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EXTENSION AND REFINEMENT OF THE VALUATION OF AIR FORCE EXPERIENCE

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This paper documents the extension and enhancements made to three previously developed value of Air Force experience models. Full investment cost, stochastic rewards valuation, and expected net present value models were applied to 10 additional enlisted and 14 additional officer occupational specialties. Several new cost estimating measures were developed during the model applications. Results showed the models provide defensible cost and value estimates of replacing and retaining trained personnel.

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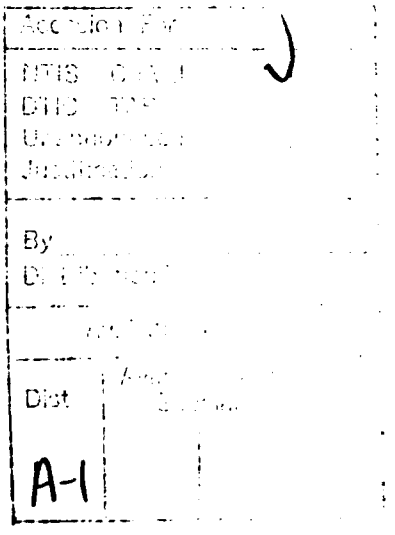
PREFACE

This work is part of the Manpower and Personnel Research Division's research program to develop an understanding of the costs and value of alternative enlisted and officer force structures. It is closely related to a continuing econometric research effort to model the relationship between economic factors and accession, retention and losses in both enlisted and officer forces. This particular study is a follow-on to the original research which developed a set of three cost and value models. The research accomplished is in response to Manpower, Personnel, and Training Need 85-02, Quantifying Experience in the Cost of Human Capital, from HQ USAF/DPXA and was conducted by the prime contractor, Metrica, Inc. and RRC, Inc., the subcontractor responsible for the cost model development.



EXTENSION AND REFINEMENT OF THE VALUATION OF AIR FORCE EXPERIENCE

SUMMARY

This technical paper documents the application of the cost-based models developed in previous research efforts to determine the value of Air Force experience (Stone, Rettenmaier, Saving, and Looper, 1989a and Stone, Saving, Looper, and McGarrity, 1989b). In these studies, three different approaches to valuing experience were developed and tested on several enlisted and officer occupations. Each of these three models, full investment cost model (FICM), stochastic rewards valuation model (SRVM) and expected net present value model (ENPVM) were applied to 10 additional enlisted and 14 additional officer specialties in the present study.

Refinements to the original models include a new approach to estimating separation costs based on job performance measurement data, a modified technique to estimate the productivity of those reenlisting compared to those not reenlisting, and new training cost data. FICM values at the 10 year of service (YOS) point ranged from $55,635 for avionics specialists to $134,453 for air traffic controllers. SRVM values for four more years of service at the four year point ranged from $29,387 for machinists to $60,200 for jet engine mechanics with ENPVM values following the same trends with smaller number due to the accounting for additional future costs of retaining personnel.

Results of this extension and refinement of the cost and value models show that the models can be used to make defensible estimates of the cost of replacing key trained Air Force personnel and the future worth to the Air Force of keeping such individuals on active duty.

INTRODUCTION

This report is an extension of previous research to assess the applicability of three human capital value models (Stone, Rettenmaier, Saving, & Looper, 1989a and Stone, Saving, Looper, & McGarrity, 1989b) to valuing the experience of officers and enlisted personnel at various levels.

Section II presents a brief review of the three models and the data requirements for testing them within the context of the Air Force personnel structure. Sections III and IV present a test of the feasibility and generality of applying the models to the valuation of enlisted and officer experience. Section V presents conclusions and recommendations.

MODELS FOR VALUING HUMAN RESOURCES

This section briefly reviews the three models used to value Air Force experience: full investment cost model (FICM), stochastic rewards valuation model (SRVM), and expected net present value model (ENPVM).

The full investment cost model (FICM) includes acquisition, development, and separation costs for each position (Flamholtz, 1985). The concept of positional investment cost refers to the cost that would have to be incurred today to replace a person occupying a specific position with a substitute who is capable of rendering equivalent services in the given position. FICM considers potential attrition and the costs associated with attrition at each position recognizing that the Air Force must access, train, and separate many individuals in order to gain one person at desired level.

The stochastic rewards valuation model (SRVM) (Flamholtz, 1985) is based on the notion that an individual is valuable to an organization only in relation to the organizational roles that individual may potentially occupy. These organizational roles are defined as service states with the decision to leave the organization designated as the state of exit. Thus, an individual's value is determined accordingly by incorporating the future services which he is expected to render to the organization with the value of the service state he currently occupies. SRVM regards the movement of people from one service state to another as a random process with the resulting probabilities dependent upon the service states previously occupied.

SRVM requires the calculation of the economic value of a service state or the estimation of a monetary value of the product of military personnel at points along their career paths. In a perfectly competitive market for factors of production, a firm will hire labor until the value of the marginal product (VMP) of the last unit of labor hired equals the cost of the labor unit itself; e.g., its wage (Becker, 1971). The Air Force competes with the private sector industries for experienced enlisted and officer personnel. Since the Air Force competes with the private sector for labor, the civilian labor market provides a consistent market evaluation of VMP in the Air Force. For the SRVM analysis, wages paid in the private sector are the measure of the VMP of Air Force enlisted and officer personnel in the production of national defense and serve as estimates for service state values.

The only difference between the calculation of SRVM and ENPVM is the inclusion in ENPVM of all future expected costs of maintaining skills, additional training, special pay, and compensation. Thus, each service state value represents the monetary value of the product produced minus any costs associated with maintaining the labor input to obtain the value. The same present value calculation is performed for ENPVM as for SRVM, which accounts for the probability assigned the state of exit. ENPVM uses the cost aspects of FICM and the value perspective of SRVM to produce an expected present value of future service to be rendered during a given service tenure.

ESTIMATION OF FICM, SRVM, AND ENPVM FOR ENLISTED AIR FORCE SPECIALTIES

The most difficult task of applying these models to Air Force experience is the collection, estimation, and/or determination of a proxy for the cost elements and transition matrix necessary to perform the calculations. The first step in the calculation of costs and values for individuals at different stages in their careers is the definition of positions or service states in the Air Force career ladder. In previous research, grade and skill level were used to define of the service states (Stone et al., 1989a). For the present analysis, year of service (YOS) was selected as the basis for service state values. Grade was used only as a secondary criteria in the calculation of formal and informal training. Year of service does not strictly meet the criteria for the standard definition of a service state as used in the private sector, but it does coincide with most Air Force planning and policy. Length of service, circumscribed by YOS, represents experience and quality in the Air Force personnel structure and forms an integral part of the manning requirements for all Air Force specialties (AFSs). Thus, each YOS from 0 to 25 represents a service state.[1]

Several data sources were used for the estimation of service state costs and values. The primary sources for data were the Uniform Airman Records (UARs) in the Historical Airman Data (HAD) base (Saving, Stone, Looper, & Taylor, 1985), AFHRL files of occupational survey data for the following ten 5-digit enlisted AFSs for which costs were estimated:

AFS	Description
122x0	Aircrew Life Support
272x0	Air Traffic Control
305x4	Electronic Computer & Switching Systems Specialist
328x4	Avionic Inertial & Radar Navigation Systems Specialist
423x1	Aircraft Environmental Systems Mechanic
426x2	Jet Engine Mechanic
427x0	Machinist/Machine Shop
492x1	Information Systems Radio Operations Specialist
672x1	Financial Management Specialist
811x0	Security Specialist

The selection of career fields on which the models were to be tested was based on (a) the availability of direct cost data; (b) the opportunity to obtain estimates of indirect costs; and (c) the inclusion of all service states within

[1]Enlisted and officer personnel can receive Congressional approval to remain on active duty through 33 years, but the small numbers and the high probability of separating from the Air Force during the years beyond 25 make value estimation for these years very difficult and, thus, they were not included in this analysis.

the AFS personnel structure. The selection of AFSs for this analysis was made to maximize the possibility of obtaining both direct and indirect training costs during an airman's career while minimizing the changes and complexity of job structure. For example, in a particular AFS, the job structure may consist of a certain group of tasks in year n; however, in year n+2 the job structure for the same AFS may then consist of an entirely different group of tasks. These changes in job structure could produce different results using the same methodology. Therefore, careful consideration was given to the selection of AFSs.

