient is negative but not significant at the 95 percent confidence level. In addition, the combined effect of the two wage variables in this model is positive (to be discussed in the next Chapter using policy simulations).

Unemployment Rate

The parameter estimate on the Unemployment Rate has the expected positive sign in all four models and is significant in all four models. This variable is negatively correlated with the Airline Hiring Rate. Together they show the effect that the civilian economy has on separation decisions. In this case, increases in the Unemployment Rate increase the probability that an individual will remain in the Air Force.

Correlation Coefficient

The value of the correlation coefficient ranges from .45 in the five year combined model to .635 in the 1970 model. In all cases it is highly significant. The value of this coefficient gives an indication of the explanatory capabilities of The variables in the model. Since the correlation coefficient is equal to the following formula,

$$\rho = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_u^2}$$

it gives an indication of the variance in the random effect when compared with the unexplained error term. In this case, they are nearly equal.

Chapter VII

Prediction in Separate Samples and Policy Simulations

The previous chapter presented the results of several different estimations of the individual decision model. With the large data sets available for each year group, it is a natural extension to test how well a different sample is predicted by the estimated model. Also, these models can be used to simulate individual decisions and overall retention rates under different realizations of the variables in the model. Results of such simulations will lead to policy recommendations. This chapter will present an analysis of the 1968, 1969 and five year combined models on the above subjects.

Prediction in Different Samples

One of the main conclusions from Chapter VI is that the combined model is the most appropriate for analyzing individual decision behavior. Individual year group models are seriously limited in their value due to the overspecification of all such models except the 1968 and 1969 Year Groups. Also, they cannot be used to predict behavior in different groups.

To see how well the estimated parameters for these three models could predict individual behavior, the following procedure was used. Predicted retention rates for a random sample of 50 percent of each year group were computed using the estimated parameter values for the appropriate model. The vector of individual characteristics and macro variables was multiplied by the vector of parameter estimates for the appropriate model. the

probability of surviving in the sample through each time period was then calculated using the equicorrelated framework. The predicted retention at the end of each period is the sum of these individual probabilities. The estimated models for the 1968 and 1969 used 35 percent of each of those groups and the combined model used 19 percent of the pilots from each year group. Since all samples were random, there is some overlap in those individuals used in the estimated model and the predicted model. Tables 31 through 33 present the results of this predicted retention behavior based upon the three estimated models (hereafter referred to as the "base case"). The figures show the percentage of the original sample surviving to the end of the period.

Table 31

Predicted Retention Behavior
for 1968 Year Group

Year in Sample	Predicted Retention	Actual Retention
1	60.2%	61.4%
2	50.0	51.6
3	46.3	48.1
4	42.8	44.9
5	39.1	41.7
6	35.0	38.2
7	30.7	35.1

1433 Individuals in Prediction Simulation

Table 32

Predicted Retention Behavior
for 1969 Year Group

Year in Sample	Predicted Retention	Actual Retention
1	68.8%	67.5%
2	58.3	59.9
3	52.1	54.2
4	46.5	49.9
5	38.4	43.5
6	33.0	37.8
7	30.9	36.4

1436 Individuals in Prediction Simulation

Table 33

Predicted Retention Behavior
for Five Year Combined Model

Year in Sample	Predicted Retention	Actual Retention
1	73.2%	74.7%
2	60.6	62.6
3	52.0	53.6
4	45.2	47.4
5	33.4	35.3
6	21.5	23.6
7	13.1	15.9

6417 Individuals in Prediction Simulation

The retention figures in this five year combined model can only be compared with the individual year groups through the fourth year. After that point in the combined model, one year group is lost with each subsequent period. The retention figure computed effectively treats this as the entire year group separating. (The 1972 Year Group is lost in year five, 1971 in year six, and 1970 in year seven). Thus one should only compare predicted versus actual retention within the five year model for the last three periods. The figure itself is meaningless.

The results of this comparison of predicted retention rates using independent samples are very encouraging. The estimated models under-predict retention in all three models. but by a fairly small factor.

The predicted models are approximately twelve percent low after the seven year sample period. One would expect these results to be low for the following reason. In order to calculate a predicted retention probability value, it was necessary to have individual updates for each of the periods. For those individuals who had separated, and thus had no data available, their last update was duplicated for all subsequent periods. If the people who separated had characteristics which would predict this fact, then to add more observations of this data to later periods will cause underprediction of retention in those later periods. This shows that the theoretical model predicts actual retention behavior fairly well. These predicted results can now be compared with the predicted retention rates from other models simulating changes in economic or policy variables.

Policy and Economic Simulations

The simulations performed may be divided into three general areas, 1) Air Force personnel policy, 2) wage policy, and 3) economic environment. The same simulation model was used to calculate the predicted retention for the same sample as that used to test the predicted retention in Tables 31-33.

Air Force Personnel Policy

The results presented in Chapter VI on individual characteristics do not give the Air Force many options to improve retention through personnel policy. It would be difficult to institute policies which recruited potential pilots based upon their age or the fact that they came from the

South. The realizations of the family variables (wife and dependents) at the five to eleven year point cannot be anticipated when the officer first comes on active duty. There are currently several programs available for graduate education (GI Bill and Tuition Reimbursement). Further emphasis on these programs. while increasing government expenditures. might be more than offset by retention gains. Further study could be done on this subject and such programs are under consideration by Congress.

