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ABSTRACT

A research project was developed to construct and demonstrate a methodology for estimating the costs of conducting on-the-job training (OJT) in the Air Force. The project focused on the formal upgrade training to the three, five, and seven skill levels. Project efforts involved five major tasks: literature review, cost factor identification, cost factor quantification, specification of costing methodology, and demonstration costings. A series of cost estimating relationships were produced that will employ existing Air Force data systems to generate the desired OJT program costs at various command levels and over a range of user specified time intervals. The methodology, based on factor estimation, provides reasonable cost estimates for budgeting and planning purposes, without burdening the user with costly and time-consuming data collection requirements. (CSS)

AFHRL-TR-78-88

AIR FORCE HUMAN RESOURCES LABORATORY

COST ANALYSIS OF AIR FORCE ON-THE-JOB TRAINING:

DEVELOPMENT AND DEMONSTRATION OF A METHODOLOGY

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The Air Force on-the-job training (OJT) cost estimating methodology documented in this report is applicable to formal airman upgrade training to the 3, 5, and 7 skill levels. The methodology can be used to provide reasonable cost estimates for budgeting and planning purposes at various command levels and for various time intervals. Design of the methodology has emphasized use of existing data bases to derive direct OJT costs. Cost elements which have been quantified include program overhead costs at all command levels, personnel time cost for actual training and supervision, and program support costs such as for career development courses and the Extension Course Institute. Recommendations have been made concerning equipment and opportunity costs. The methodology employs additive cost factors which are sensitive to OJT cost variation among career fields and among organizations at each

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command level. Periodic factor reestimation will insure cost factor currency allowing OJT cost forecasts driven by forecasted OJT trainee-month volumes.

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1.0 INTRODUCTION AND SUMMARY

CONSAD Research Corporation has been under contract to the Air Force Human Resources Laboratory (AFHRL) of the Air Force Systems Command to construct and demonstrate a methodology for estimating the costs of conducting on-the-job training (OJT) in the Air Force. The project focus has been on the formal upgrade training to the 3, 5, and 7 skill levels. The objective of this research has been to produce a series of cost estimating relationships which will employ existing Air Force data systems to generate the desired OJT program costs at various command levels and over a range of user-specified time intervals. This methodology is intended to provide reasonable cost estimates for budgeting and planning purposes, without burdening the user with costly and time-consuming data collection requirements. The costing approach detailed in this report should also be of value to the Air Force in maximizing the efficiency of resource allocation.

1.1 Summary of Project Tasks

The project effort consisted of five major tasks:

- Task 1.0 - Literature Review.
- Task 2.0 - Cost Factor Identification.
- Task 3.0 - Cost Factor Quantification.
- Task 4.0 - Specification of Costing Methodology.
- Task 5.0 - Demonstration Costings.

1.2 Literature Review Summary

The literature review activities focused on the analysis and evaluation of a wide range of completed and ongoing research in the areas of program costing, benefit-cost analysis, program evaluation, and training program management. An emphasis was given to research dealing with OJT and vocational-technical education. The major sources of information included the Defense Documentation Center, AFHRL, the USAF Air Training Command (ATC), US Department of Health, Education and Welfare, and the US Department of Labor.

This review of the state-of-the-art was extremely valuable in formulating a taxonomy of relevant cost factors. However, most existing program costing techniques would have required too much collection of new data for practical application in the current effort.

1.3 Cost Factor Identification Summary

In pursuing the identification of relevant cost factors associated with an OJT program, costs were categorized using the following general cost accounting categories:

- Fixed overhead expenses.
- Variable input costs.
- Opportunity costs.
- Capital expenditures.

Each of these categories was then broken down into a set of specific cost items.

The major category of capital costs eventually quantified was the cost of development and revision of materials for career development courses (CDCs). The initial cost of development of a given CDC is recovered over the expected useful life of the course.

Fixed overhead costs are those which result from the administration and management of the OJT program and which do not vary with the number of trainees. In this category, cost factors were developed to reflect the costs of regularly maintained OJT personnel at the Air Force Headquarters, major command (MAJCOM), and consolidated base personnel office (CBPO) levels, as well as the cost of the time spent in OJT activities by personnel of the Extension Course Institute (ECI).

Variable input costs are those which depend specifically on the number of trainees present. Cost factors included in this category accounted for supervision, unit OJT administration, and the cost of printing and distributing CDC materials.

Opportunity costs, the subject of considerable debate, were included as a policy option. As no clear consensus exists concerning the use of opportunity costs, their employment in the costing

methodology was classified as one of the optional costing modes. This cost category was represented by a factor for the value of trainee time. Opportunity costs, as well as overhead and variable input costs, were treated as expenses in the accounting period in which they occur.

These chosen cost factors are the product of critical evaluation of available data and quantification techniques. Initially, the "wish list" of possible cost factors included such items as land, buildings, and office and training equipment and supplies, as well as factors for the cost of personnel time and the cost of training materials. Based on a review of existing Air Force data bases and management information systems, as well as on several interviews with OJT personnel, the more practical list of cost factors was compiled. The overriding criterion in selecting these cost factors was the availability of quantification information through existing Air Force data structures. Application of this criterion to the set of possible cost items resulted in the following conclusions:

- Cost items dealing with OJT shared equipment, supplies, facilities, and land were not specifically accounted for in any total Air Force data system and would thus require primary unit-specific data collection for measurement.

- Equipment used exclusively for OJT purposes is normally purchased under operational budgets that do not separately account for OJT capital, operations, and maintenance costs.

- No specific accounting of OJT trainee time is available through any systemwide manpower or personnel data structure.

In light of these major data system constraints, the list of measurable cost factors to be included in the methodology was narrowed to the aforementioned items. These cost factors represent direct costs of the Air Force OJT program.

It should be noted that some of these cost factors overlap several of the cost categories. Development costs for instructional aids include the overhead costs incurred by the responsible agency. Production costs for those aids also encompass supplies, postage, handling, and clerical services. Personnel costs for administration and management

include time spent in planning OJT programs and producing OJT management reports. Even though some of these sub-items are not delineated as separate cost factors, they are accounted for in the total cost figure.

1.4 Cost Factor Quantification Summary

In evaluating various quantification techniques for estimating the value of defined OJT cost factors, the first consideration was the level of aggregation at which the costs were to be reported. Since derived cost estimates may be desirable at several levels of aggregation ranging from base level to systemwide, emphasis was placed on selecting an estimating variable which could be readily measured at various program levels. The selected quantification variable also required measurement flexibility with respect to alternative time frames, since quarterly and semi-annual, as well as annual, cost estimates might be desired.

Based on the above requirements, two quantification options were selected for analysis. The first is a "cost per trainee" approach which requires an accounting of total trainee volume over time for each selected program stratification. The second is a "cost per trainee-month" approach which requires an accounting of monthly trainee volumes for each program stratification over a selected time period. These options were selected for the following reasons:

- Trainee volume data are available through existing Advanced Procurement Data System (APDS) reporting mechanisms at the base level in the form of the Uniform Airman Record (UAR).

- Trainee volumes are easily aggregated from the unit to the base, MAJCOM, or system levels in an additive sense.

- Trainee volumes are generally reported on a quarterly basis, but monthly data can be extracted through existing data systems.

The second consideration in defining a quantification approach was the use of derived cost estimating relationships instead of empirically measured cost data. Although some measured OJT costs are available, e.g., CDC development and production costs, the majority of the defined cost factors are not treated as separable accounts in existing Air Force cost accounting systems. Since the option of instituting primary data collection procedures to measure these costs was not within the scope or intent of the project, emphasis was placed on developing derived cost estimating parameters. Whenever possible, however, actual cost data were used to derive the desired cost parameters on a per trainee or per trainee-month basis.

Chapter 3 describes, in detail, the data bases used for quantifying the identified cost factors. Analysis of the Occupational Survey Data Base provided OJT supervision time estimates for several career fields, as well as information concerning other background characteristics. Combinations of this information were used to estimate supervision requirements for given trainee-month volumes in the career fields examined. The cost of this supervision time was based on the standard wage rates by grade as specified in AFR 173-10, Volume 1, USAF Cost and Planning Factors Regulation.

Factors for administration and management costs were derived from several sources. A survey of MAJCOMs provided information concerning manpower used for OJT administration at MAJCOM and system headquarters, as well as at intermediate commands. Contacts with ATC and the Air University provided inventories of OJT manpower requirements for the OJT Advisory Service and for ECI. Base level OJT management personnel are specified in AFM 26-3. Using one OJT administrator per unit, as specified in AFM 50-23, unit OJT administration costs were estimated using 45 trainees as the standard load requiring full-time OJT responsibility. These base level administration requirement estimates were verified through contacts with Bergstrom Air Force Base personnel.

The costs of other OJT program support functions were established through contacts with ECI. CDC development and revision costs are established through controlled accounting procedures, as are printing costs. These costs have been associated with enrollee-months instead of trainee-months since not all Air Force Specialty Codes (AFSCs) employ CDCs.

1.5 Summary of Project Results

The major result of this project is an OJT costing procedure that works and is understandable. Where no pragmatic procedure existed before in operational terms, there is now a flexible and easily applied approach to estimating the costs of OJT activities at the unit, base, MAJCOM, and Air Force levels. The methodology can be applied to assess the variability of OJT costs among skills and, in some cases, between units and commands as an aid in considering the implications of OJT activities within overall Air Force operations. Though the methodology relies on existing data and approximation based on averages, its reliability can be judged as quite good at the higher aggregate levels and fair at the individual unit level.

The methodology developed and demonstrated in this project can be extended to a broader array of practical Air Force applications. The most obvious expansions and extensions suited to applying the methodology across the Air Force as a whole include:

- Expanded data analysis and cost factor estimation based on the processing of data from occupational surveys and other sources for as wide an array of skills as possible.
- Augmented calculation of cost factors associated with the use of operational equipment and facilities for OJT purposes.
- Intensified assessment of trainee productivity while in OJT in order to sharpen the analytical power and reliability of the method so far developed.
- Formalized development of an OJT costing procedure and related manuals or data forms for promulgation as specific Air Force manual materials to guide uniform, systemwide calculation of OJT costs.

The basic result of this project has been a realistic demonstration that OJT costs can be calculated on the basis of existing Air Force data and under realistic application conditions.

An overview of the costing methodology itself -- along with descriptive materials on its practical demonstration -- is provided in the next chapter. That material is followed by a detailed, step-by-step derivation of the methodology, its application, and its significance.

2.0 OVERVIEW OF OJT COSTING METHODOLOGY

Initially, several different approaches to estimating the cost of OJT were considered. Gay (1974) has described some aspects of an approach to training cost assessment that attempts to capture the value of the human capital invested in OJT programs. Such a theoretical approach has provided guidance in establishing cost categories but remains too cumbersome to be used in a working cost methodology. An earlier study by Dunham (1972), which also provided many useful guidelines, examined in detail the cost of OJT to a single skill level in a single Air Force specialty. This study, which included an OJT survey, identified many of the cost factors that have since been incorporated in the methodology presented here.

Most recently, Stephenson and Burkett (1975) have completed a systems analysis of On-The-Job Training in the Air Force. In addition to further specifying the relevant cost factors, this analysis has provided a well-defined framework of OJT operations in the Air Force. The costing methodology presented herein has been designed to reflect this organization of OJT operations. However, cost factor estimation using existing data bases has been emphasized so that costly surveys might be avoided.

Benefits of a costing approach based on factor estimation include both practicality and flexibility. The methodology as presented requires only a minimum of easy user calculations. Furthermore, cost estimates can be made for a wide variety of training aggregations, all based on the same standard cost factors. This inherent simplicity also enhances the comprehension and communication of results.

2.1 Aggregation of Training Costs

Having identified the quantifiable costs of OJT, it became clear that the cost of any given trainee-month could be expressed as the sum of costs in each of the basic cost categories. The cost of a trainee-month could be simply stated as the sum of the costs of OJT supervision, unit OJT administration, base CBPO OJT administration, MAJCOM OJT administration, USAF HQ OJT administration, and CDC enrollment. Using the capability to assess the cost of a single trainee-month, it would become possible to assess the cost of any trainee-month aggregate by summing the costs of the trainee-months included.

In practice, it became possible to easily assess the costs of training in an AFSC at any unit by simply applying the cost factor sum to the total number of trainee-months since all these trainee-months were subject to the same supervision cost, being AFSC dependent, and the same unit, base, MAJCOM, and USAF HQ administration costs.

The additive nature of the training costs further allows cost aggregations to any desired level. In particular, the cost of OJT in a career field at a base or MAJCOM can be determined by summing the costs of OJT in that AFSC across all units in the base or MAJCOM. Alternatively, the total cost of OJT at a unit can be assessed by summing the OJT costs in all career fields present in the unit. Cost estimates for progressively larger training aggregates can be made by summing all unit OJT costs for a base OJT cost, summing all base OJT costs for a MAJCOM OJT cost, and eventually summing all MAJCOM OJT costs for an Air Force system OJT cost.

Part of the virtue of such a simple additive structure is that the cost components can be combined in numerous meaningful ways. If need be, overhead costs alone can be examined by simply excluding the supervision cost factor before aggregating trainee-month costs. The cost of training a single person to upgrade can be assessed by summing the cost each month over the number of months in training. OJT costs can be compared with formal in-class training costs in any career field by examining the average cost to upgrade by both means.

2.2 Cost Factor Variation

Having outlined the overall framework within which cost factors are to be employed, the factors themselves need to be clearly described. The cost factors have been defined such that each factor is the result of a particular OJT-related activity. Each cost factor must also be associated with the training load to which it applies, that is, the training quantity supported by the OJT-related activity. The cost of OJT administration at USAF HQ can be attributed to all OJT systemwide. Therefore, the "worldwide" OJT cost factor is a single additive cost factor that is one component of the cost of every trainee-month. The MAJCOM overhead cost factor, however, cannot be applied to all trainee-months. Since MAJCOM OJT overhead supports the OJT in only that MAJCOM, the MAJCOM OJT cost factor applies equally to all trainee-months occurring in the MAJCOM but is not applicable to the trainee-months in any other MAJCOM. Similarly, overhead cost

factors have been established for each base and for each unit. A "worldwide" cost factor reflecting the costs of ECI staff personnel and CDC printing costs has been established and is applied uniformly to all CDC enrollee-months.

The remaining cost factors -- supervision cost, trainee-time cost, CDC development cost -- vary more significantly by AFSC than by organization. Whereas a very clear organizational delineation exists for the trainees associated with each overhead cost source, the three remaining cost items apply to trainees found systemwide. However, the cost of supervision in a career field is applied to training in only that career field. The cost of CDC development is applied to enrollees in only the related CDC.

These identified types of variation in the cost factors have been specified only after considering other possible variations. It was originally hypothesized that factor values could vary according to four parameters -- MAJCOM, geographic location, Air Force specialty, and upgrade level. Variance by location was eliminated as a simplification. Size restrictions of the Occupational Survey Data Base required that supervision costs be examined by varying not more than one parameter.

2.3 Cost Factor Estimation

A central feature of the OJT costing methodology is reliance on continued data collection and factor reestimation. To estimate the factors, total training costs for each OJT cost component, as assessed for the most recent accounting period, are attributed to all of the affected trainee-months carried during the same period.

$$\left(\frac{\text{Total cost of OJT component}}{\text{Total trainee-months carried}}\right)_{\substack{\text{Most recent}\\ \text{accounting}\\ \text{period}}} = \begin{array}{l}\text{OJT cost factor}\\ \text{in dollars per}\\ \text{trainee-month}\end{array}$$

After each cost factor has been estimated, using known costs during the most recent accounting period, the newly estimated factors can be applied to training load projections to derive associated cost projections.

(Cost factor) • (Projected trainee-months) = Projected OJT cost

The periodic reestimation of cost factors enhances the reliability of cost estimates.

2.4 Optional Costing Modes

So that the costing methodology might be as broadly applicable as possible, a number of optional modes have been described. One type of option allows the inclusion of cost factors not included in the standard costing modes. In particular, one option allows the cost of trainee time to be added to the usual cost factor components. Another option promotes the use of user-specified cost factors to replace standardized values so that costings, particularly of small trainee-month aggregates, can be based on situation-specific data. This option helps provide for accurate costings of OJT in any unit whose training load is above or below average. In sum, the optional costing modes provide the user with the necessary flexibility to apply the methodology to specific needs.

3.0 DATA SOURCES AND ANALYSES OF COST FACTORS

The purpose of this chapter is to define the sources for data used in the derivation of cost factors and to provide procedures and techniques for developing those factors as inputs to the actual costing methodology described in Chapter 4. For those data items and cost factors which are career field dependent, actual examples of data obtained and procedures employed will be utilized for demonstration purposes.

3.1 Assessment of OJT Supervisor/Trainer and OJT Trainer Time Allocations Through Analysis of Occupational Survey Data

As discussed in earlier chapters, several alternatives to assessing supervisor and trainer time commitments to OJT were considered. Each alternative was evaluated relative to the criteria of utilizing existing Air Force data sources and minimizing the data collection and analysis burden. The end result of this evaluation was a decision to utilize the Air Force Occupational Survey Data Base and its accompanying data analysis capabilities to estimate, for costing purposes, the amount of time spent by OJT supervisors/trainers and trainers in conducting formalized OJT. This data base constitutes essentially the sole source of task time data available for most AFSCs on a centralized basis suitable for mass data analysis.

The Occupational Survey Data Base is maintained by the ATC Occupational Measurement Center in conjunction with AFHRL. The data represent responses to surveys conducted in various career fields which solicited information on the number and types of tasks performed by members of those career fields and the relative amounts of time spent on those tasks. In addition, background data on the respondent's current assignment, grade, and responsibility are also maintained. Currently, the data base contains completed survey results for approximately 67 percent of all career fields, with an additional 9 percent of the remaining career fields scheduled for survey completion within the next 2 years. A more detailed discussion of the status of the Occupational Survey Data Base is contained in Appendix A.

The primary objective of the analysis of Occupational Survey Data was to develop procedures for defining samples of OJT supervisor/trainer and trainer populations and for estimating the amount of time allocated to OJT by members of these groups. The above groups are considered subsets of the total career field population. These subsets are delineated by defining a set of OJT-related career field tasks for which indicated respondent performance results in the inclusion of the respondent in the defined group. The procedure by which task subsets are defined is one of determining OJT supervisor/trainer and trainer duties and responsibilities from AFM 50-23, as well as selected field interviews, and then selecting from the career field task inventories those tasks which best reflect the determined responsibilities and duties.

An analysis of each career field's population sample is then performed which results in the generation of distributional statistics on percent time spent on OJT tasks, grade structure, and other background organizational/management information. These statistics are then used to determine whether sufficient similarity exists among the populations to justify career field groupings relative to percent time spent, grade distribution, and other descriptive characteristics. The remainder of this section discusses the procedures employed and the examples used in analyzing the Occupational Survey Data Base to produce measures of percent time allocated to OJT within discrete or grouped supervisor and trainer populations.

3.1.1 Definition and Analysis of OJT Supervisor/Trainer and OJT Trainer Population Samples

The first step in the analysis of the Occupational Survey Data Base was to extract from the universe of survey respondents that subset of respondents which could be classified as OJT supervisors/trainers or trainers in each career field. To facilitate this type of analysis, AFHRL maintains a battery of Comprehensive Occupational Data Analysis Programs (CODAP) which delineates population subsets according to user-specified task performance criteria and then generates descriptive statistics for the defined groups. Under the initial assumption that the characteristics of the OJT supervisor/trainer and trainer groups would vary with career field, the following generalized procedures were developed for conducting CODAP analyses:

1. Obtain from AFHRL/OR the Occupational Survey study number and most current task inventory for the subject career field.

2. Utilizing AFM 50-23, Tables 4-5 and 4-6, in conjunction with selected field interviews, select from the task inventory those tasks (by number) which best describe the duties and responsibilities of an OJT supervisor/trainer or trainer. This task list is designated as Subset A.

3. Select from Subset A those tasks for which indicated performance would best assure that the respondent is an active OJT supervisor/trainer or trainer. This task list is designated as Subset C.

4. Select from Subset A those tasks for which non-performance would best assure that the respondent is not a formally designated OJT supervisor/trainer. This task list is designated as Subset B.

5. Develop a CODAP data analysis request which contains the desired study number, the designated task subsets, and the following task performance criteria for defining groups:

   a. The OJT supervisor/trainer group is defined as the set of respondents who perform one or more tasks indicated in Subset C and do not have a "T" prefix on their Duty AFSC.*

   b. The OJT trainer group is defined as the set of respondents who perform one or more of the tasks indicated in Subset C, do not perform the tasks indicated in Subset B, and do not have a "T" prefix on their Duty AFSC.

In addition to the task subset descriptions and task performance criteria, the analysis request should also contain the following specifications for generating the statistical summaries necessary to evaluate the magnitude and variability of OJT time allocations by the various groups:

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*This condition seeks to eliminate possible bias due to the inclusion of "full-time instructors" in the OJT groups.

i. For each of the groups defined for each career field in Step 5a above, the following statistics are to be generated for the total list of OJT tasks in the subset career fields:

- Percent performing each task.
- Average percent time spent on each task by members performing.
- Average percent time spent on each task by all members.
- Percent performing all tasks.
- Average percent time spent in all tasks by members performing.
- Average percent time spent on all tasks by all members.

ii. For each of the groups defined for career fields in Step 5b above, the following statistics are to be generated for the list of OJT tasks specified for each career field excluding those tasks indicated in Subset B:

- Percent performing each task.
- Average percent time for members performing.
- Average percent time for all members.
- Percent performing all tasks.
- Average percent time spent on all tasks by members performing.
- Average percent time on all tasks by all members.

iii. For each of the groups defined for the career fields in Steps 5a and 5b above, the distribution statistics for the following background information categories are to be generated:

- Grade.
- MAJCOM.
- Primary AFSC.
- Duty AFSC.
- Job location (CONUS versus non-CONUS).
- Total months active Federal military service.
- Number of subordinates reporting for supervision.
- Organization.
- Base or installation.
- Present work assignment.

iv. The following are desirable but not required cross-tabulations of background variables that can be requested:

- Distribution of total months active Federal military service by grade.
- Distribution of number of subordinates reporting by MAJCOM.
- Number of respondents with organization designated as HQ.

For demonstration purposes, the group definition and task criteria procedures were carried out for the 15 selected career fields listed in Table 1. The format and content of the OJT task subsets which resulted from this demonstration are contained in Appendix B.

After the development of task subsets and task performance criteria, the next step is to carry out the CODAP analysis of the Occupational Survey Data Base for each of the career fields being considered. This was accomplished by submitting an analysis request to AFHRL/OR containing the task subsets and sample definition criteria developed in Steps 1 to 5 above and the statistical summary specifications outlined in Steps i to iv above. In addition to these items, the analysis request should also indicate the desired stratifications of the variable summaries requested for the analysis. While these stratifications may vary depending on desired level of detail, the following set of specifications are considered adequate for the current methodology:

- Duty AFSC: 3, 5, 7, and 9 skill levels.
- Primary AFSC: 3, 5, 7, and 9 skill levels.
- Grade: E1 to E9 inclusive.
- MAJCOM: all major commands and separate operating agencies.
- Job Location: CONUS and non-CONUS.
- Number of Subordinates: intervals of five up to a maximum of 20.

TABLE 1: Career Fields Selected for Occupational Survey Analysis of OJT Supervisor/Trainer and Trainer Samples

AFSC Career Field	Title	Study Number
291x0	Telecommunication Operations	6217[c]
293x3	Radio Operator	5477[c]
303x2	Aircraft Control and Warning Radar Repair	5177
304x4	Ground Radio Communication Equipment Repair	5735
316x0F	Missile Systems Analyst	4721
316x1L	Missile Systems Maintenance	4852[c]
326x1	Integrated Avionics	4762[c]
431x0C	Helicopter Mechanic	4809[c]
431x1A/C/E	Aircraft Maintenance	6071[c]
552x0	Carpentry	5427
552x5	Plumbing	5596
611x0	Supply Services	3688
672x1	General Accounting	5627
702x0	Administration	4391
732x1	Personnel Affairs	5395

[c]These career fields were analyzed for the costing methodology demonstration.

- Number of Supervisor/Trainer Tasks Performed: intervals of one up to the total number of tasks indicated.

- Percent Time Spent on Supervisor/Trainer Tasks: intervals of one up to 10 percent, then intervals of 10 up to 100 percent.

- Number of Exclusively Supervisory Tasks Performed: intervals of one up to the total specified number of tasks.

- Number of Sample-Qualifying Tasks Performed: intervals of one up to the total specified number of tasks.

- Number of Non-Exclusively Supervisory Tasks Performed: intervals of one up to the total specified number of tasks.

- Percent Time Spent on Non-Exclusively Supervisory Tasks: intervals of one up to 10 percent, then intervals of 10 up to 100 percent.

As a means of further demonstrating the Occupational Survey Analysis procedures and concurrently generating sample statistics for subsequent costing demonstrations,. a CODAP analysis request was submitted, containing all developed criteria and specifications for the 15 selected career fields. AFHRL completed the analysis of six of these career fields. They are indicated by the superscript "c" on the Study Numbers in Table 1.

The results of the CODAP analysis of the specified career fields are given in several computer summaries of the sample statistics. Of primary importance to the costing methodology are those summaries contained in the VARSUM listings. These listings provide frequency distributions of the defined OJT supervisor/trainer and OJT trainer groups for each career field over the specified variable stratifications contained in the analyses request. These distributions, in turn, provide the means by which the percent time allocated to OJT tasks and the variability of that time allocation relative to other population variables can be evaluated.

3.1.2 Evaluation of Percent Time Spent by OJT Supervisors/ Trainers and OJT Trainers

The results of the Occupational Survey Analysis offer three basic sample distributions which can be utilized to assess the cost of time allocated by OJT supervisors/ trainers and OJT trainers to the OJT program. First, the distribution of each group over the percent of work time spent on OJT-related tasks allows for the calculation of the "mean percent of work time allocated to OJT" for OJT supervisors/ trainers and OJT trainers in each career field.* Second, the distribution of each group over the number of trainees supervised allows for

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*Archer, W. B., Computation of Group Job Descriptions from Occupational Survey Data, Lackland AFB, Texas, Personnel Research Laboratory, Aerospace Medical Division, Air Force Systems Command, PRL-TR-66-12, December, 1966. It has been recognized that the means of estimating the percent of work time is based on surveys soliciting subjective estimates. However, these surveys were designed to produce overall job descriptions. Neither the survey administrator nor the respondents can be expected to have placed any particular emphasis or deemphasis on those task items that happened to be training-related. In this respect, the estimates of training-related time as a portion of total work time should be suitably unbiased. This position is supported by McFarland (1974) in a study assessing the compatibility of Management Engineering Team (MET) and Occupational Survey estimates of task time requirements. "The correlation obtained between the job inventory estimates of [percent] time spent and the measured time provided by MET was 0.7912 with N = 1,784...it can be said that both methodologies are clearly measuring the same job performance." Thus, it appears that both means of describing the AFSs provide similar estimates of relative time requirements for task performance. However, it remains true that the survey analyses do not actually measure the absolute time requirements for task performance. Nevertheless, the demonstrated compatibility of such estimates with those made by METs, combined with the absence of consolidated absolute training task time measurements, suggests that the approach employed in estimating absolute time requirements based on job survey analyses is appropriate. This conversion from percent work time to absolute time has been based on the standards for total available work time described in AFM 26-3, Volume 1. (McFarland, B. P., Potential Uses of Occupational Analysis Data by Air Force Management Engineering Teams, Brooks AFB, Texas, AFHRL-TR-74-54, July, 1974.)

the calculation of an average number of trainees over which the calculated percent times are allocated. Finally, the distribution of each group over grade allows for the stratification of OJT supervisor/trainer and OJT trainer time allocations over the various grade levels for costing purposes.

Although the above distributional statistics can be obtained directly from the computer output, it was felt that an intermediate step of graphically representing the distributions would provide a more practical means of assessing the characteristics of each group. It was also felt that such graphical representations would enhance subsequent analyses of time factor similarities among the various groups.

As a means of demonstrating this graphical approach to evaluating the cost factor characteristics of the groups, the 291x0, Telecommunications Operator career field, was chosen as an example. This field contained 591 OJT supervisors/trainers and 400 OJT trainers. The distributions of these groups over the number of OJT tasks performed are presented in Figures 1 and 2. These figures demonstrate the expected difference between the groups in that supervisors who concurrently function as trainers show a more extensive involvement in OJT tasks than do those who have only trainer responsibility.

The graphical interpretation of percent time allocated by the various groups was determined to be best represented by a sequence of graphs that allowed for better definition of the time distribution peaks. The simple graph of percent time spent (Figure 3) is somewhat misleading in that the true sample peak is not clearly defined but rather implied somewhere within the 0 to 10 percent interval. A more detailed graph of the 0 to 10 percent interval given in Table 5 provides a more explicit indication of the distribution shape but the mean is suspect because the tailing effect of the greater than 10 percent intervals is not considered. To capture both the tailing effects and the shape definition, the graphs in Figures 3 and 4 are combined in Figure 5. This composite form provided the best visual representation of both shape and mean and was thus chosen as the format for tabulating percent time data from the Occupational Survey Analysis.

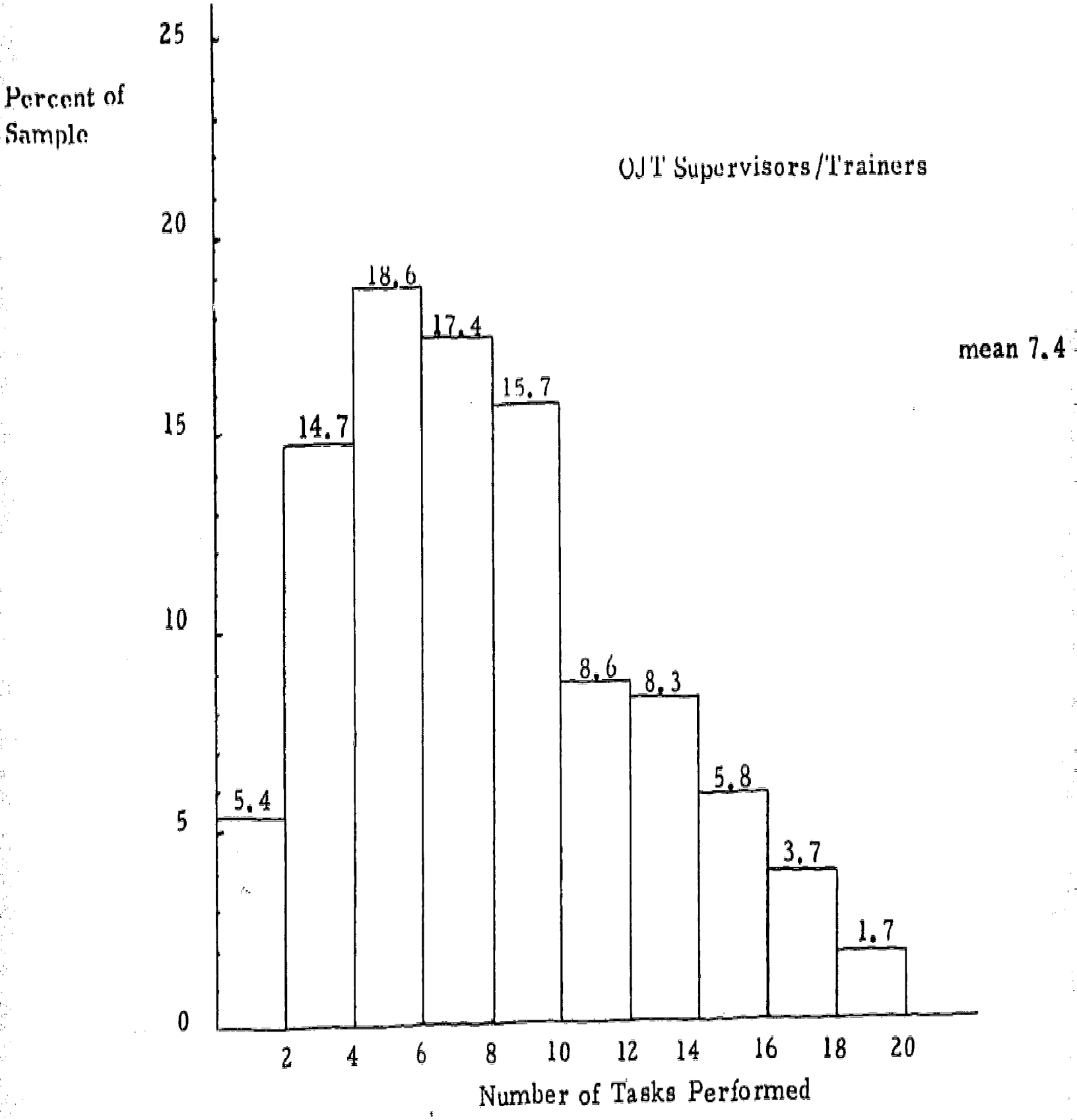

FIGURE 1: Percent Distribution of the Number of Tasks Performed in Subset A, AFSC 291x0, Telecommunications Operator

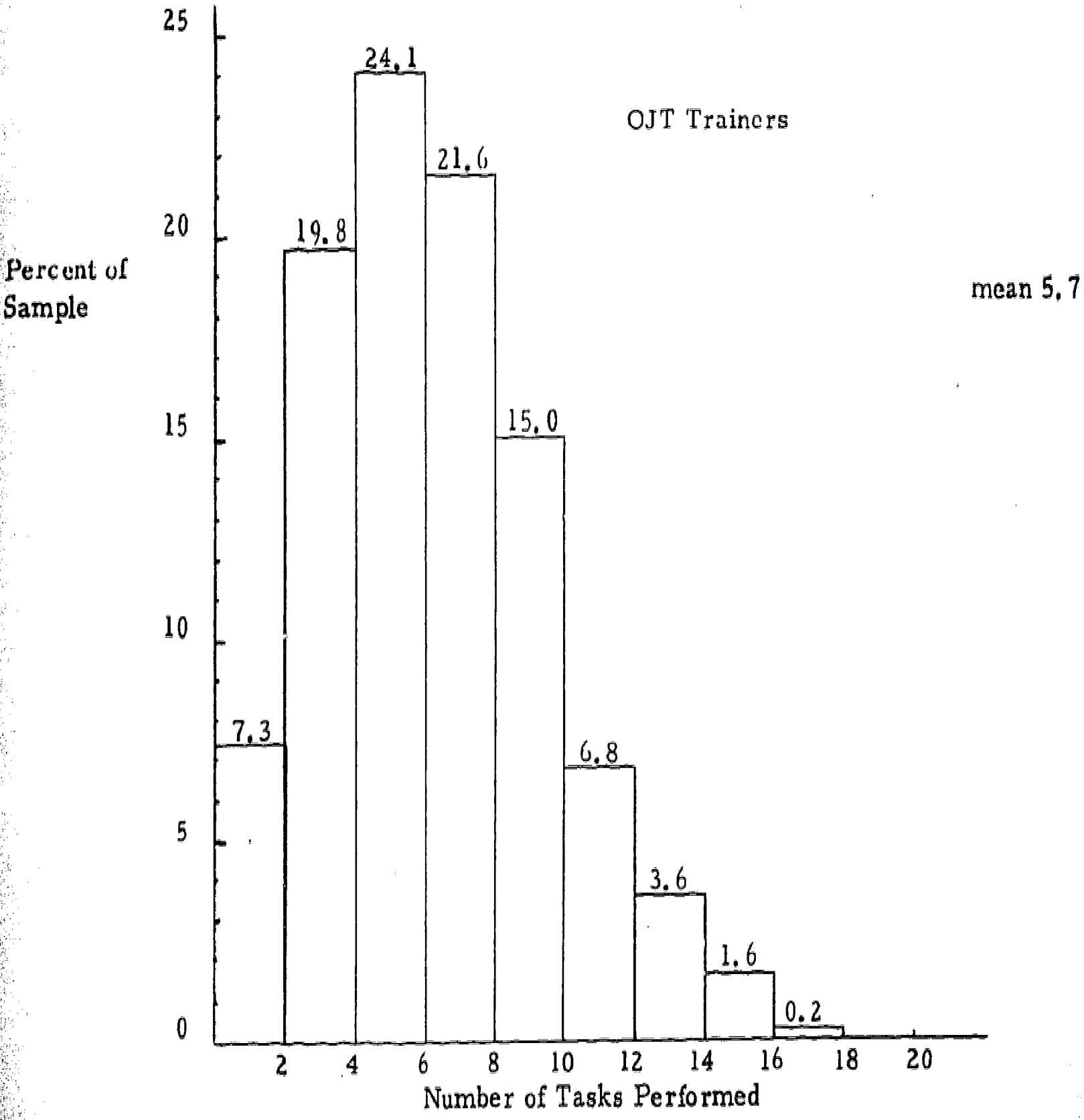

FIGURE 2: Percent Distribution of the Number of Tasks Performed in Subset A, AFSC 291x0, Telecommunications Operator

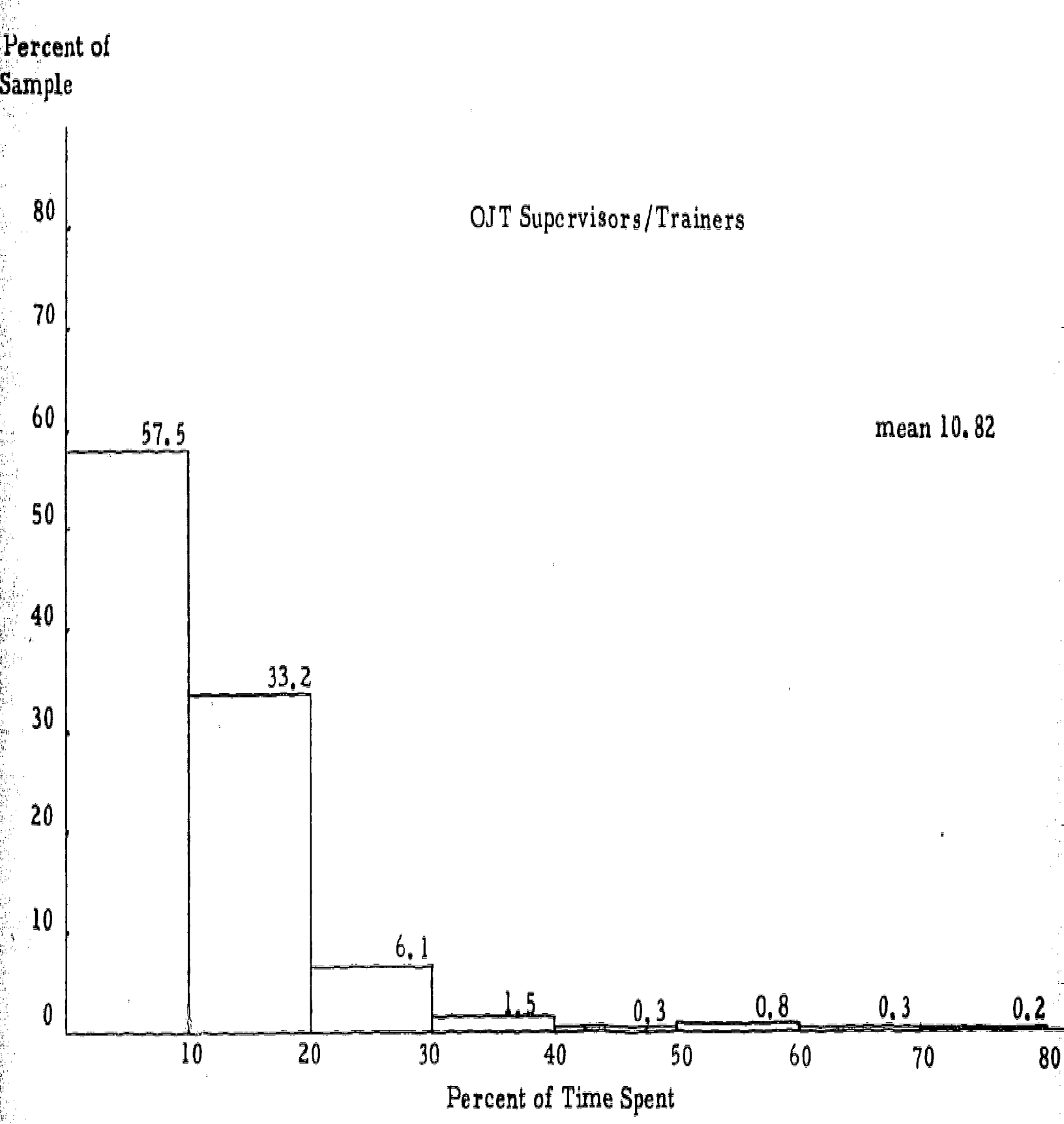

FIGURE 3: Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 291x0, Telecommunications Operator

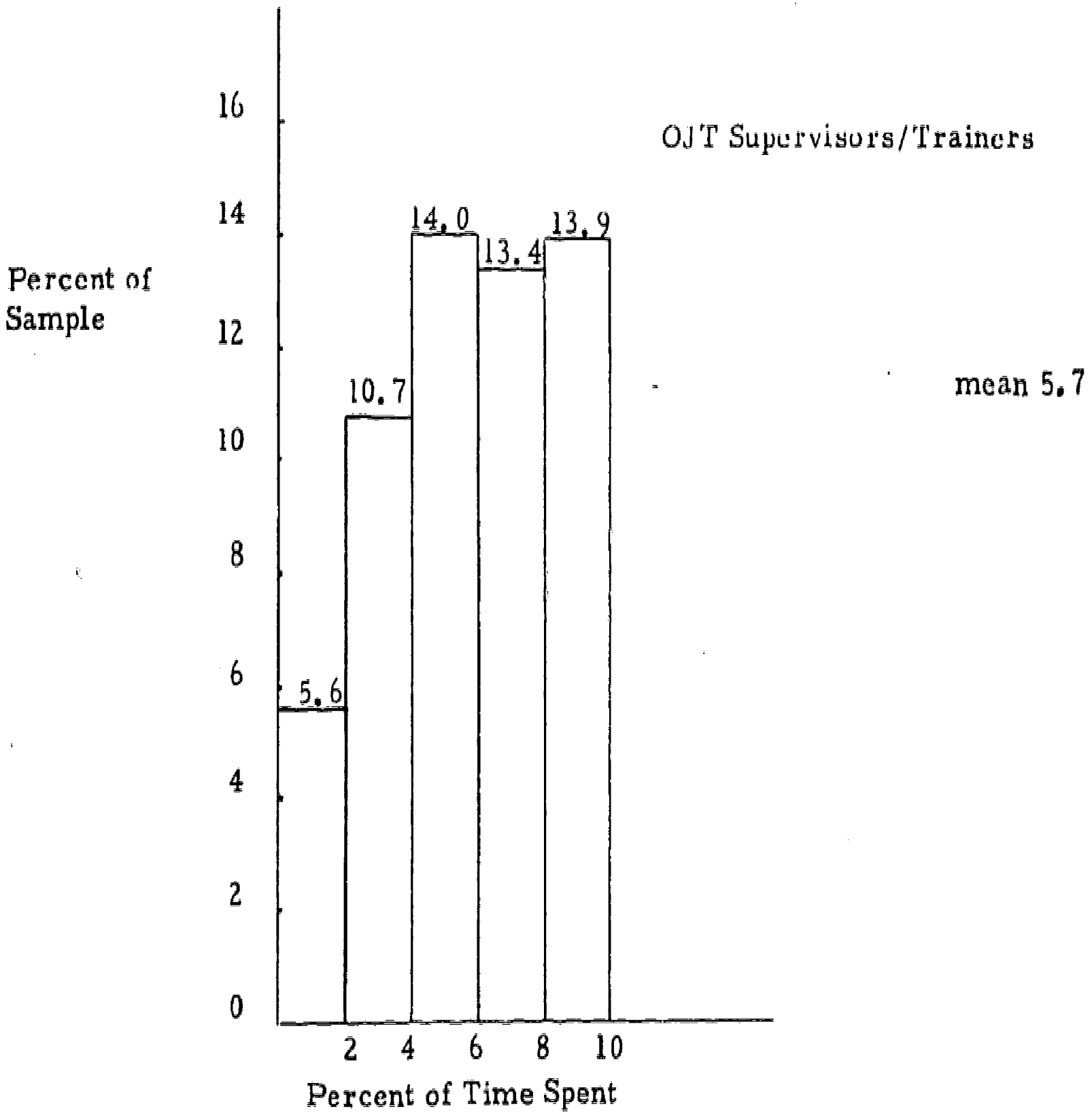

FIGURE 4: Breakdown of Telecommunications Operators Who Spent Less Than 10 Percent of Their Time on Tasks in Subset A AFSC 291x0, OJT Supervisors/Trainers

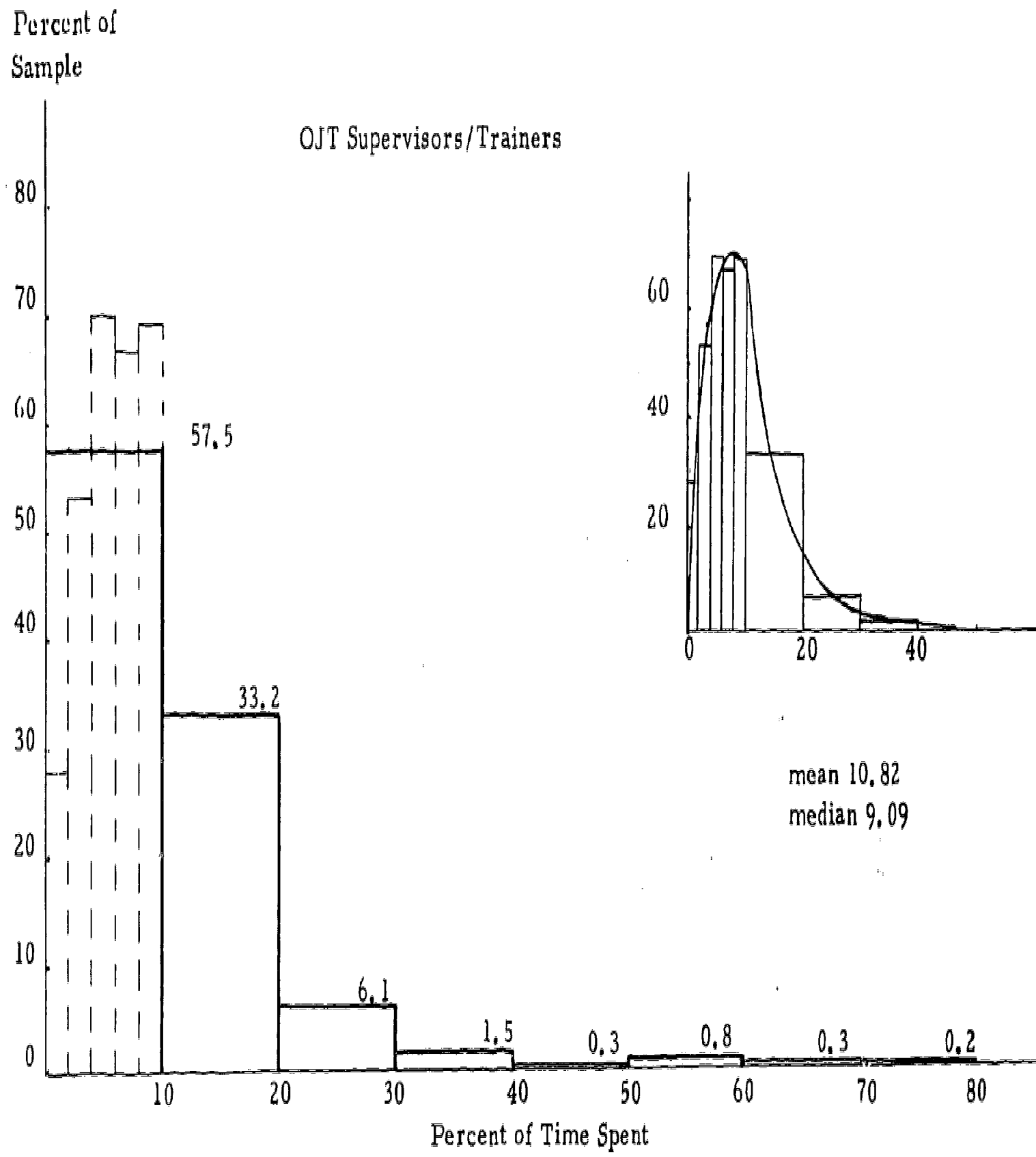

FIGURE 5: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A AFSC 291x0, Telecommunications Operator

The composite form must, however, be interpreted carefully. Only the wide columns can be read on the vertical scale. The narrow columns contain the same total area between 0 to 10 percent time spent as does the large column, but they have been height-adjusted for visual comparison. As an intuitive guide, the scaled-down inset reveals an approximate curve whose shape indicates the pattern of OJT time commitment for Telecommunications Operator supervisors/trainers. These supervisors generally spend between 4 and 12 percent of their work time in OJT. In a similar fashion, Figure 6 demonstrates that OJT trainers in this career field commonly spend 2 to 12 percent of their work time in OJT, reflecting again their lesser overall responsibility.