Transition Matrix

A transition matrix was developed based upon the 25 YOS service states, consisting of the probabilities that an individual in a given YOS will progress to the next YOS 1 time period (year) in the future. The state of exit was represented by the 26th service state. To calculate the transition matrix for the enlisted AFSs, data necessary to estimate continuation rates from the HAD's UAR files for June 1988 and June 1989 were analyzed to develop the probability of advancing from YOS to the next, as well as the probability of separating from the Air Force at each YOS. An AFS-specific transition matrix was calculated for each of the ten AFSs and is a diagonal matrix (26x26) of probabilities with the 26th column representing the probability of separating at each year of service. The continuation rates for each enlisted AFS are presented in Appendix A.

Direct Cost Components: Recruitment, Basic Military Training, and Formal Technical Training

The source for the monetary costs of recruitment, basic military training (BMT), and formal technical training was the Air Training Command's FY88 Cost Factors Manual (1988). FICM identifies all explicit and implicit costs necessary to develop the human capital of the individuals in each YOS. The initial cost of admitting an individual into the Air Force is the cost of recruitment, the average cost of travel from Lackland AFB to the first duty station, and a clothing issue cost. These cost elements account for the expenditures necessary to train an individual in BMT. The average total cost for basic military training accounts for all the fixed and variable costs of training an individual, as well as the premature attrition during BMT. The final calculation of FICM includes all the costs required to replace an individual at each of the 25 service states and therefore includes the fixed costs of providing BMT. BMT costs are not considered to be AFS specific.

The Air Force continues to invest in the human capital of its employees after the completion of BMT through formal technical training in different specialty areas. The information provided in the Air Training Command's FY88 Cost Factors Manual (1988) was used in conjunction with the occupational survey data to develop the costs of providing technical training for each of the ten AFSs. The formal technical training costs allocated to each YOS were estimated

as a weighted average based upon the proportion of individuals who had taken a course in each YOS (Stone et al., 1989a). These technical training costs represent the total costs incurred to produce a single training graduate. The factors are a summary of direct or schoolhouse costs, indirect or installation support costs, flying costs, command support costs, and student costs. The military and civilian cost components are for staff personnel in the direct, indirect, and command support areas. The non-personnel component represents purchased services, material/supplies, other, and flying costs. Student costs include pay/allowances and either TDY (travel/per diem) or PCS (permanent change of station) costs whichever is appropriate.

The proportion of individuals in each YOS that completed training courses was estimated using the occupational survey data. The survey contains information on whether or not an individual completed the course and the completion date. The costs of formal technical training for each YOS was based on the courses normally taken by personnel in each YOS. For each YOS, the expected cost for each technical training course (the product of the probability of taking the course in a specific YOS times the cost of the course) was summed across all courses to produce a total technical training cost for each YOS. The technical training costs for each AFS by YOS are presented in Appendix B.

Indirect Costs: On-the-Job Training (OJT) and Separation Costs

Estimation of OJT Costs. OJT was estimated primarily for individuals in skill levels 3 and 5; i.e., those individuals with the rank of either E-2, E-3, or E-4 and with a skill level of 3 (apprentice) or 5 (technician). To estimate the level of OJT individuals received while in these two skill levels, occupational survey data were analyzed to provide an estimate of the relationship between length of service and proficiency. In order to map these skill levels to years of service, frequency distributions were run on YOS stratifying by skill levels. From these frequency distributions, the OJT costs were spread over the appropriate YOS for each skill level. The methodology used to estimate the OJT costs was the same as used by Stone et al. (1989a), with the exception that the delineation of which tasks were training tasks was expanded from the original research effort to those used by Flemming, Cowardin, Reynolds, and Nielson, (1986). A similar approach was followed for the calculation of supervisor costs (Stone et al., 1989a). Estimates of the total costs due to lost productivity from trainees and trainers are presented for each AFS by YOS in Appendix C.

Estimation of Separation Costs. Airmen may exhibit a tendency to decrease their productivity as they approach a date of separation. An estimate of this lost productivity due to impending separation was included in the estimation of FICM values. This approach, different from the original method (Stone et al., 1989a), used data from the Walk Through Performance Test (WTPT) surveys of the Air Force's job performance measurement program.

In the conduct of the WTPT surveys, enlisted personnel were questioned as to whether or not they would reenlist at the end of their current terms with their responses categorized accordingly. The productivity of those who actually remained in service was compared with those who actually separated from service. The total WTPT performance measure (TWTPT) was chosen to measure productivity (Carpenter, Monaco, O'Mara, & Teachout, 1989; Stone et al., 1990).

Productivity was estimated across all AFS's using ordinary least squares regression with the following functional form:

$$y = a_0 + b_1 t + b_2(1/t) + b_3 u + b_4(u)(t)$$

where

y = TWTPT score

t = YOS in months

u = dummy variable representing the reenlistment/separation decision: 0 for separation and 1 for reenlistment

Given the estimated values for the coefficients, the productivity equation was integrated over the range of values from t=36 to t=48, for both those who reenlisted (u=1) and those who did not (u=0). The area beneath the curve for those who did not reenlist (u=0) was smaller than that for those who did reenlist (u=1). The difference between the two curves represents the loss in productivity. The lost productivity was divided by the total productivity of those who reenlisted (u=1) providing a ratio of 0.045. This proportion implies that over the last 12 months of active duty, first term airmen who separate are approximately 4.5% less productive than those airmen who reenlist. To monetize the lost productivity, the proportion of lost productivity was multiplied by the average compensation cost to the Air Force of maintaining an airman from the 36th to the 48th month of service. Thus, separation costs were estimated to be approximately $781.20 for first term airmen. This estimate was used for all AFSs since no evidence exists to suggest that separation costs differ across AFSs. In addition, no separation costs were empirically supportable for separations beyond the first term decision point by the WTPT surveys or the occupational survey data.

Full Investment Cost Calculation

The component costs of the FICM described above are presented together in Table 1 for one of the ten AFSs, aircraft environmental systems mechanic, AFS 423x1. Column 1 presents the cost of acquiring an individual and providing BMT. The amount presented in column 1 is the average cost and takes into account premature attrition in BMT. Column 2 lists formal technical training costs for each YOS. The cost of the lost productivity due to OJT is listed for each YOS in Column 3. The lost productivity cost was allocated to those YOS where the skill level 3 and the initial skill level 5 experience were found.

For YOS beyond 6 (see Appendix C), the estimated lost productivity cost was not measurable with the existing data. The final cost component of FICM consists of the separation costs listed only for YOS 4 in Column 4. YOS 4 represents the first term decision point for enlisted personnel, and, thus, the most likely juncture at which separation costs might occur to any significant degree.

The sum of columns 1 through 3 yields an estimate of the marginal investment of training and promoting a single individual through each YOS, ignoring the probability of separation at each intermediate level. These costs are presented in Column 5. However, FICM recognizes that to train and promote an airman to each YOS requires an investment in more than one airman at each stage of the career ladder. The replacement number presented in Column 6 is the number of individuals who were admitted into the Air Force and are necessary to replace a single individual in each of the 25 YOSs. For example, 1.57 new recruits are required in order to attain one airman in YOS 4; i.e., approximately 1.57 minus 1 airmen separate during the progression to YOS 4. The replacement numbers are developed from the continuation rates presented in Appendix A.

Column 7 in Table 1 contains the full cost of training and promoting an individual to each YOS. Included in that cost calculation are all the previously estimated investment costs which were incurred by the Air Force in developing the productive capabilities of its enlisted personnel to perform as aircraft environmental systems mechanics, including the lost investment in individuals who separated prior to each YOS. For example, to train and promote an individual to YOS 4, which is the equivalent of a fully trained, first-term airman, the Air Force will invest $44,858 in the training of 1.57 new employees. The cost to the Air Force of training and retaining an airman to YOS 20 is $178,448. YOS 20 requires 5.85 new recruits in order to obtain one airman with 20 years of experience in the Air Force.