The main personnel action that the Air Force could undertake is to increase the number of officers being augmented to the Regular Officer Corps. We have seen in Chapter VI how large an effect this will have on the individual's decision on whether to remain in the Air Force. As previously mentioned. becoming a Regular Officer provides job security for the officer. and therefore increased probability of remaining in the Air Force. What would retention have been if all officers had been augmented to the Regular Officer Corps by the fifth year of service? This question was simulated in the three models and the results are presented in Tables 34-36. Such a policy action is not without cost to the Air Force. Once a pilot receives a Regular Commission. he cannot be involuntarily separated except in rather extreme cases. With this inflexibility, the Air Force could be left with too many officers in the mid-level management range in later years if insufficient numbers voluntarily separate. Consequently. the use of this as a policy instrument must be done with care on a selective basis by year groups.

Table 34

Predicted Retention Behavior
for All Regular Officers
for 1968 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	78.2%	60.2%
2	69.9	50.0
3	66.8	46.3
4	63.5	42.8
5	59.5	39.1
6	54.8	35.0
7	49.4	30.7

1433 Individuals in Prediction Simulation

Table 35

Predicted Retention Behavior
for All Regular Officers
for 1969 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	90.6%	68.8%
2	85.3	58.3
3	81.3	52.1
4	76.8	46.5
5	68.4	38.4
6	61.7	33.0
7	59.0	30.9

1436 Individuals in Prediction Simulation

Table 36

Predicted Retention Behavior
for All Regular Officers
for Five Year Combined Model

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	88.5%	73.2%
2	80.4	60.6
3	73.5	52.0
4	67.2	45.2
5	51.9	33.4
6	34.8	21.5
7	15.9	13.1

6417 Individuals in Prediction Simulation

The predicted retention rates show very large increases in retention, especially in the very first year. This indicates that many of the Reserve Officers that separated in the first eligible year would not have separated had they been Regular Officers. The loss rates for the first year when compared with the Base Case range from thirty percent in the 1969 model to fifty-four percent in the 1968 model. The decrease in predicted losses from the second through seventh years are as follows (only four years for the combined model).

1968	2 percent
1969	16 percent
Combined Model	23 percent

It is doubtful that this policy action would have such a large effect on first year retention, although it would certainly have some effect. The model predicts that approximately fifty percent of those who left in the first separation year would have remained. This seems like too much to expect from such a policy action. The security of being a Regular Officer may actually have this large effect predicted by the model. The decreases in losses after the fifth year of service in the combined model indicate that substantial increases in retention can be gained even after the first year of eligible separations. Estimations of this model in the future when more year groups are available over the entire period will give a more accurate prediction of retention through eleven years with such a policy.

Economic Environment

The effect of the economic environment in which individual decisions are made has been explored in this thesis. These economic factors were specifically modeled by using the rate at which the airlines hired new pilots and the overall unemployment rate. The airline hiring rate shows the status of the airline industry and the unemployment rate shows the general state of the economy. These two variables have been seen to significantly affect career choice in the model derived in this thesis. It would be interesting to see what would happen to retention if these variables were to take on different values over time. The specific question to be examined here is what effect would different realizations of these two economic variables have had on retention in 1980?

The reason for this test is to show the effect of a healthier economy on retention in 1980. There have been published statements that the improved pay in 1980 had "turned around" the retention rate figures.

Retention improved considerably in the economic downturn in 1980 and it would be helpful to know what would have happened to retention, and therefore overall manning, in the presence of a healthy economy. This test will separate the economic environment effects from the wage effects by returning the hiring and unemployment variables to near their 1978-1979 levels. Such a simulation might indicate to the Air Force the continued seriousness of their retention problem if forecasted losses were to continue at unacceptable levels. Tables 37 and 38 present the results of two simulations for the 1969 Model. (1) Tables 39 and 40 summarize the results for the Combined Model. The first model simply substituted an Airline Hiring Rate of 3000 pilots (approximately the average for 1977-1979) and an unemployment rate of 6.0. All other factors were held constant. The second model used Airline Hires of 3500 (200 below the 1978-1979 average) and an Unemployment Rate of 5.7.

(1) No results are presented for the 1968 Model since the sample period ended in 1979 for this group.

Table 37

Predicted Retention Behavior
Airline Hires 3000 - Unemployment 6.0%
for 1969 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	68.8%	68.8%
2	58.3	58.3
3	52.1	52.1
4	46.5	46.5
5	38.4	38.4
6	33.0	33.0
7	28.1	30.9

1436 Individuals in Prediction Simulation

Additional Losses Over Base Case - 41

Table 38

Predicted Retention Behavior
Airline Hires 3500 - Unemployment 5.7%
for 1969 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	68.8%	68.8%
2	58.3	58.3
3	52.1	52.1
4	46.5	46.5
5	38.4	38.4
6	33.0	33.0
7	27.2	30.9

1436 Individuals in Prediction Simulation

Additional Losses Over Base Case 54

Table 39

Airline Hires 3000 - Unemployment 6.0%
for Five Year Combined Model

Year Group	Predicted Losses	Base Case Losses
1969	60	40
1970	68	49
1971	70	47
1972	62	41
Total	260	177

Percentage Increase in Predicted Losses 47%

Table 40

Airline Hires 3500 - Unemployment 5.7%
for Five Year Combined Model

Year Group	Predicted Losses	Base Case Losses
1969	66	40
1970	74	49
1971	78	47
1972	68	41
Total	286	177

Percentage Increase in Predicted Losses 62%

The results of these simulations change only in the last year for the 1969 Year Group. A comparison of the predicted retention of this simulation against the Base Case will show the additional losses which could have been expected if the 1980 economic variables had been for this

healthier economy. The summaries in Tables 39 and 40 for the combined model reflect predicted losses in each year group against the predicted losses in the Base Case. These simulations indicate that considerably more losses would have been realized in a healthier economy based upon this model. (1)

Wage Policy

The Air Force can affect wages only by changing the wages in the military sector. The estimated models indicate that increased wages will have a positive effect on the probability of the officer remaining in the Air Force. Since Real Military Wages were claimed to be comparable in 1972, it would be interesting to see the effect of constant real wages on retention over the sample period.