As an input to subsequent costing demonstrations, the percent time data for each of the OJT groups in the five remaining sample career fields have been tabulated in the recommended graphical form and are contained in Appendix C.

To further verify the expected characteristics of the OJT groups, the frequency distributions over skill level are graphed in Figures 7 and 8. These graphs indicate that the majority of the supervisors/trainers and trainers are journeymen (5 level) and technicians (7 level) with only small numbers being employed in these levels. The relative shapes of these distributions agree strongly with the observed use of skilled personnel in the field. Although not directly utilized in the costing methodology, these skill level distributions may also prove useful in estimating the utilization and workload of skilled personnel for resource management purposes.

The "mean percent time" estimates derived from the developed percent time distributions represent those amounts of work time which are allocated to all trainees supervised. Percent work time estimates have been converted to approximations of absolute time estimates using the guidelines for available man-hours as published in AFM 26-3, Volume 1, Air Force Manpower Standards. The validity of this conversion should be established before OJT cost estimating is operationalized. In order to maintain cost estimating flexibility at all organizational levels, the current methodology design calls for the quantification of cost factors on a unit basis, e.g., per trainee or per trainee-month. In the case of OJT supervisor/trainer and trainer time, this is accomplished by estimating, for each group and career field, the mean number of trainees supervised. The Occupational Survey Analysis provides a distribution of groups over intervals of the number of subordinates reporting for supervision.

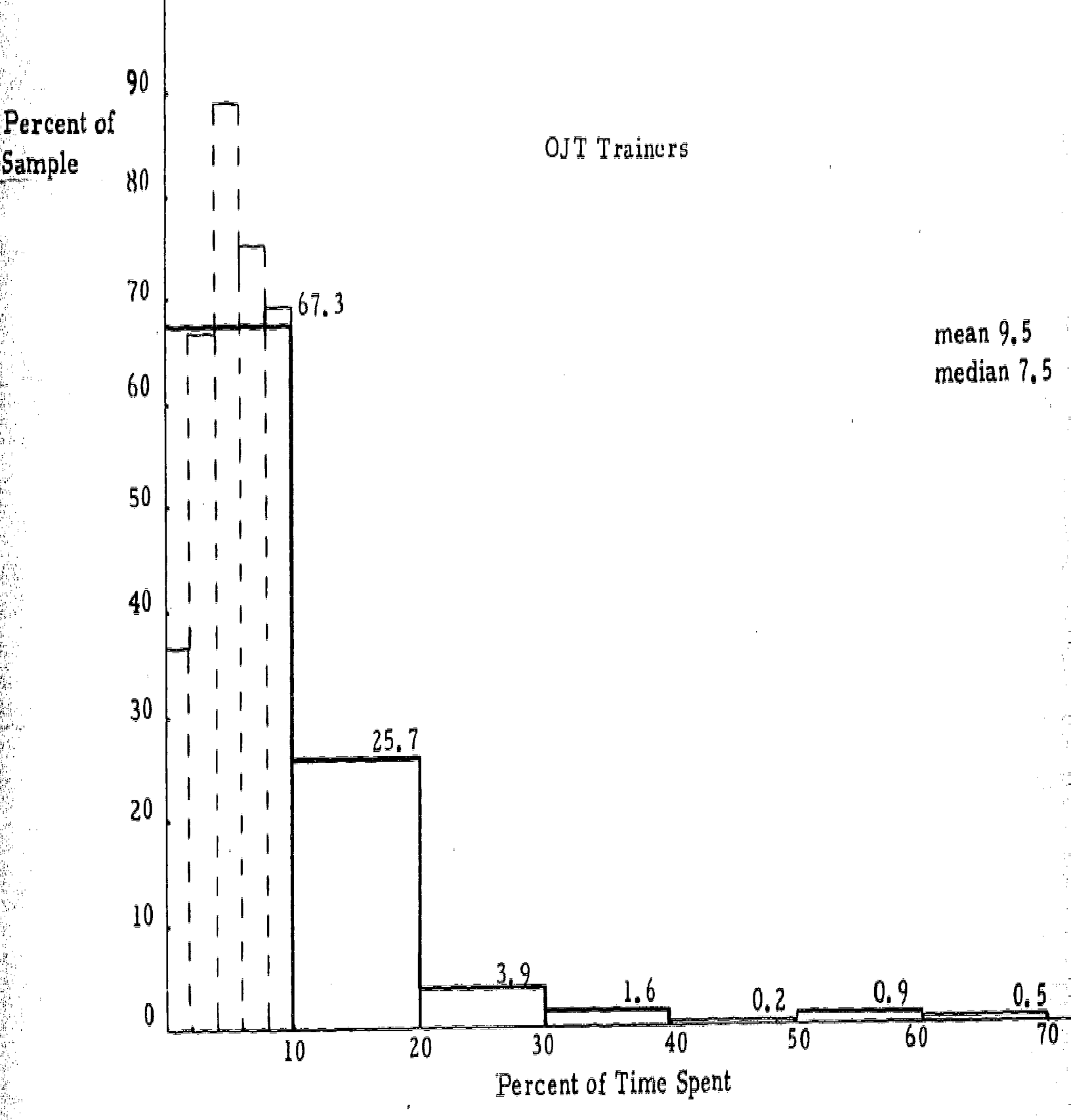

FIGURE 6: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 291x0, Telecommunications Operator

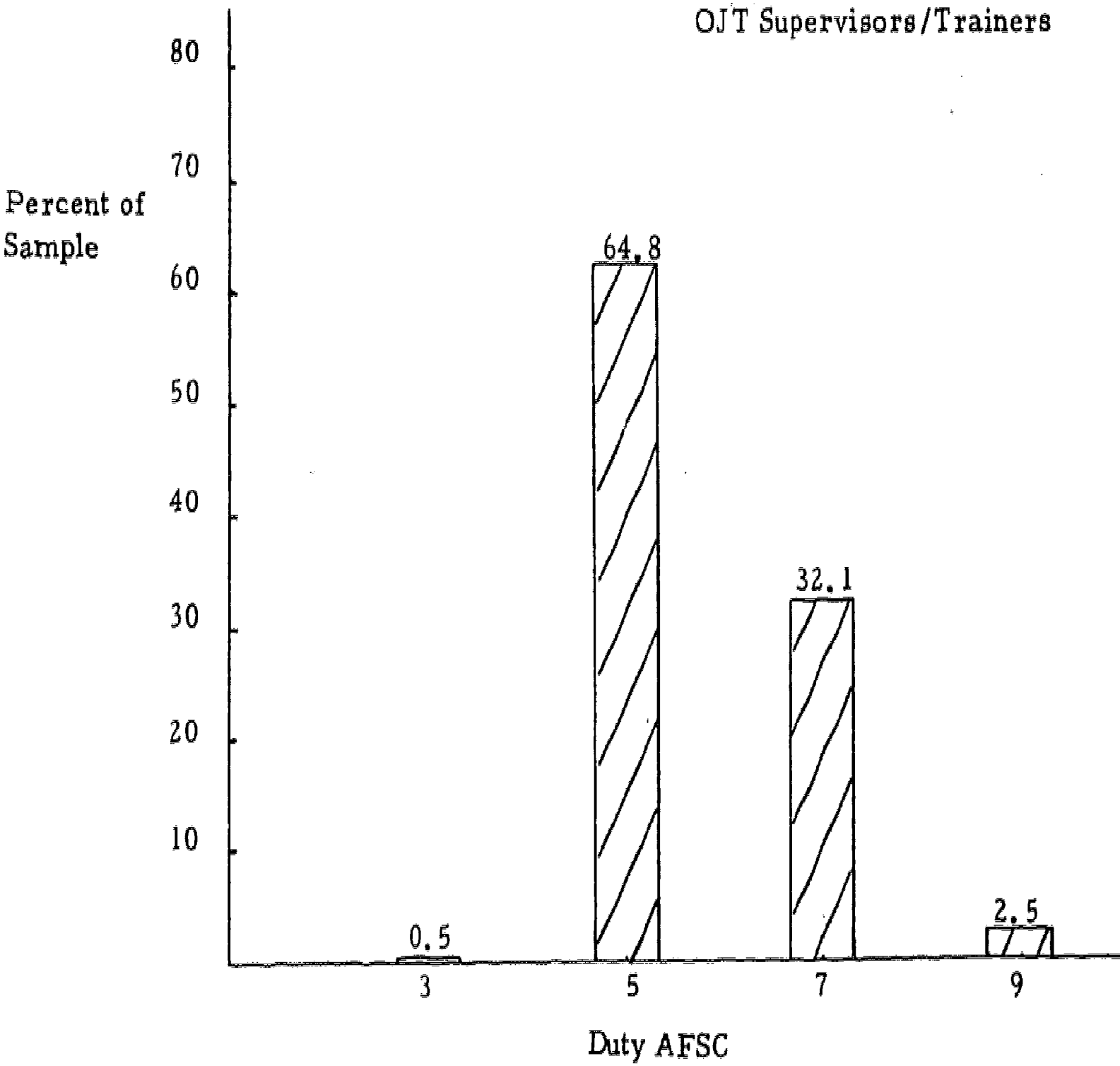

FIGURE 7: Percent Distribution of Duty AFSC
AFSC 291x0, Telecommunications Operator

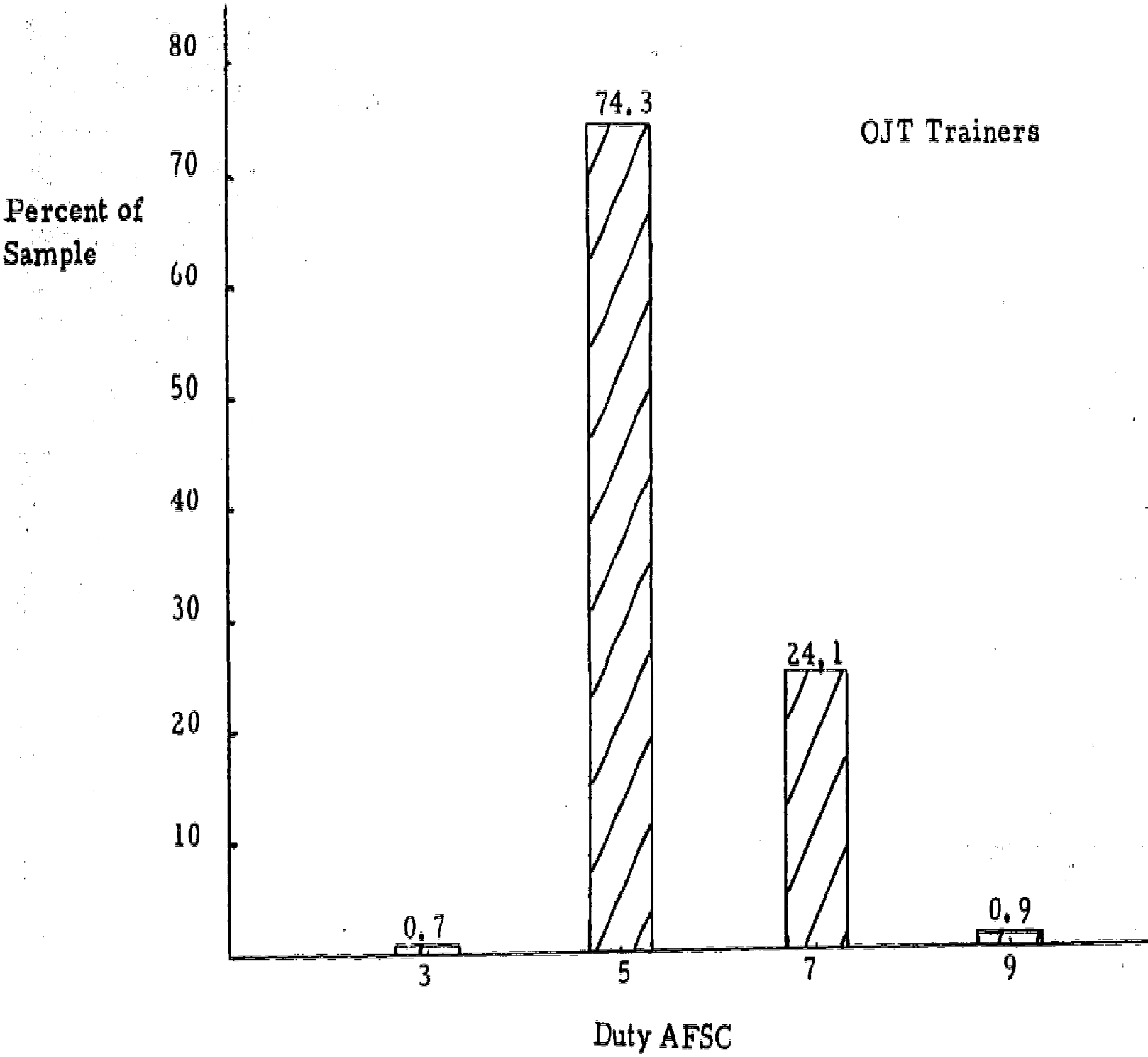

FIGURE 8: Percent Distribution of Duty AFSC
AFSC 291x0, Telecommunications Operator

Figures 9 and 10 give graphical depictions of these distributions for OJT supervisors/trainers and OJT trainers respectively in the 291x0 career field. Although some bias is to be expected in these distributions due to the definition of the variable, the mean should provide a reasonable estimate of the number of trainees supervised because groups have been restricted to OJT supervisory and training personnel. Additionally, independent estimates of the number of trainees supervised were obtained for verification purposes from the OJT Advisory Service Survey* and from Noncommissioned Officers In Charge (NCOIC) of OJT programs in the major commands.** These estimates indicated means in the intervals of 1 to 3 and 1 to 5 trainees supervised respectively which compare favorably with the distributions developed from the Occupational Survey Analysis. The means of these distributions will thus be used in conjunction with mean percent time estimates to develop the appropriate percent time per trainee for each training personnel group in each career field. Alternate forms of this cost factor, such as estimated time per trainee-month, can also be derived from these data. These options will be discussed in later sections.

The development of OJT supervisor/trainer and OJT trainer time per trainee estimates will allow for the calculation of the total training personnel time required for a given number of trainees. In order to place a dollar value on this time estimate, the distribution of time spent over the grades held by members of the training personnel population must be known. Again, the Occupational Survey Analysis provides distributions of OJT supervisors/trainers and OJT trainers over grade levels for each career field analyzed. Figures 11 and 12 show these distributions for the respective groups in the 291x0 career field. Returning to the skill level distributions in Figures 7 and 8 and recalling the personnel management guideline of two grades per skill level, it can be seen that the grade distributions are consistent with the skill level stratification of the OJT training personnel. Field inquiries have also indicated peak usage of OJT training personnel in the E4 to E6 grade levels which is consistent with the distributions derived from the Occupational Survey Analysis. As such, these distributions will be used in the methodology to stratify calculated OJT supervisor/trainer and OJT trainer time by grade level for costing purposes.

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*Stephenson, R. W., and J. R. Burkett, On-the-Job Training in the Air Force: A Systems Analysis, AFHRL/TT, December, 1975.

**The MAJCOM OJT/NCOIC Survey was conducted by CONSAD. See Appendix E.

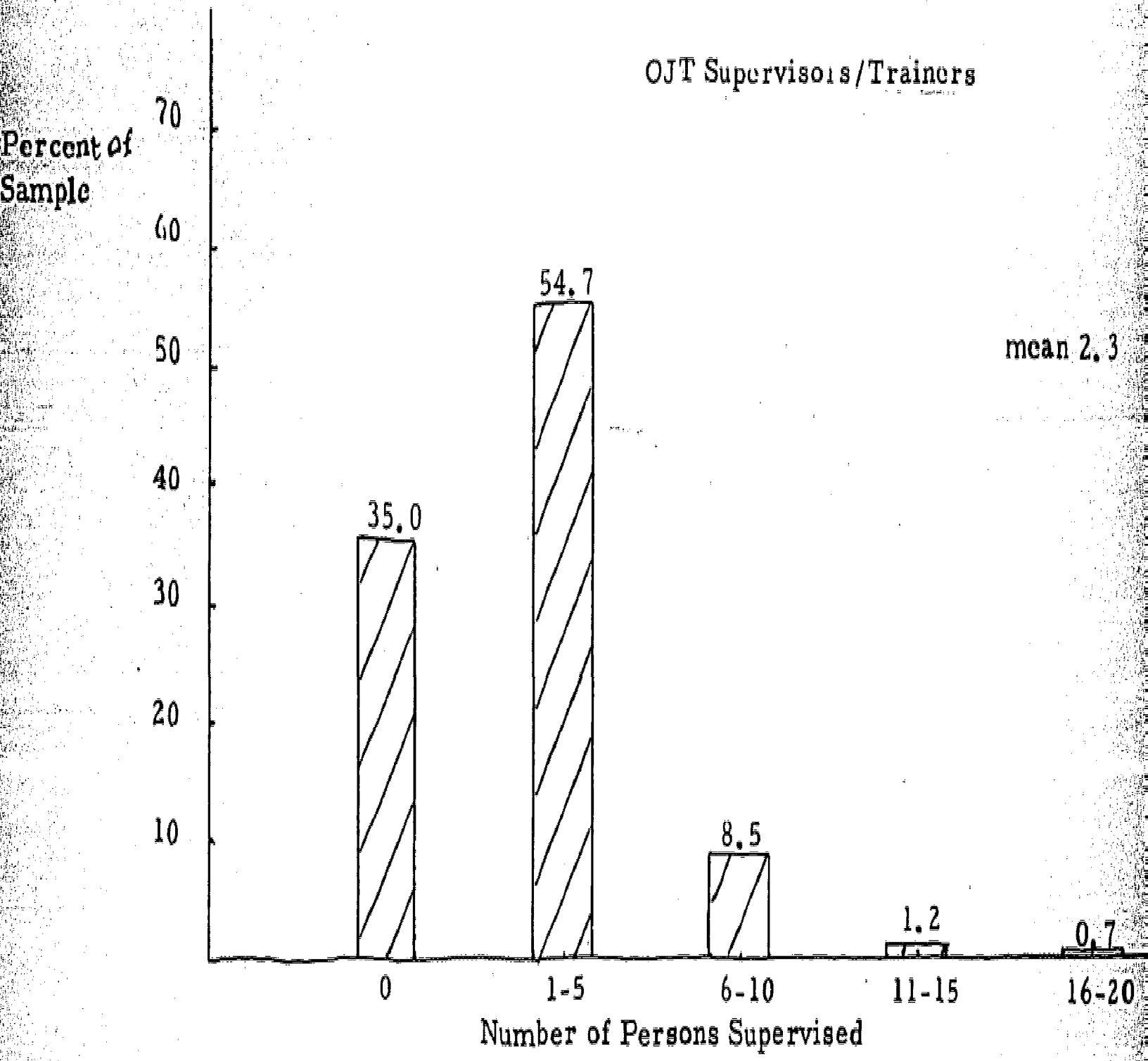

FIGURE 9: Percent Distribution of the Number of Persons Supervised AFSC 291x0, Telecommunications Operator

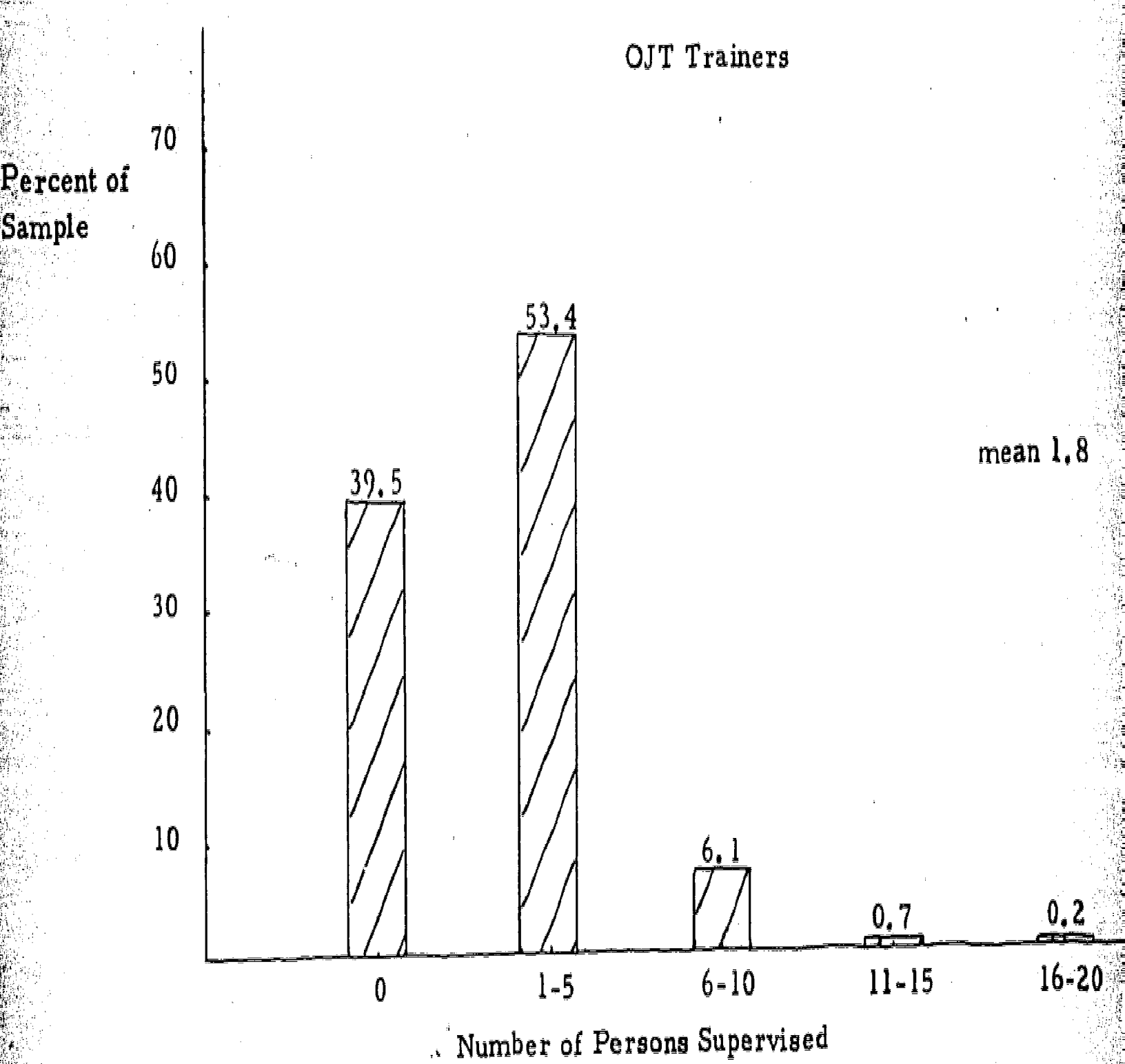

FIGURE 10: Percent Distribution of the Number of Persons Supervised
AFSC 291x0, Telecommunications Operator

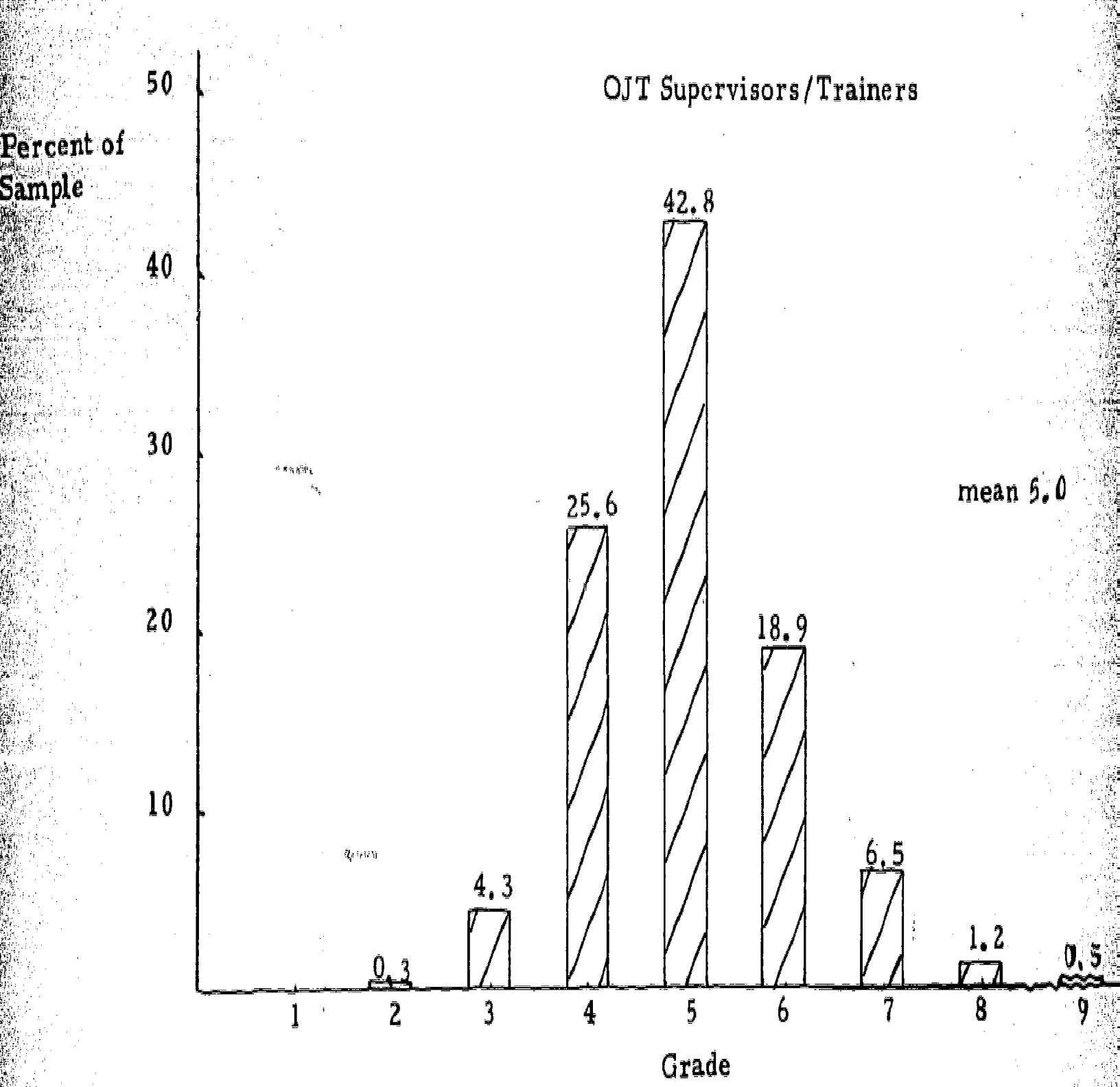

FIGURE 11: Percent Distribution of Grade
AFSC 291x0, Telecommunications Operator

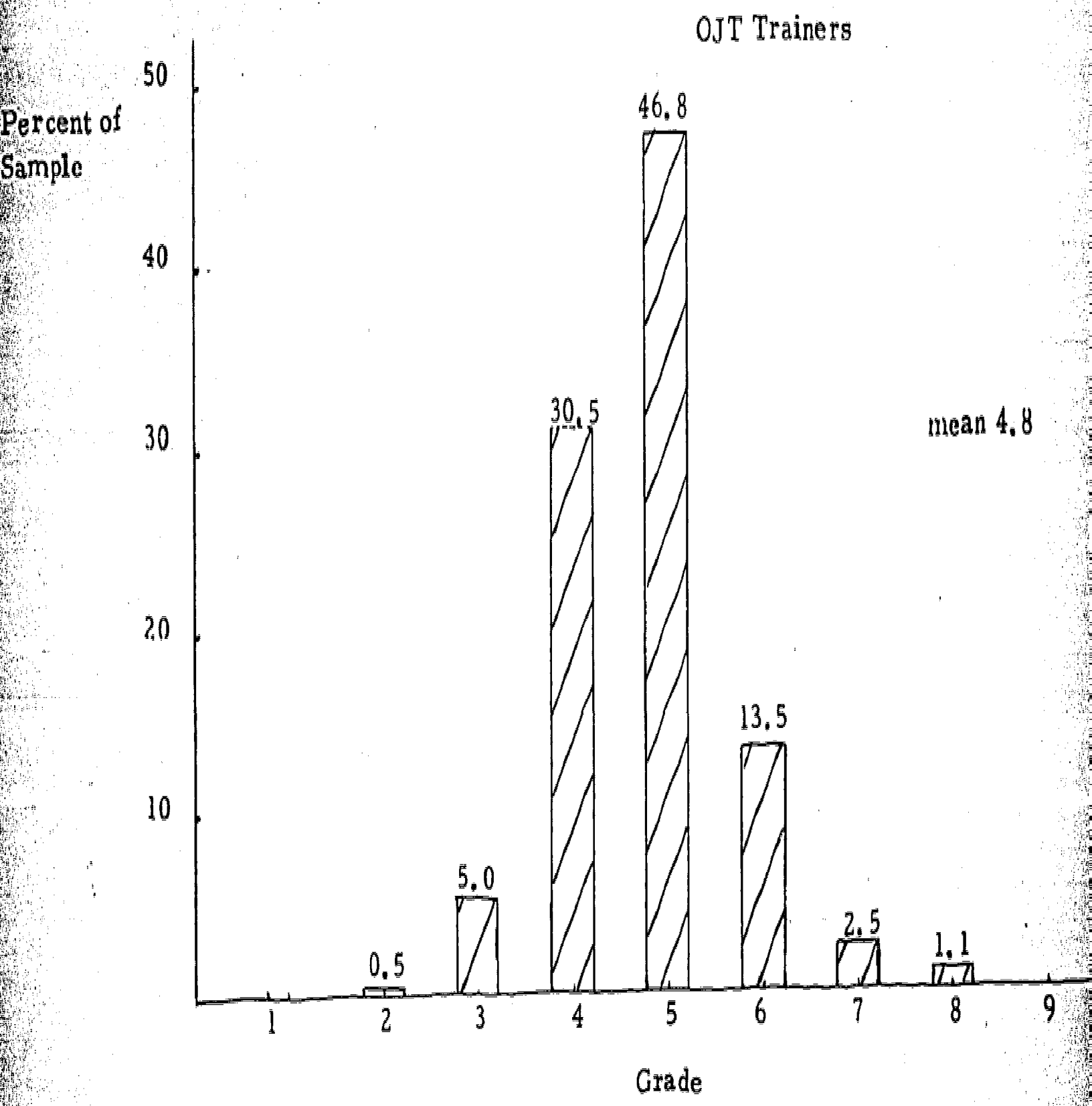

FIGURE 12: Percent Distribution of Grade
AFSC 291x0, Telecommunications Operator

3.1.3 Analysis of Cost Factor Aggregations

As indicated in the above analysis procedures, the costing analysis for OJT supervisor/trainer and OJT trainer time allocation will require that three data items -- mean percent time, mean number of trainees supervised, and percent distribution by grade -- be developed and maintained in the cost factor table for each group in each career field. While these procedures will result in reliable data at the career field level, it was felt that some aggregation of similar career fields might be made which would reduce the size of the cost factor table required for the costing analysis.

In defining an approach to aggregating OJT training groups within and among career fields, it was determined that if groups could be shown to be statistically alike, then the groups could be aggregated and characterized by a single set of cost factors. In the case of the six sample career fields used in previous sections, there existed a total of 12 groups (six career fields containing two groups each). Each of these groups is primarily characterized by four variable distributions generated from the Occupational Survey Analysis: (1) percent time spent on OJT tasks, (2) number of trainees supervised, (3) grade, and (4) skill level. Any two or more groups to be aggregated would have to be shown to be similar with respect to all of these variables in order to statistically support the use of a common set of cost factors.

Several statistical analysis techniques for assessing distribution similarity were considered and the use of the chi square test of dependency was chosen as the most straightforward. Through the use of contingency tables, chi square statistics were generated for all possible pairs of groups relative to the four characteristic sample variables. Utilizing these statistics in conjunction with standard chi square tables, the probability of being in error if group similarity were rejected was assessed. Under this hypothesis, a very low probability of being in error meant that groups could not be statistically treated as similar. A higher probability meant that similarity could not statistically be rejected. Tables 2, 3, and 4 show the results of the chi square aggregation analysis for the example career fields. The alpha (α) values in those tables indicate the error probability with $\alpha < 0.05$ indicating rejection of group similarity and $\alpha \geq 0.05$ indicating non-rejection of similarity.

TABLE 2: Chi Square Pairwise Comparisons of the OJT Supervisor/Trainer Groups for Six Career Fields

Interpretation: In general, one could decide to treat groups together unless α, for one or more measures, was very small, less than 0.05 for instance.

	Radio Operators		Missile Systems Maintenance		Integrated Avionics		Helicopter Mechanic		Aircraft Maintenance	
	χ^2	α	χ^2	α	χ^2	α	χ^2	α	χ^2	α
Telecommunications Operator 291x0	31.353	.04	7.8125	.99	37.921	.01	325.19	.005	477.02	.005
	72.903	.005	117.224	.005	11.137	.20	25.183	.005	77.899	.005
	13.821	.01	44.720	.005	13.229	.025	27.989	.005	33.024	.005
	47.750	.005	66.778	.005	16.941	.005	21.672	.005	69.708	.005
Radio Operator 293x3			11.082	.92	53.742	.005	425.63	.005	683.14	.005
			37.879	.005	4.163	.85	54.912	.005	93.056	.005
			36.349	.005	4.614	.33	15.371	.005	3.310	.52
			17.941	.005	2.912	.42	57.262	.005	63.405	.005
Missile Systems Maintenance 316x1					35.556	.02	189.403	.005	218.777	.005
					18.573	.025	82.451	.005	110.07	.005
					5.757	.23	10.550	.05	40.486	.005
					1.973	.59	56.996	.005	45.885	.005
Integrated Avionics 326x1							37.993	.005	33.575	.03
							13.546	.10	14.873	.10
							0.903	.92	3.120	.55
							16.027	.005	10.786	.975
Helicopter Mechanic 431x0									26.238	.13
									49.034	.005
									18.113	.005
									16.721	.005

Key: a) Percent Time Spent on Tasks in Subset A (19 degrees of freedom)
b) Grade (eight degrees of freedom)
c) Number of Persons Supervised (four degrees of freedom)
d) Duty AFSC (three degrees of freedom)

TABLE 3: Chi Square Pairwise Comparisons of the OJT Trainer Groups for Six Career Fields

Interpretation: In general, one could decide to treat groups together unless a, for one or more measures, was very small, less than 0.05 for instance.

	Radio Operators		Missile Systems Maintenance		Integrated Avionics		Helicopter Mechanic		Aircraft Maintenance	
	χ^2	α	χ^2	α	χ^2	α	χ^2	α	χ^2	α
Telecommunications Operator 291x0	22.879	.29	16.498	.62	35.044	.01	304.56	.005	396.06	.005
	48.274	.005	14.001	.10	5.303	.73	29.134	.005	75.751	.005
	9.946	.05	15.251	.005	3.439	.41	10.610	.05	18.622	.005
	26.151	.005	1.410	.70	5.780	.20	16.263	.005	71.930	.005
Radio Operator 293x3			27.258	.10	50.249	.005	343.41	.005	475.45	.005
			17.201	.05	5.161	.73	55.146	.005	58.772	.005
			10.089	.05	1.289	.87	7.331	.20	6.131	.20
			1.313	.73	0.509	.95	27.648	.005	30.798	.005
Missile Systems Maintenance 316x1					8.311	.98	49.976	.005	31.405	.04
					4.053	.85	13.192	.20	9.428	.31
					1.996	.74	9.438	.10	4.903	.28
					0.801	.95	2.952	.42	4.889	.20
Integrated Avionics 326x1							47.766	.005	28.766	.09
							8.287	.41	9.296	.32
							0.329	.99	0.379	.99
							6.810	.10	3.485	.33
Helicopter Mechanic 431x0									36.366	.01
									55.612	.005
									4.418	.35
									40.345	.005

Key: a) Percent Time Spent on Tasks in Subset A (19 degrees of freedom)
b) Grade (eight degrees of freedom)
c) Number of Persons Supervised (four degrees of freedom)
d) Duty AFSC (three degrees of freedom)

TABLE 4: Chi Square Comparisons of the OJT Supervisor/ Trainer and OJT Trainer Groups for Each of Four Distributions and Each of Six Career Fields

Interpretation: In general, one could decide to treat groups together unless α, for one or more measures, was very small, less than 0.05 for instance.

Distributions Under Consideration / Career Field	Percent Time Spent (A) v = 19		Grade v = 8		Number of Supervisors v = 4		Duty AFSC v = 3	
	x^2	α	x^2	α	x^2	α	x^2	α
Telecommunications Operator 291x0	14.297	.78	18.295	.025	4.998	.40	12.782	.005
Radio Operator 293x3	15.118	.72	29.484	.005	14.408	.005	8.427	.04
Missile Systems Management 316x1	27.411	.10	22.018	.005	6.252	.08	16.096	.005
Integrated Avionics 326x1	4.390	.99	7.070	.54	3.376	.52	2.617	.46
Helicopter Mechanic 431x0	43.679	.005	34.869	.005	23.790	.005	23.656	.005
Aircraft Maintenance 431x1	37.842	.01	27.965	.005	22.819	.005	24.009	.005

The comparisons often revealed similarities in one or two variables but not for all four measures, with two exceptions. Both supervisors/trainers and trainers appear very similar in the Integrated Avionics career field and could perhaps be treated as an aggregate group (Tables 4 and 5). Trainers for Integrated Avionics and Missile Systems Maintenance also seem similar (Table 3). Though larger aggregations were not examined, it appeared that an aggregation of all three of these populations would be possible. For demonstration purposes, however, only the pair of Integrated Avionics groups was considered. This would have reduced the costing demonstration from 12 groups to 11 groups (see Table 5).

However, aggregations should be considered carefully. Though the chi square test can be used to quantify the probability that distributions are significantly different, it cannot describe the confidence levels for deciding that groups are substantially similar. This fact is demonstrated upon a closer examination of Table 5 which reveals consistently less time involvement by OJT trainers as opposed to OJT supervisors/trainers even though the chi square test does not reject the possibility of similarity. The bias toward not rejecting similarity is discussed in more detail in Appendix D.

Because of the relatively small number of groups involved in the current example, it was decided to maintain cost factor detail for each group and ignore the possible aggregation suggested by this analysis. In a full-scale implementation of the costing methodology involving several hundred groups, it is anticipated that the aggregation analysis would generate larger and more reliable aggregates which would result in a significant reduction in the required number of cost factors. This reduction would render the methodology easier to use. It should be noted, however, that career field OJT cost estimates based on aggregate cost factors would differ slightly from those based on group-specific cost factors. If groups are appropriately aggregated, such differences should be of little consequence.

TABLE 5: Integrated Avionics Aggregate
AFSC 326x1

Interval	Supervisors	Trainers	Aggregate
Percent Time Spent on Tasks in Subset A			
0.0000 - 0.9999	4	4	8
1.0000 - 1.9999	4	4	8
2.0000 - 2.9999	10	8	18
3.0000 - 3.9999	3	2	5
4.0000 - 4.9999	5	4	9
5.0000 - 5.9999	6	4	10
6.0000 - 6.9999	8	5	13
7.0000 - 7.9999	2	1	3
8.0000 - 8.9999	1	0	1
9.0000 - 9.9999	1	1	2
10.0000 - 10.0001	0	0	0
10.0001 - 20.0000	11	3	14
20.0001 - 30.0000	1	0	1
30.0001 - 40.0000	0	0	0
40.0001 - 50.0000	0	0	0
50.0001 - 60.0000	0	0	0
60.0001 - 70.0000	0	0	0
70.0001 - 80.0000	0	0	0
80.0001 - 90.0000	0	0	0
90.0001 - 100.0000	0	0	0
Total	56	36	92
Mean	6.0870	4.4864	5.4607

TABLE 5 (continued)

Interval	Supervisors	Trainers	Aggregate
Grade			
1	0	0	0
2	0	0	0
3	4	4	8
4	8	8	16
5	20	17	37
6	18	7	25
7	6	0	6
8	0	0	0
9	0	0	0
Total	56	36	92
Mean	5.2500	4.7500	5.0543
Number of Subordinates Who Report to You Directly for Supervision			
0	19	17	36
1-5	23	15	38
6-10	10	3	13
11-15	3	1	4
16-20	1	0	1
Total	56	36	92
Mean	3.4821	1.8889	2.8587
Duty AFSC			
32631	0	0	0
32651	23	21	44
32671	33	15	48
32692	0	0	0
Total	56	36	92

3.2 Assessment of the OJT Administrative/ Management Burden

A key element in determining the overall costs of the OJT program are the personnel costs associated with the administration and management of OJT at all affected organizational levels. In identifying these costs, CONSAD first sought to delineate those groups at various organizational levels which have full- or part-time responsibility for direct administration or management of OJT. Those groups which provided direct support to the OJT program in terms of course development or instruction were also considered part of the overall administrative/management structure. The procedure utilized to identify these "direct overhead components" was one of reviewing applicable organizational manuals and regulations and constructing from them a composite organizational chart for the OJT program structure. The resulting chart is presented in Figure 13. The hierarchy represented in the chart indicates the management chain from the OJT trainee to the HQ USAF/OPR. This chain exists in a similar form for each MAJCOM with some variations at wing and base levels.

Having defined those groups involved in the direct management and administration of OJT, CONSAD then sought to ascertain the staffing for these groups and characterize that staffing by grade structure and variable or fixed size. The primary source for staffing data at the MAJCOM and intermediate command levels was a survey of the HQ MAJCOM NCOIC's for OJT. This survey, conducted by telephone, collected data on the size of OJT staff, their grade distribution, their fixed or variable nature relative to trainee load, their full- or part-time responsibility and the percent of staff time directly allocated to the OJT management/administration function. Staffing data of a similar nature for base level OJT management was obtained from Air Force Manpower Standards (AFM 26-3). Table 6 contains references to the staffing information collected for each organizational level indicated by the corresponding letter on the organizational chart. Appendix E contains a list of MAJCOMs and Separate Operating Agencies (SOAs) interviewed during the survey process, as well as a table of summary statistics on their responses to staffing inquiries.

