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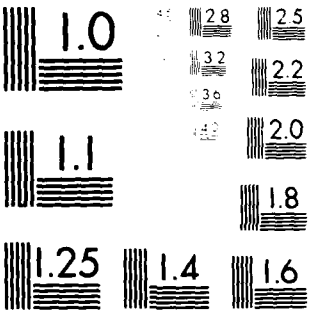

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THESIS

AN INVESTIGATION OF THE FEASIBILITY OF
MANNING THE AIRWINGS OF THE PROJECTED
FY 1990 CARRIER FORCE

by

John J. Infield

December 1981

Thesis Advisor: Richard S. Elster

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This thesis is a study of the feasibility of manning the airwings of a fifteen carrier force by FY 1990. An initial review of the history of the carrier force and the composition of its airwings and the manpower requirements needed to man them was accomplished. Manpower studies were conducted of the 131X/132X designators for officers and for eleven selected enlisted aviation ratings (AD, AE, AME, AMH, AMS, AO, AQ, AT,

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An Investigation of the Feasibility of Manning the Airwings of the Projected FY 1990 Carrier Force

by

John J. Infield
Lieutenant, United States Navy
B.A., Glassboro State College, 1973

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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December 1981

Author: _____

Approved by: _____
Thesis Advisor

_____
Second Reader

_____
Chairman, Department of Administrative Science

_____
Dean of Information and Policy Sciences

ABSTRACT

This thesis is a study of the feasibility of manning the airwings of a fifteen carrier force by FY 1990. An initial review of the history of the carrier force and the composition of its airwings and the manpower requirements needed to man them was accomplished. Manpower studies were conducted of the 131X/132X designators for officers and for eleven selected enlisted aviation ratings (AD, AE, AME, AMH, AMS, AO, AW, AT, AW, AX and PR). Specific predictive information used included personnel attrition, retention, promotion and accession data. All of this information was processed by an APL computer program designated MANMOD, which allowed projection of manpower requirements and personnel supply data forward to the year 1990. The MANMOD model permitted estimation of the accessions and retention requirements for the officer designators and enlisted ratings chosen for study. This projection of data provided predictions on whether current-day policies will meet future billet requirements or whether changes in policies will have to be made in order to man a fifteen-carrier force. This thesis indicates serious problems in manning if present supply and requirements trends continue. The thesis also identifies other manpower problem areas.

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I. INTRODUCTION

The manning of the all-volunteer force has been a problem since its inception. Without the draft to produce a steady flow of personnel into the armed forces, it has become necessary for those in command to examine, in depth, the administrative policies which affect the maintenance of a strong, peace-time volunteer force. In the face of the present administration's avowed commitment to expand the size of the Navy to a six hundred ship force, which will embody a fifteen aircraft carrier complement, the feasibility of providing trained personnel for such a force by FY 1990 becomes a critical question.

This thesis addresses itself to the study of the airwings of the FY 1990 fifteen carrier force. Its purpose is to discover whether the projected billet requirements can be met, and to identify serious problem areas. Such a study is of potential value to the Navy in that it identifies those rates and designators which may have personnel shortfalls over the next decade.

To accomplish this study, a review was initially made of past and present data relating to three major factors which control the effective manning of all the armed services: attrition, retention and accession.

The cost, both in financial terms and in operational readiness, of the attrition rate cannot be minimized, nor can the impact of low retention rates through both the pyramidical officer rank structure and the enlisted structure. The shortage of mid-management personnel, especially in the aviation community, is a matter of great concern. The civilian aviation job market virtually relies on the military to train its technicians and pilots. Low enlisted pay scales, particularly in the first few years of service, and the noncommensurate salaries paid to aviators, coupled with various other factors such as family separations, have combined to make the offer of civilian employment attractive. Civilian aviation expansion projections for the next decade offer no decline in demand for trained and experienced personnel.

Beyond the question of attrition and retention is the problem of accessing sufficient personnel to compensate for losses and to provide needed growth. As this thesis will state, the pool of potential officers and enlistees is shrinking rapidly over the upcoming ten years at the very time when demand for personnel is seen as sharply increasing.

An APL program designated MANMOD was utilized in this thesis to project personnel accession, retention and attrition data to the year 1990 in order to provide predictions of areas of personnel shortages or overages in the fifteen-carrier airwing manning complement. This model allows for

the determination of the impacts of changes in accession, retention, promotion and attrition on future manpower availability.

The next chapter of this thesis investigates the size and role of today's carrier force and its present airwing manning status. It will also discuss the proposed future carrier strength requirements. Chapter III will present a study of past and present aviation officer and enlisted retention and attrition data. Chapter IV will utilize the APL program MANMOD to predict aviation officer and enlisted supply vs. demand in FY 1990, using billet numbers, and accession, attrition, retention and promotion rates as variables. Finally, in Chapter V, conclusions are drawn concerning the feasibility of manning the FY 1990 fifteen carrier force.

II. NATURE OF PROBLEM

Every branch of the Armed Forces must, by definition, operate to fill the defense needs of this country as set out by the Department of Defense and, further, do so within the confines of the budgetary restrictions placed upon it by the Congress. The Navy, no less than any of its fellow services, has over the years undergone changes mandated by the various administrations in response to their views of the perceived threat to this country.

It is not surprising, then, to find that in the course of these years the demands and expectations placed upon the Navy have varied with the state of foreign relations, national opinion, technological progress and economic constraints.

The United States Navy in FY 81 finds itself with a multitude of present and future manpower problems. Retention of trained personnel and recruitment of suitable potential rated personnel and officers has become of crucial concern to the service, particularly in light of the latest fleet force projections outlined by the Secretary of the Navy (SECNAV). John Lehman, Jr., the present Secretary of the Navy, stated [Ref. 1]:

> We are at a major turning point in the history of our nation, with a new turn in policy which includes a stronger Navy. The President is totally committed to a stronger naval force to cover a three ocean requirement and protect the sea lanes.

> We will have a 600-ship Navy built around fifteen battle groups.

A. CARRIER FORCE

Two decades ago the carrier force numbered 24; of that number 15 were considered attack carriers (CV's or CVN's for nuclear powered types) and 9 were anti-submarine warfare (ASW) carriers.

Table I shows there has been a slow and steady decline in the number of carriers from 1964 until the present force of only 13 CV/CVN's [Ref. 2]. This in itself might be considered unusual because the time frame encompassed the Viet Nam conflict. The naval force remained fairly steady until the withdrawal of American support from Viet Nam, and then there was a steady decline in the number of Navy ships [Ref. 3]. This steady decline in ships of all types, not only in aircraft carriers, is more dramatically shown in Figure 1 where the total active fleet force of ships can be seen to bottom out at around 415 in number [Ref. 4]. In a decade and a half, the number of ships was reduced by slightly over 54 percent. The number of ships planned was on the increase during the Ford administration, but shipbuilding cuts by the Carter administration reduced the number of ships projected for the 1990's [Ref. 5]. Included in this shipbuilding budget cut was a CVN. Since this thesis deals with the manning of carrier airwings in particular, it is worthy of mention that inherent in the reduction of the carrier force is the simultaneous

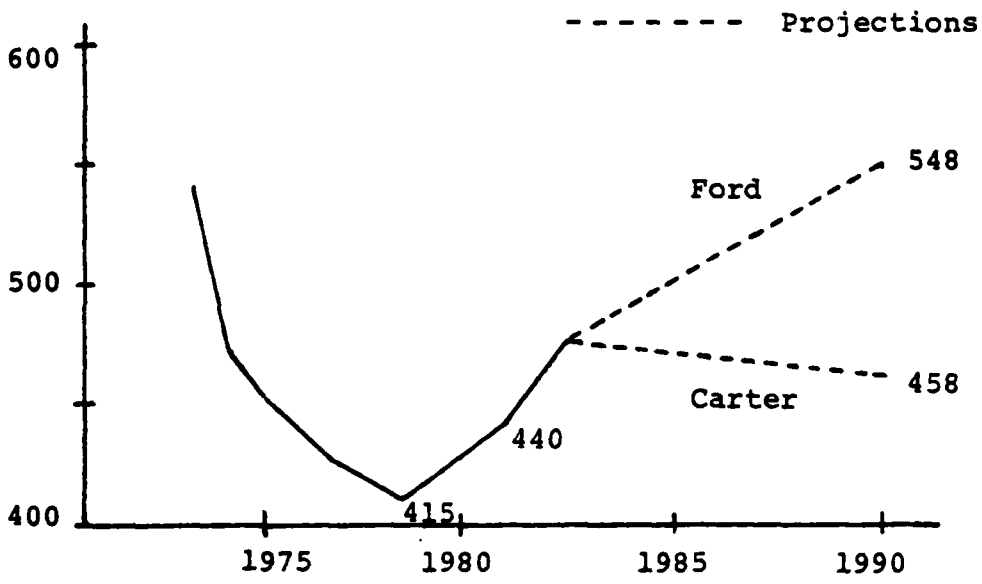
TABLE I

CARRIER FORCE HISTORY

	Fiscal Year													
	64	68	69	70	71	72	73	74	75	76	77	78	79	80
Attack carriers (CV/CVN)	15	15	15	15	14	14	14	14	15	13	13	13	13	13
ASW carriers (CVS)	9	8	7	4	4	3	2	0	0	0	0	0	0	0
Total	24	23	22	19	18	17	16	14	15	13	13	13	13	13

Source: Historical Budget Data, April 1979, Department of the Navy, Office of the Comptroller.

FORD/CARTER PROJECTIONS OF NUMBERS
OF GENERAL PURPOSE SHIPS



Source: Estimates of Military Officer Force Structure Required to Man the Projected Naval Combatant Forces of 1980's and 1990's. Naval Postgraduate School Technical Report, NPS 55-80-015, October 1980.

Figure 1

reduction in requirements for airwing personnel, both officer and enlisted.

B. CARRIER ROLE

Another factor leading to the present situation was a change in the naval carrier role. The last of the World War II (WW II) carriers used for ASW left active service in FY 73. Until this time there had been two types of aircraft carriers, or rather, two different roles for an aircraft carrier. The main role was to project airpower, accomplished with the fighter and attack aircraft of the attack carrier [Ref. 6]. The second role was ASW. The ASW carrier's job was to aid in protection of the attack carriers from the submarine threat. This job, ASW, was also given to other ships, but the CVS's could extend this protection further from the CV/CVN's. The ASW ships were also part of the air defense net covering the CV/CVN's from air attacks [Ref. 7].

In order to keep the extended coverage that ASW aircraft could give the carrier, the two roles were combined into a single carrier operation. Carriers were required to carry fighter, attack and ASW aircraft. This, of course, reduced the number of fighters and attack aircraft, and therefore decreased the amount of projected power a CV/CVN could produce [Ref. 8]. To correct this deficit, the Navy asked for and received, after constant Congressional battles, larger and larger carriers until reaching the Nimitz class carriers of today [Ref. 9].

C. PRESENT CARRIER FORCE

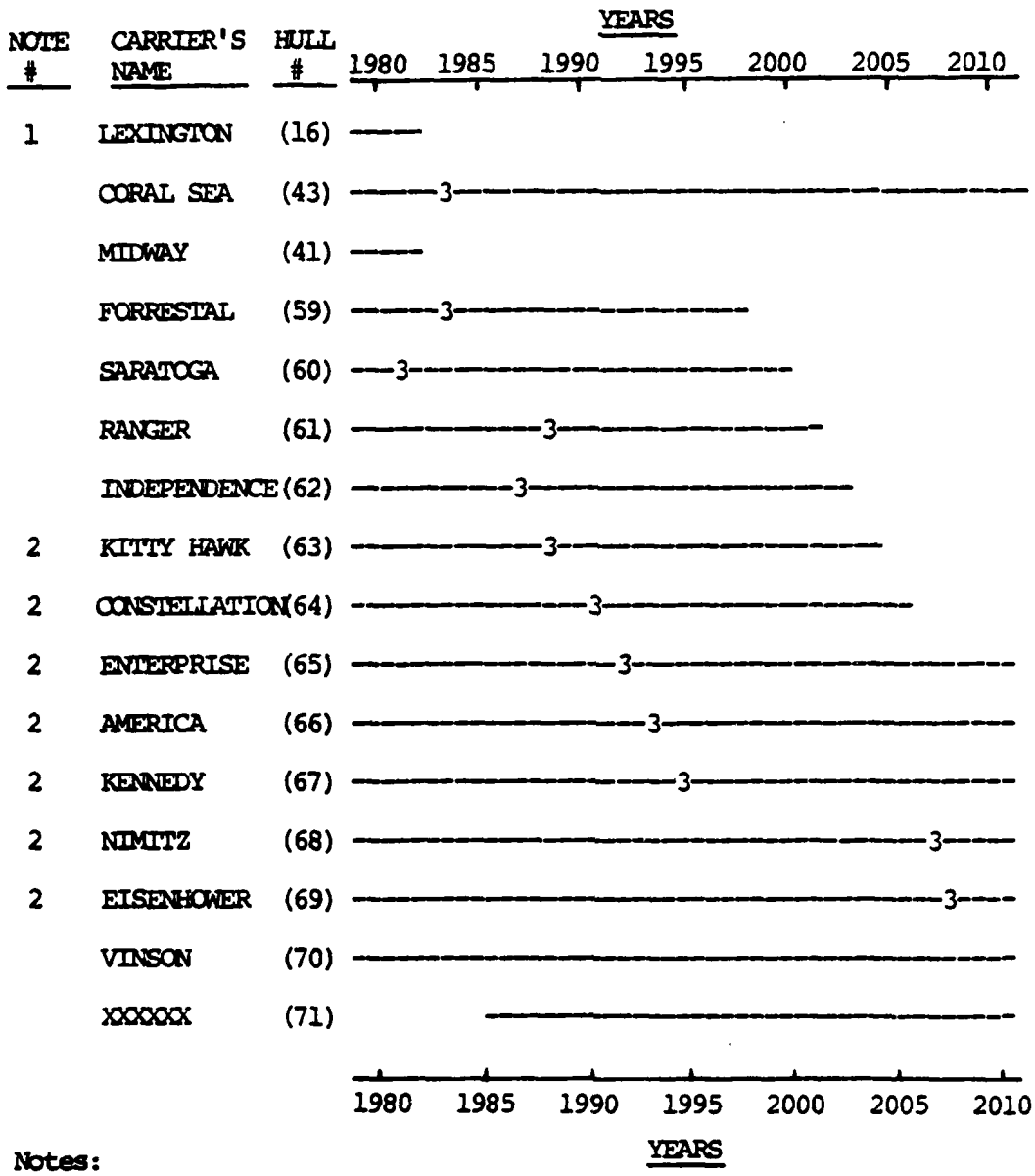
Figure 2 shows the present carrier force level and the projected force strength through year 2010 [Ref. 10]. The aircraft carrier Lexington (ATV-16) operates as a training carrier and is not counted as one of the 13 CV/CVN's.

In 1983, the Coral Sea (CV-43) was to have taken over the training carrier Lexington's role and become ATV-43. The USS Vinson (CVN-70), when commissioned in FY 82, would then have maintained the carrier force strength at thirteen. The last of the WW II type carriers, the Midway (CV-41), would have been decommissioned in FY 85, with the new CVN-71, as yet unnamed, becoming operational to replace her. This would have kept the force level at thirteen until the end of the 1990's, at which time the retirement of the Forrestal (CV-59) would have decreased the number to twelve. The new thirteenth carrier to replace the Forrestal fell afoul of the Carter administration's budget cuts [Ref. 11].

D. PRESENT AIRWING MANNING

In holding the carrier force steady in number, the number of airwings would have also remained at its current level (eleven airwings). (It should be explained that there are only eleven airwings for thirteen carriers, because there are usually two carriers in the Service Life Extension Program (SLEP)). SLEP requires placing a carrier into a shipyard for a period of approximately two years. At the present time, the SLEP program is taking longer than two years to complete

PRESENT/PROJECTED CARRIER FORCE



Notes:

1. AVT-16 operates as a training ship and is based at Pensacola, Florida. It is anticipated that CORAL SEA (43) will replace LEXINGTON in the training role about 1983.
2. Tentative Service Life Extension Program under consideration for these ships.
3. Tentative two year Service Life Extension Program Schedule.

Source: Janes Fighting Ships 1980-1981 Edition, Franklin Watts Inc., New York

Figure 2

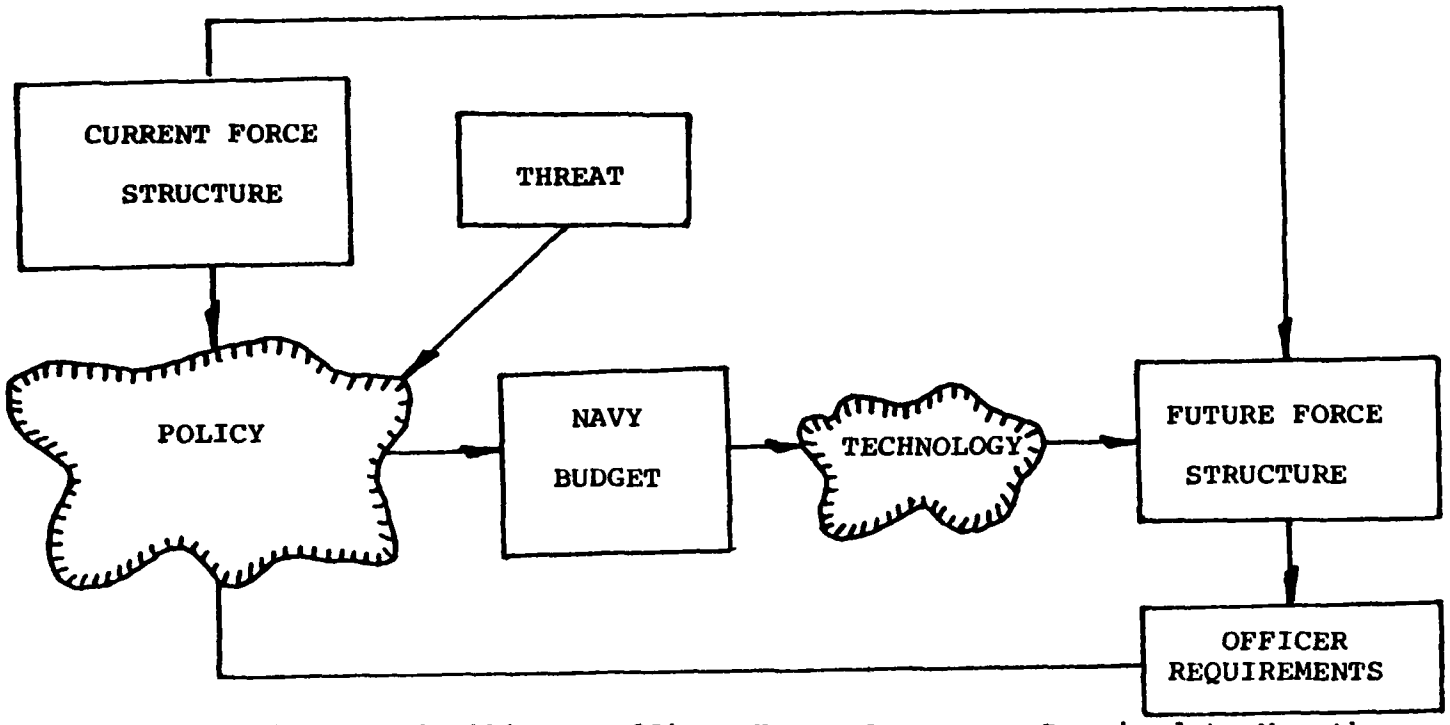
its rehabilitation of aircraft carriers. At the time of this writing, the USS Enterprise (CVN-65) has been in the shipyard for almost three years.

E. PERCEIVED THREAT

While the United States has been decreasing the number of ships in its Navy, the Soviets have been increasing theirs, until they now have a superiority in number of fleet ships. This superiority has changed the U.S. Government's view on the size of our own Navy [Ref. 12]. Figure 3 shows how perceived threat affects force structure and manning structures [Ref. 13]. The Reagan administration is committed to increasing our Navy from approximately 440 combat capable ships presently to a force of 600 by the end of FY 90 [Ref. 14]. Why this sudden turn around? It is in response to the belief that the Soviets have equalled, if not surpassed, the U.S. in naval power. Following is part of a speech delivered by Vice Admiral Ernest R. Seymore, Commander Naval Air Systems Command, as part of a briefing for industry [Ref. 15].

> For years we have acknowledged that the Soviet Union held a quantitative lead in military equipment, but believed that our qualitative lead would more than compensate for this. It is time to reexamine that belief and to reject the complacency that went with it.
>
> During the decade of the 1970's the Soviets made a major advance in the development and production of defense material and, as a consequence, will enter the 1980's in a dramatically different defense posture than they had as they entered the 1970's. Their objective was to challenge the United States lead in defense technology while maintaining their numerical advantage. They have had a remarkable degree of success in achieving that objective

DERIVATION OF THE FUTURE NAVY FORCE STRUCTURE AND OFFICER REQUIREMENTS



Source: Estimates of Military Officer Force Structure Required to Man the Projected Naval Combatant Forces of 1980's and 1990's, Naval Postgraduate School Technical Report, NPS 55-80-015, October 1980.