Tables 41-43 present results for simulations of the three models with the Real Military Wage constant at its 1972 level. Tables 44-46 present results with the Real Military Wage set five percent higher than the 1972 Real Wage throughout the sample period. Summaries of predicted losses through 1980 are presented for the combined model. (2)

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(1) This only takes into account those pilots in the 1969-1972 year groups and does not include the 1973-1974 year groups which were also able to separate during 1980.

(2) By raising real wages, the wage differential also changes. Thus the wage differential variable was changed appropriately to reflect this increase.

Table 41

Predicted Retention Behavior
with Real Wages Constant at 1972 Level
for 1968 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	62.7%	60.2%
2	58.9	50.0
3	57.9	46.3
4	57.1	42.8
5	55.5	39.1
6	54.4	35.0
7	53.7	30.7

1433 Individuals in Prediction Simulation

Table 42

Predicted Retention Behavior
with Real Wage Constant at 1972 Level
for 1969 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	88.6%	68.8%
2	85.2	58.3
3	82.9	52.1
4	79.7	46.5
5	76.3	38.4
6	75.3	33.0
7	74.9	30.9

1436 Individuals in Prediction Simulation

Table 43

Predicted Losses with
Real Wages Constant at 1972 Level
for Five Year Combined Model

Year Group	Predicted Losses to 1980	Base Case Losses to 1980
1968	958	1025
1969	913	1005
1970	607	691
1971	741	847
1972	499	579
Total	3718	4147

Predicted Decrease in Losses 429

Percentage Decrease in Losses 10%

Table 44

Predicted Retention Behavior
with Real Wages Constant at 105% of 1972 Level
for 1968 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	76.8%	60.2%
2	74.5	50.0
3	73.9	46.3
4	73.3	42.8
5	72.3	39.1
6	71.4	35.0
7	70.9	30.7

1433 Individuals in Prediction Simulation

Table 45

Predicted Retention Behavior
with Real Wages Constant at 105% 1972 Level
for 1969 Year Group

Year in Sample	Predicted Retention	Base Case Predicted Retention
1	95.9%	68.8%
2	94.5	58.3
3	93.5	52.1
4	91.8	46.5
5	89.9	38.4
6	89.3	33.0
7	89.1	30.9

1436 Individuals in Prediction Simulation

Table 46

Predicted Losses with
Real Wages Constant at 105% 1972 Level
for Five Year Combined Model

Year Group	Predicted Losses to 1980	Base Case Losses to 1980
1968	918	1025
1969	872	1005
1970	573	691
1971	698	847
1972	468	579
Total	3529	4147

Predicted Decrease in Losses 618

Percentage Decrease in Losses 15%

Once again, the simulations show that there would be increased retention with this policy action. The 1968 and 1969 Year Group Models indicate rather large changes which probably overestimate the decreased losses in those groups. The Combined Model gives a more realistic view of expected reaction to such policy actions. Here there is a significant increase in retention.

This increased retention has been gained at some cost. Wages have been raised for all pilots. Is this increased expense offset by the savings in training costs and increased experience levels? It is difficult to put a monetary value on experience and readiness but it is possible to compare the expected costs of such a program against the training cost savings. This will not be done precisely here, but a rough estimate of

these two costs will be derived for the 1968-1972 sample.

The increased costs of increasing wages will be caused by two factors. The first is the nominal increase in the wages in each period. This was computed for the two simulations by determining the difference in each year between the actual nominal wages and the nominal wages necessary to hold Real Military Wages constant at the 1972 level. The second cost factor is that there will be an increase in the number of pilots receiving these higher wages. Thus, the predicted retention figures must be used to compute this increased cost. Further assumptions were required to complete this comparison. The total number of pilots in the 1968-1972 year groups were summed to determine a total pilot inventory for each year. The wage used was for an eight year Captain on flying status. This assumption will cause overestimation of the additional costs in early years and underestimation in later years, by approximately two percent. This is a small concession in this grossly oversimplified calculation. Tables 47 and 48 present the additional cost figures for the constant 1972 Real Wage and 105 percent of the 1972 Real Wage, respectively.

The estimate of savings in training costs is also an extremely rough estimate. The savings also come from two factors, 1) the increase in the number of pilots retained, and 2) the estimated cost savings per pilot. Table 9 in Chapter II gave cost estimates for an experienced pilot in several weapon systems. These costs were for minimum experience levels and will underestimate the true skill level of departing pilots. For this comparison, we will use the conservative figure of two million dollars per pilot. The total cost savings are also shown in Tables 47 and 48 for comparison with the additional cost figures. It is easy to see that the cost savings far exceed the additional expenditures for this sample.