FIGURE 13: Organizational Structure for OJT Administration, Management, and Program Support

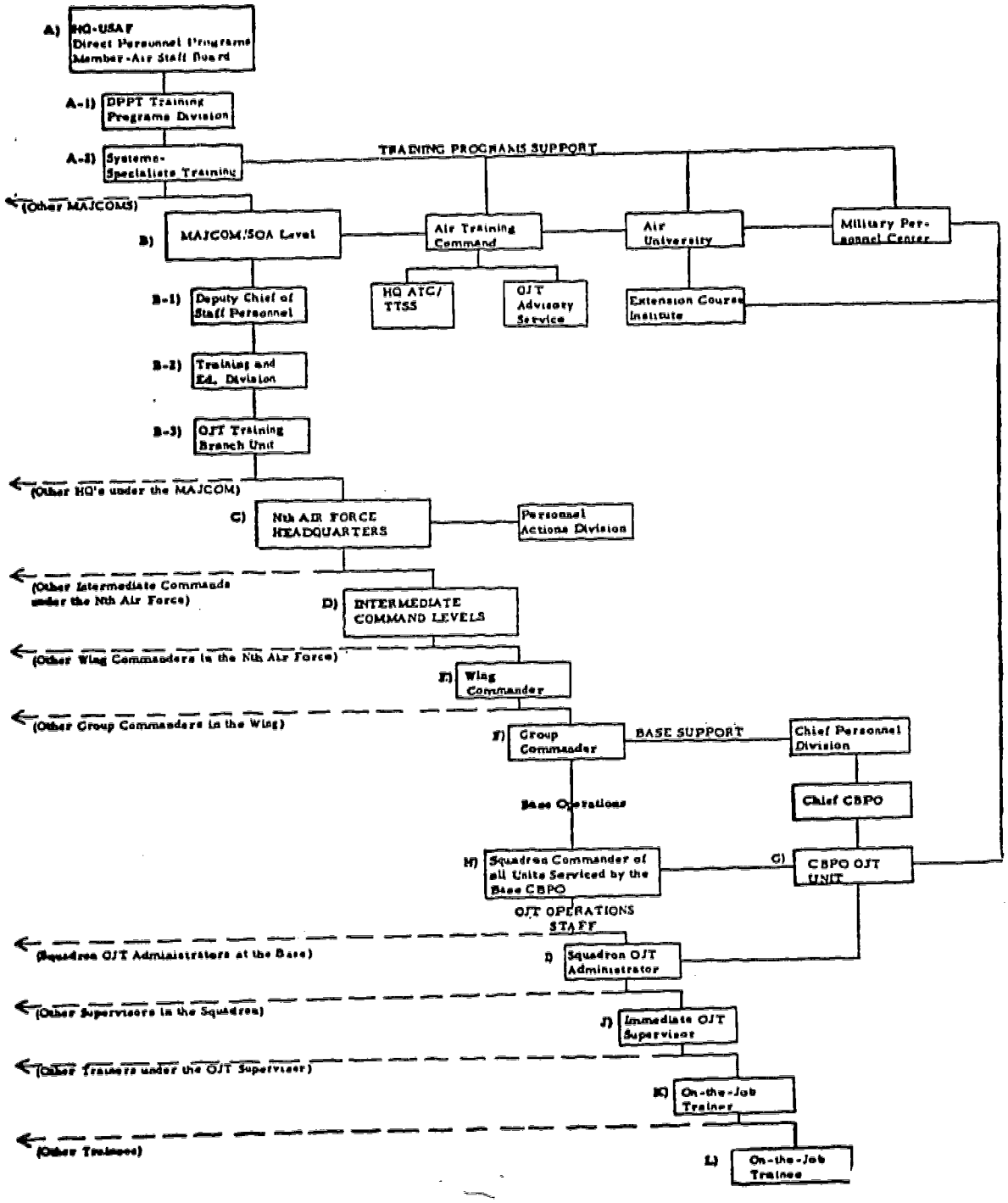

TABLE 6: Data Sources for OJT Administrative, Management, and Program Support Staff

Organizational Level	OJT Staff Function	Authorized Staff Data Source	Data Obtained for Current Study	Staff Utilization Data	Data Update Requirement
A: HQ USAF/DPXP	As defined in AFR 28-1, Chapter 15	UDL	1 Staff authorization - 05 as determined from field interview	Part-time responsibility as indicated by interview	Maintain current copy of UDL
B: HQ MAJCOM	As defined in AFM 50-23, Table 4-1	UDL for Organizational Level B-2 and B-3	Staff authorization by AFSC and Grade from UDL - obtained through OJT/NCOIC Survey for 13 MAJCOMs and 2 seperate operating agencies - see Table E3, Appendix E this report	Data on number of full-time staff and percent time allocated to OJT for part-time staff - obtained through OJT/NCOIC Survey - see Table E3, Appendix E, this report	Maintain current copy of UDL for offices indicated in Exhibit E3, Appendix E and request periodic update of utilization data
B: HQ ATC/TTSS	As defined in ATCR 52-2, Figure 6-1	UDL	Staff authorization by grade level - obtained through field interview - see Table E3, Appendix E, this report	Percent of staff time allocated to OJT/CDC function - see Table E2, Appendix E, this report	Maintain current copy of UDL and update utilization data
B: ATC/OJT Advisory Service	Develop, control and conduct Advisory Service courses - described in Chapter 12 of AFM 50-5 and also Section 3-7 of AFM 50-23	UDL	83 Field and 2 HQ Staff authorizations by AFSC and grade from UDL - obtained through OJT/NCOIC Survey - see Table E2, Appendix E, this report	All authorizations have full-time OJT responsibility	Maintain current copy of UDL
B: AU/ECI	As defined in ATCR 52-2, Figure 6-1	UDL	21 Military and 152 Civilian staff authorizations by grade from UDL - obtained through ECI Staff Survey - see Appendix G, this report	Percent of staff time allocated to OJT/CDC function - obtained through ECI Staff Survey - see Appendix G, this report	Maintain current copy of UDL for offices identified in Appendix G and request periodic update of OJT/CDC percent workload
B: MPC	As defined in AFM 30-3, data maintenance	UDL	No specific OJT staffing indicated*	No specific OJT staff utilization indicated*	Maintain current copy of UDL
C: Nth AF HQ	Maintain OJT programs - see Table 24, AFR 35-33	UDL	5 authorized training personnel at each of two numbered AF HQ given by AFSC and grade from the UDL - obtained through OJT/NCOIC Survey - see Table E3, Appendix E	All authorizations at numbered AF HQ level are full-time OJT personnel	Maintain current copy of UDL
D: Intermediate Command Levels	As defined in AFM 50-23, Table 4-2	UDL	No specific OJT staffing indicated*	No specific OJT staff utilization indicated*	Maintain current copy of UDL
E: Wing Command	In some MAJCOMs the Wing Command consolidates some unit OJT administrators - otherwise as defined in AFM 50-23, Table 4-2	UDL	2 full-time training specialists in SAC - obtained through OJT/NCOIC Survey - see Table E2, Appendix E, this report	The training specialists have full-time OJT responsibility	Maintain current copy of UDL
F: Group Commander	As defined in AFM 50-23, Table 4-2 - oversees OJT management	UDL	1 per group	No specific OJT staff utilization indicated*	Maintain current copy of UDL
G: CBPO OJT Unit	As defined in AFM 50-23, Table 4-3	UDL, Command Manpower Authorization File, Manpower and Personnel Assignment Document	1 OJT Monitor per CBPO and Career Control Personnel as defined in AFM 26-3, Vol. II, 16335: Y persons per CBPO where Y = 0.94154 + 0.00058098 X and X is total airmen authorized in units served by the CBPO - and for AFLC, 45 persons authorized by AFSC and grade - obtained through OJT/NCOIC Survey	All authorizations have full-time OJT responsibility	Maintain current copies of UDL, CMAF, and MPAD - maintain current manpower standard from AFM 26-3 for unit OJT administration
H: Squadron Commander	As defined in AFM 50-23, Table 4-2	UDL	1 per squadron	No specific OJT staff authorization indicated*	Maintain current copy of UDL
I: Squadron OJT Administrator	As defined in AFM 50-23, Table 4-4 - maintains OJT roster	UDL	1 per squadron plus staff supervisors (see Section 4-5, AFM 50-23)	Full-time authorization for the Squadron OJT Administrators	Maintain current copy of UDL.
J: OJT Supervisors	As defined in AFM 50-23, Table 4-5	Squadron OJT roster, UDL, analysis of Occupational Survey Data	Varies by AFSC - refer to discussion in Section 3.2 of this report	See Section 3.2 of this report	Maintain current copies of UDL and Squadron OJT rosters - keep Occupational Survey Data up to date
K: OJT Trainers	As defined in AFM 50-23, Table 4-6	Squadron OJT roster, UDL, Analysis of Occupational Survey Data	Varies by AFSC - refer to discussion in Section 3.2 of this report	See Section 3.2 of this report	Maintain current copies of UDL and Squadron OJT rosters - keep Occupational Survey Data up to date

*OJT/NCOIC Survey and other field interviews indicated no explicit authorizations for the documented OJT function or produced no explicit delineation of staff time allocated to that function.

The purpose of the staffing data collected through these procedures is to facilitate the calculation of "direct personnel overhead factors" which will define the overhead burden associated with each unit measure of OJT trainee load. Because the size of OJT staff indicated in Table 6 is subject to variation with changes in authorization or workload, the calculated burden will be considered an annual factor which will require reestimation each year. Staffing data for each indicated organizational level are to be collected annually according to the data update requirements specified in Table 6. The staffing data for the current year are then used to calculate the overhead factor for costing analyses conducted during that period.

Since the costing methodology is designed for application at the unit, base, intermediate command, MAJCOM or Air Force-wide levels, overhead factors must be calculated to correspond with the hierarchical structure depicted in Figure 13. Each unit, base, and MAJCOM must therefore have a defined overhead burden which exists to support OJT conducted within their organizational boundaries. In other words, the overhead staff burden at the unit/squadron level would be distributed over the squadron training load, the base overhead staff burden over the sum of all unit training loads for which it is responsible, and the MAJCOM overhead staff burden over the sum of all base training loads for which it is responsible. Overhead staff burdens for OJT program support such as the Advisory Service and other organizational levels above HQ MAJCOM would be distributed over the entire Air Force training load. Costing at various levels is then accomplished by summing the overhead burdens to the desired costing level. For example, costing at the MAJCOM level would require adding the overhead burden for each unit and base within the MAJCOM to that established for the HQ MAJCOM and higher levels and then applying that burden to the corresponding training loads at the unit level. Each unit-base-MAJCOM would then have a composite overhead factor reflecting the overhead staff burden existing for each command string.

Given that overhead staff burdens may change on an annual basis and that trainees may be supported across year boundaries, it was decided that the most appropriate training load unit for calculating annual overhead cost factors would be a measure of "trainee-months." Under the assumption that a trainee is supported administratively for the duration of active enrollment in formal OJT, the trainee-month measure will facilitate the splitting of the overhead burden between the years where the size of the burden may vary. For example, a trainee enrolled in OJT for a duration of 6 months starting in September 1977

and ending in February 1978 would constitute 4 trainee-months supported by the 1977 overhead burden and 2 trainee-months by the 1978 burden.

At the outset of the costing analysis, trainee-months by organizational level are obtained for the most recently completed annual cycle according to procedures outlined in Section 3.6 below. The personnel overhead burden assessed for the current year by organizational level is then divided by the trainee-months supported at the organizational level, thus yielding the annual "direct personnel overhead cost factor" in units of man-hours or dollars per trainee-month. These factors can then be applied for costing purposes at varying levels during the current year as described earlier.

Because annual overhead cost factors are of necessity based on trainee loads from the previous year, some loss of estimation reliability is to be expected when these loads change drastically from year to year within a given AFSC or organization. This estimation error can be minimized by reestimating the factors within a year through utilization of the most recent monthly, quarterly or semi-annual trainee-month data. Procedures outlined in Section 3.6 for deriving trainee-month data can be employed over any specified time interval and would thus allow for this type of within-year estimation of the cost factors.

3.3 Assessment of OJT Program Support Cost Factors

In Section 3.2, procedures were established for calculating "direct personnel overhead" cost factors for each organizational level involved in the direct administration and/or management of the OJT program. At each organizational level, these factors represent the personnel overhead burden which is assigned for each OJT trainee within that organization for the duration of the trainee's involvement in the OJT program. In addition to those organizations involved in the direct management or administration of OJT trainees, there exist certain organizations which provide support for OJT in terms of course development, administration, instruction, and other related activities. These organizations differ from the others in that the support which they provide crosses organizational boundaries and the burden of that support must therefore be allocated to all supported trainees regardless of unit, base or MAJCOM affiliation. As such, the development

of overhead cost factors for these support functions will be treated separately in this section.

3.3.1 Development of Cost Factors for the Career Development Course (CDC) Program

The CDCs play a vital role in the "dual channel" OJT concept. It is through these "home study" courses that the OJT trainee supplements his/her job proficiency training with more generalized knowledge of his/her specialty. Although some non-OJT usage of CDCs does occur, the primary purpose of the CDC program is to provide career knowledge course support to the OJT program. As such, the costs of personnel and materials utilized in the development, production, administration, and revision of CDCs must be considered OJT program support costs which are attributable to participating trainees.

CDC program costs are stratified into two major cost categories. The first are those non-course-specific costs incurred in the development and revision of CDCs, the enrollment and tracking of trainees, and the production and maintenance of instructional materials inventories. The second category are those course-specific costs incurred in the development and revision of each set of CDC volumes. Non-course-specific costs can reasonably be considered as an annual support burden which is generated equally by each CDC enrollee for the duration of his enrollment. Procedures for developing this annual "CDC personnel support burden" are similar to those outlined in Section 3.2 and will be discussed in more detail below. Course-specific costs require a more individualized analysis of each CDC and are thus addressed as a separate cost factor in Section 3.4.

Major staff involvement in non-course-specific CDC activities occurs within the Technical Standards Office of HQ ATC (ATC/TTSS) and the ECI of the Air University (AU/ECI). The role of ATC/TTSS is to manage the development and revision of CDCs through coordination of designated CDC responsibility centers with the editing and production staff of ECI. This function is primarily carried out by a staff consisting of two civilian members allocating approximately three-quarters of their productive time to the management of CDC development and revision activities. Concurrent responsibility for the editing, production, and dissemination of revised or newly developed CDCs and the enrollment and monitoring of trainees in those CDCs is delegated to AU/ECI. To meet this responsibility, ECI is authorized a mixed staff of 173 military and civilian personnel. As indicated in a recent

ECI internal audit of staff time allocated by function, these ECI personnel spent an average of 66 percent of their productive time in support of their designated CDC responsibilities.

As with the "direct personnel overhead burden" discussed in Section 3.2., the assessment of the "CDC support personnel burden" for ATC/TTSS and AU/ECI is accomplished through the annual collection of staffing and staff utilization data as described in Table 6. Having collected these data for the current year, the support personnel burden is calculated as the annual "full-time" staff load multiplied by the percent of productive staff time allocated to the CDC function in each organization. Actual staffing and staff utilization data collected for the current study are referenced in Table 6 and contained in Appendices E and G for ATC Technical Standards Office (TTSS) and AU/ECI, respectively.

Development of actual "CDC support personnel cost factors" is accomplished by allocating the calculated support personnel burden equally over each enrollee supported, for each month of his/her enrollment in the current year. Data required to calculate supported enrollee-months on an annual basis can be obtained from the AU/ECI Course Management Information System. This system generates data files on a monthly basis which contain summaries of active and inactive enrollments by reason and category for each career development course. These monthly summaries are developed by calculating the net change in the number of active and inactive enrollments during the month and then adding that net change to the opening enrollment balance to generate the closing enrollment balance for the month. Activities monitored during the month which contribute to the calculated net enrollment change include: new enrollments, course completions, enrollments suspended (made inactive) due to non-completion, and enrollments dropped due to lack of progress or for administrative expedience.

For the purpose of calculating annual enrollee-months supported, the ECI Monthly Summary by Reason (File Number PCNUE020-49A) has been determined to be the most appropriate data source. A complete list of the summary variables contained in this file is given in Appendix G. Of these, only the ACTIVE variable is required in the calculation of enrollee-months. The ACTIVE category represents the total number of enrollees who are actively participating in the CDC program at the end of each month. Under the assumption that personnel support is primarily directed toward the active enrollees, the following procedures can be employed to estimate annual enrollee-months for use in calculating CDC support personnel cost factors:

Obtain from ECI/EDX the total value of the ACTIVE variable (summed over courses and reasons) for CDC enrollees from the ECI Monthly Summary by Reason (PCNUE 020-49A) for each of the 13 months immediately preceding the current costing year.

Define the average active enrollment (AAE) for any month i as:

$$AAE\ (i) = \frac{[ACTIVE\ (i) + ACTIVE\ (i-1)]}{2}$$

Defining each active enrollee in a month to be equivalent to one enrollee-month, the total annual enrollee-months (TEM) is obtained by summing the monthly averages over the specified number of months (M):

$$TEM = \frac{[ACTIVE\ (1) + ACTIVE\ (0)]}{2} + \frac{[ACTIVE\ (2) + ACTIVE\ (1)]}{2} + \ldots + \frac{[ACTIVE\ (12) + ACTIVE\ (11)]}{2}$$

Because the ACTIVE variable represents an end-of-month figure, the 13 monthly values actually bracket 12 monthly periods (M = 12) with ACTIVE (0) representing the ending value of the twelfth month preceding the current year. Keeping this in mind, the annual summation reduces to the following form:

$$TEM = \frac{[ACTIVE\ (0) + ACTIVE\ (M)]}{2} + \sum_{i=1}^{M-1} ACTIVE\ (i) \qquad (1)$$

Once calculated, the estimate of enrollee-months supported can then be divided into the calculated CDC support personnel burden for each participating organization, to derive the "CDC support personnel cost factor" in units of staff burden per enrollee-month. As with the "direct personnel overhead cost factors" (Section 3.2), the CDC support factors must be reestimated annually. More frequent monthly, quarterly, or semi-annual reestimations can be made if desired, by simply utilizing active enrollment data for the 13 months immediately preceding the most recently completed monthly, quarterly, or semi-annual period.

In addition to the CDC support personnel burden, enrollees also share in the generation of annual costs incurred in the maintenance of CDC volume inventories. Because the printing of instructional materials is more directly dictated by inventory control requirements than enrollment levels in any given course, these costs are also considered non-course-specific. As such, the annual printing costs can be attributed equally to all CDC enrollees for the duration of their active enrollment in the current year.

Since the personnel component of annual inventory maintenance costs is included in the ECI support personnel cost factor, only an annual "CDC printing costs factor" remains to be calculated. Data required for the calculation of annual printing costs can be obtained from monthly printing cost statements transferred from the Air University Print Shop to ECI Printing Control Branch (ECI/DAP). These statements contain an accounting of actual printing costs incurred each month and can be summed over 12 months to develop an annual cost total according to the following procedures:

- Obtain from ECI/DAP the total printing costs (TPC) indicated on the monthly statements for each of the 12 months immediately preceding the current year.

- Calculate the annual printing cost (APC) as the sum of the total monthly printing costs over the designated 12-month period:

$$APC = \sum_{i=1}^{12} TPC\ (i) \qquad (2)$$

To derive the "CDC printing cost factor" for the current year, the calculated annual printing cost is then divided by total enrollee-months (Equation (1)) for the 12-month period corresponding to the printing cost summation. Again, this factor requires annual reestimation using the most recent year's printing costs and enrollee-month data. Within-year factor estimations are also possible by obtaining monthly printing cost and active enrollee data for the required number of periods immediately preceding the most recently completed month or quarter within the current year.

The calculation of printing cost factors according to the above procedures represents a reasonable, direct cost approach to the analysis of CDC inventory costs. It should be noted, however, that some portion of the printing costs incurred in a given year is necessitated by inventory level requirements established for the succeeding year. To avoid possible confusion with cost accounting conventions, the annual printing costs are considered to be an "expense" attributed to the year in which they occur and amortized over the enrollee-months supported in that year.

3.3.2 Development of an OJT Advisory Service Cost Factor

The OJT Advisory Service provides important support to the OJT program through the development, conduct, and maintenance of indoctrination and instruction courses for OJT administrators, supervisors, and trainers. In addition to this primary responsibility, the Service provides management and administrative guidance to MAJCOMs, bases, and units in the establishment and operation of OJT programs. The OJT program support provided by the Service is worldwide in scope and is carried out by a staff consisting of 83 field advisors and two headquarters personnel. This staff is utilized full time in support of OJT and, because their services are offered to all OJT organizations and participants, the annual cost of Advisory Service personnel must be attributed equally to all OJT trainees for the duration of their program participation.

The development of an "Advisory Service support cost factor," therefore, requires an estimate of the annual number of service personnel and the number of trainee-months served. The size of the annual personnel burden stratified by AFSC and grade can be obtained directly from the UDL for the Advisory Service. As referenced in Table 6 (Section 3.2), these annual staffing data have been collected for the current study and are contained in Table E3, Appendix E.

To determine the portion of the staff burden utilized in support of OJT, the percent of productive staff time allocated to this function must also be determined. This OJT staff utilization percentage can be estimated on an annual basis through the use of the Advisory Service PREFIT Report. This report, which is updated monthly and summarized quarterly, contains documentation of staff time utilized by function, e.g., instruction, travel, and course development.

By summing staff time over all OJT functions for the 12 months immediately preceding the current year, an annual OJT time allocation can be developed. This value can then be taken as a percentage of annual productive man-hours available for the entire staff* to determine the OJT staff utilization factor. Multiplying this factor by the current year's annual staffing, the size of the Advisory Service annual personnel burden allocated to OJT program support can be estimated for the current year. If the OJT support role of the Advisory Service were to change drastically in any given year, the above procedure would allow for an assessment of changed OJT responsibility. However, interviews conducted during the current study have indicated that current Advisory Service staff utilization in support of OJT is full time. This fact has been reasonably verified through analysis of PREFIT data for the first half of 1977.

Once the Advisory Service support personnel burden has been assessed for the current year, it must be divided by the number of trainee-months supported. The rationale for the use of the "trainee-month" measure has been discussed in Section 3.2 and that rationale is considered equally applicable to the Advisory Service cost factor. An estimate of the worldwide total of OJT trainee-months supported by the Advisory Service should therefore be made for the 12 months immediately preceding the current costing year. The annual trainee-month total should reflect a summation across all career fields and MAJCOMs with active OJT programs. Procedures for calculating the required trainee-month estimate are contained in Section 3.6 of this report. Dividing this estimate into the support personnel burden will produce the OJT Advisory Service cost factor in units of personnel burden per trainee-month for the current costing year.

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*Utilizing the estimate of 142 available man-hours per month from AFM 26-3, Volume 1, Table 2.1, annual productive man-hours available would be equal to 142 x 12 x the number of staff personnel.

As with all other annual support and overhead cost factors, the Advisory Service cost factor must be reestimated annually through collection of the most recent staffing and trainee-month data according to designated procedures. Since both the staff utilization data from the PREFIT Report and trainee-month data (Section 3.6) are updated on a monthly basis, more frequent reestimations for monthly, quarterly, or semi-annual periods during the costing year are possible.

3.4 Derivation of an Annual Course Development/Revision Cost Factor for Career Development Courses

In addition to the non-course-specific costs discussed in Section 3.3, an assessment of the total annual CDC program cost incurred in support of OJT must include those costs realized in the development and revision of CDC instructional materials. These costs are unique in that they may vary from course to course, they are considered capital investment costs which are amortized over the useful life of the course, and the burden of these costs is attributable equally to only those enrollees supported by the course over time. Thus, the focus of this section will be on the development of procedures which will facilitate the estimation of an "annual CDC development/revision cost factor" which reflects the unique time and course-dependent variability of this cost category.

3.4.1 Collection and Analysis of CDC Development and Revision Cost Data

As with the development of other OJT cost factors in this study, the primary consideration in the derivation of CDC development/revision costs was to establish costing procedures which are supportable with existing and readily available data. In keeping with this, a series of telephone and field interviews were conducted with responsible CDC program agencies to ascertain the source and availability of documented CDC development and revision costs. These interviews indicated that a formal requirement for documenting these costs existed within ATC/TTSS. A directed field interview with TTSS personnel verified that each school or training center responsible for CDC development or revision is required to document the costs they incurred in meeting this responsibility on a standardized set of ATC costing forms (ATC Form 435). Copies of the completed costing forms are maintained by each school or center, and summary cost statistics are accumulated by ATC/TTSS.

A subsequent interview with TTSS revealed that the ATC Form 435 costing requirement had been recently suspended but that a significant history of CDC development and revision costs could be made available for the derivation of cost estimating procedures. Specifically, it was indicated that these data covered 5 to 6 years, with the most recent cost figures extending through the first half of 1977. In order to further examine the data and better determine what type of capital costing approach could be supported, the most recent development and revision costs for CDCs utilized in the 15 career fields listed in Section 3.1.1 were requested from ATC/TTSS. In response to this request, TTSS accumulated and forwarded data reflecting development and revision costs for 79 CDC volumes representing course materials for 22 of the requested career fields. These costs were well documented and provided detailed information on the purpose of the expenditure (initial development, revision, rewrite, or change), the number of man-hours required by grade level, the unit man-hour costs, and the total costs incurred for the level of effort expended. A sample of the format and content of these costing data is contained in Appendix H.

In reviewing the documented CDC costs, it was determined that the following major costs were involved in the development and maintenance of a CDC:

- Initial development cost.
- Annual review cost.
- Minor revision or change cost.
- Major revision or change cost.

Since these costs are incurred to establish or sustain the utility of a CDC over time, they are considered to be life cycle costs which must be evaluated over the useful life of the course. Additionally, since the course provides instructional support to its enrollees for the duration of its useful life, the burden of those life cycle costs must be shared equally by all who receive this support over time. Keeping these criteria in mind, and recognizing the need to be consistent with other annual CDC cost factors, it was determined that development and revision life cycle costs should be evaluated on a uniform annual basis. This can be accomplished by employing a standardized economic formulation known as a "Uniform Annual Payment (or Cost) Series." Utilizing this formulation, the total life cycle costs of a course can be converted into an equivalent single annual cost burden to be incurred in each year of the useful life of the CDC. This uniform annual cost burden can then be allocated equally over all course enrollees for the duration of their enrollment in a given year.

In order to support this life cycle costing approach, data must be available to document the useful life, initial development cost, annual review cost, minor revision cost, and major revision cost for each CDC. With the exception of a measure of useful life, all of these required costing measures can be obtained directly from data contained on ATC Form 435. Depending upon the age of a particular course, these costing measures can be extracted from available ATC Form 435 data for up to 6 years, and they can be documented in actual dollar units or man-hour units expended by grade level. Utilizing these documented historical cost measures, an assessment can be made of average expected life cycle costs.

Because a measure of expected course life is not directly available from existing data, this component of the costing formulation must be derived. By definition, the useful life of any entity is that span of time (measured in years, months, or days) over which the entity, under normal maintenance conditions, is actively employed in the capacity for which it was originally designed. In the case of a CDC, the useful life would be that span of time during which the current version, subject to review and minor revision, is actively used for instructional purposes. Under this definition, a major revision or rewrite of an existing course would constitute both the end point of the current CDC's useful life and the beginning point of the revised version's useful life. As such, a reasonable measure of a CDC's expected useful life would be the average number of years between initial development and the first major revision, or a combined average of that number of years with the times between subsequent major revisions. A comparison of the initial development and major revision efforts documented for the sample CDCs revealed that costs incurred were of similar magnitude. This fact would appear to support the above definition of useful life in that it verifies the assumption that a major revision actually constitutes a course redevelopment which both terminates the current life cycle and begins the next. The current costing approach therefore utilizes this definition of useful life and provides procedures for its quantification on a per course basis.

As a first step in implementing the life cycle costing approach outlined above, procedures must be implemented to collect and analyze the data required for an annualized costing formulation. The sources for these data and the techniques for calculating the required average costing measures are thus presented below:

1. Obtain through ATC/TTSS the entire development/revision cost history for all volumes of each CDC utilized in the OJT program.

2. For each year in which data are available, record the following for each volume of each CDC:

   a. Total man-hours expended by grade for minor revisions (MIR).
   b. Total man-hours expended by grade for annual review (AR).
   c. Total man-hours expended by grade for initial development (ID).
   d. Total man-hours expended by grade for major revision (MAR).

3. Sum the recorded expenditures by grade for each category 2.a-2.d, in each year (n), over all volumes (i) of each CDC (j) to calculate the total annual CDC expenditures by grade for the indicated categories:

$$MIR\ (j,\ n) = \sum_i MIR\ (i,\ j,\ n)$$

$$AR\ (j,\ n) = \sum_i AR\ (i,\ j,\ n), \text{ and so on.}$$

4. Utilizing all annual expenditures (N) by grade, calculate the average annual CDC expenditures by grade for categories 2.a and 2.b:

$$\overline{MIR}\ (j) = \frac{\sum_{n_1}^{N_1} MIR\ (j,\ n_1)}{N_1}$$

$$\overline{AR}\ (j) = \frac{\sum_{n_2}^{N_2} AR\ (j,\ n_2)}{N_2}$$

5. Utilizing the single occurrence of initial development expenditures (if available) and all occurrences (N) of major revision expenditures, calculate a composite average development and revision expenditure by grade (DR) for each CDC (i):

$$DR\ (i) = \frac{ID\ (i) + \sum_{n}^{N} MAR\ (i, n)}{N + 1\ (\text{if } ID\ (i) \neq 0)\ \text{or}\ N\ (\text{if } ID\ (i) = 0)}$$

In developing an estimate of useful life as the time between major revisions, one must also consider the marginal time required to publish the revised version after the revision work has been completed. Since the current version remains in use until the revised version is published, the time span between the publication dates of major revision would be a more accurate measurement of useful life. Data required to calculate an average time between major CDC revision publications can be found in Section IV, Volume 2, of the USAF Program Technical Training Document (PTT). This document is published by HQ TAC and is updated in February, June, and October of each year. In Section IV of the PTT, the publication date of the current version and the completion date of major revisions are given for each volume of each CDC. Utilizing these data in the manner described below, an average time between major revision publication can be devised as an estimate of expected useful course life for each CDC:

1. From Section IV of the most recent PTT, determine the publication date for the current version of each volume of each CDC.

2. Referencing PTT documents for the months immediately preceding the current publication date, determine if that date reflects a revision or inital development as indicated by information contained in the "ATC Production" columns.

3. If the current publication date reflects a revision, then record the previous publication date from the referenced PTT and repeat the process until three revision cycles have been identified or the initial publication date has been established.

4. Beginning with the initial publication date or the last identified revision publication date, calculate the time between revisions in months for each volume in each CDC.

5. Calculate the average time between revisions for each volume by summing the individual revision cycle time spans and dividing by the number of revision cycles utilized.

6. Calculate the average time between revisions in years for each CDC by taking the mean of the average revision cycle times for all volumes in a CDC and dividing that mean by 12.

A comparison of major revision cost data and completion dates for the sample CDCs, with the revision indicators in the PTT, revealed that the definition of a major revision adopted for this study appears to be compatible with the revision definition employed in the PTT. As such, the procedures outlined above should provide a fairly accurate delineation of major revision cycles and thus a reasonable estimate of useful course life according to the convention utilized earlier in this section. It should be pointed out, however, that these procedures would result in a less reliable estimate of useful life for those CDCs whose revision periods varied widely. In this case, a specific inquiry as to a reasonable estimate of useful life might be made of the training center personnel responsible for the course revisions.

3.4.2 Derivation of Annual CDC Development and Revision Life Cycle Costs

As discussed in the preceding section, the life cycle of a CDC can be estimated as the time between major course revisions. The life cycle costs of a CDC would therefore consist of those costs incurred over the defined useful course life. Specifically, these costs consist of the development/revision costs required to activate a new or heavily revised course, the annual review costs expended to assure course adequacy, and any minor revision costs incurred to maintain that adequacy. The basic premise to be used in evaluating these life cycle costs in the current study is that, in the presence of these continuous review and revision efforts, each CDC has a lifetime consisting of several discrete life cycles, whose average duration can be related to [illegible] This premise is supported by ATC/TTSS

personnel who have indicated that the man-hour expenditures documented for each cost category are relatively constant over time, with dollar expenditures varying according to current wage and salary scales. As such, the annual evaluation of the current cost of average man-hour expenditures over the average life cycle of a CDC will provide a reasonable estimate of the uniform annual CDC cost burden in any given year of any given life cycle.

The calculation of a uniform annual CDC cost burden can be accomplished through the use of the standard economic formulation for a "Uniform Annual Payment (or Cost) Series."

$$R = P \cdot \left[\frac{i \cdot (1 + i)^n}{(1 + i)^n - 1}\right]$$

where: R = the uniform annual cost.

P = the principal amount invested.

n = the number of periods in the life cycle.

i = the prevailing interest rate.

Since P is considered to be a one-time investment (cost) at the outset of the life cycle, any costs incurred over the life cycle must be converted to an equivalent present cost. This can also be accomplished through a standard economic formulation for "Present Value."

$$PV = \sum_{t=1}^{n} \frac{C_t}{(1 + i)^t}$$

where: PV = the present value of life cycle costs.

n = the number of periods in the life cycle.

C_t = the costs incurred in each period t.

i = the prevailing interest rate.

Employing these standard formulations, the annual CDC development/revision costs can be derived according to the following procedures:

1. Referring to procedures outlined in Section 3.4.1, develop the average development/revision expenditure ($\overline{DR}$), the average annual minor revision expenditure ($\overline{MIR}$), the average annual review expenditure ($\overline{AR}$), and the mean useful life in years (n) for each CDC (j).

2. Utilizing the estimate of 1704* available productive man-hours per year, divide the average man-hours expended by grade in each cost category by 1704 to convert these expenditures into equivalent man-years by grade.

3. Employing the most current standard annual cost (AC) figures by grade (g) referenced in Section 3.5, convert the man-year expenditures for each cost category into actual dollar amounts by multiplying each expenditure by its corresponding annual cost and totaling those dollar costs across grade levels:

$$MIRC(j) = \sum_{g} \overline{MIR}(j, g) \cdot AC(g)$$

$$ARC(j) = \sum_{g} \overline{AR}(j, g) \cdot AC(g)$$

$$DRC(j) = \sum_{g} \overline{DR}(j, g) \cdot AC(g)$$

4. Calculate the present value of the life cycle costs for each CDC as:

$$PV(j) = \sum_{t=1}^{n} \frac{(MIRC(j, t) + ARC(j, t))}{(1 + i)^t}$$

5. Calculate the total present life cycle cost (PLC) for each CDC (j) as:

$$PLC(j) = PV(j) + DRC(j)$$

---

*Using 142 available man-hours per month from AFM 26-3, Volume 1, Table 2-1, the available man-hours per year are estimated as 12 x 142.

6. Calculate the uniform annual CDC development and revision cost (ADRC) for each CDC (j) as:

$$ADRC\ (j) = PLC\ (j) \cdot \left[\frac{i \cdot (1 + i)^n}{(1 + i)^n - 1}\right]$$

In the above calculations, the interest rate (i) may be set to the Office of Management and Budget (OMB) approved value of 10 percent. If another OMB approved rate is normally utilized by the cost analyst, that rate may be employed in these equations.

3.4.3 Calculation of Annual CDC Development and Revision Cost Factors

Having calculated the uniform annual CDC development and revision costs, the corresponding cost factor can be derived by allocating those costs equally over the CDC enrollee-months supported by the course. Utilizing the rationale and procedures developed in Section 3.3.1, the required annual estimates of enrollee-months supported can be calculated as follows:

1. Obtain the value of the ACTIVE enrollee variable as described in Section 3.3.1 but maintain its discrete value for each CDC (j) summed only over reasons for enrollment.

2. Employing Equation 3.3.1 with the same variable and time frame definitions, the total annual enrollee-months for each CDC (j) can be calculated as:

$$TEM\ (j) = \frac{[ACTIVE\ (j,\ 0) + ACTIVE\ (j,\ M)]}{2} + \sum_{i=1}^{M-1} ACTIVE\ (j,\ i)$$

3. Referencing Step 6 in Section 3.4.2, the CDC development and revision cost factor (DRCF) for the current costing year is derived in units of dollars per enrollee-month for each course as follows:

$$DRCF\ (j) = ADRC\ (j)/TEM\ (j)$$

As with other CDC program support cost factors, the development and revision factor must be reestimated annually, utilizing the most recent annual estimate of enrollee-months and the most current annual cost figures for man-hour expenditures. Once the man-hour expenditures have been estimated using the most recent annual cost figures, within-year reestimations of the cost factor can be made by adjusting the enrollee-month estimate for the most recently completed monthly, quarterly, or semi-annual period.

3.4.4 Estimating CDC Enrollee-Months as a Function of Trainee-Months

In the actual application of the costing methodology, the CDC cost factors developed here and in Section 3.3 must be applied to the number of enrollee-months present at each organizational level during the designated costing period. Unlike the procedures designed for estimating trainee-months (Section 3.6), there appears to be no direct way of stratifying monthly ECI enrollee data by organization without some primary programming effort. Since most MAJCOMs, CBPOs, and units monitor the CDC enrollment status of their OJT trainees, a direct measurement of enrollee-months could be employed when costing OJT at these organizational levels. However, in order to provide the user with an option to direct field measurement, the following procedures have been developed to facilitate the estimation of enrollee-months by organization as a function of measured trainee-months conducted within the organization:

1. Obtain from ECI/EDX, the average months for satisfactory course completion (AVG MO) of each CDC as calculated for enrollees in Category 6 (regular Air Force airman) with designated enrollment reason L (OJT upgrade, lateral or retraining). These averages are available on the History File of ECI Summary by Reason and Category (File Number PCN UE020-36A/36B).

2. Obtain the most recent quarterly edition of the AFMPC report entitled "Average Time to Complete OJT by AFSC in Months" (PMC-P260) and extract the average completion times (ACT) for those AFSCs and upgrade levels which have CDCs. If completion times are given for both upgrade and retraining, take the numerical average of the two times.

3. For each AFSC (i) and upgrade level (j), calculate the average percent of OJT completion time involving concurrent CDC enrollment (% E) as:

$$\%E(i, j) = AVG\ MO(i, j)/ACT(i, j)$$

If, due to averaging, % E should exceed 1.00, then set it equal to 1.00. This recognizes the fact that CDC completion is required for training completion and should therefore never extend beyond the training period.

These percent enrollment factors can then be multiplied by measured organizational trainee-month loads for their corresponding AFSCs and upgrade levels to develop an estimate of the number of enrollee-months present for costing purposes.

3.5 Quantifying the Costs of OJT Personnel

All of the procedures outlined in previous sections of this chapter are designed to generate OJT cost factors in units of "personnel burden" such as man-hours or man-years stratified by grade level. The use of these units is designed to provide more flexibility and reliability to the costing methodology in that measures of personnel time allocations tend to be more stable over time than do their cost equivalences. As such, the development of cost factors seeks first to calculate personnel burdens on the basis of more stable percent time or direct man-hour allocations and then evaluate the actual cost of those burdens according to the most current wage and salary scales.

The primary source of personnel cost data for establishing the dollar amount of calculated OJT personnel burdens is AFR 173-10, Volume 1, which is maintained and published by HQ USAF/ACMCA. This regulation provides standard costs and rates on an annual or hourly basis for Air Force military and civilian personnel and equipment utilization stratified by organization and equipment classification. Of specific interest to the current methodology are the annual personnel costs contained in the following tables.

1. Annual Composite Standard Rates, Table 20, Appendix A, page A112, which gives the annual composite cost of Air Force military personnel for airman grades E-1 through E-9 and officer grades O-1 through O-10. This composite cost reflects the sum of basic pay, basic allowance for quarters, miscellaneous expense, and incentive and special pay.

2. Average Annual Cost of Civilian Employees by Grade, Table 24, Appendix A, page A116, which gives the annual costs of General Schedule (GS) civilian personnel for grades GS-01 through GS-18.

3. Commands' Civilian Average Man-Year Costs, Table 25, Appendix A, page A117, which gives the average annual cost of civilian personnel in the General Schedule, Wage Board, and Direct Hire categories. These costs reflect an average across all levels in each category and they are documented for each MAJCOM.

The application of these data for the purpose of costing OJT personnel burdens is a straightforward process of multiplying the calculated man-year burden for each personnel category, e.g., training, direct overhead, and support, by the most current annual cost for the corresponding grade levels involved. For the specific cost factors addressed in previous sections, this costing process would be accomplished as follows:

OJT Supervisor/Trainer and
OJT Trainer Personnel

1. Given that the trainee load for a supervisor (S) in each career field (i) is represented by the average number of trainees per supervisor (R) for that career field (Section 3.1.2) and that this trainee load is constant over time, the annual trainee-month load (ATL) for a supervisor can be calculated as:

$$ATL(s, i) = R(s, i) \cdot 12$$

2. For a measured trainee-month load (TML) by career field (i) over a specified costing period (Section 3.6), the number of equivalent annual supervisors (S) required is given as:

$$S(i) = TML(i)/ATL(s, i)$$

3. Given that the number of trainers required to supplement the supervisor's responsibility in each career field (i) is represented by the ratio of trainers to supervisors (TSR) in each career field (Section 3.1.2), the number of equivalent annual trainers (T) required for the given trainee-month load is calculated as:

$$T(i) = S(i) \cdot TSR(i)$$

4. Since the calculated mean percent of time allocated to OJT (PT) for supervisors and trainers in each career field (Section 3.1.2) represents the fraction of a man-year required to support the annual trainee-month load, the number of supervisor (SM) and trainer (TM) man-years required for the given trainee-month load is calculated as:

$$SM(i) = S(i) \cdot PT(s, i)$$
$$TM(i) = T(i) \cdot PT(s, i)$$

5. Given that the distribution of supervisors (s) and trainers (t) over grade in each career field (Section 3.1.2) represents the percent (P) of total required supervisor and trainer time expected in each grade level (g), the number of supervisor and trainer man-years by grade required for the given trainee-month load is calculated as:

$$SM(i, g) = SM(i) \cdot P(s, g)$$
$$TM(i, g) = TM(i) \cdot P(t, g)$$

6. Having calculated the required number of supervisor and trainer man-years by grade, the cost of those personnel burdens can be assessed by applying the corresponding annual cost (AC) for each grade from AFR 173-10, Table 20, as follows:

$$SMC(i, g) = SM(i, g) \cdot AC(g)$$
$$TMC(i, g) = TM(i, g) \cdot AC(g)$$

7. The total supervisor and trainer cost burden (TC) for the given trainee-month load can then be calculated as:

$$TC(i) = \sum_{g} [SMC(i, g) + TMC(i, g)]$$

Direct OJT Overhead Personnel

1. For each organizational level (k), assess the number of overhead personnel (OP) by grade (g) involved in the administration and management of OJT and the percent of available staff time (PST) spent in this capacity (Section 3.2).

2. Calculate the equivalent number of overhead staff man-years (OSM) by grade for each organizational level as:

$$OSM(g, k) = OP(g, k) \cdot PST(k)$$

3. Utilizing the appropriate AFR 173-10 Cost Table for each staff category (Table 20, AF Officers and Airmen; Table 24, General Schedule Civilians; and Table 25, Wage Board Civilians), the cost of the direct OJT overhead personnel (OSC) burden for each organization can be calculated by applying the annual cost (AC) by grade (g) to the corresponding staff man-years by grade as follows:

$$OSC(g, k) = OSM(g, k) \cdot AC(g)$$

4. The total overhead staff cost for each organization can then be calculated as:

$$OSC(k) = \sum_{g} OSC(g, k)$$

5. The direct OJT overhead cost factor is then derived by dividing the total overhead staff cost for each organization by the trainee-month load allocated to that organization (Section 3.6) over the costing period.

OJT Program Support Personnel

1. For each organization (k) involved in the provision of CDC program and OJT Advisory Service support, assess the number of support personnel required (SP) by grade (g) and the percent of available staff time (PST) spent in this capacity (Section 3.3).

2. Calculate the equivalent number of support staff man-years (SSM) by grade for each organization as:

$$SSM(g, k) = SP(g, k) \cdot PST(k)$$

3. Utilizing the appropriate AFR 173-10 Cost Table as described in Step 3 for overhead personnel, calculate the support staff cost (SSC) by grade for each organization as:

$$SSC(g, k) = SSM(g, k) \cdot AC(g)$$

4. The total support staff cost for each organization can then be calculated as:

$$SSC(k) = \sum_{g} SSC(g, k)$$

5. The OJT program support cost factor can then be derived for the CDC program by dividing the total support staff cost for each CDC organization by the total enrollee-months supported over the costing period (Section 3.3.1). The support cost factor for the OJT Advisory Service is similarly calculated by dividing its support costs by the total number of trainee-months supported worldwide over the costing period (Section 3.3.2).

CDC Development and Revision Personnel

1. For each CDC (j), assess the man-hours expended by grade for each cost category and convert them into equivalent man-years expended (ME) by grade (i) utilizing the estimate of available man-hours per year from AFM 26-3 (Section 3.4.1 and Section 3.4.2, Step 2).

2. Utilizing the appropriate AFR 173-10 Cost Table as described in Step 3 for overhead personnel, calculate the cost of man-years expended by grade for each cost category (minor revision, annual review, development/revision) and CDC (see Step 4, Section 3.4.2).

3. Calculate the uniform annual CDC cost as described in Section 3.4.2 and divide this by the number of enrollee-months supported by the course over the costing period (Section 3.4.3) to derive the CDC development and revision cost factor.

Employing the procedures outlined above, the cost of OJT personnel burdens established for various trainee loads and organizations can be assessed. The only update requirement is that the cost analyst maintain the most current annual version of AFR 173-10, as well as any mid-year changes which may have been made. For reference purposes, the cost tables referred to in this section and utilized in the costing demonstration in Chapter 5 have been extracted from the October 1976 version of AFR 173-10 and are included in Appendix F. The use of these tables as described above has been discussed with ACMCA personnel and they have indicated that such use represents a legitimate application of the AFR 173-10 cost data in a cost estimating environment.