Table 2 presents FICM estimates for each of the ten AFSs. The same methodology and data sources used to develop the estimates for aircraft environmental systems mechanic were also used to develop the FICM estimates for the remaining nine AFSs. Only two cost factors are the same across the ten AFSs, BMT acquisition cost and separation cost. The remaining cost factors are AFS-specific. For each of the ten AFSs, continuation rates, technical training costs, and lost productivity costs due to OJT are provided in Appendixes A, B, and C, respectively. The key differences between the ten AFSs are the cost of formal technical training, lost productivity due to OJT, and the replacement numbers, all of which contribute to the difference in the FICM estimates.

The most expensive career field using the FICM estimate at YOS 10 is 272x0, air traffic controllers. As the technical training costs of Appendix B indicate, air traffic controllers are one of the more expensive AFSs to train, as well as exhibiting one of the highest turnover rates (see Appendix A). AFS 672x1, financial management specialist, has no one in the AFS with more than 19 YOS. AFS 672x1 is a career field which supports only a few airman at the higher grades and higher YOS. The continuation rates for AFS 672x1 in YOS beyond YOS 19 are zero for the June 1988 to June 1989 time period.

TABLE 1. FULL INVESTMENT COST CALCULATION: AIRCRAFT ENVIRONMENTAL SYSTEMS MECHANIC

Service State	(1) (Recruitment) BMT Acquistion Cost	(2) Technical Training	(3) OJT Cost	(4) Separation Cost	(5) Service State Cost	(6) Replacement Number	(7) Full Investment Cost
1	$6,415	$ 0	$1,677	$ 0	$ 8,092	1.05	$ 8,473
2	0	4,388	5,698	0	10,086	1.11	19,660
3	0	3,840	3,676	0	7,516	1.18	28,788
4	0	2,331	2,434	0	4,766	1.57	44,858
5	0	1,646	0	781	1,646	1.71	50,616
6	0	1,509	0	0	1,509	1.91	58,239
7	0	0	0	0	0	2.00	60,983
8	0	0	0	0	0	2.10	64,193
9	0	0	0	0	0	2.28	69,473
10	0	0	0	0	0	2.44	74,382
11	0	0	0	0	0	2.63	80,413
12	0	0	0	0	0	2.73	83,416
13	0	0	0	0	0	2.77	84,687
14	0	0	0	0	0	2.88	88,032
15	0	0	0	0	0	3.10	94,556
16	0	0	0	0	0	3.14	95,996
17	0	0	0	0	0	3.22	98,156
18	0	0	0	0	0	3.22	98,156
19	0	0	0	0	0	3.29	100,466
20	0	0	0	0	0	5.85	178,448
21	0	0	0	0	0	10.44	318,657
22	0	0	0	0	0	11.74	358,445
23	0	0	0	0	0	17.07	520,995
24	0	0	0	0	0	21.33	651,244
25	0	0	0	0	0	28.45	868,325

TABLE 2. FICM RESULTS ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$ 11,161	$ 8,402	$ 6,807	$ 6,625	$ 8,473	$ 9,519	$ 8,433	$ 11,634	$ 8,184$	$ 14,131
2	24,019	24,921	17,386	13,629	19,660	18,014	17,130	31,247	13,294	29,228
3	34,892	34,399	27,428	23,883	28,788	31,538	24,456	39,486	23,793	39,638
4	58,231	60,346	51,309	32,255	44,858	54,148	53,285	56,135	37,905	65,042
5	67,413	73,958	58,236	36,345	50,616	61,236	67,617	64,742	43,730	75,695
6	76,958	88,640	64,503	42,051	58,239	65,284	81,905	67,090	48,258	88,561
7	81,892	98,708	69,418	44,640	60,983	69,989	84,963	69,379	51,113	93,320
8	88,573	112,041	75,738	49,163	64,193	75,738	91,776	73,573	58,215	99,383
9	95,235	124,907	81,253	53,966	69,473	83,394	99,429	79,453	61,564	105,278
10	101,008	134,453	85,891	55,635	74,382	87,691	109,409	81,323	67,532	111,998
11	105,250	140,348	94,385	57,474	80,413	90,403	109,409	83,067	73,120	115,707
12	108,481	143,066	94,385	57,474	83,416	92,437	112,329	84,418	75,850	120,303
13	111,603	147,339	96,213	60,372	84,687	95,394	112,329	86,141	75,850	124,112
14	113,831	148,977	97,877	61,983	88,032	97,242	117,254	88,714	75,850	126,869
15	115,950	151,863	98,766	63,507	94,556	98,823	117,254	93,679	75,850	128,310
16	117,795	153,261	98,766	65,947	95,996	99,720	117,254	98,609	75,850	130,341
17	120,197	154,804	98,766	65,947	98,156	100,121	117,254	98,609	113,718	131,658
18	121,234	156,504	98,766	65,947	98,156	100,624	117,254	98,609	113,718	133,527
19	122,649	157,012	101,299	65,947	100,466	101,446	117,254	98,609	132,694	134,198
20	222,700	253,967	198,236	94,211	178,448	183,627	207,529	153,120	0	243,559
21	306,106	341,353	294,119	150,737	318,657	245,490	332,046	199,115	0	324,750
22	418,895	479,429	387,508	251,228	358,445	384,179	368,941	248,894	0	413,177
23	570,472	549,803	533,024	439,979	520,995	477,241	646,131	298,792	0	555,353
24	749,902	720,581	666,280	513,395	651,244	675,979	646,131	298,792	0	694,192
25	932,629	857,835	761,463	0	868,325	746,938	646,131	298,792	0	833,363

Stochastic Rewards Valuation Calculation

FICM is a measure of the present cost of replacing enlisted personnel in each of the 25 YOS. SRVM addresses the question of the value to be derived by the Air Force from employing individuals at each relevant YOS over some selected future horizon. Estimation of SRVM values for aircraft environmental systems mechanics represents a monetary valuation of the future expected services to be provided by enlisted personnel in that AFS from continued active duty. SRVM accounts for the probability of separation at all future YOS points by using the transition matrix developed for the estimation of FICM. In essence, the estimation of SRVM for some selected tenure of future service provides an estimate of the expected value of that future service based on the probabilities of occupying various YOSs.

The two main data elements required by the SRVM are the service state values and the transition probabilities. The value of each YOS is based on the civilian wage of an aircraft environmental systems mechanic as computed from surveys administered monthly by the Bureau of the Census (U.S. Department of Commerce, 1986). The civilian wage represents the opportunity cost to the airman of remaining in the service, i.e., income which the airman could have made in the private sector for providing similar services (Stone, 1989a). One-fourth of the individuals responding to the survey each month are asked to provide weekly earnings information. The respondents can be categorized by occupation using the Standard Occupational Codes (SOCs) provided on each individual record. The age-earnings function estimated for each of the ten AFSs exhibits the following relationship between earnings and age (Stone, 1989a):

$$\text{Earnings} = a + b_1\text{Age} + b_2(\text{Age}^2) + b_3\text{msin} + b_4\text{fsin} + b_5\text{fmar} + b_6\text{race},$$

where

msin equals 1 for single, males, 0 otherwise,
fsin equals 1 for single, females, 0 otherwise,
fmar equals 1 for married, females, 0 otherwise, and
race equals 1 for caucasian, 0 otherwise.

Values for race, sex, and marital status were obtained from the UAR for each AFS. These demographic values were used to estimate the civilian earnings opportunity for airman. Appendix D provides the estimated service state values for each of the ten AFSs by YOS.

Table 3 presents SRVM estimates which represent the future value to the Air Force of an individual in AFS 423x1 for an expected tenure of 4 years, accounting for the probability of separation during the 4-year tenure. Furthermore, the future service state values were discounted at a rate of 6.21% (Treasury Bill rate for 1988), thus, resulting in present value estimates of the future flow of services. For example, $1000 in YOS 5 is worth $740 in present value terms for YOS 1, and $1000 in YOS 10 is worth only $547 in present value terms for YOS 1. The value of $44,750+ in Table 3 for the first three YOS

reflects the relative flatness of the earnings function during the first term of an airman's career and the effect of a low probability of reenlistment at the first-term decision point, YOS 4. Once the first-term reenlistment decision has been made, the value of an airman's future services increases significantly. The SRVM estimate of an airman continues a steady increase after YOS 5 reflecting the high probability of continuing on active duty for the next 10 to 15 years. The value to the Air Force of 4 years additional service for YOSs beyond YOS 16 declines because of the short tenure of service before the 20-year retirement point and consequently the high probability of retirement. A similar pattern is exhibited for all AFSs as indicated in Table 4. The differences between the SRVM estimates for each AFS are caused by the differences in the continuation rates (Appendix A) and the service state values (Appendix D). At YOS 4, AFS 426x2 (jet engine mechanic) exhibits the highest projected reward for 4 additional years of service, but, by YOS 10 AFS 272x0 (air traffic controllers) has surpassed AFS 426x2 significantly.