Table 47

Cost Comparison for Constant
Real Wage at 1972 Level

Year	Increase in Nominal Wage	Predicted Total Pilots	Additional Costs
1973	146	11846	1.7 Million
1974	1417	10642	15.0 Million
1975	2133	10038	21.4 Million
1975	2370	8972	21.3 Million
1977	2394	7754	18.5 Million
1978	3244	6536	21.2 Million
1979	4825	5688	27.4 Million
1980	5252	5398	28.3 Million
Total			154.8 Million

Predicted Decrease in Losses 429

Total Training Cost Savings 858 Million

Table 48

Cost Comparison for Constant Real Wage at 105% of 1972 Level

Year	Increase in Nominal	Predicted Total Pilots	Additional Costs
1973	153	11916	1.8 Million
1974	1487	10794	16.0 Million
1975	2239	10226	22.9 Million
1976	2488	9236	22.9 Million
1977	2513	8086	20.2 Million
1978	3406	6900	23.4 Million
1979	5066	6062	30.6 Million
1980	5514	5776	31.8 Million
Total			169.6 Million

Predicted Decrease in Losses 618

Total Cost Savings 1.236 Billion

Chapter VIII

Policy Implications and Areas for Further Study

The results of the model developed in this thesis and the predicted results from various simulations indicate several policy actions which may be undertaken by the Air Force to improve pilot retention. It is obvious that the Air Force is in direct competition with the airline industry for the services of qualified transport pilots. These policy recommendations must therefore improve the competitive position of the Air Force in that market. Any policy which will improve the probability of the pilot remaining in the Air Force should be considered.

The Air Force has been seriously studying many alternatives to improve pilot retention. These have included efforts to eliminate or lessen career irritants, improve benefits, and increase pay. It is difficult at this time to determine what effect the improved benefits and large pay increase (1) enacted in October, 1980 will have on long term retention. The model does predict an increase in retention. As stated in the last chapter, there have been published statements that this pay increase has had the effect of increasing retention to acceptable levels already. The models presented in this thesis have shown that it is a combination of the wage level and the economic environment which enters the individual decisionmaking process. Thus, it is too early to say that improved pay and benefits have turned around retention in 1980. A combination of pay and

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(1) The increase in Base Pay, Housing and Subsistence Allowance barely kept pace with inflation. The twenty-five percent increase in Flight Pay raised real wages of pilots by 1.4 percent over real wages at the time of the previous pay raise.

the economic factors, plus the addition of officers from the Reserve Recall program, have caused the increase in retention statistics in 1980. The addition of these Recallees makes it impossible to legitimately compare 1980 retention rates with past figures. (1) This improvement would not have taken place if the economy had been healthy in 1980. Consequently, there is a place for further policy recommendations to continue this improvement in retention to insure the proper readiness of the Air Force.

Advanced Education

As stated earlier, Congress is considering plans which would increase tuition assistance. Such programs would have a positive effect on retention of pilots through the effects described in Chapter V. We have already seen the costs involved in losing a trained pilot. The old G.I. Bill allowed payments of approximately $10,000 per person. If each pilot used this total amount, such a policy would be cost effective if one out of every two hundred pilots remained in the Air Force due to the availability of funds for advanced education. Further study must be done to determine the costs and benefits of such programs.

Augmentation of Reserve Officers

Congress recently approved the Defense Officer Personnel Management Act (DOPMA), which significantly changes the structure of the officer corps. All officers will be Regular Officers by the eleventh year of service if they are to remain on active duty. Still there is room for the

(1) There was also a change in the manner in which these statistics were calculated which again raised the figures. These artificial increases, while making the Air Force look good, only cover up the real problem.

Air Force to work within this framework to insure sufficient retention of its pilots. Augmentation rates for each year group could be changed in the early career stages for each year group. For example, the small pilot production years of FY76-FY80 should have very high augmentation rates at the three and five year Regular Officer Boards. This would signal to those officers very early in their careers that they have a good future with the Air Force and would help guarantee the necessary retention levels for mid-level management. The high value placed on this factor in the individual utility framework indicates that many more pilots would remain in the Air Force with a Regular Commission. In future groups with too many pilots, the augmentation rate could be lowered.

This policy tool should be used to attempt to have the desired numbers of pilots in each year group at the end of the eleven year separation interval. It will probably be necessary to augment higher percentages of pilots than non-rated officers to meet this goal. Again, the training cost differences between flyers and non-flyers is justification for such policy.

Wage Policy

The Air Force has made attempts in the past two years to increase military pay. The pay for pilots has not increased as rapidly due to the constant Flight Pay before October 1980. (1) That is why the figures for Real Military Wages have dropped for pilots more than for military pay in general. Remember that the 25 percent increase in Flight Pay in October, 1980 made current Flight Pay equal in real terms to Flight Pay in 1978. Thus Flight Pay is still far below what it was in earlier years in real

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(1) See Chapter II A.

terms.

The model derived in this thesis, and the results of simulations with wage changes indicate that wage policy is useful and cost effective at improving retention. If the Air Force expects to compete with the private sector for scarce and valuable labor resources, then they must be willing to pay a competitive wage. Paying comparable wages to military pilots should increase retention and trim long run costs.

There are two ways in which compensation improvements can take place. The first is the general wage increases for all pilots which were simulated in Chapter VII. The second is a selective bonus system which could be based upon weapon system, year group and the current economic situation. Congress has already passed such legislation but the Air Force has not begun to use this authority. They are currently formulating programs to be submitted to Congress for approval. These lump sum payments for increased commitments may offer the cheapest form to obtain desired retention rates. Either of these wage policies would have the effect of increasing retention, experience levels and readiness. The increased expenditures are much less than the cost savings for either approach.

Possible Policy Actions
Not Suggested by the Model

In addition to those policies suggested by the model, here are some other ideas from my own experience which might aid in improving retention.

Increased Compensation for Undesirable Assignments

It might be possible to provide incentives to individuals to accept

what are generally considered to be undesirable assignments. Since many pilots separate rather than accept one of these assignments, increased incentives might keep them in the Air Force. This could be done in a similar manner to the selective continuation bonus. Another possible incentive would be to offer increased credit towards retirement for the acceptance of such assignments. For example, people going to Loring AFB, Maine could be given 1.2 years of credit for each year spent at Loring. If individuals are indeed responsive to wage increases, such programs would increase retention.