3.6 Extraction and Analysis of OJT Trainee and Trainee-Month Data

This section outlines the procedures and analysis techniques necessary to develop measures of OJT training load required in the cost analysis methodology. These measures are utilized for the purpose of estimating annual overhead and support cost factors, as well as establishing the size of the OJT training load to be costed at various organizational levels over varying time periods. As discussed in earlier sections, measures of training load can be developed in units of trainees or trainee-months. Although the trainee unit is perhaps a more intuitive measure of training load, it does not reflect the influence of training duration on program costs. This influence is important in that it recognizes that training costs due to factors such as supervisor time, administrative/management overhead and program support are incurred by the trainee for the length of time he/she is actively involved in the training program.

The trainee-month unit is therefore a more analytically correct measure of training load since, by definition, it measures the presence of a trainee over the number of months in which training is actively conducted. This measure also allows for more costing flexibility in that it can be clearly defined and recorded for any desired costing period, e.g., annual, semi-annual, quarterly, monthly, or for the specified duration of a given training program. As such, the trainee-month was selected as the unit of quantification for most of the cost factors discussed in earlier sections and the following discussion will focus on procedures for measuring training load in that manner.

The most readily available, systemwide source of data for measuring OJT training loads is the Uniform Airman Record (UAR) maintained by the Air Force Manpower and Personnel Center (AFMPC) and updated through the Automated Personnel Data System (APDS). The UAR contains a current accounting of airman status with respect to such categories as personal data, skill classification, job location, current assignment, educational background, and training. Changes in an airman's status in any of these categories are transferred to MPC through the APDS and an update of the UAR reflecting such changes is made every 3 to 5 days. The UAR thus represents a reliable source of training status data which can be readily employed to measure training loads as required by the costing methodology.

Since the estimation of cost factors and the implementation of costing techniques requires an assessment of active training load for each organizational level, the procedures for extracting trainee-month data from the UAR must allow for the stratification of these data by unit, CBPO, and MAJCOM. Additionally, these data must be further stratified by career field and upgrade level to facilitate the appropriate matching of cost factors with trainee loads. Software packages designed to extract any selected subset of UAR records, such as active OJT trainees, and stratify those records by any number of descriptive or status variables, are available at AFMPC/Director of Personnel Military Systems Management Section (DPMDQY) and AFHRL/Staff Management (SM). Utilizing available software, the number of active OJT trainees can then be assessed on a monthly basis, stratified by desired descriptive variables, and accumulated over any desired time frame.

The monthly extraction of active OJT trainee records from the UAR and the creation of a monthly OJT training file containing those records can best be accomplished by AFMPC/DPMDQY. To facilitate this type of ongoing data collection requirement, a formal task agreement should be established with DPMDQY which calls for the creation of a monthly OJT training file according to the following specifications:

1. Define an active OJT trainee record as one containing any of the following training status code* values in the "normal upgrade" variable:

   - Code A: Normal upgrade training to the 3-skill level.
   - Code B: Normal upgrade training to the 5-skill level.
   - Code C: Normal upgrade training to the 7-skill level.
   - Code E: Retraining to the 3-skill level.
   - Code F: Retraining or continued retraining to the 5-skill level.
   - Code G: Retraining or continued retraining to the 7-skill level.

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*Training status codes as defined in AFM 300-4, Volume II, effective July 1, 1974.

2. At the end of each month, extract all active OJT trainee records as defined in Step 1 above from the most current UAR version.

3. Masking out descriptive personal data as required, transfer each active OJT trainee record to a standard magnetic tape which should contain at least the following status data for each record:

   .. Personnel Accounting Symbol (PAS) consisting of the two-digit CBPO number, the two-digit MAJCOM ID, the one-digit DOD organization symbol (only records with the Air Force code "F" should be considered), and the three-digit PAS number which provides a unique identifier for each unit.

   .. Primary and Duty AFSCs consisting of a five-digit number and any indicated prefix or suffix.

   .. The one-digit training status code as described in Step 1 above.

Having generated monthly active OJT trainee files according to the above specifications, an analysis can then be performed to develop the required measurement of OJT trainee-months. Due to existing workload and machine time constraints at AFMPC, it is anticipated that the actual trainee-month analysis of the generated tapes could be more efficiently conducted by a separate agency with existing UAR analysis capabilities. The AFHRL Computational Sciencies Division has such an established analysis capability which is already supported by an ongoing UAR data transfer agreement with AFMPC. Based on the existence of required analytical capabilities and the presence of an ongoing data transfer agreement, it is recommended that a formal data analysis task agreement be established with AFHRL/SM to produce required OJT trainee-month data in support of the OJT cost analysis methodology. Such an agreement would call for the development of trainee-month measures on a monthly, quarterly, semi-annual, or annual basis according to the following procedures and specifications:

1. At the beginning of each month, obtain from AFMPC/DPMDQY the active OJT trainee file tape for the preceding month.

2. Utilizing the AFHRL/SM Distribution Generator (DIG) utility software, summarize the monthly OJT trainee file as follows:

   a. For each unit defined by a unique three-digit PAS number, tabulate the number of OJT trainees by Duty AFSC and upgrade level where upgrade level is indicated by the "normal upgrade" variable according to the following convention:

      i. 3-level trainees = Code A trainees + Code E trainees.

      ii. 5-level trainees = Code B trainees + Code F trainees.

      iii. 7-level trainees = Code C trainees + Code G trainees.

   b. For each CBPO defined by number in the PAS code, tabulate the number of OJT trainees by Duty AFSC and upgrade level as indicated in 2.a above.

   c. For each MAJCOM defined by the MAJCOM ID in the PAS code, tabulate the number of OJT trainees by Duty AFSC and upgrade level as indicated in 2.a above.

   d. Tabulate the total number of OJT trainees indicated in the file by Duty AFSC and upgrade level as described in 2.a above.

3. Label the generated OJT trainee tabulations by the month and year of the corresponding UAR monthly OJT trainee file and store them in chronological order on a reference tape.

Under the assumption that the average number of active OJT trainees present during a month represents an equivalent average number of trainee-months, the chronological OJT trainee tabulations can be used to generate annual training loads for cost factor estimation as follows:

1. For the specified 12-month estimation period, retrieve the corresponding 12-month-ending OJT trainee tabulations from the chronological file, plus the month-ending tabulation for the month immediately preceding the first month of the estimation period (referred to as month zero).

2. Define the average monthly trainees (AMT) in month (m) for AFSC (i) and upgrade level (j) in organization (k) as:

$$AMT(i,j,k,m) = \frac{MT(i,j,k,m) + MT(i,j,k,m-1)}{2}$$

where MT is the tabulated number of active OJT trainees in the designated month.

3. The annual trainee-month load (ATML) for the designated factor estimation period is then calculated as the sum of each month's average active OJT trainees:

$$ATML(i,j,k) = \frac{MT(i,j,k,1) + MT(i,j,k,0)}{2} + \frac{MT(i,j,k,2) + AMT(i,j,k,1)}{2} + \cdots + \frac{MT(i,j,k,12) + MT(i,j,k,11)}{2}$$

Considering M to be equal to the total number of monthly tabulations in the estimation period (M = 12), the above equation reduces to the following form with MT (0) as defined in Step 1 above:

$$ATML(i,j,k) = \frac{MT(i,j,k,0) + MT(i,j,k,M)}{2} + \sum_{m=1}^{M-1} MT(i,j,k,m) \qquad (3)$$

4. Generate a report which lists the annual trainee-month load by AFSC and upgrade level for each organization (unit, CBPO, MAJCOM, Air Force-wide) in the designated estimation period.

Several variations of the above procedures can be easily employed to develop trainee-month measures for use in performing a cost analysis of various OJT program stratifications over varying costing cycles. The only restriction is that the desired costing cycle encompass a time period for which the required monthly trainee tabulations have been made. For example, quarterly analyses would be conducted in April, July, October of the current year, and January of the succeeding year, semi-annual analyses would be conducted in July of the current year and January of the succeeding year, and annual analyses would be conducted in January of the succeeding year. In each of the cases, the value of M in Equation 3 would reflect the number of months encompassed in the cycle plus the designated zero month. Other OJT costing stratification which can be accomplished by extracting selected subsets of the monthly trainee tabulations for the designated costing cycle would include:

- A single AFSC or group of AFSCs within a given organization.
- A single AFSC or group of AFSCs within a group of organizations or on an Air Force-wide basis.
- All AFSCs within a given organization or group of organizations.
- All AFSCs on an Air Force-wide basis.

The ability to extract subsets or groupings of trainee-month tabulations also plays an important role in support of the cost factor grouping analyses discussed in Section 3.1.3. Should the full-scale analysis of Occupational Survey Data produce well-defined aggregates of OJT supervisor/trainer or OJT trainer groups with respect to AFSC or organization, then the required trainee-month measures must be developed in accord with the developed aggregates. In these cases, the monthly trainee tabulations would be summed across the aggregated AFSCs and/or organizations and the composite number of monthly trainees for the aggregate would be employed in Equation 3.

Since the trainee-month measures derived through all of the above procedures will be stratified by organization according to PAS codes, one further step is required for practical interpretation of the training load data. This step involves the conversion of indicated PAS codes into their corresponding unit, CBPO, and MAJCOM names. The organizational name equivalents of PAS codes are contained in the PAS Symbol Directory which is updated and distributed monthly by AFMPC. Part 2 of this directory is ordered by PAS symbol and would thus be the most appropriate reference for interpreting tabulated trainee-month measures.

Due to the frequent updating of the PAS directory, it is recommended that those who utilize the trainee-month data, maintain the most current hard copy or microfiche version of the directory, and employ it to manually interpret the training load data as required. Alternatively, a computerized name equivalence of the PAS codes could be developed and updated by AFHRL/SM so that computer-generated reports could be matched with the name list and a revised report generated with actual organizational name references. Since the UAR does contain some organizational name references, a third option would be to produce a mixed report containing actual names or acronyms for relatively stable organizations such as MAJCOMs, and PAS codes for organizations subject to more variation such as units. The coded portion of this mixed report could then be interpreted manually or with a computerized list as desired. Considering that the two latter interpretation approaches would require an additional processing burden, the direct manual approach appears to be the best interpretation alternative, both in terms of user flexibility and ease of implementation.

3.7 Trainee Time

As described in Section 4.1, one of the optional costing modes requires an estimate of the portion of trainee time attributable to training activities. In the trainee time cost modes, an equivalent portion of the total cost of trainees can be attributed to OJT. Accordingly, a trainee time factor needs to be developed.

OJT trainees are expected to be somewhat productive, but less productive than they would be if already fully trained in their positions. The difference between the productivity of a fully trained airman and one who is in OJT, other things being equal, is a productivity loss

associated with the OJT. Furthermore, the value of this productivity foregone by the airman in OJT can be seen as a cost of the OJT program. This interpretation of lost productivity has been the subject of enough controversy that trainee time factors have been included in the methodology as optional.

Percent trainee work time (PNTT) should be derived from an existing data base, such as the Occupational Survey Data Base, in the same way that supervisor/trainer and trainer percent time factors have been derived. The percent trainee work time would be stratified by AFSC, skill level, and organization. Such a derivation of trainee work time factors poses no theoretical difficulty, but it is not currently possible since the Occupational Survey Data Base does not maintain an inventory of OJT-related tasks except as related to supervisory functions.

To establish working values of percent trainee time for demonstration purposes, estimates were solicited in the OJT/NCOIC MAJCOM survey. As shown in Appendix E, the NCOICs were requested to estimate the percent of available trainee work time that is typically spent on duties specified in specialty job descriptions. These estimates were used as surrogates for OJT trainee partial productivity as compared with trained airmen. The remaining percentage of available trainee work time was used as an estimate of trainee time attributable to OJT, since this represents the productivity difference between the OJT trainee and the trained counterpart. Results of this survey are summarized in Table E4. Since specified duties as described in the specialty job description are estimated to require 61.9 percent of trainee time, about 38.1 percent of trainee time has been estimated as the portion attributable to OJT. In this instance, percent trainee time has not been stratified by either AFSC or skill level since the necessary data were unavailable. In the sample costing tables of Chapter 5, the appropriate MAJCOM-specific percent trainee time factors have been employed as identified by the OJT/NCOIC MAJCOM survey.

4.0 THE OJT COSTING METHODOLOGY PROCEDURES AND OPTIONS

The purpose of this chapter is to provide a detailed, step-by-step description of the procedures to be employed and the options available for the application of the OJT costing methodology. The basic methodology design allows for application of developed cost factors and techniques in either a standardized or user-customized mode. The standardized application involves the employment of generalized cost factors at the unit, base, and MAJCOM levels to generate OJT costs for user-specified organizational and time aggregations. The customized approach allows the user to modify and/or replace some or all of the standardized cost factors through the use of more specific organizational or program data which may be available for the desired application. The following sections will discuss each of these approaches in turn and outline their procedural structure in a format amenable to user implementation.

4.1 Data Collection and Cost Factor Estimation

Regardless of the costing approach employed, there are data collection and cost factor estimation activities which must be carried out initially to implement the methodology and repeated periodically to assure that the most current costing data are available for analysis purposes. Primarily, these activities deal with the initial development and periodic update of the following cost factor and OJT training load data:

- The number by grade and utilization (full or percent part-time) of personnel involved in the management and administration of OJT at the HQ USAF, HQ MAJCOM, and HQ Intermediate Command levels.
- The number by grade and utilization (full or percent part-time) of personnel involved in the management and administration of the CDC program.
- The number by grade and utilization (full or percent part-time) of personnel involved in the management, administration, and operation of the OJT Advisory Service.

- Person-hours by grade expended for initial development, major revision, and annual review of each CDC.
- Total annual expenditures for the production of all CDC volumes.
- The percent of OJT supervisor/trainer and OJT trainer time allocated to the conduct of OJT in each career field.
- The percent distribution of OJT supervisor/trainer and OJT trainer populations over grade.
- Average supervisor/trainee and supervisor/trainer ratios.
- The annual cost of personnel by grade.
- The total number of trainees formally enrolled in OJT stratified by career field, upgrade level, MAJCOM, and base/unit.
- The total number of CDC enrollees stratified by individual course.
- The average months to successful completion OJT for each career field and upgrade level
- The average months to successful completion each CDC.

Sources for the above data and procedures for their collection and analysis have been specified in Chapter 3. Referencing the appropriate sections of that chapter, the following represent the recommended sequence of steps required to implement and maintain the supporting data structure of the OJT costing methodology. Representative examples of calculations and data tables, as developed for the demonstration, can be found in Chapter 5.

OJT Supervisor/Trainer and
OJT Trainer Performance Data

1. Utilizing the Occupational Survey Data Base and procedures defined in Section 3.2, develop the following data tables:

   - Table Ia: Consisting of the percent time (PT) allocated to OJT and the trainees per supervisor ratio (R) for the OJT supervisor/trainer and OJT trainer populations in each career field -- Reference Sections 3.1.2 and 3.1.3.

   - Table Ib: Consisting of the percent (P) of OJT supervisor/trainer and OJT trainer populations in each grade level and the ratio of OJT trainers to OJT supervisors/trainers (TSR) for each career field -- Reference Section 3.1.2.

   Updating of these tables should coincide with the completion of new or revised Occupational Surveys.

Personnel Cost Data

2. Utilizing data sources outlined in Section 3.5, develop the following composite data table:

   - Table IIa: Containing the annual and equivalent hourly costs for airman grades E1 to E9, officer grades O1 to O10, and civilian grades GS1 to GS18.

   This table should be updated in conjunction with the release of revised cost figures from the referenced data sources.

CDC Development and Revision Cost Data

3. Utilizing data sources and procedures outlined in Section 3.4, develop the following composite data table:

   - Table IIIa: Containing development and revision cost data for each CDC as follows:

- .. Average annual man-hour expenditures for minor revision ($\overline{MIR}$) and annual review ($\overline{AR}$) -- Reference Section 3.4.1.
- .. Average development/revision man-hour expenditures (DR) -- Reference Section 3.4.1
- .. Average useful CDC lifetime in years -- Reference Section 3.4.1.

4. Employing man-hour expenditure and useful lifetime data recorded in Table IIIa and the personal cost data contained in Table IIa, calculate the present life cycl cost (PLC) of each CDC according to procedures outlined in Section 3.4.2. Record these values next to the corresponding expenditure data in Table IIIa.

5. Utilizing the present life cycle cost (PLC) values recorded in Table IIIa, calculate the uniform annual development and revision cost (ADRC) for each CDC according to procedures outlined in Section 3.4.2. Record these values in Table IIIa next to the previously recorded data for the corresponding CDCs.

   Table IIIa should be updated by repeating Steps 4 and 5 whenever the personnel cost data in Table IIa are revised. Steps 3, 4, and 5 should be repeated and Table IIIa updated accordingly, whenever new or revised CDC man-hour/expenditure data become available as well.

OJT Upgrade and CDC Completion Time Data

6. Utilizing data sources and procedures contained in Section 3.4, develop the following data table:

   - Table IVa: Containing for each career field and upgrade level, the average months required for successful OJT upgrade (ACT), the average month for successful CDC completion (AVG MO), and the ratio of CDC completion time to upgrade completion time (% E) -- Reference Section 3.4.4.

The percent enrollment time factors contained in Table IVa should be updated at least once per year utilizing the most recent OJT upgrade and CDC completion time data. Since OJT upgrade duration data are available quarterly and enrollment time data are available monthly, more frequent quarterly or semi-annual updates could be made.

Selection of a Cost Factor Estimation Period

7. Define the data and cost factor estimating period to be employed in the application of the methodology. As discussed in Chapter 3, this period would usually represent the most recent fiscal year or calendar year or the 12-month period immediately preceding the month in which factor estimation is to take place.

CDC Enrollee Load Data

8. Employing procedures and data referenced in Section 3.4.3, calculate for each CDC (j), the total annual enrollee-months (TEM) present during the current factor estimation period. Enter these values in Table IIIa next to previously recorded costing data for the corresponding CDCs.

9. Calculate the total annual enrollee-months (TEM) for all CDCs by summing across the CDC-specific enrollee-months obtained in Step 8 for the current factor estimation period -- Reference Section 3.3.1.

Enrollee-month data generated in Steps 8 and 9 should always represent the most current 12-month enrollee totals for the selected factor estimation period. Since enrollee-months constitute the amortization base for CDC development/revision costs, CDC printing costs, and CDC overhead personnel costs, more frequent updates may be required to correspond with the estimation of these cost factors.

OJT Trainee Load Data

10. Utilizing procedures and data sources contained in Section 3.6, develop the following trainee load tables for the current factor estimation period:

- Table Va: Containing the annual trainee-month load (ATML) for each career field stratified by MAJCOM with column and row summations reflecting career field and MAJCOM totals respectively -- Reference Section 3.6.

- Table Vb: Containing the annual trainee-month load (ATML) for each career field and upgrade level stratified by unit or squadron with column and row summations reflecting career field/level and unit totals respectively -- Reference Section 3.6. One of these tables will be required for each base under consideration with the total base training load represented as the sum of annual trainee-months across all unit totals listed in the base table.

11. For each career field listed in Tables Va and Vb, multiply the ATML for each organization by the CDC enrollee-month to trainee-month ratio (% E) listed in Table IVa to obtain the estimated CDC enrollee-months by organization (k), career field (i), and upgrade level (j) for the current factor estimation period:

$$EM(i, j, k) = ATML(i, j, k) \cdot \%E(i, j)$$

Record the values of EM next to the corresponding career field entries in Tables Va and Vb and indicate appropriate row and column totals -- Reference Section 3.4.4.

Trainee-month and enrollee-month data contained in Tables Va and Vb should be updated every month since they constitute the organizational training loads against which cost factors are applied in an actual costing application. Monthly updates will also assure that required

12-month totals are available for adjusting USAF, MAJCOM, Advisory Service, CBPO, and unit/ squadron overhead factors for the defined factor estimation period.

Overhead and Support Personnel Cost Data

12. Utilizing procedures and data sources contained in Section 3.2, develop the following tables of OJT overhead and support personnel based on the most current manning authorizations:*

- Table VIa: Containing the number of authorized personnel by AFSC and grade serving in an OJT administrative, management or program support capacity at HQ MAJCOM, HQ SOA, and intermediate command levels indicated in Table 6, Section 3.2.** In addition, this table should contain the percent of work time spent by authorized personnel in carrying out the OJT functions indicated for each organization in Table 6. All data sources for collecting the required staffing and utilization information are contained in Section 3.2 and Table 6.

- Table VIb: Containing the number of authorized personnel by grade serving in a CDC program support capacity at the Air University Extension Course Institute -- Reference Table 6, Section 3.2.

*Regardless of the factor estimation period being used, the assessment of OJT overhead and support staff should always be based on the most current manning documents available for the involved organization.

**For HQ ATC, this includes staff employed in the OJT Advisory Service (TTFJ) and in the management of CDC development and review (TTSS).

- Table VIc: Containing for each base under consideration, the number of full-time equivalent* authorized personnel by grade serving in the CBPO/OJT unit and the number of full-time equivalent authorized personnel by grade serving as OJT administrators in each unit/squadron at the base -- Reference Table 6, Section 3.2. One of these tables will be required for each base for which cost analysis is to be conducted.

13. Employing data on the authorized staff and percent staff time allocated to OJT from Table VIa and the annual personnel cost by grade from Table IIa, calculate the total OJT overhead (OSC) and support staff costs (SSC) for each organization according to procedures outlined for Direct OJT Overhead Personnel and OJT Program Support Personnel in Section 3.5. Enter these values next to their corresponding organizational staffing data in Table VIa.

14. Employing data on the authorized ECI staff from Table VIb, the percent of ECI time allocated to the CDC program as discussed in Section 3.3.1 and the annual personnel cost by grade from Table IIa, calculate the total OJT support staff cost (SSC) for ECI according to procedures outlined for OJT Program Support Personnel in Section 3.5.

15. Employing data on the number of full-time equivalent authorized staff man-years (OSM) from Table VIc and the annual personnel cost by grade from Table IIa, calculate the total overhead staff costs (OSC) for each base and unit according to procedures outlined for Direct Cost Overhead Personnel in Section 3.5. Enter these values next to their corresponding staffing data in Table VIa.

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*This term refers to the conversion of part-time OJT staff to an equivalent number of annual full-time personnel. For example, an E6 spending 40 percent of his productive time as an OJT administrator would constitute an annual staff burden of 0.40 E6 man-years.

Organizational OJT staffing data contained in Tables VIa, VIb, and VIc should be updated at least once a year to reflect the most current authorized manning for cost factor estimation purposes. Staffing cost data developed in Steps 13 to 15 should be updated in conjunction with authorized manning updates and whenever personnel cost data contained in Table IIa is updated. Staff utilization data reflecting OJT involvement should be reviewed at least once a year or whenever a major change in organizational OJT responsibility occurs. More frequent updates of manning data and their resultant staff costs may be required to reflect mid-year changes in authorized personnel.

CDC Printing Cost Data

16. Utilizing procedures and data sources referenced in Section 3.3.1, calculate the total printing costs (APC) incurred for the maintenance of CDC inventories over the designated factor estimation period.

Implementation of Steps 1 to 16 will result in the development of data tables and values required to support the calculation of OJT unit cost factors and facilitate their use in a program costing application. The following sequence of steps describes the procedures for developing these cost factors based on data generated in earlier steps.

Worldwide OJT Overhead and Support Cost Factors

17. Utilizing procedures outlined in Section 3.5, OJT support and overhead cost data derived in Steps 12 to 16 and trainee-month/enrollee-month data obtained in Steps 8 to 11, develop the following table of worldwide cost factors for the current factor estimation period:

    - Table VIIa: Record the total annual CDC support staff costs (SSC) for ATC/TTSS (Table VIa), AU/ECI (Table VIb), the annual CDC printing costs (APC) from Step 16. Record the annual support staff cost for the OJT Advisory Service (Table VIa)

and the overhead staff cost (OSC) for HQ USAF (Table VIa). Calculate the CDC support cost factor (CSCF) for each organization (k) by dividing the support staff cost by the total enrollee-months supported (TEM) over the current factor estimation period (Step 9):

$$CSCF(k) = SSC(k)/TEM \text{ (dollars/enrollee-month)}$$

Calculate the CDC printing cost factor (PCF) by dividing the annual printing cost by the total enrollee-months supported:

$$PCF = APC/TEM \text{ (dollars/enrollee-month)}$$

Calculate the HQ USAF overhead factor (AFOF) by dividing the overhead staff cost by the total annual trainee-month load (ATML) summed over MAJCOMs and career fields (Table Va) for the current factor estimation period:

$$AFOF = OSC(HQ\ AF)/ATML \text{ (dollars/trainee-month)}$$

Calculate the OJT Advisory Service (ATC/TTFJ) cost factor (ASCF) by dividing the support staff cost by the total annual trainee-months supported:

$$ASCF = SSC(TTFJ)/ATML \text{ (dollars/trainee-month)}$$

Record the cost factors next to their corresponding annual cost data and calculate the worldwide enrollee-month cost factor (WEM) and worldwide trainee-month cost factor (WTM) as follows:

$$WEM = PCK + \sum_{k} CSCF(k)$$

$$WTM = AFOF + AFCF$$

CDC Development and Revision Cost Factors

18. Employing the uniform annual development and revision costs (ADRC) for each CDC (j) from Table IIIa and the total enrollee-months (TEM) supported by each CDC from Step 8, calculate the development and revision cost factor (DRCF) for each CDC in the current factor estimation period according to procedures outlined in Section 3.4.3.

$$DRCF(j) = ADRC(j)/TEM(j) \quad \text{(dollars/enrollee-month)}$$

Record the values of enrollee-months supported and the resultant cost factors next to the corresponding development and revision cost data in Table IIIa.

MAJCOM Overhead Cost Factors

19. Utilizing procedures outlined in Section 3.5, OJT overhead personnel cost data derived in Steps 12 and 13, and trainee-month data obtained in Step 10, develop the following table of MAJCOM overhead cost factors for the current factor estimation period:

- Table VIIIa: For each MAJCOM and SOA, record the overhead staff cost (OSC) from Table VIa and the annual trainee-month load (ATML) summed across career fields from Table Va. Calculate the MAJCOM overhead cost factor (MOCF) for each MAJCOM (k) by dividing the MAJCOM overhead staff cost by the annual trainee-month load supported by the MAJCOM during the current factor estimation period:

$$MOCF(k) = OSC(k)/ATML(k) \quad \text{(dollars/trainee-month)}$$

Record the cost factor values next to the corresponding MAJCOM entries.

Base and Unit/Squadron Overhead Cost Factors

20. Employing the total overhead staff costs for each base (K) and each unit/squadron (k) from Table VIc and the annual trainee-month load (ATML) summed over career fields for each base and unit from Table Vb, calculate the base overhead cost factors (BOCF) and unit overhead cost factors (UOCF) for the current factor estimation period as follows:

$$BOCF\ (K) = OSC\ (K)/ATML\ (K)$$

$$UOCF\ (k) = OSC\ (k)/ATML\ (k)$$

Record the values of trainee-months supported and the resultant base and unit cost factors next to their corresponding staffing data in Table VIc.

Cost factors developed in Steps 17 to 20 above are designed to be updated at least once during the specified factor estimation period. Ideally, all cost factors and their constituent data should be updated at the same time to reflect the most current data values for the 12-month period defined by the factor estimation cycle. More frequent updates of certain cost factors may be required to reflect interim adjustments to either their cost component, e.g., authorized staff, personnel costs, printing costs, or their amortization base, e.g., trainee-months or enrollee-months. In all cases, care must be taken to assure that both the cost component and the amortization base are measured over an equivalent factor estimation period.

The execution of Steps 1 to 20 as outlined in this section constitutes the first phase of an OJT costing application. The end result of this phase is the production of a series of cost factor and costing data tables which will be employed in the actual analysis of OJT costs for a defined organizational level and time period. As discussed earlier, the second, or cost analysis phase of the methodology, can be carried out in either a standardized or user-customized format. Procedures and options for conducting Phase II analyses are outlined in the following sections.

4.2 Standardized Analysis of OJT Program Costs

The standardized approach to OJT cost analysis involves the assessment of OJT program costs through a series of organizational training load and cost aggregations. This process starts with the definition of the training program to be costed in terms of organization and time period. Using this dimension, the training load associated with the program is identified and all unit training costs attributable to the specified organizational level are applied to the trainee volume. The resultant program costs are thus an estimate of the dollar amount required to train the identified number of personnel over the specified time period, within the given organization.

In selecting an OJT program configuration for cost analysis, four dimensions must be considered: (1) skill, (2) skill level, (3) organizational level, and (4) time period. Each of these dimensions has several stratifications, the most basic of which are presented below.

- Skill: Cost analysis may focus on any or all AFSCs or AFSC aggregates for which an Occupational Survey Analysis of supervisor/trainer and trainer groups has been conducted or for which alternative data on percent OJT involvement, grade distribution, and supervisor/trainer ratios have been obtained.

- Skill Level: Cost analysis may be conducted independent of skill level or it may focus on training to the apprentice (3), journeyman (5), or technician (7) levels.

- Organizational Level: Cost analysis can be conducted for any unit or squadron; any base defined as a collection of units, squadrons and/or organizations; any MAJCOM or SOA defined as a collection of bases, intermediate commands and/or organizations; or the entire Air Force which encompasses training conducted at all organizational levels.

- Time Period: Since training load data are designed to be collected on a monthly basis, cost analysis can be performed for any discrete month or any aggregation of months.

The cost factor tables developed in Phase I of the methodology will facilitate the analysis of OJT costs for any combination of the above program dimensions. The only restriction in the standardized approach is that an assessment of total OJT costs at any organizational level requires the analysis and aggregation of costs at all lower levels encompassed within the organizational structure being analyzed. In other words, an assessment of base-level OJT costs would require an analysis and aggregation of OJT costs for each unit at the base. This type of "bottom-up" or "building block" approach is designed to recognize the fact that each unit, base, and MAJCOM may have substantially different training cost factors which are applicable only to training conducted within their organizational structure.

Recognizing both the options and restrictions discussed above, the following sequence of steps outlines the procedures and data to be employed in conducting a standardized analysis of OJT program costs. For ease of reference, these steps will continue the sequence from Section 4.1.

Definition of Cost Analysis Scope

21. Employing the OJT program definition options discussed earlier in Section 4.2, define the AFSCs (i), skill levels (j), and time periods (t) for which the cost analysis is to be performed.

22. Specify the organizational level to which costs are to be aggregated and, utilizing trainee-month data contained in Tables Va and Vb for the defined time period, delineate those units, bases and/or MAJCOMs within the defined organizational level which have active OJT training loads in the specified AFSCs and skill levels.

Assessment of Training Load

23. Utilizing procedures and data sources outlined in Section 3.6, create trainee-month load (TML) tables reflecting the training load over the specified costing period for each AFSC, skill level, and organization defined in Steps 21 and 22. These tables should be constructed according to the format specified for Tables Va and Vb in Step 10. If the costing period is equivalent to the current factor estimation period, then Tables Va and Vb can be directly employed as initially developed in Step 10.

24. Utilizing CDC data contained in Table IIIa, determine which AFSCs and skill levels specified in Step 21 employ CDCs. For these AFSCs, determine the expected number of enrollee-months (TEM) over the costing period according to procedures outlined in Step 11. These enrollee-month estimates will be based on training loads established in Step 23 and they should be entered into the training load tables next to their corresponding AFSCs.

OJT Supervisor/Trainer and OJT Trainer Costs

25. Employing procedures outlined in Section 3.5 and the trainees per supervisor ratios (R) contained in Table Ia, calculate, for each AFSC under consideration, the annual trainee-month load (ATL) which can be supported by an OJT supervisor.

26. Utilizing procedures outlined in Section 3.5, annual trainee-month loads (ATL) per supervisor from Step 25, trainee-month loads established for the costing period in Step 23, and trainer to supervisor ratios (TSR) from Table Ib, calculate the number of equivalent annual supervisors (S) and trainers (T)* required to support the established training loads for each AFSC and organization** defined in Steps 21 and 22.

27. Utilizing procedures outlined in Section 3.5, percent time (PT) allocated to OJT for supervisors and trainers from Table Ia, and the percent grade distribution (P)

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*An equivalent annual supervisor or trainer represents one individual supporting the designated annual trainee-month load over a one-year period.

**Since the standardized approach calls for the aggregation of organizational costs from the "bottom-up," the calculation of required supervisors and trainers and their associated costs should always be performed at the lowest level under consideration -- typically the unit/squadron.

for supervisors and trainers from Table Ib, convert the required supervisor and trainer personnel from Step 26 into the equivalent number of supervisor man-years (SM) and trainer man-years (TM)* required by grade for each AFSC and organization under consideration.

28. Referencing the results of Steps 25 to 27, develop the following cost table:

    - Table IXa: Containing for each AFSC and organization addressed in Steps 25 to 27, the established trainee-month load for the costing period (TML) and the number of equivalent annual supervisors and trainers by grade, required to support the established training load.**

    Since the organizational level typically dealt with in Steps 25 to 27 is the unit/squadron, one of these tables will be required for each base containing units under consideration.

29. Employing procedures developed in Section 3.5, supervisor and trainer man-year requirements calculated in Step 27, and personnel cost data from Table IIa, calculate the supervisor man-year cost (SMC) and trainer man-year cost (TMC) by grade for each AFSC and organization.

30. For each AFSC (i), grade (g), and organization (k), calculate the total supervisor cost (TSC) and total trainer cost (TTC) as:

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*An equivalent man-year represents one equivalent annual supervisor or trainer working a fraction of a full-time year (PT) to support his designated annual trainee-month load (ATL).

**Data on the number of required personnel by grade can be obtained as an interim result of Step 27 involving the application of percent grade distributions to the supervisor and trainer requirements established in Step 26. These data deal more with personnel management considerations, thus making their inclusion in Table IXa optional.

$$TSC(i, k) = \sum_{g} SMC(i, k, g)$$

$$TTC(i, k) = \sum_{g} TMC(i, k, g)$$

Employing the results of the above equation and the trainee-month loads (TML) recorded for each AFSC and organization in Table IXa, calculate the supervisor cost factors and trainer cost factors* for the costing period as follows:

$$SCF(i, k) = TSC(i, k)/TML(i, k) \text{ (dollars/trainee-month)}$$

$$TCF(i, k) = TTC(i, k)/TML(i, k) \text{ (dollars/trainee-month)}$$

Calculate the total supervision cost factor (TSCF) as the sum of SCF (i, k) and TCF (i, k) and record both the individual and total cost factors in Table IXa next to their corresponding trainee loads.

Calculation of OJT Costs
Alternative Form 1: By Organization

31. Utilizing cost factors, trainee-month and enrollee-month data tables derived in earlier steps, develop the following table of organizational OJT costs.

Table Xa: Record for all AFSCs (i) under consideration in each organization (k), the trainee-month cost factors obtained as follows:

Total supervision cost factor - TSCF (i, k) from Table IXa.

Unit overhead cost factor - UOCF (k) from Table VIc.

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*Although total supervisor and trainer costs could be directly applied to each organization OJT cost, these cost factors are calculated to maintain compatibility with other cost categories.

Base overhead cost factor - BOCF from Table VIc referencing the base at which organization (k) resides.

MAJCOM overhead cost factor - MOCF from Table VIIIa referencing the MAJCOM or SOA whose HQ function encompasses organization (k).

Worldwide trainee-month cost factor - WTM from Table VIIa.

Calculate the total organization cost factor (ORCF) as:

$$ORCF(i, k) = TSCF(i, k) + UOCF(k) + BOCF + MOCF + WTM \quad \text{(dollars/trainee-month)}$$

Record the trainee-month load (TML) for each AFSC and organization from Table IXa and calculate organizational training costs (OTC) as:

$$OTC(i, k) = ORCF(i, k) \cdot TML(i, k) \quad \text{(dollars)}$$

Record, for each AFSC having a CDC (j), the total enrollee-months (TEM) by upgrade level from Step 24 and the corresponding CDC development and revision cost factor (DRCF) from Table IIIa and calculate the organizational development and revision cost share (DRCS) as:

$$DRCS(i, k) = \sum_{j} TEM(i, j, k)^{*} \cdot DRCF(j) \quad \text{(dollars)}$$

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*Here the subscript (j) refers to the upgrade level which indicates the applicable CDC development and revision cost factors unique to the particular skill level.

Record for all AFSCs the total enrollee-months from Step 24 and the worldwide enrollee-month cost factor (WEM) from Table VIIa and calculate the organizational CDC support cost share (CSCS) as:

$$CSCS\ (i,\ k) = TEM\ (i,\ k) \cdot WEM \quad \text{(dollars)}$$

Calculate the total organizational OJT costs (TOTC) for all specified AFSCs as:

$$TOTC\ (k) = \sum_{i} [OTC\ (i,\ k) + DRCS\ (i,\ k) + CSCS\ (i,\ k)] \quad \text{(dollars)}$$

Record all interim and total costs calculated above in the organizational cost table.

One of these cost tables will be required for each organization included in the defined OJT cost analysis scope. Total OJT costs for the specified AFSCs at the base, MAJCOM, and Air Force levels can be respectively obtained by summing TOTC across all organizations at a given base, across all organizations in a given MAJCOM/SOA or simply across all organizations considered.

Calculation of OJT Costs
Alternative Form 2: By AFSC

32. Utilizing the basic cost factor, trainee-month, and enrollee-month data employed in Step 31, develop a table of AFSC-specific OJT costs as follows:

Table XIa: For each AFSC (i) under consideration, develop and record as in Table Xa the total organizational cost factor (ORCF), the trainee-month load (TML), and the total enrollee-months by upgrade level (TEM) for all organizations at a defined level with active training loads in the specified AFSCs. For those AFSCs with CDC enrollment, obtain the CDC development and revision cost factor (DRCF) and the worldwide enrollee-month cost factor (WEM)

as referenced in Table Xa and calculate the total enrollee-month cost burden (EMCB) for each CDC (j) as:

$$EMCB(j) = DRCF(j) + WEM \quad \text{(dollars/enrollee-month)}$$

For each AFSC, calculate the organizational training costs (OTC) and the CDC enrollment cost burden (ECB) incurred in all organizations (k):

$$OTC(i, k) = ORCF(i, k) \cdot TML(i, k) \quad \text{(dollars)}$$

$$ECB(i, k) = \sum_{j} TEM(i, j, k) \cdot EMCB(j) \quad \text{(dollars)}$$

Calculate the total career field (AFSC) OJT costs (TCFC) in each organization and over all organizations at the specified level as:

$$TCFC(i, k) = OTC(i, k) + ECB(i, k) \quad \text{(dollars)}$$

$$TCFC(i) = \sum_{k} TCFC(i, k) \quad \text{(dollars)}$$

Typically, this AFSC costing alternative would be applied to career field training in all organizations at a specified level -- usually a base. The resultant cost table therefore represents the total cost of OJT for each AFSC at a base. MAJCOM career field costs can be obtained by summing each base AFSC total across all bases in the MAJCOM, and Air Force AFSC totals can be calculated as the sum of base AFSC totals across all bases.

Calculation of OJT Costs
Alternative Form 3: Average
Cost of Upgrade by Organization

33. Utilizing the basic cost factor data employed in Steps 31 and 32 and OJT upgrade and CDC completion time data generated in Step 6, develop a table of average OJT upgrade costs by organization as follows:

Table XIIa: For all AFSCs in each organization, develop and record the total organizational cost factor (ORCF) from Table Xa. For each AFSC (i) considered, record from Table IVa the average trainee-months (ACT) and the average CDC enrollee-months (AVG MO) required for upgrade to the 3, 5, and 7 levels (j). For those AFSCs with CDC enrollment, develop and record the total enrollee-month cost burden (EMCB) for each CDC as in Table XIa. Employing these costing data, calculate the average upgrade costs (AUC) for all skill levels and AFSCs in each organization as follows:

$$AUC(i, j, k) = (ORCF(i, k) \cdot ACT(i, j)) + (EMCB(j) \cdot AVG\ MO(i, j))$$

(dollars/trainee)

Record the above calculated average upgrade costs in the organizational OJT upgrade cost table next to their corresponding AFSCs and skill levels.

As with Table Xa, one of the above tables would be required for each organization included in the cost analysis if this alternative were chosen. The primary use of these cost tables would be to estimate the cost of anticipated upgrade training during a given time span. In such applications, the total training cost (TTC) for a given number of trainees (NT) by organization (k), AFSC (i), and upgrade level (j) could be calculated in any of the following optional forms depending on desired stratification:

$$TTC(i, j, k) = NT(i, j, k) \cdot AUC(i, j, k) \text{ (dollars)}$$

$$TTC(i, k) = \sum_{j} NT(i, j, k) \cdot AUC(i, j, k) \text{ (dollars)}$$

$$TTC(j, k) = \sum_{i} NT(i, j, k) \cdot AUC(i, j, k) \text{ (dollars)}$$

$$TTC(i) = \sum_{k} \sum_{j} NT(i, j, k) \cdot AUC(i, j, k) \text{ (dollars)}$$

$$TTC\ (k) = \sum_i \sum_j NT\ (i, j, k) \cdot AUC\ (i, j, k) \quad \text{(dollars)}$$

$$TTC\ (j) = \sum_k \sum_i NT\ (i, j, k) \cdot AUC\ (i, j, k) \quad \text{(dollars)}$$

As they were obtained in both Tables Xa and XIa, base, MAJCOM, and Air Force totals could be obtained by summing any desired TTC stratification across all organizations within each of those organizational levels.

Calculation of OJT Costs Alternative Form 4: Average Cost of Upgrade by AFSC Using the Average Cost Factor Method

This alternative costing approach employs the same basic data and procedures as in Step 33 except that trainee-month cost factors are averaged over all organizations within a particular organizational level. This allows for the direct costing of training loads at higher organizational levels without having to cost out and aggregate each individual organization. Since enrollee-month cost factors are independent of organization, only the trainee-month factors need be averaged over organizations. Such averaging can be done for all units/squadrons at a base, within a MAJCOM or Air Force-wide. Alternatively, average base cost factors could be used to calculate MAJCOM averages and those, in turn, used to obtain system averages. Step 34 will outline the general procedures for calculating average AFSC upgrade costs at a specified organizational level using the average cost factor approach.

34. Utilizing the basic cost factor data employed in Steps 31 to 33, and OJT upgrade and CDC completion time data generated in Step 6, develop a table of average OJT upgrade costs by AFSC at a defined organizational level as follows:

Table XIIIa: For each AFSC (i) under consideration, develop and record, as in Table Xa, the total organizational cost factor (ORCF) and the trainee-month load (TML) for all organizations at the defined level. For each AFSC, record from Table IVa the average trainee-months (ACT) and the average CDC enrollee-months (AVG MO) required for upgrade to the 3, 5, and 7 levels (j).

For those AFSCs with CDC enrollment, develop and record the total enrollee-month cost burden (EMCB) as in Table XIa. For all organizations (k) within the specified organizational level (K), calculate the average organizational cost factor (AOCF) as:

$$AOCF(i, K) = \frac{\sum_k (ORCF(i, k) \cdot TML(i, k))}{\sum_k TML(i, k)} \quad \text{(dollars/trainee-month)}$$

Employing these average organizational cost factors, calculate the average upgrade cost for each AFSC at the specified organizational level as:

$$AUC(i, j, K) = (AOCF(i, K) \cdot ACT(i, j)) + (EMCB(j) \cdot AVG\ MO(i, j)) \quad \text{(dollars/trainee)}$$

Record the average cost factors and average upgrade costs next to their corresponding AFSCs and upgrade levels in the costing table.

As in Step 33, one of the above tables would be required for each specified organizational level. The use of developed average upgrade costs would also be similar to Step 33 in that these costs could be applied to a given number of upgrade trainees to directly calculate total training costs (TTC) at the specified organizational level, for any AFSC and skill level stratification. Equations developed in Step 33 for calculating total training costs are equally applicable to the costing data generated in Table XIIIa and TTC aggregations to higher organizational levels could also be obtained as described in Step 33.

Calculation of OJT Costs Alternative Form 5: Including the Cost of Trainee Time

The purpose of this costing alternative is to provide the user with the option of including the cost of OJT trainee time in the analysis of OJT program costs. The inclusion of trainee time costs is presented as an option because investigations have failed to establish a consensus on the part of Air Force personnel as to the validity of attributing these costs to the OJT program.* As such, the following steps outline procedures for estimating trainee time costs and including them in the cost analysis at the discretion of the user. In general, these procedures involve the measurement of OJT trainee-months by upgrade level, grade, and organization for the defined factor estimation period. These trainee loads are then converted into an equivalent amount of trainee-years by multiplying them by an organizational estimate of percent time spent in OJT activities and dividing the resultant amount by 12. Annual personnel costs by grade are then applied to the trainee time estimate, and the resultant total trainee time cost is divided by the number of trainee-months to develop a trainee time cost factor in dollars/trainee-month. This cost factor can then be applied to actual costing period trainee loads using any of the previously defined costing alternatives. Specific implementation steps for this approach are given below.

35. Utilizing procedures and data sources outlined in Section 3.7 and training load data employed in earlier steps, develop a table of trainee time cost factors as follows:

    Table XIVa: For each organization (k) at the desired organizational level, record from Tables Va and Vb the annual trainee-month load (ATML) by AFAC (i), skill level (j), and grade (g) for the current factor estimation period. Also for each organization, obtain the percent trainee time (PNTT) for each AFSC and skill level as described in Section 3.7. Employing these data, calculate the equivalent annual amount of trainee time (ANTT) for each grade and skill level as:

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*Refer to Chapter 2, this report, for a more detailed explanation of trainee cost considerations.

$$ANTT(i, j, k, g) = ATML(i, j, k, g) \cdot PNTT(i, j, k)/12$$

(trainee-years)

$$ANTT(i, j, k) = \sum_{g} ANTT(i, j, k, g)$$

(trainee-years)

Referencing Table IIa, record the annual personnel cost (AC) for each grade and calculate the total cost of trainee time (CTT) for each grade and skill level as:

$$CTT(i, j, k, g) = ANTT(i, j, k, g) \cdot AC(g)$$

(dollars)

$$CTT(i, j, k) = \sum_{g} CTT(i, j, k, g)$$ (dollars)

Employing the recorded values of annual trainee-month loads, calculate the trainee time cost factor (TRCF) for each grade and skill level as:

$$TRCF(i, j, k, g) = CTT(i, j, k, g)/AMTL(i, j, k, g)$$

(dollars/trainee-month)

$$TRCF(i, j, k) = CTT(i, j, k)/\sum_{g} ATML(i, j, k, g)$$

(dollars/trainee-month)

Record the values of PNTT, ANTT, CTT, and TRCF next to their corresponding organizations in the cost factor table. As with cost factors developed in Steps 17 to 20, these cost factors should be updated once per factor estimation period or as required by interim changes in annual cost, training load or percent trainee work time data.

