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Assessing Projections of Institutional Training Program Requirements

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CHAPTER 1
INTRODUCTION AND SUMMARY

PURPOSE OF PAPER

This paper presents the results of our work on developing tools for reviewing military training loads and resource projections. This analysis focuses on two training categories: Recruit Training (RT) and the Army's One-Station Unit Training (OSUT). Subsequent work will explore other training categories (e.g., Specialized Skill Training, Flight Training). Our ultimate aim is to develop a model that can analyze projected training loads and resources.

SUMMARY OF FINDINGS

Our findings address the following three areas: RT and Army OSUT training loads, training manpower resources, and fiscal resources.

RT AND ARMY OSUT TRAINING LOADS

We found a consistent, quantifiable relationship between RT and Army OSUT training loads and non-prior service (NPS) accessions. We calculated the ratios of RT and OSUT training loads to NPS accessions over the 11-year period from FY80 through FY90. We compared these ratios to actual experience in FY85 through FY90 and found only 5 cases out of 24 (four Military Services times 6 years for each) in which the actual ratio was more than 10 percent different from the 11-year average ratio. These ratios, listed in Table 1-1, are useful in estimating RT and OSUT loads based on the number of NPS accessions.

To estimate the annual RT load for a Military Service, multiply estimated NPS accessions (including active and reserve components) for that year by the appropriate ratio shown in Table 1-1.

TABLE 1-1

AVERAGE RATIOS OF TRAINING LOADS TO NPS ACCESSIONS

Military Service	Ratio
Army	.19[a]
Navy	.17
Marine Corps	.23
Air Force	.12
Average – DoD	.18

[a]Composite RT and Army OSUT ratio.

TRAINING MANPOWER RESOURCES

We performed regression analyses using training workloads as the independent variable and training manpower, as reported in the Future Years Defense Program (FYDP) program elements, as the dependent variable.[1] We found that training workloads by themselves are *not* good predictors of training manpower (coefficients of determination are generally less than .5). More research is required to identify additional explanatory variables. However, in exploring an interim approach, we found that ratios of training workload to instructors and support manpower are reasonably stable within each Service. These ratios, which are useful for analysis, are shown in Table 1-2.

TABLE 1-2

RATIOS OF TRAINING WORKLOAD TO INSTRUCTORS AND SUPPORT MANPOWER

Training category	Factor
Army RT	5.0
Army OSUT	2.75
Navy RT	8.5
Marine Corps RT	4.0
Air Force RT	10.0

[1]There is a difference between training loads and training workloads. Training loads refer to the amount of training that a Military Service's members are undergoing, regardless of which Military Service is administering that training. Training workloads, on the other hand, refer to the amount of training that a Military Service is conducting, regardless of the parent Military Service. The distinction is developed further in Chapters 2 and 3.

To estimate instructors and support manpower levels in the FYDP for a Military Service, divide training workloads by the factors shown in Table 1-2.

FISCAL RESOURCES

As with our analysis of manpower resources, we performed regression analyses using workload to predict operations and maintenance (O&M) funding. We also analyzed the ratios of O&M funding per man-year of workload. We could not develop a useful analytical tool using either technique. Coefficients of determination for the regression analyses that we performed indicate that, at best, variances in workload account for only about one-half of the variance in O&M funding. Furthermore, ratios of O&M funding to man-year of workload vary widely over time.

- Low coefficients of determination indicate that other factors, beyond workloads, affect O&M funding levels. These factors include changes in course content (such as increases or decreases in the amount of hands-on equipment training), replacement of military instructors with civilians, and other similar kinds of decisions. Proxies to represent these factors need to be developed and incorporated into the prediction expressions.

- We examined the ratios of O&M funding to workload as an interim technique. The dramatic decreases the Army expects on a per man-year basis for both RT and OSUT cause us to hold short of proposing single ratios to use in analyzing Army O&M funding. The Navy's O&M funding ranged between $410 and $494 per man-year during FY85 through FY90, and the ratio is forecasted to remain within that range over the next 3 years. The Marine Corps' (MC) ratios have ranged widely (between $623 and $923) with no apparent trend throughout the period from FY85 through FY90. The Air Force's (AF) ratio increased dramatically, from $367 to $830 per man-year, over the same period. We did not conduct the more detailed analysis required to understand the factors that drive these variations over the course of time. Until such an analysis has been completed, we believe it would be imprudent to suggest specific ratios for use in analysis.

ORGANIZATION OF PAPER

In Chapter 2, we describe the relationship between NPS accessions and training loads in RT and the Army's OSUT. In Chapter 3, we investigate the relationship between training manpower resources and training workloads. In Chapter 4, we address fiscal resources and training workloads.

The appendices provide graphical displays of NPS accessions and training loads (Appendix A) and our regression analyses (Appendices B and C).

CHAPTER 2
ANALYSIS OF TRAINING LOADS

INTRODUCTION

This chapter discusses how training loads are calculated and presents information about actual training loads and near-term projections. We present information about NPS accessions, the factor that most directly influences RT and Army OSUT training loads. We then relate training load and NPS accession data. The chapter ends with an illustrative example.

RECENT RT AND ARMY OSUT LOADS

DEFINITION OF TRAINING LOAD

A Military Service's training load[2] is the average number of its trainees, students, and cadets in training during a given period of time, usually a year. It consists of all individual training that trainees are undergoing, regardless of the agency actually conducting the training – the parent Service, another Service, or an agency outside of the DoD. Training loads include all military manpower in all assignment statuses. That is, some trainees and students receive the training while in a permanent change of station status, some are in a temporary duty or temporary additional duty status, and still others are attending class while in transit from one permanent assignment to another. Training load pertains to both active and reserve component personnel. Finally, training loads are the product of manpower and time; as such, they are expressed in man-years or man-months, for example.

The Military Services report training loads to the Office of the Secretary of Defense and to Congress in annual Military Manpower Training Reports (MMTRs) and in justification materials with appropriation requests submitted to Congress.

[2]This discussion is derived from Department of Defense, *Military Manpower Training Report*, April 1991, p. VIII-1.

CALCULATION OF TRAINING LOAD

Three factors are used to calculate the training load for a course: (1) the number of entrants, (2) the number of graduates, and (3) the length of the course. For a given course, the training load is calculated using the following expression:

$$\frac{(\text{Entrants} + \text{graduates})}{2} \times \text{course length (as a fraction of a year)}$$

For example, if 100 enlisted personnel enter an 8-week course and 90 personnel graduate, the training load for the course is

$$(100 + 90)/2 \times 8/50 = 15.2 \text{ man-years.}^3$$

The Military Services forecast annual training loads for RT and Army OSUT by summing the training loads, as calculated above, for all individual courses conducted during the year.

RECENT EXPERIENCE AND NEAR-TERM PROJECTIONS

In the aggregate, training loads have *steadily decreased* since FY85. Also, according to information in the MMTRs, course lengths and the number of times the courses are conducted annually have remained about the same since FY85. Therefore, the decreases in training loads reflect the fact that the Military Services have fewer personnel entering and graduating from RT and Army OSUT.

Table 2-1 provides the actual and projected (estimated) training loads for Service RT and Army OSUT for the period from FY85 through FY93. Entries include both active and reserve component personnel. Data from FY85 through FY90 reflect actual experience; numbers for FY91 and beyond are estimates.[4]

Next, we discuss NPS accessions, who are the entrants to RT and Army OSUT.

[3]Calculations for training load use 50 weeks per year.

[4]At the time this report was prepared, the FY93 MMTR containing the actual FY91 data was not available. We will update this analysis when FY91 data become available.

TABLE 2-1
RT AND ARMY OSUT TRAINING LOADS
(Thousands of trainee man-years)

Training category	Training loads (000)								
	Actual experience						Estimates		
	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
Army RT	17.6	18.0	19.0	17.2	18.0	19.6	16.3	15.2	15.2
Army OSUT	19.0	16.7	13.5	13.5	13.4	14.0	13.3	12.5	12.1
Navy RT	14.8	16.0	15.9	15.2	13.0	11.1	12.4	11.1	10.9
Marine Corps RT	10.4	9.4	9.3	9.5	9.3	9.4	8.8	9.1	8.8
Air Force RT	9.0	8.6	7.4	5.5	5.5	5.1	4.3	4.4	4.3
Total DoD	70.8	68.7	65.1	60.9	59.2	59.2	55.1	52.3	51.3

Source: MMTRs for FY91 (dated March 1990) and FY92 (dated April 1991).

NON-PRIOR SERVICE ACCESSIONS

Table 2-2 provides actual (FY85 through FY90) and projected (FY91 through FY93) NPS accessions for each of the Military Services. The entries are taken from Defense Manpower Requirements Reports (DMRRs) and include both active and reserve component accessions as reported in those documents.

TABLE 2-2
NPS ACCESSIONS
(Thousands of persons)

Military Service	NPS accessions (000)								
	Actual experience						Estimates		
	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
Army	187.7	204.4	196.1	170.7	176.7	150.2	152.8	132.0	125.7
Navy	82.8	88.5	87.8	90.0	89.4	70.5	80.4	71.5	70.6
Marine Corps	43.3	43.7	42.4	43.8	40.7	41.0	38.2	37.7	39.3
Air Force	73.3	73.4	63.5	47.9	50.6	42.5	37.5	37.6	36.6
Total DoD	387.1	410.0	389.8	352.4	357.4	304.2	308.9	278.8	272.2

Total NPS accessions have declined for all of the Military Services since their peak values in the mid-1980s, particularly for the Army and the (AF).