Guaranteed Promotions for Pilots

With the large training costs for pilots, it makes little sense to force them out of the Air Force for non-promotion. If the pilot has served ten or eleven years and is a competent pilot, he should not be forced out. A few officers may not have command potential, but by guaranteeing promotion to Major, the Air Force would be able to keep the pilot for his entire career. Such a guarantee would have a similar effect to making pilots Regular Officers early in their careers, in that it would guarantee long term job security. This of course is conditional on the officer being competent as a pilot. Any such policy which greatly benefits pilots with respect to another group requires another action. That is to have better testing procedures to insure that the best people get into pilot training in the first place. The Air Force has gone halfway on this subject by allowing pilots not promoted to continue on active duty. Promoting these people to Major would certainly improve their self esteem and overall morale. This would have the effect of keeping more pilots on active duty than the current program.

Lengthen Initial Commitment

Further study into the supply and demand for military pilots at the production level would probably show that there is a current excess of supply (potential pilots) over demand. One could increase the commitment following pilot training, to where supply and demand were equal. Presumably, that would be higher than the current six year commitment begun in 1979. Pilots would then have a greater investment in future retirement benefits, and would be less likely to separate. There appears to be no difficulty finding sufficient numbers of potential pilots, indicating that such policy would definitely increase long term retention.

Areas for Further Study

This thesis certainly does not answer all of the questions about Air Force Pilot Retention and the effects of the economic environment on retention. The omitted variables discussed in Chapter III might make the individual decision model more reliable. The use and availability of Air Force Personnel Data would help in this regard. There are serious limitations on the model due to the limited number of year groups and relatively short time interval upon which the model was estimated. These data limitations have been discussed before. The fact that only five years of reliable time series data on Air Force retention rates and airline industry data also limit conclusions to use with this sample. As more data becomes available in subsequent years on more year groups, this model will present more reliable results which can be generalized to future expectations in individual decision behavior. Additional sample years will also make it possible to better separate the wage, personnel policy and

economic effects which the model has shown to be significant in individual decision behavior.

The first year separation eligibles present a particularly interesting modeling problem. Many officers separate at the first opportunity. Are their decisions based upon the same facts as those making a decision in later years? Probably not, but there are certainly those who are affected by the variables presented in this model in the first year. Further research into this first year effect might better describe the factors involved in first year separations.

Appendix A

Calculation of Eleven Year Continuation Rate

The following table shows the methodology used by the Air Force to determine the overall retention rate. This calculation has been made at the end of every quarter since the end of 1975. Data presented in this appendix is from March 1980. At the end of the quarter, the pilot population is divided into year groups by total months of service. Those officers with one to twelve months service are in the first year group, and so on. A retention statistic is then calculated for each year group by dividing the total number at the end of the year by the number in that year group at the beginning of the year. These individual year group retention rates are then multiplied together to obtain an overall retention rate through eleven years of service. Note that this statistic does not follow a cohort over time. Instead, it is a projection of expected retention of the first year group, assuming that they have the same retention behavior as the year groups ahead of them had in this period.

Table A.1

Calculation of Overall Retention Rate

Year Group	Total Pilots Beginning	Total Losses During Year	Retention Rate
2	879	14	.9841
3	1109	7	.9937
4	1012	10	.9901
5	1670	28	.9832
6	1384	582	.6911
7	1692	421	.7512
8	1618	250	.8455
9	1614	276	.8290
10	1455	192	.8630
11	1400	130	.9071

Overall Projected Retention Rate 27.1%

Appendix B

Additional Information on the Data

Many times throughout this thesis it has been mentioned that the officers with six to eleven years of service were to be considered. It was necessary to add the individual's fifth year of service to the analysis to take account of the four year commitment for the early year groups and the early out programs of the mid-70's. Officers who fit into this category in the period 1973 to 1980 must therefore have begun their service at an earlier time. Officers with five years of service in 1973 entered in 1968. Thus they are the earliest year group that could be considered. It was felt that the last year group to be considered should have at least three periods in which to make a voluntary separation decision. Consequently, the last year group to be used was that group which entered in 1972.

Other Air Force related data was obtained through an office at the Air Force Manpower and Personnel Center, AFMPC, which has been charged with working the officer retention problem. This office is called the Officer Retention Group. This office was established in September, 1979 and has determined and maintained the retention statistics back to 1975.

The Air Force has begun keeping statistics on retention rates in earnest only since 1975. Since then they have kept very comprehensive statistics by weapon system group And for Air Force pilots in general. The pilot force is divided into year groups by year of accession and a retention rate is computed by dividing the number who remain in the year group at the end of the period by the number who were in the year group at the beginning of the year. These retention rates for each year group are

then multiplied together to get a continuation rate, which is a projected rate based on the past twelve month's experience. The data from March 1980 is shown in Appendix A.

The requirements for Air Force pilot manning, experience and personnel plans have come from the various offices charged with making such decisions. This information was obtained through the files of the Retention Group at the Air Force Manpower and Personnel Center. Information on costs of training, flying each type of aircraft and other cost data came from Air Force Pamphlet 173-13 entitled "USAF Cost and Planning Factors Guide," Feb, 1980.

The information on wages in the Air Force are a matter of public record as they are approved by Congress and signed by the President. They become law by Executive Order and are recorded in the Congressional Record. The Executive Order numbers and the effective dates are listed here.