TABLE 3. SRVM ESTIMATION FOR 4 YEARS OF FUTURE SERVICE: AIRCRAFT ENVIRONMENTAL SYSTEMS MECHANIC

Service State	Service State Values	Projected Values
1	$12,610.15	$ 44,750.24
2	13,865.49	44,827.93
3	15,078.01	44,326.32
4	16,247.69	43,193.22
5	17,374.53	56,719.31
6	18,518.96	60,290.84
7	19,628.21	66,336.88
8	20,702.31	67,504.52
9	21,741.24	68,818.48
10	22,608.17	72,988.64
11	23,432.27	76,944.88
12	24,213.54	81,991.15
13	24,951.97	83,970.50
14	25,583.24	83,727.39
15	26,171.68	86,070.55
16	26,717.28	92,531.32
17	27,220.05	84,730.66
18	27,679.99	71,378.95
19	28,097.10	54,027.71
20	28,471.37	34,738.87
21	28,802.80	43,126.80
22	29,091.41	61,301.59
23	29,337.18	43,900.82
24	29,540.12	38,231.34
25	29,700.22	21,056.43

TABLE 4. SRVM 4 ESTIMATION FOR 4 YEARS OF FUTURE SERVICE ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$47,417	$64,162	$42,521	$46,538	$44,750	$72,854	$41,052	$47,116	$37,833	$48,527
2	48,117	62,990	39,953	45,252	44,828	67,549	40,280	47,785	37,983	46,913
3	48,285	60,642	38,271	42,692	44,326	63,590	35,024	50,400	36,065	44,499
4	48,213	57,676	37,731	42,056	43,193	60,200	29,387	52,711	36,516	41,211
5	67,199	79,306	55,612	53,801	56,719	78,308	48,140	67,133	48,204	54,406
6	72,457	82,549	58,137	57,641	60,291	77,537	58,063	73,476	48,880	56,825
7	80,084	83,179	62,534	63,181	66,337	77,563	65,365	76,790	50,939	63,611
8	83,772	87,155	64,978	65,368	67,505	77,849	64,480	80,181	50,869	65,212
9	89,366	95,070	69,618	71,582	68,818	79,791	67,137	86,742	55,448	68,066
10	95,467	103,859	73,941	78,912	72,989	84,549	71,192	96,193	57,023	70,998
11	101,372	111,115	77,834	81,536	76,945	87,122	76,330	100,170	61,979	75,024
12	105,965	115,768	86,773	84,363	81,991	88,349	76,509	102,519	67,273	77,114
13	109,581	117,849	87,609	83,413	83,971	89,146	79,069	102,687	70,527	80,082
14	113,093	121,753	90,428	87,492	83,727	91,430	79,421	103,393	65,729	82,713
15	115,796	123,449	93,395	90,072	86,071	92,966	84,123	105,533	60,490	84,615
16	118,505	126,677	95,188	92,916	92,531	94,500	85,245	111,840	53,200	85,712
17	108,531	117,215	85,190	91,111	84,731	85,827	77,569	109,676	35,739	78,318
18	93,818	102,264	70,530	79,033	71,379	72,932	64,906	96,531	35,974	66,940
19	73,105	81,956	52,751	61,784	54,028	55,838	50,483	79,328	17,122	53,040
20	48,396	57,869	33,473	40,474	34,739	36,379	32,138	58,739	0	35,603
21	65,180	71,689	47,780	36,722	43,127	47,644	41,574	76,245	0	49,694
22	67,622	76,030	55,315	33,092	61,302	46,720	55,591	88,835	0	52,083
23	67,547	81,726	57,693	29,006	43,901	53,456	51,567	93,876	0	50,463
24	63,739	64,421	54,799	24,168	38,231	41,698	90,635	92,912	0	51,468
25	53,363	52,834	43,092	0	21,056	33,716	90,861	61,829	0	48,646

Calculation of ENPVM Values

Table 5 presents calculations for ENPVM for aircraft environmental systems mechanics, assuming an expected tenure of 4 more years. An aircraft environmental systems mechanic at YOS 4 has an ENPVM value of $41,114, which is the value of 4 additional years of service less all costs to maintain, train, promote, and compensate the mechanic. In essence, the Air Force will incur a net benefit of $41,114 from retaining the services of an airman in YOS 4 for 4 additional years of service. Table 5 exhibits a trend in value similar to the SRVM calculation in Table 3 since most training costs are incurred in the early YOS.

TABLE 5. EXPECTED NET PRESENT VALUE MODEL: AIRCRAFT ENVIRONMENTAL SYSTEMS MECHANIC

Service State	Service State Values	Projected Values
1	$ 4,518.04	$ 25,466.55
2	3,779.49	32,740.65
3	7,562.38	38,242.47
4	11,481.99	41,113.95
5	15,728.84	55,412.60
6	17,010.42	60,290.84
7	19,628.21	66,336.88
8	20,702.31	67,504.52
9	21,741.24	68,818.48
10	22,608.17	72,988.64
11	23,432.27	76,944.88
12	24,213.54	81,991.15
13	24,951.97	83,970.50
14	25,583.24	83,727.39
15	26,171.68	86,070.55
16	26,717.28	92,531.32
17	27,220.05	84,730.66
18	27,679.99	71,378.95
19	28,097.10	54,027.71
20	28,471.37	34,738.87
21	28,802.80	43,126.80
22	29,091.41	61,301.59
23	29,337.18	43,900.82
24	29,540.12	38,231.34
25	29,700.22	21,056.43

Several factors affect the values for ENPVM which could be altered by personnel policies. For example, if an SRB were implemented for first-term personnel, the increase in the continuation rates at the first-term decision point

would increase the ENPVM value at the same time that the value of the bonus would decrease the ENPVM value. The net effect would determine the overall value of the bonus. Employment of ENPVM in such an analysis requires a caveat: ENPVM is totally a forward-looking model and does not consider the savings in reduced recruiting, selecting, and training which occurs prior to a particular YOS. BMT and formal technical training costs are incurred in YOS 1 while OJT lost productivity costs are primarily incurred in YOS 2 and 3. A reenlistment bonus for first-termers would affect the continuation rates for YOS 4 and beyond while reducing training costs in YOS 1 through 3. This is because fewer recruits are required to replace losses in YOS 4 and beyond. Thus, when analyzing the effects of a proposed bonus program, the size of the net benefit may not be as important as a positive ENPVM estimate.

Table 6 provides ENPVM estimates for each of the ten AFSs for a projection period of 4 years. Appendix E provides the net service state values for each of the ten AFSs by YOS. Whereas in Table 4, AFS 272x0 was a close second to AFS 426x2 in providing the largest return for 4 years of additional service, the ENPVM estimates have removed AFS 426x2 farther from AFS 272x0 due to AFS 272x0's high training costs.

ESTIMATION OF FICM, SRVM, AND ENPVM FOR OFFICERS: ENGINEERS

General Data Requirements

The sources for data for the analysis were the Human Resources Directorate's officer personnel files, commonly called Uniform Officer Records (UOR) and Air Training Command (ATC) Cost Factors (1988). Personnel inventories developed from UOR snapshots in June 1988 and June 1989 were again used to compute the transition matrix for YOS 1 to 25. Transition matrices were developed for each 4-digit AFS in the engineering career field while service state values were estimated at the 2-digit AFS level. Continuation rates and service state values are provided in Appendix F and G, respectively, for each of the 2-digit AFSs in this career field. The officer career fields included in the analysis are:

	AFS	Description
Engineering	25xx	Weather
	26xx	Scientific
	28xx	Development Engineering
	55xx	Civil Engineering

The sources for training costs such as technical training and commissioning costs were the ATC's FY88 Cost Factors. The initial cost of commissioning an officer who is to become an engineer was calculated as a weighted average of the three primary sources of commissioning: Air Force Reserve Officer Training Corps (AFROTC), Officer Training School (OTS), and the Air Force Academy. The weights for averaging the costs of commissioning were based on the proportion of officers from each source of commission who entered the Air Force from June 1988 to June 1989.