36. Depending upon user preference, trainee time costs can be included in the analysis of OJT program costs by making the following modifications to the alternative costing approaches developed in Steps 31 to 34.

Alternative 1: Employing data developed in Step 24, replace the trainee-month loads (TML) stratified by AFSC (i) and organization (k) in Table Xa, with their equivalent training loads further stratified by skill level (j). Record the appropriate trainee time cost factor (TRCF) from Table XIVa and calculate the modified organizational training cost (OTC) as:

$$OTC\ (i,\ j,\ k) = (ORCF\ (i,\ k) + TRCF\ (i,\ j,\ k))\ TML\ (i,\ j,\ k) \quad \text{(dollars)}$$

Employing all other cost factors as defined in Step 31, the total organizational training cost (TOTC) is then calculated as:

$$TOTC\ (k) = \sum_i [(\sum_j OTC\ (i,\ j,\ k)) + DRCS\ (i,\ k) + CSCS\ (i,\ k)] \quad \text{(dollars)}$$

These modified training costs are then recorded in the costing table and the optional cost aggregation described in Step 31 can be calculated as desired.

Alternative 2: Employing data developed in Step 24, replace the trainee-month loads (TML) stratified by AFSC (i) and organization (k) in Table XIa, with their equivalent training loads further stratified by skill level (j). Record the appropriate trainee time cost factor (TRCF) from Table XIVa and calculate the modified organizational training cost (OTC) as indicated in Step 36, Alternative 1. Utilizing these modified organizational costs and all other cost factors as defined in Step 31, calculate and record the total career field costs (TCFC) as:

$$TCFC\ (i) = \sum_k [(\sum_j OTC\ (i,\ j,\ k)) + ECB\ (i,\ k)] \quad \text{(dollars)}$$

If desired, additional cost aggregations to the MAJCOM and Air Force levels can be obtained as described in Step 31.

Alternative 3: Utilizing all cost factors and OJT upgrade and CDC completion time data as defined in Step 33, record the appropriate trainee time cost factor (TRCF) from Table XIVa and calculate the modified average upgrade costs (AUC) for each AFSC (i), skill level (j), and organization (k) as:

$$AUC(i, j, k) = [(ORCF(i, k) + TRCF(i, j, k)) \cdot ACT(i, j)] + [EMCB(j) \cdot AVG\ MO(i, j)]$$

(dollars/trainee)

Record the modified upgrade costs next to their corresponding trainee time cost factors in Table XIIa. Then, employing these modified upgrade costs (AUC), the total training costs (TTC) for the various AFSC, skill level, and organizational stratifications can be calculated according to procedures and equations outlined in Step 33.

Alternative 4: As discussed in Step 34, this costing alternative calls for the use of cost factors which have been averaged across all organizations within a specified organizational level. If the trainee time cost factors developed in Step 35 are given for organizations below the level at which costing is to be performed under this alternative, then an average trainee time cost factor (ATRCF) must be developed. Utilizing the trainee-month loads (TML) for each AFSC (i), skill level (j), and organization (k) as defined in Step 24, and the trainee time cost factors (TRCF) from Table XIVa, calculate the average trainee time cost factor for the specified organizational level (K) as:

$$ATRCF(i, j, K) = \left[\sum_k TRCF(i, j, k) \cdot TML(i, j, k)\right] / \sum_k TML(i, j, k) \quad \text{(dollars/trainee-month)}$$

Employing these average trainee time cost factors and all other cost factors and training time data as defined in Step 34, calculate the modified average upgrade cost (AUC) for the specified organizational level as:

$$AUC(i, j, k) = [(AOCF(i, k) + ATRCF(i, j, k)) \cdot ACT(i, j)] + [EMCB(j) \cdot AVG\ MO(i, j)] \quad \text{(dollars/trainee)}$$

Record the average trainee time cost factors and the modified average upgrade costs next to their corresponding AFSCs and upgrade levels in Table XIIIa. As discussed in Alternative 3 above, these modified upgrade costs can then be employed to calculate total training costs (TTC) for various AFSC, skill level, and organizational stratifications according to procedures and equations developed in Step 33.

Steps 21 to 36 above outline the basic methodological approach for conducting cost analysis of an OJT program defined according to the skill level, organization, and time period dimensions discussed at the outset of this section. Although this approach has been labeled "standardized," it does offer the user a considerable amount of flexibility, both in terms of program definition (Steps 21 and 22) and cost analysis format (Steps 31 to 36). These costing options, as well as the basic overall cost analysis approach, have been exercised relative to an existing OJT program and the results of this demonstration are contained in Chapter 5. A discussion of additional costing options, capable of further customizing the approach to suit individual user needs, is presented in the following section.

4.3 User-Customized Analysis of OJT Program Costs

In developing the OJT costing methodology, it was recognized that the standardized "building block" approach may provide too much detail for aggregate cost analyses and that the use of estimated cost factors may not entirely reflect the uniqueness of unit or base level OJT programs. As such, the methodology has been carefully designed to allow for direct costing at more aggregate organizational levels and for the actual development of cost factors by users employing data on the specific structure of OJT within their organizations. In general, this flexibility to "customize" the cost analysis relative to individual user needs is facilitated by the following user options:

Data Substitution: Data employed in the development of cost factors and the measurement of training load are clearly defined as to their source and utilization. Given this information, users can readily assess the applicability of standardized data to their specific OJT programs and replace any or all of the defined data with information they feel better reflects the structure and operation of OJT within their realm of responsibility.

Cost Factor Development/Modification: As a logical extension of data substitution, users may also elect to redevelop or modify standardized cost factors to better reflect OJT staffing and time requirements within their specific organizations. Since the methodology outlines specific procedures and equations for developing each cost factor, this option can be exercised with a minimal expenditure of time and resources on the part of the user.

Cost Factor Averaging: To further enhance the utility of the costing methodology at all program levels, users may elect to develop average cost factors which can be directly applied to training loads at various organizational levels without employing the standardized "building block" approach. This option is an extension of Step 34 in that averaging techniques presented therein can be applied at Intermediate Command, MAJCOM, and Air Force levels in addition to

the indicated base level averaging. Since training loads can be readily measured at any organizational level, cost factor averaging permits the user to directly estimate the cost of OJT at higher program levels where more aggregate cost estimates are deemed adequate.

The degree to which the above options are employed by the cost analyst is primarily dependent on his/her assessment of the relevance of standardized data and cost factors to the specific OJT program being considered. The following subsections will therefore discuss each of these options in terms of potential user modifications which could be made to "customize" the methodology in response to such an assessment.

4.3.1 Data Substitution

Since the methodology's data requirements and utilization have been fully defined, literally all of the standardized data could be subject to user replacement. However, three key considerations should be kept in mind when determining a desirable degree of data substitution: (1) the degree to which standardized data fail to reflect the structure and operation of the program being considered, (2) the expected impact of data substitution on the reliability of cost estimates, and (3) the ability of the user to obtain desired replacement data in a cost-effective manner.

Relative to the first consideration, users should determine whether standardized data items are at least reasonable relative to their knowledge of the OJT program being analyzed. If, for example, the trainee-to-supervisor ratio required in Step 1 varies within a given range for the program being considered and the standardized value falls within that range, then replacement would probably te unnecessary for estimating purposes. If, however, the standard value was outside the actual range or a specific ratio was employed in the given program, then the substitution of a more representative value would be desirable.

When a more representative value is available, users should determine whether "desirable" substitutions are really necessary relative to their contribution to estimated program costs. For example, if the desired substitution were to increase the estimated reliability of a cost category which represented less than 1 percent of total costs, then such a substitution would probably be unnecessary for most costing applications.

The final and perhaps most constraining consideration is the level of effort required to obtain more reasonable or accurate replacement data. Given that the mechanics of data substitution are relatively simple, a user who routinely collects required OJT program data at his/her organizational level might consider substitution even if the first two considerations do not dictate a real need for data replacement. In other words, if program-specific data are readily available, their use can only serve to enhance the utility of the methodology. If, on the other hand, data replacement would involve primary data collection activities, then the user should carefully weigh the cost of these activities against the assessed desirability and need for data substitution.

Keeping in mind the above considerations, a list of potential data substitutions with guidelines for their evaluation is presented below:

> OJT Supervisor and Trainer Data - Step 1: These data provide estimates of percent time allocated to OJT (PT), supervisor to trainee ratios (R), trainer to supervisor ratios (TSR), and the percent of training personnel in each grade level (P). They are developed as career field averages from a survey conducted on a systemwide basis and are considered representative of all organizations in the standardized approach. If so desired, users may substitute specific program data for PT, R, TSR, or P, and calculate required supervisory personnel as described in Steps 25 to 28. Alternatively, users may elect to provide the actual number of supervisor and trainer man-years by grade employed for the conduct of OJT in their organizations over the costing period (Table IXa). In either case, consideration of such substitution should focus primarily on unit or base level applications where system averages might be less representative.
>
> OJT Upgrade and CDC Completion Time Data - Step 6: These data represent systemwide averages of the time required for OJT upgrade and CDC completion in each career field and skill level. Should the user have readily available data for these values relative to a specific program, then substitution can be made if deemed appropriate. Again, consideration of such substitutions should probably focus on unit and base level applications where averages may be less representative.

Overhead and Support Personnel Data - Step 12: Since the standardized approach calls for direct measurement of the number of OJT overhead and support personnel, replacement of these data should not be necessary unless the user has specific knowledge of a significant staff variation within his/her organization. The percent of time spent in designated OJT functions is, in some cases, an estimated value and would thus be a candidate for substitution if users determined the standardized values to be non-representative of known staff utilization.

Training Load Data - Steps 10 and 23: Trainee and trainee-month data reflecting the training load for each organization during the costing period are obtained from the UAR in the standardized approach. Since these data reflect actual field measurements of training conducted, substitutions should not be required. If, however, users detect discrepancies in the training load data or they wish to estimate trainees for costing some future time period, direct substitution of trainee load data can be made according to specifications set for Tables Va and Vb.

CDC Enrollment Data - Steps 11 and 24: Enrollee-month data employed in the estimation of CDC cost factors are obtained directly from AU/ECI records and should not require user replacement. Measurements of enrollee-month loads by organization are, however, estimated as a function of trainee-months utilizing the ratio of enrollment time to upgrade time (% E) as defined in Step 11. If these estimates are determined to be inaccurate for a particular organization, then users may elect to: (1) recalculate the estimates based on user-supplied value of % E or (2) provide actual data on the number of trainees actively enrolled in CDCs in their organization over the costing period.

Trainee Time Data - Step 35: To calculate the amount of trainee time which is due to OJT activities, the standardized approach employs estimates of the percent of trainee time (PNTT) representing the difference between the productivity of a trained airman and the

lesser productivity of the OJT trainee. Currently, these estimates are based on subjective inputs from a sample of OJT managers. Since the cost of trainee time can constitute a substantial portion of total OJT costs, it is recommended that users strongly consider replacing these values with either subjective or empirical estimates which are more representative of their specific OJT program structure and management.

4.3.2 Cost Factor Redevelopment and/or Modification

Primarily, the option to recalculate or modify the standardized cost factors would be employed by those users who have elected to perform data substitutions as described in Section 4.3.1. In these cases, the cost factors which are based on data replaced by the user will need to be recalculated according to procedures specified for their development in Sections 4.1 and 4.2. Specifically, the data substitution options presented in the previous section would involve the following modifications of standardized cost factors:

- OJT Supervisor/Trainer and OJT Trainer Cost Factors should be recalculated according to procedures and equations set forth in Steps 25 to 30 whenever the user choses to employ data substitutions as described in Step 1.

- Average Upgrade Cost Factors should be recalculated according to procedures and equations set forth in Steps 33 or 34 whenever the user elects to replace OJT upgrade and CDC completion time data as described in Step 6.

- Overhead and Support Cost Factors should be recalculated according to procedures and equations set forth in Steps 17, 19 or 20 whenever the user elects to replace their respective worldwide, MAJCOM, or base level overhead and support staff data as described in Step 12.

- All Cost Factors based on trainee-month amortization should be recalculated according to procedures and equations set forth in Steps 17, 19, 20, 25 to 30, and 35 whenever the user elects to replace training load data as described for Steps 10 and 23. Specific cost factors subject to change under these conditions are: the HQ USAF overhead factor (AFOF), the OJT Advisory Service support factor (ASCF), the MAJCOM overhead factor (MOCF), the base overhead factor (BOCF), the unit overhead factor (UOCF), the supervisor factor (SCF), trainer factor (TCF), total supervision factor (TSCF), and the trainee time factor (TRCF).

- All Cost Factors based on enrollee-month amortization should be recalculated according to procedures and equations set forth in Steps 17 and 18 whenever the user elects to replace or recalculate enrollee-month data as described for Steps 11 and 24. Specific cost factors subject to change under these conditions are: the CDC support factors (CSCF), the CDC printing factor (PCF), and the CDC development/revision factor (DRCF).

- Trainee Time Cost Factors should be recalculated according to procedures and equations set forth in Step 35 whenever the user elects to replace the standardized estimates of percent trainee time as described for Step 35.

In addition to those cost factor modifications necessitated by data substitutions, the user may wish to further customize the methodology by specifying alternative cost factor definitions which better represent OJT management conditions within a particular organization. Examples of revised cost factor definitions would include:

- The replacement of individual unit overhead cost factors with an organizational unit administration cost factor which reflects the presence of a consolidated training management function at some level other than the unit/squadron.

- The redefinition of the trainee-month or enrollee-month amortization bases to reflect the allocation of personnel burdens over some subset of all trainees present or over some time period other than the total OJT or CDC completion times.

- The exclusion of certain cost categories from cost factor totals, such as worldwide enrollee-month or trainee-month factors (WEM, WTM), total supervision factors (TSCF), and total organizational factors (ORCF), to make resultant program costs reflect a desired subtotal for budget planning or program comparison purposes.

Again, given the specificity of cost factor development procedures, the redefinition and revised calculation of cost factors according to user specification can be accomplished with relative ease. As an extension of this restructuring process, the user may also include additional cost factors which are not currently addressed in the methodology but are considered by the user to have a potentially significant impact on final program costs. Such factors would primarily deal with that share of indirect overhead/support costs or equipment/facilities costs which can be legitimately attributed to the conduct of OJT within a particular organization. In order to include such costs, the user must be able to account for that marginal amount incurred in support of OJT. Since normal base level accounting procedures do not provide an OJT breakdown of general base support and equipment/facilities costs, the proportional OJT share would have to be estimated by the user. Should empirical or subjective estimates of these shares be readily available, the user could develop a set of indirect overhead or equipment cost factors by employing the same general procedures outlined for direct cost factors in Steps 17, 19 or 20. These cost factors could then be added to the direct OJT factors and applied to actual training loads according to the costing alternative presented in Steps 31 to 36.

Although investigation of indirect overhead/support costs indicates that a legitimate OJT share of these costs would probably be quite small, similar investigations have indicated that, in certain functional areas, equipment cost shares might have an impact on total OJT costs. As such, it is recommended that, if reliable cost sharing data are available, the user should exercise the option of developing an equipment cost factor for inclusion in the costing procedures.

4.3.3 Cost Factor Averaging

As an additional means of "customizing" the methodology to fit individual user needs, standardized cost factors can be averaged at various organizational levels so that direct, aggregate OJT costing can be performed. This option should prove particularly useful to analysts who wish to estimate OJT costs for programs which encompass several suborganizations. In this case, the standardized approach would require that costs be individually assessed for each suborganization and then aggregated to the desired program level. By employing cost factor averaging, the cost contribution of each suborganization is reflected in the calculated average value which can then be directly applied to the total training load identified for the aggregate program structure. For example, direct OJT costing at the MAJCOM level can be accomplished by averaging unit base and intermediate command cost factors across all such organizations within the given MAJCOM and then applying those average cost factors to the sum of all training conducted within the MAJCOM over the costing period.

In developing average cost factors for a given organizational level, several options are available to the user. These options range from direct estimation of aggregate cost factors to the arithmetic or weighted averaging of individual suborganization cost factors. Specifically, the following techniques can be employed in conjunction with standardized data and procedures, to develop cost factor averages for use in user-specified, direct costing applications:

- Aggregate Cost Factor Estimation. Should a user decide that all costing applications will deal with a specific organizational level, he/she may wish to estimate cost factors at that level from the outset. This can be accomplished by summing overhead staff and support staff costs across all organizations within the given level and dividing that total cost by the training load summed over the same organizations. Employing data and procedures outlined in Steps 19 and 20, the calculation of aggregate base and MAJCOM overhead factors would be performed as follows:

$$BOCF(K) = (OSC(K) + \sum_{k} OSC(k))/ATML(K)$$

(dollars/trainee-month)

$$MOCF\ (M) = (OSC\ (M) + \sum_{K} OSC\ (K) + \sum_{k} OSC\ (k))/ATML\ (M)$$

(dollars/trainee-month)

In these calculations, the index (M) refers to a particular MAJCOM, the index (K) refers to any or all bases within a MAJCOM, and the index (k) refers to all units within a base. Similar aggregate cost factors could be developed for the total Air Force or intermediate commands by summing all costs and training loads to those levels. These procedures are applicable to all cost factors which are organization-specific, including the trainee time factors developed in Step 35.

Arithmetic Cost Factor Averaging. If aggregate cost factor estimation is not employed, the user may still develop average factors for use in direct costing by simply calculating the arithmetic average of standardized organizational cost factors at the desired program level. Again, referencing Steps 19 and 20, these averages would be calculated for a base and MAJCOM as follows:

$$\overline{BOCF}\ (K) = (\sum_{k} UOCF\ (k))/k + BOCF\ (K)$$

(dollars/trainee-month)

$$\overline{MOCF}\ (M) = (\sum_{K} BOCF\ (K))/K + (\sum_{k} UOCF\ (k))/k + MOCF\ (M)$$

(dollars/trainee-month)

or: $$\overline{MOCF}\ (M) = (\sum_{K} \overline{BOCF}\ (K))/K + MOCF\ (M)$$

(dollars/trainee-month)

These procedures are also applicable to all cost factors which are organization-specific and to other organizational levels such as intermediate command or systemwide. If aggregate cost factors have been estimated for a specific organizational level, they also could be directly averaged to higher levels using these same basic procedures.

Weighted Cost Factor Averaging. Due to an uneven distribution of training load or staff costs, the use of an arithmetic average may not adequately reflect the true cost contribution of certain suborganizations. In these cases, the average cost factor should be developed by weighting each suborganization cost factor by its corresponding training load and dividing the sum of these weighted factors by the total training load over all contributing organizations. Employing data and procedures set forth in Steps 19 and 20, these weighted averages can be calculated for a base and MAJCOM as follows:

$$\overline{BOCF}\,(K) = \left(\sum_k UOCF\,(k) \cdot ATML\,(k)\right)/\sum_k ATML\,(k)) + BOCF\,(K) \quad \text{(dollars/trainee-month)}$$

$$\overline{MOCF}\,(M) = \left(\sum_k UOCF\,(k) \cdot ATML\,(k)\right)/\sum_k ATML\,(k)) + \left(\sum_K BOCF\,(K) \cdot ATML\,(K)\right)/\sum_K ATML\,(K)) + MOCF\,(M) \quad \text{(dollars/trainee-month)}$$

$$\text{or: } \overline{MOCF}\,(M) = \left(\sum_K \overline{BOCF}\,(K) \cdot ATML\,(k)\right)/\sum_K ATML\,(K)) + MOCF\,(M) \quad \text{(dollars/trainee-month)}$$

As with arithmetic averaging, these weighting procedures are applicable to all organizational cost factors at all levels and they can also be used to develop higher level averages for aggregate cost factors if available.

4.4 Interpretation and Use of Cost Estimating Results

Taken in total, the procedures, data, and estimating equations presented in Chapters 3 and 4 comprise the basic design of an OJT cost estimating methodology. In keeping with original design specifications, this methodology has focused on the use of existing Air Force data sources and has been structured to allow the user maximum flexibility

in developing reasonable cost estimates for a wide range of OJT program configurations. It is important to remember, however, that while the methodology is soundly based on economic principles and cost accounting techniques, it is still an estimating tool whose results should not be interpreted as an actual audit of program expenditures. Far from being a detriment, the fact that OJT costs can be estimated without the burden of a lengthy audit only serves to enhance the ultimate utility of the methodology as a program planning and policy evaluation tool.

As is the case with any methodology, the ultimate benefit to be gained from its use can be realized only through a complete understanding of the capabilities being offered and the results which can be obtained. To assist the user in reaching such an understanding, guidelines for the interpretation and use of developed OJT cost factors and estimated program costs are presented below:

- Because the estimates of OJT supervisor and trainer costs represent systemwide career field averages, the use of these estimates in the standardized approach (Section 4.2) would produce the most reliable program cost estimates for individual career fields at the more aggregate MAJCOM and Air Force program levels.

- If the methodology were to be directly applied to OJT programs at the unit or base levels, it is recommended that users take full advantage of the "customizing" options presented in Section 4.3 so that resultant costs reflect, to the degree necessary, the uniqueness of the individual program structures.

- Given that the methodology estimates "direct" OJT personnel and materials costs, comparison of developed OJT costs with those of other training programs should be made on the basis of those cost categories which are compatible across the programs being evaluated.

- Since the methodology does provide estimates of the type, quantity, and utilization of OJT management, administrative, and training personnel, it can be legitimately used as a generalized personnel planning tool. These estimates should not, however, be considered as substitutes for more detailed management engineering studies.

- Although the methodology provides a flexible and effective means of assessing OJT costs, it should be kept in mind that costs alone should not be the sole criterion in a policy or program evaluation environment. Additional consideration should always be given to the quality of training being produced for the costs incurred.

Keeping these guidelines in mind, the methodology can be exercised to address a wide range of OJT program and policy issues in which knowledge of estimated training costs is essential to the evaluation process. It is felt that this capability will make a needed contribution to the continued cost-effective management of the overall Air Force training program.

5.0 DEMONSTRATION OF THE METHODOLOGY

The purpose of this chapter is to demonstrate the use of the methodology by applying developed procedures, techniques, and options to a realistic Air Force OJT program. This demonstration follows the analytical sequence set forth in Chapter 4 and the resultant costs and cost factors are tabulated according to specifications established in each step of that sequence. While the majority of the data employed in the demonstration represent actual OJT conditions for the subject program, some of the staffing and training load data used in quantifying cost factors have been estimated so that immediate emphasis is directed toward qualitative rather than quantitative evaluation of methodology performance. As such, the results of the demonstration should not be interpreted as an actual delineation of estimated OJT costs but rather as a realistic representation of relative cost magnitudes.

5.1 Description and Analysis of Demonstration Career Fields

Of the 15 career fields considered for testing Occupational Survey Analysis techniques developed in Section 3.2, six were chosen as candidates for the actual costing demonstration. The following list of these demonstration career fields contains page number references to the OJT task sets used for the career fields and the graphical results of the Occupational Survey analyses conducted.

AFSC	Title	Occupational Survey OJT Task Set	Occupational Survey Graphical Analysis
291x0	Telecommunications Operator	B.2	3.17 - 3.18
293x3	Radio Operator	B.6	C.2 - C.3
326x1	Integrated Avionics	B.8 - B.9	C.6 - C.7
431x1	Aircraft Maintenance	B.11	C.10 - C.11
431x0	Helicopter Mechanic	B.10	C.8 - C.9
316x1	Missile Systems Maintenance	B.5	C.4 - C.5

Employing these data, and procedures referenced in Step 1, Section 4.1, Tables Ia and Ib containing OJT supervisor/trainer and OJT trainer group characteristics for the demonstration career fields were developed according to specifications and are presented in Tables 7 and 8, respectively. Having completed this initial career field analysis step, the demonstration then focused on the execution of data collection and cost factor estimation steps.

5.2 Demonstration of Data Collection and Cost Factor Estimation Procedures

In order to narrow the scope of the demonstration, it was decided to limit the data collection/estimation and cost factor estimation activities to the specific career fields and organizations which will be involved in the actual costing applications. Because of this narrowing of scope, it was considered feasible to demonstrate the methodology at its most disaggregate level of application so that all procedures and techniques could be exercised. As such, the demonstration was focused on the OJT program at Bergstrom Air Force Base which includes training in both resident Tactical Air Command (TAC) and tenant Air Force Communication Service (AFCS) and Military Airlift Command (MAC) units. Having thus established the organizational structure to be employed in the analysis, the remaining data collection and cost factor estimation steps were carried out as follows:

- Personnel Cost Data. As prescribed in Step 2, Section 4.1, the required annual and hourly personnel costs were obtained from AFR 173-10 and recorded as Table IIa which is presented in Table 9.

- CDC Development and Revision Cost Data. Of the six career fields considered in the demonstration, three employed CDCs for training to various levels. As prescribed in Steps 3 to 5, Section 4.1, data for the required CDC expenditure categories were obtained and used to calculate the present value of life cycle costs and the resultant uniform annual cost burdens. For demonstration purposes, a mean useful CDC lifetime was calculated and used in lieu of individual CDC life cycles. This calculation

TABLE 7: OJT Time Involvement Factor and Trainees Per Supervisor Ratio for Six Career Fields - Table Ia

Career Field a) Supervisors/ Trainers b) Trainers		Trainees Per Supervisor Ratio	Time Involvement Factor (Proportion Time Spent)
291x0	a)	R = 2.306	PT = 0.10818
	b)	R = 1.796	PT = 0.09509
293x3	a)	R = 2.510	PT = 0.10859
	b)	R = 1.706	PT = 0.09676
326x1	a)	R = 3.482	PT = 0.06087
	b)	R = 1.889	PT = 0.04486
431x1	a)	R = 2.654	PT = 0.05698
	b)	R = 2.178	PT = 0.04794
431x0	a)	R = 3.353	PT = 0.04439
	b)	R = 2.000	PT = 0.02847
316x1	a)	R = 4.361	PT = 0.10369
	b)	R = 3.343	PT = 0.05396

TABLE 8: Distribution of Supervisors by Grade for Six Career Fields - Table Ib

Career Field a) Supervisors/ Trainers b) Trainers		E3	E4	E5	E6	E7	E8	E9	Ratio of Trainers Total to Supervisors/ Trainers Total = TSR
291x0	a)	25	150	251	111	38	7	3	0.742
	b)	22	133	204	59	11	5	0	
293x3	a)	49	92	231	187	96	22	11	0.616
	b)	37	82	161	105	36	3	0	
316x1	a)	3	22	48	56	51	13	9	0.178
	b)	1	10	16	7	1	0	1	
326x1	a)	4	8	20	18	6	0	0	0.643
	b)	4	8	17	7	0	0	0	
431x0	a)	23	123	181	82	47	17	2	0.541
	b)	19	99	98	32	9	0	0	
431x1	a)	326	741	773	478	288	69	35	0.792
	b)	294	656	650	316	169	39	23	

		Proportion of All Grades							Total*
291x0	a)	0.0427	0.2564	0.4291	0.1897	0.0650	0.0120	0.0051	1.0000
	b)	0.0507	0.3065	0.4700	0.1359	0.0253	0.0115	0.0	0.9999
293x3	a)	0.0712	0.1337	0.3358	0.2718	0.1395	0.0320	0.0160	1.0000
	b)	0.0872	0.1934	0.3797	0.2476	0.0849	0.0071	0.0	0.9999
316x1	a)	0.0149	0.1089	0.2376	0.2772	0.2525	0.0644	0.0446	1.0000
	b)	0.0278	0.2778	0.4444	0.1944	0.0278	0.0	0.0278	1.0000
326x1	a)	0.0714	0.1429	0.3571	0.3214	0.1071	0.0	0.0	0.9999
	b)	0.1111	0.2222	0.4722	0.1944	0.0	0.0	0.0	0.9999
431x0	a)	0.0484	0.2589	0.3811	0.1726	0.0989	0.0358	0.0042	0.9999
	b)	0.0739	0.3852	0.3813	0.1245	0.0350	0.0	0.0	0.9999
431x1	a)	0.1203	0.2734	0.2852	0.1764	0.1063	0.0255	0.0129	1.0000
	b)	0.1369	0.3055	0.3027	0.1472	0.0787	0.0182	0.0107	0.9999

*Totals may not add to one due to rounding.

TABLE 9: Standard Annual and Hourly Rates, FY 1977* - Table IIa

Military Personnel			Civilians		
Grade	Annual Rate ($)	Hourly Rate ($)	Grade	Annual Rate ($)	Hourly Rate ($)
E1	6,313	3.7048	GS1	6,894	3.8557
E2	6,996	4.1056	GS2	7,889	4.4122
E3	7,563	4.4384	GS3	9,222	5.1577
E4	9,342	5.4824	GS4	10,692	5.9798
E5	10,646	6.2477	GS5	12,275	6.8652
E6	12,509	7.3410	GS6	13,844	7.7427
E7	14,509	8.5147	GS7	14,939	8.3551
E8	16,716	9.8099	GS8	16,980	9.4966
E9	19,606	11.5059	GS9	18,412	10.2975
			GS10	20,523	11.4782
W4	27,035	15.8656	GS11	22,227	12.4312
			GS12	26,594	14.8736
01	11,948	7.0117	GS13	30,814	17.2338
02	16,485	9.6743	GS14	36,421	20.3697
03	21,481	12.6062	GS15	42,525	23.7836
04	25,242	14.8132	GS16	44,857	25.0878
05	30,521	17.9114	GS17	44,935	25.1314
06	36,162	21.2218	GS18	44,935	25.1314
07	40,567	23.8069			
08	46,597	27.3457			
09	47,283	27.7482			
010	50,036	29.3638			

*Based on Tables 20 and 24, pp. A-112 and A-116, of AFR 173-10, Vol. 1 (C5), January 20, 1977. Annual available work hours computed on the basis of 142 hours per month for military personnel and 149 hours per month for civilians as indicated by Table 2-1, p. 2-3, of AFM 26-3, Vol. 1 (C1), March 7, 1973.

employed a cross-sectional sample of CDCs, whose summary statistics are presented in Table 10. All collected and calculated CDC costing data were recorded in Table IIIa according to specifications and the results are given in Table 11.

OJT Upgrade and CDC Completion Time Data. As specified in Step 6, Section 4.1, the average upgrade and CDC completion time data were obtained for each demonstration career field and the ratios of these averages were calculated. Both the averages and their ratios were tabulated according to specifications for Table IVa and the results are presented in Table 12.

Selection of a Cost Factor Estimation Period. Although a specific calendar time period was not employed in the demonstration, the factor estimation period used corresponded to a 12-month time frame over which training loads and staff burdens were assessed. The use of a 12-month factor estimation period is in keeping with the criteria referenced in Step 7, Section 4.1.

CDC Enrollee Load Data. Utilizing referenced procedures and specifications from Step 8, Section 4.1, the total enrollee-months present over the factor estimation period were estimated for each CDC costed in Table IIIa, Table 11. Since only a single monthly file was available, these estimates were obtained by extrapolating a cross-sectional ECI enrollment file over a 12-month period rather than summing individual monthly files as called for in Step 8. As specified, the resultant enrollee-month data were recorded in Table IIIa, Table 11. An estimate of the total enrollee-months present over all CDCs was also developed for use in later steps as prescribed in Step 9, Section 4.1. As with individual CDC enrollments, this value was estimated from cross-sectional data rather than measured from summed monthly files.

TABLE 10: Summary Statistics - CDC Lifetimes
(from Section IV, PTT 78-1, October 1976)

Summary of the time periods between the current publication date of course volumes (as of October 1976) and the ATC production completion date for volumes requiring revision as of the last review.

Lifetime (In Months)	Number of Volumes	Percent of Revised Volumes	Lifetime (In Years)
0-12	11	5.3	1
13-24	37	17.8	2
25-36	54	26.0	3
37-48	40	19.2	4
49-60	34	16.3	5
61-72	18	8.7	6
73-84	8	3.8	7
85-96	4	1.9	8
97-108	2	1.0	9
Total	208	100.0	

Mean lifetime = 40.1 months or 3.34 years

Standard deviation = 19.8 months

Standard error of the mean = 1.4 months

TABLE 11: CDC Development and Revision Investment Cost Factors for Selected CDCs - Table IIIa

$$\text{Annual Cost, } R = \left[\frac{i\,(1+i)^N}{(1+i)^N - 1}\right] \times P$$

where P = present value of total investment
i = 10% interest rate
N = lifetime in years

CDC	Type of Cost	Costs by Grade: Grade	Man-Hours	Costs ($)	Lifetime (Years)	Present Value ($)	Annual Cost ($)	Annual Enrollee-Months	Cost Per Enrollee-Month ($)
43151A	Initial Development (4 volumes)	E5	0.3	1.87					
		E6	873.5	6,412.36					
		E7	1,279.0	10,890.30					
		03	1.0	12.61					
		GS2	163.0	719.19					
		GS3	156.5	807.18					
		GS6	88.1	682.13					
		GS7	143.6	1,199.79					
		GS11	963.0	11,971.25					
		GS12	188.0	2,796.24					
		GS13	1.0	17.23					
		All	3,617.0	35,510.15					
	Major Revision (4 volumes)	E6	255.0	1,871.96					
		E7	746.0	6,522.26					
		E8	175.0	1,716.73					
		GS3	99.1	511.13					
		GS7	87.3	729.40					
		GS9	30.3	312.01					
		GS10	31.0	355.82					
		GS11	1,324.0	16,458.91					
		GS12	133.1	1,979.68					
		GS13	1.0	17.23					
		All	2,899.0	30,475.13					
	Average Revision/ Development		3,378.0	32,992.64	3.34	32,992.64			
	Average Minor Revision	NA	NA	NA	NA	NA			
	Average Annual Review	NA	NA	NA	NA	NA			
	Total Investment		3,378.0		3.34	32,992.64	12,102.00	3,696	3.2743
43151C	Initial Development (4 volumes)	E4	0.5	2.74					
		E5	2.0	12.50					
		E6	734.1	5,389.03					
		E7	423.3	3,604.27					
		03	0.8	10.08					
		GS3	209.5	1,080.54					
		GS6	963.5	4,363.01					
		GS9	0.8	8.24					
		GS11	1,200.45	14,923.03					
		GS12	132.0	1,963.32					
		GS13	1.0	17.23					
		All	3,265.0	31,373.99					
	Major Revision (4 volumes)	E7	1,141.5	9,719.53					
		GS3	67.0	345.57					
		GS6	181.7	1,406.85					
		GS9	3.0	30.89					
		GS11	965.6	12,003.57					
		GS12	93.0	1,383.24					
		GS13	1.0	17.23					
		All	2,459.8	24,906.48					
	Average Revision/ Development		2,862.4	28,140.44	3.34	28,140.44			
	Minor Revision	NA	NA	NA	NA	NA			
	Annual Review	NA	NA	NA	NA	NA			
	Total Investment		2,862.4		3.34	32,992.64	10,322.17	41,472	0.2489
43151 A/C	Combined Total Investment		6,240.4		3.34	61,133.08	22,424.16	45,168	0.4965

TABLE 11 (continued)

CDC	Type of Cost	Costs by Grade: Grade	Man-Hours	Costs ($)	Lifetime (Years)	Present Value ($)	Annual Cost ($)	Annual Enrollee-Months	Cost Per Enrollee-Month ($)
43150C	Initial Development (4 volumes)	E5	0.5	3.12					
		E6	980.5	7,197.85					
		E7	56.0	476.82					
		03	0.5	6.30					
		GS3	186.0	959.33					
		GS4	253.45	1,962.39					
		GS9	19.5	200.80					
		GS11	1,420.95	17,664.11					
		GS12	159.5	2,372.34					
		GS13	1.0	17.23					
		All	3,077.9	30,860.29	3.34	30,860.29			
	Average Minor Revision	NA	NA	NA	NA	NA			
	Average Annual Review	NA	NA	NA	NA	NA			
	Total Investment		3,077.9		3.34	30,860.29	11,319.83	3,048	3.7139
29353	Major Revision (2 volumes)	E7	987.0	8,404.01					
		GS3	1.0	5.16					
		GS4	142.0	849.13					
		GS6	15.0	116.14					
		GS9	88.0	906.18					
		GS12	143.0	2,126.92					
		GS13	1.0	17.23					
		All	1,377.0	12,424.77	3.34	12,424.77			
	Average Minor Revision	NA	NA	NA	NA	NA			
	Average Annual Review	NA	NA	NA	NA	NA			
	Total Investment		1,377.0		3.34	12,424.77	4,557.52	5,544	0.8221
29150	Major Revision (3 volumes)	E5	155.0	968.39					
		E7	1,266.0	10,779.61					
		GS3	280.0	1,444.16					
		GS7	243.5	2,034.47					
		GS11	142.5	1,771.45					
		GS12	69.0	1,026.28					
		GS13	1.0	17.23					
		All	2,157.0	15,741.59	3.34	16,741.59			
	Average Minor Revision	NA	NA	NA	NA	NA			
	Average Annual Review	NA	NA	NA	NA	NA			
	Total Investment		2,157.0		3.34	16,741.59	6,140.97	18,036	0.3405
29130	Major Revision (3 volumes)	E3	37.0	164.22					
		E5	20.0	124.95					
		E6	930.0	6,827.13					
		E7	10.0	85.15					
		GS3	1.0	5.16					
		GS4	324.0	1,937.46					
		GS6	189.0	1,463.37					
		GS11	65.0	808.03					
		GS12	132.0	1,963.32					
		GS13	1.0	17.23					
		All	1,709.0	13,396.02	3.34	13,396.02			
	Average Minor Revision	NA	NA	NA	NA	NA			
	Average Annual Review	NA	NA	NA	NA	NA			
	Total Investment		1,709.0		3.34	13,396.02	4,913.78	8,508	0.5775

TABLE 12: Comparison of Time Spent in Training to Time Enrolled in CDCs - Table IVa

AFS	Upgrade Training Level	Average Months to Successful Upgrade*	Average Months to Successful Completion of CDC**	Ratio of Enrollee-Months to Trainee-Months
291x0	3	5.7	5.0	0.88
	5	7.9	5.0	0.63
	7	10.9	0	0
293x3	3	4.0	0	0
	5	7.0	4.0	0.57
	7	10.3	0	0
316x1	3	7.0	0	0
	5	9.8	6.0	0.61
	7	10.9	6.0	0.55
326x1	3	5.7	0	0
	5	8.3	5.5	0.66
	7	11.4	3.5	0.31
431x0	3	2.4	0	0
	5	7.9	4.5	0.57
	7	10.0	4.0	0.40
431x1	3	2.5	0	0
	5	8.3	5.5	0.66
	7	10.6	5.0	0.47

*Average obtained by first finding mean time to upgrade and mean time for retraining for all letter suffixes in each career field as shown in PMC-P260 of September 30, 1976. The composite weighted average of upgrade and retraining times was then formed by weighting each according to worldwide trainees at each training level as identified in PMC-P260, October 1976.

**Obtained from ECI History File by Reason for January-March 1975.

OJT Trainee Load Data. As called for in Step 10, Section 4.1, annual trainee-month loads for each career field and MAJCOM are to be measured over the factor estimation period using actual UAR data. Similarly, these training loads are to be further stratified by upgrade level and unit/squadron using the same measurement procedures. Since these measurement procedures are part of the methodology design and are thus not yet implemented, the training loads required for the demonstration were estimated from cross-sectional data as follows:

- The total trainee-month load over all career fields, which would normally be obtained by totalling Table Va, Step 10, was estimated by extrapolating an average monthly training load for each MAJCOM over a 12-month period. The results of these extrapolations are presented in Table 13.

- To obtain an estimate of the total training load in each demonstration career field, the total trainee-month estimate from Table 13 was distributed over the career fields according to the ratio of each career field's population to the total airman population. The results of this distribution are presented in Table 14.

- To satisfy the requirements for Table Va, Step 10, the career field training loads contained in Table 14 were assigned to MAJCOMs according to the number of OJT supervisory personnel estimated for each career field and MAJCOM from the Occupational Survey Analysis. The contents of Table Va are presented in Table 15.

TABLE 13: Trainee-Months for Each MAJCOM in Year I*

MAJCOM/SOA	Skill Level			Total
	3	5	7	
AUN	396	1,908	900	3,204
ATC	6,072	31,392	12,468	49,932
AAC	240	6,120	3,276	9,636
ADCOM	1,752	23,496	8,496	33,744
AFCS	7,404	62,736	15,696	85,836
AFLC	1,224	4,452	3,156	8,832
AFSC	2,412	17,988	6,792	27,192
MAC	8,100	75,048	24,612	107,760
PACAF	672	17,856	8,952	27,480
SAC	15,480	124,908	36,888	177,276
TAC	11,496	105,144	27,096	143,736
USAFE	1,188	35,520	15,108	51,816
USAFSS	828	10,596	4,992	16,416
USAFA	48	804	588	1,440
Total	57,312	517,968	169,020	744,300

*Based on October 1976 training load as indicated in PMC-P260, OJT Report.

TABLE 14: Portion of Yearly Total Trainee-Months Belonging to AFSCs Studied

AFS	Proportion of Airmen in AFS to All Airmen (from UAR)	Air Force Total Trainee-Months	Trainee-Months in Year by AFS
291x0	0.01783	774,300	13,271
293x3	0.00446	744,300	3,320
316x1	0.00274	744,300	2,039
326x1	0.00225	744,300	1,675
431x0	0.00338	744,300	2,516
431x1	0.08998	744,300	66,972

TABLE 15: Trainee-Months in AFS for MAJCOMs During Year I - Table Va

MAJCOM/SOA	Career Field						Total
	291x0	293x3	316x1	326x1	431x0	431x1	
AAC	0	0	77	0	107	709	893
USAFA	0	0	0	0	0	0	0
ADC	981	81	180	0	0	3,065	4,307
USAFE	282	113	454	273	41	5,409	6,572
AFLC	27	6	0	0	0	531	564
AFSC	658	97	9	0	152	1,662	2,578
ATC	81	0	60	201	24	4,837	5,203
AU	27	0	0	0	0	109	136
MAC	94	200	0	0	1,531	16,280	18,105
PACAF	67	119	86	0	24	1,471	1,767
SAC	376	768	711	310	505	19,174	21,844
TAC	846	184	463	893	124	13,669	16,179
USAFSS	752	0	0	0	0	0	752
AFCS	9,080	1,752	0	0	7	54	10,893
Total	13,271	3,320	2,040	1,677	2,515	66,970	89,793

.. To satisfy the training load data requirements for Table Vb, Step 10, the actual number of trainees present in a given month for each of the demonstration career fields was obtained from the CBPO/OJT unit at Bergstrom Air Force Base. These data were given by upgrade level and were further broken down by the unit/squadron in which the training was conducted. Assuming these data to represent an average monthly training load, the annual trainee-month data required for Table Vb were obtained by extrapolating the cross-sectional number of trainees over a 12-month period. The resultant unit/squadron level training loads are presented in Table 16.

As specified in Step 11, Section 4.1, the trainee-month loads contained in Table 16 were then multiplied by their respective CDC enrollee-month to trainee-month ratios from Table 12 to obtain an estimate of CDC enrollee-months present in each unit/squadron. These estimates were recorded in Table V5 as specified and they are presented in Table 16.

Overhead and Support Personnel Cost Data. Exercising procedures set forth in Step 12, Section 4.1, data on the amount and utilization of OJT overhead and support personnel at HQ MAJCOM levels were collected and recorded according to the specifications for Table VIa. In a like manner, staffing data for AU/ECI were obtained as specified for Table VIb. The resultant contents of data tables VIa and VIb are presented in Tables 17 and 18, respectively. The third category of overhead staff data required under Step 12 involves an assessment of the amount and utilization of staff employed in the administration and management of OJT at the base and unit/squadron levels. As dictated by the methodology, staffing for the Bergstrom CBPO/OJT unit was estimated as a function of base population and recorded in Table VIc.