RELATING RECENT RT AND ARMY OSUT LOADS TO NPS ACCESSIONS

Now we combine the data presented in the first two parts of this chapter. Figure 2-1 provides an overall perspective by tracing how NPS accessions and RT and Army OSUT loads for the DoD as a whole have changed over time.[5]

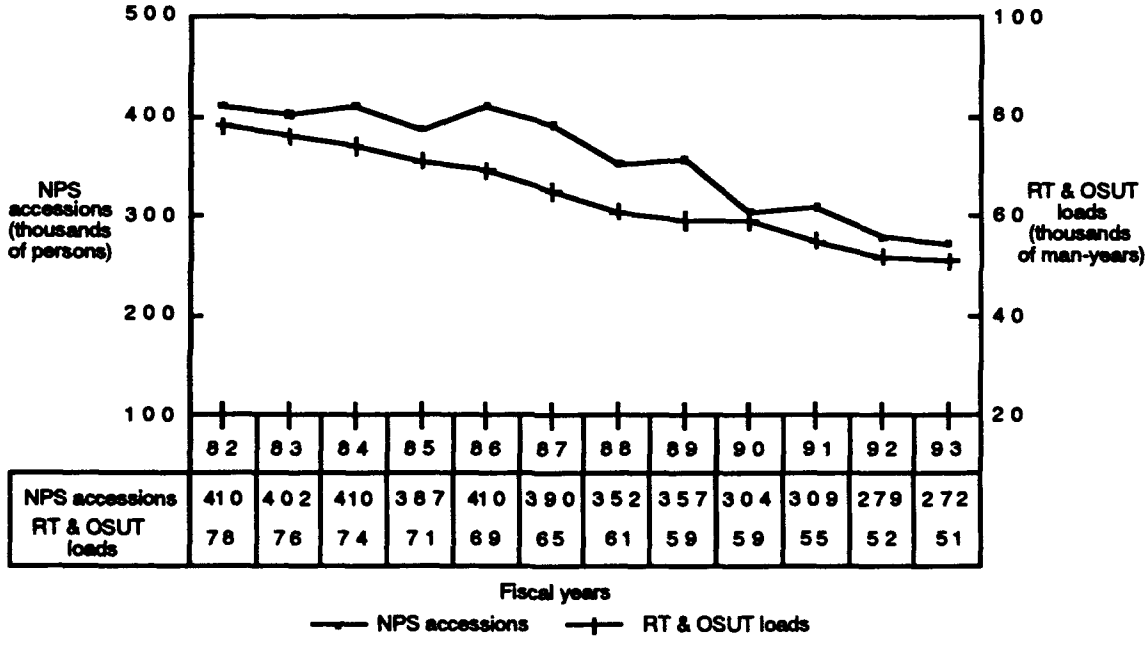


FIG. 2-1. TOTAL DoD NPS ACCESSIONS AND RT AND ARMY OSUT LOADS

The trends suggest that the relationship between RT and Army OSUT loads and NPS accessions is generally consistent over time.

[5]As mentioned earlier, we have restricted our data sources for this initial study to the publications routinely made available to the OSD staff: the FYDP, the MMTRs, and the DMRRs. In collecting data on NPS accessions from the DMRRs, we found that the FY84 figures for the Air Force were missing. Therefore, Figure 2-1 uses the average of FY83 and FY85 to estimate FY84 Air Force NPS accessions.

To provide a more quantitative characterization, Table 2-3 displays the ratios of RT and Army OSUT training loads to NPS accessions from FY80 through FY90. We provide an average ratio and the range of values for the period as well.

TABLE 2-3

RATIO OF RT AND ARMY OSUT LOADS TO NPS ACCESSIONS

Military Service	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	FY90	Avg.	Range
Army	.19	.19	.21	.21	.19	.19	.17	.17	.18	.18	.22	.19	.17–.22
Navy	.14	.16	.18	.17	.18	.18	.18	.18	.17	.15	.16	.17	.14–.18
Marine Corps	.24	.24	.23	.24	.24	.24	.22	.22	.22	.23	.23	.23	.22–.24
Air Force[a]	–	–	.13	.12	.11	.12	.12	.12	.11	.11	.12	.12	.11–.13

[a]We do not have data on the AF accessions-to-training-load ratio for FY80 and FY81 since the DMRRs for those years do not contain AF NPS accession data.

The ratios of training loads to NPS accessions remain within narrow bands throughout the period. The minor year-to-year fluctuations in the ratios displayed in Table 2-3 are due to several factors.

- *Spill-over into the next fiscal year and reserve component delays.* The most productive recruiting months are June through September and January; some late-summer accessions do not become entrants into RT and OSUT until the fall and would be included as entrants in the following fiscal year's courses. Furthermore, some reserve component enlisted personnel may delay attending initial training because of civilian employment commitments or other reasons. This creates a pool of NPS accessions who are not immediately incorporated into the training loads for the fiscal year in which accessed.

- *Changes in attrition rates.* A course's attrition rate is the percentage of entrants who do not graduate. A lower attrition rate would increase training loads and a higher attrition rate would decrease training loads.

- *Changes in course length.* For the same level of accessions, a decision to change course length will result in a change in loads. Since we found that RT and Army OSUT course-length changes are made infrequently and typically result in adding or subtracting at most 1 week from the course, this factor would contribute only to minor fluctuations.

- *Incorrect data.* Beyond the explanations described above is the possibility that the data have been incorrectly processed or reported.

To assess how estimates developed using the 11-year averages compare to actual experience, we multiplied NPS accessions by the average ratios shown in the second column from the right in Table 2-3 for each Military Service. The results are shown in Table 2-4; load information is expressed in thousands of man-years.

TABLE 2-4
ACTUAL VERSUS ESTIMATED TRAINING LOADS

Training category	FY85	FY86	FY87	FY88	FY89	FY90	Total
Army RT and OSUT							
NPS accessions (thousands)	188	204	196	171	177	150	1,086
Actual load	36.6	34.7	32.5	30.7	31.4	33.6	199.5
Estimated load using average ratio (.19)	35.7	38.8	37.2	32.5	33.6	28.5	206.3
Percentage difference	2.4%	(11.7%)	(14.6%)	(5.8%)	(7.1%)	15.2%	(3.4%)
Navy RT							
NPS accessions (thousands)	83	89	88	90	89	71	510
Actual load	14.8	16.0	15.9	15.2	13.0	11.1	86.0
Estimated load using average ratio (.17)	14.1	15.1	15.0	15.3	15.1	12.1	86.7
Percentage difference	4.7%	5.4%	5.9%	(0.7%)	(16.4%)	(8.7%)	(0.8%)
Marine Corps RT							
NPS accessions (thousands)	43	44	42	44	41	41	255
Actual load	10.4	9.4	9.3	9.5	9.3	9.4	57.3
Estimated load using average ratio (.23)	9.9	10.1	9.7	10.1	9.4	9.4	58.7
Percentage difference	5.1%	(7.4%)	(4.3%)	(6.3%)	(1.1%)	0.0%	(2.4%)
Air Force RT							
NPS accessions (thousands)	73	73	64	48	51	43	351
Actual load	9.0	8.6	7.4	5.5	5.5	5.1	41.1
Estimated load using average ratio (.12)	8.8	8.8	7.6	5.8	6.1	5.2	42.1
Percentage difference	2.7%	(1.9%)	(2.2%)	(4.7%)	(11.3%)	(1.2%)	(2.5%)

As Table 2-4 shows, the estimates are usually within 10 percent of actual experience.

FINDING

We found a consistent, quantifiable relationship between RT and Army OSUT training loads and NPS accessions. We calculated the ratio of RT and Army OSUT training loads to NPS accessions over the period from FY80 through FY90 and found that actual experience in any given year was usually within 10 percent of the 11-year ratio average. The Military Service ratios, listed in Table 2-5, can be used to estimate RT and Army OSUT loads by multiplying them by the number of expected NPS accessions in a given year.

TABLE 2-5

AVERAGE RATIOS OF TRAINING LOADS TO NPS ACCESSIONS

Military Service	Ratio
Army	.19[a]
Navy	.17
Marine Corps	.23
Air Force	.12
Average – DoD	.18

[a]Composite RT and Army OSUT Ratio.

When conducting analyses, those ratios can be used to identify major departures from past experience and thereby guide required follow-on analyses.

ILLUSTRATIVE HYPOTHETICAL EXAMPLE

Consider the following hypothetical example. The Military Services submitted the training load profiles shown in Table 2-6 for RT and Army OSUT training loads in their *Program Objective Memoranda.*

TABLE 2-6
SUBMISSIONS FOR RT AND ARMY OSUT TRAINING LOADS
(Thousands of man-years)

Training category	FY94	FY95	FY96	FY97	FY98	FY99
Army RT and OSUT	27.2	25.0	24.4	23.8	30.0	30.0
Navy RT	11.5	12.1	11.6	10.0	10.0	10.0
Marine Corps RT	8.8	8.9	9.1	8.7	8.6	9.4
Air Force RT	4.5	4.4	4.7	4.6	4.5	4.8

Note: The data shown are hypothetical.

Also, suppose that the Military Services have submitted the profiles shown in Table 2-7 for total NPS accessions during the same period.