TABLE 6. ENPVM RESULTS ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$25,263	$36,538	$22,473	$32,722	$25,467	$51,259	$25,287	$22,899	$24,479	$25,810
2	33,657	43,941	27,572	36,622	32,741	50,473	27,927	37,752	26,510	33,452
3	39,835	46,428	31,305	41,769	38,242	54,561	26,327	43,913	30,817	36,525
4	44,919	48,821	35,856	41,303	41,114	57,064	24,962	50,156	33,668	38,487
5	65,520	72,301	55,173	52,927	55,413	76,937	40,230	67,133	47,261	53,631
6	72,011	82,549	57,903	57,641	60,291	75,996	50,340	73,476	48,277	56,825
7	79,694	83,179	62,384	63,181	66,337	76,393	59,123	76,790	50,294	63,536
8	83,449	87,155	64,917	65,368	67,505	77,204	60,074	80,181	50,670	65,035
9	89,098	95,070	69,618	71,582	68,818	79,791	64,296	86,742	55,235	67,729
10	95,162	103,859	73,941	78,912	72,989	84,549	71,192	96,193	56,808	70,473
11	101,104	111,115	77,834	81,536	76,945	87,122	76,330	100,170	61,979	74,532
12	105,712	115,532	86,773	84,363	81,991	88,349	76,509	102,519	67,273	76,665
13	109,399	117,369	87,609	83,413	83,971	89,146	79,069	102,687	70,527	79,797
14	112,962	120,892	90,428	87,492	83,727	91,430	79,421	103,393	65,729	82,620
15	115,605	122,141	93,395	90,072	86,071	92,804	84,123	105,533	60,490	84,544
16	118,298	125,243	95,188	92,916	92,531	94,108	85,245	111,840	53,200	85,709
17	108,339	115,987	85,190	91,111	84,731	85,407	77,569	109,676	35,739	78,314
18	93,654	101,396	70,530	79,033	71,379	72,483	64,906	96,531	35,974	66,933
19	73,016	81,535	52,751	61,784	54,028	55,573	50,483	79,328	17,122	53,032
20	48,393	57,869	33,473	40,474	34,739	36,379	32,138	58,739	0	35,597
21	65,176	71,689	47,780	36,722	43,127	47,644	41,574	76,245	0	49,686
22	67,620	76,030	55,315	33,092	61,302	46,720	55,591	88,835	0	52,078
23	67,547	81,726	57,693	29,006	43,901	53,456	51,567	93,876	0	50,463
24	63,739	64,421	54,799	24,168	38,231	41,698	90,635	92,912	0	51,468
25	53,363	52,834	43,092	0	21,056	33,716	90,861	61,829	0	48,646

It was assumed that engineers enter active duty with an initial ability to perform the duties and responsibilities of an Air Force officer at less than 100% proficiency. Thus, during the first 12 months of active duty service, the engineer receives on the job training (OJT). The less-than-100% performance during OJT represents a loss in productivity to the Air Force. For this analysis, two different scenarios were used to calculate the costs of this lost productivity. Productivity scenario 1 assumed that engineers enter this OJT period at 75% of full proficiency and increase their proficiency to 100% during the first 12 months. The alternative productivity scenario assumed that the engineer enters active duty service at 50% proficiency and increases their proficiency to 100% during the first 12 months. The learning curve is assumed to be linear (Stone et al., 1989a).

Full Investment Cost Calculation for Officers

FICM estimates were initially calculated for all engineers using the attrition rates for the June 1988 to June 1989 time period. Similar calculations were performed for each of the officer specialties. The component costs of FICM for engineers are presented in Table 7. Column (5) presents the number of officers which must be commissioned in order to obtain one officer at the designated YOS. For example, 1.8 officers must be commissioned in order to obtain one officer in YOS 7. Column (1) presents the cost of commissioning an officer, column (2) provides the cost of formal technical training, and (3) provides the cost of lost productivity due to OJT.

The sum f all the costs for each YOS, columns (1) through (3), yields an estimation of the service state cost, Column (4). Column (6) in Table 7 contains the full cost of replacing an individual in each YOS. The calculation of FICM for each YOS includes all the investments which were estimated in columns (1) through (3) as necessary development activities in the production of Air Force engineer capabilities. Estimates of FICM also include the lost investment in individuals who separated at each service state in the progression to any selected YOS. For example, to replace an individual in YOS 7, which is the equivalent of a fully trained and experienced engineer, the Air Force will recruit 1.8 new officers and invest $67,149 over 7 years. The cost to the Air Force of replacing an engineer in YOS 14 is $99,110 and requires 2.65 recruits. When a single engineer reaches voluntary retirement at 20 years, the Air Force has incurred a full replacement cost of $158,413 and lost 4.24 engineers along the career path. The Table 7 calculations assumed that there were no measurable separation costs for the officer corps.

Table 8 presents the FICM values assuming a less conservative estimation of the lost productivity costs (productivity scenario 2) as reflected by the differences in costs in column 3. As a result, the FICM values increase for each YOS beyond YOS 1. For example, the FICM value for YOS 7 increases to $72,295, a 7.66% increase from Table 7.

TABLE 7. FULL INVESTMENT COST CALCULATION: PRODUCTIVITY SCENARIO 1 CIVIL ENGINEERS - AFS 55xx

Service State	(1) Acquistion Cost	(2) Technical Training	(3) Service OJT Cost	(4) State Cost	(5) Full Replacement Number	(6) Investment Cost
1	$31,727	$2,794	$2,866	$37,387	1.00	$ 37,387
2	0	0	0	0	1.00	37,387
3	0	0	0	0	1.04	38,783
4	0	0	0	0	1.37	51,098
5	0	0	0	0	1.51	56,462
6	0	0	0	0	1.66	62,046
7	0	0	0	0	1.80	67,149
8	0	0	0	0	1.92	71,817
9	0	0	0	0	2.06	77,140
10	0	0	0	0	2.15	80,354
11	0	0	0	0	2.24	83,615
12	0	0	0	0	2.52	94,055
13	0	0	0	0	2.65	99,110
14	0	0	0	0	2.65	99,110
15	0	0	0	0	2.65	99,110
16	0	0	0	0	2.74	102,280
17	0	0	0	0	2.83	105,662
18	0	0	0	0	2.83	105,662
19	0	0	0	0	2.83	105,662
20	0	0	0	0	4.24	158,413
21	0	0	0	0	5.45	203,616
22	0	0	0	0	5.45	203,616
23	0	0	0	0	5.45	203,616
24	0	0	0	0	5.45	203,616
25	0	0	0	0	5.45	203,616

TABLE 8. FULL INVESTMENT COST CALCULATION: PRODUCTIVITY SCENARIO 2 CIVIL ENGINEERS - AFS 55xx

Service State	(1) Acquistion Cost	(2) Technical Training	(3) Service OJT Cost	(4) State Cost	(5) Full Replacement Number	(6) Investment Cost
1	$31,727	$2,794	$5,731	$40,252	1.00	$ 40,252
2	0	0	0	0	1.00	40,252
3	0	0	0	0	1.04	41,755
4	0	0	0	0	1.37	55,013
5	0	0	0	0	1.51	60,788
6	0	0	0	0	1.66	66,800
7	0	0	0	0	1.80	72,295
8	0	0	0	0	1.92	77,321
9	0	0	0	0	2.06	83,051
10	0	0	0	0	2.15	86,512
11	0	0	0	0	2.24	90,022
12	0	0	0	0	2.52	101,263
13	0	0	0	0	2.65	106,705
14	0	0	0	0	2.65	106,705
15	0	0	0	0	2.65	106,705
16	0	0	0	0	2.74	110,118
17	0	0	0	0	2.83	113,758
18	0	0	0	0	2.83	113,758
19	0	0	0	0	2.83	113,758
20	0	0	0	0	4.24	170,552
21	0	0	0	0	5.45	219,219
22	0	0	0	0	5.45	219,219
23	0	0	0	0	5.45	219,219
24	0	0	0	0	5.45	219,219
25	0	0	0	0	5.45	219,219

Table 9 presents the FICM values for the 2-digit engineering AFSs. At YOS 5, the FICM values for these officers exhibit significant increases due to the high attrition rates for these AFSs (Appendix F).