TABLE 16: Annual Trainee-Month and Enrollee-Month Loads Anticipated in Four Career Fields for Seven Squadrons at Bergstrom Air Force Base - Table Vb

Unit or Squadron	Career Field	Annual Trainee-Months by Upgrade Level				Annual CDC Enrollee-Months by Upgrade Level			
		3	5	7	Total	3	5	7	Total
712th DASC	293x3	2	17	6	25	-	10	-	10
	291x0	1	8	3	12	1	5	-	6
	Subtotal	3	25	9	37	1	15	-	16
602 TACCS	291x0	3	25	8	36	3	16	-	19
727 TCS	291x0	5	42	14	61	4	26	-	30
1882nd CS (AFCS)	291x0	3	25	8	36	3	16	-	19
701st TASS	431x0	1	8	3	12	-	5	1	6
4502 Camron	431x0	4	33	11	48	-	19	4	23
	431x1	18	158	52	228	-	104	24	128
	Subtotal	22	191	63	276	-	123	28	151
OMS	431x1	43	383	127	553	-	253	60	313
Total		80	699	232	1,011	11	454	89	554

TABLE 17: MAJCOM Level OJT Direct Overhead and Program Support Personnel - Table VIa

Organization	Office	Authorized AFSCs	Authorized Grades	Standard Annual Cost*	Percent of Productive Time/Cost Due to OJT	MAJCOM HQ Costs Attributable to OJT Annually
Air University	DPAT	73270	1 TSgt E6	12,509	20	2,502
HQ ATC	TTFJ	75172	1 MSgt E7	14,509	100	1,137,160
		75193	1 MSgt E7	14,509		
		75xxx	2 SSgt E5	21,292		
		75xxx	16 MSgt E7	232,144		
		75xxx	65 TSgt E6	813,085		
	TTSS		1 GS-12	26,594	72.5	
			1 GS-13	30,814		
HQ AAC	DPT	75172	1 TSgt E6	12,509	100	12,509
HQ ADCOM	DPXTO	75193	1 SMSgt E8	16,716	100	16,716
HQ AFCS	DPATE	75193	1 MSgt E7	14,509	100	14,509
HQ AFLC	DPMTT	75193	1 MSgt E7	14,509	100	14,509
HQ AFRES	DPTST	75193	1 CMSgt E9	19,606	40	196,613
		75172	2 MSgt E7	29,018		
Other OJT/OPR authorized at the 14th and 4th AFs		75xx	1+1 Major O4	50,484	100**	
		751xx	1+1 CMSgt E9	39,212		
		751xx	1+1 SMSgt E8	33,432		
		751xx	1+1 MSgt E7	29,018		
		751xx	1+1 TSgt E6	25,018		
HQ AFSC	DPAT	7321	1 Major O4	25,242	20	5,048
HQ MAC	DPATJ	75193	1 CMSgt E9	19,606	100	55,966
		75172	1 TSgt E6	12,509		
		75172	1 MSgt E7	14,509		
		75250	1 Sgt E4	9,342		
HQ PACAF	DPATM	75172	1 MSgt E7	14,509	100	14,509
HQ SAC	DPPHTTO	75193	1 SMSgt E8	16,716	100	81,257
		75172	1 MSgt E7	14,509		
		75172	2 TSgt E6	25,018		
Wing I		75172	2 TSgt E6	25,018		
HQ TAC	DPPTO	75172	2 MSgt E7	29,018	100	68,545
		75172	2 TSgt E6	25,018		
		751x2	1 MSgt E7	14,509		
HQ USAFE	DPATJ	75193	1 CMSgt E9	19,606	50	51,954
		75172	1 TSgt E6	12,509		
		75132	1 Sgt E4	9,342		
Other OJT/OPR at the AF		75193	1 SMSgt E8	16,716	100**	
		75172	1 MSgt E7	14,509		
HQ USAFSS	DPAT	75172	1 TSgt E6	12,509	100	12,509
HQ USAFA	DPMPO	751x2	2 SSgt E5	21,292	100	85,837
		751x2	1 TSgt E6	12,509	100	
Base level responsibility with MAJCOM emphasis		702x0	2 MSgt E7	29,018	50**	
		702x0	4 TSgt E6	50,036	50**	
		811x2	1 TSgt E6	12,509	100	
Total Authorization = 138					Total Cost =	1,770,143

*Table 20, Annual Composite Standard Rates (FY 1977 - Effective 1 October 1976), p. A-112, AFR 173-10, Vol. 1 (C5), Attachment 27.
**Estimated by CONSAD; not supplied by respondent.

TABLE 18: ECI Authorized Personnel by Costs - Table VIb

Office	Personnel by Grade	Totals		
		Officers	Airmen	Civilians
Command (CC)	1-O5, 1-O6, 1-GS7	(2)	(0)	(1)
Administrative Control Division (DA)	1-O5, 1-E6, 1-GS4, 1-GS6	1	1	2
Education Information Branch (DAV)	1-O4, 1-E6, 1-GS4, 1-GS5	1	1	2
Printing Control Branch (DAP)	1-O4, 1-GS3, 2-GS5	1	0	3
	Division Subtotal	(3)	(2)	(7)
Curriculum Division (EDC)	1-GS5, 1-GS14	0	0	2
Text Review Branch (EDCT)	15-GS12, 1-GS13	0	0	16
Test Development Branch (EDCI)	1-GS4, 2-GS7, 14-GS12, 1-GS13	0	0	18
Editorial Branch (EDCE)	10-GS6, 1-GS7	0	0	11
Curriculum Control Branch (EDCA)	4-GS3, 2-GS4, 2-GS5, 1-GS7	0	0	9
	Division Subtotal	(0)	(0)	(56)
Operations Division (EDO)	1-O5, 1-GS5	1	0	1
Registrar Branch (EDOR)	5-GS3, 1-GS4, 1-GS9	0	0	7
Student Instruction Branch (EDOI)	9-GS5, 6-GS6, 4-GS7, 1-GS9	0	0	20
Data Branch (EDOD)	1-WG4, 1-WG5, 9-GS3, 1-GS4, 4-GS5, 1-GS7, 1-GS9	0	0	18
	Division Subtotal	(1)	(0)	(46)
Plans and Programs Division (EDX)	1-O4, 1-O5, 1-E7, 2-GS5, 1-GS9, 1-GS12	(2)	(1)	(4)
Evaluation and Research Div (EDV)	4-O3, 1-O4, 1-E6, 1-GS5, 2-GS12	(5)	(1)	(3)
Course Materials Division (DMS)	1-O5, 1-GS5	1	0	1
Materials Control Branch (DMSA)	1-E4, 1-E6, 1-GS3, 3-GS4, 1-GS5, 1-GS9	0	2	6
Storage and Distribution Br (DMSD)	1-E3, 14-WG5, 3-WG6, 3-WG8, 3-WG10, 1-WS4, 1-WS5, 1-WS9, 1-WL6, 1-GS9	0	1	28
	Division Subtotal	(1)	(3)	(35)
ECI Totals		14	7	152

However, in the interest of demonstration expedience, methodological procedures for collecting individual unit overhead staffing data were not employed. Instead, the number of full-time equivalent OJT unit administrators were estimated as a function of the average annual trainee-month load present in each unit.* The resultant unit overhead staffing estimates were then recorded in Table VIc as specified and the completed staffing table is presented in Table 19. Having thus developed the required staffing tables, Steps 13 to 15, Section 4.1, were executed to convert staffing data into equivalent annual costs. These conversions employed personnel cost data contained in Table 9 and resultant staff costs were recorded in their respective data tables as shown in Tables 17 and 19.

- CDC Printing Cost Data. As called for in Step 16, Section 4.1, monthly CDC printing costs are to be summed over the factor estimation period to establish the total annual cost for cost factor development. For demonstration purposes, however, the annual CDC printing cost was derived by extrapolating an average monthly printing cost over a 12-month period. The resultant cost was then recorded for use in later cost factor estimation steps.

- Worldwide Overhead and Support Cost Factors. Employing staff cost and trainee/enrollee load data developed in Steps 8 to 16 and presented in earlier tables, the worldwide enrollee-month and trainee-month cost factors were calculated according to equations and procedures set forth in Step 17, Section 4.1. The developed cost factors were recorded in the format specified for Table VIIa and they are presented in Table 20.

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*Based on a review of unit manning standards, a minimum of 46 trainees (552 trainee-months) was established as a requirement for a full-time unit administrator. Units below this minimum were assigned fractional (part-time) administrators according to the ratio of their training loads to the minimum. Although maintenance unit administrators are consolidated at Bergstrom Air Force Base, they have been kept at the unit level to fully demonstrate the standardized costing procedures.

TABLE 19: Base Level and Unit Level Personnel Costs for Bergstrom Air Force Base - Table VIc

Level	OJT Staff Authorized	Annual Cost of Authorized Staff ($)	Annual Trainee-Months Anticipated	Cost Per Trainee-Month Attributable at Level ($)
Base CBPO	1-E7, 1-E6, 2-E4	45,702	8,604	5.3117
67th FMS	1-E6	12,509	828	15.1075
AMS	1-E6	12,509	720	17.3736
OMS	1-E6	12,509	552	22.6612
Supplies	0.9111-E6	11,397.09	492	23.1648
12th TRS	0.4667-E6	5,837.53	252	23.1648
91st TRS	0.3111-E6	3,891.69	168	23.1648
Transport	0.6667-E6	8,339.33	360	23.1648
HQ Squadron	1-E5	10,646	876	12,1530
CES	0.6444-E6	8,061.35	348	23.1648
SPS	0.5556-E6	6,949.44	300	23.1648
Services	0.3111-E5	3,312.09	168	19.7148
Hospital	0.5333-E6	6,671.47	288	23.1648
602 Tactical TAIRC HQ Squadron	0.4000-E6	5,003.60	216	23.1648
602 TACCS	0.7778-E6	9,729.22	420	23.1648
23rd TASS	0.2444-E6	3,057.75	132	23.1648
602 TAIRCW Det 1	0.1333-E5	1,419.47	72	19.7148
712th DASC	0.4444-E5	4,731.56	240	19.7148
727 TCS	1-E6	12,509	684	18.2880
4502 Camron	1-E6	12,509	840	14.8917
701st TASS	0.0667-E6	833.93	36	19.7148
12th TIS	0.0222-E5	236.58	12	19.7148
12th AF HQ Squadron	0.1556-E5	1,656.04	84	19.7148
Subtotal		200,021.14		
Tenant - Units				
1882nd Comm. Squ. (AFCS)	0.5778-E6	7,227.42	312	23.1648
Det 10 25th Weather Squ. (MAC)	0.0667-E6	833.93	36	23.1648
Det 14 5th Weather Squ. (MAC)	0.2222-E5	2,365.78	120	19.7148
2048 Commun. Squ. (AFCS)	0.0889-E5	946.31	48	19.7148
Total		211,394.58		

TABLE 20: Worldwide OJT Cost Factors - Table VIIa

Amortization Base	Source of Cost	Total Annual Cost ($)	Cost Factor ($)
All CDC enrollee-months Worldwide*	ATC/TTSS	41,621	0.0250 per enrollee-month
	AU/ECI	1,930,178	1.1593 per enrollee-month
	CDC Printing	1,440,000	0.8649 per enrollee-month
	All	3,411,799	2.0492 per enrollee-month
All trainee-months Worldwide**	AF/HQ	12,509	0.0168 per trainee-month
	ATC OJT Advisory Service	1,095,539	1.4719 per trainee-month
	All	1,108,048	1.4887 per trainee-month.
Total		4,519,847	

*Based on an average presence of 138,745 active CDC enrollees or an annual equivalent of 1,664,940 CDC enrollee-months. (See summary statistics from the ECI monthly file by reason from PCN UE 020-49A of July 28, 1977.)

**See Table 13. Estimated total annual trainee-months = 744,300.

- CDC Development and Revision Cost Factors. Utilizing the annual cost and enrollee-month data contained in Table 11, the development and revision cost factors for all CDCs being considered were calculated according to the equation set forth in Step 18, Section 4.1. Resultant cost factors were added to Table IIIa, and are presented with previously developed CDC data in Table 11.

- MAJCOM Overhead Cost Factors. Utilizing overhead staff costs contained in Table 17 and training load data presented in Table 15, the MAJCOM overhead cost factors were developed according to the equation set forth in Step 19, Section 4.1. As required, the developed cost factors were tabularized according to specifications for Table VIIIa, and they are presented in Table 21.

- Base and Unit/Squadron Overhead Cost Factors. Utilizing unit and base overhead staff costs contained in Table 19 and estimated base and unit trainee-month loads,* the overhead cost factors for Bergstrom Air Force Base and its constituent units were calculated according to procedures and equations set forth in Step 20, Section 4.1. Resultant training loads and cost factors were then added to Table VIc as specified and these data are presented along with previously developed staffing data in Table 19.

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*Normally, unit and base training loads would be obtained directly from Table Vb. However, since the demonstration focused on specific career fields, the base and unit totals across all career fields were obtained directly from the Bergstrom CBPO/OJT unit.

TABLE 21: MAJCOM Direct Personnel Overhead Factors - Table VIIIa

MAJCOM/SOA	Annual Direct Personnel Overhead Costs ($)*	Anticipated Annual Trainee-Months in MAJCOM**	MAJCOM Level OJT Cost Per Trainee-Month ($)
AUN	2,502	3,204	0.7809
ATC	20,729***	49,932	0.4151
AAC	12,509	9,636	1.2982
ADCOM	16,716	33,744	0.4954
AFCS	14,509	85,836	0.1690
AFLC	14,509	8,832	1.6428
AFSC	5,048	27,192	0.1856
MAC	55,966	107,760	0.5194
PACAF	14,509	27,480	0.5280
SAC	81,257	177,276	0.4584
TAC	68,545	143,736	0.4769
USAFE	51,945	51,816	1.0025
USAFSS	12,509	16,416	0.7620
USAFA	85,837	1,440	59.6090****

*From Table 17.
**From Table 15.
***Estimated by CONSAD, not an actual cost figure.
****This comparatively large factor for administrative management overhead cost represents all organizational levels at the Air Academy. A comparable figure for other MAJCOMs would include the sums of factors from the base and unit levels.

5.3 Demonstration of Costing Alternatives

As documented in the previous section, the demonstration of data collection and cost factor estimation procedures resulted in the production of a series of standardized "unit cost" tables. The purpose of this section is to further demonstrate how those developed unit costs are employed in the actual cost analysis of a defined OJT program. The procedures employed in this second phase of the demonstration are those outlined in Section 4.2 for the "standardized analysis of OJT costs." Following the analytical sequence set forth in that section, the estimated OJT costs for the demonstration program at Bergstrom Air Force Base were calculated in the various alternative forms and the stepwise results of this demonstration are presented below.

- Definition of Cost Analysis Scope. As called for in Steps 21 and 22, Section 4.1, the scope of the demonstration OJT cost analysis was defined to include all those unit/squadrons at Bergstrom Air Force Base which conducted formal OJT in any of the six career fields listed in Section 5.2. Examination of training load data contained in Table Vb, Table 16, revealed that such a scope would encompass six resident units and one tenant unit at Bergstrom in which training was conducted in four of the six demonstration career fields. For ease of demonstration, the time frame selected for conducting cost analysis of this defined program scope was the 12-month period corresponding to the factor estimation period employed in Steps 1 to 20.

- Assessment of Training Load. Since the time frame selected for the cost analysis demonstration was equivalent to the 12-month factor estimation period used in earlier steps, the trainee- and enrollee-month data developed for that period were used for costing purposes. Should the defined costing period have represented a different time frame, then the reassessment of trainee-month and enrollee-month data, as described in Steps 23 and 24, Section 4.1, would have been required.

- OJT Supervisor/Trainer and OJT Trainer Costs. Employing the trainees per supervisor ratios contained in Table Ia, Table 7, the annual trainee-month load for supervisors in each of the four demonstration* career fields was calculated as specified in Step 25, Section 4.1. For the seven squadrons conducting training in these career fields at Bergstrom, the number of equivalent annual supervisors and trainers needed to support the training loads contained in Table Vb, Table 16, was calculated as described in Step 26, Section 4.1. Utilizing these supervisory personnel requirements and the percent time and grade data contained in Table Ib, Table 8, the equivalent number of supervisor and trainer man-years required was calculated according to procedures referenced in Step 27, Section 4.1. Having thus established the training personnel burdens for each career field and organization, the supervisor and trainer cost factors and total costs were calculated using personnel costs from Table IIa, Table 9, and the equations set forth in Steps 29 and 30, Section 4.1. All calculated personnel requirements, cost factors, and total costs were then recorded in Table IXa as specified in Steps 28 and 30, and the resultant costing table is presented in Table 22.

- Calculation of Organizational OJT Costs - Alternative 1. As a demonstration of this costing alternative, the procedures and equations set forth in Step 31, Section 4.1, were applied to 431x1 career field training conducted in the OMS squadron at Bergstrom. All cost factor and training load data employed in the demonstration were obtained from the earlier tables corresponding to table references given in Step 31. As required, all referenced cost factors, training loads, and calculated costs were recorded in Table Xa according to specifications and the resultant organizational OJT costs are presented in Table 23.

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*As dictated by the definition of scope, the demonstration was focused on the 291x0, 293x3, 431x0, and 431x1 career fields which were present at Bergstrom Air Force Base.

TABLE 22: Annual OJT Supervision Costs for Selected Squadrons and Career Fields at Bergstrom Air Force Base - Table IXa

Unit	AFSC	Trainee-Months Load	Supervisors/Trainers Needed	Supervisors/Trainers Cost Per Trainee-Month ($)	Trainers Needed	Trainer Cost Per Trainee-Month ($)	Combined Supervision Cost Per Trainee-Month ($)	Total Annual Cost ($)
OMS	431x1	552	2-E3, 5-E4, 5-E5, 3-E6, 2-E7	19.1119	2-E3, 4-E4, 4-E5, 2-E6, 1-E7	12.3437	31.4556	17,363.49
602 TACCS	291x0	36	1-E5	41.6191	1-E5	27.1446	68.7637	2,475.49
712th DASC	291x0	12	1-E5	41.6191	1-E5	27.1446	68.7637	825.16
	293x3	24	1-E5	36.9676	1-E5	21.0674	58.0350	1,392.84
727 TCS	291x0	60	1-E4, 1-E5	39.0699	1-E5	27.1447	66.2146	3,972.88
4502 Camron	431x1	228	1-E3, 2-E4, 2-E5, 1-E6, 1-E7	19.0559	1-E3, 2-E4, 2-E5, 1-E6	11.9314	30.9873	7,065.10
	431x0	48	1-E5	11.7452	1-E4	3.5761	15.3213	735.42
701st TASS	431x0	12	1-E5	11.7452	1-E4	3.5761	15.3213	183.86
Tenant Units:								
1882nd CS (AFCS)	291x0	36	1-E5	41.6191	1-E5	27.1446	68.7637	2,475.49
Total		1,008	2-E3, 8-E4, 14-E5, 4-E6, 3-E7		3-E3, 8-E4, 11-E5, 3-E6, 1-E7			36,489.73*

*Average supervision cost per trainee-month = $36.2001; estimated total annual supervision cost at Bergstrom = $311,465.

TABLE 23: Estimated Annual Cost of OJT for a Selected Squadron at Bergstrom Air Force Base (TAC) - Table Xa

Squadron	Career Field	Trainee-Month Cost Factors ($ per trainee-month)	Trainee-Months	Annual Cost of Trainee-Months ($)	CDC Specific Costs for Revision and Development	General CDC Cost Factor = 2.0492		Total Annual OJT Cost at Squadron ($)
						Enrollee-Months	Annual Cost ($)	
OMS	431x1	Supervision: 31.4556 Squadron OJT Admin: 22.6612 Base CBPO: 5.3117 MAJCOM (TAC): 0.4769 Worldwide: 1.4887 Total: 61.3941	552	33,889.54	Upgrade 5: 253 enrollee-months at 0.4965 Upgrade 7: 60 enrollee-months at 0.5* Total Annual Cost = $155.61	313	641.40	34,686.55

*Seven-level CDC Development and Revision costs were not calculated for this demonstration. The value employed was estimated by CONSAD.

Calculation of Career Field OJT Costs - Alternative 2. As a demonstration of this costing alternative, the procedures and equations set forth in Step 32, Section 4.1, were applied to training conducted for each of the four demonstration career fields in all of the unit/squadrons at Bergstrom Air Force Base. Total organizational cost factors employed in this demonstration were developed as shown in Table 23. All other cost factor and training load data were obtained from the earlier tables corresponding to table references given in Step 32. As called for in Step 32, all referenced cost factors, training loads, and calculated costs were tabularized according to specifications for Table XIa, and the resultant career field costs are presented in Table 24. In addition to the total demonstration career field costs presented in Table 24, an estimate of the total 12-month OJT cost for all career fields at Bergstrom was also calculated. This was accomplished by calculating average unit overhead and supervisory cost factors and applying those factors to a 12-month extrapolation of the total OJT training load present in a given month across all career fields at Bergstrom. For a more detailed explanation of this type of cost factor average, refer to Section 4.1, Step 34, or Section 4.3.3.

Calculation of Average OJT Upgrade Costs by Organization - Alternative 3. As a demonstration of this costing alternative, the procedures and equations developed in Step 33, Section 4.1, were applied to 431x1 upgrade training conducted within the OMS squadron at Bergstrom Air Force Base. Average upgrade and CDC completion time data were obtained from Table IVa, Table 12, for the subject career field. Other organizational and CDC cost factors employed in this demonstration were developed as shown in Table 23. The calculated OJT upgrade costs and their component cost factors were recorded in Table XIIa according to the requirements of Step 33, and the resultant cost table is presented in Table 25.

TABLE 24: Annual OJT Costs in Selected Career Fields at Bergstrom Air Force Base - Table XIa

AFSC	Sum of Trainee-Month Costs by Squadron A: Squadron	Squadron Factor*	Trainee-Months	Annual Cost ($)	CDC Costs**	B Annual Cost ($)	Total Annual Cost of Training in AFS A&B ($)
431x1	OMS	61.3941	552	33,889.54	Upgrade 5: 357 enrollee-months at 2.5457		
	4502 Camron	53.1563	228	12,119.64	Upgrade 7: 84 enrollee-months at 2.5492***		
	All		780	46,009.18		1,122.95	47,132.13
431x0	701st TASS	42.3134	12	507.76	Upgrade 5: 24 enrollee-months at 5.7631		
	4502 Camron	37.4903	48	1,799.53	Upgrade 7: 5 enrollee-months at 5.7492***		
	All		60	2,307.29		167.06	2,474.35
293x3	712th DASC	85.0271	24	2,040.65	Upgrade 5: 10 enrollee-months at 2.8713		
	All		24	2,040.65		28.71	2,069.36
291x0	602 TACCS	99.2058	36	3,571.41	Upgrade 3: 11 enrollee-months at 2.6267		
	712th DASC	95.7558	12	1,149.07			
	727 TCS	91.7799	60	5,506.79	Upgrade 5: 63 enrollee-months at 2.3897		
	1882nd CS (AFCS)	98.8813	36	3,559.73			
	All		144	13,787.00		179.44	13,966.44
Total Annual OJT Cost at Bergstrom for these 1008 Trainee-Months							65,642.28
Estimating 8604 total annual trainee-months, one can estimate annual OJT costs at Bergstrom in all career fields as:							560,000

*Each squadron's factor composed of: Supervision, Squadron OJT Administration, Base CBPO, MAJCOM, plus Worldwide.
**Each CDC factor composed of: Revision and Development, ATC/TTSS, AU/ECI, plus CDC Printing.
***CDC Revision and Development costs estimated by CONSAD as cost information was unavailable.

TABLE 25: Average Cost of Training to Upgrade in a Selected Squadron at Bergstrom Air Force Base - Table XIIa

Squadron	AFSC	Upgrade Level	Trainee-Month Cost Factors ($)		Average Trainee-Months to Upgrade	Enrollee-Month Cost Factors ($)		Average Enrollee-Months to Upgrade	Cost to Upgrade ($)
OMS	431x1	3	Supervision	31.4556	2.5	(No CDC)		--	153.49
			OJT Admin.	22.6612					
			Base CBPO	5.3117					
			MAJCOM (TAC)	0.4769					
			Worldwide	1.4887					
			Total	61.3941					
		5	Supervision	31.4556					
			OJT Admin.	22.6612					
			Base CBPO	5.3117					
			MAJCOM (TAC)	0.4769		R&D	0.4965		
			Worldwide	1.4887		All CDCs	2.0492		
			Total	61.3941	8.3	Total	2.5457	5.5	523.57
		7	Supervision	31.4556					
			OJT Admin.	22.6612					
			Base CBPO	5.3117					
			MAJCOM (TAC)	0.4769		R&D	0.5*		
			Worldwide	1.4887		All CDCs	2.0492		
			Total	61.3941	10.6	Total	2.5492	5.0	663.52

*Seven-level CDC Development and Revision costs were not calculated for this demonstration. The value employed was estimated by CONSAD.

Calculation of OJT Costs Using the Average Cost Factor Method - Alternative 4. As a demonstration of this costing alternative, the procedures and equations developed in Step 34 were applied to upgrade training conducted for each of the four demonstration career fields in all of the unit/squadrons at Bergstrom Air Force Base. This particular application was designed to demonstrate how cost factors can be averaged to facilitate the direct calculation of total career field, total organizational or average upgrade costs at higher organizational levels. Focusing on the direct calculation of average career field upgrade costs at the base level, this demonstration employed the same basic cost factor and upgrade time data referenced in Alternative 3 to calculate average organizational cost factors and then average base level upgrade costs for each demonstration career field. The results of these calculations were recorded according to the specifications for Table XIIIa, and they are presented in Table 26.

Calculation of OJT Costs Including the Cost of Trainee Time - Alternative 5. The demonstration of this costing alternative was a two-step process involving first the development of trainee time cost factors as outlined in Step 35, Section 4.1, and second, the inclusion of these cost factors in the estimation of program costs by the various alternative methods presented earlier. Since the overall demonstration dealt with TAC and AFCS units at Bergstrom Air Force Base, the development of trainee time cost factors employed estimates of the percent trainee work time for upgrade training in these MAJCOMs. Specifically, the value of PNTT required in Step 35 was estimated for TAC and AFCS using the results of the MAJCOM OJT/NCOIC Survey contained in Table E4, Appendix E. In addition to these percent trainee time estimates, the development of trainee time cost factors also requires a measurement of trainee-month loads stratified by grade. Normally, this stratification would be available from training load tables developed from the UAR as described in Section 3.6. However, since these procedures have not yet been implemented, trainee-month loads were stratified by grade through the use of grade

TABLE 26: Average Cost of OJT to Upgrade by AFSC at Bergstrom Air Force Base - Table XIIIa

AFSC	Upgrade Level	Base-Wide Average Cost Factor*				Average Factor	Average Trainee-Months to Upgrade	CDC Cost Factor**	Average Enrollee-Months to Upgrade	Cost to Upgrade ($)
		Squadron	Squadron Factor	Trainee-Months	Cost in Squadron ($)					
291x0	All	602 TACCS	99.2058	36	3,571.4088					
		712th DASC	95.7558	12	1,149.0696					
		727 TCS	91.7799	60	5,506.7940					
		1882nd CS	98.8813	36	3,559.7268					
		All		144	13,786.9984	95.7430				
	3					95.7430	5.7	2.6267	5.0	558.87
	5					95.7430	7.9	2.3897	5.0	768.32
	7					95.7430	10.9	--	--	1,043.60
293x3	All	712th DASC	85.0271	24	2,040.6504	85.0271				
	3					85.0271	4.0	--	--	340.11
	5					85.0271	7.0	2.8713	4.0	606.67
	7					85.0271	10.3	--	--	875.78
431x0	All	4502 Camron	37.4903	48	1,799.5344					
		701st TASS	42.3134	12	507.7608					
		All		60	2,307.2952	38.4549				
	3					38.4549	2.4	--	--	92.29
	5					38.4549	7.9	5.7631	4.5	329.73
	7					38.4549	10.0	5.8000***	4.0	407.75
431x1	All	OMS	61.3941	552	33,889.543					
		4502 Camron	53.1563	228	12,119.636					
		All		780	46,009.179	58.9861				
	3					58.9861	2.5	--	--	147.47
	5					58.9861	8.3	2.5457	5.5	503.59
	7					58.9861	10.6	2.5000***	5.0	637.75

*Each squadron's cost factor is composed of: Supervision, Squadron OJT Administration, Base CBPO, MAJCOM, plus Worldwide.
**Each indicated CDC cost factor is composed of: Revision and Development, ATC/TTSS, AU/ECI, plus CDC Printing.
***Seven-level CDC Development and Revision costs were not calculated for this demonstration. The value employed was estimated by CONSAD.

and skill level guides presented in the USAF Personnel Plan. Employing these guides in conjunction with MAJCOM trainee-month loads and personnel costs from Table 9, the procedures and equations set forth in Step 35, Section 4.1, were executed to produce trainee time cost factors for TAC and AFCS. The results of these calculations were recorded in Table XIVa as specified, and they are presented in Table 27.

The second step of this trainee time costing demonstration was carried out by adding the developed trainee time cost factors to other trainee-month cost factors employed in the demonstrations of Alternatives 1 to 4. Utilizing the modified equation structures presented in Step 36, Section 4.1, revised program costs were calculated for each of these alternatives and the results summarized in Table 28. In conducting this demonstration, it was considered sufficient to address only one or two career fields to exhibit the impact of trainee time costs in each alternative. Table 28 therefore represents a narrowing of scope relative to the previous demonstration.

In summary, the sequence of calculations and costing tables presented above comprises a realistic demonstration of the standardized approach to OJT cost analysis. Although several alternative forms of this approach were demonstrated, they all employ the same basic analytical sequence of:

- Developing and estimating per trainee- or enrollee-month cost factors on a career field and/or organizational basis.
- Assessing the career field and organizational training loads to be costed according to the defined cost analysis scope.
- Summing cost factors which apply to training loads at the various organizational levels.
- Applying the summed cost factors to the corresponding training loads within each organization.

TABLE 27: Trainee Time Costs Estimated by Upgrade Level on a MAJCOM-Wide Basis for TAC and AFCS - Table XIVa

MAJCOM	Trainee-Months by Grade: Upgrade Level	Grade	Trainee-Months*	Portion of Trainees' Time for O/T**	Training Load in Trainee-Years	Annual Cost of Training Load ($)***	Average Trainee Time Cost Per Trainee-Month ($)
TAC	3	E2	5,748		119.75	837,771	145.7500
		E3	5,748		119.75	905,669	157.5625
		E2 & E3	11,496	0.25	239.50	1,743,440	151.6562
	5	E4	55,726		1,160.96	10,845,688	194.6253
		E5	49,418		1,029.54	10,960,483	221.7913
		E4 & E5	105,144	0.25	2,190.50	21,806,171	207.3934
	7	E6	17,612		366.93	4,589,865	260.6101
		E7	9,484		197.58	2,866,688	302.2657
		E6 & E7	27,096	0.25	564.51	7,456,553	275.1902
	All	All	143,736	0.25	2,994.5	31,006,164	215.7161
AFCS	3	E2	1,206		22.61	158,180	131.1609
		E3	1,206		22.61	170,999	141.7902
		E2 & E3	2,412	0.225	45.22	329,179	136.4755
	5	E4	9,534		178.76	1,669,999	175.1625
		E5	8,454		158.51	1,687,524	199.6125
		E4 & E5	17,988	0.225	337.27	3,357,523	186.6535
	7	E6	4,415		82.78	1,035,511	234.5438
		E7	2,377		44.57	646,648	272.0438
		E6 & E7	6,792	0.225	127.35	1,682,159	247.6677
	All		27,192	0.225	509.84	5,368,861	197.4427

*Trainee-months distributed over Grades E2 through E7 according to the following proportions:

Grade	Skill Level 7	5	3
E7	35%		
E6	65%		
E5		47%	
E4		53%	
E3			50%
E2			50%

Proportions of trainees in Grades E4 through E7 are so defined in The USAF Personnel Plan, p. A-6. CONSAD estimates, for demonstration purposes only, a 50-50 split in trainees of Grades E2 and E3.

**See Exhibit E4, Appendix E, of this report.

***The standard rates employed herein can be found in Table 9.

TABLE 28: Alternative 5 - Selected OJT Costings Which Include Trainee Time Costs

Training Aggregate for Which OJT Costs are Assessed	MAJCOM	Base	AFSC	Squadron	Upgrade Level	Trainee-Months	Trainee Time Cost Factor ($)	Trainee Time Costs ($)	Other OJT Costs ($)	OJT Costs Including Trainee Time Costs ($)
Annual OJT costs in a squadron - Alternative 1	TAC	Bergstrom	431x1	OMS	3	43	151.6562	6,521.22	2,639.95	9,161
					5	383	207.3934	79,431.67	24,158.00	103,590
					7	127	275.1902	34,949.16	7,950.00	42,899
					All	553		120,902	34,748	155,650
Annual OJT costs by career fields at an AF base - Alternative 2	TAC	Bergstrom	431x1	All	3	61	151.6562	9,251.03	3,596.76	12,848
					5	541	207.3934	112,003.23	32,821.45	144,825
					7	179	275.1902	49,259.05	10,775.31	60,034
					All	781		170,513	47,194	217,707
			291x0*	All	3	12	151.6562*	1,774.33	1,177.86	2,952
					5	100	207.3934*	20,220.84	9,723.53	29,944
					7	33	275.1902*	8,861.10	3,156.88	12,018
					All	145		30,856	14,058	44,914
Cost of OJT to upgrade in a given squadron and career field - Alternative 3	TAC	Bergstrom	291x0	712th DASC	3	5.7	151.6562	864.44	558.94	1,423
					5	7.9	207.3934	1,638.41	768.42	2,407
					7	10.9	275.1902	2,999.57	1,043.74	4,043
	AFCS	Bergstrom	291x0	1882nd CS	3	5.7	136.4755	777.91	576.75	1,355
					5	7.9	186.6535	1,474.56	793.11	2,268
					7	10.9	247.6677	2,699.58	1,077.81	3,777
Cost of OJT to upgrade in a career field at an AF base - Alternative 4	TAC	Bergstrom	291x0	All	3	5.7	151.6562	864.44	558.87	1,423
					5	7.9	207.3934	1,638.41	768.32	2,407
					7	10.9	275.1902	2,999.57	1,043.60	4,043
	TAC	Bergstrom	293x3	All	3	4.0	151.6562	606.62	340.11	947
					5	7.0	207.3934	1,451.75	606.67	2,058
					7	10.9	275.1902	2,834.46	875.78	3,710

*Included in the 291x0 career field at Bergstrom AFB are 36 trainee-months estimated for the 1882nd CS, a tenant unit formally belonging to AFCS. In summing the costs of training over the squadrons doing training in 291x0, the appropriate MAJCOM dependent factors were employed for both MAJCOM level direct personnel overhead and for the trainee time cost factor.

To further demonstrate this analytical sequence, the stepwise process of calculating average career field upgrade costs within selected squadrons at Bergstrom Air Force Base is presented in Table 29. This summary costing table employs all overhead, support, and CDC cost factors but does not include the cost of trainee time.

As indicated above, the emphasis for this and previous costing examples has been on the standardized approach and its alternative forms. The user-customized approach described in Section 4.3 involves, for the most part, straightforward data substitution and cost factor modification options which employ the same procedures and equations demonstrated herein. Additional demonstrations of these customizing procedures would have, therefore, been procedurally redundant and as such were not conducted. It is recommended, however, that users review the options contained in Section 4.3 relative to the demonstration results, so that they might better assess the analytical requirements for implementing the customized approach.

5.4 Review of Cost Factor Accuracy

The emphasis throughout the methodology has been to use well-substantiated bases for cost factor values whenever possible. In most cases, the overhead cost factors have been based on actual counts of OJT support personnel and records of time spent on OJT-related activities. The assessment of OJT supervisor/trainer and OJT trainer time has been carefully designed to be as objective as possible without the use of actual time and motion studies. Nevertheless, several characteristics of the various cost factors should be examined to assess their accuracy impacts on training cost estimates.

From the demonstration costings, it can be seen that cost factor magnitudes vary from about $200 per trainee-month for the value of trainee time to less than $1 per trainee-month for the value of MAJCOM OJT overhead. Typically, the three factors most influencing OJT cost are trainee time cost (if considered), supervision time cost, and squadron OJT administration cost. Accordingly, the accuracy of these three factors most influences the accuracy of OJT cost estimates.

TABLE 29: Cost of OJT to Upgrade for Selected Squadrons and Career Fields at Bergstrom Air Force Base

AFSC	Squadron	Upgrade Level	Factors for Trainee-Months: Supervision	Squadron OJT Administration	Base CDPO	MAJCOM	Worldwide	Total	Trainee Months to Upgrade	Cost of Trainee-Months ($) A	Factors for Enrollee-Months: Revision and Development	Worldwide	Total	Enrollee Months to Upgrade	Cost of Enrollee Months ($) B	Total Cost of Training to Upgrade A & B ($)
291x0	602 TACCS	3	68.7637	23.1648	5.3117	0.4769	1.4887	99.2058	5.7	565.47	0.5775	2.0492	2.6267	5.0	13.13	578.60
		5	68.7637	23.1648	5.3117	0.4769	1.4887	99.2058	7.9	783.73	0.3405	2.0492	2.3897	5.0	11.95	795.68
		7	68.7637	23.1648	5.3117	0.4769	1.4887	99.2058	10.9	1081.34	--	--	--	--	--	1081.34
	712th DASC	3	68.7637	19.7148	5.3117	0.4769	1.4887	95.7558	5.7	545.81	0.5775	2.0492	2.6267	5.0	13.13	558.94
		5	68.7637	19.7148	5.3117	0.4769	1.4887	95.7558	7.9	756.47	0.3405	2.0492	2.3897	5.0	11.95	768.42
		7	68.7637	19.7148	5.3117	0.4769	1.4887	95.7558	10.9	1043.74	--	--	--	--	--	1043.74
	727 TCS	3	66.2146	18.2880	5.3117	0.4769	1.4887	91.7799	5.7	523.15	0.5775	2.0492	2.6267	5.0	13.13	536.28
		5	66.2146	18.2880	5.3117	0.4769	1.4887	91.7799	7.9	725.06	0.3405	2.0492	2.3897	5.0	11.95	737.01
		7	66.2146	18.2880	5.3117	0.4769	1.4887	91.7799	10.9	1000.40	--	--	--	--	--	1000.40
	1802nd CS (AFCS)	3	68.7637	23.1648	5.3117	0.1690	1.4887	98.8813	5.7	563.62	0.5775	2.0492	2.6267	5.0	13.13	576.75
		5	68.7637	23.1648	5.3117	0.1690	1.4887	98.8813	7.9	781.16	0.3405	2.0492	2.3897	5.0	11.95	793.11
		7	68.7637	23.1648	5.3117	0.1690	1.4887	98.8813	10.9	1077.81	--	--	--	--	--	1077.81
291x3	712th DASC	3	58.0350	19.7148	5.3117	0.4769	1.4887	85.0271	4.0	340.11	--	--	--	--	--	340.11
		5	58.0350	19.7148	5.3117	0.4769	1.4887	85.0271	7.0	595.19	0.8221	2.0492	2.8713	4.0	11.49	606.67
		7	58.0350	19.7148	5.3117	0.4769	1.4887	85.0271	10.3	875.78	--	--	--	--	--	875.78
431x0	701st TASS	3	15.3213	19.7148	5.3117	0.4769	1.4887	42.3134	2.4	101.55	--	--	--	--	--	101.55
		5	15.3213	19.7148	5.3117	0.4769	1.4887	42.3134	7.9	334.28	3.7139	2.0492	5.7631	4.5	25.93	360.21
		7	15.3213	19.7148	5.3117	0.4769	1.4887	42.3134	10.0	423.13	3.7000*	2.0492	5.7492	4.0	23.00	446.13
	4502 Camron	3	15.3213	14.8917	5.3117	0.4769	1.4887	37.4903	2.4	89.98	--	--	--	--	--	89.98
		5	15.3213	14.8917	5.3117	0.4769	1.4887	37.4903	7.9	296.17	3.7139	2.0492	5.7631	4.5	25.93	322.10
		7	15.3213	14.8917	5.3117	0.4769	1.4887	37.4903	10.0	374.90	3.7000*	2.0492	5.7492	4.0	23.00	397.90
431x1	4502 Camron	3	30.9873	14.8917	5.3117	0.4769	1.4887	53.1563	2.5	132.89	--	--	--	--	--	132.89
		5	30.9873	14.8917	5.3117	0.4769	1.4887	53.1563	8.3	441.20	0.4965	2.0492	2.5457	5.5	14.00	455.20
		7	30.9873	14.8917	5.3117	0.4769	1.4887	53.1563	10.6	563.46	0.5000*	2.0492	2.5492	5.0	12.75	576.20
	OMS	3	31.4556	22.6612	5.3117	0.4769	1.4887	61.3941	2.5	153.49	--	--	--	--	--	153.49
		5	31.4556	22.6612	5.3117	0.4769	1.4887	61.3941	8.3	509.57	0.4965	2.0492	2.5457	5.5	14.00	523.57
		7	31.4556	22.6612	5.3117	0.4769	1.4887	61.3941	10.6	650.78	0.5000*	2.0492	2.5492	5.0	12.75	663.53

*Seven-level CDC Development and Revision costs were not calculated for this demonstration. The value employed was estimated by CONSAD.

The values chosen for trainee time cost factors for use in the demonstration costings are reasonable, and after further refinements, trainee time cost estimates are expected to be very reliable. Possibly the simplest valuable refinement could be made by supplementing the task inventory used for the Occupational Survey Data Base with items representing trainee activities. Subsequent CODAP analyses of the data so collected could yield mean values of OJT-related trainee time by grade, skill level, organization, and AFSC, while also generating the associated supervision time factors. In so doing, both trainee time and supervision time factors would be objectively established. Furthermore, their derivations would be consistent with those of other indicators produced by analyses of the Occupational Survey Data Base. As a byproduct of these similarities, accuracy assessments of CODAP results would also apply to trainee and supervision time factors, the two factors whose accuracy most determines the accuracy of OJT cost estimates.

Unit OJT administration cost can also be established with reasonable accuracy. Since the OJT administration workload in any unit varies with the number of trainees in the unit, it would be appropriate to establish unit OJT administration costs by unit. An examination of trainee distribution among units may suggest similar unit OJT administration requirements in units of the same function, allowing the development of an average unit OJT administration cost factor. A moderate level of accuracy in the estimation of this factor would be sufficient to substantiate base level OJT costings and higher aggregations.

The remaining overhead and support cost factors constitute less than 10 percent of the cost of OJT. Most of these factors have been derived using actual counts of the manpower involved. Reliability of the associated cost estimates should be very good.

The foregoing factor sensitivity considerations have been summarized in Table 30. Factor accuracy and impact on final estimates have been qualitatively described. The estimates of relative factor magnitude reflect the current status of cost factors. Refinement of the three major cost factors can be expected to eventually yield very accurate estimates.

TABLE 30: Summary of Error Potentials for Costing Data and Cost Factors

Variable	Accuracy	Typical Magnitude of Resultant Factor ($)	Critical Characteristics of Variable
Trainee Time (TRCF) Step 35, Section 4.1	Low	200	-User-supplied estimates can be used to raise accuracy by replacing current subjective estimate. At base level, could reduce error impact to medium. -MAJCOM-wide estimate subject to significant base or unit level variation. Should be recalibrated for such applications.
Supervisor Time (SCF) Step 30, Section 4.1	MAJCOM & Worldwide: Medium Base and Squadron: Low	50	-Needs to be calibrated for level of application. User-supplied data can be used to set standards at MAJCOM level and above. -Deviations large relative to Career Field mean. Less reliable for unit level costing
Trainees Per Supervisor (R) Step 25, Section 4.1	Medium	--	-Can be based on actual counts of trainees and supervisors. -High supervisor-to-supervisor variation indicates consideration of customization for squadron level applications.
Distribution of Supervisors by Grade (P) Step 27, Section 4.1	High	--	-Analysis of Occupational Survey. Data gives good Career Field estimates for application at MAJCOM and Worldwide levels. -Squadron and base level costing can employ actual counts.
Proportion Squadron OJT Administrator's Time (UOCF) Step 20, Section 4.1	Medium	20	-User-supplied data can be used to better establish MAJCOM and Worldwide standards.
Grade of Squadron OJT Administrator Step 20, Section 4.1	High	--	-Defined records for squadron and base level costings. Summation appropriate for MAJCOM and Worldwide costings.
Base CBPO OJT Overhead (BOCF) Step 20, Section 4.1	High	5	-Defined records. Management engineering standards already exist.
CDC Enrollment (EMCB) Step 22, Section 4.2	High	3	-Direct counts of ACTIVE enrollment.
ATU/TTSS	High	--	-Direct count of personnel.
AU/ECI	High	--	-Direct count of personnel. Official time estimate
CDC/Printing	High	--	-Documented accounting.
Revision and Development (DRCF) Step 18, Section 4.1	High	--	-Documented accounting.
Worldwide OJT Overhead (WTM) Step 17, Section 4.1	High	1.5	-Documented personnel counts.
MAJCOM OJT Overhead (MOCF) Step 19, Section 4.1	Medium	0.75	-Personnel counts by interview. -Subjective time involvement estimate.
Summation of All Variables	--	280	
Summation of All Variables Other Than Trainee Time	--	80	

One further consideration remains concerning the organizational level at which cost estimates are used. As shown in the analysis of OJT supervision as identified by the Occupational Survey Data Base, OJT commitments vary widely among supervisors. Similarly, trainee productivity and unit OJT administration requirements can be expected to vary significantly. As long as OJT costs are being assessed for training aggregations at the base level or higher or by AFSC, the individual variations can be expected to net out. Whenever OJT training costs are identified for a smaller aggregation, typically a unit or squadron, the interpretation requires more care. The statistical nature of the standardized cost factors precludes direct interpretation when the application base is not sufficiently large. In most cases, if interpretation of costs is desired at the unit level, an accurate value can still be derived using a user-customized costing option. By using exact counts of actual supervisors/trainers and trainers by grade and AFSC, an accurate unit-specific OJT supervision cost can be established. By treating trainee time and unit OJT administration costs similarly, a reliable estimate of overall training cost can be derived for the unit level, as well as for higher training aggregates.

In summary, the power of the OJT costing methodology lies in its straightforward reliance on actual personnel counts and reliable existing data bases. The use of appropriate cost factors, user-customized as needed, can be expected to yield accurate cost estimates.

6.0 CONCLUSIONS, RESULTS, AND RECOMMENDATIONS

6.1 Functionality of Costing Structures

As the demonstration costings have shown, costings can be made in a variety of formats and for various training volumes. This flexibility is primarily a result of the additive nature of the cost factors since additive quantities can be combined in numerous ways. The meaning of each cost factor has been kept clear by associating cost factors with the existing Air Force structural hierarchy. By specifying cost factors by AFSC, unit, base, and MAJCOM, as well as systemwide, variation within the OJT system is identified and accounted for.

6.2 Variability of Costs

It was found that significant variation exists in the variable cost factors. Of most importance, it appears that OJT supervision costs per trainee-month can vary by as much as a factor of five among career fields. When cost per trainee-month variations were combined with variations in the length of time to upgrade, the estimated costs of training to upgrade in four career fields varied between $100 and $1,000, exclusive of the value of trainee time. Very briefly, then, the use of variable cost factors appears to be justified since potential variation of actual costs seems to be quite large.