Executive Order	Date
11691	Dec 15, 1972
11739	Oct 3, 1973
11811	Oct 7, 1974
11883	Oct 6, 1975
11941	Oct 1, 1976
12020	Sep 28, 1977
12087	Oct 7, 1978
12165	Oct 1, 1979
12248	Oct 1, 1980

Information and data on the airline industry came predominately from a Las Vegas based firm, Future Aviation Professionals of America, FAPA. This company provides counseling information to prospective airline pilots. To do this they follow the hiring practices of all major air carriers, commuters and corporate flying services. They are able to obtain reliable

data on monthly hiring and layoffs with each company. This data comes from airline company sources.

Salary and benefit data on the civilian airline industry has been obtained from FAPA and the Airline Pilots Association, ALPA. The pilot union, ALPA, represents almost 90% of all pilots flying with the major carriers. Each year, their research department compiles a summary of all contract negotiations for that year which gives explicit information on pay and benefits with each airline company. They provided average salary data on their members. These figures and those from FAPA were used to determine civilian pilot earnings.

Other information on the airline industry has been obtained from annual reports of the Air Transport Association and the Federal Aviation Adminstration.

The unemployment figures and growth rates in real GNP were taken from the "Economic Indicators, 1973-1981", published by the U. S. Government, Council of Economic Advisors to the President.

The following tables give the statistical breakdowns for the various sub-samples of the year groups used in various estimations. The first two are for the 1968 and 1969 year group models. The last five show the 19 percent extract used in the three and five year combined models. These tables may be compared with those in Chapter V to see that the statistics are comparable to the entire year group.

Table B.1

1968 Year Group Sample
1055 Individuals

Variable	Year in Sample Period 1	2	3	4	5	6	7
Age	26.85 (1.08)	26.82 (1.07)	26.88 (1.09)	26.88 (1.08)	26.89 (1.09)	26.89 (1.09)	26.91 (1.09)
Academy Graduate	.113	.147	.166	.164	.160	.165	.162
ROTC Graduate	.443	.423	.449	.450	.446	.451	.447
OTS Graduate	.444	.428	.383	.386	.394	.385	.392
Southern State Dummy	.353	.375	.389	.390	.388	.393	.401
Masters Degree	.038	.056	.109	.187	.314	.455	.549
Married	.782	.833	.878	.899	.922	.930	.931
Number of Dependents	1.45 (1.06)	1.69 (1.10)	2.00 (1.17)	2.15 (1.12)	2.37 (1.14)	2.51 (1.15)	2.61 (1.13)
Rated Supplement	.021	.083	.162	.205	.294	.312	.299
Regular Officer	.230	.575	.670	.682	.706	.714	.715
Retention Rate	.607	.515	.487	.462	.432	.399	.365

	Mean	Standard Deviation
Airline Hiring Rate	1610	1555.776
Real Military Wage	.911	.045
Wage Differential	.653	.059
Unemployment Rate	6.5	1.278
Sample Period	1973-1979	

Table B.2

1969 Year Group Sample
1025 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.89 (1.04)	26.86 (1.04)	26.85 (1.05)	26.86 (1.06)	26.85 (1.06)	26.87 (1.07)	26.90 (1.08)
Academy Graduate	.120	.140	.148	.152	.151	.162	.162
ROTC Graduate	.337	.327	.343	.358	.361	.338	.351
OTS Graduate	.540	.528	.502	.485	.482	.495	.482
Southern State Dummy	.357	.376	.382	.389	.386	.395	.398
Masters Degree	.048	.078	.119	.232	.349	.441	.524
Married	.807	.866	.884	.920	.941	.954	.959
Number of Dependents	1.53 (1.14)	.1.83 (1.20)	2.05 (1.17)	2.28 (1.15)	2.45 (1.17)	2.59 (1.16)	2.62 (1.16)
Rated Supplement	.023	.071	.117	.205	.241	.263	.272
Regular Officer	.297	.516	.576	.610	.622	.692	.809
Retention Rate	.689	.598	.547	.498	.427	.373	.358

	Mean	Standard Deviation
Airline Hiring Rate	1524	1582.315
Real Military Wage	.889	.034
Wage Differential	.622	.083
Unemployment Rate	6.8	1.073
Sample Period	1974-1980	

Table B.3

1968 Year Group Sample
542 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.90 (1.10)	26.88 (1.14)	26.92 (1.16)	26.92 (1.14)	26.91 (1.13)	26.93 (1.14)	26.92 (1.15)
Academy Graduate	.111	.147	.163	.156	.164	.172	.174
ROTC Graduate	.411	.404	.442	.447	.436	.439	.434
OTS Graduate	.478	.450	.395	.397	.400	.389	.393
Southern State Dummy	.304	.306	.322	.324	.208	.305	.320
Masters Degree	.039	.058	.091	.164	.312	.435	.502
Married	.780	.817	.859	.882	.892	.916	.918
Number of Dependents	1.42 (1.02)	1.64 (1.08)	1.92 (1.15)	2.12 (1.11)	2.31 (1.14)	2.49 (1.21)	2.61 (1.20)
Rated Supplement	.018	.080	.130	.187	.304	.331	.297
Regular Officer	.242	.569	.663	.683	.696	.711	.726
Retention Rate	.604	.510	.484	.462	.442	.405	.376

	Mean	Standard Deviation
Airline Hiring Rate	1610	1555.776
Real Military Wage	.911	.045
Wage Differential	.653	.059
Unemployment Rate	6.5	1.278
Sample Period	1973-1979	