TABLE 2-7
SUBMISSIONS FOR NPS ACCESSIONS
(Thousands of persons)

Military Service	FY94	FY95	FY96	FY97	FY98	FY99
Army	110.0	95.0	80.0	90.0	100.0	100.0
Navy	68.8	74.0	73.0	78.0	80.4	81.0
Marine Corps	38.5	38.7	39.0	40.0	38.5	38.0
Air Force	35.0	30.0	28.0	26.0	33.0	35.0

Note: The data shown are hypothetical.

To estimate training loads using historical data, multiply the estimated NPS accessions (from Table 2-7) by the associated ratios in Table 2-5 for each year. Table 2-8 shows these estimated training loads; Table 2-9 shows the percentage difference between these load estimates and the hypothetical Military Service projections.

TABLE 2-8

ESTIMATED TRAINING LOADS USING HISTORICAL EXPERIENCE

(Thousands of man-years)

Military Service	FY94	FY95	FY96	FY97	FY98	FY99
Army	20.9	18.1	15.2	17.1	19.0	19.0
Navy	11.7	12.6	12.4	13.3	13.7	13.8
Marine Corps	8.9	8.9	9.0	9.2	8.9	8.7
Air Force	4.2	3.6	3.4	3.1	4.0	4.2

Note: The data shown are hypothetical.

TABLE 2-9

SUBMISSIONS LESS ESTIMATES DIVIDED BY SUBMISSIONS

Military Service	FY94 (%)	FY95 (%)	FY96 (%)	FY97 (%)	FY98 (%)	FY99 (%)
Army	23.2	27.6	37.7	28.2	36.7	36.7
Navy	–1.7	–4.0	–7.0	–32.6	–36.7	–37.7
Marine Corps	–1.1	0.0	1.1	–5.7	–3.5	–18.1
Air Force	6.7	18.2	27.7	32.6	11.1	12.5

Note: The data shown are hypothetical.

Based on the differences shown in Table 2-9, we would conclude the following (all conclusions are hypothetical):

- The Army's RT and OSUT load submissions are higher than expected in every year. The Army may have decided to alter its RT and OSUT programs dramatically, understated its NPS accessions (e.g., a training load of 27,200 man-years in FY94 equates to an NPS accession level of about 143,000 persons using historical experience), or mistakenly reported its training load. Follow-up analysis and discussion with the Army to identify reasons for higher than expected loads are appropriate.

- The Navy's RT projected loads are comparable with past experience through FY96. The Navy's out-year loads, beginning in FY97, are significantly lower than historical trends. The Navy may have simply "straight-lined" its out-year training load submission. Follow-up on the three out-years is appropriate.

- The MC projected loads seem consistent with past experience. Follow-on research or discussions appear to be unnecessary.
- The AF's projected loads, like the Army's, are generally higher than historical experience. Follow-up analysis is appropriate.

CHAPTER 3

ANALYSIS OF TRAINING MANPOWER

INTRODUCTION

This chapter discusses manpower resources that have been programmed in FYDP program elements (PEs) to conduct RT and Army OSUT, relates those resources to workloads, and explores tools for conducting resource analysis based on relationships observed between resources and workloads.

In this chapter, we will be focusing on *training workloads*, as opposed to *training loads*, which we discussed in Chapter 2. A Military Service's *training workload* includes all trainees and students whom the Service is training, regardless of the parent Military Service. Training workload measures the output of that Service's training establishment. On the other hand, a Military Service's *training load* refers to the members of that Service undergoing training, regardless of the Service conducting the training. An example best illustrates the distinction between the two concepts: The MC sends its pilots to Navy aviation schools for training. The MC includes these students in its training load, whereas the Navy includes these students in its training workload. In this chapter, we will be analyzing the resources necessary to conduct training (the inputs to the training establishment); therefore, we will be focusing on training workloads (the output of the training establishment).

All the Military Services conduct RT for their own members only and the Army conducts OSUT for Army personnel only. Therefore, in these cases, training loads and workloads are quantitatively the same. For all other training categories, in which the Military Services train individuals from other Services and agencies, training loads and workloads differ quantitatively.

Since we have limited this analysis to the information contained in the FYDP, the levels of instructors and support manpower are *end strengths* as of the 30th of September in each of the fiscal years we have considered. A more appropriate measure of instructors and

support manpower related to training workload is probably *average strength*, which is the arithmetic mean of the number of personnel assigned to the PE during the year. This may be calculated on a monthly, quarterly, or yearly basis. In this report, we work with end strength figures; in subsequent research, we will conduct analyses using average strengths.

ESTIMATING RT AND ARMY OSUT MANPOWER RESOURCES

Performance of RT and Army OSUT requires instructors, support personnel, training facilities and equipment, and associated maintenance activities. The Military Services program and budget the resources needed to support these requirements in the RT and Army OSUT PEs of the FYDP. Manpower assigned to RT (PEs 804711 for all four Military Services) and Army OSUT (PE 804761) includes personnel who conduct and directly support instruction. Manpower providing indirect support of RT and Army OSUT, such as operating bases and facilities, maintaining equipment, and producing training aids, is assigned to the PEs for base operations (PE 805796) and real property maintenance activities (PE 805794) within Program 8T. Manpower in support of training includes military personnel, civilians, and contractor personnel.

Table 3-1 displays end strengths programmed in the FYDP in the four RT PEs and the Army OSUT PE for the period from FY85 through FY93. Entries for FY85 through FY90 represent actual experience; figures for FY91 through FY93 are estimates.[6] Total DoD manpower in support of training decreased from about 18,200 at the end of FY85 to 14,100 by the end of FY90. The Army reduced its manpower in support of training by the greatest amount: combined RT and Army OSUT manpower declined from about 13,200 in FY85 to about 8,800 by the end of FY90. The Navy assigned essentially the same amount of manpower to RT from FY85 through FY90 as the MC did. However, the Navy plans to reduce its RT manpower over the next few years while the MC intends to remain essentially at current levels. The Air Force has also been reducing manpower assigned to PEs since FY85, and their projections call for continued reductions.

[6]The data are from the FYDP, as of the Amended FY92/93 President's Budget, submitted to Congress in January 1992.

TABLE 3-1
MANPOWER SUPPORTING TRAINING ASSIGNED TO RT AND OSUT PEs

Manpower in support of training	Actual experience						Estimates		
	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
PE 804711A – Army RT									
Army officers	607	527	591	543	451	386	370	333	302
Army enlisted	4,259	3,950	4,576	4,230	3,539	3,196	2,890	2,624	2,623
Army civilians	145	90	157	177	132	122	84	80	86
Total Army RT	5,011	4,567	5,324	4,950	4,122	3,684	3,344	3,037	3,011
PE 804761A – Army OSUT									
Army officers	751	941	578	470	398	414	394	351	318
Army enlisted	6,898	6,589	6,073	4,667	4,149	4,373	4,367	3,860	3,966
Army civilians	536	493	585	324	334	311	298	265	248
Total Army OSUT	8,185	8,023	7,236	5,461	4,881	5,098	5,077	4,476	4,532
PE 804711N – Navy RT									
Navy officers	84	91	88	85	83	75	77	74	71
MC officers	24	24	23	28	29	25	28	20	19
Navy enlisted	1,420	1,436	1,438	1,429	1,410	1,538	1,301	1,187	1,116
MC enlisted	20	19	18	24	25	23	26	21	20
Navy reserve enlisted	295	346	424	151	2	654	5	5	3
Navy civilians	14	19	19	15	16	12	15	19	23
Total Navy RT	1,857	1,935	2,010	1,732	1,565	2,327	1,452	1,326	1,252
PE 804711M – Marine Corps RT									
MC officers	244	239	250	241	251	230	264	264	235
MC enlisted	2,186	2,107	2,099	2,088	2,086	2,185	2,050	2,050	2,043
MC civilians	10	11	9	9	9	9	8	8	8
Total Marine Corps RT	2,440	2,357	2,358	2,338	2,326	2,424	2,322	2,322	2,286
PE 804711F – Air Force RT									
AF officers	32	30	30	29	29	29	29	29	29
AF enlisted	694	681	587	450	478	518	390	390	390
AF civilians	18	18	18	8	8	8	8	8	8
Total Air Force RT	744	729	635	487	515	555	427	427	427
Total DoD manpower	18,237	17,611	17,563	14,968	13,409	14,088	12,622	11,588	11,508

Source: FY92/93 President's Budget.

Note: MC = Marine Corps; AF = Air Force.

RELATING TRAINING MANPOWER RESOURCES TO WORKLOADS

We present our analysis of the relationship between training manpower (instructors and support manpower) and training workloads in two forms: (1) forecasting using regression techniques and (2) trend analysis using ratios of workload to instructors and support manpower. The aim of this analysis is to develop a method for predicting instructors and support manpower program levels in the Service RT and Army OSUT PEs based on workload.

REGRESSION ANALYSIS

Using regression analysis, we developed equations to predict instructors and support manpower using workload as an independent variable. We used data from the FYDP over the 11 years between FY80 and FY90, inclusive, for each of the Military Services. We did not include estimates for FY91 through FY93 in the calculations. Appendix B provides graphic plots and "best fit" equations for all cases; for illustration, we present in Figure 3-1 below the plot of Navy RT instructors and support manpower versus workload.