6.3 Reliability

Several features of the OJT costing methodology help insure reliability of the results. By periodically reestimating cost factors, up-to-date values can be maintained. Furthermore, the options for user customization provide for the inclusion of more accurate cost information whenever available. Since only the direct costs of OJT have been included, there is little possibility of double-counting or other inflations of cost estimates. Those cost estimates which have been used have been based, to the extent possible, on existing data whose reliability has already been established or on actual accounting

of OJT-related personnel and material costs. Eventual refinements in the accuracy of the three most costly factors -- supervision time, trainee time, and unit OJT administration -- can be expected to yield very reliable cost estimates.

It should be kept in mind, however, that reliability does vary with the volume of training that is being costed. Each of the cost factors represents a meaningful average for the training load upon which it is based, but because of differences in the actual requirements of different trainees and different units, cost estimates of small training aggregates require careful interpretation. The supervision cost factor is an accurate average for OJT supervisors/trainers and OJT trainers in a whole career field but is likely to be a little off the mark in a particular unit. However, by combining cost estimates in several units to produce a basewide estimate, the variations among units tend to net out, yielding a more accurate estimate when interpreted at the base level. Similarly, costings of larger aggregates, all trainees in a career field, a MAJCOM, or the whole Air Force, become progressively more accurate as the costings are interpreted at training aggregate levels which include the whole training load base upon which factors were estimated in the first place.

6.4 General Recommendations

- Periodic reestimation of factors will be required to insure cost accuracy.
- The costing methodology is best employed when cost estimates are interpreted only for sizable training aggregations. Costings that will be interpreted at the unit level should employ actual data concerning unit manpower requirements for OJT in a user-customized costing.

6.5 Recommendations for Refinement of Methodology

- Data collected in Occupational Surveys should:
  - Include identification by personnel as to whether they are an OJT trainee, an OJT trainer, or an OJT supervisor/trainer.
  - Include task items reflecting time spent on non-specialty-related activities by trainees so that trainee time can be accurately assessed.
- Analysis of larger samples of the Occupational Survey Data Base.
- Supervision requirements in career fields should continue to be searched for possible homogeneity so that the number of different cost factor values can be kept to a minimum.
- Equipment and facility utilization accounting should be initiated to track these material support costs of OJT.
- Study of unit OJT administration requirements should be made in order to firmly establish procedures for accurately assessing the value of this cost factor.
- Results of the costing methodology should be verified independently in a few cases to substantiate cost estimates:
  - Time and motion studies of training in typical units to provide supervision and trainee time estimates for comparison.

Initiate average time to upgrade accounting including accounting of average CDC enrollment months per upgrade where applicable.

6.6 Recommendations for Future Study

Establishment of an OJT costing center and preparation of a formalized OJT costing program for systematic Air Force application on a regular basis.

Examination of the relationship between OJT costs and the capacity to conduct OJT.

APPENDIX A: Description of Occupational Survey Data Base

Occupational Surveys, conducted by the Air Force Occupational Measurement Center, provide task performance data for approximately 67 percent of all Air Force specialties. As specialties gradually change with the introduction of new technologies and new policies, task inventories are kept up to date by occasional resurvey of the airmen. A schedule of such resurveys can be found in Section VIII of PTT 78-1, October 1976, which lists the date of the last survey and projects forthcoming resurveys for each of 196 specialties. Of these 196 specialties, 22 were scheduled to be surveyed for the first time as of October 1976. Of the remaining, 174 specialties had all been surveyed within the last 9 years and the majority of these had been surveyed within the last 4 years. A mean survey age of 3.05 years* was calculated on the basis of an average age of 4.5 months for those surveys completed in 1976 before October.

Since resurvey schedules take into account the rapidity of change in Air Force specialties, the data are kept up to date in all career fields. Career fields which undergo little change need be surveyed only occasionally, while those which change more quickly must be surveyed more frequently. The procedure outlined in this report therefore draws upon the most current available descriptions for Air Force specialties.

For the six Air Force specialties considered herein, PTT 78-1 of June 1977 indicates the following dates of last survey:

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*This estimate of average age for the Occupational Survey data is supported by an independent estimate of 5.9 years mean survey lifetime. The mean lifetime was estimated by noting the time between the last survey publication date and the anticipated resurvey completion date for those specialties having firm anticipated resurvey completion dates.

AFS	Last Survey	Expected Resurvey Completion
291x0	February 1977	Not yet scheduled
293x3	July 1975	Not yet scheduled
316x1L	August 1973	Indefinite
326x1	March 1973	Indefinite
431x0	December 1973	October 1977
431x1	May 1977	Not yet scheduled

APPENDIX B: OJT Supervisor/Trainer and OJT Trainer Task Subsets for Selected Career Fields

This appendix contains Occupational Survey task lists for 15 sample career fields which describe an OJT supervisor/trainer and/or OJT trainer for each of those career fields. These task lists were developed according to procedures outlined in Section 3.1 of this report. The following information pertains to those task lists:

As indicated in Note A on each list, the entire set of tasks indicated describe the responsibilities and activities of an OJT supervisor/trainer for the subject career field.

As indicated in Note B on each list, the set of tasks also describe the responsibilities and activities of an OJT trainer for the subject career field subject to the respondents not indicating performance of a specified subset of tasks in the task list.

Note C indicates that subset of tasks and/or background variables which are to be used to define the population for which OJT supervisor/trainer and OJT trainer statistics are to be analyzed.

AFSC-291X0 Career Field - Telecommunications Operations

Task No.	Description
31	Counsel personnel on career development or job progression
41	Draft job descriptions
69	Evaluate individuals for promotion, demotion or reclassification
82	Administer written, oral or performance tests
83	Arrange for training aids, space or equipment
84	Attend training conferences or briefings
87	Conduct on-the-job training for communications personnel
88	Conduct supervisory orientations
89	Conduct training conferences or briefings
90	Demonstrate how to locate or interpret technical information
91	Demonstrate methods and techniques of operating communications equipment
92	Develop on-the-job training materials
95	Evaluate on-the-job training programs
98	Explain policies or directives to personnel
99	Maintain training records
100	Review training progress of individuals
101	Schedule on-the-job training
104	Select or assign instructors

A. The above tasks define an OJT supervisor for the AFSC 291x0 career field.

B. The above taks define an OJT trainer for the AFSC 291x0 career field with the caveat that the defined trainer population does not perform the following task: 88.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 87, 92, and 101.

AFSC-304X4 Career Field - Aircraft Control and Warning Radar Repair

Task No.	Description
4	Determine training needs
14	Plan on-the-job training programs
44	Prepare job descriptions
67	Evaluate Career Development Courses (CDC)
77	Evaluate training programs
81	Administer or score tests
82	Assign trainers or instructors
83	Brief personnel on changes in methods or procedures
85	Demonstrate operation of equipment or test instruments
86	Determine proficiency of trainees prior to upgrading
87	Develop or construct tests
88	Maintain instructor records
89	Maintain training records
92	Plan or prepare training aids
94	Prepare job proficiency guides
96	Prepare training reports
97	Prepare training literature or aids
98	Serve as OJT Trainer
100	Write job proficiency guides

A. The above tasks describe OJT supervisor for the AFSC 303x2 career field.

B. The above tasks also describe an OJT trainer for the AFSC 303x2 career field provided respondents do not indicate performance of the following tasks: 82 and 88.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondents in the OJT supervisor and/or trainer populations: 82, 94, 98, 100.

AFSC-304X4 Career Field - Ground Radio Communications Equipment Repair

Task No.	Description
11	Plan or schedule on-the-job training programs
26	Update job descriptions of military personnel
34	Conduct supervisory orientations or briefings
49	Direct training or training support functions
51	Implement or follow up OJT programs
88	Administer oral or written tests
89	Administer skill performance tests
91	Arrange for special training of individuals
92	Arrange for training aids or materials
93	Assign OJT trainers
94	Assign specific training tasks to individuals
96	Conduct OJT for AFSC-304X4 personnel
97	Conduct OJT for civilians working in AFSC-304X4 specialty areas
98	Conduct OJT for personnel working in specialty areas other than AFSC-304X4
101	Conduct special equipment training
102	Construct training aids
103	Counsel trainers or trainees
104	Determine individual training needs
105	Develop or update Career Development Course (CDC) materials
107	Develop or update OJT materials
108	Distribute or control CDC materials
109	Evaluate training progress of individuals
110	Monitor self-paced training programs
121	Maintain individual Consolidated Training Record Forms (AF 623)

A. The above tasks describe an OJT supervisor for the AFSC 304x4 career field.

B. The above tasks also describe an OJT trainer for the AFSC 304x4 career field provided respondents do not indicate performance of the following tasks: 34, 93.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer population: 11, 93, 96, 97, 98, 108, 121.

AFSC-316X1L Career Field - Missile Systems Maintenance

Task No.	Description
24	Conduct supervisory orientations
25	Counsel subordinates
34	Prepare recommendations for changes to job descriptions
62	Write recommendations for personnel actions
63	Administer oral, written or performance tests
64	Arrange for training aids, space or equipment
65	Assign instructors or trainers
66	Check operation of training equipment
68	Conduct on-the-job training
69	Conduct proficiency training programs
72	Demonstrate new maintenance procedures or equipment
73	Develop proficiency tests
74	Evaluate instructor performance
76	Evaluate specialty training standards
77	Evaluate student progress or performance
78	Evaluate training programs
80	Maintain training records
82	Prepare oral, written or performance tests
84	Prepare training materials
85	Review training progress of individuals
87	Schedule in-service training programs
88	Schedule or monitor upgrade training

A. The above tasks describe an OJT supervisor for the AFSC 316x1L career field.

B. The above tasks also describe an OJT trainer for the AFSC 316x1L career field provided the respondents do not indicate performance of the following tasks: 24, 65, 74.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 65, 68, 69, 88.

AFSC-293X3 Career Field - Radio Operator

Task No.	Description
23	Counsel subordinates on career progression
34	Draft job descriptions
44	Prepare job proficiency standards
66	Evaluate individuals for promotion, demotion or reclassification
79	Administer written, oral or performance tests
80	Arrange for training aids, space or equipment
81	Attend training conferences or briefings
83	Conduct job proficiency training
84	Conduct on-the-job training for radio operators
86	Conduct training conferences or briefings
87	Demonstrate how to locate or interpret technical information
88	Develop OJT materials
90	Develop written, oral or performance tests
92	Evaluate training programs other than resident course training
93	Indoctrinate newly assigned personnel
94	Integrate policies and directives for subordinates
95	Maintain or review training records
97	Review training progress of individuals
98	Schedule OJT
100	Select or assign instructors or trainers

A. The above tasks define an OJT supervisor for the AFSC 293x3 career field.

B. The above tasks also define an OJT trainer for the AFSC 293x3 career field provided the respondents do not indicate performance of the following task: 100.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondents in the OJT supervisor and/or trainer populations: 83, 84, 88, 98, 100.

AFSC-316X0F Career Field - Missile Systems Analyst

Task No.	Description
5	Determine unit training requirements
25	Conduct supervisory evaluations
27	Counsel subordinates on job progress or career development
31	Draft changes to job descriptions
40	Orient newly assigned personnel
53	Evaluate missile crew training
76	Administer oral, written or performance tests
77	Arrange for training aids, space or equipment
78	Assign instructors and trainees
79	Conduct crew or maintenance training
82	Conduct or attend collateral training
83	Conduct or attend conferences
85	Conduct upgrade or on-the-job training
86	Develop proficiency tests
88	Evaluate specialty training standards (STS)
89	Explain policies and directives
90	Instruct technical order procedures
91	Maintain training records
93	Prepare changes to job proficiency guides (JPG)
94	Prepare oral, written or performance tests
96	Prepare training materials
97	Product auto ted recurring training records
98	Review trai progress of individuals
99	Review tra g status of the section
100	Schedule or monitor upgrade training
102	Verify crew qualifications
103	Verify maintenance qualifications
112	Maintain crew or maintenance training records

A. The above tasks describe an OJT supervisor for the AFSC 316x0F career field.

B. The above tasks also describe an OJT trainer for the AFSC 316x0F career field provided respondents do not indicate performance of the following tasks: 25, 78.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondents in the OJT supervisor and/or trainer populations: 85, 93, 100.

AFSC-326X1A/B Career Field - Integrated Avionics
(pending C, D, E)

Task No.	Description
6	Draft job descriptions
23	Conduct supervisory orientation of newly assigned personnel
24	Convert specialty training standards to job proficiency guides
25	Counsel subordinates on career progression or job performance
33	Interpret policies and procedures for subordinate personnel
39	Select instructors or trainers
45	Evaluate effectiveness of training programs
48	Evaluate individual for promotion or reclassification
54	Evaluate proficiency of section personnel
57	Evaluate specialty training standards
60	Attend training conferences or meetings
61	Brief supervisors on training progress of personnel
63	Conduct preoperational training for newly assigned personnel
64	Conduct remedial instruction
65	Conduct training conferences or briefings
66	Counsel individuals on training progress
67	Demonstrate procedures for locating technical information
68	Demonstrate the use of equipment or tools
69	Develop, administer or score tests
71	Develop training or briefing aids
72	Draft actions to advance or retrain students
73	Establish training programs
74	Evaluate student progress
75	Prepare and maintain training records
78	Procure training facilities or equipment
79	Review training progress of individuals
80	Schedule on-the-job training
81	Schedule training sessions
82	Select instructors or trainers
83	Serve as OJT trainer
84	Write or revise training material

AFSC-326X1A/B (continued)

A. The above tasks describe an OJT supervisor for the AFSC 326x1B career field.

B. The above tasks also describe an OJT trainer for the AFSC 326x1B career field provided the respondents do not indicate performance of the following tasks: 23, 39, 82.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondents in the OJT supervisor and/or trainer populations: 24, 39, 80, 83.

AFSC-431X0C/D Career Field - Helicopter Maintenance

Task No.	Description
20	Update position descriptions
24	Conduct supervisory orientations or briefings
28	Implement or follow-up on-the-job training programs
47	Supervise training or training support functions
60	Evaluate unit training programs
69	Inspect training records
86	Administer oral or written tests
87	Arrange for training aids or training materials
88	Attend training conferences or meetings
90	Conduct OJT training
93	Conduct skill performance tests
94	Conduct training conferences or meetings
95	Construct training aids
96	Counsel trainers or trainees
97	Demonstrate use of equipment or tools
98	Determine individual training needs
99	Determine unit training needs
100	Develop career development course (CDC) materials
102	Develop job proficiency guides (JPG)
103	Develop OJT materials other than CDC or JPG
104	Develop technical evaluation tests
105	Evaluate upgrade training progress of individuals
106	Maintain individual training records (AF Form 623)

A. The above tasks describe an OJT supervisor for the AFSC 431x0C/D career field.

B. The above tasks also describe an OJT trainer for the AFSC 431x0C/D career field provided the respondent does not indicate performance of the following tasks: 24, 47.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 90, 102, 106.

AFSC-431X1A/C/E/F Career Field - Aircraft Maintenance

Task No.	Description
30	Plan unit training programs
44	Direct subordinates in maintaining work performance
53	Orient newly assigned personnel
68	Evaluate training programs
72	Evaluate work performance of military personnel
73	Inspect work performed by subordinates
77	Prepare recommendations for change to training programs
81	Administer oral, written or performance tests
83	Conduct lectures or briefings
84	Conduct on-the-job training
86	Develop OJT materials
87	Develop proficiency tests
88	Direct OJT programs
89	Evaluate or review specialty training standards (STS)
90	Initiate request for training aids, classrooms or equipment
91	Prepare job proficiency guides (JPG) or JPG Continuation Sheets
92	Prepare requests for career development course (CDC) materials
93	Review training progress of individuals
94	Select or assign instructors or trainers
127	Maintain or file OJT record forms (AF Form 623)

A. The above tasks describe an OJT supervisor for the AFSC 431x1A/C/E/F career fields.

B. The above tasks also describe an OJT trainer for the AFSC 431x1A/C/E/F career fields provided respondents do not indicate performance of the following tasks: 92, 94.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 84, 91, 127.

AFSC-552X3 Career Field - Carpentry/Masonry
AFSC-552X0

Task No.	Description
16	Plan or schedule on-the-job training
32	Direct or implement OJT programs
34	Draft or revise job descriptions
62	Evaluate individuals for promotion, demotion or reclassification
64	Evaluate job descriptions
78	Administer or score tests
79	Assign OJT trainers
81	Conduct OJT
83	Conduct training conferences or briefings
84	Counsel trainees or training programs
85	Demonstrate how to locate technical information
87	Develop phase tests for evaluating upgrade training progress
90	Establish or maintain study reference files
91	Evaluate OJT trainees
93	Evaluate training methods, techniques or programs
94	Implement or direct training programs
95	Maintain training records, charts or graphs
97	Prepare training aids
98	Procure training aids, space or equipment
99	Verify personnel are enrolled in CDC
100	Write test questions
101	Write training reports

A. The above tasks describe an OJT supervisor for the AFSC 552x0 career field.

B. The above tasks also describe an OJT trainer for the AFSC 552x0 career field provided respondents do not indicate performance of the following task: 79.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 16, 79, 81, 91.

AFSC-552X5 Career Field - Plumbing

Task No.	Description
22	Prepare job descriptions
46	Direct or implement on-the-job training
57	Interpret policies, directives or procedures for subordinates
72	Evaluate individuals for promotion, demotion or reclassification
74	Evaluate job descriptions
86	Administer or score tests
87	Assign OJT trainers
90	Conduct OJT
92	Conduct training conferences or briefings
93	Counsel trainees on training progress
94	Demonstrate how to locate technical information
95	Determine training requirements
97	Develop tests
98	Establish or maintain study reference files
99	Evaluate OJT trainees
100	Evaluate OJT trainers
103	Evaluate training methods, techniques or programs
104	Implement or direct training programs
105	Maintain training records, charts or graphs
106	Procure training aids, space or equipment
107	Write training reports

A. The above tasks describe an OJT supervisor for the AFSC 552x5 career field.

B. The above tasks also describe an OJT trainer provided respondents do not indicate performance of the following tasks: 87, 99.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 87, 90, 99.

AFSC-612X0 - Career Field - Supply Services/Meatcutter
AFSC-611X0

Task No.	Description
30	Plan training requirements
40	Prepare training programs
86	Monitor on-the-job training programs
93	Prepare job or position descriptions
171	Assign OJT Trainers
172	Conduct customer relations training
173	Conduct formal OJT on the job
174	Conduct group training on the job
175	Conduct individual training on the job
177	Counsel airmen on career and educational opportunities
178	Counsel individuals on training progress
179	Evaluate course materials or training methods
180	Evaluate individuals for specialty knowledge tests (SKTs)
181	Evaluate specialty training standards (STSs)
182	Maintain training progress records such as AF Form 623
183	Prepare, administer or score tests
184	Prepare job proficiency guides
186	Prepare OJT programs for individual trainees
188	Schedule training
190	Supervise career development course training (CDC)
191	Supervise personnel conducting OJT

A. The above tasks describe an OJT supervisor for the AFSC 611x0 career field.

B. The above tasks also describe an OJT trainer for the AFSC 611x0 career field provided respondents do not indicate performance of the following tasks: 171, 191.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 173, 174, 175, 184, 186.

AFSC-672X1 Career Field - General Accounting
formerly
AFSC-671X1

Task No.	Description
74	Draft or revise job descriptions
106	Evaluate job descriptions
128	Administer or score oral or written tests
129	Assign on-the-job trainers
131	Conduct OJT
134	Conduct training conferences or briefings
135	Conduct training on equipment procedures
137	Counsel trainees on training progress
138	Demonstrate how to locate technical information
142	Establish or maintain study reference files
143	Evaluate OJT trainees
144	Evaluate OJT trainers or resident course instructors
145	Evaluate OJT training methods, techniques or programs
147	Implement or direct OJT programs
148	Maintain Consolidated Training Record forms (AF 623)
149	Maintain training charts or graphs
150	Monitor individuals taking career development courses
151	Plan or schedule OJT programs
153	Prepare training aids
154	Procure training aids, space or equipment
155	Write test questions
156	Write training reports

A. The above tasks describe an OJT supervisor for the AFSC 672x1, AFSC 672x0, and AFSC 672x2 career fields.

B. The above tasks also describe an OJT trainer for the AFSC 672x1, AFSC 672x0, and AFSC 672x2 career fields provided the respondents do not indicate performance of the following tasks: 129, 144.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 131, 148, 150.

AFSC-702X0 Career Field - Administration

Task No.	Description
29	Plan on-the-job training programs
47	Draft job or position descriptions
49	Interpret directives for subordinates
111	Evaluate OJT programs
136	Conduct individual OJT
141	Counsel trainees on training progress
144	Develop OJT programs for individual trainees
146	Develop student training materials such as study guides
148	Initiate or maintain Consolidated Training Records, AF Form 623
151	Maintain training aids or devices
152	Prepare job proficiency training guides (JPGs) or tasks to accompany training standards
156	Review job proficiency guides
157	Review OJT records
158	Review specialty training standards
159	Review student training materials
162	Write student counseling reports

A. The above tasks describe an OJT supervisor for the AFSC 702x0 career field.

B. The above tasks also describe an OJT trainer for the AFSC 702x0 career field provided respondents do not indicate performance of the following task: 148.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondent in the OJT supervisor and/or trainer populations: 136, 144, 152, 156.

AFSC-732X1 Career Field - Personnel Affairs

Task No.	Description
19	Prepare job descriptions
38	Direct or implement on-the-job training programs
67	Evaluate job descriptions
69	Evaluate OJT programs or procedures
78	Assign OJT trainers
80	Conduct OJT
82	Conduct training conferences or briefings other than resident course
83	Counsel trainees on training progress
84	Demonstrate how to locate technical information
86	Determine unit training requirements
87	Develop tests
89	Establish or maintain study reference files
90	Evaluate OJT trainees
92	Evaluate training methods, techniques or programs
93	Maintain Consolidated Training Record Forms (AF 623)
94	Procure training aids, space or equipment
95	Write training reports

A. The above tasks describe an OJT supervisor for the AFSC 732x1 career field.

B. The above tasks also describe an OJT trainer for the AFSC 732x1 career field provided respondents do not indicate performance of the following task: 78.

C. Performance of one or more of the following task(s) will constitute inclusion of the respondents in the OJT supervisor and/or trainer populations: 80, 90, 93.

APPENDIX C: Graphical Representation of Percent Time Spent on OJT for Selected Career Fields

This appendix contains graphical representations of the percent time allocated to OJT by supervisors/trainers and trainers in five sample career fields. The graphs contained in Figures C1 to C10 were developed from an analysis of Occupational Survey Data according to the procedures outlined in Section 3.1 of this report and should be interpreted as indicated therein. The data contained in the following graphs are utilized to generate the "mean percent time" factors employed in the assessment and costing of OJT supervisor/trainer and OJT trainer time allocations for each career field considered in the application of the developed cost analysis techniques.

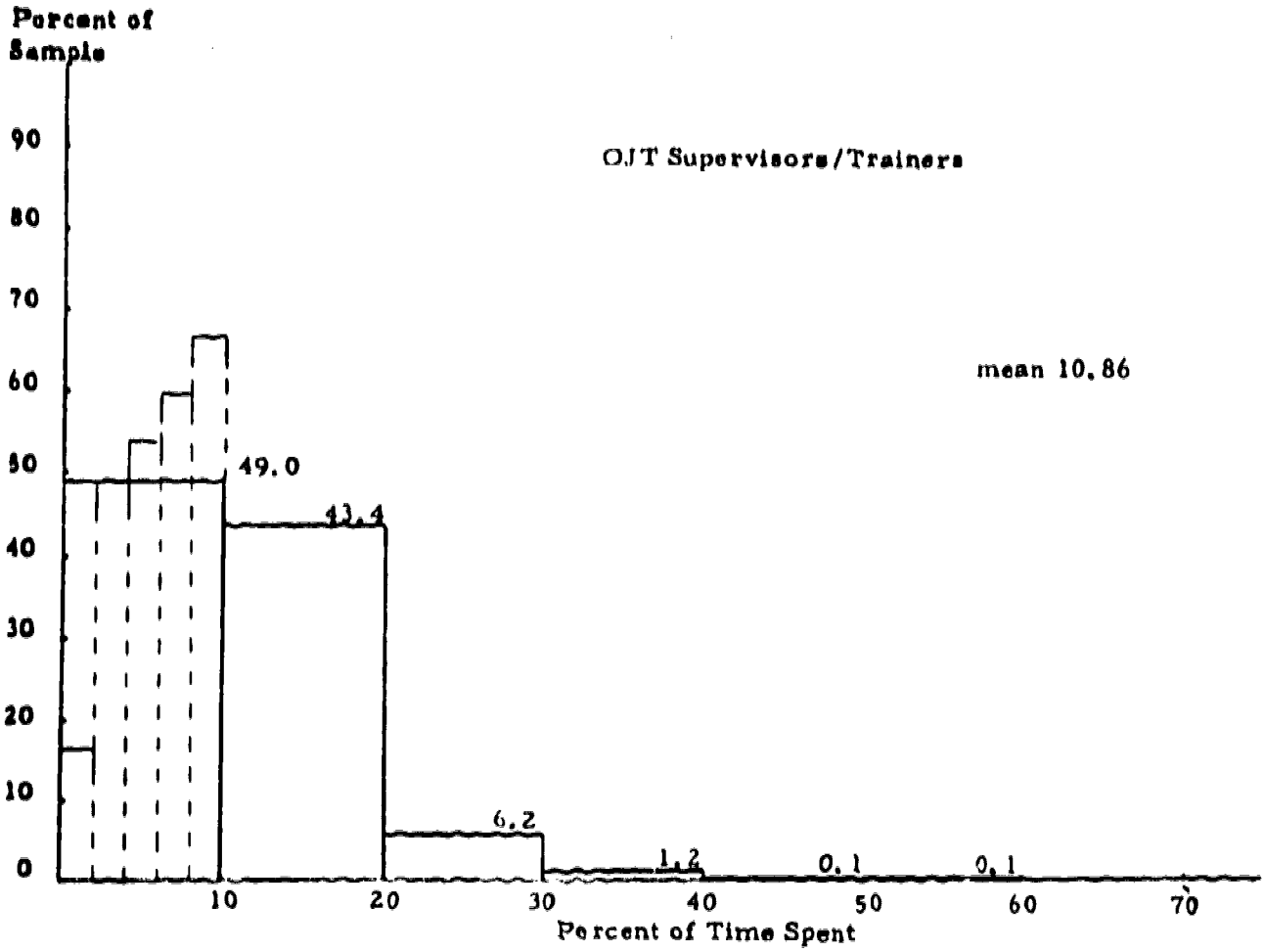

FIGURE C1: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 293x3, Radio Operator

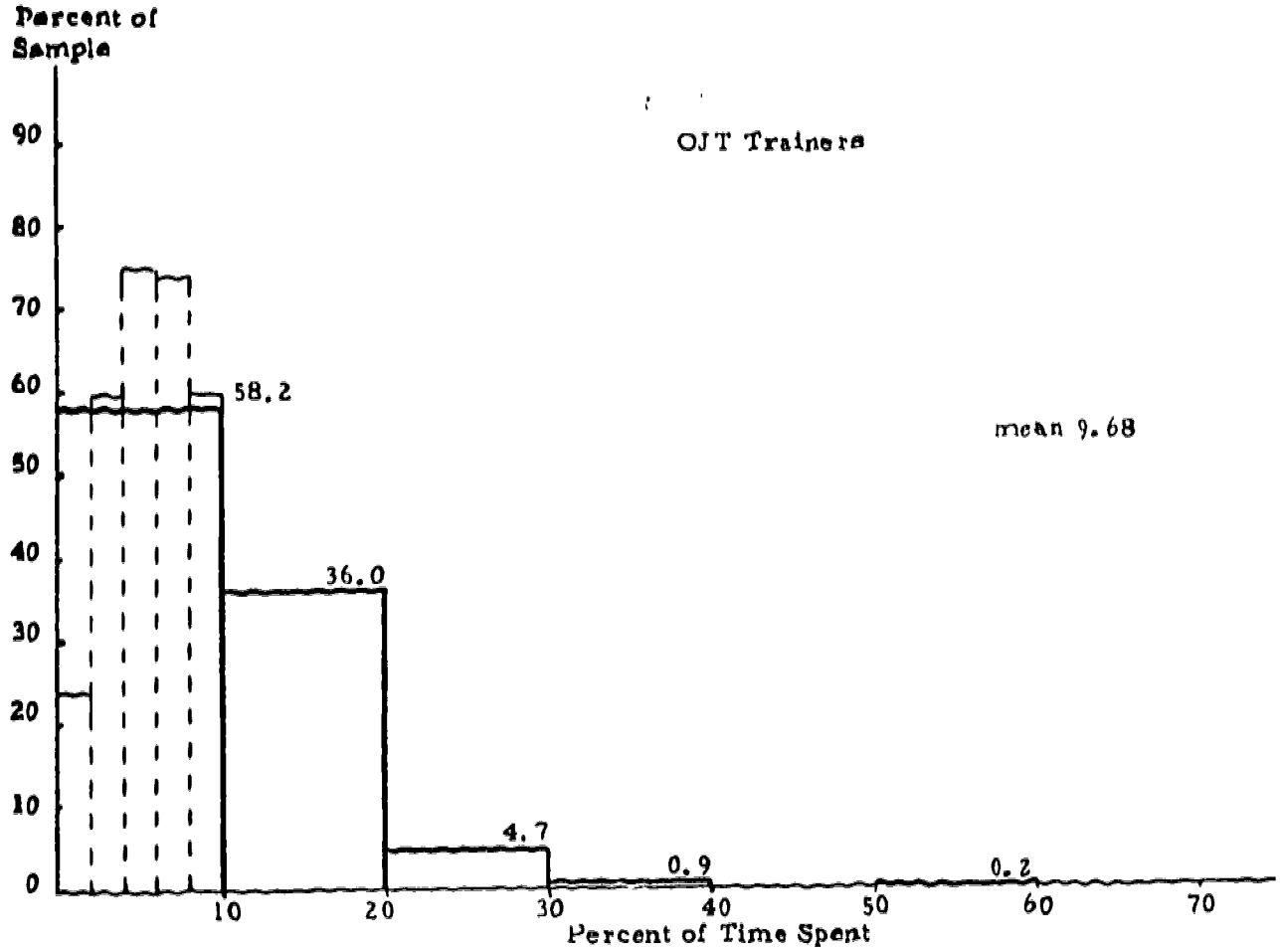

FIGURE C2: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 293x3, Radio Operator

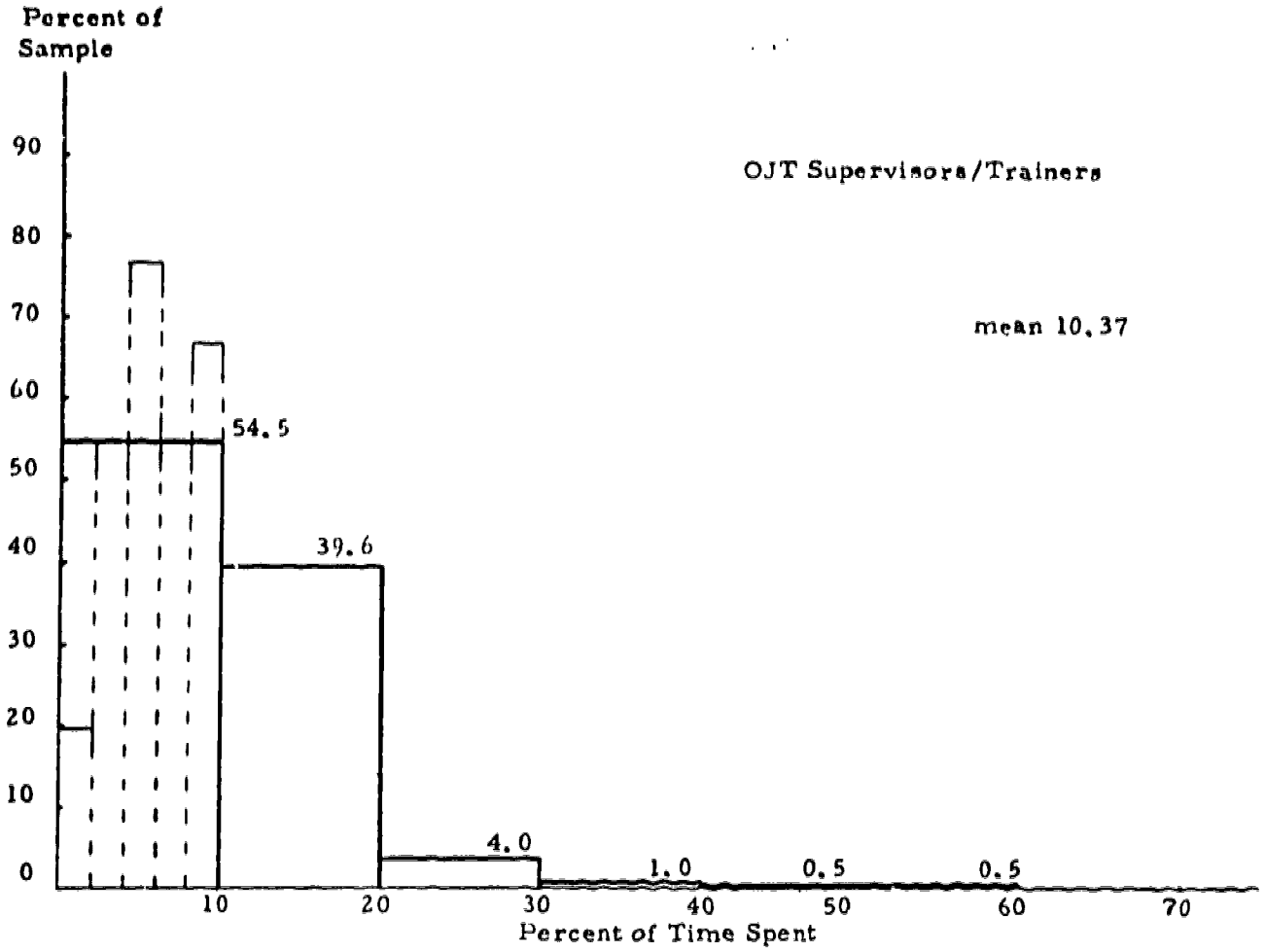

FIGURE C3: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 316x1, Missile Systems Maintenance

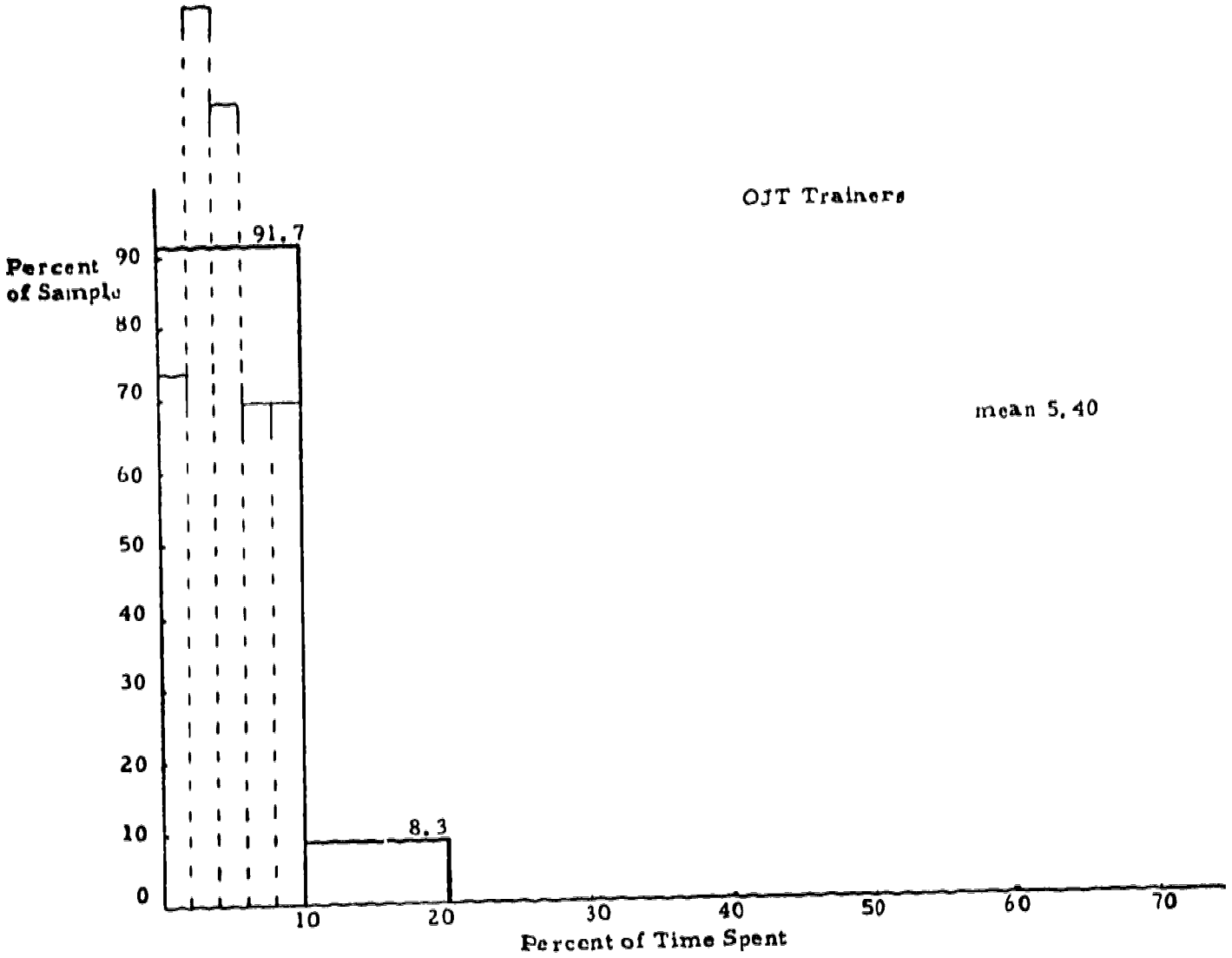

FIGURE C4: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 316x1, Missile Systems Maintenance

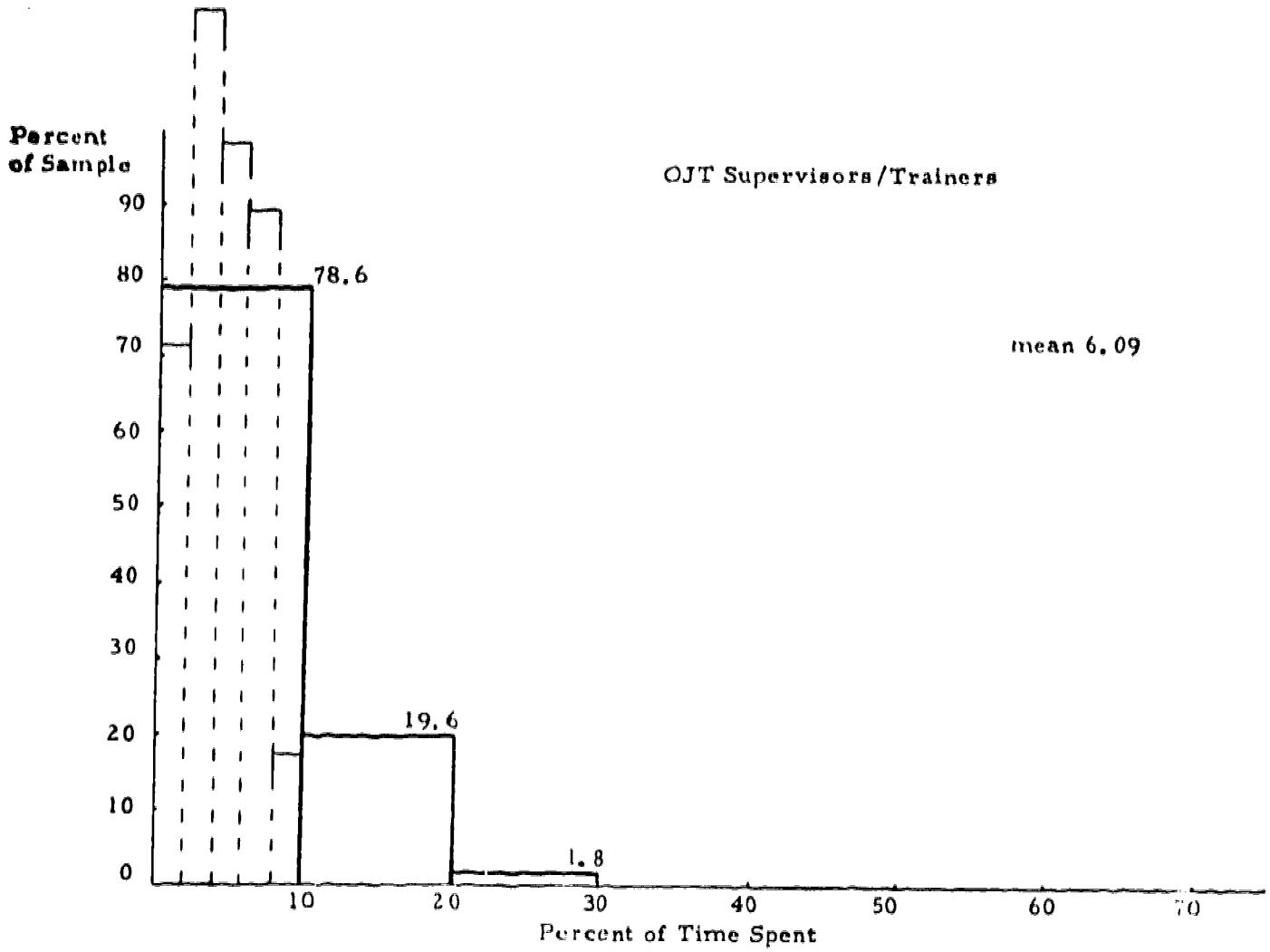

FIGURE C5: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 326x1, Integrated Avionics

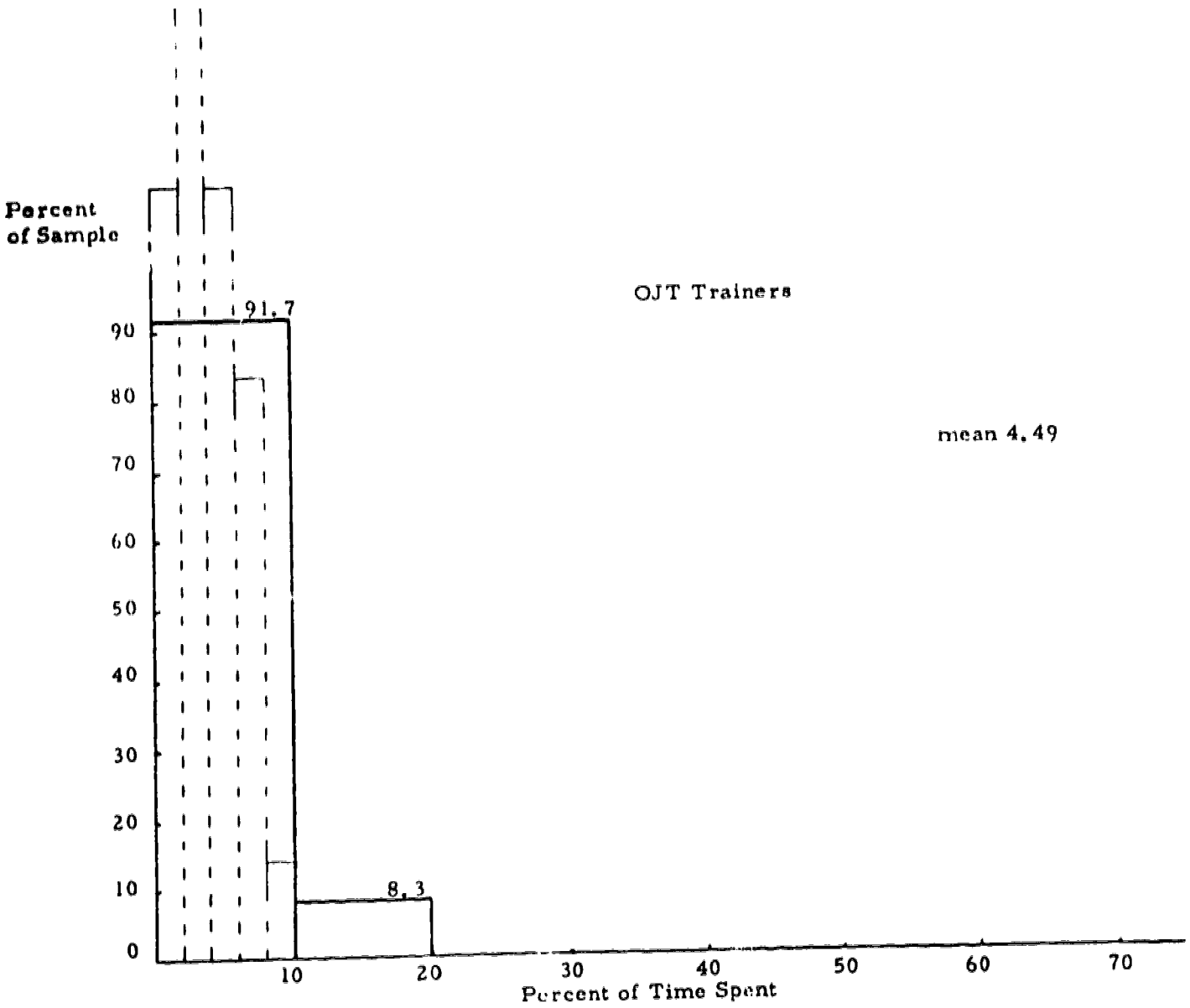

FIGURE C6: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 326x1, Integrated Avionics