TABLE 9. FICM ESTIMATION FOR OFFICERS: PRODUCTIVITY SCENARIO 1

	Engineers			
YOS	25xx	26xx	28xx	55xx
1	$36,360	$52,480	$49,528	$37,387
2	36,360	52,480	49,777	37,387
3	37,523	53,010	50,128	38,307
4	41,973	61,283	57,951	49,556
5	46,533	72,183	65,929	54,940
6	48,121	78,374	74,749	59,978
7	50,336	82,067	81,783	64,701
8	52,324	84,693	87,095	68,685
9	53,392	88,313	92,556	73,225
10	56,679	91,139	96,918	76,197
11	57,836	93,572	99,915	79,372
12	67,017	96,665	102,582	86,180
13	70,396	100,483	104,039	88,754
14	72,499	102,849	105,516	88,754
15	73,978	105,270	107,779	90,197
16	73,978	109,088	108,212	91,478
17	73,978	109,088	108,212	92,777
18	73,978	109,088	108,212	92,777
19	73,978	109,088	108,865	94,477
20	125,813	196,910	156,416	123,338
21	170,478	333,746	248,279	158,126
22	192,631	584,493	316,279	204,561
23	231,250	803,980	390,468	219,251
24	266,724	1,205,367	543,070	246,627
25	327,269	1,326,036	712,691	258,248

Stochastic Rewards Valuation Estimates for Officers

The estimation of SRVM for engineers represents a monetary valuation of the future expected services to be provided from continued active duty, whereas FICM is a measure of the cost of replacing personnel. SRVM accounts for the probability of separation at all future points on the career ladder by using the transition matrix developed for the estimation of FICM. The estimation of SRVM for some selected tenure provides an estimate of the expected value of that future service based on the probabilities of occupying future YOS service states. The estimation of SRVM also employs the same service state definitions as FICM.

Two essential components in the estimation of SRVM values are the service state specific values and transition probabilities between service states. The same transition probabilities used for FICM are used in the SRVM estimations. The value of each YOS is based on the civilian wage of engineers as computed from data collected monthly by the Bureau of the Census (U.S. Department of Commerce, 1986). The respondents were categorized by occupation using the Standard Occupational Codes provided on each individual record. The same age-earnings function used for the enlisted AFSs was estimated for each of the 2-digit AFSs for engineers.

Military compensation was based on FY88 Regular Military Compensation (RMC) which includes basic pay, basic allowance for quarters (BAQ), basic allowance for subsistence (BAS), and the marginal tax advantage accrued from not taxing BAQ and BAS. The calculation of military compensation was a weighted average of RMC based on the distribution of grade by YOS from the June 1989 UOR.

Table 10 presents SRVM estimates for civil engineers, AFSs 55xx, under the assumption that future service tenure extends for four additional years of service. The SRVM estimate for civil engineers is $107,333 for YOS 7. This means that the Air Force can expect to receive $107,333 worth of value from the services provided by a civil engineer in YOS 7 whose expected tenure is through YOS 11. SRVM values reach a maximum in YOS 16 as the decreasing length of the horizon to YOS 20 begins to adversely affect the value of SRVM. A slight decline in SRVM values also occurs from YOS 1 through YOS 4 due to the modest change in earnings in the early time periods and the attrition which begins to escalate with the end of the active duty commitment at YOS 4 (see Table 7, Column(2)). A similar pattern is exhibited by all AFSs as indicated in Table 11. The differences between the SRVM estimates for each AFS are caused by differences in the continuation rates (Appendix F) and the service state values (Appendix G). At YOS 4 in Table 11, AFS 25xx (weather officer) exhibits the highest projected reward for 4 additional years of service, $94,897, but, by YOS 10 AFS 26xx (scientific officer) has surpassed AFS 25xx significantly.

Table 12 presents calculations for ENPVM assuming retention for four additional years of service. A civil engineer (AFS 55xx) at YOS 7 has an ENPVM value of $107,333, column 3, which is the value of 13 additional years of service net of all costs to maintain, train, promote, and compensate the engineer. YOS 1 exhibits negative values for ENPVM which are predominately caused by three factors: (1) Since all future value and costs are discounted at a T-bill rate of 6.21%, the large service state values exhibited by trained and experienced engineers in the latter years of service are discounted significantly. For example, $1000 in YOS 5 is worth $740 to the ENPVM for YOS 1, and $1000 in YOS 10 is worth only $547 to the ENPVM for YOS 1. Conversely, the value estimated for the service state has increased approximately 55% from YOS 1 to YOS 10. (2) Since training costs are incurred primarily in the first few service states, the discounting of these future costs has little

impact on the negative effect of training costs on the estimate of ENPVM. (3) The attrition of engineers occurring at each service state continues to increase, causing the probability of attaining a particular service state in the future to decline and, thus, reducing the expected present value of any one future service state.

TABLE 10. STOCHASTIC REWARDS VALUATION MODEL CIVIL ENGINEERS - AFS 55xx

Service State	Service State Values	Projected Values
1	$26,187	$ 94,624
2	27,577	90,372
3	28,835	83,773
4	30,074	77,405
5	31,371	95,369
6	32,627	101,530
7	33,939	107,333
8	35,067	112,840
9	35,954	116,271
10	37,074	120,960
11	38,068	123,391
12	38,919	126,673
13	39,914	137,690
14	40,689	142,296
15	41,167	142,847
16	42,049	145,411
17	42,579	140,123
18	43,068	128,721
19	43,737	109,233
20	44,352	87,931
21	44,726	95,482
22	45,223	107,079
23	45,608	121,821
24	41,757	117,252
25	46,531	111,426

Table 13 presents similar ENPVM estimates for the 2-digit engineering AFSs. Appendix H presents the service state values for the ENPVM calculations.

TABLE 11. SRVM ESTIMATION FOR 4 YEARS OF FUTURE SERVICE FOR OFFICERS

	Engineers			
YOS	25xx	26xx	28xx	55xx
1	$98,532	$93,840	$103,161	$94,624
2	98,738	92,843	100,603	90,372
3	96,071	88,266	94,943	83,773
4	94,897	83,233	87,106	77,405
5	103,447	92,318	93,274	95,369
6	113,692	106,460	99,807	101,530
7	115,543	115,292	108,516	107,333
8	119,063	120,696	115,352	112,840
9	119,235	124,048	120,353	116,271
10	115,525	128,827	126,639	120,960
11	116,960	131,985	132,123	123,391
12	113,313	134,063	135,919	126,673
13	130,128	136,771	139,810	137,690
14	137,373	141,634	142,473	142,296
15	142,850	145,208	145,482	142,847
16	147,475	149,111	150,112	145,411
17	134,367	140,413	141,503	140,123
18	115,288	116,430	122,268	128,721
19	92,808	85,207	98,115	109,233
20	66,324	49,962	70,436	87,931
21	92,843	55,569	72,969	95,482
22	107,855	62,843	90,353	107,079
23	102,004	78,262	87,272	121,821
24	100,242	79,416	74,113	117,252
25	85,573	95,879	67,558	111,426

CONCLUSIONS AND RECOMMENDATIONS

Section III and IV presented the results of applying FICM, SRVM, and ENPVM to enlisted and officer career fields. The following conclusions can be drawn from the application of these three models:

1. FICM, SRVM, and ENPVM provide information which is useful in determining and explaining the costs and implications of personnel policy.

2. FICM, SRVM, and ENPVM can be estimated for any career field or any level of aggregation by employing the same methodology as used in the application presented in Section III or Section IV.

3. BMT acquisition costs and separation costs estimated in Section III and IV are generalizable to all AFSs. Additional study is necessary to identify better/easier approaches for estimating indirect costs such as separation costs and lost productivity costs due to OJT.

4. FICM, SRVM, and ENPVM can be applied to the officer corps employing the same methodology used in Section III for the enlisted corps.

5. Alternative measures for the valuation of service states for SRVM and ENPVM estimates should be considered, such as productive capacity (Carpenter et al., 1989).