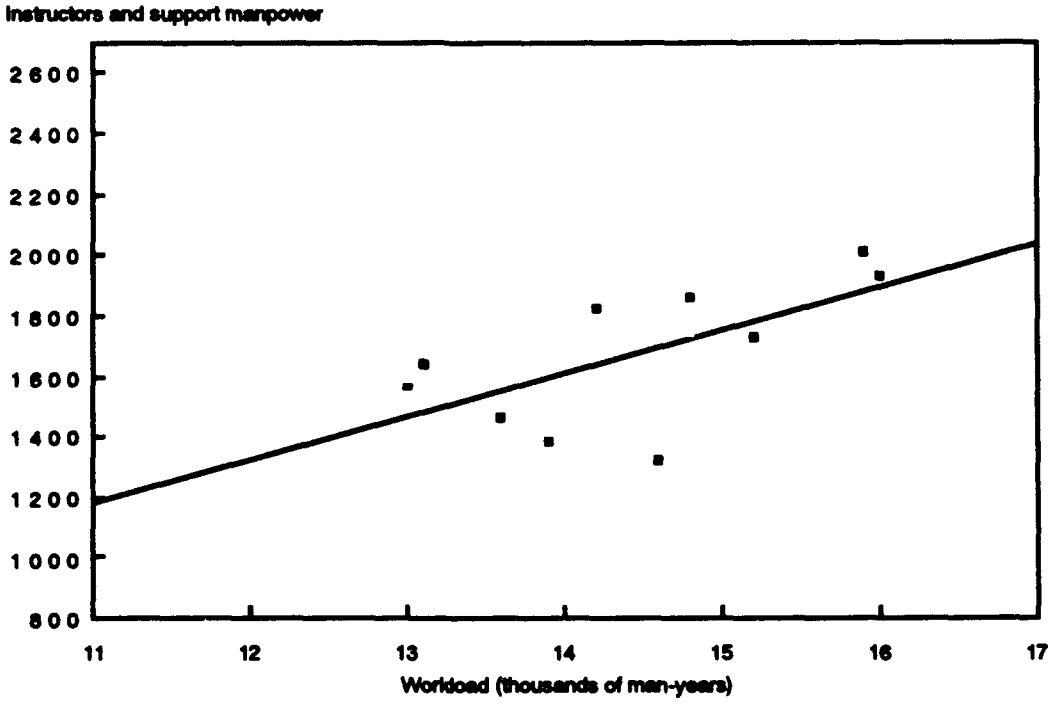


FIG. 3-1. NAVY RT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOADS

The equation of the best fit line is

$$Navy\ RT\ manpower = -384 + .14 \times Navy\ RT\ workload$$

The coefficient of determination is .41.

Among the regression analyses we performed, only AF RT workload and RT manpower correlate well – the coefficient of determination is .93. None of the other regressions produces a correlation approaching this level. The generally low correlations between instructors and support manpower and workloads indicate that a relatively small portion of the variation in instructors and support manpower is related to variation in workloads. To get a sense of what these non-workload factors might be, we reviewed budget justification materials that the Army submitted to Congress over several recent years. We found several instances in which manpower levels changed due to reasons unrelated to workload. Examples include reprogramming of manpower among Budget activity groups, changes in manpower to upgrade facilities, and changes attributed to congressional action. Additional research is needed to find ways to represent those factors and incorporate them into regression analyses.

TREND ANALYSIS USING RATIOS

Until research produces a method for developing predictive equations, analysts still need to develop an approach that highlights departures from past trends and provides the basis for further, more detailed analysis. A useful metric is to relate, in the form of a ratio, the amount of workload to the instructors and support manpower end strengths.

Workload-to-manpower ratios for each Military Service appear in Table 3-2. The table's entries result from dividing the number of man-years of RT and OSUT workload, as displayed in Table 2-1, by the number of instructors and support personnel assigned to each PE, as displayed in Table 3-1. (The ratios are similar to the student-teacher ratios we observe in the analysis of school systems.)

TABLE 3-2
RATIOS OF WORKLOAD TO INSTRUCTORS AND SUPPORT PERSONNEL

Training category	Training workloads								
	Actual experience						Estimates		
	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
Army RT	3.51	3.94	3.57	3.47	4.37	5.32	4.87	5.00	5.05
Army OSUT	2.32	2.08	1.87	2.47	2.75	2.75	2.62	2.79	2.67
Navy RT	7.97	8.27	7.91	8.78	8.31	4.77	8.54	8.37	8.71
Marine Corps RT	4.26	3.99	3.94	4.06	4.00	3.88	3.79	3.92	3.85
Air Force RT	12.10	11.80	11.65	11.29	10.68	9.19	10.07	10.30	10.07

Source: MMTRs for FY91, dated March 1990 and FY92, dated April 1991.

Over time, Army RT instructors and support manpower have been supporting increasing training workloads, from about 3.5 man-years of workload per instructor/support person in FY85 to more than 5.3 man-years by FY90. Army data indicate that the ratio is expected to remain at about 5 man-years per instructor/support person for the period from FY91 through FY93. The Navy RT ratios of workload to instructor/support person average about 8.5 for the entire period. [We have excluded FY90 in calculating this average because we noticed an unusually large one-time increase (from 2 in FY89, to 654 in FY90, to 5 in FY91) in the number of Navy reserve enlisted personnel assigned to this PE.] MC ratios remain at about 4 man-years of workload per instructor/support person throughout the period. The AF ratio decreased from over 12 man-years per instructor/support person in FY85, when training workload was about 9,000 man-years, to about 9.2 in FY90, when training workload was about 5,100 man-years. The ratio is expected to remain at about 10 in the 1990s.

FINDINGS

For the most part, workloads by themselves are not good predictors of programmed instructors and support manpower. More research is needed to identify additional variables that capture the effects of non-workload factors. In exploring for an interim approach, we found that the ratios of workload to instructors and support manpower can be used to make rough approximations, identify major departures from past experience, and highlight areas for additional analysis. These suggested ratios are shown in Table 3-3.

TABLE 3-3

RATIOS OF TRAINING WORKLOAD TO INSTRUCTORS AND SUPPORT MANPOWER

Training category	Ratio
Army RT	5.0
Army OSUT	2.75
Navy RT	8.5
Marine Corps RT	4.0
Air Force RT	10.0

ILLUSTRATIVE EXAMPLE

Suppose the Army's RT workload for a given fiscal year is expected to be 15,000 man-years. Using the ratio (5.0) provided in Table 3-3, we estimate that the Army will program about 3,000 instructors and support personnel in the Army's RT PE.

CHAPTER 4
ANALYSIS OF FISCAL RESOURCES

INTRODUCTION

The Military Services program and budget fiscal resources to support individual training in several appropriations. Most fiscal resources are programmed and budgeted in the military personnel and operations and maintenance (O&M) appropriations. Military pay appropriations address pay and allowances of instructors, support personnel, students, and trainees. The O&M appropriations cover civilian pay and benefits, trainee support, resident instruction, local preparation of training aids and training literature, consumer procurement of supplies and equipment, and contractual services. Temporary duty costs for staff and faculty, organizational clothing, and equipment issued for use in the training period are also included.[7] In this research we have chosen to concentrate on the O&M appropriations.

FISCAL RESOURCES

Tables 4-1 and 4-2 display funds programmed in the O&M appropriations for the period from FY85 through FY93 in current and constant FY92 dollars.[8] Entries from FY85 through FY90 represent actual experience, and figures from FY91 through FY93 are estimates.

[7]Department of the Army, "Amended FY92/FY93 Biennial Budget Estimates." *Justification Book* for the Operations and Maintenance, Army appropriation, submitted January 1992.

[8]We used standard DoD-wide deflators for O&M appropriations in converting current-year dollars to constant dollars. These deflators are contained in *National Defense Budget Estimates for FY92*, Office of the Comptroller of the Department of Defense, March 1991. The Military Services have unique deflators that differ slightly among the Services; use of Service-specific deflators would have negligible effects on our results.

TABLE 4-1

O&M APPROPRIATIONS PROGRAMMED IN RECRUIT TRAINING PEs
(Current dollars in millions)

PE	Title	Actual experience						Estimates		
		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
804711A	Recruit Training Units, Army	10,578	8,399	11,412	9,013	9,434	8,541	8,422	6,269	5,715
804761A	Integrated Recruit and Skill Training Units (OSUT)	31,275	26,408	28,345	19,656	18,895	19,224	15,177	13,903	11,599
804711N	Recruit Training Units, Navy	5,735	6,166	6,134	5,267	4,917	4,867	4,965	4,665	4,837
804711M	Recruit Training Units, MC	6,113	6,363	5,465	7,421	5,729	5,384	4,823	4,192	4,147
804711F	Recruit Training Units, AF	2,592	2,878	3,380	2,390	3,122	3,889	2,860	3,260	2,825
	Total	56,293	50,214	54,736	43,747	42,097	41,905	36,247	32,289	29,123

Note: MC = Marine Corps; AF = Air Force.

TABLE 4-2

O&M APPROPRIATIONS PROGRAMMED IN RECRUIT TRAINING PES
(Constant FY92 dollars in millions)

PE	Title	Actual experience						Estimates		
		FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
804711A	Recruit Training Units, Army	13,477	10,589	13,923	10,652	10,641	9,294	8,748	6,269	5,495
804761A	Integrated Recruit and Skill Training Units (OSUT)	39,846	33,293	34,580	23,231	21,312	20,918	15,765	13,903	11,152
804711N	Recruit Training Units, Navy	7,307	7,774	7,483	6,225	5,546	5,296	5,157	4,665	4,651
804711M	Recruit Training Units, MC	7,788	8,022	6,667	8,771	6,462	5,859	5,010	4,192	3,987
804711F	Recruit Training Units, AF	3,302	3,628	4,123	2,825	3,521	4,232	2,971	3,260	2,716
	Total	71,720	63,306	66,776	51,704	47,482	45,599	37,651	32,289	28,001

Note: MC = Marine Corps; AF = Air Force.