Figure 3

> by making an enormous investment, and by maintaining an unwavering emphasis on technology.
>
> In sum, we see the Soviets entering the decade of the 1980's with a commitment to compete in equality with United States weapon systems.

This line of thought was also supported by the Secretary of the Navy when asked for a frank appraisal of U.S. military preparedness [Ref. 16].

> Overall our capability today is in a very dangerous position.....we have lost both our naval and strategic nuclear edge of superiority. As an island nation we must maintain military naval superiority.
>
> I can assure you all today.....we are finished with being second best.

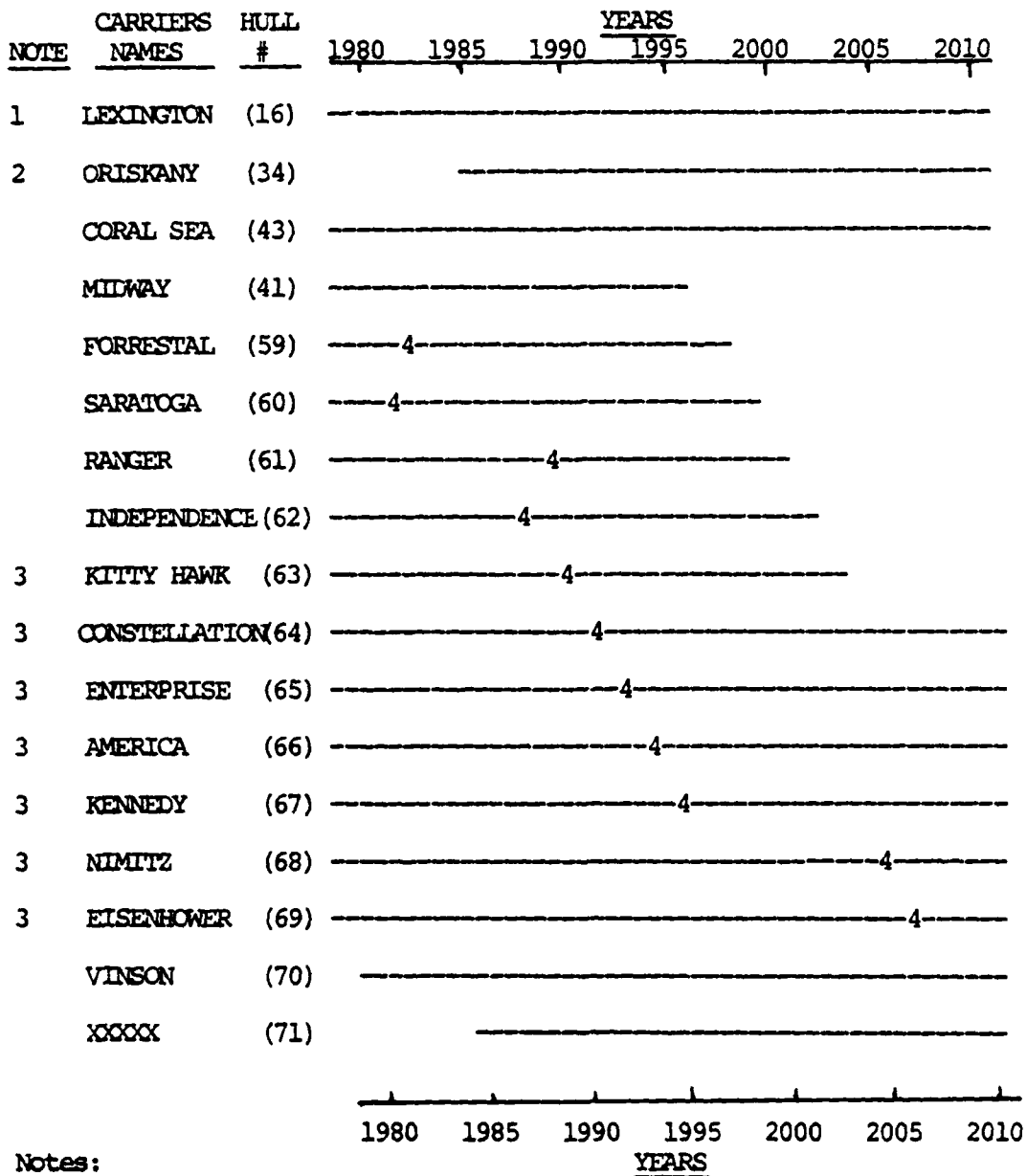
F. PROPOSED CARRIER STRENGTH

To increase the Navy's size with new ships would take a major effort in shipbuilding. Figure 4 shows a new projected carrier force that will increase from thirteen to fifteen attack carriers--which will be the nucleus of a fifteen battle group force [Ref. 17].

In order to achieve this increase from thirteen to fifteen CV/CVN's, the Lexington (ATV-16) will remain the training carrier [Ref. 18]. The Coral Sea (CV-43) will enter SLEP and continue on active duty as an attack carrier. This will bring the carrier force up to fourteen when the Vinson (CVN-70) makes its appearance in FY 82. The fifteenth carrier would in all probability be the unnamed CVN-71.

To maintain the force at fifteen past FY 85, the Midway (CV-41) would not be decommissioned. Whether it would enter

PROPOSED/PROJECTED CARRIER FORCE



Notes:

1. AVT-16 continues to operate as a training ship.
2. CV-34 ORISKANY brought back into service
3. Tentative schedule (SLEP) under consideration for these ships.
4. Tentative two year SLEP schedule.

Source: Janes Fighting Ships 1980-1981 Edition, Franklin Watts Inc., New York City, and the Department of the Navy, OP-01.

Figure 4

SLEP at that time is not known. The Navy has also expressed the desire to bring the Oriskany (CV-43) out of mothballs and use it as an amphibious support ship manned by two Marine A-4 Skyhawk attack aircraft wings.

Table II shows the time schedule and manning levels suggested by the Navy to Congress [Ref. 19]. This proposal was not accepted for the FY 81 budget, but the Navy hopes to again place it into the budget for FY 82, and this time get it approved.

Table III shows the projected timetable for Naval carriers and for increases in other force levels [Ref. 20]. This table does not include the ATV carrier in its count. A major problem the Navy faces in the increase in carrier forces is providing the necessary manpower at the times needed [Ref. 21].

With the Coral Sea (CV-43) remaining on line and the Vinson (CVN-70) entering into service, the Navy already has one airwing less than it needs. (By having two carriers in SLEP and eleven active carriers, there is only a requirement for eleven airwings. But, with having twelve active, there would be a need for twelve airwings in order to have each carrier perform its combined ship/airwing training prior to deployment. One airwing could support two carriers, but this would leave the airwing/squadrons without enough time for their required one year of shore-based training.) A naval airwing for the Oriskany (CV-34) is not required, because,

TABLE II

MANPOWER REQUIREMENTS FOR THE ORISKANY

FY 82	FY 83
74 Officers/1285 Enlisted	116 Officers/2085 Enlisted

ORISKANY manpower requirements with an added 30 percent standard factor for shore and sea billets other than those billets required for squadron manning.

FY 82	FY 83
96 Officers/1671 Enlisted	151 Officers/2711 Enlisted

Airwing requirements vary with number and mix of aircraft in wing.

Range of airwing options beginning in FY 83.

	FY 83
Minimum (40 aircraft)	92 Officers/922 Enlisted
Maximum (60 aircraft)	189 Officers/1342 Enlisted

Range of airwing options with an added 30 percent standard factor for shore and sea billets other than those billets required for squadron manning.

Minimum (40 aircraft)	120 Officers/1606 Enlisted
Maximum (56 aircraft)	247 Officers/1606 Enlisted

Total ORISKANY airwing manpower requirements with an added 30 percent factor for shore and sea billets other than those billets required for squadron manning.

	FY 82	FY 83
Minimum (40 aircraft)	96 Off/1671 Enl	271 Off/3946 Enl
Maximum (56 aircraft)	96 Off/1671 Enl	398 Off/4317 Enl

TABLE III

PROPOSED DEPLOYABLE SHIP TIME TABLE

	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90
CV/CVN[1]	13	14	14	14	15[2]	16	16	16	16	16
BB	0	0	1	2	2	2	3	4	4	4
CG/CGN	27	28	29	30	32	35	38	41	43	45
DD/DDG	82	83	84	84	84	82	82	84	86	86
FF/FFG	79	79	85	91	96	98	103	108	113	113
SS/SSN	92	98	103	107	109	109	109	109	112	112
SSBN[3]	36	34	33	34	35	35	36	37	38	39
AMPHIB	63	63	63	63	63	63	63	63	63	63
UNREP	33	33	33	32	32	31	31	31	31	31
MAT SUPT	27	29	30	31	31	31	31	31	31	31
FLT SUPT	17	17	17	17	17	17	17	17	17	17
OTHER	8	11	11	11	13	15	21	29	37	37
TOTAL	477	489	503	516	529	550	567	587	608	611

Notes:
1. Includes CV in SLEP and does not include the training carrier LEXINGTON AVT-16.
2. Adds ORISKANY (CV-34)
3. Includes SSBN conversion.

Source: These data were gathered from various sources and were presented in a manpower class at the Naval Postgraduate School, MN 4106 MPT Policy Analysis, in June 1981. The course addressed the question of how to man a 600 ship Navy.

as stated previously, Marine aviators are scheduled to man the Oriskany's squadrons.

One reason the Navy has had to maintain only eleven airwings for thirteen carriers is the existence of the SLEP program. If, however, the SLEP program is shortened so more carriers can be deployed, a greater airwing shortage will immediately be felt by the Navy. (If the SLEP program is reduced to one year intervals in order for the United States to cover all its carrier commitments, then there would have to be one airwing for each carrier.) (An airwing can have two deployments of six month duration and one year ashore for training during a two-year SLEP program. In this way airwings can move between ships and cover all commitments. But if the SLEP program is lessened to one year, the airwing/squadrons would have to deploy with a particular carrier and train ashore while that carrier was in SLEP. The airwing would then be available to that carrier for their combined ship/airwing training cycle. This would not allow the airwing to be utilized on another carrier.) The suggestion that SLEP may be changed and a greater number of airwings required is based on the number of carriers needed to fulfill commitments as listed by ocean: one in the North Atlantic for the North Atlantic Treaty Organization (NATO) commitment, two in the Mediterranean, one or two in the Indian Ocean, and at least one, and perhaps two, in the Pacific Ocean. This would entail a force anywhere from five to seven carriers at sea

at any given time. If the normal six-month deployment per carrier is maintained with one carrier working up its airwing and the ship's new crew, one in the yards for overhaul, with its airwing working its new personnel into the squadron, then fifteen to twenty-one carriers would be needed to maintain the global commitments of the United States. (Prior to the Soviet's placing ships in the Indian Ocean, the standard carrier deployment length was six months. This length of time was selected because it helped retention. Longer deployments are said to cause higher attrition rates because of family separation. At this time, the standard deployment length is eight months, so that the United States can keep a carrier in the Indian Ocean.)

To help meet the carrier commitment, the Navy has asked for two more Nimitz class carriers to be approved and built before the end of this decade. Congress may not want to approve these large Nimitz class carriers, as in the past they have favored smaller, less costly carriers. [Ref. 22].

The larger carriers have two roles, as previously stated, attack and ASW, while at this time the smaller carriers could only do one role effectively. Also, if Congress chose smaller carriers, the surface Navy would require more manpower to run these additional ships than to man a large, single Nimitz class carrier. The average size crew for a Nimitz class carrier is 3300 men, officers and enlisted, whereas the smaller Forrestal class requires 2800 men.

It seems, therefore, that it might take 5600 men to man the two smaller ships which would be required to replace the Nimitz class carrier.

G. MANNING

The approximate airwing manning levels needed to man the present carrier force are shown in Table IV. It can be seen that as the carrier class changes, so does the requirement for airwing manpower change. From the Midway class to the larger Nimitz class carrier there is a required 32 percent increase in number of officers and a 72 percent increase in the enlisted force to support the new airwing. The numbers given are for maximum manpower requirements, and may change depending on whether the carrier force wants fewer or more attack aircraft. In other words, a carrier may increase or decrease its deck load (number of aircraft a carrier can accommodate) depending on its mission [Ref. 23].

To investigate thoroughly the manpower requirements of the airwings, it is necessary to divide the personnel into officer and enlisted, and to separate these by designator and grade, and by rating and paygrade. The Squadron Manning Documents (SQMD's) will be used for this purpose. First, it is necessary to make a determination as to what type of squadron will be used in a model airwing's composition. Normally an airwing for a larger carrier (Nimitz class) operates 85 to 95 aircraft consisting of the following:

TABLE IV

TYPICAL CARRIER AIRWING MANPOWER FORCE BREAKDOWN

CARRIER	#	TOTAL SIZE	OFFICERS	ENLISTED
LEXINGTON	(16)	0	0	0
ORISKANY	(34)	0	0	0
MIDWAY	(41)	1800	270	1530
CORAL SEA	(42)	1800	270	1530
FORRESTAL	(59)	2150	356	1794
SARATOGA	(60)	2150	356	1794
RANGER	(61)	2150	356	1794
INDEPENDENCE	(62)	2150	356	1794
KITTY HAWK	(63)	2150	356	1794
CONSTELLATION	(64)	2150	356	1794
ENTERPRISE	(65)	2400	356	2044
AMERICA	(66)	2400	356	2044
KENNEDY	(67)	2400	356	2044
NIMITZ	(68)	3000	356	2644
EISENHOWER	(69)	3000	356	2644
VINSON	(70)	3000	356	2644
XXXXXX	(71)	3000	356	2644

Note. There is a 32 percent increase in officer billets and a 72 percent increase in enlisted billets from the Midway class to the Nimitz class of carriers. These increases are due to the increase of aircraft on the larger Nimitz class carriers

Source: Janes Fighting Ships 1980-1981 Edition, Franklin Watts Inc., New York, N.Y.

- Two fighter squadrons consisting of 24 F-4 Phantoms or F-14 Tomcats (at this time the F-4 Phantoms are being phased out and the F-14 Tomcat is the primary fighter aircraft; its SQMD will be used in this thesis for projected fighter squadron manpower requirements).

- Two light attack squadrons of 24 A-7 Corsairs. The A-7 Corsairs will start to be replaced by the F/A-18 Hornet in FY 83, but the replacement rate may increase or decrease depending on the production of the new aircraft and whether or not the Oriskany (CV-34) is recommissioned. If the Oriskany (CV-34) is recommissioned and Marine A-4 Skyhawks are used on it, this could step up introduction of the F/A-18 Hornet into the Navy [Ref. 24]. Because of the uncertainty of the plans and progress of the F/A-18 Hornet, all manpower requirements will be projected from the A-7 Corsair SQMD....(See Table V for schedule of phase out of A-4's and A-7's).

- One medium attack squadron of 12 A-6 Intruders and 4 KA-6D tanker aircraft.

- One ASW squadron of 10 S-3 Scout aircraft.

- One ASW squadron of 6 SH-3 Sea King Helicopters for plane guard/ASW.

- Smaller squadrons or detachments of 3 RF-8-reconnaissance aircraft. (At a later date, 2 F-14 Tomcats may be configured as photo reconnaissance aircraft.) Four EA-6B Prowler Electronic Warfare aircraft, and 4 E-2 Hawkeye Early-Warning/Control aircraft.

The Midway class carriers cannot accommodate the full airwing as described above, and normally would not operate the RF-8's, one-half of the SH-3's (as cargo helicopters and possibly for plane guard), or any of the S-3's [Ref. 25].

Based on this composition of a typical carrier airwing force, an examination will be made of the officer requirements for each of the above squadrons using SQMD's. A sample officer SQMD can be seen in Table VI. (All other relevant officer SQMD's are in Appendix A.) Tables VII through IX

show the designator and grades for officers of various airwing compositions for a large carrier (Nimitz class). Tables X through XII show the designator and grades for officers of various airwing compositions for a small carrier (Midway class).

TABLE V

F/A-18 REPLACEMENT (PHASE OUT) SCHEDULE

	YEAR				
SQUADRON	83	84	85	86	87
F-4 USN	2	2	0	0	0
A-7 USN	0	2	4	2	4
F-4 USMC	2	1	2	2	1
A-4 USMC	0	0	1	1	1
Total	4	5	7	7	7

Source: NTP A-50-7703, Chief of Naval Operations OP-112D32.

The information in Tables VIII and XI was utilized in the construction of Table XIII. Table XIII shows the total airwing manpower requirements over the next decade. This is done in two ways. First, sections A1, A2, A3 of Table XIII utilize the assumption of two small carriers being in service until FY 88, when two added Nimitz class carriers presently being proposed by the Navy would come into service. This, of course, proposes that both carriers are funded by Congress and are built at the same time. Second, sections B1, B2 and

B3 of Table XIII calculate manpower projections based on large carriers only. Table XIII, sections B1, B2 and B3, will give a larger number of officer personnel required, but could be more accurate than the numbers in sections A1, A2 and A3 because the small carriers often leave their excess airwing personnel in strategic points ashore in case the carrier has need of them quickly or a change in roles is dictated [Ref. 26]. Although they are not on the carriers as part of the airwing, the remaining aircraft and personnel are on a standby basis and could be counted.

TABLE VI

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-6E/KA-6D OFFICER

10 A-6E/4KA-6D AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			14	5	2		21
132X			13	6	2		21
1520					1		1
1630		1	1				2
6330				1			1
7360	1						1
7380	1						1
TOTAL	2	1	28	12	5	2	50

Source: OPNAVINST 5320.298A, Chief of Naval Operations OP-111C2.

TABLE VII

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7, (1)E-2, (1)EA-6, (2)F-4, (1)S-3, (1)SH-3 and (1)RF-8 SQUADRONS)

	Rank						
Designator	W-2	01	02	03	04	05	TOTAL
130X						12	12
131X			88	54	27	8	177
132X			74	30	14		118
1520		3		6	3		12
1630		10	1				11
3100		1					1
6330				2			2
6380				1			1
7321	2						2
7360	6						6
7380	8						8
TOTAL	16	14	163	93	44	20	350

Source: Various OPNAVINST for squadrons listed above.

TABLE VIII

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF
(1)A-6, (2)A-7, (1)E-2, (1)EA-6, (2)F-14,
(1)S-3, (1)SH-3 and (1)RF-8 SQUADRONS)

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						12	12
131X			90	52	27	8	177
132X			74	30	14		118
1520		5		4	5		14
1630		10	1				11
3100		3					3
6330				2			2
6380				3			3
7321	2						2
7360	6						6
7380	8						8
TOTAL	16	18	165	91	46	20	356

Source: Various OPNAVINST for squadrons listed above.

TABLE IX

LARGE CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF

(1)A-6, (1)E-2, (1)EA-6, (2)F-14, (1)S-3,
(2)F/A-18, (1)SH-3 and (1)RF-8 SQUADRONS)

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						12	12
131X			92	46	27	8	173
132X			74	31	14		119
1520		5		4	5		14
1630		10	1				11
3100		3					3
6330				2			2
6380				3			3
7321	2						2
7360	6						6
7386	6						6
TOTAL	14	18	167	86	46	20	351

Source: Various OPNAVINST for squadrons listed above.

TABLE X

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7,

(1)E-2, (1)EA-6, (2)F-4 and (1)SH-3 SQUADRONS)

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						10	10
131X			62	38	19	5	124
132X			58	21	11		90
1520		3		6	1		10
1630		8	1				9
6330				1			1
6380				1			1
7321	1						1
7360	6						6
7380	6						6
TOTAL	13	11	121	67	31	15	258

Source: Various OPNAVINST for squadrons listed above.

TABLE XI

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (2)A-7,

(1)E-2, (1)EA-6, (2)F-14, (1)SH-3 SQUADRONS)

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						10	10
131X			64	36	19	5	124
132X			58	21	11		90
1520		5		4	3		12
1630		8	1				9
3100		2					2
6330				1			1
6380				3			3
7321	1						1
7360	6						6
7380	6						6
TOTAL	13	15	123	65	33	15	264

Source: Various OPNAVINST for squadrons listed above.

TABLE XII

SMALL CARRIER AIRWING OFFICER PERSONNEL

(AIRWING CONSISTING OF (1)A-6, (1)EA-6,

(1)E-2, (2)F-14, (2)F/A-18, (1)SH-3 SQUADRONS)

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						10	10
131X			66	33	19	5	123
132X			58	21	11		90
1520		5		4	3		12
1630		8	1				9
3100		2					2
6330				1			1
6380				3			3
7321	1						1
7360	6						6
7380	4						4
TOTAL	11	15	125	62	33	15	261

Source: Various OPNAVINST for squadrons listed above.

TABLE XIII

TOTAL AIRWING OFFICER FORCE FOR CARRIERS

(BOTH LARGE AND SMALL CARRIERS)[a]

Scenario A1
2 Small & 11 Large Carriers
FY 80 to FY 81

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						152	152
131X			1118	644	335	98	2195
132X			930	372	176		1478
1520		65		52	61		178
1630		120	13				133
3100		37					37
6330				24			24
6380				39			39
7321	24						24
7360	78						78
7380	100						100
TOTAL	202	222	2061	1131	572	250	4438

Scenario B1
13 Large Carriers
FY 80 to FY 81

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						156	156
131X			1170	676	351	104	2301
132X			962	390	182		1534
1520		65		52	65		182
1630		130	13				143
3100		39					39
6330				26			26
6380				39			39
7321	26						26
7360	78						78
7380	104						104
TOTAL	208	234	2145	1183	598	260	4628

[a]Large means Nimitz class and small means Midway class carriers.