TABLE 12. EXPECTED NET PRESENT VALUE MODEL
CIVIL ENGINEERS - AFS 55xx

Service State	Service State Net Values	Projected Values
1	$ -11,201	$ 94,625
2	27,577	90,372
3	28,835	83,773
4	30,074	77,405
5	31,371	95,369
6	32,627	101,530
7	33,939	107,333
8	35,067	112,840
9	35,954	116,271
10	37,074	120,960
11	38,068	123,391
12	38,919	126,673
13	39,914	137,690
14	40,689	142,296
15	41,167	142,847
16	42,049	145,411
17	42,579	140,123
18	43,068	128,721
19	43,737	109,334
20	44,352	87,931
21	44,726	95,482
22	45,223	107,079
23	45,608	121,821
24	41,757	117,252
25	46,531	111,426

TABLE 13. ENPVM ESTIMATION FOR OFFICERS: PRODUCTIVITY SCENARIO

	Engineers			
YOS	25xx	26xx	28xx	55xx
1	$98,532	$93,840	$103,161	$94,624
2	98,738	92,843	100,603	90,372
3	96,071	88,266	94,943	83,773
4	94,897	83,233	87,106	77,405
5	103,447	92,318	93,274	95,369
6	113,692	106,460	99,807	101,530
7	115,543	115,292	108,516	107,333
8	119,063	120,696	115,352	112,840
9	119,235	124,048	120,353	116,271
10	115,525	128,827	126,639	120,960
11	116,960	131,985	132,123	123,391
12	113,313	134,063	135,919	126,673
13	130,128	136,771	139,810	137,690
14	137,373	141,634	142,473	142,296
15	142,850	145,208	145,482	142,847
16	147,475	149,111	150,112	145,411
17	134,367	140,413	141,503	140,123
18	115,288	116,430	122,268	128,721
19	92,808	85,207	98,115	109,233
20	66,324	49,962	70,436	87,931
21	92,843	55,569	72,969	95,482
22	107,855	62,843	90,353	107,079
23	102,004	78,262	87,272	121,821
24	100,242	79,416	74,113	117,252
25	85,573	95,879	67,558	111,426

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APPENDIX A
CONTINUATION RATES ACROSS TEN AFSs: JUNE 1988 TO JUNE 1989

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
0	0.961	0.955	0.981	0.988	0.955	0.947	0.892	0.953	0.910	0.931
1	0.917	0.949	0.934	0.979	0.944	0.925	0.956	0.915	0.941	0.923
2	0.907	0.931	0.895	0.924	0.944	0.915	0.944	0.922	0.886	0.927
3	0.738	0.692	0.660	0.750	0.748	0.724	0.573	0.791	0.725	0.708
4	0.933	0.906	0.927	0.895	0.920	0.945	0.811	0.921	0.942	0.904
5	0.928	0.927	0.907	0.889	0.895	0.938	0.882	0.965	0.916	0.865
6	0.935	0.898	0.931	0.942	0.955	0.941	1.000	0.967	0.948	0.949
7	0.893	0.881	0.918	0.908	0.950	0.933	0.950	0.943	0.887	0.939
8	0.946	0.897	0.933	0.911	0.924	0.917	0.944	0.926	0.946	0.944
9	0.976	0.929	0.946	0.970	0.934	0.951	0.938	0.977	0.912	0.940
10	0.946	0.958	0.910	0.968	0.925	0.970	1.000	0.979	0.927	0.969
11	0.952	0.981	1.000	1.000	0.964	0.978	0.974	0.984	0.964	0.963
12	0.969	0.971	0.981	0.952	0.985	0.969	1.000	0.980	1.000	0.971
13	1.000	0.989	0.983	0.974	0.962	0.981	0.958	0.971	1.000	0.980
14	0.949	0.981	0.991	0.976	0.931	0.984	1.000	0.947	1.000	0.989
15	0.947	0.993	1.000	0.963	0.985	0.991	1.000	0.950	1.000	0.985
16	0.976	0.992	1.000	1.000	0.978	0.996	1.000	1.000	0.667	0.990
17	1.000	0.992	1.000	1.000	1.000	0.995	1.000	1.000	1.000	0.986
18	1.000	1.000	0.975	1.000	0.977	0.994	1.000	1.000	0.857	0.995
19	0.674	0.620	0.511	0.700	0.563	0.554	0.565	0.644	0.000	0.551
20	0.862	0.744	0.674	0.625	0.560	0.748	0.625	0.769	0.500	0.750
21	0.846	0.712	0.759	0.600	0.889	0.639	0.900	0.800	0.000	0.786
22	0.778	0.872	0.727	0.571	0.688	0.805	0.571	0.833	0.000	0.744
23	0.714	0.763	0.800	0.857	0.800	0.706	1.000	1.000	0.000	0.800
24	0.923	0.840	0.875	0.000	0.750	0.905	1.000	1.000	0.000	0.833
25	0.750	0.421	0.800	0.000	0.000	0.375	1.000	0.500	0.000	0.643

APPENDIX B
TECHNICAL TRAINING COSTS ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 617.95	$ 0.00	$ 0.00	$ 0.00	$ 0.00
2	1,916.61	4,364.98	6,518.32	1,153.16	4,388.49	3,310.18	3,745.28	3,910.42	1,226.62	2,922.08
3	4,181.42	3,273.74	3,012.23	1,153.16	3,839.93	2,653.28	3,277.12	1,807.49	2,736.69	2,452.64
4	4,228.85	3,273.74	677.32	307.51	2,331.39	2,674.85	1,989.68	1,646.44	2,192.59	2,150.00
5	773.85	3,091.86	233.31	192.19	1,645.69	169.78	1,404.48	241.37	1,949.02	886.36
6	1,225.02	4,183.11	267.89	1,037.85	1,508.54	0.00	4,623.20	0.00	474.43	910.45
7	605.67	0.00	125.10	0.00	0.00	575.69	3,057.78	0.00	197.08	0.00
8	89.65	0.00	109.63	0.00	0.00	674.95	2,223.84	0.00	524.17	0.00
9	373.39	0.00	70.66	0.00	0.00	734.51	2,084.85	0.00	24.55	0.00
10	278.00	0.00	0.00	0.00	0.00	0.00	3,196.77	0.00	24.55	0.00
11	389.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	250.09	121.94
12	518.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	144.51
13	370.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	210.10
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	219.10
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.84
16	0.00	325.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	75.95
17	0.00	304.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	447.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	508.32	0.00	0.00	0.00	213.60	0.00	0.00	0.00	0.00
20	0.00	447.32	0.00	0.00	0.00	283.15	0.00	0.00	0.00	3.35
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.35
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.50
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000
25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0

APPENDIX C
LOST PRODUCTIVITY COSTS DUE TO OJT ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$1,616.41	$ 1,608.94	$ 262.31	$ 130.31	$ 1,677.11	$ 1,981.41	$1,107.62	$4,672.31	$1,032.65	$6,740.71
2	6,066.58	10,882.86	2,913.38	5,564.54	5,697.51	3,834.05	4,197.99	13,046.55	3,098.70	9,924.98
3	7,949.22	3,830.79	4,150.19	7,286.47	3,675.70	8,189.41	2,678.45	3,351.17	5,050.11	5,063.25
4	6,204.21	4,087.10	5,758.14	0.00	2,434.31	4,990.69	4,087.39	3,270.34	1,495.70	4,261.96
5	0.00	3,494.18	2,386.11	0.00	0.00	3,507.35	0.00	3,189.51	1,293.77	2,424.73
6	0.00	4,028.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX D
SRVM SERVICE STATE VALUES ACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$13,009	$18,262	$12,092	$12,247	$12,610	$26,067	$13,591	$13,035	$12,560	$16,030
2	14,825	20,122	13,413	13,584	13,865	26,073	14,528	14,640	13,268	16,800
3	16,590	21,951	14,694	14,875	15,078	26,080	15,435	16,197	13,957	17,525
4	18,305	23,749	15,936	16,120	16,248	26,088	16,314	17,705	14,629	18,203
5	19,968	25,515	17,137	17,318	17,375	26,097	17,164	19,165	15,283	18,836
6	21,740	27,003	18,238	18,458	18,519	26,179	17,983	20,529	15,855	19,409
7	23,498	28,449	19,300	19,555	19,628	26,242	18,776	21,851	16,419	19,937
8	25,241	29,853	20,322	20,609	20,702	26,288	19,545	23,132	16,976	20,418
9	26,969	31,214	21,305	21,619	21,741	26,315	20,287	24,373	17,526	20,854
10	28,179	32,076	22,273	22,509	22,608	26,462	20,916	25,902	18,136	21,533
11	29,339	32,906	23,203	23,353	23,432	26,608	21,515	27,412	18,736	22,167
12	30,449	33,704	24,094	24,150	24,214	26,753	22,086	28,905	19,328	22,754
13	31,509	34,470	24,947	24,902	24,952	26,896	22,628	30,379	19,910	23,296
14	32,387	35,075	25,560	25,577	25,583	27,067	23,080	31,185	20,151	23,831
15	33,215	35,648	26,132	26,205	26,172	27,239	23,504	31,942	20,373	24,320
16	33,991	36,190	26,664	26,787	26,717	27,413	23,899	32,651	20,578	24,763
17	34,717	36,700	27,156	27,324	27,220	27,587	24,265	33,311	20,765	25,160
18	35,391	37,178	27,609	27,814	27,680	27,762	24,603	33,923	20,934	25,512
19	36,014	37,625	28,022	28,258	28,097	27,938	24,911	34,487	21,086	25,817
20	36,587	38,041	28,394	28,655	28,471	28,115	25,191	35,002	21,219	26,077
21	37,108	38,425	28,727	29,007	28,803	28,292	25,442	35,469	21,335	26,291
22	37,579	38,777	29,020	29,312	29,091	28,471	25,664	35,887	21,433	26,460
23	37,998	39,097	29,273	29,571	29,337	28,651	25,857	36,258	21,513	26,582
24	38,367	39,386	29,487	29,784	29,540	28,831	26,021	36,579	21,575	26,659
25	38,685	39,644	29,660	29,951	29,700	29,013	26,157	36,853	21,619	26,690