In constant-dollar terms, Table 4-2 shows that total O&M funding declined by more than 36 percent from FY85 through FY90. The Military Services plan to continue that trend through FY93. By FY93, the Military Services (in the aggregate) will be programming only about 40 percent as much for O&M funding of recruit training activities as they did in FY85. The Army in particular forecasts that O&M costs will decrease dramatically by FY93 from the mid-1980s levels.

RELATING FISCAL RESOURCES FOR TRAINING TO WORKLOADS

As with our analysis of manpower resources, we performed regression analysis to characterize the relationship between workloads and O&M funding. We also calculated ratios of O&M funding to workload to identify trends over time. In the subsections below we discuss the results of each of these analyses.

REGRESSION ANALYSIS

We hypothesized that there is a correlation between workload (a measure of output) and O&M funding (a measure of input). Therefore, we performed regression analysis using actual training workloads as the independent variable and actual O&M funding (expressed in FY92 constant dollars) as contained in the RT and Army OSUT PEs as the dependent variable. We performed this analysis for RT for all Military Services and for Army OSUT.

An example of our analysis is shown in Figure 4-1 which is the plot of MC RT workloads versus O&M funding. (The complete set of displays and regression equations that track O&M funding with RT and Army OSUT workloads are in Appendix C.)

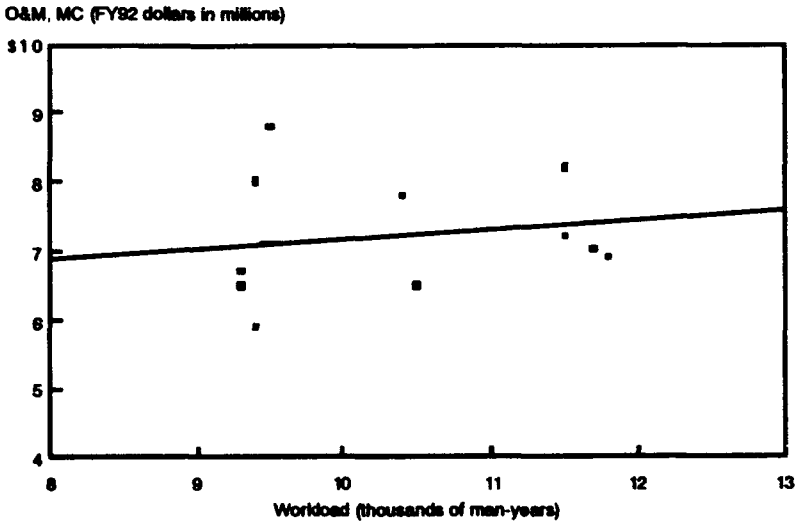


FIG. 4-1. MC RT WORKLOADS VERSUS O&M

The equation that best fits these data is

MC O&M funding for RT = 6,422 + .08 x MC RT workload

The coefficient of determination is .01.

After reviewing the results of all five regression analyses, we found that actual workloads do not correlate well with actual O&M funding. The coefficients of determination ranged from a low value of .01 for MC RT, as shown above, to a high value of only .42 for Navy RT. In other words, variations in O&M funding stem from variations in workloads in only a minor way. (In the case of MC RT, the two variables are virtually independent!)

To gain insight as to why workloads and O&M funding correlate so poorly, we reviewed budget justification materials provided over the past several years by the Military Services to Congress. Those materials provide a detailed breakdown of program increases and decreases that accompany year-to-year changes. Consider the Army's FY91 budget request for O&M funding to support RT, submitted to Congress in January 1990. Although the Army forecasted at the time that the RT training load would *decline* from 19,750 man-years in FY90 to 18,971 man-years in FY91, the Army's budget request, in current dollars, *increased* from $7.5 million in FY90 to $8.6 million in FY91. Of the total increase of $1.1 million, the Army attributed about $.6 million to price growth, resulting in a net program increase of about $.4 million (the numbers do not add precisely due to rounding). Table 4-3 breaks out the elements comprising that net projected program increase.

TABLE 4-3

NET PROJECTED PROGRAM INCREASE
(In millions of dollars)

Net projected program increase elements	Amount ($)
Program increases	
More field training and more training with hands-on equipment	.4
Replacement of military training personnel by civilians	.2
Total increases	.6
Program decreases	
Training workload reduction	.2
Net program increase	.4

The projected decrease in O&M funding associated with the reduction of 779 man-years of workload (from 19,750 to 18,971) is more than offset by expected increases in funding to support additional field training and more hands-on training. The expected replacement of military instructors with civilian instructors leads to an increase in O&M funding. (This increase will be offset by a reduction in the Military Personnel, Army appropriation, also programmed in the PE.)

After reviewing other budget justification materials and discussing the issue with resource analysts within the DoD, we concluded that the above example is representative of programming and budgeting realities. We believe that workloads alone cannot be used to predict O&M funding levels. As illustrated above, decisions to change the content of the training or to adjust the way in which it is administered can dominate workload changes. Proxies to represent these latter factors must be identified and incorporated into the analysis. Overall total obligational authority, the previous year's level of funding, and forecasted end strength appear to be reasonable candidates for such proxy variables. The use of these and other variables should be addressed in follow-on research.

TREND ANALYSIS USING RATIOS

As discussed above, the low correlations between O&M funding in the program elements and workloads indicate that workloads alone cannot be used with confidence to predict O&M funding. Until follow-on research can produce better predictive methods, some technique is needed to quickly identify anomalies or major changes in a Military Service's RT program that might warrant detailed follow-on review. One such technique is simply to calculate annual ratios of O&M funding in constant dollars to workload for each Military Service and to examine the ratios over time. We have made these calculations for each of the Services; the results are displayed in Table 4-4.

TABLE 4-4
O&M FUNDING PER MAN-YEAR OF TRAINING WORKLOAD
(Constant FY92 dollars in millions)

Training category	Actual experience						Estimates		
	FY85	FY86	FY87	FY88	FY89	FY90	FY91	FY92	FY93
Army – RT	766	588	733	619	591	474	537	412	361
Army – OSUT	2,097	1,994	2,561	1,721	1,590	1,494	1,185	1,112	922
Navy – RT	494	486	471	410	427	477	416	420	427
MC – RT	749	853	717	923	695	623	569	461	453
AF – RT	367	422	557	514	640	830	691	741	632

The Army has programmed far less O&M funding per RT and OSUT trainee man-year in the early 1990s than the level executed in the mid-1980s. For example, that the Army spent $733 per RT trainee man-year in FY87 and plans to expend $361 per man-year in FY93 – a decrease of about 50 percent in real terms. The Army also forecasts almost a *70 percent* reduction per trainee in OSUT over that same time frame. The Navy's expenditures remain about the same throughout the period, ranging from $410 per man-year to $494 per man-year. The MC' expenditures per trainee workload ranged widely during the period from FY85 through FY90, from a high of $923 per trainee man-year in FY88 to a low of $623 in FY90. The AF's per man-year expenditures generally rose through the latter half of the 1980s but are expected to decline significantly through FY93.

FINDINGS

Our findings are summarized as follows:

- We could not develop a useful analytical tool using training workloads *alone* to predict O&M funding levels. The two variables do not correlate well statistically. The coefficients of determination for the regression analyses that we performed indicate that, at best, variances in workload account for only about one-half of the variance in O&M.

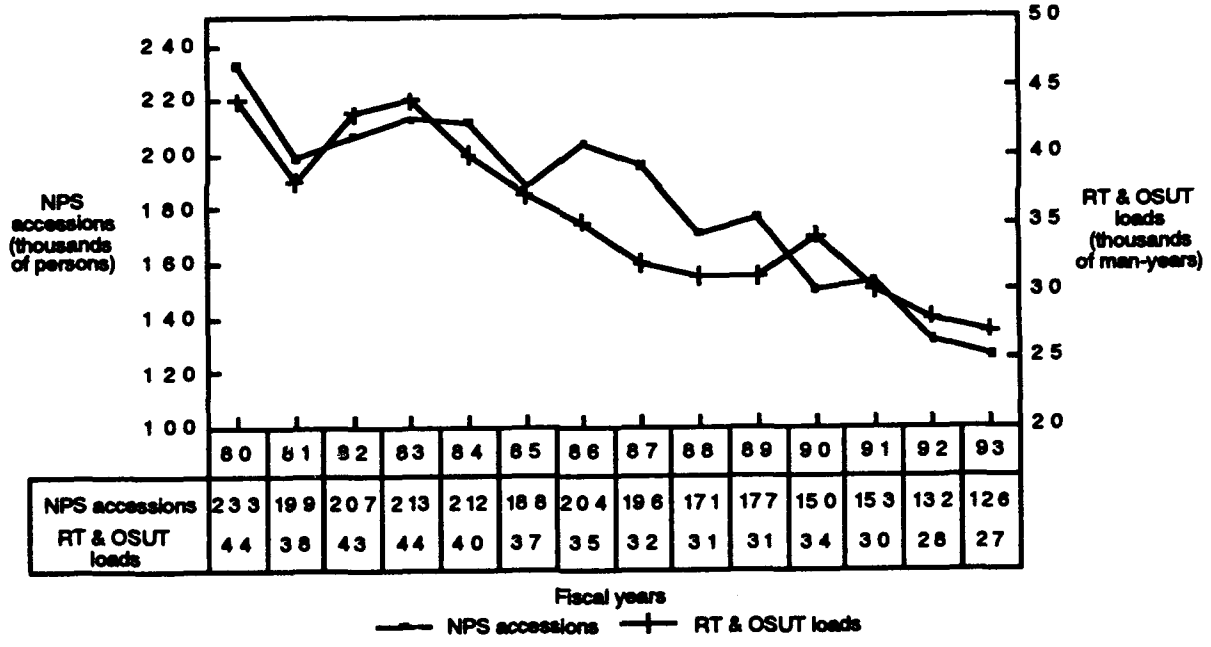
- Low coefficients of determination indicate that other factors, beyond workloads, affect O&M funding levels. These factors include, for example, changes in course content (such as increases or decreases in the amount of hands-on equipment training) and replacement of military instructors with civilians. Proxies to represent these factors need to be developed and incorporated into the prediction expressions.