Table B.4

1969 Year Group Sample
538 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.83 (.98)	26.79 (.98)	26.78 (.96)	26.82 (.99)	26.81 (.98)	26.81 (.98)	26.81 (1.00)
Academy Graduate	.112	.141	.153	.163	.169	.173	.178
ROTC Graduate	.368	.385	.401	.428	.438	.427	.426
OTS Graduate	.517	.469	.439	.406	.388	.400	.396
Southern State Dummy	.372	.404	.414	.410	.427	.413	.411
Masters Degree	.035	.062	.089	.201	.208	.382	.487
Married	.805	.835	.857	.926	.935	.938	.940
Number of Dependents	1.45 (1.04)	1.73 (1.15)	1.91 (1.19)	2.22 (1.16)	2.31 (1.17)	2.38 (1.16)	2.40 (1.17)
Rated Supplement	.028	.095	.127	.205	.250	.262	.284
Regular Officer	.279	.520	.589	.636	.650	.680	.751
Retention Rate	.687	.584	.527	.484	.419	.367	.351

	Mean	Standard Deviation
Airline Hiring Rate	1524	1582.315
Real Military Wage	.889	.034
Wage Differential	.622	.083
Unemployment Rate	6.8	1.073
Sample Period	1974-1980	

Table B.5

1970 Year Group Sample
438 Individuals

Year in Sample Period

Variable	1	2	3	4	5	6	7
Age	26.96 (.96)	26.92 (.97)	26.92 (.94)	26.95 (.96)	26.99 (.97)	26.98 (.98)	
Academy Graduate	.139	.159	.165	.172	.186	.188	
ROTC Graduate	.500	.486	.478	.492	.480	.471	
OTS Graduate	.358	.351	.353	.332	.328	.335	
Southern State Dummy	.379	.384	.408	.420	.417	.400	
Masters Degree	.089	.126	.199	.315	.392	.465	
Married	.811	.835	.871	.899	.887	.892	
Number of Dependents	1.49 (1.05)	1.75 (1.16)	2.00 (1.18)	2.17 (1.22)	2.30 (1.29)	2.41 (1.32)	
Rated Supplement	.021	.054	.121	.172	.260	.247	
Regular Officer	.352	.498	.551	.576	.770	.841	
Retention Rate	.760	.621	.543	.466	.388	.363	

	Mean	Standard Deviation
Airline Hiring Rate	1738	1619.259
Real Military Wage	.882	.031
Wage Differential	.601	.070
Unemployment Rate	7.01	1.018
Sample Period	1975-1980	

Table B.6

1971 Year Group Sample
527 Individuals

Variable	Year in Sample Period 1	2	3	4	5	6	7
Age	26.92 (.96)	26.89 (.96)	26.91 (.97)	26.98 (1.04)	27.00 (1.04)		
Academy Graduate	.140	.155	.160	.157	.142		
ROTC Graduate	.417	.414	.388	.393	.406		
OTS Graduate	.442	.431	.453	.450	.452		
Southern State Dummy	.381	.380	.385	.386	.397		
Masters Degree	.102	.171	.244	.307	.402		
Married	.805	.836	.862	.857	.868		
Number of Dependents	1.51 (1.11)	1.77 (1.21)	1.98 (1.26)	2.16 (1.28)	2.29 (1.35)		
Rated Supplement	.019	.074	.100	.139	.178		
Regular Officer	.288	.493	.585	.646	.863		
Retention Rate	.819	.700	.531	.416	.376		

	Mean	Standard Deviation
Airline Hiring Rate	2063	1576.591
Real Military Wage	.876	.032
Wage Differential	.585	.065
Unemployment Rate	6.72	.798
Sample Period	1976 1980	

Table B.7

1972 Year Group Sample
382 Individuals

Variable	Year in Sample Period 1	2	3	4	5	6	7
Age	26.92 (1.44)	26.93 (1.50)	26.98 (1.62)	26.87 (1.09)			
Academy Graduate	.186	.197	.209	.229			
ROTC Graduate	.526	.500	.448	.454			
OTS Graduate	.288	.303	.343	.317			
Southern State Dummy	.474	.471	.478	.473			
Masters Degree	.105	.168	.216	.293			
Married	.798	.835	.836	.873			
Number of Dependents	1.49 (1.10)	1.67 (1.15)	1.81 (1.19)	1.96 (1.19)			
Rated Supplement	.018	.050	.067	.093			
Regular Officer	.366	.418	.608	.761			
Retention Rate	.890	.702	.537	.476			

	Mean	Standard Deviation
Airline Hiring Rate	2437	1543.430
Real Military Wage	.869	.032
Wage Differential	.567	.060
Unemployment Rate	6.47	.670
Sample Period	1977-1980	

Appendix C

Probit Results

Appendix C contains the results of all estimated models. The first five tables contain results of probit models for individual year groups. The models for the 1970-1972 Year Groups only include two macro variables. The last two tables present probit results for the three and five year combined models.

Table C.1

Probit Results for
1968 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-20.162	7.271	-2.77
Age (divided by ten)	.482	.249	1.93
Academy Dummy	-.068	.095	-.714
ROTC Dummy	.012	.057	.203
South Dummy	.102	.054	1.879
Seniority	.484	.161	3.013
Masters Dummy	.199	.086	2.138
Wife Dummy	.093	.089	1.039
Number of Dependents	.080	.030	2.649
Rated Supplement Dummy	.102	.087	1.173
Regular Officer Dummy	.557	.069	8.031
Number of Airline Pilots Hired (thou)	-.064	.061	-1.043
Real Military Wage	9.006	4.697	1.917
Wage Differential	8.985	2.680	3.351
Unemployment Rate (percentage divided by ten)	2.544	.494	5.148