Source: Compiled from Tables VIII and XI of this thesis.

TABLE XIII (continued)

Scenario A2
2 Small & 12 Large Carriers
FY 80 to FY 85

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						164	164
131X			1208	696	362	106	2372
132X			1004	402	190		1596
1520		70		56	66		192
1630		129	14				143
3100		40					40
6330				26			26
6390				42			42
7321	26						26
7360	84						84
7380	108						108
TOTAL	218	239	2226	1222	618	270	4793

Scenario B2
14 Large Carriers
FY 80 to FY 85

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						168	168
131X			1260	728	378	112	2478
132X			1036	420	196		1652
1520		70		56	70		196
1630		140	14				154
3100		42					42
6330				28			28
6390				42			42
7321	28						28
7360	84						84
7380	112						112
TOTAL	224	252	2310	1274	644	280	4984

Note: Large carriers means Nimitz class and small carriers means Midway class.

TABLE XIII (continued)

Scenario A3
2 Small & 13 Large Carriers
FY 80 to FY 88

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						176	176
131X			1298	748	389	114	2549
132X			1078	432	204		1714
1520		75		60	71		206
1630		139	15				154
3100		43					43
6300				28			28
6380				45			45
7321	28						28
7360	90						90
7380	116						116
TOTAL	234	257	2391	1313	664	290	5149

Scenario B3[b]
15 Large Carriers
FY 80 to FY 90

Designator	Rank W2	01	02	03	04	05	TOTAL
130X						180	180
131X			1350	780	405	120	2655
132X			1110	450	210		1770
1520		85		68	81		234
1630		159	17				176
3100		49					49
6300				32			32
6380				51			51
7321	30						30
7360	102						102
7380	132						132
TOTAL	264	293	2477	1381	696	300	5411

[a]Large means Nimitz class and small means Midway class carriers.

[b]Scenario B3 is the set of manpower requirements used in the remainder of this thesis.

Source: Compiled from Tables VIII and XI of this thesis.

Section B3 of Table XIII was chosen to represent projected officer manpower requirements in this thesis because of the following assumptions. The typical airwing composition will be that of the large carrier airwing. This is so because it seems obvious, in the light of the Navy's insistence on continuing to commission Nimitz class carriers that the larger airwings are the realistic projection for the next ten years, besides being the "worst case" airwing manpower situation. In addition to these factors, it has been previously shown that smaller carriers, although carrying fewer aircraft on board, still maintain the approximate airwing size of the large carriers by leaving part of their assigned force ashore.

Table XIV reproduces Table XIII, Section B3, but gives total number of billets plus a 30 percent increase for sea and shore billets. These sea and shore billets are for aviation personnel required to man positions other than airwing billets [Ref. 27]. Air Department personnel for carriers, flight instructors, recruiters and project managers are a few examples of aviation billets that are included in the 30 percent factor. It is assumed in this thesis that the 30 percent factor will be valid through 1990.

Table XV shows a sample of the enlisted manpower requirements from the same composite airwing as that used for officers. (See Appendix B for all other enlisted SQMD's.) This information was taken from the respective SQMD's, Table XV and all other tables in this section pertaining to the enlisted manpower

TABLE XIV

TOTAL AIRWING OFFICER FORCE FOR FIFTEEN LARGE CARRIERS
(30 PERCENT FACTOR ADDED)[a]

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						234	234
131X			1755	1014	537	156	3462
132X			1443	585	273		2301
1520		111		88	105		304
1630		207	22				229
3100		64					64
6300				42			42
6380				66			66
7321	39						39
7360	133						133
7380	172						172
TOTAL	344	382	3220	1795	915	390	7046

Note: a. Standard factor for shore and sea billets other than those billets required for squadron manning.

Source: Compiled from Table XIII, Section B3.

TABLE XV

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-6E/KA-6D ENLISTED

10 A-6E/4 KA-6D AIRCRAFT SQUADRON[a]

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	7	9	6	5	2	1		30
AE	4	8	9	3	1	1		26
AF							1	1
AK	2	1	3	1				7
AM						1		1
AME	2	2	4	2				10
AMH	2	3	4	3				12
AMS	7	7	3	4	2			23
AN	56							56
AO	8	7	5	4	1			25
APO			2	1			1	4
AQ	4	9	11	3	1	1		29
AT	4	7	9	3		1		24
AZ	2	2	2	1				7
DK			1					1
HM			1					1
IS	1	1						2
MS	3	1	2					6
NC			1					1
PN	1	1	1	1				4
PO		1	2					3
PR	1	2	1	1				5
SN	2							2
YN	2	2	1	1				6
TOTAL	108	63	68	33	7	5	2	286

Note: a. This squadron would have 10 attack aircraft (A-6's) and 4 tankers (KA-6D inflight refueling aircraft).

Source: OPNAVINST 5320.298A, Chief of Naval Operations OP-111C2.

force will show this force broken down by paygrade and rating. Table XVI shows the enlisted force for a small carrier, and Table XVII shows this breakdown for a large carrier, even though only the large carrier manpower will be used in the following tables. Tables XVIII and XIX are constructed to be congruent with the officer data in Table XIII, Section B3, and Table XIV. Tables XIV and XIX will be used in a manpower model in Chapter IV of this thesis.

TABLE XVI

SMALL CARRIER AIRWING ENLISTED PERSONNEL CONSISTING OF (1)A-6, (2)A-7, (1)E-2, (1)EA-6B, (2)F-14 and (1)SH-3 SQUADRONS

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
ABH			1					1
AD	27	44	36	32	8	9		156
AE	29	44	13	7	6			99
AF							3	3
AK	11	5	22	6				44
AME	14	18	17	14		2	4	69
AMH	23	26	24	18	5			96
AMS	41	39	33	24	9	3		149
AN	313							313
AO	41	35	31	18	5			130
APO			17	8				25
AQ	20	33	41	11	5	5		115
AT	33	69	74	17	10	8		211
AV							5	5
AZ	11	15	15	6				47
DK			8					8
HM		2	6					8
IM		1						1
IS	1	1						2
MS	18	5	15					38
NC			1	4				5
OS				2				2
PN	5	8	8	8				29
PO		5	16	1				22
PR	8	10	10	3				31
SN	13	1						14
YN	6	18	10	5		2		41
TOTAL	614	379	398	184	48	29	12	1664

Source: Various OPNAVINST for squadrons listed above.

TABLE XVII

LARGE CARRIER AIRWING ENLISTED PERSONNEL CONSISTING OF (1)A-6, (2)A-7, (1)E-2, (1)EA-6B, (2)F-14, (1)S-3, (1)SH-3 and (1)RF-8 SQUADRONS

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
ABH			1					1
AD	36	58	44	39	11	11		199
AE	41	55	54	19	8	8		185
AF							4	4
AK	13	7	30	7				57
AM						2		2
AME	18	23	21	17		2	4	85
AMH	26	32	29	21	6			114
AMS	52	51	41	32	10	4		190
AN	410							410
AO	48	38	34	32	8			160
APO			22	11			2	35
AQ	20	33	41	11	5	5		115
AT	51	89	94	22	13	9		278
AV							6	6
AW	13	11	12	4	3			43
AX	6	9	5	4	1	1		26
AZ	14	20	20	8				62
DK			10					10
HM		2	8					10
IM		2						2
IS	1	1						2
MS	21	7	20					48
NC			1	4				5
OS				2				2
PN	7	10	10	9				36
PO		5	21	2				28
PR	14	12	13	4				43
SN	17	1						18
YN	11	22	11	7		2		53
TOTAL	819	488	542	255	65	44	16	2229

Source: Various OPNAVINST for squadrons listed above.

TABLE XVIII

TOTAL AIRWING ENLISTED FORCE FOR FIFTEEN LARGE CARRIERS

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
ABH			15					15
AD	540	870	660	585	165	165		2985
AE	615	825	810	285	120	120		2775
AF							60	60
AK	195	105	450	105				855
AM						30		30
AME	270	345	315	255		30	60	1275
AMH	390	480	435	315	90			1710
AMS	780	765	615	480	150	60		2850
AN	6150							6150
AO	720	570	510	480	120			2400
APO			330	165			30	525
AQ	300	495	615	165	75	75		1725
AT	765	1335	1410	330	195	135		4170
AV							90	90
AW	195	165	180	60	45			645
AX	90	135	75	60	15	15		390
AZ	210	300	300	120				930
DK			150					150
HM		30	120					150
IM		30						30
IS	15	15						30
MS	315	105	300					720
NC				15	60			75
OS					30			30
PN	105	150	150	135				540
PO		75	315	30				420
PR	210	180	195	60				645
SN	255	15						270
YN	165	330	165	105		30		795
TOTAL	12285	7320	8115	3750	1065	660	240	33435

Source: Compiled from Table XVII

TABLE XIX

TOTAL AIRWING ENLISTED FORCE FOR FIFTEEN LARGE CARRIERS
30 PERCENT FACTOR ADDED[a]

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
ABH			20					20
AD	702	1131	858	761	215	215		3882
AE	800	1073	1053	1141	156	156		4379
AF							78	78
AK	254	137	585	137				1113
AM						39		39
AME	351	449	410	332		39	78	1659
AMH	507	624	566	410	117			2224
AMS	1014	1095	800	624	195	78		3806
AN	7995							7995
AO	936	741	663	624	156			3120
APO			429	215			39	683
AQ	390	644	800	215	98	98		2245
AT	895	1736	1833	429	254	176		5323
AV							117	117
AW	254	215	234	78	59			840
AX	117	176	98	78	20	20		509
AZ	273	390	390	156				1209
DK			195					195
HM		39	156					195
IM		39						39
IS	20	20						40
MS	410	137	410					957
NC				20	78			98
OS					39			39
PN	137	195	195	176				703
PO		98	410	39				547
PR	273	234	254	78				839
SN	332	20						352
YN	215	429	215	137		39		1035
TOTAL	15875	9622	10574	5650	1387	860	312	44280

Note: a. Standard factor for shore and sea billets other than those billets required for squadron manning.

Source: Compiled from Table XVIII.

III. ATTRITION AND RETENTION

A problem of manpower shortages faces today's Navy, particularly among middle grade officers (Lieutenant (LT) and Lieutenant Commanders (LCDR)), and among the experienced petty officers grades (E-5 through E-9) [Ref. 28]. At the present time, the Navy has about 35 percent fewer pilots than it needs and is short approximately 21,000 experienced petty officers [Ref. 29]. Art Buchwald, a satirist, wrote a column titled "Anchors Aweigh," which stated the following:

> The United States is giving in to a crash program to build up its military might. We want to be in a position to match the Soviets on land, on sea and in the air. There is only one problem. Once we get all the new helicopters, planes and ships built, where do we find the people to man them?
>
> The Navy, for example, does not have enough crewmen to handle the ships they're supposed to keep on the high seas now. [Ref. 30]

Time magazine published an article "Who'll Fight for America?" From this article the following examples are quoted:

> For all of its sophisticated weaponry, America is facing a shortage of the most valuable military resource of all: Manpower.
>
> Today, however, a career in the armed forces is not attracting enough talented Americans. The Pentagon is handicapped by shortages of sufficiently skilled and disciplined personnel in all ranks.
>
> And Joint Chiefs of Staff chairman David C. Jones admits that "Our No. 1 readiness problem is people, the availability of trained people." [Ref. 31]

An article which relates more closely to the manpower problem which this thesis addresses was written by syndicated columnist Jack Anderson:

> Two 90,000 ton nuclear-powered aircraft carriers are proposed in the president's budget, and the twelve-carrier fleet is to be expanded eventually to fifteen.
>
> But the trouble is, the Navy is finding it tough to hang onto enough pilots to man its present carrier strength much less those who'll be needed to fly the planes from an increased flattop fleet.
>
> Last year, 436 Navy pilots quit. The Navy wound up twenty-five percent short in pilots of commander rank and below--the ones who would be most tempted by commercial airline jobs. The Navy needed almost 13,000 pilots; it had only 9,000, and this of course is before any new carriers are built. [Ref. 32]

As can be seen from the above articles, the Navy is perceived as having a manpower problem, both with its aviation officers and with its enlisted personnel, particularly those in the middle grades and ranks.

There is some expectation that the aviation-officer manpower problem will not get better for some time to come. The demand from the airlines for aviators for the next six to eight years has been estimated to be between 1,000 and 1,200 pilots a year. A primary reason for this large number of pilot vacancies is that the WW II era pilots who have held positions with the airlines are now at retirement age. Also, there is an expected growth of the airlines to accommodate approximately 860 new pilots, bringing this total demand for pilots by the airlines to about 1,900 per year through the middle to late 1980's [Ref. 33]. When this 1,900 per year

pilot need for commercial airlines is compared to the expected growth in the pilot requirements for the Navy, one can expect that the Navy's pilot shortage may continue, if not in fact increase. At the present time, the combined Navy and Air Force pilot training rate is only 2,075 per year [Ref. 34]. Currently, approximately 80 percent of the pilots hired by the airlines were previously military pilots [Ref. 35]. This does not take into consideration the growth or requirements for pilots in general aviation which cause the 1,900 number to increase. Of the 1,520 pilots (80 percent of the total 1,900 airline hirings projected yearly), the Air Force supplies one-half and the Navy supplies the other half. In other words, the Navy supplies, or will most likely supply, approximately 760 pilots per year to the airlines [Ref. 36]. From these facts, it can be seen that the military will have a difficult time meeting its requirements for pilots.

These figures are of course subject to change in the future as unforeseen developments take place. The recent Professional Air Traffic Controllers Organization (PATCO) action, which has caused a number of pilot layoffs, is a prime example of how the projected picture can be altered. Nevertheless, despite the temporary ebb and flow in demand, overall projections still call for increased hiring by civil aviation.

A. AVIATION OFFICER RETENTION

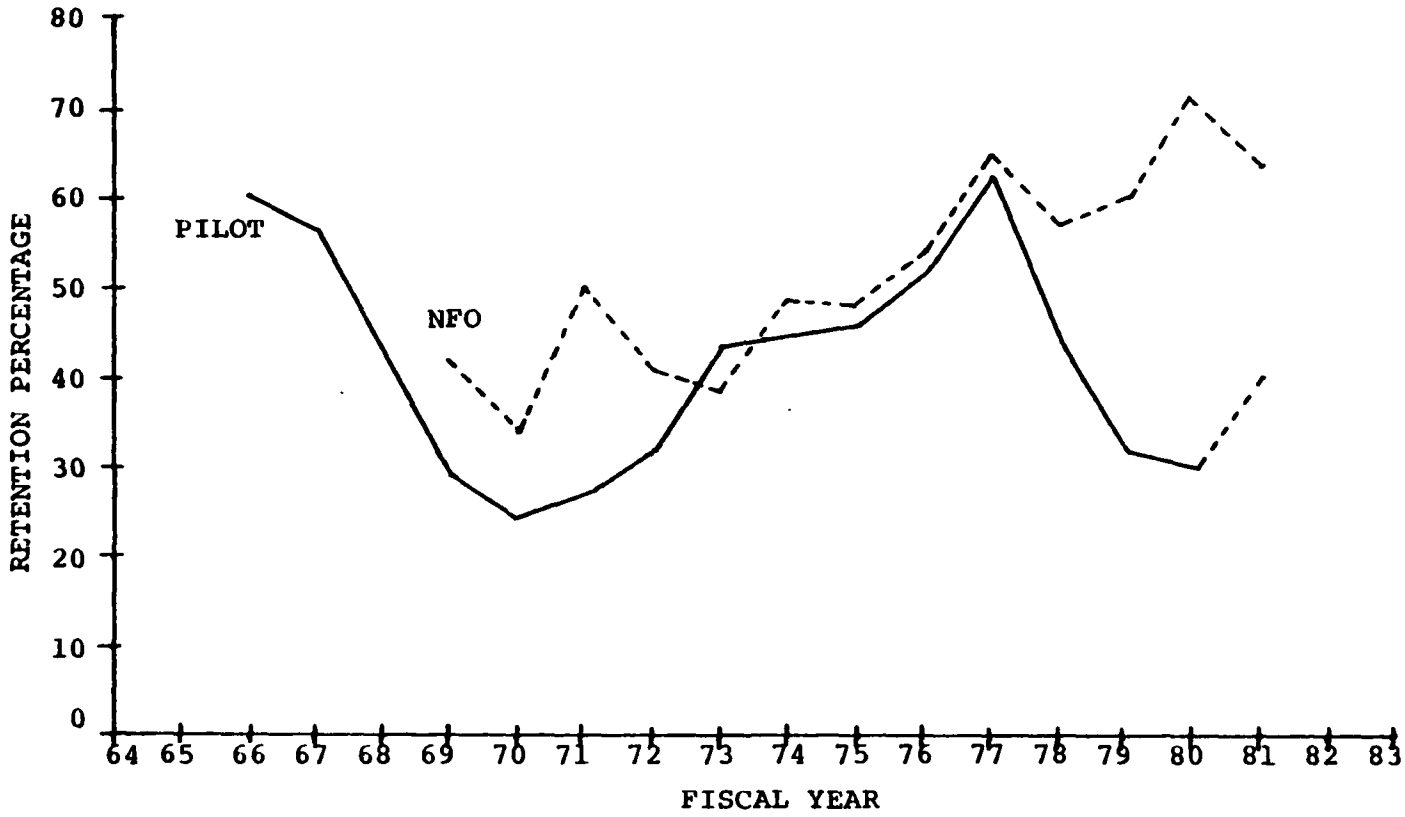
The Navy's aviation officer community consists of two distinct groups: the pilot (1310/5 designator), and the Naval

Flight Officer (NFO) (1320/5 designator). The pilot's role is self-explanatory. But the NFO, on the other hand, performs a variety of jobs. The NFO may be a navigator, weapons system operator, electronic-counter-measures operator, or fill any other job requiring an officer that does not involve piloting of the aircraft, but does involve flying in an aircraft.

Pilots and NFO's also face different demand curves in the outside job market. The military pilot sees, during many periods, a high demand by the commercial airlines. An NFO, since he does not handle the airplane itself, but instead handles the electronic equipment, does not have this demand for his services. Because of the demand difference, there is a difference between pilot and NFO retention rates, i.e., the NFO has a higher retention rate than does the pilot. Figure 5 shows that the pilots leave the service at a much greater rate than do the NFO's [Ref. 37]. The NFO's higher retention rate has helped the Navy to some extent, in that the NFO has been used to fill jobs formerly given to pilots.

Another problem tied to low retention is that pilots are needed to train pilots and NFO's. Therefore, if pilots are taken away from sea-going squadrons to fill training billets, this increases the shortage of pilots at sea. Also, placing pilots in training roles may decrease retention because pilots don't want to be assigned to flight-instructor billets, since flight-instructor billets are perceived to be of a lower status than are sea-going squadron billets [Ref. 38].

RETENTION TRENDS OF PILOTS AND NAVAL FLIGHT OFFICERS



Source: Aviation Week & Space Technology, 5 Nov 1979; Perspective, Naval Military Personnel Command (NMPC-461C4) Washington, D.C., July/August 1981.

Figure 5

B. AVIATION OFFICER ATTRITION

It is not possible to determine the feasibility of manning the aviation wings of the fifteen carrier force without considering all of the factors which influence the final numbers of personnel required. It must therefore be recognized that retention is only a part of the problem. An equally important factor is the attrition rate which acts to determine the total number of personnel who must be attracted to a given designator in order to realize the required numbers of personnel (all billets filled).

Table XX shows the programmed and actual training production of Navy pilots from FY 75 to FY 80, and Table XXI shows this information for NFO's. When the totals of Table XX are compared with the 760 pilots per year the Navy has supplied to the airlines, one can see that the Navy is producing a few more pilots than the airlines projected they would hire prior to the PATCO action in mid-1981.

Tables XX and XXI show the number who made it through training compared to the number the Navy wanted. The figures in these tables (XX and XXI) show the difference between requirements met and actual numbers needed. (Where the goal of 100 percent was met, the estimated aviation student attrition rate was correct, but, where the percentage was below 100, the Navy's attrition of aviation students was higher than expected. Conversely, if the percentage is above 100, the aviation students attrited at a lower rate than expected.)

TABLE XX

CHIEF OF NAVAL AIR TRAINING PRODUCTION OF PILOTS
FOR FY 75 - FY 80

Programmed/Actual
and Percentage

YEAR	JET	PROP	HELO	TOTAL
FY 75	319/332	427/415	230/177	976/924
	104%	97%	77%	95%
FY 76	340/324	375/375	205/205	920/904
	98%	100%	100%	98%
FY 77TQ[a]	87/81	83/81	55/55	225/217
	93%	98%	100%	96%
FY 77	372/346	340/325	188/144	900/744
	93%	75%	77%	83%
FY 78	335/276	270/182	195/139	800/597
	82%	67%	71%	75%
FY 79	375/208	295/208	215/116	885/532
	56%	71%	54%	60%
FY 80	318/320	316/320	251/251	885/891
	101%	101%	100%	101%

Note: a. TQ is July 1 through September 30.

Source: Department of the Navy, Chief of Naval Air Training OP-591D.