- We examined the use of ratios of O&M funding to workload as an interim technique. The Navy's ratio is the only one that remained about the same over the period from FY85 to FY90. We believe that using a range – $400 to $450 per man-year in constant FY92 dollars – would be reasonable when reviewing O&M costs for given workload levels. None of the other Services' ratios have been stable enough to support using a number or range of numbers as an analytical device.

APPENDIX A

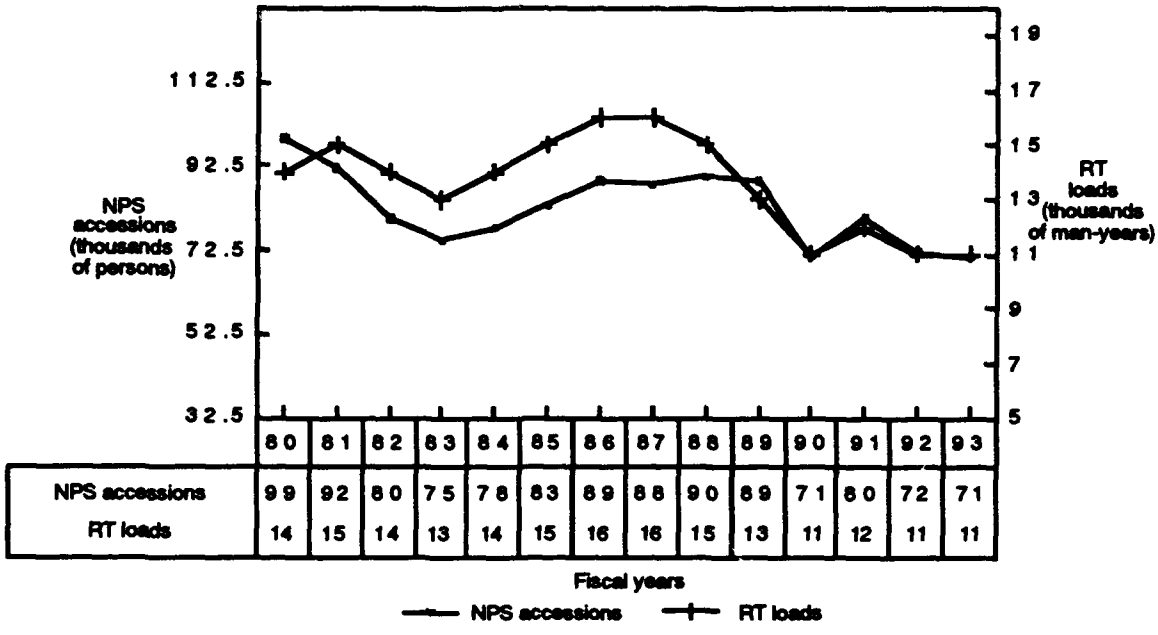
NON-PRIOR SERVICE ACCESSIONS AND TRAINING LOADS

Figures A-1 through A-4 present data on non-prior service (NPS) accessions and Recruit Training (RT) loads for each Military Service. The Army data also includes One-Station Unit Training (OSUT).



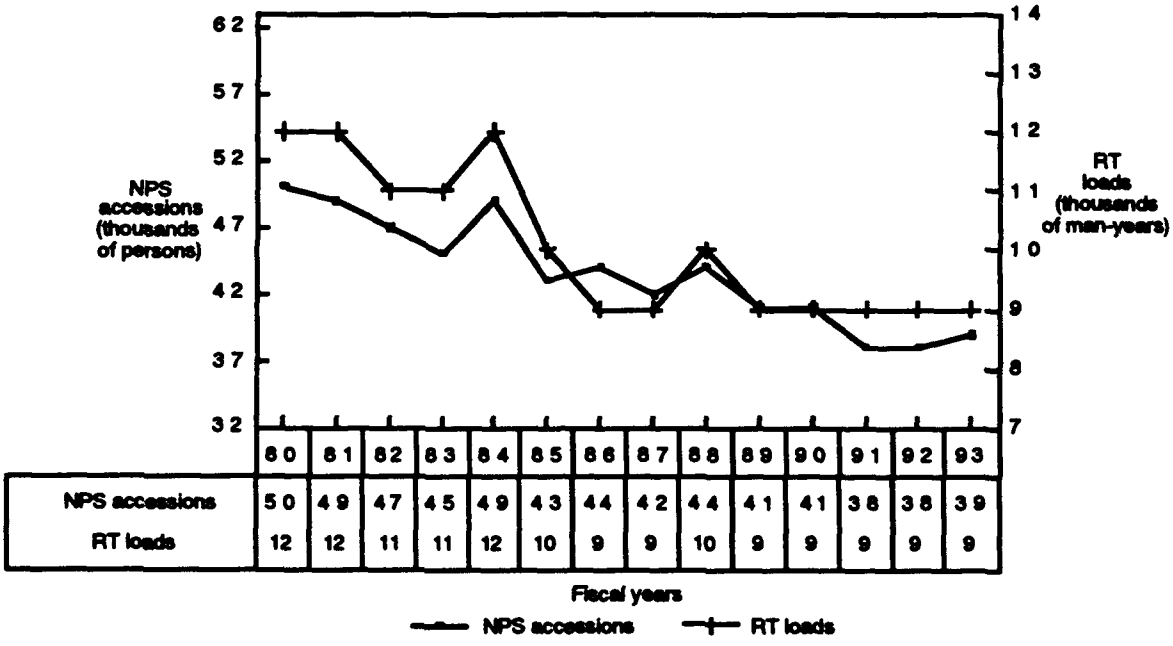
	80	81	82	83	84	85	86	87	88	89	90	91	92	93
NPS accessions	233	199	207	213	212	188	204	196	171	177	150	153	132	126
RT & OSUT loads	44	38	43	44	40	37	35	32	31	31	34	30	28	27

FIG. A-1. ARMY NPS ACCESSIONS AND RT AND OSUT LOADS



	80	81	82	83	84	85	86	87	88	89	90	91	92	93
NPS accessions	99	92	80	75	78	83	89	88	90	89	71	80	72	71
RT loads	14	15	14	13	14	15	16	16	15	13	11	12	11	11

FIG. A-2. NAVY NPS ACCESSIONS AND RT LOADS



	80	81	82	83	84	85	86	87	88	89	90	91	92	93
NPS accessions	50	49	47	45	49	43	44	42	44	41	41	38	38	39
RT loads	12	12	11	11	12	10	9	9	10	9	9	9	9	9

FIG. A-3. MC NPS ACCESSIONS AND RT LOADS

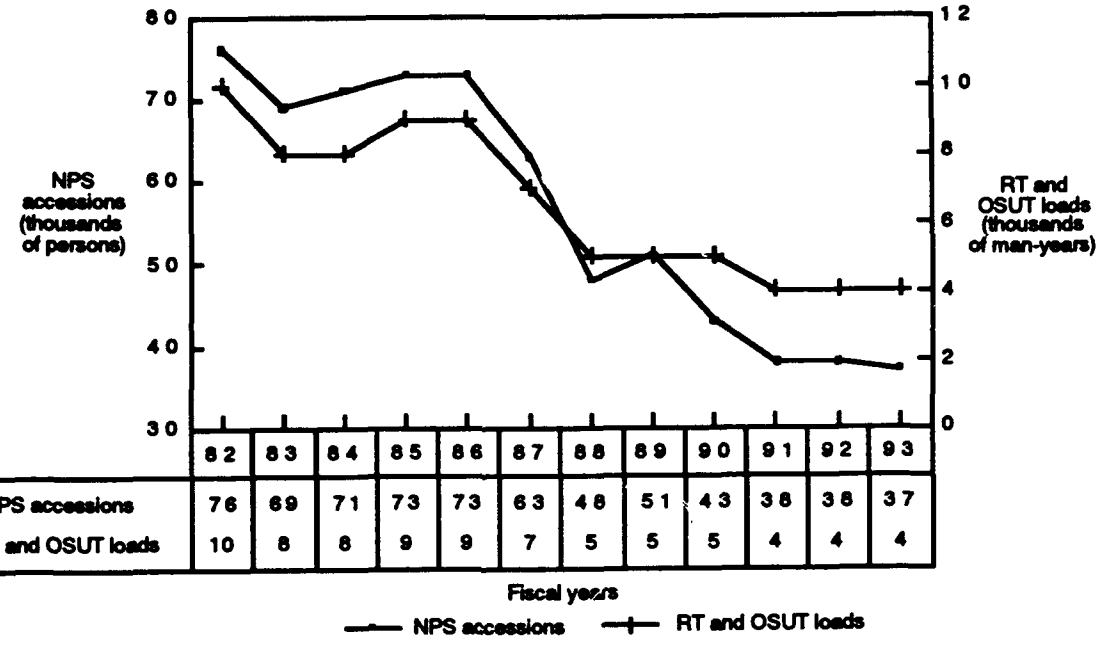


FIG. A-4. AF NPS ACCESSIONS AND RT AND OSUT LOADS

APPENDIX B

REGRESSION PLOTS OF INSTRUCTOR AND SUPPORT MANPOWER VERSUS WORKLOAD

Figure B-1 plots Army Recruit Training (RT) instructors and support manpower against workload.