Number of Individuals 1055

Number of Observations 4114

Log Likelihood Value = -1494.34

Table C.2

Probit Results for
1969 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-28.962	10.882	-2.661
Age (divided by ten)	.155	.264	.587
Academy Dummy	-.178	.095	-1.879
ROTC Dummy	.018	.059	.308
South Dummy	.103	.053	1.954
Seniority	.844	.325	2.599
Masters Dummy	.056	.073	.773
Wife Dummy	-.046	.087	-.533
Number of Dependents	.094	.028	3.377
Rated Supplement Dummy	.207	.086	2.397
Regular Officer Dummy	.831	.067	12.433
Number of Airline Pilots Hired (thou)	-.240	.079	-3.007
Real Military Wage	15.396	5.300	2.905
Wage Differential	11.946	5.921	2.017
Unemployment Rate (percentage divided by ten)	2.341	.529	4.424

Number of Individuals 1024

Number of Observations 4236

Log Likelihood Value = -1572.07

Table C.3

Probit Results
1970 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	11.007	2.256	4.879
Age (divided by ten)	.647	.294	2.203
Academy Dummy	.019	.095	.201
ROTC Dummy	-.007	.058	-.129
South Dummy	.127	.052	2.439
Seniority	-.519	.102	-5.101
Masters Dummy	.096	.069	1.378
Wife Dummy	-.242	.082	-2.942
Number of Dependents	.087	.028	3.033
Rated Supplement Dummy	.027	.084	.324
Regular Officer Dummy	.569	.062	9.141
Number of Airline Pilots Hired (thou)	.115	.042	2.733
Real Military Wage	*	*	*
Wage Differential	-13.934	2.457	-5.671
Unemployment Rate (percentage divided by ten)	*	*	*

Number of Individuals 985

Number of Observations 3783

Log Likelihood Value = -1605.35

All of the macro variables could not be used with the 1970, 1971 and 1972 Year Groups due to the shorter time intervals for those samples. Probit results are shown for these two year groups without the Real Military Wage and Unemployment.

Table C.4

Probit Results
1971 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	2.582	2.712	.952
Age (divided by ten)	-.464	.279	-1.661
Academy Dummy	-.236	.097	-2.436
ROTC Dummy	-.096	.060	-1.611
South Dummy	-.007	.054	-.128
Seniority	-.0086	.055	-.157
Masters Dummy	.102	.070	1.454
Wife Dummy	.086	.088	.979
Number of Dependents	.074	.029	2.561
Rated Supplement Dummy	.164	.099	1.665
Regular Officer Dummy	.676	.070	9.599
Number of Airline Pilots Hired (thou)	-.109	.022	-5.005
Real Military Wage	*	*	*
Wage Differential	-.671	2.556	-.263
Unemployment Rate (percentage divided by ten)	*	*	*

Number of Individuals 1005

Number of Observations 3475

Log Likelihood Value = -1505.84

Table C.5

Probit Results for
1972 Year Group

Variable	Parameter Value	Standard Error	T-Statistic
Constant	5.658	2.500	2.263
Age (divided by ten)	.183	.271	.678
Academy Dummy	-.427	.108	-3.945
ROTC Dummy	-.429	.069	-6.209
South Dummy	.085	.058	1.462
Seniority	-.371	.112	-3.325
Masters Dummy	.067	.076	.876
Wife Dummy	.046	.091	.505
Number of Dependents	.090	.032	2.752
Rated Supplement Dummy	.134	.135	.988
Regular Officer Dummy	.647	.076	8.537
Number of Airline Pilots Hired (thou)	-.094	.061	-1.533
Real Military Wage	*	*	*
Wage Differential	-4.850	3.164	-1.532
Unemployment Rate (percentage divided by ten)	*	*	*

Number of Individuals 1008

Number of Observations 3179

Log Likelihood Value = -1284.86

Table C.6

Probit Results
Three Year Combined Model

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-8.789	1.591	-5.525
Age (divided by ten)	.517	.218	2.373
Academy Dummy	.014	.080	.171
ROTC Dummy	.067	.047	1.427
South Dummy	.085	.044	1.932
Seniority	.275	.033	8.238
Masters Dummy	.084	.063	1.333
Wife Dummy	-.174	.072	-2.435
Number of Dependents	.139	.025	5.652
Rated Supplement Dummy	.095	.069	1.370
Regular Officer Dummy	.693	.054	12.854
Number of Airline Pilots Hired (thou)	-.088	.026	-3.409
Real Military Wage	3.528	1.088	3.242
Wage Differential	2.712	.725	3.741
Unemployment Rate (percentage divided by ten)	1.664	.271	6.133

Number of Observations 5956

Number of Individuals 1518

Log Likelihood Value = -2282.06

Table C.7

Probit Results for
Five Year Combined Model

Variable	Parameter Value	Standard Error	T-Statistic
Constant	-3.236	.935	-3.459
Age (divided by ten)	.269	.155	1.740
Academy Dummy	-.116	.062	-1.858
ROTC Dummy	-.035	.037	-.937
South Dummy	.073	.034	2.124
Seniority	.092	.017	5.373
Masters Dummy	.099	.049	2.049
Wife Dummy	-.148	.055	-2.708
Number of Dependents	.122	.018	6.675
Rated Supplement Dummy	.116	.058	1.978
Regular Officer Dummy	.670	.043	15.685
Number of Airline Pilots Hired (thou)	-.030	.018	-1.718
Real Military Wage	1.811	.782	2.315
Wage Differential	-.436	.452	-.966
Unemployment Rate (percentage divided by ten)	1.713	.221	7.749

Number of Observations 8978

Number of Individuals 2427

Log Likelihood Value = -3648.16

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