TABLE XXI

CHIEF OF NAVAL AIR TRAINING PRODUCTION OF NFO'S
FOR FY 75 - FY 80

Programmed/Actual
and Percentage

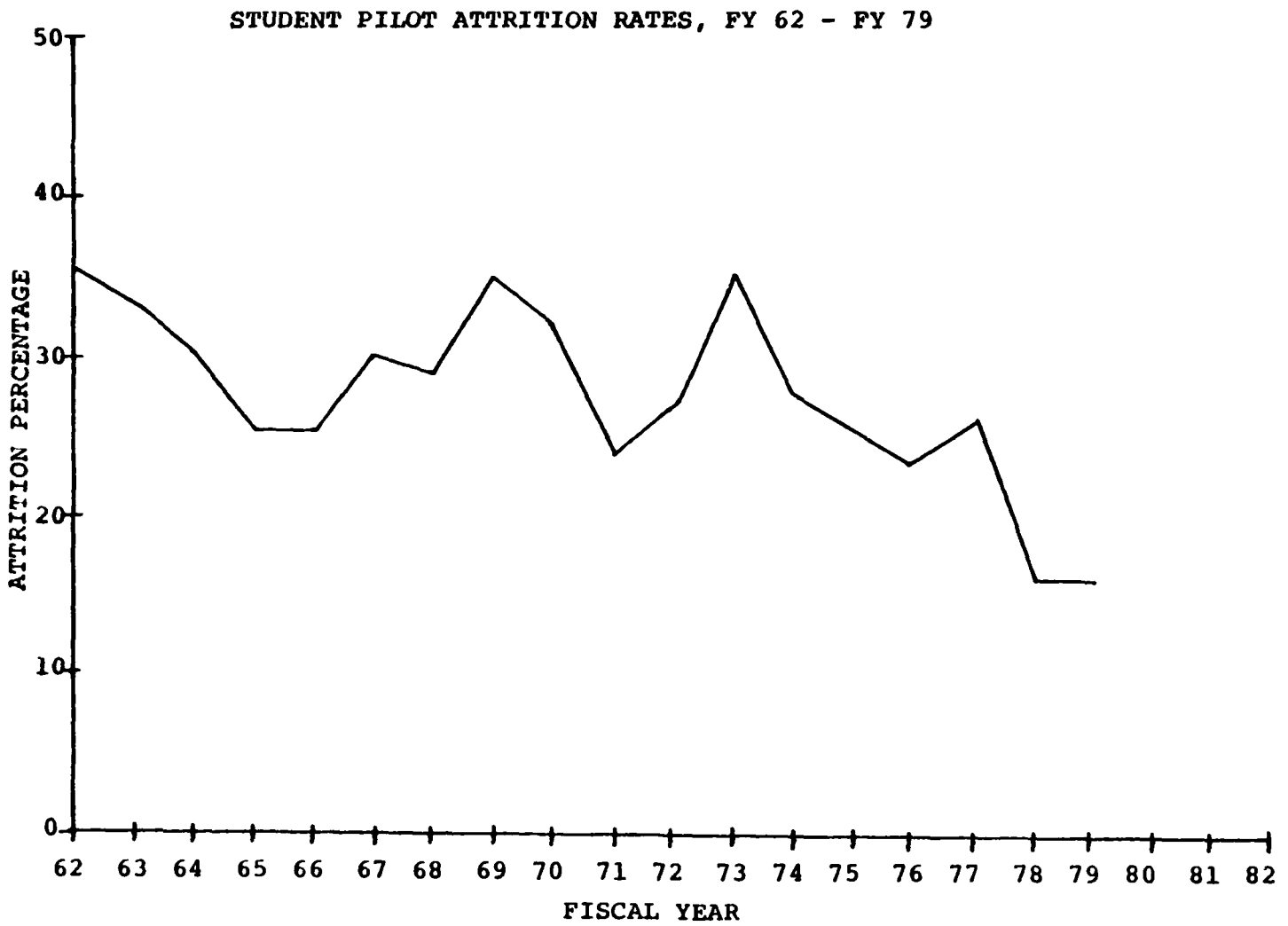
YEAR	TJN[a]	RIO[b]	ATDS[c]	NAV[d]	TOTAL
FY 75	52/44	85/74	43/21	172/172	361/322
	85%	88%	49%	100%	89%
FY 76	169/150	79/59	22/23	190/190	460/422
	88%	74%	104%	100%	91%
FY 77TQ[e]	43/43	10/10	12/16	50/50	115/119
	100%	100%	133%	100%	103%
FY 77	142/142	74/74	40/40	184/186	440/442
	100%	100%	100%	101%	101%
FY 78	142/133	98/90	30/30	190/172	460/425
	95%	92%	100%	91%	92%
FY 79	130/121	78/72	37/37	205/179	450/409
	93%	92%	100%	87%	91%
FY 80	130/130	74/74	41/41	205/206	450/451
	100%	100%	100%	101%	101%

Notes:
a. Tactical Jet Navigator, A-6's,S-3's aircraft.
b. Radar Intercept Officer, F-4's,F-14's aircraft.
c. Airborne Tactical Data Systems, EA-6's & E2-C aircraft.
d. Navigator, P-3, aircraft.
e. TQ is July 1 through September 30, 1977.

Source: Department of the Navy, Chief of Naval Air Training, OP-591D.

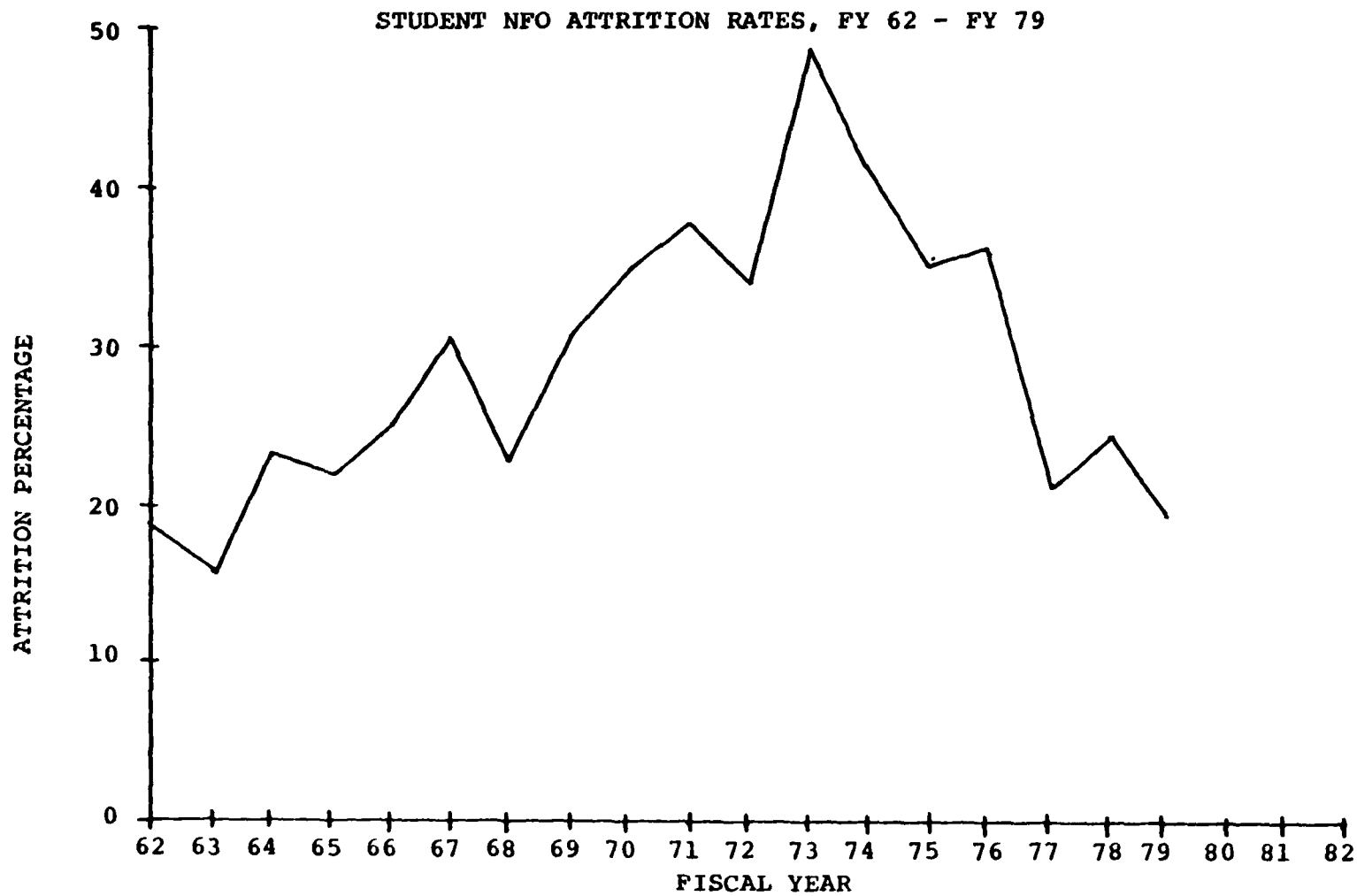
Those who did not complete training and either left the service or selected another designator (not aviation) are not included in these figures. Figure 6 shows attrition rates during training for pilots, and Figure 7 shows the rates for NFO's. Taking the average attrition rates over the years (shown in Figures 6 and 7), one finds a 28 percent attrition rate for pilots and a 29 percent attrition rate for NFO's. If the 28 percent attrition rate from pilot training is subtracted from 100 percent entering training, the resultant figure, when multiplied by the 30 percent pilot retention figure for FY 80, indicates that the Navy would need approximately five college graduates starting flight training in order to ultimately fill every junior officer billet required up to the LCDR (04) level. And this would only keep the pilot force (up to LCDR) at today's strength, which is 25 to 35 percent below what is required [Ref. 39]. Performing the same computations for NFO's shows that the Navy would only need two college graduates for every NFO billet (up to LCDR) requirement. These calculations do not take into account deaths or those officers who are passed over twice and are forced to leave the service, but it does include those few officers who choose to leave after the ten-year point. (Because the number of officers who leave the Navy after the ten-year point is so small, the full 30 percent attrition rate was assigned to the first opportunity period.)

Table XXII shows historical promotion results for pilots and NFO's. It can be seen that the promotion rates have



Source: Naval Aviation Attrition 1950-1976: Implications for the Development of Future Research and Evaluation, Griffin, G.R. & Mosko, J.D., Naval Aerospace Medical Research Lab. NAMRL-1237; and Department of the Navy, Chief of Naval Air Training, OP-591D.

Figure 6



Source: Naval Aviation Attrition 1950-1976: Implications for the Development of Future Research and Evaluation, Griffin, G.R. & Mosko, J.D., Naval Aerospace Medical Research Lab. NAMRL-1237; and Department of the Navy, Chief of Naval Air Training, OP-591D.

Figure 7

increased as the retention rates have decreased. Because the promotion rates are not at 100 percent, we can assume some pilots and NFO's leave the service because they have failed to be selected to the next higher rank. It cannot be determined from this table (Table XXII) what percentage of pilots and NFO's left the Navy after being passed over for promotion, so attrition rates will only be calculated for the training-attrition data.

TABLE XXII

LIEUTENANT TO LIEUTENANT COMMANDER PROMOTION RATES FOR PILOT AND NFO'S FROM FY 73 - FY 79

	Percentage	
YEAR	1310[a]	1320[b]
FY 73	.87	.65
FY 74	.75	.76
FY 75	.75	.76
FY 76	.67	.65
FY 77	.82	.83
FY 78	.85	.83
FY 79	.97	1.11[c]

Notes: a. 1310 Designator for pilots.
b. 1320 Designator for NFO's.
c. Selection percentages are defined as the total number of selectees above, below and in zone divided by the number of officers eligible in the zone. A percentage of greater than 100% is obtained when the number of all selectees is greater than the number of in zone eligibles.

Source: Officer Promotion Opportunity within the Navy Unrestricted Line 1973-1979, Hansell, R.C., Naval Postgraduate School Thesis, June 1979.

Later in this thesis the aviation personnel attrition and retention data will be coupled with other data for use in a requirements vs. inventory model.

C. ENLISTED ATTRITION AND RETENTION

This section will deal with eleven categories of enlisted personnel working in Naval aviation. There are more than eleven categories for enlisted ratings within the Navy, but we are only concerned with those that have a direct impact on the aviation side of the Navy. The personnel in the following ratings deal primarily with aircraft, and specifically the maintenance of aircraft: PR, AD, AE, AME, AMH, AMS, AO, AQ, AT, AW and AX (see Appendix C for explanation of ratings). There are other ratings that have an A prefix, but they are only involved in paper work, work at shore based installations only, or are not assigned to a squadron, i.e., AB, ABE, ABF, AG, AS, ASE, ASH, and AVS personnel are not assigned to a squadron. AZ and AK personnel are assigned to squadrons, but they do not perform maintenance on aircraft. The PR rating, even though not prefixed with an A, is assigned to squadrons and does work on equipment for the aircraft as well as on the survival equipment for the aviators. The PR rating is therefore included in this study.

The enlisted ratings chosen are all on the Career Reenlistment Objectives (CREO) list in Table XXIII [Ref. 40]. Table XXIII shows that the aviation ratings are in demand by the Navy. Translated, this means that an individual with

TABLE XXIII

CAREER REENLISTMENT OBJECTIVES (CREO) CATEGORIES

Rating	CREO Category	Paygrade E1-E3	E4	E5	E6	E7	E8	E9
AQ	A	0[b]	A	A	B	C	B	-[c]
AE	B	0	B	B	C	C	A	-
AT	B	0	A	B	C	C	B	-
AW	B	0	A	B	B	C	C	C
AD	C	0	C	B	C	C	C	-
AME	C	cl[d]	C	C	C	C	-	-
AMH	C	0	D	B	C	D	-	-
AMS	C	0	D	B	C	D	-	-
AO	C	0	C	C	C	C	C	B
AX	C	0	C	C	C	D	B	-
PR	C	cl	C	C	C	C	C	A

Notes: a. See Appendix C for explanation of ratings.

b. 0 means that there are no requirements at this level.

c. No requirements at this paygrade.

d. These ratings closed for reenlistment at this paygrade level.

An A means that there is a high demand for personnel in a rating and a D means that the demand is less.

Source: Career Reenlistment Objectives, OPNAVINST 1133.3, 8 January 1980.

a rating on the CREO list has a very good opportunity to reenlist, should he so desire. Also, variable reenlistment bonuses are tied to the CREO list. (The alphabetical code A means there is a strong need for people to reenlist in that rating and D means there is a lesser need. If the code (c1) appears, it indicates that a particular rating area is filled, and no individual of that rating (usually tied to a specific paygrade) can reenlist in that rating. If the person wants to reenlist he would have to change ratings.) One can also ascertain from Table XXIII that there is a larger need of ratings in the E-4 through the E-6 paygrades, i.e., the middle paygrades.

One of the recent theses completed at the Naval Postgraduate School addressed attrition severity [Ref. 41]. In that thesis, data were gathered to show shortages or excesses of personnel in U.S. Navy ratings. Data for those ratings that are relevant to aviation are shown in Table XXIV. As one can see, there seems to be an overage in almost all ratings except AO's, the billets of which were filled to the exact amount required. Table XXIV takes into account paygrades E-3 through E-9. (The Navy has no formal billet requirements for E-1 and E-2 paygrades. These requirements are usually covered and encompassed by the E-3 paygrade.) Thus, the picture created by Table XXIV gives the impression that the Navy does not have an enlisted aviation manpower problem. This may be true as far as total numbers go, but, if Table XXV is examined, it

TABLE XXIV

SIZE AND SHORTAGE OR EXCESS OF REQUIREMENTS FOR U.S. NAVY AVIATION RATINGS

Rating[a]	Size[b]	Shortage/Excess[c]
AD	6,613	.00
AE	3,264	.15
AME	1,487	.07
AMH	2,913	.05
AMS	4,254	.08
AO	3,096	.17
AQ	892	.28
AT	3,612	.14
AW	1,208	.11
AX	734	.08
PR	977	.12

Notes: a. See Appendix C for rating names.

b. Size equals inventory.

c. Shortage or excess equals (requirements minus inventory) divided by requirements.

Source: Fourth Quarter FY 80 Navy Military Personnel Statistics.

can be seen that there is an overage in the E-1 to E-3 paygrades, while paygrades E-4 through E-9 have a shortage, and there are large shortages in the E-5 and E-9 paygrades. So, by noting the shortages of the middle-grade enlisted paygrades shown in Table XXV, one can determine that the Navy does, in fact, have an enlisted aviation manpower problem.

TABLE XXV

NAVY ENLISTED MANNING STATUS, 1981, BY PAYGRADE

Paygrade	Billet Requirement	Current Number	Shortages Percentage
E1-E3	168,667	172,246	102[a]
E4	104,825	98,852	6
E5	100,455	80,107	20
E6	78,831	66,447	16
E7	33,483	29,199	13
E8	9,799	8,378	15
E9	4,154	3,224	22

Note: a. E1-E3 has an overage, all others are shortages.

Source: These data were gathered from various sources and were presented in a manpower class, MN 4106 MPT Policy Analysis, in June 1981. The course addressed the question of how to man a 600-ship Navy.

Attrition of first-term Navy enlisted personnel has increased substantially from rates observed in the mid-1960's. In 1966, total premature loss after two years was 10 percent of accessions. That number had risen to 29 percent by 1976. Losses by the fourth year of enlistment increased from 17 percent in 1966 to 41 percent by 1976. [Ref. 42]

Table XXVI shows the reenlistment opportunity (at entry) for grouped aviation ratings in 1979 [Ref. 43]. Even though the Navy only attrites approximately 24 to 27 percent of its enlisted aviation force in four years of service (as shown in Table XXVI), the chances of reenlisting an individual are small.

Table XXVII shows the reenlistment rates for all ratings. In comparing Tables XXVI and XXVII, it can be seen that the Navy has more problems in retaining aviation personnel at the first reenlistment opportunity than it does in retaining personnel in most other ratings that do not involve aviation.

Table XXVIII shows attrition and retention rates Navy-wide. These data were gathered for a project at the Naval Postgraduate School in which the billet requirements for a 600-ship Navy were forecasted.

The last table (Table XXIX) of this section was derived from the Naval Military Personnel Command (NMPC-DSS), Navy Military Personnel Statistics [Ref. 44]. Table XXIX includes attrition and retention percentages for all aviation ratings included in this study. Paygrade will be assumed by length

TABLE XXVI

NAVY FIRST TERM REENLISTMENT CHANCES (AT ENTRY)
BY RATING/GROUP (IN PERCENTAGE)

AVWEP[a]	Four Year Survival Chance	Reenlistment Chance if Survived	Retention Chance at Entry
AT,AW,AQ, AC,AX	76	16	12

AVM[a]	Four Year Survival Chance	Reenlistment Chance if Survived	Retention Chance at Entry
AM,AD, AE,AO	73	22	16

Note: a. AVWEP and AVM are names for composite groups of ratings.

Source: First Term Survival and Reenlistment Chances for Navy Ratings and a Strategy for Their Use. Thomason, James S., Center for Naval Analyses (CRC 382), May 1979.

TABLE XXVII

FIRST TERM NAVY ENLISTED RETENTION RATES,
FY 71 TO FY 79

ACTUAL				ESTIMATED			PROJECTED	
FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79
28	32	34	38	32	35	38	31	28

Source: American Volunteers: A Report on the All-Volunteer Armed Forces, Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics), 31 December 1978.

TABLE XXVIII

NAVY ATTRITION AND RETENTION STATISTICS,
FY 81 (TO JUNE 1981)

1st Term Attrition	26 percent
1st Term Retention	31 percent
2nd Term Retention	55 percent
3rd Term Retention	64 percent

Source: These data were gathered from various sources and were presented in a manpower class, MN 4106 MPT Policy Analysis, in June 1981. The course addressed the question of how to man a 600-ship Navy.

of service, i.e., length of service time from E-1 to E-2 will be assumed to be six months; from E-2 to E-3, six months; time from E-3 to E-4 will be assumed to be one year (but could be as little as nine months); E-4 to E-5, one year; E-5 to E-6, three years; and three years from E-6 to E-7, E-7 to E-8, and E-8 to E-9. These are the minimum times for an individual to be eligible for promotion to the next higher grade.

The data set forth in this chapter have addressed three areas (attrition, retention, and promotion) affecting ultimate numbers of personnel available, both officer and enlisted, in the Naval aviation community. The data will be the basis for the transition matrix to be used in a Markov Chain model in Chapter IV of this thesis. The model will be used to establish projections of numbers of personnel required to fill billets for a projected fifteen carrier airwing force by 1990.