APPENDIX E
ENPVM SERVICE STATE VALUESACROSS TEN AFSs

YOS	122x0	272x0	305x4	328x4	423x1	426x2	427x0	492x1	672x1	811x0
1	$2,488	$10,238	$5,414	$5,702	$4,518	$17,052	$6,069	$1,948	$5,112	$2,874
2	3,651	4,874	3,981	6,866	3,779	18,929	6,584	-2,317	8,942	3,953
3	8,444	14,847	7,532	6,435	7,562	15,238	9,480	11,038	6,170	10,009
4	11,789	16,388	9,500	15,812	11,482	18,423	10,237	12,789	10,941	11,791
5	16,626	18,929	14,518	17,126	15,729	22,420	15,759	15,734	12,040	15,525
6	20,197	18,792	17,970	17,420	17,010	26,179	13,360	20,529	15,380	18,499
7	23,309	28,449	19,175	19,555	19,628	25,666	15,719	21,851	16,222	19,937
8	25,066	29,853	20,213	20,609	20,702	25,613	17,321	23,132	16,452	20,418
9	26,792	31,214	21,235	21,619	21,741	25,581	18,203	24,373	17,501	20,854
10	28,110	32,076	22,273	22,509	22,608	26,462	17,719	25,902	18,111	21,533
11	29,255	32,906	23,203	23,353	23,432	26,608	21,515	27,412	18,486	22,045
12	30,356	33,704	24,094	24,150	24,214	26,753	22,086	28,905	19,328	22,610
13	31,393	34,470	24,947	24,902	24,952	26,896	22,628	30,379	19,910	23,086
14	32,285	35,075	25,560	25,577	25,583	27,067	23,080	31,185	20,151	23,612
15	33,201	35,648	26,132	26,205	26,172	27,239	23,504	31,942	20,373	24,290
16	33,922	35,864	26,664	26,787	26,717	27,413	23,899	32,651	20,578	24,687
17	34,685	36,395	27,156	27,324	27,220	27,587	24,265	33,311	20,765	25,160
18	35,345	36,731	27,609	27,814	27,680	27,762	24,603	33,923	20,934	25,512
19	35,928	37,117	28,022	28,258	28,097	27,724	24,911	34,487	21,086	25,817
20	36,494	37,593	28,394	28,655	28,471	27,831	25,191	35,002	21,219	26,074
21	37,107	38,425	28,727	29,007	28,803	28,292	25,442	35,469	21,335	26,288
22	37,576	38,777	29,020	29,312	29,091	28,471	25,664	35,887	21,433	26,453
23	37,995	39,097	29,273	29,571	29,337	28,651	25,857	36,258	21,513	26,576
24	38,367	39,386	29,487	29,784	29,540	28,831	26,021	36,579	21,575	26,659
25	38,685	39,644	29,660	29,951	29,700	29,013	26,157	36,853	21,619	26,690

APPENDIX F
CONTINUATION RATES ACROSS NINE OFFICER AFSs: JUNE 1988 TO JUNE 1989

	Engineers			
Yos	**25xx**	**26xx**	**28xx**	**55xx**
1	0.981	1.000	0.996	1.000
2	1.000	1.000	0.995	1.000
3	0.969	0.990	0.993	0.976
4	0.894	0.865	0.865	0.773
5	0.902	0.849	0.879	0.902
6	0.967	0.921	0.882	0.916
7	0.956	0.955	0.914	0.927
8	0.962	0.969	0.939	0.942
9	0.980	0.959	0.941	0.938
10	0.942	0.969	0.955	0.961
11	0.980	0.974	0.970	0.960
12	0.863	0.968	0.974	0.921
13	0.952	0.962	0.986	0.971
14	0.971	0.977	0.986	1.000
15	0.980	0.977	0.979	0.984
16	1.000	0.965	0.996	0.986
17	1.000	1.000	1.000	0.986
18	1.000	1.000	1.000	1.000
19	1.000	1.000	0.994	0.982
20	0.588	0.554	0.696	0.766
21	0.738	0.590	0.630	0.780
22	0.885	0.571	0.785	0.773
23	0.833	0.727	0.810	0.933
24	0.867	0.667	0.719	0.889
25	0.815	0.909	0.762	0.955

APPENDIX G
SRVM SERVICE STATE VALUES ACROSS NINE OFFICER AFSs

	Engineers			
Yos	25xx	26xx	28xx	55xx
1	$26,770	$23,552	$28,215	$26,187
2	28,600	25,699	29,542	27,577
3	29,465	28,045	30,879	28,835
4	31,437	29,297	31,890	30,074
5	32,270	30,573	33,092	31,371
6	33,644	33,035	34,110	32,627
7	34,805	33,641	35,229	33,939
8	35,901	35,137	36,218	35,067
9	36,448	36,391	37,123	35,954
10	37,272	37,371	37,898	37,074
11	38,183	38,715	38,870	38,068
12	38,888	40,062	39,597	38,919
13	39,493	40,881	40,471	39,914
14	39,551	41,719	41,043	40,689
15	40,512	42,356	41,773	41,167
16	41,413	43,236	42,344	42,049
17	42,373	43,881	43,047	42,579
18	42,454	44,691	43,565	43,068
19	42,981	45,341	44,093	43,737
20	43,356	45,483	44,504	44,352
21	43,513	46,349	45,018	44,726
22	44,075	46,676	45,379	45,223
23	44,208	46,957	45,923	45,608
24	44,189	46,390	46,109	41,757
25	44,662	47,782	46,402	46,531

APPENDIX H
ENPVM SERVICE STATE VALUES ACROSS NINE OFFICER AFSs

	Engineers			
Yos	25xx	26xx	28xx	55xx
1	($8,899)	($28,928)	($21,116)	($11,201)
2	28,600	25,699	29,542	27,577
3	29,465	28,045	30,879	28,835
4	31,437	29,297	31,890	30,074
5	32,270	30,573	33,092	31,371
6	33,644	33,035	34,110	32,627
7	34,805	33,641	35,229	33,939
8	35,901	35,137	36,218	35,067
9	36,448	36,391	37,123	35,954
10	37,272	37,371	37,898	37,074
11	38,183	38,715	38,870	38,068
12	38,888	40,062	39,597	38,919
13	39,493	40,881	40,471	39,914
14	39,551	41,719	41,043	40,689
15	40,512	42,356	41,773	41,167
16	41,413	43,236	42,344	42,049
17	42,373	43,881	43,047	42,579
18	42,454	44,691	43,565	43,068
19	42,981	45,341	44,093	43,737
20	43,356	45,483	44,504	44,352
21	43,513	46,349	45,018	44,726
22	44,075	46,676	45,379	45,223
23	44,208	46,957	45,923	45,608
24	44,189	46,390	46,109	41,757
25	44,662	47,782	46,402	46,531