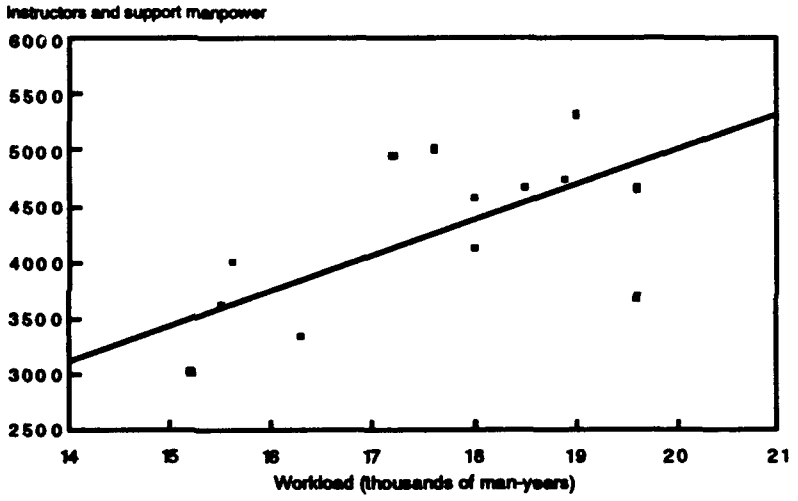


FIG. B-1. ARMY RT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOAD

The equation of the best fit line is:

$$\textit{Army RT manpower} = 1{,}851 + .15 \times \textit{Army RT workload}$$

The coefficient of determination is only .13, indicating that only about 13 percent of the variance in instructors and support manpower can be attributed to changes in workload.

Figure B-2 plots Army One-Station Unit Training (OSUT) instructors and support manpower against workload.

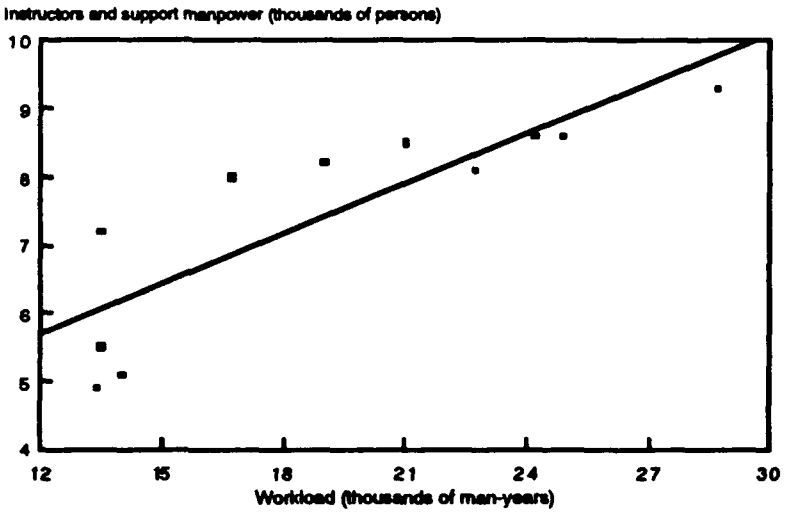


FIG. B-2. ARMY OSUT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOAD

The equation of the best fit line is:

Army OSUT manpower = 2,742 + .24 x Army OSUT workload

The coefficient of determination is .72.

Figure B-3 tracks instructors and support manpower against workload for Navy RT.

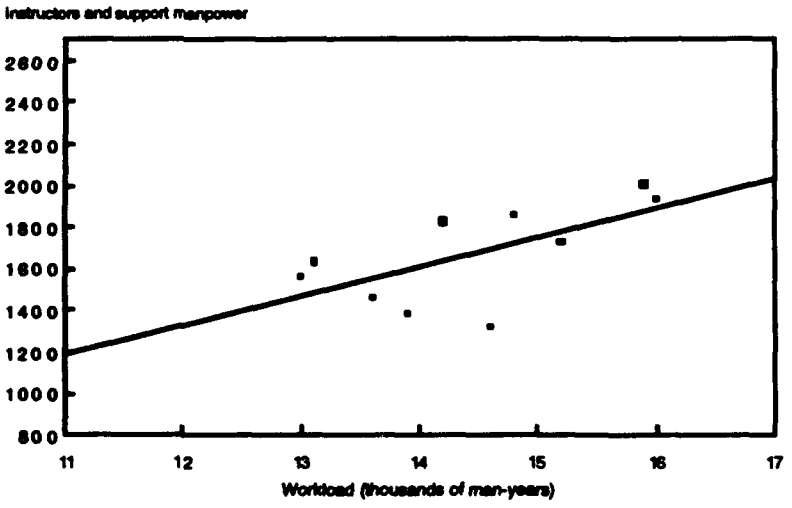


FIG. B-3. NAVY RT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOAD

The best fit equation is:

$$Navy\ RT\ manpower = -384 + .14 \times Navy\ RT\ workload$$

The coefficient of determination is .41, indicating that about 41 percent of the variance in instructors and support manpower is due to variance in workload.

Figure B-4 plots the relationship between instructors and support manpower and workload for MC RT.

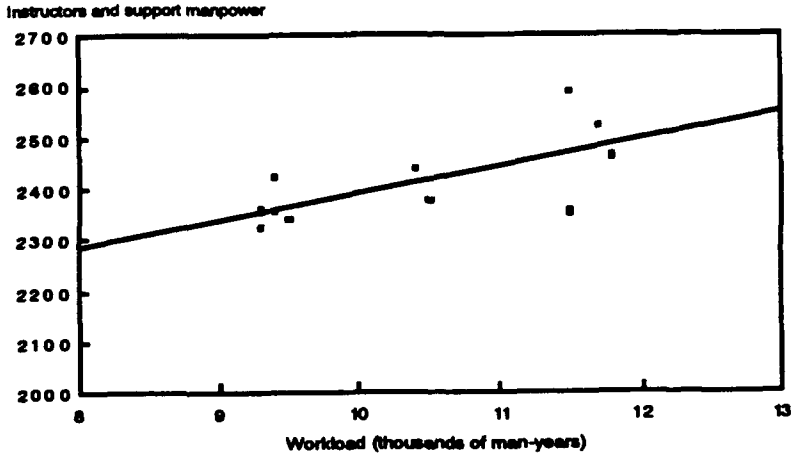


FIG. B-4. MC RT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOAD

The best fit equation is:

$$MC\ RT\ manpower = 1{,}815 + .06 \times MC\ RT\ workload$$

The coefficient of determination is .47.

Figure B-5 plots instructors and support manpower against workload for AF RT.

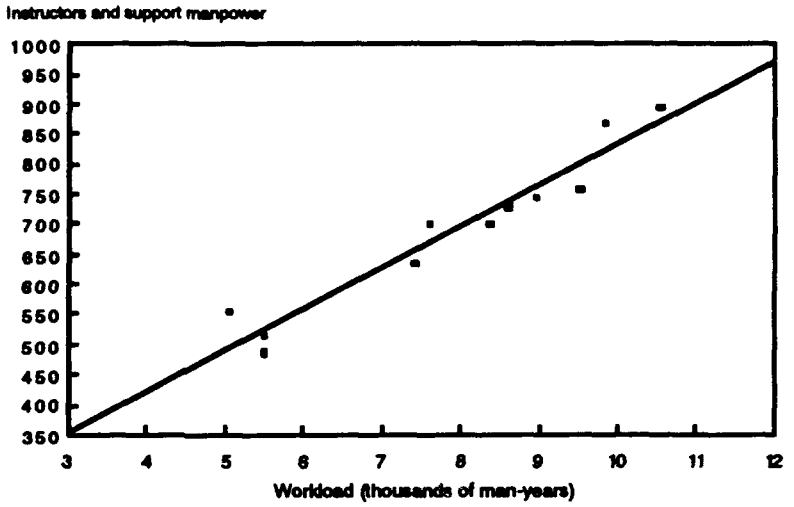


FIG. B-5. AF RT INSTRUCTORS AND SUPPORT MANPOWER VERSUS WORKLOAD

The equation of the best fit line is:

AF RT manpower = 130 + .07 x AF RT workload

The coefficient of determination is .93, by far the highest value among our regression analyses.

APPENDIX C

REGRESSION PLOTS OF OPERATIONS AND MAINTENANCE FUNDING VERSUS WORKLOAD

Figure C-1 plots funding in the Operations and Maintenance (O&M), Army appropriation against workload for Army Recruit Training (RT).