TABLE XXIX

ENLISTED CONTINUATION RATES FOR NAVY
AVIATION ENLISTED PERSONNEL

Year of Service	Ratings					
	AD	AE	AME	AMH	AMS	AO
1.	.9478	.9998	.9998	.9287	.9341	.9746
2.	.7969	.9133	.9293	.8250	.8285	.8187
3.	.6402	.7523	.8091	.6567	.6489	.6401
4.	.2870	.3567	.3733	.3403	.3228	.3097
5.	.2674	.3373	.3515	.3190	.2992	.3018
6.	.2418	.2973	.3206	.2916	.2690	.2565
7.	.2285	.2722	.2942	.2723	.2525	.2405
8.	.2094	.2352	.2543	.2439	.2321	.2194
9.	.1933	.2120	.2115	.2199	.2075	.2031
10.	.1783	.1910	.1994	.1978	.1821	.1800

Year of Service	Ratings				
	AQ	AT	AW	AX	PR
1.	.9998	.9998	.9998	.9998	.9998
2.	.9250	.9174	.9212	.9573	.9137
3.	.8163	.7852	.7707	.8076	.7937
4.	.5611	.5380	.3795	.5296	.4044
5.	.5306	.5170	.3732	.5287	.3969
6.	.3745	.3958	.3207	.4594	.3666
7.	.3236	.3649	.2897	.4407	.3401
8.	.2554	.3066	.2432	.4049	.3158
9.	.1782	.2537	.2185	.3756	.3121
10.	.1333	.2241	.2185	.3571	.2691

Note: The data go up to thirty years of service, but only ten years of data are needed for calculations in Chapter IV.

Source: Naval Military Personnel Commands (NMPS-DSS), Navy Military Personnel Statistics, dated 17 March 1981.

IV. MANPOWER PROJECTIONS (MARKOV CHAIN MODEL MANMOD)

In this chapter a program named MANMOD, which is based on a Markov Chain model, will be used to predict officer and enlisted manpower accession and retention requirements for a fifteen carrier force. These predictions will be based on rank for the two aviation officer designators and on pay-grade for the eleven enlisted aviation ratings used. The period of time covered will be from present day to FY 1990.

To understand this section, a simple explanation of a Markov Chain model is in order. The first assumption of a Markov Chain model is that an individual will move from one time period to the next independently of other individuals, and with identical probabilities which do not vary over time [Ref. 45]. Secondly, each person has a given probability of making any particular transition [Ref. 46]. These probabilities of transition are arranged in an array as follows:

$$\begin{matrix} P_{11} & P_{12} & P_{13} \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & P_{1k} & W_1 \\ P_{21} & P_{22} & P_{23} \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & P_{2k} & W_2 \\ \vdots & \vdots & \vdots & & & & & & & \vdots \\ P_{k1} & P_{k2} & P_{k3} \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & P_{kk} & W_k \end{matrix}$$

where the element P_{ij} is the probability that an individual

in grade at the beginning of an interval of time will move to grade j at the end of that time interval, while W_i is the probability that an individual of grade i at the start has left the Navy by the end of the interval. Another assumption is that each person must stay where he is, move to another grade, or leave [Ref. 47]. The row sums for each row must equal one, i.e.,

$$P_{11} + P_{12} + P_{13} \cdots\cdots\cdots + P_{1k}$$

The matrix $P =)p_{ij})$ is the transition matrix and the column vector $W = (w_1, w_2, w_3, \ldots\ldots w_k)$ is known as the wastage vector [Ref. 48]. It is implicit in this model that time is discrete. In practice, the unit of time will be a year or a month. (In this thesis all periods are yearly.) All the P and W elements will be assigned numerical values using estimates of probabilities from past data. To use this model, one also needs information on the initial stock vector $(N = n_1, n_2, n_3, \ldots n_k)$. At any time an individual can be classified into a group on the basis of whatever attributes are relevant. Finally, a recruitment vector $(R = r_1, r_2, r_3, \ldots r_k)$ is used to replenish the stocks (N) [Ref. 49].

This model, Markov Chain (MANMOD), was chosen because manpower systems are regarded as a set of interconnected stocks and flows and the common empirical observations are that flows are proportional to stocks [Ref. 50].

Unfortunately, data for the P matrix come in different forms, and various computations have to be made before the

information can be utilized. For the officer data, the information was fairly straightforward. The attrition data given in Figures 6 and 7 need only conform to P + W = 1, where the attrition rates equal the wastage rates. The officer retention rates from Figure 5 are already in the W - 1 form, i.e., the wastage rate has been taken into account. But the following formula had to be applied to the enlisted data:

$$P = 1 - W = \frac{G_i + 1}{G_i}$$

where G_i is the probability that an individual will survive from one year to the next. These data for enlisted are shown in Table XXIX of the previous chapter. The reason G_i is divided into $(G_i + 1)$ is that $G_i + 1$ will have a compound wastage rate.

If the data were applied directly to the P matrix, the wastage rate from row 1 would also be contained in row 2 and the wastage rate in row 3 would contain the wastage rates of rows 1 and 2, etc. This would compound the wastage rates and give a false picture of the P matrix, thereby showing a greater loss of personnel than there really would be.

A. OFFICER MANMOD MODEL

The first manpower projection made with the MANMOD model was for the NFO's (1320/5 designators). This projection covered a ten-year span. The ten-year time span was chosen for two reasons. First, the carrier force is planned to

increase over this time; and second, the average length of time spent by officers in the ranks Ensign (ENS) to LCDR is nine years of service. The breakdowns for the year groups are as follows: ENS (01) first and second years of service, LTJG (02) third and fourth year, LT (03) fifth to end of ninth year, and the tenth year for LCDR (04).

To calculate the stock vector (the N stock vector is the amount of the initial stocks of the individual groups in the study), Table XIII, section B1, and Table XXI (FY 80 data) were used. The data from Table XXI were used because this would give the most current look at NFO production and, hopefully, reflect the upcoming years. Data selected from Table XXI (FY 80) included TJN's, RIO's, ATD's, and only 5 percent of the NAV (Navigator on an aircraft, usually a patrol type aircraft). This figure, 5 percent of the NAV, was chosen because the majority of these individuals serve on Patrol aircraft and are not involved in shipboard squadrons. It was felt that 5 percent would cover the E2C aircraft (the only propellor squadron assigned to a large carrier) NFO needs.

Taking these figures and applying the average attrition rate of 29 percent for student NFO's (from Figure 7), one would end up with a stock of 879 NFO's for the Ensign (01) time span. The average attrition rate for the past twenty years (29 percent) was used in order to provide an overall estimate of NFO students.

Stock vectors for the 02 (LTJG), 03 (LT) and 04 (LCDR) come directly from Table XIII, section B1. It is assumed, then, that all current airwing billets are filled. The 02 and 03 grades are spaced out over two and five year time periods respectively. Since the officer structure is pyramidical, the junior years in each grade were given a larger proportion of the stock. This apportionment of the N (stock vectors) can be seen in the computer run example shown in Table XXX. The same assumptions for apportionment were used for the pilot (1310/5 designators) predictions utilizing Table XIII, section B1, for the 02 to 04 groups, and Table XX for the 01's. (Here, too, personnel stocks are derived by assuming all billets are filled.)

Table XX stocks were calculated by using the percentage of the pilot figures which applied to JET aircraft and 10 percent of the figures which applied to PROP and HELO pilots. (These figures were percentages of the actual production of pilot numbers.) The reason for using only 10 percent of the PROP and HELO was that the same assumptions as were made when calculating the numbers of NFO's needed for propellor aircraft were applied, with the exception that the E2C has two pilots. The 10 percent for HELO's was added to the N (stock vector) to cover the needs of the SH-3 squadrons aboard carriers. Using these figures, and applying the 28 percent average attrition rate (from Figure 6) for student pilots, gives a total stock of 1339 for 01's. Again, the N (stock vectors)

TABLE XXX

EXAMPLE OF OFFICER MANMOD COMPUTER RUN
FOR LCDR ACCESSIONS

```
ENTER N(INITIAL CLASS VALUES)......
 :
   739 600 670 500 200 200 100 100 76 351[a]
ENTER P(TRANSITION MATRIX) BY ROWS..
ENTER 1TH ROW
 :
   0 .8 0 0 0 0 0 0 0 0[b]
ENTER 2TH ROW
 :
   0 0 .919 0 0 0 0 0 0
ENTER 3TH ROW
 :
   0 0 0 1 0 0 0 0 0 0
ENTER 4TH ROW
 :
   0 0 0 0 .98 0 0 0 0 0
ENTER 5TH ROW
 :
   0 0 0 0 0 1 0 0 0 0
ENTER 6TH ROW
 :
   0 0 0 0 0 0 1 0 0 0
ENTER 7TH ROW
 :
   0 0 0 0 0 0 0 1 0 0
ENTER 8TH ROW
 :
   0 0 0 0 0 0 0 0 .65 0
ENTER 9TH ROW
 :
   0 0 0 0 0 0 0 0 0 .5274
ENTER 10TH ROW
 :
   0 0 0 0 0 0 0 0 0 0
ENTER NUMBER OF RECRUIT TYPE........
   1  FIXED RECRUIT TYPE
   2  ADDITIVE (RECRUIT SIZE)
   3  MULTIPLICATIVE (RECRUIT SIZE)
   4  ADDITIVE (SYSTEM SIZE)
   5  MULTIPLICATIVE (SYSTEM SIZE)
 :
   1
```

NOTES

This is the initial stock vector showing the number of individuals who are already in the Navy.

This is the P matrix where the percentage rates are derived from calculations which include attrition, retention and promotion information. A rate is needed for each year studied, with the last rate being all zeroes because no more calculations are required past this point.

This section is where the programmer chooses the type of recruitment policy to be observed. In this thesis recruitment type one (1) was chosen because in each run accession was assumed to be constant over the projected period.

Notes a, b - see page 83.

TABLE XXX (continued)

NOTES

```
ENTER R(RECRUITMENT VECTOR)
 :
   2173 0 0 0 0 0 0 0 0 0[c]
ENTER PERCENT CODE.....................
   0  NO GRADE PERCENTAGES
   1  GRADE SIZE AS PERCENTAGE OF
      TOTAL GRADE SIZE
   2  GRADE SIZE AS PERCENTAGE OF
      ORIGINAL GRADE SIZE
 :
   1
DO YOU WISH TO SEE INTERVENING YEARS..
   0  NO
   1  YES
 :
   1
END OF INPUT PROGRAM
   BASEQN 10[d]
```

T		N	PERCENT	R
0	1[e]	739	(21)	
	2	600	(17)	
	3	670	(19)	
	4	500	(14)	
	5	200	(6)	
	6	200	(6)	
	7	100	(3)	
	8	100	(3)	
	9	76	(2)	
	10	351	(10)	
	TOTAL	3536	(100)	2173
1	1	2173	(43)	
	2	591	(12)	
	3	551	(11)	
	4	670	(13)	
	5	490	(10)	
	6	200	(4)	
	7	200	(4)	
	8	100	(2)	
	9	65	(1)	
	10	40	(1)	
	TOTAL	5081	(144)	2173

At this point the programmer could select the percentage rate that will appear in the percentage column in the program runs. This thesis used selection one (1).

At this section the programmer would be able to choose whether all years of projection are to be shown or just the last year. If a zero is chosen, only the zero year and the last year selected will be displayed. When a one (1) is selected, all years, including the zero year, will be shown.

The T column shows the year of the projection and the N column shows the number of individuals found at each row for that year, while the percent column shows the percent of the total N of individuals at each level. The total percentage is based not on the sum of the percentage column but instead on the percent increase or decrease of the zero N stocks. The R column shows the number of recruits for the period shown.

Notes c, d, e - see page 83.

TABLE XXX (continued)

2	1	2173	(33)	
	2	1738	(26)	
	3	543	(8)	
	4	551	(8)	
	5	657	(10)	
	6	490	(7)	
	7	200	(2)	
	8	200	(2)	
	9	65	(1)	
	10	34	(1)	
	TOTAL	6652	(188)	2173
3	1	2173	(27)	
	2	1738	(21)	
	3	1598	(20)	
	4	543	(7)	
	5	540	(7)	
	6	657	(8)	
	7	490	(6)	
	8	200	(2)	
	9	130	(2)	
	10	34	(0)	
	TOTAL	8104	(229)	2173
4	1	2173	(23)	
	2	1738	(18)	
	3	1598	(17)	
	4	1598	(17)	
	5	532	(6)	
	6	540	(6)	
	7	657	(7)	
	8	490	(5)	
	9	130	(1)	
	10	69	(1)	
	TOTAL	9525	(269)	2173
5	1	2173	(20)	
	2	1738	(16)	
	3	1598	(15)	
	4	1598	(15)	
	5	1566	(15)	
	6	532	(5)	
	7	540	(5)	
	8	657	(6)	
	9	319	(3)	
	10	69	(1)	
	TOTAL	10789	(305)	2173

NOTES

This is the second year point and the second row is now at steady state. The following projected years will have a steady state at each associated row, i.e., at the fourth year point the fourth row will be at steady state. Steady state will occur when the input remains at a constant level over time. Therefore, each year will bring its respective row to a steady state condition until the whole projection is at a steady state and the only way to change this state is to change the recruitment vector (accessions).

Three rows of steady states have been achieved. This third row for each of the following projected years will be in a steady state, i.e., row 3 for each projected year will have the same number. The other N rows will continue to change until they reach a steady state. The changes are caused by the P matrix percentages.

TABLE XXX (continued)

6	1	2173	(18)	
	2	1738	(15)	
	3	1598	(13)	
	4	1598	(13)	
	5	1566	(13)	
	6	1566	(13)	
	7	532	(4)	
	8	540	(5)	
	9	427	(4)	
	10	168	(1)	
	TOTAL	11905	(337)	2173
7	1	2173	(17)	
	2	1738	(13)	
	3	1598	(12)	
	4	1598	(12)	
	5	1566	(12)	
	6	1566	(12)	
	7	1566	(12)	
	8	532	(4)	
	9	351	(3)	
	10	225	(2)	
	TOTAL	12912	(365)	2173
8	1	2173	(16)	
	2	1738	(13)	
	3	1598	(11)	
	4	1598	(11)	
	5	1566	(11)	
	6	1566	(11)	
	7	1566	(11)	
	8	1566	(11)	
	9	346	(2)	
	10	185	(1)	
	TOTAL	13900	(393)	2173
9	1	2173	(15)	
	2	1738	(12)	
	3	1598	(11)	
	4	1598	(11)	
	5	1566	(11)	
	6	1566	(11)	
	7	1566	(11)	
	8	1566	(11)	
	9	1018	(7)	
	10	183	(1)	
	TOTAL	14569	(412)	2173

NOTES

Each of the following year projections will behave in the same manner as the preceding ones until the end projection point is reached. At this end point (10 years in this thesis) all N rows are in steady state. There would be no further changes in the N column if year 20 was requested. The N column represents the amount of individuals who can be found in the period.

TABLE XXX (continued)

10	1	2173	(15)	
	2	1738	(12)	
	3	1598	(11)	
	4	1598	(11)	
	5	1566	(10)	
	6	1566	(10)	
	7	1566	(10)	
	8	1566	(10)	
	9	1018	(7)	
	10	537	(4)	
	TOTAL	14924	(422)	2173

Notes:

a. Each value refers to the initial stock of individuals for each year, i.e., 739 ENS in their first year of service, 600 ENS in their second year of service, 670 LTJG's in their first year (third row of table), 500 LTJG's in their second year, 200 LT's in their first year, etc.

b. The .8 shows that only 80 percent of the ENS go into the next year point (20 percent lost by attrition). The .919 shows that only 91.9 percent of the ENS at this year point go on to the next point (LTJG). The other rows also show what percentage goes on to their next year points. If the percentage is less than 100 percent, retention, attrition and promotion were taken into account.

c. The recruitment vector number is only used at the first year point because all recruitment is at the first year point, and no lateral entries are included. If lateral entries were to be included, then recruitment vector numbers would be used at other year points.

d. BASEQN 10 shows that only a 10 year projection was asked for; if a 20 year projection had been asked for, BASEQN 20 would be entered at this point.

e. Each row coincides with the N (initial class vector), i.e., row 1 equals ENS at the first year point.....row 10 is equal to LCDR's.

Appendix D shows a step-by-step utilization of MANMOD as the program exists in the Naval Postgraduate School's computer.

Appendix E is the step-by-step APL program used to generate MANMOD.

were apportioned in a pyramidical fashion over each appropriate segment.

Next, the P (transition matrix) was generated. For the NFO's this matrix contained the wastage rate minus 1 ($P = W - 1$), and the retention rates derived from Figure 7 and Figure 5, respectively. The attrition rate was divided between the first and second year for the 01's. This division was done to cover both years, because the training cycle can take up to two years before an individual is qualified to go on to a squadron. The division of the 29 percent average attrition rate for student NFO's was assessed higher for the first year, at 20 percent, because the greatest loss of students is during the initial training phase [Ref. 51]. The other 9 percent was attached to the second year of the 01 cycle.

For the matrix rows containing the grade of 02 (row three and row four), it was assumed that all individuals who survived ENS (01) second year point would survive to the third year point (first year as a LTJG (02)). Therefore, the value of one (1) was assigned to the third row of the P matrix.

At the fourth year point (fourth row of the matrix), the retention rate was taken to be 98 percent. A 98 percent rather than a 100 percent rate was chosen to cover any losses that might have occurred from promotion failure to LT (03) or change of designator for various reasons. The 2 percent wastage rate could also include death or health problems which could be the cause of an aviator not continuing on to the LCDR (03) level.

If an individual survived to the fourth year 03 point, it was assumed he would have a 100 percent chance of reaching the seventh year (seventh row of the P matrix). The assumption behind this was that once an individual made it to the 03 level, prior to finishing his aviation obligation, the only losses would be through medical problems or death. These two losses were considered to have insufficient impact (at least in peacetime) on the P matrix to cause any significant changes.

The normal obligation for flight trained individuals is six years for pilots, and four and one-half for the NFO's. This obligation is a payback period required from an individual in return for the flight training he received. The six year total obligation was allotted to both the pilots and NFO's in this thesis, because the normal issue of orders carries a clause that upon acceptance of the orders an obligation is incurred. This obligation would bring the NFO's up to the sixth year of aviation duty along with the pilots.

At the eighth and ninth year point (eighth and ninth row), the P matrix uses the retention data from Figure 5. The retention data were divided equally over the two years because even though the retention data cover all grades, the majority of losses are at the end of the six-year obligation point. This obligation usually places an individual at the eighth or ninth row of the P matrix, depending on acceptance of prior orders. The FY 80 retention data from Figure 5 were utilized.

For the ninth year (ninth row of the P matrix), the retention data from FY 80 were combined with the average promotion data from Table XXII. The average promotion data were selected because of the large differences in the percentage rates over the years shown. Also, it was felt that the promotion rates will not remain as high as those of FY 79 because the long-term effect of such a high rate would be a change in the officer pyramid structure. The same assumptions made for the NFO P matrix were used in making the pilot P matrix.

Last to be described is the recruitment vector (R). Since the military has a pyramidical structure, and brings new individuals in at the bottom, only the first year in the recruitment vector has recruits. In other words, there is little or no lateral entry. This assumption of no lateral entry was made for pilots also.

B. ENLISTED MANMOD MODEL

The enlisted N (stock vector) was calculated from Table XVII in the same way as the officer N (stock vector), with the following exceptions. First, Table XVII's stock was multiplied by thirteen to give a present day stock. (Table XVII shows only the enlisted personnel needs for one carrier and since the initial stock of individuals would be for thirteen carriers, the multiplication was required. This multiplication had already been done for the officer data given in Table XIII, section B1.) Second, the apportionment

of stocks over the year groups was more uniform (not as pyramidical as for the officers) because the pyramid effect is less prevalent for enlisted, as is shown by Table XXV. Also, the first period covers E-1 to E-3. Since there are no billets assigned to the E-1's and E-2's, and it takes only one year to make E-3, these paygrades (E-1, E-2 and E-3) were lumped together. It is realized that in those three paygrades individuals have different probabilities of promotion to E-4, but for the model to be tractable, that assumption was made.

The second stock vector contained all E-4's. (E-4's can be promoted to E-5 in nine months, but to keep the groups at yearly intervals a one-year promotion time was assumed.) Third, fourth and fifth rows of the P matrix contained the E-5's. For the sixth, seventh and eighth rows of the P matrix, E-6's were used, and E-7's were used for the ninth row. The E-5 and E-6 paygrades have three-year slots because that is the minimum time that an individual can remain in those paygrades before he can be promoted. It is assumed that all individuals proceed to the next year. There are only nine years in this section, because at the tenth year an individual will still only be at the E-7 paygrade point.

The P matrix for the enlisted was calculated from Table XXIX by applying the formula $P = 1 - W = \frac{G_i + 1}{G_i}$. This calculation takes into account wastage and promotion rates which were applied directly to the P matrix. The R (recruitment vector) is generated in the same fashion as that for officers.

Table XXXI provides an example of the results obtained from the MANMOD program for the eleven different enlisted ratings.

C. OFFICER AND ENLISTED SUPPLIES UNDER A PRESENT DAY ACCESSION AND RETENTION SCENARIO

The first MANMOD computer runs were done to show how present day accession rates would affect the FY 1990 force requirements if those rates were projected over the next ten years. Table XXXII represents the officer and enlisted supplies as compared to the billets required by the FY 1990's fifteen carrier force. Both FY 80 and FY 81 accession data were used in the computations. No figures appear in column "FY 1990 Projections by FY 1981 Accessions" when the manpower projections are unchanged from the previous column [Ref. 52].

It must also be noted that the figures shown as available for the enlisted ratings/paygrades include all aviation enlistees, and not just those available to the fleet airwings. Therefore, enlisted figures from Table XXXII will be explained more fully later in this chapter.