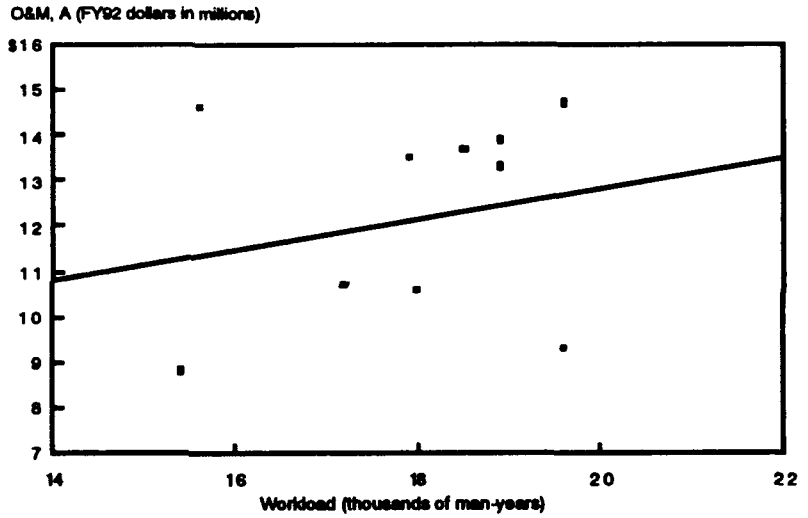


FIG. C-1. ARMY RT O&M FUNDING VERSUS WORKLOAD

The best fit equation for this data is:

Army O&M funding for RT = 6,092 + .34 x RT workload

The coefficient of determination is .05, indicating that only 5 percent of the variance in O&M funding is related to variance in workload.

Figure C-2 provides a plot of Army One-Station Unit Training (OSUT) O&M funding against workload.

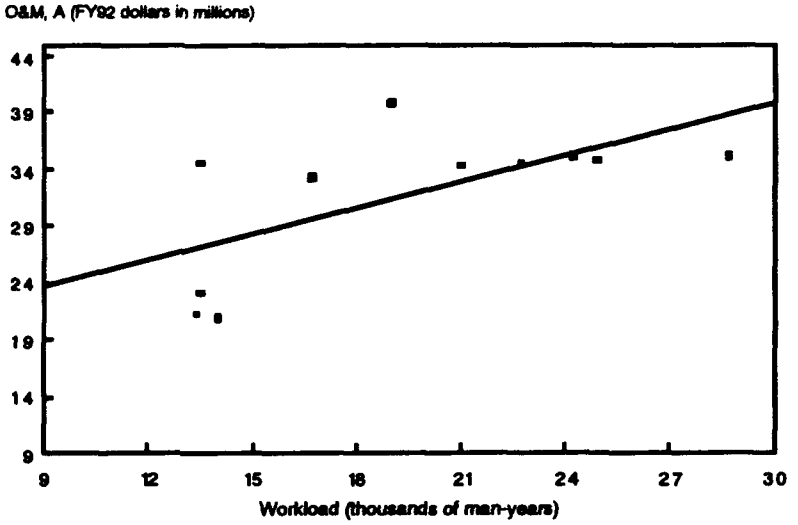


FIG. C-2. ARMY OSUT O&M FUNDING VERSUS WORKLOAD

The best fit equation is:

Army O&M funding for OSUT = 16,859 + .77 x OSUT workload

The coefficient of determination is .41.

Figure C-3 plots funding in the O&M, Navy appropriation versus workload.

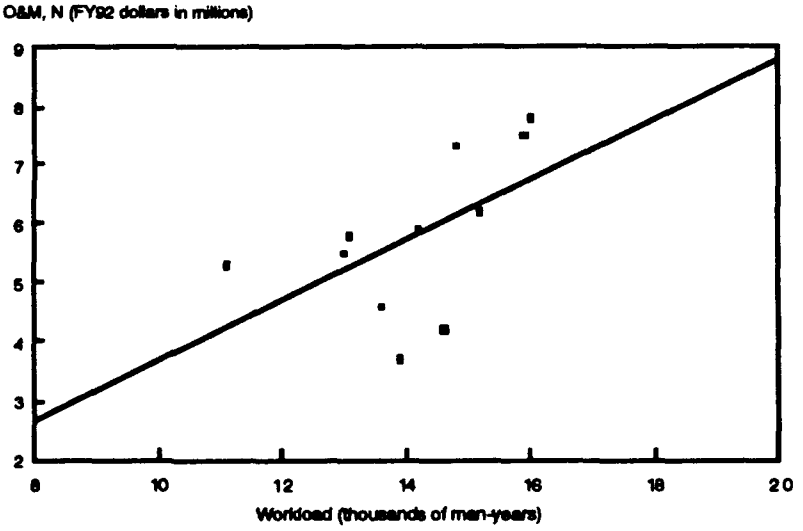


FIG. C-3. NAVY RT O&M FUNDING VERSUS WORKLOAD

The best fit equation is:

Navy O&M funding for RT = -6,408 + .85 x RT workload

The coefficient of determination is .42.

Figure C-4 plots data on funding in the O&M, MC appropriation against workload.

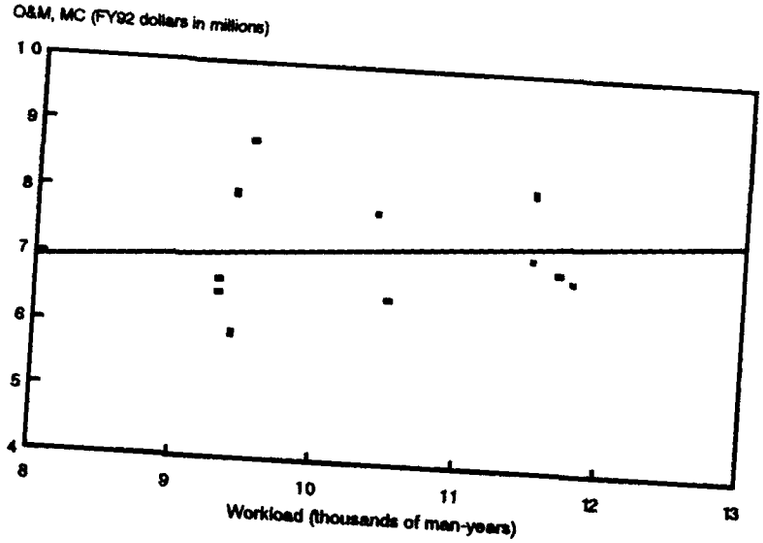


FIG. C-4. MC RT O&M FUNDING VERSUS WORKLOAD

The best fit equation is:

MC O&M funding for RT = 6,422 + .08 x MC RT workload

The coefficient of determination is .01.

Figure C-5 plots information on funding in the O&M, AF apropriation versus workload.

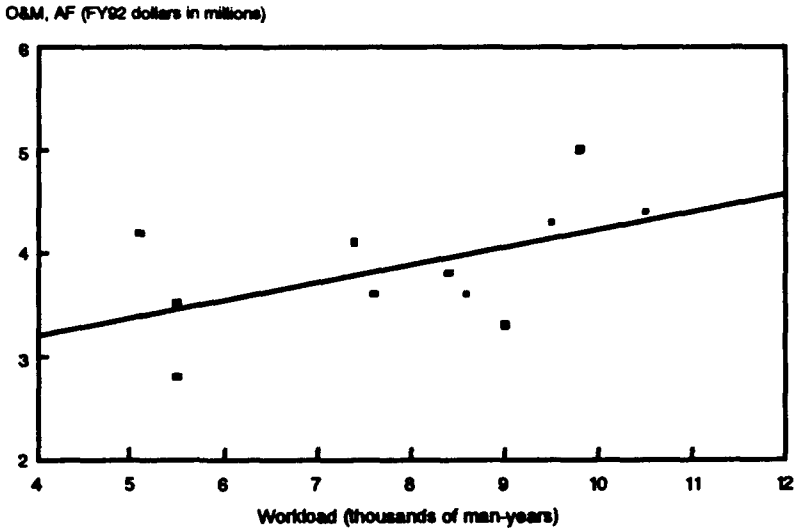


FIG. C-5. AF RT O&M FUNDING VERSUS WORKLOAD

The best fit equation is:

AF O&M funding for RT = 2,582 + .16 x AF RT workload

The coefficient of determination is .26.

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13. ABSTRACT *(Maximum 200 words)*

This report describes our initial efforts to develop analytical tools for assessing projections of training program resource requirements. We focused on Recruit Training and the Army's One-Station Unit Training.

- We considered the relationship between non-prior service accessions and training loads. We found a generally consistent relationship between the two variables; we developed ratios that will enable analysts to forecast training loads given estimates of non-prior service projections.
- We examined the relationship between manpower programmed in the individual training program elements of the Future Years Defense Program and training workloads. Training workloads by themselves are not good predictors of training manpower, and more research is necessary to identify additional explanatory variables. Ratios of training manpower to training workload have been reasonably stable over time, and analysts can use these ratios to test the reasonableness of projections.
- We also analyzed the relationship between the amount of operations and maintenance funding and training workloads. As with training manpower and workloads, workload alone is not a good predictor of funding. Furthermore, the ratios of funding to workload tend to vary significantly over time, except for Navy Recruit Training, in which funding per man-year of workload has been stable for a number of years.

14. SUBJECT TERMS
Training loads, training workloads, training manpower resources, non-prior service accessions, Recruit Training, One-Station Unit Training, Operations and Maintenance funding, Military Manpower Training Report, *regression analysis, trend analysis.*

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