An examination of the figures shown in Table XXXII for pilots shows clearly that the Navy will have a deficit of seagoing pilot LCDR's (04's) by FY 1990 if the accession, retention, attrition and promotion rates continue at present levels. Particularly interesting is the overage in pilot LT's (03's) which is predicted. With this in mind, it should be remembered that the LT's (03's) are spread over a five-year promotion zone. They are not all eligible for promotion

TABLE XXXI

EXAMPLE OF ENLISTED MANMOD COMPUTER RUN
FOR AD (E-7) ACCESSIONS

```
ENTER N(INITIAL CLASS VALUES)
 :
    468 754 192 190 190 169 169 169 143[a]
ENTER P(TRANSITION MATRIX) BY ROWS
ENTER 1TH ROW
 :
    0 .9478 0 0 0 0 0 0 0[b]
ENTER 2TH ROW
 :
    0 0 .8408 0 0 0 0 0 0
ENTER 3TH ROW
 :
    0 0 0 .8034 0 0 0 0 0
ENTER 4TH ROW
 :
    0 0 0 0 .4483 0 0 0 0
ENTER 5TH ROW
 :
    0 0 0 0 0 ,9319 0 0 0
ENTER 6TH ROW
 :
    0 0 0 0 0 0 .9043 0 0
ENTER 7TH ROW
 :
    0 0 0 0 0 0 0 .945 0
ENTER 8TH ROW
 :
    0 0 0 0 0 0 0 0 .9164
ENTER 9TH ROW
 :
    0 0 0 0 0 0 0 0 0
ENTER NUMBER OF RECRUIT TYPE
   1 FIXED RECRUIT VECTOR
   2 ADDITIVE (RECRUIT SIZE)
   3 MULTIPLICATIVE (RECRUIT SIZE)
   4 ADDITIVE (SYSTEM SIZE)
   5 MULTIPLICATIVE (RECRUIT SIZE)
 :
    1
ENTER R (RECRUITMENT VECTOR)
 :
    1025 0 0 0 0 0 0 0 0[c]
```

NOTES

This is the initial stock vector showing the number of individuals who are already in the Navy.

This is the P matrix where the percentage rates are derived from calculations which include attrition, retention and promotion information. A rate is needed for each year studied, with the last rate being all zeroes because no more calculations are required past this point.

This section is where the programmer chooses the type of recruitment policy to be observed. In this thesis recruitment type one (1) was chosen because accession was assumed to be constant over the projected period.

Notes a,b,c - see page 93.

TABLE XXXI (continued)

```
ENTER PERCENT CODE.....................
   0 NO GRADE PERCENTAGES
   1 GRADE SIZE AS PERCENTAGE
     OF TOTAL GRADE SIZE
   2 GRADE SIZE AS PERCENTAGE
     OF ORIGINAL GRADE SIZE
 :
    1
DO YOU WISH TO SEE INTERVENING YEARS.
   0 NO
   1 YES
 :
    1
END OF INPUT PROGRAM
    BASEQN 10[d]
```

T		N	PERCENT	R
0	1[e]	468	(19)	
	2	754	(31)	
	3	192	(8)	
	4	190	(8)	
	5	190	(8)	
	6	169	(7)	
	7	169	(7)	
	8	169	(7)	
	9	143	(6)	
	TOTAL	2444	(100)	1025
1	1	1025	(34)	
	2	444	(15)	
	3	634	(21)	
	4	154	(5)	
	5	85	(3)	
	6	177	(6)	
	7	153	(5)	
	8	160	(5)	
	9	155	(5)	
	TOTAL	2986	(122)	1025
2	1	1025	(29)	
	2	971	(28)	
	3	373	(11)	
	4	509	(15)	
	5	69	(2)	
	6	79	(2)	
	7	160	(5)	
	8	144	(4)	
	9	146	(4)	
	TOTAL	3478	(142)	1025

NOTES

At this point the programmer could select the percentage rate that will appear in the percentage column in the program runs. This thesis used section one (1).

At this section the programmer would be able to choose whether all years of projection are to be shown or just the last year. If a zero is chosen, only the zero year and the last year selected will be displayed. When a one is selected, all years, including the zero year, will be shown.

The T column shows the year of the projection and the N column shows the number of individuals found at each row for that year. While the percent column shows the percent from the total N of individuals at each level. The total percentage is based not on the sum of the percentage column, but instead on the percent increase or decrease of the zero N stocks. The R column shows the number of recruits for the period shown.

This is the second year point and the second row is now at steady state. The following projected years will have a steady state at each associated level, i.e., at the fourth year point the fourth row will be at steady state.

TABLE XXXI (continued)

3	1	1025	(27)	
	2	971	(26)	
	3	817	(22)	
	4	300	(8)	
	5	228	(6)	
	6	64	(2)	
	7	72	(2)	
	8	151	(4)	
	9	132	(4)	
	TOTAL	3761	(154)	1025
4	1	1025	(25)	
	2	971	(24)	
	3	817	(20)	
	4	656	(16)	
	5	134	(3)	
	6	213	(5)	
	7	58	(1)	
	8	68	(2)	
	9	139	(3)	
	TOTAL	4081	(167)	1025
5	1	1025	(24)	
	2	971	(23)	
	3	817	(19)	
	4	656	(16)	
	5	294	(7)	
	6	125	(3)	
	7	192	(5)	
	8	55	(1)	
	9	62	(1)	
	TOTAL	4199	(172)	1025
6	1	1025	(23)	
	2	971	(22)	
	3	817	(19)	
	4	656	(15)	
	5	294	(7)	
	6	274	(6)	
	7	113	(3)	
	8	182	(4)	
	9	50	(1)	
	TOTAL	4383	(179)	1025

NOTES

Steady state will occur when the input remains at a constant level over time. Therefore, each year will bring its respective level to a steady state condition until the whole projection is at a steady state and the only way to change this state is to change the recruitment vector (accessions).

Three rows of steady state have been achieved. This third row for each of the following projected years will be in a steady state, i.e., row 3 for each projection year will have the same number. The other N rows will continue to change until they reach a steady state. The changes are caused by the P matrix percentages.

TABLE XXXI (continued)

7	1	1025	(22)	
	2	971	(21)	
	3	817	(18)	
	4	656	(14)	
	5	294	(6)	
	6	274	(6)	
	7	248	(5)	
	8	107	(2)	
	9	167	(4)	
	TOTAL	4559	(187)	1025
8	1	1025	(22)	
	2	971	(21)	
	3	817	(18)	
	4	656	(14)	
	5	294	(6)	
	6	274	(6)	
	7	248	(5)	
	8	234	(5)	
	9	98	(2)	
	TOTAL	4618	(189)	1025
9	1	1025	(22)	
	2	971	(21)	
	3	817	(17)	
	4	656	(14)	
	5	294	(6)	
	6	274	(6)	
	7	248	(5)	
	8	234	(5)	
	9	215	(5)	
	TOTAL	4735	(194)	1025
10	1	1025	(22)	
	2	971	(21)	
	3	817	(17)	
	4	656	(14)	
	5	294	(6)	
	6	274	(6)	
	7	248	(5)	
	8	234	(5)	
	9	215	(5)	
	TOTAL	4735	(194)	1025

NOTES

Each of the following year projections will behave in the same manner as the preceding ones until the end projection point is reached. At this point (9 years in this thesis) all N rows are in steady state. There would be no further changes in the N column if year 20 was requested. The N column represents the amount of individuals who can be found in the period.

TABLE XXXI (continued)

Notes:

a. Each value refers to the initial stocks of individuals for each year segment, i.e., 468 E-1's to E-3's in the first year, 754 E-4's in the second year of service, 192 E-5's in their first year, 190 E-5's in their second year, 190 E-5's in their third year, etc.

b. The .9478 shows that only 94.78 percent of the E-1's to E-3's go onto the next year point (5.22 percent loss by attrition). The .8408 shows that only 84.08 percent of the E-4's at this year point go onto E-5's. The other rows also show what percentage go onto the next year. If the percentages are less than 100 percent retention, attrition and promotion were taken into account.

c. The recruitment vector number is only used at the first year point because all recruitment was at the first year point and no lateral entries were included. If lateral entries were to be included, their recruitment vector numbers would be used at other year points.

d. BASEQN 10 shows that only ten year projections were asked for. If a twenty year projection were asked for, BASEQN 20 would be entered at this point.

e. Each row coincides with the N (initial class value), i.e., row 1 equals E-1's to E-3's at the first year point,...., row 10 is equal to E-7's.

Appendix D shows a step-by-step utilization of MANMOD as the program exists in the Naval Postgraduate School's computer.

Appendix E is the step-by-step APL program used to generate MANMOD.

TABLE XXXII

OFFICER AND ENLISTED MANMOD PROJECTIONS
UNDER A CURRENT ACCESSION SCENARIO

Designator or Ratings		Actual[a] FY 1980 Accessions	Actual[b] FY 1981 Accessions	FY 1990[c] Aviation Billet Requirements	FY 1990[d] Projections from FY 80 Accessions	FY 1990[e] Projections from FY 81 Accessions
PILOT	-LCDR[f]	1339	1339	537	331	
	-LT			1014	4487	
	-LTJG			1755	1968	
NFO	-LCDR	879	879	275	362	
	-LT			585	3010	
	-LTJG			1443	1266	
AD	-E-7	1460	1260	215	306	264
	-E-6			761	1078	930
	-E-5			858	2517	2173
	-E-4			1131	1384	1194
AE	-E-7	1432	1432	156	337	
	-E-6			1141	1299	
	-E-5			1053	2896	
	-E-4			1073	1432	
AME	-E-7	365	365	0	93	
	-E-6			322	352	
	-E-5			410	770	
	-E-4			449	365	
AMH	-E-7	519	519	117	127	
	-E-6			410	458	
	-E-5			566	946	
	-E-4			624	482	
AMS	-E-7	981	881	195	228	205
	-E-6			624	806	723
	-E-5			800	1767	1586
	-E-4			1095	916	823
AO	-E-7	713	713	156	156	
	-E-6			624	569	
	-E-5			663	1261	
	-E-4			741	695	
AT	-E-7	1502	1202	254	461	369
	-E-6			429	1920	1537
	-E-5			1833	3366	2694
	-E-4			1736	1502	1202

Notes a,b,c,d,e - see page 95.

TABLE XXXII (continued)

Designator or Ratings		Actual[a] FY 1980 Accessions	Actual[b] FY 1981 Accessions	FY 1990[c] Aviation Billet Requirements	FY 1990[d] Projections from FY 80 Accessions	FY 1990[e] Projections from FY 81 Accessions
AQ	-E-7	729	729	98	263	
	-E-6			215	1264	
	-E-5			800	2369	
	-E-4			644	1029	
AW	-E-7	618	548	59	150	133
	-E-6			78	608	540
	-E-5			234	1280	1135
	-E-4			215	618	548
AX	-E-7	325	295	20	127	115
	-E-6			78	447	405
	-E-5			98	728	661
	-E-4			176	325	295
PR	-E-7	251	211	0	79	67
	-E-6			78	277	233
	-E-5			254	530	445
	-E-4			234	229	211

Notes:

a. This column (Actual FY 1980 Accessions) shows the actual accessions at entry level into the various designators and ratings for FY 1980.

b. This column (Actual FY 1981 Accessions) shows the actual accessions at entry level into the various designators and ratings for FY 1981.

c. This column (FY 1990 Aviation Billet Requirements) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by designator/rank and rating/paygrade.

d. This column (FY 1990 Projections by FY 1980 Accessions) shows the resulting number of individuals available in each designator/rank and rating/paygrade in FY 1990 if FY 1980 accession data were projected for ten years (keeping accessions, attritions, retentions and promotion rates constant at the FY 1980 levels).

e. This column (FY 1990 Projections by FY 1981 Accessions) shows the resulting number of individuals available in each designator/rank and rating/paygrade in FY 1990 if

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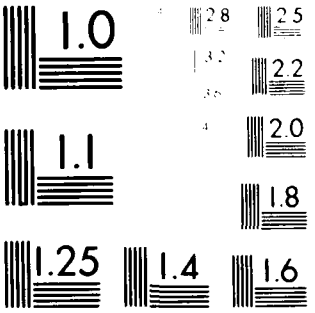

MICROCOPY RESOLUTION TEST CHART

TABLE XXXII (continued)

FY 1981 accession data were projected to FY 1990 (keeping attrition, retention and promotion rates constant at the FY 1980 levels and accessions data at the FY 1981 level).

f. By comparing the figures shown in the FY 1990 Aviation Billet Requirements column with those in the last two columns, one can find the overages and deficits of manning as calculated by MANMOD.

to the LCDR level. Further, it must be noted that due to the high attrition rate in this rank (LT), a sufficiently high number of these officers will leave the service prior to becoming eligible for promotion to keep LCDR shortages constant.

Closer examination of high attrition rates for LT's (03) shows the worst rates in the eighth and ninth years of service, making it obvious that the bulk of the pilot LT's shown to be available in Table XXXII (4487 in number) are in the first three years of that rank zone. This creates a middle management problem, not only later at the LCDR level, but also in billets which require the experience of a senior LT, i.e., catapult/arresting gear officer. Manpower problems exist, therefore, not only in terms of lack of personnel in total numbers, but also in the distribution of the available personnel throughout their years of service. The results show that there will be no manning problem in the rank of LTJG if current accession, retention, promotion and attrition data remain constant.

The figures in Table XXXII indicate that NFO manning in the fifteen carrier force airwings will not present a problem, except at the LTJG level, where a deficit of 217 individuals is found. However, these figures, like those for pilots, presuppose that accession flows remain constant at the FY 80 and FY 81 levels and that retention and attrition figures do not worsen at the eighth and ninth year point of service.

The enlisted figures in Table XXXII show, in almost all cases, a larger quantity of individuals available, if current accessions remain constant, than the fifteen carrier force airwing manpower billet projections require. These availability figures, however, are subject to a fifty percent reduction since they include all Navy aviation enlistees in the eleven chosen rates, and not just those available to be assigned to the carrier airwings. The enlisted ratings studied in this thesis are also used in Patrol Squadrons (P-3 aircraft), sea-going helicopter squadrons (LAMPS), and shore-based activities (Fleet Composite Squadrons).

D. ENLISTED MANPOWER PROJECTIONS RESULTS

Tables XXXIII and XXXIV show only fifty percent of the total number of accessions (FY 80 and FY 81 accession data respectively) by ratings/paygrade projected to FY 90. The fifty percent reduction in figures is based upon the fact that fifty percent of all officers (pilots/NFO's) trained are assigned to carrier airwing squadrons. This fact was derived from calculations based on Tables XX and XXI which show the

TABLE XXXIII

CARRIER ENLISTED AVIATION SHORTAGES/OVERAGES
BY ONE-HALF OF FY 1980 ACCESSIONS

Rating/ Paygrade	One-Half[a] of Actual FY 1980 Accessions	FY 1990[b] Aviation Billet Requirements	FY 1990[c] Manpower Supply Projections Using One-Half of FY 1980 Accessions	(Shortages)/[d] Overages: Supply Compared to FY 90 Billet Requirements
AD -E-7	730	215	153	(62)
-E-6		761	539	(222)
-E-5		858	1259	401
-E-4		1131	692	(439)
AE -E-7	716	156	168	12
-E-6		1141	650	(491)
-E-5		1053	1448	395
-E-4		1073	716	(357)
AME -E-7	183	—[e]	—	—
-E-6		322	176	(146)
-E-5		410	385	(35)
-E-4		449	183	(266)
AMH -E-7	260	117	64	(53)
-E-6		410	229	(181)
-E-5		566	473	(93)
-E-4		624	241	(383)
AMS -E-7	491	195	114	(81)
-E-6		624	403	(221)
-E-5		800	884	84
-E-4		1095	458	(637)
AO -E-7	357	156	78	(78)
-E-6		624	285	(339)
-E-5		663	631	(32)
-E-4		741	348	(392)
AT -E-7	756	254	231	(23)
-E-6		429	960	531
-E-5		1833	1683	(150)
-E-4		1736	751	(985)
AQ -E-7	365	98	132	34
-E-6		215	632	417
-E-5		800	1185	385
-E-4		644	515	(129)

Notes a,b,c,d,e - see following page.

TABLE XXXIII (continued)

Rating/ Paygrade	One-Half Actual[a] FY 1980 Accessions	FY 1990[b] Aviation Billet Requirements	FY 1990[c] Manpower Supply Projections	(Shortages)/[d] Overages: Supply
AW -E-7	309	59	75	16
-E-6		78	304	226
-E-5		234	640	406
-E-4		215	309	94
AX -E-7	163	20	64	44
-E-6		78	224	146
-E-5		98	364	266
-E-4		176	163	(13)
PR -E-7	126	—[e]	—	—
-E-6		78	139	61
-E-5		254	265	11
-E-4		234	115	(119)

Notes:

a. This column (One-Half of Actual FY 1980 Accessions) shows a 50 percent reduction in the FY 1980 accession data used in Table XXXII because it was assumed that 50 percent of the total accessions would not go to a carrier airwing. (This percentage is based on the fact that 50 percent of the aviation officer accessions go to other than carrier airwings.)

b. This column (FY 1990 Aviation Billet Requirements) show projected billet requirements for the FY 1990 fifteen carrier aviation force by rating/paygrade.

c. This column (FY 1990 Manpower Projections by One-Half of FY 1980 Accessions) is half of Table XXXII's enlisted FY 1990 Projections by FY 1980 Accessions section. (Only half the accessed personnel were used because this would be the amount of individuals if only half of of the accessions were used).

d. This column ((Shortages)/Overages from Accessions Compared to FY 90 Billet Requirements) is the resultant from subtracting the two previous columns from each other. The numbers in parentheses are shortages.

e. No figures appear at these ratings/paygrades because there are no aviation billet requirements at these levels.

Source: Compiled from Table XXXII.

TABLE XXXIV

CARRIER ENLISTED AVIATION SHORTAGES/OVERAGES
USING ONE-HALF OF FY 1981 ACCESSIONS

Rating/ Paygrade		One-Half[a] of Actual FY 1981 Accessions	FY 1990[b] Aviation Billet Requirements	FY 1990[c] Manpower Supply Projections Using One-Half of FY 1981 Accessions	(Shortages)/[d] Overages: Supply Compared to FY 90 Billet Requirements
AD	-E-7	630	215	132	(83)
	-E-6		761	465	(306)
	-E-5		858	1087	229
	-E-4		1131	597	(534)
AE	-E-7	716	156	168	12
	-E-6		1141	650	(491)
	-E-5		1053	1448	395
	-E-4		1073	716	(357)
AME	-E-7	183	—[e]	—	—
	-E-6		322	176	(146)
	-E-5		410	385	(35)
	-E-4		449	183	(266)
AMH	-E-7	260	117	64	(53)
	-E-6		410	229	(181)
	-E-5		566	473	(93)
	-E-4		624	241	(383)
AMS	-E-7	441	195	103	(92)
	-E-6		624	362	(262)
	-E-5		800	793	(7)
	-E-4		1095	412	(683)
AO	-E-7	357	156	78	(78)
	-E-6		624	285	(339)
	-E-5		663	631	(32)
	-E-4		741	348	(392)
AT	-E-7	601	254	185	(79)
	-E-6		429	769	340
	-E-5		1833	1683	(486)
	-E-4		1736	751	(1135)
AQ	-E-7	365	98	132	34
	-E-6		215	632	417
	-E-5		800	1185	385
	-E-4		644	515	(129)

Notes a,b,c,d,e - see following page.

TABLE XXXIV (continued)

Rating/ Paygrade		One-Half[a] of Actual FY 1981 Accessions	FY 1990[b] Aviation Billet Requirements	FY 1990[c] Manpower Supply Projections Using One-Half of FY 1981 Accessions	(Shortages)/[d] Overages: Supply Compared to FY 90 Billet Requirements
AW	-E-7	274	59	67	8
	-E-6		78	270	202
	-E-5		234	568	334
	-E-4		215	274	59
AX	-E-7	148	20	58	38
	-E-6		78	203	125
	-E-5		98	332	234
	-E-4		176	148	(28)
PR	-E-7	106	--[e]	--	--
	-E-6		78	117	39
	-E-5		254	223	(31)
	-E-4		234	106	(128)

Notes:

a. This column (One-Half of Actual FY 1981 Accessions) shows a 50 percent reduction in the FY 1981 accession data used in Table XXXII because it was assumed that 50 percent of the total accessions would not go to a carrier airwing. (This percentage is based on the fact that 50 percent of the aviation officers accessions go to other than carrier airwings.)

b. This column (FY 1990 Aviation Billet Requirements) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by rating/paygrade.

c. This column (FY 1990 Manpower Projections by One-Half of FY 1981 Accessions) is half of Table XXXII's enlisted FY 1990 Projections by FY 1981 Accession section. (Only half the accessed personnel were used because this would be the amount of individuals if only half of the accessions were used.)

d. This column ((Shortages)/Overages from Accession Compared to FY 90 Billet Requirements) is the result from subtracting the two previous columns from each other. The numbers in parens are shortages.

e. No figure appears at these ratings/paygrades because there are no aviation billet requirements at these levels.

Source: Compiled from Table XXXII.

number of aviation students and to which type of aviation field they are trained. The assumption is therefore made that approximately 50 percent of the aviation enlisted accessions would be required as a support factor for the seagoing airwing squadrons to which these officers are assigned. It is understood that these figures are approximate, but it was not possible to refine the available data to show exact billeting of individuals in each of the ratings discussed.

Deficits in the manning of the FY 90 carrier enlisted airwing force, according to Tables XXXII and XXXIV, would appear in the following ratings: AD, AE, AME, AMH, AMS, AO, AT, with slight shortages also in AQ, AX and PR ratings at the E-4 paygrade level only. Severe shortages are evident in seven of the eleven ratings studied using both FY 80 or FY 81 accession data. These shortages occur at almost all levels, but particularly at the mid-management E-6 level. In all of these ratings except for the AT rating shortages increase dramatically from the E-5 to E-6 level. Replacement of these trained and experienced individuals cannot be satisfactorily achieved by increasing accessions. Increased retention during the three-year promotion span from E-5 to E-6 (minimum time in grade) seems a much more satisfactory solution. Whether by increasing the percentage promoted, shortening the promotion zone (time spent in paygrade) or by offering more substantial financial incentives (reenlistment bonuses/pay increases) it seems imperative to the

feasibility of manning the enlisted billets of the FY 1990 carrier airwing force that more of the personnel in these ratings (AD, AE, AME, AMH, AMS and AO) be induced to remain past the E-5 and E-6 paygrade. This fact is driven home by the knowledge that the Navy, at the beginning of this study, was 20,000 to 22,000 middle grade petty officers undermanned.

E. ADDITIONAL AVIATION OFFICER AND ENLISTED SUPPLY-DEMAND ANALYSES USING ACCESSIONS TO FILL BILLETS

Tables XXX and XXXI provide samples of results of additional MANMOD computer runs. Each paygrade grouping required one computer run, i.e., for the officers there were three computer runs each, and for the enlisted ratings, four computer runs each. For each computer run, an R (recruitment vector) was found by the trial and error method. The number used for the R (recruitment vector), for each computer run, had to generate the required number or just exceed the manpower billet projected requirements listed in Table XIV for the officers and Table XIX for the enlisted. This was accomplished by increasing accessions at the entry level (E-1 to E-3) for enlisted and at the ENS (01) level for officers. These numbers were then projected over the decade using attrition, retention and promotion as variables. (On some computer runs, the manpower billet requirements could not be exactly fulfilled, so the R (recruitment vector) that would just exceed the requirements was selected.)

Table XXXV shows the actual number of annual entry level accessions necessary to fill exactly the FY 1990 fifteen carrier airwing billets by designator/rank and by rating/ paygrade.

In looking at the officer section of Table XXXV, one sees that the pilot accessions requirements are larger than those for the NFO's, with the required accessions for pilots being almost twice those required for NFO's, except at the LTJG level [Ref. 53]. The number of pilots needed is greater because of the difference in retention rates between pilots and NFO's.

In order to fill the FY 1990 fifteen carrier airwing force requirements at the LCDR pilot level by use of a change in accessions only, the Navy would have to start today annually training almost twice as many new aviation student pilots as being trained at present [Ref. 54]. The average student pilot load for 1980 was 1,249 individuals and the average NFO load was 552 [Ref. 55]. When these loads are compared with the actual FY 1980 production of pilots and NFO's (Tables XX and XXI), one can see that the production of pilots is far behind the projected requirements. In fact, for the Navy to meet its FY 90 LCDR pilot requirements utilizing increased accessions as the solution to its manning problem, the Navy would have to start a massive pilot recruitment program (2173 annually), as well as increase the throughput of all phases of flight training.

TABLE XXXV

OFFICER AND ENLISTED MANMOD PROJECTED MANPOWER ACCESSIONS FOR REQUIRED BILLETS

Designator or Ratings		FY 1990[a] Aviation Billets Required for 15 Carriers	Annual Entry Level[b] Accessions Required to Fill Billets Needed
PILOT	-LCDR[c]	537	2173
	-LT	1014	303
	-LTJG	1755	1193
NFO	-LCDR	275	662
	-LT	585	171
	-LTJG	1443	1003
AD	-E-7	215	1025
	-E-6	761	1031
	-E-5	858	498
	-E-4	1131	1193
AE	-E-7	156	662
	-E-6	1141	1259
	-E-5	1053	521
	-E-4	1073	1073
AME	-E-7	--[d]	--[d]
	-E-6	322	343
	-E-5	410	195
	-E-4	449	449
AMH	-E-7	117	475
	-E-6	410	465
	-E-5	566	311
	-E-4	624	672
AMS	-E-7	195	838
	-E-6	624	761
	-E-5	800	445
	-E-4	1095	1172
AO	-E-7	156	709
	-E-6	624	781
	-E-5	663	375
	-E-4	741	760
AT	-E-7	254	827
	-E-6	429	336
	-E-5	1833	819
	-E-4	1736	1736

Notes a,b,c,d - see next page.

TABLE XXXV (continued)

Designator or Ratings		FY 1990[a] Aviation Billets Required for 15 Carriers	Annual Entry Level[b] Accessions Required to Fill Billets Needed
AQ	-E-7	98	382
	-E-6	215	175
	-E-5	800	348
	-E-4	644	644
AW	-E-7	59	241
	-E-6	78	80
	-E-5	234	113
	-E-4	215	215
AX	-E-7	20	51
	-E-6	78	57
	-E-5	98	44
	-E-4	176	176
PR	-E-7	--[d]	--[d]
	-E-6	78	70
	-E-5	254	120
	-E-4	234	234

Notes:

a. This column (FY 1990 Aviation Billets Required for 15 Carriers) shows projected billet requirements for the FY 1990 fifteen carrier aviation force by designator/rank and rating/paygrade.

b. This column (Annual Accessions Required to Fill Billets Needed) shows the numbers of individuals who would have to be accessed (at entry level) into each designator and rating annually between the present time and FY 1990 in order to provide the necessary numbers of personnel at the ranks and paygrades shown in the Designator or Ranks column for FY 1990. (Each accession figure shown in the accession column was calculated solely for the designator/rank and rate/paygrade opposite using the attrition, retention and promotion data from FY 1980.)

c. The number 2173 which appears at the top of the accessions column indicates the entry accessions, required yearly, to provide 573 (billet requirements column) pilot LCDR's by FY 1990. If only the LT pilots rank were considered, then only 303 individuals would have to be accessed annually to meet the FY 1990 requirements (1014 billets required). (It is obvious, therefore, that changes in accessions policies alone cannot solve the FY 1990 manning problems, since no single accession figure provides adequate manning at all levels due to variance in retention, attrition and promotion.)

TABLE XXXV (continued)

Notes:

d. No figures appear at these ratings/paygrades because there are no aviation billet requirements at these levels.

At this point, it becomes necessary to point out that increased accessions, or indeed maintenance of FY 80 and FY 81 levels of accessions, may not be easily achieved over the next decade. Demographic studies show a decreasing manpower pool in the 17 to 24 year age group from which the Navy draws the greatest part of its present accessions [Ref. 56]. Bearing this in mind and remembering that the Navy is presently 20,000 to 22,000 midle grade petty officers undermanned, it is evident that Naval aviation will have great difficulty in combating the shortages seen occurring in pilot ranks and in the enlisted ratings (AD, AE, AME, AMH, AMS and AO) by FY 1990. If accessions are not maintained, or in some cases increased, as shown in Tables XXXIII and XXXIV, it becomes apparent that the feasibility of adequately manning the FY 1990 fifteen carrier airwing force is in serious question.

F. ALTERNATIVE RETENTION, ACCESSION AND PROMOTION POLICIES

Presently, the LT and LCDR (pilot) retention rates are at only 30 percent. In order to achieve the FY 1990 airwing pilot LCDR's required levels by use of accessions alone, the Navy would have to access 2,173 entry level student pilots

per annum. The column labeled "Retention Rates Change, All Other Rates Remain Constant" in Table XXXVI shows that by increasing the present retention rate (30 percent) to 66 percent, the need for such massive numbers of new accessions would be alleviated. A retention rate of 66 percent is quite high, of course.

The projected supply of NFO LCDR's at FY 1990 is in excess of the projected required billets. Should the Navy desire to eliminate the overage, a change in promotion policy would be required, lowering the present promotion rate from LT to LCDR to 52 percent. (The present rate is 70 percent.) Such a change in policy with respect to NFO's would, however, have effects on both accessions and retention at earlier career stages. It is, therefore, not recommended that such sharp cuts in retention (by promotion policy changes) be adopted.

"The Retention and Promotion Rates Change, All Other Rates Remain Constant" column of Table XXXVI shows the interaction between promotion and retention rates for LT to LCDR ranks, both pilots and NFO's. It was found that if the pilot promotion rate (from LT to LCDR) was raised from 81 percent (present day level) to 87 percent, and accession and attrition rates remained constant, the retention level required to meet FY 1990 carrier airwing projected billets would be 60 percent rather than the 66 percent shown in the previous column, where no change in promotion, accession or attrition was made.

TABLE XXXVI

SUMMARY OF AVIATION OFFICER DESIGNATOR
ACCESSION, RETENTION AND PROMOTION ALTERNATIVES

Designator[a] and Rank	Actual[b] FY 80/1 Accession	FY 1990[c] Aviation Billet Requirements	FY 1990[d] Supply Projections Using FY 1980 Accessions	Annual[e] Accessions Required to Fill Billets Needed	Retention[f] Rates Change All Other Rates Remain Constant	Retention[g] & Promotion Rates Change All Other Rates Remain Constant	Changes[h] in Retention, Promotion by Reducing Accessions
PILOT-LCDR	1339	537	331	2173	f	—	—
-LT		1014	4487	303	66%	60%/87%	75%/92% or 86%/81%
NFO -LCDR	879	275	362	662	f	—	—
-LT		585	3010	171	52%	70%/58%	70%/73%

Notes:

a. Data from Table XXXII.

b. Data from Table XXXII.

c. Assumes FY 80 accession numbers used FY 81 - FY 90, and retention, promotion and attrition rates stay at FY 80 levels.

d. Data from Table XXXV.

e. This column shows that a 66% pilot retention rate and a NFO retention rate of 52% will attain the FY 1990 billet requirements (accession, attrition and promotion remaining at present day rates).

TABLE XXXVI (continued)

Notes:

f. This column shows that to meet the FY 1990 billet requirements, a promotion rate increase (from 81 to 87 percent) will reduce the needed retention rate from 66 to 60 percent for pilots and a promotion rate of 58 percent for the NFO's will allow a 70 percent retention rate.

g. This column shows that if yearly accessions are allowed to decrease (150) for pilots, the retention rate would have to increase to 75 percent with an increase in the promotion rate to 92 percent, or an 86 percent retention rate coupled with an 81 percent promotion rate would be required to fulfill the FY 1990 billet requirements. A reduction for the NFO's by 125 annually would allow the present day retention rate of 70 percent coupled with a 7 percent decrease in promotions (from 80 to 73 percent) to meet the FY 1990 requirements.

h. Only data for the 8th and 9th year LT rank were generated because this level is in the area of maximum concern.

Source: Tables XXXII and XXXV coupled with officer attrition, accession, retention and promotion data.

Lowering the numbers of NFO LCDR's from the present projected over supply to the levels required by the FY 1990 fifteen carrier airwings by use of promotion policy would involve cutting promotions from the present day 80 percent level to 58 percent. This figure (58 percent) and the analysis assumes the present 70 percent retention rate would stay intact. It is most unlikely that either accessions or retentions could be kept at today's levels if the possibility of promotions for NFO's to the rank of LCDR were reduced to only 58 percent.

Increasing accessions was not considered as a viable solution to the Navy's pilot problem because of demographic trends over the next decade. The possibility of accessions actually decreasing is worth consideration. Should this reduction be only 150 individuals per annum (a reduction from 1339 to 1189 pilots per year), an increase in pilot retention rates from the present 30 percent to 75 percent would be necessary, along with an increased promotion rate of 92 percent (it is presently at 81 percent). Obviously this accession decrease, or indeed any accession decrease, could worsen severely the Navy's already serious pilot problem. If accessions could be held constant, policies aimed at increased retention, coupled with some increase in promotion rates, seem to be the most viable approach to ensuring a force sufficient to fill the pilot billets which the FY 1990 fifteen carrier airwings will require.

Accession decreases, on the other hand, seem to be the best way in which to reduce the NFO's at the LT to LCDR level. Large reductions in promotions for mid-career officers could have unpredictable results. A backlash might lead to fewer accessions, or increased carrier attrition rates might develop--either could cause an eventual deficit in numbers of NFO's. An accession decrease of only 125 (a reduction from 879 to 754 per year) at present day retention rates would require only a 7 percent reduction in promotions (from 80 percent to 73 percent) in order to meet FY 1990 requirements. This accession decrease is recommended as the best approach to containing the numbers of NFO LCDR's within required projected levels.

The enlisted rates, like the pilots, have been shown to suffer their greatest losses at the mid-management level (E-5 to E-6 for enlisted). This particular problem would not lend itself readily to correction from increased accessions even if the manpower pool were not diminishing as it is. With the numbers of 17-21 year olds decreasing steadily over the next ten years, policies aimed at improved retention are recommended as the best solution to enlisted problems at all levels, but particularly at the E-5 to E-6 level where the Navy is currently 20,000 to 22,000 petty officers undermanned. Increased promotion rates, and the financial benefits inherent in such rates, would also in all probability be an aid to providing higher re-enlisted rates and help to provide the enlisted manpower for the FY 1990 fifteen carrier force.

V. CONCLUSION

The use of computer projections by Navy management level personnel to enhance the effectiveness of long term accession, retention and promotion policies can prove of great value. In this thesis, the application of the MANMOD (Markov Chain model) computer program to requirement, retention, accession, promotion and attrition data has yielded an analysis of alternative means for manning the fifteen carrier airwing force in FY 1990.

It has been found that unless drastic overall changes are made in retention figures, the FY 1990 carrier force will be severely undermanned in most areas of its airwing complement. There will be a 50 percent shortage of pilots if current trends in retention continue until 1990. Attaining the required number of NFO's, on the other hand, seems to present no problem. With the NFO retention rate at 70 percent and the NFO promotion rate (LT to LCDR) above 80 percent, the Navy could afford to reduce the number of NFO accessions and still meet its requirements.

In terms of enlisted personnel, the Navy as a whole is presently 20,000 to 22,000 middle grade petty officers undermanned. The aviation community, as the CREC list (an example was shown in Table XXIII) indicates, shares heavily in the deficit. Aviation enlisted data contained in this thesis

show severe shortages in seven of the eleven enlisted ratings studied, particularly at mid-management levels, and lesser shortages in three other rates at the E-4 level. As the fleet increases and demographic trends make maintaining accession levels more difficult, it becomes unrealistic for the Navy to look to the new crop of 17 to 21 year olds to fill its increasing billet requirements, or possibly even to maintain its current manning deficit levels.

A return to the draft would provide manpower at the entry level; however, a more serious problem arises in the field of middle management. Retention of personnel, once acquired, must take a priority place in Navy's policy making. The incentives to both officers and enlisted whose services are in demand in the civilian job market must be such that the personnel will remain.

Present aviation bonus incentives being offered to pilots and NFO's, as well as special sea pay, indicate that Washington has recognized the problem. Whether this new policy will be sufficient to increase the pilot retention rate at the eight or nine year point (LT to LCDR) to the rate needed remains to be seen.

A change in promotion policy, with a more rapid advancement potential and added financial rewards likely to be inherent in such a policy, might prove a valuable weapon in the enlisted retention war. The young men in question (17 to 21 year olds) whose numbers are projected to decline until 1995, are the source from which accessions are overwhelmingly made.

This thesis concludes that of the officers and eleven enlisted ratings studied, the following will be undermanned in FY 1990 unless immediate policy changes are put into effect:

Officers.....Pilots 131X

Enlisted.....AT, AD, AE, AME, AMH, AMS and AO--severe deficits at most levels

Enlisted.....AQ, AX, PR--deficits at E-4 level only.

Those designators/ratings which continue to be available in sufficient numbers are:

Officers.....NFO 132X

Enlisted.....AW

Careful long term management of Navy manpower resources will continue to be necessary over the coming years, particularly in light of the increased demand for manpower and the shrinking pool of accessible personnel. The utilization of such vehicles as the APL program MANMOD in the projection of data to make long term manning predictions can serve to channel funding decisions and develop policies to maintain the all-volunteer peacetime Navy and to provide for the manning of a larger fleet.

APPENDIX A

AIRCRAFT SQUADRON MANPOWER DOCUMENTS FOR OFFICERS

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-7E OFFICER

12 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X			7	6	4	2	19
1520		1		1			2
1630		1					1
7360	1						1
7380	1						1
TOTAL	2	2	7	7	4	2	24

Source: OPNAVINST 5320.102B, Chief of Naval Operations OP-111E.

AIRCRAFT SQUADRON MANPOWER DOCUMENT

E-2C OFFICER

4 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			6	4	1		11
132X			9	5	3		17
1520		1		1			2
1630		1					1
7380	1						1
TOTAL	1	2	15	10	4	2	34

Source: OPNAVINST 5320.153B, Chief of Naval Operations OP-111E.

AIRCRAFT SQUADRON MANPOWER DOCUMENT

EA-6B OFFICER

4 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			6	2	2		10
132X			16	2	2		20
1520				1			1
1630		1					1
7360	1						1
7380	1						1
TOTAL	2	1	22	5	4	2	36

Source: OPNAVINST 5320.138A, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F-4J OFFICER

12 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			8	6	2		16
132X			10	4	2		16
1520				1			1
1630		1					1
7360	1						1
TOTAL	1	1	18	11	4	2	37

Source: OPNAVINST 5320.255B, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F-14 OFFICER

12 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			9	5	2		16
132X			10	4	2		16
1520		1					1
1630		1					1
3100		1					1
6380				1			1
7260	1						1
TOTAL	1	3	19	10	4	2	39

Source: OPNAVINST 5320.170A, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F/A-18 OFFICER

12 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
131X			8	3	4	2	17
1520		1		1			2
1630		1					1
7360	1						1
TOTAL	1	2	8	4	4	2	21

Source: NTP A-50-7703, Chief of Naval Operations OP-112D32

AIRCRAFT SQUADRON MANPOWER DOCUMENT

S-3A OFFICER

10 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
130X						2	2
131X			17	9	3		29
132X			16	9	3		28
1520					1		1
1630		1					1
3100		1					1
6330				1			1
7321	1						1
7380	1						1
TOTAL	2	2	33	19	7	2	65

Source: OPNAVINST 5320.178A, Chief of Naval Operations OP-124F

AIRCRAFT SQUADRON MANPOWER DOCUMENT

SH-3 OFFICER

6 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
131X			12	6	4	2	24
1630		1					1
6380				1			1
7321	1						1
7380	1						1
TOTAL	2	1	12	7	4	2	28

Source: OPNAVINST 5320.177B, Chief of Naval Operations OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

RF-8 OFFICER

4 AIRCRAFT SQUADRON

	Rank						
Designator	W2	01	02	03	04	05	TOTAL
131X			3	4	3	2	12
1520					1		1
1630		1					1
7380	1						1
TOTAL	1	1	3	4	4	2	15

Source: OPNAVINST 5320.144, Chief of Naval Operations OP-111E

APPENDIX B

AIRCRAFT SQUADRON MANPOWER DOCUMENTS FOR ENLISTED

AIRCRAFT SQUADRON MANPOWER DOCUMENT

A-7E ENLISTED

12 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	4	6	5	5	1	1		22
AE	5	6	6	3	1	1		22
AK	2	1	3	1				7
AM							1	1
AME	2	2	2	2				8
AMH	5	5	3	3	1			17
AMS	7	8	7	3	2			27
AN	49							49
AO	9	8	7	4	1			29
APO			3	1			1	5
AQ	5	6	5	2	1	1		20
AT	4	8	7	1	1	1		22
AV							1	1
AZ	2	2	2	1				7
DK			1					1
HM			1					1
MS	3	1	2					6
NC				1				1
PN	1	1	1	1				4
PO		1	3					4
PR	1	2	1	1				5
SN	2							2
YN	2	2	1	1				6
TOTAL	103	59	60	30	8	4	3	267

Source: OPNAVINST 5320.102B, Chief of Naval Operations OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

E-2C ENLISTED

4 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	2	2	3	3		2		12
AE	2	3	4	2		1		12
AK	1		3	1				5
AM						1		1
AME	1	1	1	1				4
AMH	2	3	1	1	1			8
AMS	4	3	2	2	1			12
AN	27							27
APO			2	1			1	4
AT	5	8	8	3	2	1		27
AV							1	1
AZ	1	2	2					5
DK			1					1
HM			1					1
MS	2		2					4
PN		1	1	1				3
PO			3	1				4
PR	2		1					3
SN	2							2
YN		2	1	1				4
TOTAL	51	25	36	17	4	5	2	140

Source: OPNAVINST 5320.153B, Chief of Naval Operations OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

EA-6B ENLISTED

4 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
ABH			1					1
AD	1	2	5	3		1		12
AE	2	5	4	2	1			14
AF							1	1
AK	1		3					4
AME	2	2	1	2				7
AMH	1	2	3	2				8
AMS	3	2	3	4		2		14
AN	27							27
AO	1		2					3
APO		2	1					3
AT	6	17	19	5	2	1		50
AZ	1	2	2	1				6
DK			1					1
HM		1						1
IM		1						1
MS	2		2					4
PN		1	1	1				3
PO			2					2
PR	1	1	1					3
SN	1							1
YN	1	3	1	1				6
TOTAL	50	41	52	21	3	4	1	172

Source: OPNAVINST 5320.138A, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F-4J ENLISTED

12 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	4	6	4	5	1	1		21
AE	4	7	5	2	1	1		20
AF							1	1
AK	2	1	3	1				7
AM						1		1
AME	3	4	2	2				11
AMH	3	4	5	2	1			15
AMS	8	4	4	3	2			21
AN	45							45
AO	7	6	4	3	1			21
APO			2	1			1	4
AQ	4	7	4	3	1	1		20
AT	3	6	5	2		1		17
AZ	2	2	2	1				7
DK			1					1
HM			1					1
MS	2	1	2					5
NC				1				1
OS				1				1
PN	1	1	1	1				4
PO		1	2					3
PR	2	2		1				5
SN	3							3
YN	3	2		1				6
TOTAL	96	54	47	30	7	5	2	241

Source: OPNAVINST 5320.255B, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F-14 ENLISTED

12 AIRCRAFT SQUADRON

Rating	Paygrade E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	4	10	5	5	2	1		27
AE	5	7	7	3	1	1		24
AF							1	1
AK	2	1	3	1				7
AM							1	1
AME	2	4	3	2				11
AMH	4	4	5	3	1			17
AMS	6	5	5	3	1			20
AN	46							46
AO	7	6	5	3	1			22
APO			2	1			1	4
AQ	3	6	10	2	1	1		23
AT	5	7	8	1	1	1		23
AZ	1	2	2	1				6
DK			1					1
HM			1					1
MS	2	1	2					5
NC				1				1
OS				1				1
PN	1	1	1	1				4
PO		1	2					3
PR	1	1	2					4
SN	2							2
YN		3	2		1			6
TOTAL	91	59	66	28	9	4	3	260

Source: OPNAVINST 5320.170A, Chief of Naval Operations OP-111C2

AIRCRAFT SQUADRON MANPOWER DOCUMENT

F/A-18 ENLISTED

12 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	Total
AD	4	5	3	3	1	1		17
AE	3	4	6	2	1			16
AF							1	1
AK	2	1	3	1				7
AM						1		1
AME	1	2	2	1				6
AMH	3	3	4	4	1			15
AMS	5	5	4	3	1			18
AN	40							40
AO	8	6	6	4	1			25
APO			2	2			1	5
AQ	2	4	6	3		1		16
AT	2	3	6	1		1		13
AZ	1	2	2	1				6
DK			1					1
HM			1					1
MS	2		2					4
PN		1	1	1				3
PO		1	2					3
PR	1		2					3
SN	2							2
YN	1	2	1	1				5
TOTAL	77	39	54	27	5	4	2	208

Source: NTP A-50-7703, Chief of Naval Operations OP-112D32

AIRCRAFT SQUADRON MANPOWER DOCUMENT

S-3A ENLISTED

10 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	Total
AD	5	7	3	3	2	1		21
AE	8	6	6	3	1	1		25
AK	1	2	3	1				7
AM							1	1
AME	3	3	3	2				11
AMH	2	4	4	2	1			13
AMS	6	7	4	3				20
AN	50							50
AO	5	2	2	3	1			13
APO			2	2			1	5
AT	10	10	9	2	1	1		33
AV							1	1
AW	5	5	6	2	2			20
AX	4	5	3	3	1	1		17
AZ	2	2	2	1				7
DK			1					1
HM			1					1
IS		1						1
MS	3	1	2					6
PN	1	1	1	1				4
PO			2					2
PR	4	1	2	1				8
SN	2							2
YN	3	2		1				6
TOTAL	114	59	56	30	9	4	3	275

Source: OPNAVINST 5320.178A, Chief of Naval Operations OP-124F

AIRCRAFT SQUADRON MANPOWER DOCUMENT

SH-3 ENLISTED

6 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	4	4	3	3	1	1		16
AE	3	3	2	2		1		11
AF							1	1
AK	1		3					4
AM						1		1
AME			1					1
AMH	1	2	1	1				5
AMS	4	4	2	3	1			14
AN	33							33
AO	2	1	1	2				6
APO			2	1			1	4
AT	2	2	3	1	1			9
AW	8	6	6	2	1			23
AX	2	4	2	1				9
AZ	1	2	2	1				6
DK			1					1
HM			1					1
MS	2	1	2					5
PN	1	1	1					3
PO			2	1				3
PR	2	1	1					4
SN	2							2
YN	1	2	1	1				5
TOTAL	69	33	37	19	4	3	2	167

Source: OPNAVINST 5320.177B, Chief of Naval Operations OP-111E

AIRCRAFT SQUADRON MANPOWER DOCUMENT

RF-8 ENLISTED

6 AIRCRAFT SQUADRON

	Paygrade							
Rating	E1-E3	E4	E5	E6	E7	E8	E9	TOTAL
AD	1	2	4	2		1		10
AE	2	4	3	2	1			12
AK	1		3					4
AME	2	3	1	2				8
AMS	2	2	3	4		2		13
AN	27							27
APO			2	1				3
AT	6	15	16	4	2	1		44
AV							1	1
AZ	1	2	2					5
DK			1					1
HM		1						1
MS	2		2					4
PN		1	1	1				3
PO			2					2
PR	1	1	1					3
SN		1						1
YN	2	1	1					4
TOTAL	47	33	42	16	3	4	1	146

Source: OPNAVINST 5320.144, Chief of Naval Operations OP-111E

APPENDIX C

RATING NAMES

Rating Abbreviation	Rating Name
AD	Aviation Machinist's Mate
AE	Aviation Electrician's Mate
AME	Aviation Structural Mechanic (Safety Equipment)
AMH	Aviation Structural Mechanic (Hydraulics)
AMS	Aviation Structural Mechanic (Structures)
AO	Aviation Ordnanceman
AQ	Aviation Fire Control Technician
AT	Aviation Electronics Technician
AW	Aviation Antisubmarine Warfare Operator
AX	Aviation Antisubmarine Warfare Technician
PR	Aircrew Survival Equipmentman

APPENDIX D

INSTRUCTION FOR IMPLEMENTATION OF A MANMOD COMPUTER RUN

After the MANMOD program is keyed into a computer work space, the following steps are required in order to accomplish a computer run.

STEP 1. When in the MANMOD APL program (at the Naval Postgraduate School this is accomplished by logging onto a computer terminal equipped for APL. First type APL (press ENTER), then press the ALT key and the APL ON/OFF key simultaneously. Next, type LOAD MANMOD (press ENTER) (The right paren is the orange printed paren key pressed in conjunction with the upper case key) (The only space required is between LOAD and MANMOD)), type INPUT (press ENTER). This starts the MANMOD program.

STEP 2. The program will request:
ENTER N(INITIAL CLASS VALUES)--This will be the initial numbers (stocks) of individuals that are in each year group selected for study. It is implicit in this specification that time is descrete and in practice the unit of time will usually be a year. (In this thesis the groups covered a nine or ten year period. So the N vector would look like this for a nine year vector: 185 156 57 56 56 18 17 17 13.

STEP 3. After the initial class values are entered via the ENTER key, the program will request:
ENTER P(TRANSITION MATRIX)
ENTER 1TH ROW----------This is called the transition matrix and each row vector is called the position vector. It is also implicit that these specifications are time descrete and are usually in year units. The elements of vector will be assigned numerical values and this is accomplished by making hypothetical assumptions or by estimating the probabilities from past data. The program requires one row for each stock group entered in step 2. The main diagonal shows the percentage of individuals remaining in a year group. To the left of the main diagonal would be those individuals that are demoted.

On the right side of the diagonal would be the promotion rates. In this thesis there was a continuous flow from one year to the next with no one individual being retained from one year group to the next and there are no demotions. This allows only the assumptions/probabilities to fall directly in the spaces to the right of the main diagonal. All other entries would be zero, i.e.:

1th row	0	.9	0	0	0	0	0	0	0
2th row	0	0	.8	0	0	0	0	0	0
3th row	0	0	0	.7	0	0	0	0	0
etc.									

STEP 4. After the P matrix is entered, the program will request:

ENTER NUMBER OF RECRUIT TYPE:

1 FIXED RECRUIT VECTOR
2 ADDITIVE(RECRUIT SIZE)
3 MULTIPLICATIVE(RECRUIT SIZE)
4 ADDITIVE(SYSTEM SIZE)
5 MULTIPLICATIVE(SYSTEM SIZE)----------This gives the operator the chance to choose various types of recruitment systems. (This thesis used recruit type 1. It would mean that over a ten year period, at 100 recruits per year, a total of 1000 recruits are recruited. The additive and multiplicative aspect allows a compound recruitment. Also, the additive and multiplicative mode can be applied to the whole system and not just recruited at the first year point.

STEP 5. If other than number one was chosen from step 4, additional information is requested as follows for each case:

ADDITIVE(RECRUIT SIZE)--ENTER RPROP(RECRUIT PROPORTION VECTOR)--ENTER RSIZE(RECRUITMENT SIZE)--and ADDITIVE INCREMENT(RSUM).

MULTIPLICATIVE(RECRUIT SIZE)--(The request is the same as above with the exception that the last request asks for MULTIPLICATIVE FACTS(FAST)).

ADDITIVE OR MULTIPLICATIVE(SYSTEM SIZE)--ENTER RPROP (RECRUIT PROPORTION VECTOR) with either ADDITIVE INCREMENT(RSUM) or MULTIPLICATIVE FACTION(FACT) as required.

For additional information on recruit type selections, contact Professor Milch at the Naval Postgraduate School.

STEP 6. If number 1 was selected from Step 4, then only the requirement ENTER R(RECRUITMENT VECTOR) is requested. When all recruits are entered at the lowest level, the vector will be as follow . The amount of recruits is

placed first followed by zeroes for each year in N, i.e., 100 0 0 0 0 0 0 0 0. There would be other numbers in the vector if lateral entry was considered. (There was no lateral entry considered in this thesis.)

STEP 7. Next the program requests:
ENTER PERCENT CODE
0 NO GRADE PERCENTAGE
1 GRADE SIZE AS PERCENTAGE OF TOTAL GRADE SIZE
2 GRADE SIZE AS PERCENTAGE OF ORIGINAL GRADE SIZE
Usually number one is chosen. (The percentage calculations will be in the output program next to the total number in each year group.)

STEP 8. In this step the program requests:
DO YOU WISH TO SEE INTERVENING YEARS
0 NO
1 YES
If 1 is chosen and it is desired to produce a program that is calculated for 100 years, then the program will show the figures from year 0 through year 100. If a look at each individual year is not desired, then a selection of 0 will give only the 0 and 100 year.

STEP 9. After step 8 is accomplished, the program will show--END OF INPUT PROGRAM. At this point ask the program to compute the data over a period of years. If a ten year look is required, type in BASEQN 10, and if a 100 year look is needed, type in BASEQN 100. (The system will only compute up to 999 years.) Once a year has been selected, one cannot request that year or any year preceding without resetting. To reset, type RESET (press ENTER) and reselect whatever year required.

STEP 10. If changes to the original input data are desired, the following procedure needs to be accomplished.

To change N(INITIAL CLASS VALUES)--type N←x. Enter the new values of N at x. The arrow is the APL orange arrow.

To change P(TRANSITION MATRIX)--type P(x;y)←z. The x is the row and the y is the column position where the change is required. The z is the new value. Use the orange parens (APL) typed without the upper case key being depressed. The arrow is the same arrow as in the above procedure. The semicolon is the orange APL semicolon.

To change R(RECRUITMENT VECTOR)--type R←x. The new values of R are recorded at x. The arrow is the APL arrow used in the above procedures.

To change INTERVENING YEARS--type LINES ← x. The x will either be a 0 or a 1. The arrow is the same.

Other changes may be made to the program and for further information contact Professor Milch, code 55 Mh, at the Naval Postgraduate School. Also, all changes should be made after resetting is accomplished unless specific changes eliminate computational errors.

If a printed copy of the MANMOD computer run is desired, then complete the following:

STEP 1. After logging onto the computer type CP SPOOL CONSOLE START * CLASS A (press ENTER). This will start a spool that will record all further entries into the computer (mistakes included).

STEP 2. Type APL (press ENTER). This logs one into the APL mode of operation.

STEP 3. Press the ALT key and the APL ON/OFF key at the same time. This gives you control of the APL characters. (orange colored keys).

STEP 4. Type)LOAD MANMOD (press ENTER) (the right paren is the orange paren pressed in conjunction with the upper case key). This has recalled the MANMOD APL program.

STEP 5. Type INPUT (press ENTER). This starts the program. Make all entries required.

STEP 6. After the program run is completed, type)OFF HOLD (press ENTER) (the right paren is the same as the one in step 4). This places the computer back into the CPU mode; (if) OFF is selected then the individual has logged off the computer altogether).

STEP 7. Type CP SPOOL CONSOLE CLOSE (press ENTER). This stops information from being recorded on the spool.

STEP 8. Type READ _ _ _ _ _ _ _ _ (Each underlined section can have up to eight characters and will become the file name for the computer run (press ENTER).

STEP 9. Type CP SPOOL CONSOLE STOP (press ENTER). This makes sure that the spool is no longer recording and all information recorded is lost. (The READ _ _ _ _ _ _ _ _ records program into personal storage space.)

STEP 10. The new file can be printed by typing PRINT (name given new file) or alternately first go to XEDIT mode and add or erase information as needed and then go to PRINT.

This file is now saved in the operator's personal storage space and can be erased or kept as the operator desires.

APPENDIX E

MANMOD APL PROGRAM

```
      ∇INPUT[⎕]∇
      ∇ INPUT;I;K;PI;ERRMSG
[1]   ERRMSG←'ERROR: DIMENSION NOT COMPATIBLE WITH N-VECTOR.
      TRY AGAIN!'
[2]   I←1
[3]   'ENTER N(INITIAL CLASS VALUES)'
[4]   N←,⎕
[5]   K←⍴N
[6]   'ENTER P(TRANSITION MATRIX) BY ROWS'
[7]   P←(K,K)⍴0
[8]  PINPUT:'ENTER ',(⍕I),'TH ROW'
[9]   PI←,⎕
[10]  →INSERT×⍳K=⍴PI
[11]  ERRMSG
[12]  →PINPUT
[13] INSERT:P[I;]←PI
[14]  →PINPUT×⍳K≥I←I+1
[15]  'ENTER NUMBER OF RECRUIT TYPE'
[16]  '      1   FIXED RECRUIT VECTOR'
[17]  '      2   ADDITIVE(RECRUIT SIZE)'
[18]  '      3   MULTIPLICATIVE(RECRUIT SIZE)'
[19]  '      4   ADDITIVE(SYSTEM SIZE)'
[20]  '      5   MULTIPLICATIVE(SYSTEM SIZE)'
[21]  TYPE←⎕
[22]  →(TYPE≠1)/RPROPENTRY
[23] RV:'ENTER R(RECRUITMENT VECTOR)'
[24]  R←,⎕
[25]  RPROP←K⍴0
[26]  →NEXT×⍳K=⍴R
[27]  ERRMSG
[28]  →RV
[29]  →NEXT
[30] RPROPENTRY:'ENTER RPROP(RECRUIT PROPORTION VECTOR)'
[31]  RPROP←,⎕
[32]  →CHECK1×⍳K=⍴RPROP
[33]  ERRMSG
[34]  →RPROPENTRY
[35] CHECK1:→((TYPE=4)∨TYPE=5)/CHECK2
[36]  'ENTER RSIZE(INITAL RECRUIT TOTAL ENTERING SYSTEM)'
[37]  RSIZE←⎕
[38] CHECK2:→((TYPE=3)∨TYPE=5)/MULT
[39] ADD:'ENTER ADDITIVE INCREASE'
```

```
[40]  INC←⎕
[41]  →NEXT
[42] MULT:'ENTER MULTIPLICATIVE FACTOR'
[43]  FACT←⎕
[44]  R←K⍴0
[45]  →NEXT
[46] NEXT:'ENTER PERCENT CODE'
[47]  '      0   NO GRADE PERCENTAGES'
[48]  '      1   GRADE SIZE AS PERCENT OF TOTAL GRADE SIZE'
[49]  '      2   GRADE SIZE AS PERCENT OF ORIGINAL GRADE SIZE'
[50]  PCODE←⎕
[51]  'DO YOU WISH TO SEE INTERVENING YEARS'
[52]  '      0   NO'
[53]  '      1   YES'
[54]  LINES←⎕
[55]  TCOUNT←0
[56] END:'END OF INPUT PROGRAM'
      ∇


      ∇OUTPUT[⎕]∇
      ∇ OUTPUT
[1]   I←0
[2]   →(TCOUNT>0)/CHECK
[3]  SETUP:PFORM←',⍞(⍞,I4,⍞)⍞'
[4]   FIRSTLINE←'I3,X3,I2,X,I9,X'
[5]   FIRSTLINE12←FIRSTLINE,PFORM
[6]   MIDLINE←'X6,I2,X,I9,X'
[7]   MIDLINE12←MIDLINE,PFORM
[8]   LASTLINE←'X4,⍞TOTAL⍞,I9,X'
[9]   LASTLINE←LASTLINE,PFORM,',I6'
[10]  ' T              N     PERCENT     R'
[11]  '================================'
[12] CHECK:→(PCODE= 0 1 2)/COLOUT0,COLOUT12,COLOUT12
[13] COLOUT0:I←I+1
[14]  →(I>K)/LAST
[15]  →(I>1)/MID0
[16] FIRST0:FIRSTLINE ⍙FMT TCOUNT,I,N[I]
[17]  →COLOUT0
[18] MID0:MIDLINE ⍙FMT I,N[I]
[19]  →COLOUT0
[20] COLOUT12:I←I+1
[21]  →(I>K)/LAST
[22]  →(I>1)/MID12
[23] FIRST12:FIRSTLINE12 ⍙FMT TCOUNT,I,N[I],PERCENT[I]
[24]  →COLOUT12
[25] MID12:MIDLINE12 ⍙FMT I,N[I],PERCENT[I]
[26]  →COLOUT12
[27] LAST:LASTLINE ⍙FMT TOTAL,TOTPERCENT,RSUM
[28]  '--------------------------------'
      ∇
```

```
      ∇BASEQN[⎕]∇
      ∇ BASEQN T
[1]    →(TCOUNT=0)/SETUP
[2]    →(T<TCOUNT)/ERROR1
[3]    →START
[4]   SETUP:N←N
[5]    RPROP←RPROP
[6]    TYPE←TYPE
[7]    P←P
[8]    ONE←(K←⍴N)⍴⍳1
[9]    ANSWER←0 ROUND 0,(1,K)⍴NINT←N
[10]   TOTAL←TOTAL←ONE+.×N
[11]   RECRUIT 0
[12]   R←R
[13]   →OUTPUTDATA
[14]  START:NINT←N+.×P
[15]   TCOUNT←TCOUNT+1
[16]   RECRUIT TCOUNT
[17]   ANSWER←ANSWER,[1] 0 ROUND TCOUNT,N←NINT+R
[18]   TOTAL←⌊(0.5+ONE+.×N)
[19]   →((TCOUNT=T)∨LINES=1)/OUTPUTDATA
[20]   →START
[21]  OUTPUTDATA:TOTAL←⌊(0.5+ONE+.×N)
[22]   TOTPERCENT←⌊(0.5+100×TOTAL DIV TOTAL)
[23]   RSUM←⌊(0.5+ONE+.×R)
[24]   →(PCODE= 1 2)/PCALC1,PCALC2
[25]   →SKIP
[26]  PCALC1:PERCENT←⌊(0.5+100×N÷TOTAL)
[27]   →SKIP
[28]  PCALC2:PERCENT←⌊(0.5+100×N÷TOTAL)
[29]  SKIP:OUTPUT
[30]  CHECK:→(TCOUNT<T)/START
[31]   →0
[32]  ERROR1:'TIME REQUESTED HAS BEEN PAST'
[33]   →0
      ∇
```

```
      ∇RESET[⎕]∇
      ∇ RESET
[1]    TCOUNT←0
[2]    N←N
[3]    RPROP←RPROP
[4]    TYPE←TYPE
[5]    P←P
[6]    'RESET COMPLETED'
      ∇
```

```
      ∇RECRUIT[⎕]∇
      ∇ RECRUIT T
[1]    →(TYPE= 1 2 3 4 5)/OUT,ADDREC,MULTREC,ADDSYS,MULTSYS
[2]    'INVALID OR MISSING RECRUIT TYPE CODE'
[3]    →0
[4]   ADDREC:R←(RSIZE+T×INC)×RPROP
[5]    →0
[6]   MULTREC:R←(RSIZE×FACT*T)×RPROP
[7]    →0
[8]   ADDSYS:R←(INC+TOTAL-NINT+.×ONE)×RPROP
[9]    →0
[10]  MULTSYS:R←(((FACT-1)×TOTAL)+TOTAL-NINT+.×ONE)×RPROP
[11]   →0
[12]  OUT:→0
      ∇
```

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