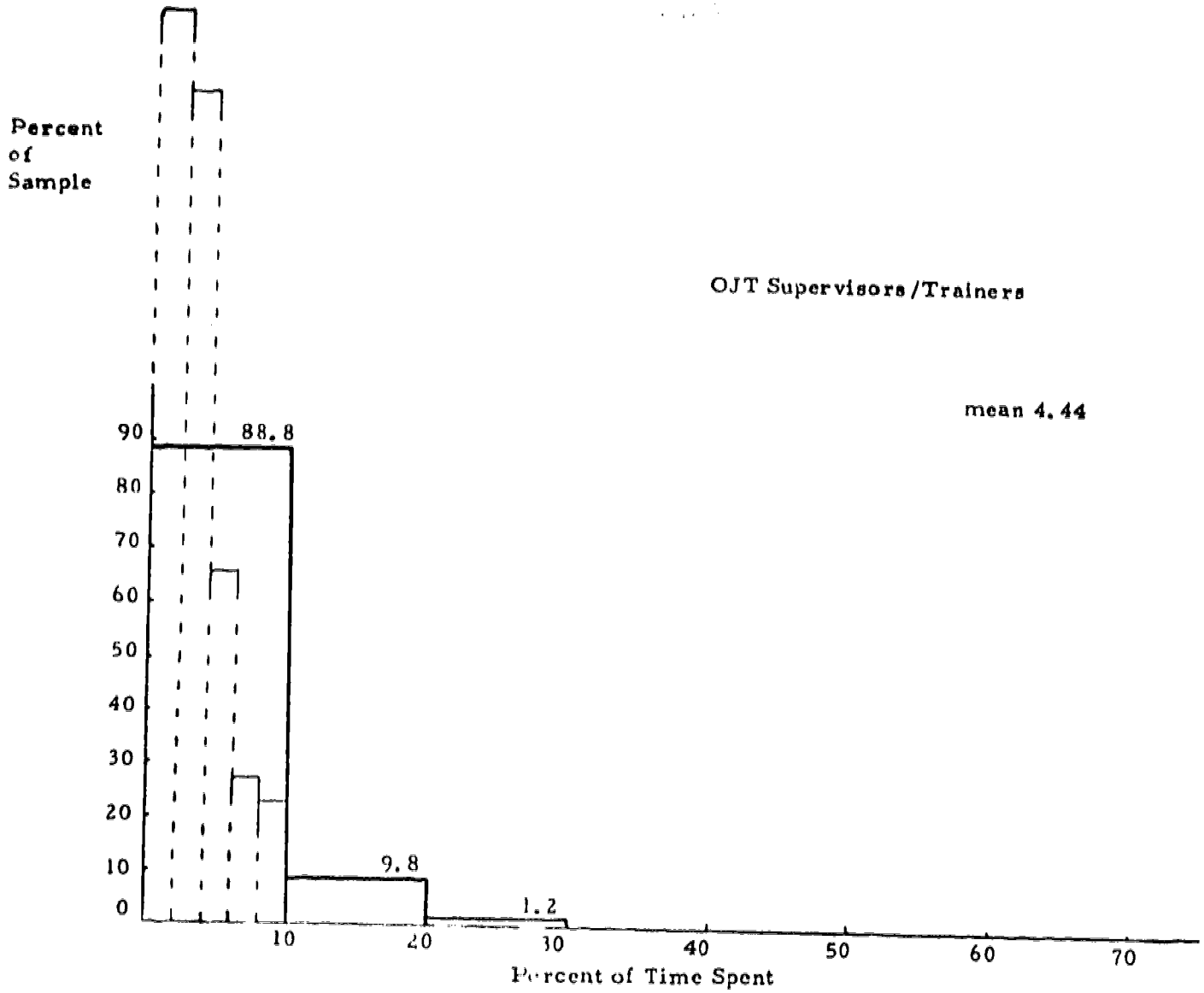

FIGURE C7: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 431x0, Helicopter Mechanic

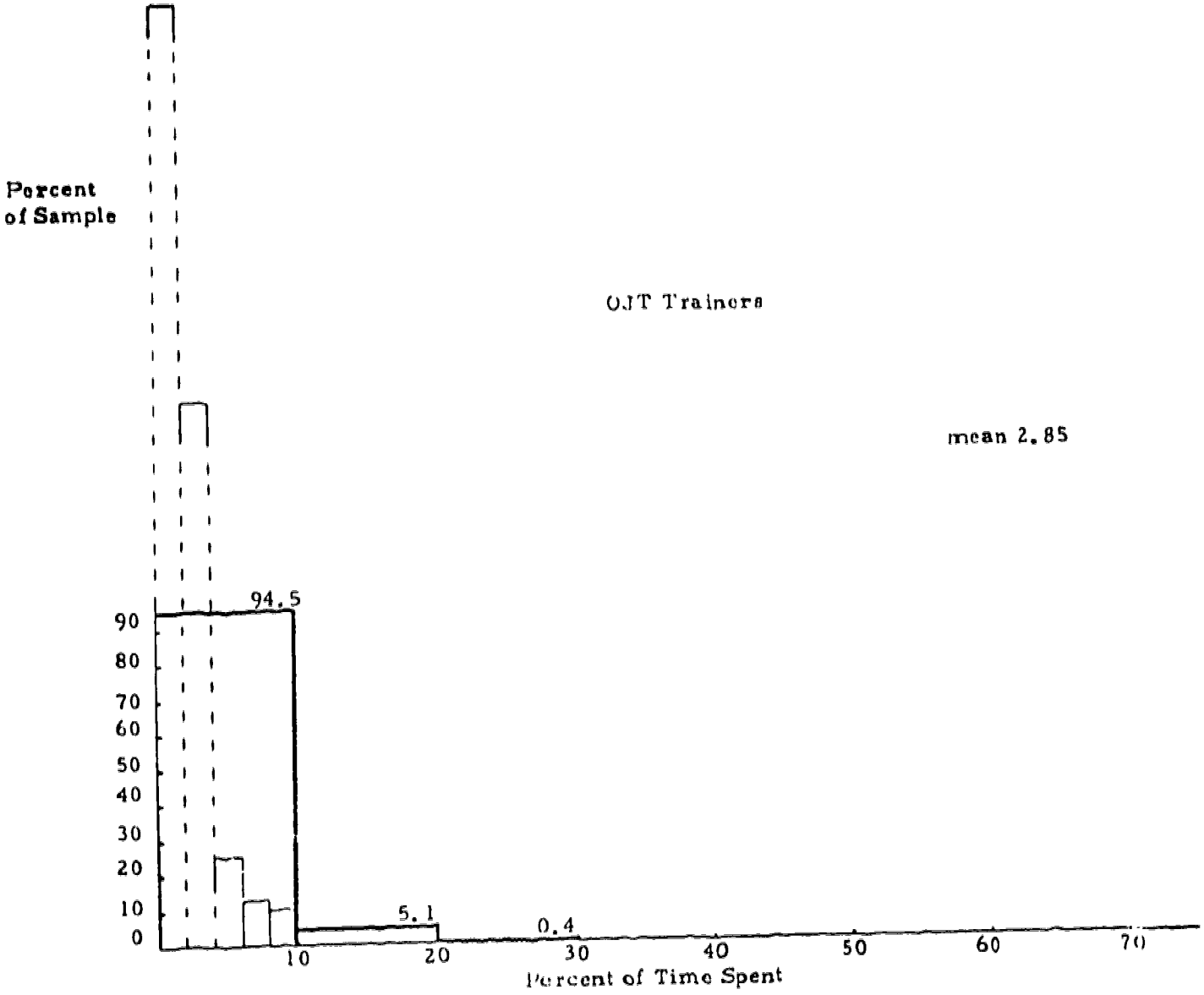

FIGURE C8: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 431x0, Helicopter Mechanic

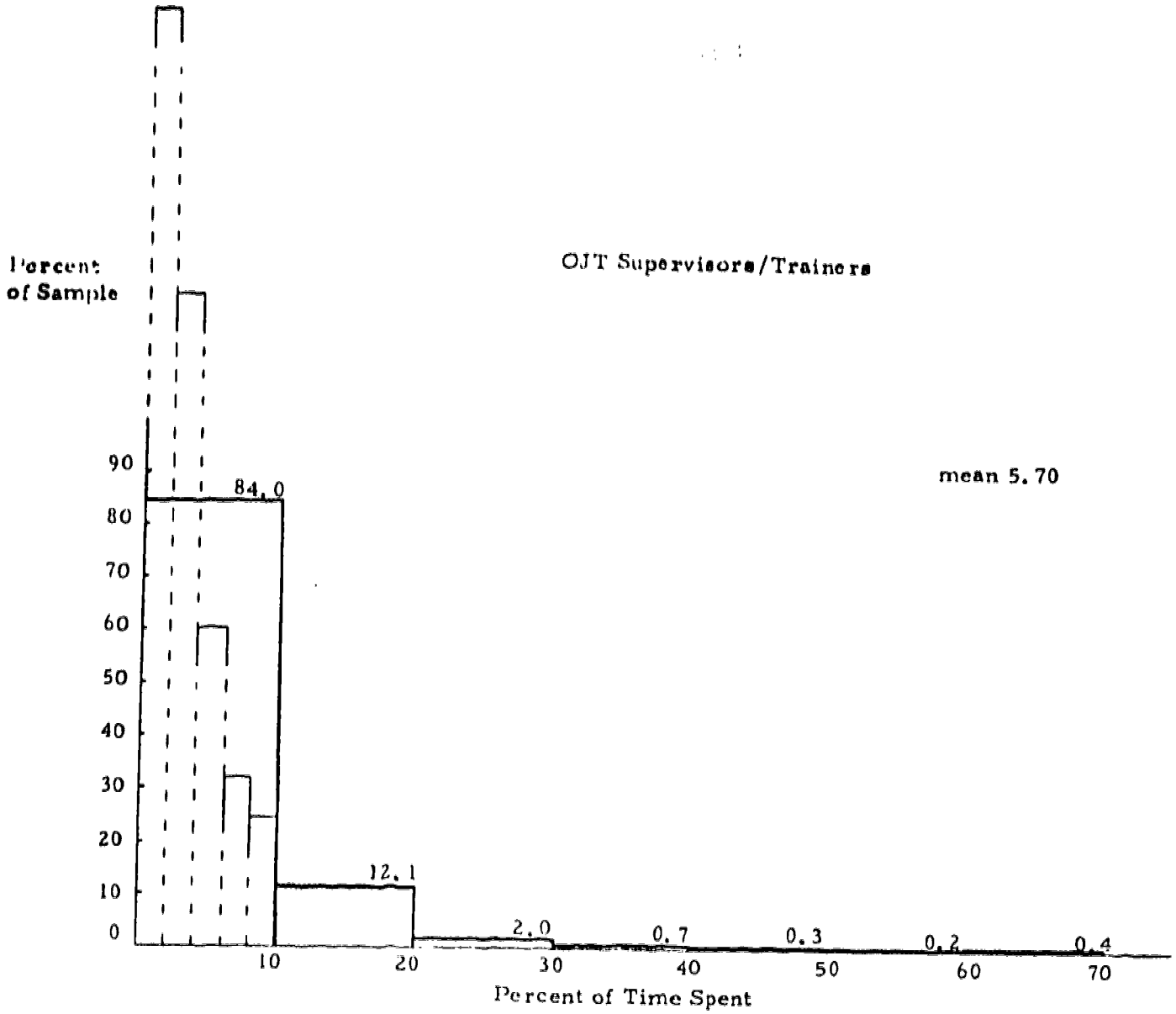

FIGURE C9: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 431x1, Aircraft Maintenance

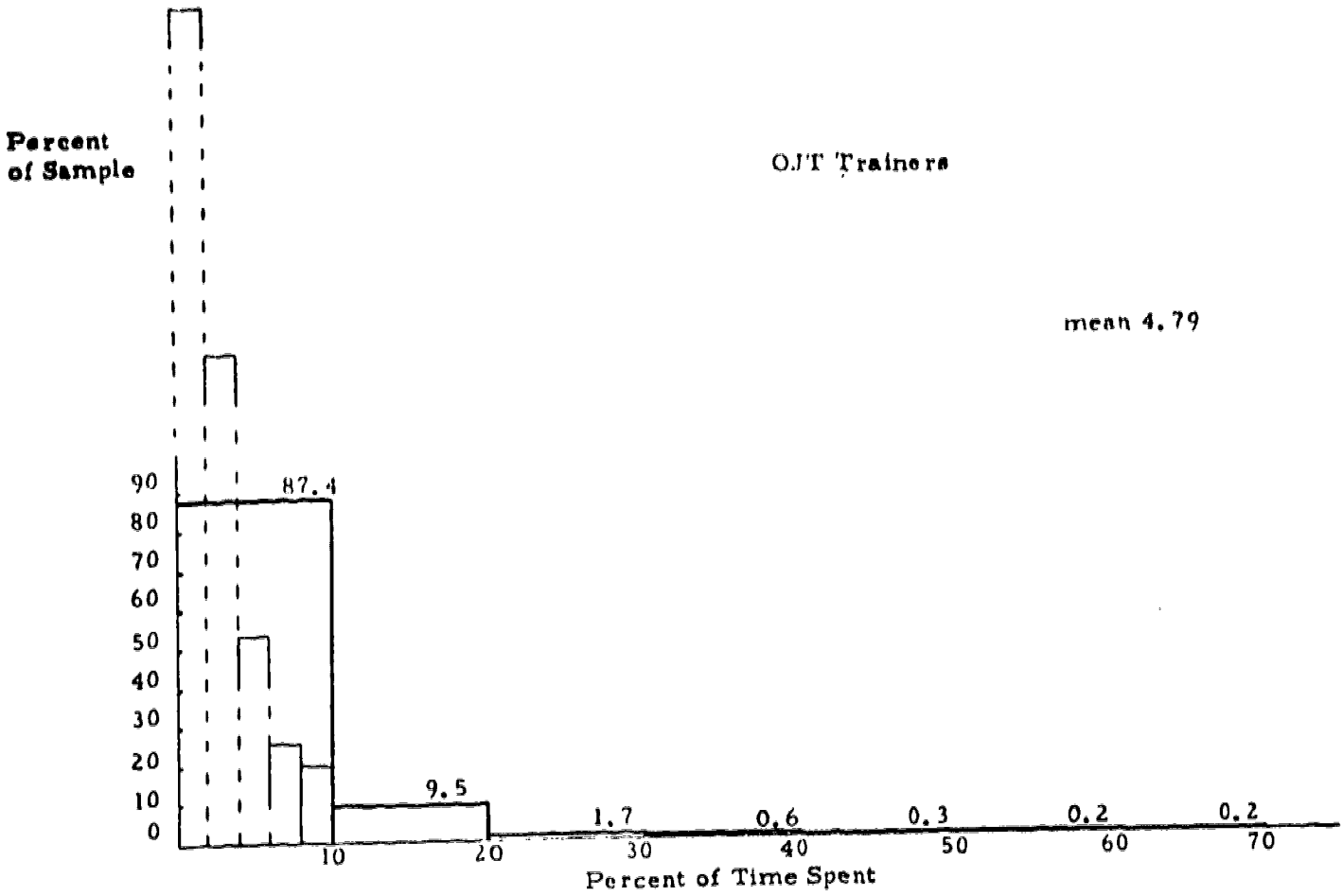

FIGURE C10: Composite Percent Distribution of the Percent of Time Spent on Tasks in Subset A, AFSC 431x1, Aircraft Maintenance

APPENDIX D: A Discussion of the Use of Chi Square to Determine Population Aggregates

The chi square test, as a measure of independence, assesses the probability that two or more distributions differ significantly. When comparing a pair of distributions, chi square increases with difference. The test values decrease as the similarity of the distributions increases, becoming equal to zero only if one distribution is a constant proportion of the other.

Figures in Appendix C visually illustrate the "shapes" of distributions depicting OJT time for the populations of five career fields. Chi square tests of various pairs should second our intuitive guesses about similarity. The more similar a pair of distributions, the smaller x^2 should be. For instance, Figure C4, for Missile Systems Maintenance OJT trainers, and Figure C6, for Integrated Avionics OJT trainers, appear markedly similar. As noted earlier, we considered their similarity quantitatively good, as measured by chi square ($\alpha = 0.98$, Table 2). On the other hand, OJT supervisors/trainers in the Radio Operator and Helicopter Mechanic career fields do not appear similar (Figures C4 and C7) and are rejected emphatically by chi square ($\alpha = 0.005$, Figure 12). However, one might be a little taken aback to know that an intuitively possible aggregate of Aircraft Maintenance OJT supervisors/trainers and OJT trainers (Figure C9 and C10) is also strongly rejected by the chi square test ($\alpha = 0.01$, Table 3).

Far from being an erroneous chi squre evaluation, this conflict of intuition and measurement points up the need to employ the chi square test with care. User decisions, test sensitivities, and inferential limitations all qualify interpretations of chi square test results.

Due to an underlying assumption in the test's design, one should avoid including intervals containing fewer than five occurrences. This posed difficulties immediately when we were comparing samples for the amount of time spent on training tasks. Since almost no supervisors/trainers spent large portions of their time in OJT, few intervals above 30 percent time spent qualified by the "at least five" rule. Since nothing tends to look a lot like nothing, inclusion of the empty intervals, a user decision, biased the chi square tests toward accepting similarities among the populations.

In much the same manner, we decided to adjust interval choices for some populations that were too small to contain any representatives in the data's 1 percent length intervals between 0 and 10 percent time spent. As in our composite graphs, which use 2 percent length intervals for the breakdown between 0 and 10 percent spent, we diminished the effect of minor perturbations by combining entries and calculating chi square on the basis of a breakdown by 2 percent intervals of the 0 to 10 percent time spent region. Table D1 demonstrates the reduction in apparent similarity resulting from adoption of 2 percent length intervals in the 0 to 10 percent breakdown and a combination of the last five 10 percent length intervals into a single 50 to 100 percent interval (b). Of the five acceptable similarities yielded by the original chi square comparisons ($\alpha \geq 0.05$), only three still show good similarity under the revised chi square test procedure.

Even this reduction of intervals left some of the smaller samples with intervals still containing fewer than five occurrences. To eliminate these intervals completely, we dropped our uniform treatment of the pairwise comparisons and combined intervals as needed. The resultant sample comparisons, also presented in Table D1, leave only two sample pairs that still come out statistically similar.

Further complicating the influence of interval grouping decisions, sample size also influences chi square. Stochastic disturbance decreases comparison reliability for small samples; if you flip a coin ten times, there is a better than even chance that you will not end up with exactly five heads and five tails. Large samples allow grater reliability; four heads and six tails is a fairly likely outcome of ten tosses, but 400 heads and 600 tails is extremely improbable for 1,000 tosses of a balanced coin. Therefore, two large samples must be distributed in almost identical proportions before they can be said similar, according to chi square. On the other hand, two small samples, such as the OJT supervisors/trainers for Missile Systems Maintenance and Integrated Avionics (only 36 members each) will tend to look like any sample that is even remotely similar merely because there are not enough occurrences to say anything definite. Six heads and four tails could be had very easily from the same coin that earlier produced four heads and six tails. For this reason alone, Aircraft Maintenance samples (over 2,000 members each) showed no reasonable similarity to any other sample. Perhaps a sort of sliding scale of Type I error significance levels could be used to counterbalance the changes in chi square stringency that accompany population size changes because of the test's sensitivity to sample size.

TABLE D1: Comparison of Three Different Procedures for Evaluating Sample Similarities in the Percent of Time Spent on Tasks in Subset A (Training Tasks) by Means of Chi Square Test

	Radio Operator 293 x 3	Missile Systems Maintenance 316 x 1	Integrated Avionics 326 x 1	Helicopter Mechanic 431 x 0	Aircraft Maintenance 431 x 1
	X^2 α	X^2 α	X^2 α	X^2 α	X^2 α
Telecommunications Operator 291 x 0	a) 22.88 .29 b) 16.57 .057 c) 18.25 .082 (ν=11)	a) 16.50 .62 b) 13.85 .141 c) 13.62 .019 (ν=5)	a) 35.04 .01 b) 23.81 .006 c) 23.57 .005 (ν=5)	a) 304 .005 b) 298 .005 c) 303 .005 (ν=8)	a) 396 .005 b) 375 .005 c) 389 .005 (ν=13)
Radio Operator 293 x 3		a) 27.26 .10 b) 23.57 .006 c) 23.46 .005 (ν=5)	a) 50.25 .005 b) 36.59 .005 c) 36.48 .005 (ν=5)	a) 343 .005 b) 338 .005 c) 340 .005 (ν=7)	a) 475 .005 b) 466 .005 c) 468 .005 (ν=12)
Missile Systems Maintenance 316 x 1			a) 8.31 .98 b) 3.09 .96 c) 3.09 .70 (ν=5)	a) 49.98 .005 b) 45.73 .005 c) 45.44 .005 (ν=5)	a) 31.41 .04 b) 24.87 .005 c) 24.20 .005 (ν=5)
Integrated Avionics 326 x 1				a) 47.77 .005 b) 35.30 .005 c) 35.01 .005 (ν=5)	a) 28.77 .09 b) 18.47 .035 c) 17.80 .005 (ν=5)
Helicopter Mechanic 431 x 0					a) 36.37 .01 b) 34.21 .005 c) 32.79 .005 (ν=5)

Key: a) Uniform procedure for all pairwise comparisons. Employs all 20 data intervals. (ν=19)
b) Uniform procedure for all pairwise comparisons (ν=9). Two percent breakdown used between zero and ten percent. Last interval includes all occurrences between 50 and 100 percent.
c) Individualized comparison procedures. Eliminates intervals with fewer than five occurrences by combining with neighboring intervals. (ν changes)

Interpretation: Bias toward similarity decreases as chi square procedure eliminates intervals containing fewer than five occurrences.

In light of these complications, and in view of the fact that AFSC populations do not have to be aggregated, the original population samples were preserved. It is not surprising that six career fields contained no reasonable sample aggregates. Just the same, aggregation possibilities should still be pursued whenever many samples are being considered. Chi square can be used to evaluate aggregation possibilities for three or more samples, as well as for sample pairs.

One final word of caution remains. Chi square measures the difference between distributions; chi square does not directly measure similarity. The α significance level indicates the probability that separate treatment is unnecessary. If $\alpha = 0.05$, for instance, then there is a 5 percent chance that we do not need to treat the samples separately. Effectively, the samples will be treated together as aggregates unless α is very small, say less than 0.05. One can always fall back on separate treatment if there is any doubt as to whether an aggregate should be made since this loses no information and should not induce greater error than would aggregation in the resultant cost estimates. Separate treatment does require more time, of course.

Since chi square does not directly measure the probability of making a mistake when deciding to go ahead and combine samples, one must be careful when inferring that samples are in fact similar. It is possible that two samples look very similar one year, but do not tend to look similar given a large enough data base; measurements taken over 5 years, for instance. This inferential limitation must always be kept in mind when an aggregation possibility is being considered.

APPENDIX E: Summary of OJT/NCOIC MAJCOM Survey

This appendix summarizes the OJT/NCOIC MAJCOM Survey which provided information to help establish the direct personnel overhead and program support cost factors for each organizational level according to procedures outlined in Sections 3.2 and 3.3 of this report. The listing of respondents and the protocol by which the interviews were conducted are presented in Tables E1 and E2, respectively. Table E3 summarizes the MAJCOM level OJT staffing requirements and indicates associated annual costs according to standard rates and indicated percent staff utilization. Respondent estimates concerning the involvement factors for supervisors/trainers and for trainers are statistically described in Table E4.

The MAJCOM OJT/NCOIC Survey was completed during the week of July 25, 1977, and resulted in interviews being conducted with 12 MAJCOMs, one SOA, and the Air Force Reserve. All respondents were initially contacted by Charles Eisele, Project Manager, to arrange for a specific telephone interview time. During the initial contact, respondents were informed of the general interview topics so that they might obtain necessary response information in advance. Once an interview time had been established, the respondents were contacted by CONSAD personnel, and the interview was conducted according to the protocol contained in Table E2.

Note that the survey assessed OJT direct personnel overhead in all Air Force MAJCOMs, as well as the Air Force Reserve and the Air Force Academy. These MAJCOMs and SOAs account for over 99 percent* of all OJT trainees in the Air Force. The OJT/NCOIC Survey therefore captures nearly all the available information concerning OJT staffing at the MAJCOM level as identified by the respondents.

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*Percentage calculated from trainee volumes for MAJCOM for October 1976 (PMC-P260, OJT Report).

TABLE E1: List of Respondents for OJT/MAJCOM Interviews

Organization	Organization
HQ TAC/DPPTO Langley AFB, Virginia 23665	HQ USAFSS/DPAE Kelly AFB, Texas 78243
HQ AFSC/DPAT Andrews AFB, D.C. 20334	HQ ADCOM/DPXTO Ent AFB, Colorado 80912
HQ AAC/DPT Elmendorf AFB, Washington APO Seattle 98742	AFRES/DPTST Robins AFB, Georgia 31098
USAFA/DPMPO USAF Academy, Colorado 80840	
HQ PACAF/DPATM Hickam AFB, Hawaii APO San Francisco 96553	
Air University/DPAT Maxwell AFB, Alabama 36112	
HQ SAC/DPHTTO Offatt AFB, Nebraska 68113	
HQ AFLC/DPMTT Wright-Patterson AFB, Ohio 45433	
HQ MAC/DPATJ Scott AFB, Illinois 62225	
HQ AFCS/DPATE Richards Gebaur AFB, Missouri 64030	
HQ USAFE/DPATJ Ramstein AFB, Germany APO New York 09012	

TABLE E2: Interview Protocol Form
for OJT/MAJCOM Survey

1. What is your official office symbol?

2. Are you the OPR (Office of Primary Responsibility) for OJT (On-the-Job Training) for your MAJCOM (Major Command)?

If no, what is the OJT/OPR for your MAJCOM?

And whom should we contact?

3. Concerning your current manning authorization:

a. What AFSC are included?

b. What is the number of authorized slots by AFSC?

c. What is the typical grade held by personnel in each of these slots?

d. What, if any, is the fixed minimum authorization?

e. Upon what basis (work load value) are additional slots authorized?

f. What are the applicable manpower standards for your work center?

TABLE E2 (continued)

3. g. Are all of your authorizations full time slots with respect to your OJT functional responsibility?

If no, how are they divided between full and part time?

And, for the part time slots, what is the typical percent of productive time spent on OJT activities?

4. Are there any other offices at the Headquarters MAJCOM level which have primary functional responsibilities for the OJT program?

If so, what are they?

And whom could we contact?

5. Within your MAJCOM, is there any OJT functional responsibility at intermediate command levels, e.g., numbered Air Force Headquarters?

If so, what are the OPRs?

And whom could we contact?

TABLE E2 (continued)

6. (If yes to questions 4 and 5) Can you provide us with manning information (as in question 3) for the other OJT functions at the Headquarters MAJCOM and intermediate command levels?

7. Regarding the OJT program in your MAJCOM:

   a. Can you provide any manning information (as in question 3) for OJT/OPRs at the Wing Command level?

   b. What use do you make of OJT data provided to you by AFMPC?

   c. Do you require any special reporting regarding OJT program management or trainee status from your base level units?

   d. What is the typical supervisor/trainee or instructor/trainee ratio, in general or for specific specialties and upgrades?

   e. What is the percent of supervisor or instructor productive time which is spent in OJT responsibilities?

   f. What is the percent of trainee productive time which is spent on duties specified in his specialty job description?

TABLE E2 (continued)

8. Can you provide us with any documentation regarding any of the topics discussed (questions 1-7)? Specifically, can you provide us with copies of relevant pages or sections of manpower standards or unit detail listings which cover the manning information discussed (question 3)?

If so, send them to:

Charles Eisele
CONSAD Research Corporation
121 North Highland Avenue
Pittsburgh, Pennsylvania 15206

TABLE E2 (continued)

Organization:

Office Symbol:

Level:

AFSC	Number of Authorized Slots	Typical Grade	Fixed Minimum Authorization	Work Load Level	Applicable Manpower Standards

TABLE E3: Results of MAJCOM OJT/NCOIC Survey: MAJCOM Level OJT Direct Overhead and Program Support Personnel

Organization	Office	Authorized AFSCs	Authorized Grades		Standard Annual Cost*	Percent of Productive Time/Cost Due to OJT	MAJCOM HQ Costs Attributable to OJT Annually
Air University	DPAT	73270	1 TSgt	E6	12,509	20	2,502
HQ ATC	TTFJ	75172	1 MSgt	E7	14,509	100	1,137,160
		75193	1 MSgt	E7	14,509		
		75xxx	2 SSgt	E5	21,292		
		75xxx	16 MSgt	E7	232,144		
		75xxx	65 TSgt	E6	813,085		
	TTSS		1	GS-12	26,594	72.5	
			1	GS-13	30,814		
HQ AAC	DPT	75172	1 TSgt	E6	12,509	100	12,509
HQ ADCOM	DPXTO	75193	1 SMSgt	E8	16,716	100	16,716
HQ AFCS	DPATE	75193	1 MSgt	E7	14,509	100	14,509
HQ AFLC	DPMTT	75193	1 MSgt	E7	14,509	100	14,509
HQ AFRES	DPTST	75193	1 CMSgt	E9	19,606	40	196,613
		75172	2 MSgt	E7	29,018		
Other OJT/OPR authorized at the 14th and 4th AFs		75xxx	1+1 Major	O4	50,484	100**	
		751xx	1+1 CMSgt	E9	39,212		
		751xx	1+1 SMSgt	E8	33,432		
		751xx	1+1 MSgt	E7	29,018		
		751xx	1+1 TSgt	E6	25,018		
HQ AFSC	DPAT	7321	1 Major	O4	25,242	20	5,048
HQ MAC	DPATJ	75193	1 CMSgt	E9	19,606	100	55,966
		75172	1 TSgt	E6	12,509		
		75172	1 MSgt	E7	14,509		
		75250	1 Sgt	E4	9,342		
HQ PACAF	DPATM	75172	1 MSgt	E7	14,509	100	14,509
HQ SAC	DPPHTTO	75193	1 SMSgt	E8	16,716	100	81,257
		75172	1 MSgt	E7	14,509		
		75172	2 TSgt	E6	25,018		
		75172	2 TSgt	E6	25,018		
HQ TAC	DPPTO	75172	2 MSgt	E7	29,018	100	68,545
		75172	2 TSgt	E6	25,018		
		751x2	1 MSgt	E7	14,509		
HQ USAFE	DPATJ	75193	1 CMSgt	E9	19,606	50	51,954
		75172	1 TSgt	E6	12,509		
		75132	1 Sgt	E4	9,342		
Other OJT/OPR at the AF		75193	1 SMSgt	E8	16,716	100**	
		75172	1 MSgt	E7	14,509		
HQ USAFSS	DPAT	75172	1 TSgt	E6	12,509	100	12,509
HQ USAFA	DPMPO	751x2	2 SSgt	E5	21,292	100	85,837
		751x2	1 TSgt	E6	12,509	100	
Base level responsibility with MAJCOM emphasis		702x0	2 MSgt	E7	29,018	50**	
		702x0	4 TSgt	E6	50,036	50**	
		811x2	1 TSgt	E6	12,509	100	
Total Authorization = 138						Total Cost =	1,770,143

*Table 20, Annual Composite Standard Rates (FY 1977 - Effective 1 October 1976), p. A-112, AFR 173-10, Vol. 1 (C5), Attachment 27.
**Estimated by CONSAD; not supplied by respondent.

TABLE E4: Results of MAJCOM OJT/NCOIC Survey:
Respondent Estimates of OJT Time Requirements

MAJCOM	Trainees Per Supervisor Ratio	OJT % of Supervisors' Time	OJT % of Trainers' Time	Training % of Trainees' Time
HQ AFSC	3	10	40	35
HQ AAC	-	25	25	50
USAFA	1	20	25	80
HQ TAC	5	25	--	75
HQ AFLC	5	25	40	50
HQ MAC	5	16	16	50
HQ AFSC	4	17.5	17.5	77.5
HQ USAFSS	3	75*	75*	80
HQ ADCOM	3	--	--	--
Mean	3.6	19.8	27.25	61.9
Standard Deviation	1.4	5.73	10.55	16.67

*These values were excluded from calculations because they are extreme.

APPENDIX F: Excerpted Tables of Standard Rates from AFR 173-10, October 1, 1976

TABLE F1: Annual Composite Standard Rates
(for Airmen and Officers)
Table 20, p. A-112

GRADE	BASIC PAY	BASIC ALLOWANCE FOR QUARTERS	MISCEL-LANEOUS EXPENSE	INCENTIVE AND SPECIAL PAY	ANNUAL COMPOSITE STANDARD RATE
O–10	$39,600	$ --	$9,210	$1,226	$50,036
O–9	39,600	643	5,700	1,340	47,283
O–8	39,492	1,308	4,178	1,619	46,597
O–7	34,340	1,277	3,322	1,628	40,567
O–6	28,821	2,260	3,031	2,050	36,162
O–5	23,563	2,540	2,493	1,925	30,521
O–4	19,167	2,309	2,124	1,642	25,242
O–3	15,687	1,955	2,371	1,468	21,481
O–2	12,211	1,340	1,969	965	16,485
O–1	8,777	888	1,777	506	11,948
W–4	19,037	1,600	6,248	150	27,035
E–9	15,458	1,526	2,502	120	19,606
E–8	12,940	1,353	2,284	139	16,716
E–7	10,974	1,235	2,169	131	14,509
E–6	9,233	1,147	2,019	110	12,509
E–5	7,490	1,112	1,969	75	10,646
E–4	6,291	923	2,081	47	9,342
E–3	5,365	628	1,542	28	7,563
E–2	5,008	457	1,512	19	6,996
E–1	4,493	298	1,508	14	6,313
Cadets	4,140	--	1,308	--	5,448

[1] *Revised 15 October 1976. Rates are valid 1 October 1976–30 September 1977. They include the full 1 October 1976 pay increase (4.83%)*

Data Source/OPR: HQ USAF/DPPPB

TABLE F2: Average Annual Cost of Civilian Employees by Grade
Table 24, p. A-116

General Schedule	1976*	1977**
GS-01	6,544	6,894
GS-02	7,489	7,889
GS-03	8,792	9,222
GS-04	10,204	10,692
GS-05	11,713	12,275
GS-06	13,219	13,844
GS-07	14,333	14,939
GS-08	16,173	16,980
GS-09	17,526	18,412
GS-10	19,504	20,523
GS-11	21,086	22,227
GS-12	25,074	26,594
GS-13	29,147	30,814
GS-14	34,028	36,421
GS-15	39,601	42,525
GS-16	41,391	44,857
GS-17	41,391	44,935
GS-18	41,391	44,935

*Executive limit to basic pay for employees at $37,800 prior to October 1, 1976.

**The rate of basic pay for employees at these rates would be limited by Section 5308 of Title 5 of the United States Code to the rate level V of the Executive Schedule which becomes $39,600 effective October 1, 1976.

Data Source: OPR: HQ USAF/ACBOC

TABLE F3: Commands' Civilian Average Man-Year Costs

Table 25, p. A-117

MAJOR COMMAND	General Schedule			Wage Board			Direct Hire			Total 2/		
	FY 1976	FY 1977	FY 1978	FY 1976	FY 1977	FY 1978	FY 1976	FY 1977	FY 1978	FY 1976	FY 1977	FY 1978
AFAFC	15,149	16,073	17,201	15,004	16,055	18,204	15,028	16,096	17,250	15,060	16,096	17,231
USAFSS	17,152	17,909	19,157	13,074	16,217	17,540	14,510	16,057	17,189	14,519	16,058	16,251
AFSC	19,529	18,770	20,165	15,901	16,797	18,408	17,985	18,918	20,337	17,971	17,982	20,250
AFLC	17,390	18,916	19,368	17,491	19,920	21,619	14,866	16,345	17,301	15,010	19,043	16,971
ATC	14,214	15,173	16,381	14,867	16,550	16,964	16,584	17,901	19,063	16,962	17,999	18,721
MAC	14,659	16,118	16,542	14,470	16,081	17,619	14,211	15,608	16,871	14,299	15,494	16,193
AU	15,353	16,360	17,423	15,124	16,280	17,182	14,012	15,208	17,126	14,029	15,963	16,924
NAC	13,851	15,006	15,870	11,761	14,229	16,240	16,039	16,440	17,170	15,318	15,808	17,129
AAC	16,180	17,604	18,791	14,395	16,647	18,051	14,217	16,415	17,200	14,200	15,034	16,907
PACAF	16,587	17,290	18,551	26,704	30,009	33,562	22,161	25,787	28,520	21,770	25,445	27,702
TAC	11,754	14,140	14,767	18,676	21,107	22,784	8,605	9,160	10,599	10,321	14,607	15,056
AFCOM	14,993	16,262	17,611	14,434	16,165	15,609	11,910	14,071	15,847	14,019	14,300	15,000
USAFE	14,600	15,852	16,904	15,716	17,020	19,110	15,210	17,091	18,406	15,106	16,005	16,100
USAFA	13,667	14,407	15,504	12,142	14,026	15,148	12,514	14,012	15,142	12,405	13,460	13,001
				13,059	15,551	16,014	13,721	15,146	16,310	13,749	15,005	16,241

1/ FY 76 factors are based on actual costs. FY 77 factors include the 1 Oct 76 pay raise for GS. FY 78 factors include any scheduled pay increases for Wage Board, Direct or Indirect Hire Personnel. Increases pending negotiation are not included.

2/ Total includes Indirect Hire.

Data Source/OPR: HQ USAF/ACMOC

APPENDIX G: ECI Authorized Personnel by Grade and Data Formats for ECI Course Enrollment Files

TABLE G1: ECI Authorized Personnel by Grade

Office	Personnel by Grade	Totals		
		Officers	Airmen	Civilians
Command (CC)	1-O5, 1-O6, 1-GS7	(2)	(0)	(1)
Administrative Control Division (DA)	1-O5, 1-E6, 1-GS4, 1-GS6	1	1	2
Education Information Branch (DAV)	1-O4, 1-E6, 1-GS4, 1-GS5	1	1	2
Printing Control Branch (DAP)	1-O4, 1-GS3, 2-GS5	1	0	3
	Division Subtotal	(3)	(2)	(7)
Curriculum Division (EDC)	1-GS5, 1-GS14	0	0	2
Text Review Branch (EDCT)	15-GS12, 1-GS13	0	0	16
Test Development Branch (EDCI)	1-GS4, 2-GS7, 14-GS12, 1-GS13	0	0	18
Editorial Branch (EDCE)	10-GS6, 1-GS7	0	0	11
Curriculum Control Branch (EDCA)	4-GS3, 2-GS4, 2-GS5, 1-GS7	0	0	9
	Division Subtotal	(0)	(0)	(56)
Operations Division (EDO)	1-O5, 1-GS5	1	0	1
Registrar Branch (EDOR)	5-GS3, 1-GS4, 1-GS9	0	0	7
Student Instruction Branch (EDOI)	9-GS5, 6-GS6, 4-GS7, 1-GS9	0	0	20
Data Branch (EDOD)	1-WG4, 1-WG5, 9-GS3, 1-GS4, 4-GS5, 1-GS7, 1-GS9	0	0	18
	Division Subtotal	(1)	(0)	(46)
Plans and Programs Division (EDX)	1-O4, 1-O5, 1-E7, 2-GS5, 1-GS9, 1-GS12	(2)	(1)	(4)
Evaluation and Research Div (EDV)	4-O3, 1-O4, 1-E6, 1-GS5, 2-GS12	(5)	(1)	(3)
Course Materials Division (DMS)	1-O5, 1-GS5	1	0	1
Materials Control Branch (DMSA)	1-E4, 1-E6, 1-GS3, 3-GS4, 1-GS5, 1-GS9	0	2	6
Storage and Distribution Br (DMSD)	1-E3, 14-WG5, 3-WG6, 3-WG8, 3-WG10, 1-WS4, 1-WS5, 1-WS9, 1-WL6, 1-GS9	0	1	28
	Division Subtotal	(1)	(3)	(35)
ECI Totals		14	7	152

ECI Monthly Summary by Reason (PCNUE020-49A)

The report details monthly activity by Reason for Enrollment within each active course number. It is divided into three sections: (1) Professional Military Education Courses; (2) Specialized Courses; and (3) Career Development Courses. A summary total is shown at the end of each section with an overall summary of all courses at the end of the product. Explanations of titles follow:

RSN	Reason for Enrollment (See Atch 4)
OB	Opening Balance is closing balance as of the end of previous month. This is the total of all records on file (before this processing run) including both active and inactive enrollees.
YTD ENR	Year-To-Date Enrollments includes enrollees through end of month being reported on since the beginning of the current CY.
MO ENR	Month Enrollments - Those students enrolled during current month.
SP	Solutions Processed - Volume Review Exercises (VREs) and Course Examinations (CEs) processed during the current month.
CC1	Course Completions One - Satisfactory completions of CE on first attempt during current month.
CC2	Course Completions Two - Satisfactory completions of CE on second attempt during current month.
CC TOT	Course Completions Total - Total satisfactory completions during current month.
CF1	Course Failures One - Failures of CE on first attempt during current month.
CF2	Course Failures Two - Failures of CE on second attempt during current month.

AE — Administrative Expedience - Records dropped due to retirement, deaths, and other administrative reasons.

NS 12 — No-Start Twelve - Student records dropped during current month due to nonsubmission of any VREs in 12-month period.

NC 18 — Non-Completion Eighteen - Student records dropped during current month due to noncompletion in 18-month period. Includes students who completed one or more volumes during the 12-month period but did not complete the course nor request an extension.

ACTIVE — Total active records on file of students still within the prescribed 12-month enrollment period.

INACTIVE — Total number of students who completed one or more volumes during first 12 months but did not complete the course nor ask for an extension. These students remain in Inactive Status for an additional 6 months and then are dropped as NC 18 if course is not completed nor an extension requested.

CB — Closing Balance - Reflects total number of active and inactive enrollees as of the end of current month.

ECI Monthly Summary by Category (PCN UE020-49B)

The report details monthly activity by Category of Enrollment within each active course number. It is divided into three sections: (1) Professional Military Education Courses; (2) Specialized Courses; and (3) Career Development Courses. A summary total is shown at the end of each section with an overall summary of all courses at the end of the product. Explanations of titles follows:

CAT — Category (See Atch 3)

OB — Opening Balance is the closing balance as of the end of the previous month. This is the total of all records on file (both active and inactive) before this processing run.

YTD ENR	Year-To-Date Enrollments includes enrollees through end of month being reported on since the beginning of the current CY.
MO ENR	Month Enrollments - Those studens enrolled during current month.
CC	Course Completions - Total satisfactory completions during current month.
OTH ATT	Other Attritions - Encompasses all attritions other than satisfactory course completions during current month.
CB	Closing Balance - Reflects total number of active and inactive enrollees as of the end of current month.

History File
ECI Summary by Reason and Category (PCN UE020-36A/36B)

The report relates attritions within each course by student category and reason for enrollment to actual enrollments during a specified period of time. It is divided into three sections: (1) Professional Military Courses; (2) Specialized Courses; and (3) Career Development Courses. Data are shown by Reason for Enrollment (PCN UE020-36B) and by Category and Reason (PCN UE020-36A) for each active course. Summaries are provided at the end of each section. Frequency of report is quarterly. It spans a 24-month period, the first three months of which is the enrollment period being reported upon, i.e., January-March 1975 report a/o end December 1976; April-June 1975 report a/o end March 1977; July-September 1975 report a/o end June 1977; October-December 1975 report a/o September 1977; and so forth. Explanation of titles follows:

CATEGORY	See Atch 3
RSN	Reason for Enrollment (See Atch 4)
ENR	Enrollment - Number of students enrolled during reported period.
CC1	Course Completion One - Satisfactory completions on first examination.
CC2	Course Completion Two - Satisfactory completions on second examination.
CC TOTAL	Course Completion Total - Total satisfactory completions.
AVG MO	Average Months - Average number of months taken for satisfactory course completion.
RATE	Percent of satisfactory completions to total enrollment.
FAILURES TOTAL	Failures on second course examination.
RATE	Percent of failures to total enrollment.

NS 12	No-Start Twelve - Student records dropped due to non-submission of any Volume Review Exercises in 12-month period.
NC 18	Non-Completion Eighteen - Student records dropped for not completing course after 18 months.
AE	Administrative Expedience - Records dropped due to retirements, deaths, and other administrative reasons.
TOTAL ATT	Total Attrition - Total of NS 12, NC 18, and AE.
RATE	Percent of non-completions to total enrollment.

Categories

1	AFRES-EAD OFF
2	AFRES-EAD AMN
3	ANG-EAD OFF
4	ANG-EAD AMN
5	Reg AF-OFF
6	Reg AF-AMN
7	CAP
8	Army - ACT/RES/NG
9	Navy - ACT/RES
Q	Marine - ACT/RES
H	Coast Guard - ACT/RES
A	AFRES - Non-EAD OFF
B	AFRES - Non-EAD AMN
C	ANG - Non-EAD OFF
D	ANG - Non-EAD AMN
F	Allied Military
P	U. S. Civilians
S	Allied Civilians

Reasons for Enrollment

Codes

A	Other Directed Enrollment: Personnel enrolled as required by regulation, manual, or other directive except those specified for Code L; includes personnel in qualification training under AFM 50-23. Allied military and civilians not living in the US use this code.
C	Career Related Enrollment: Personnel enrolled voluntarily to expand knowledge of their own or related career fields; also reservists in categories A, B, C, and D who desire to take the course exam; excludes Code X enrollees.
L	OJT Upgrade, Lateral or Retraining to AFSC: Enlisted personnel in categories 2, 4, 6, B, and D enrolled as directed by AFM 50-23; also includes personnel enrolled in Course 9 to meet the management requirement for 7-level upgrading.
N	Non-Career Related Enrollment: Personnel enrolled voluntarily in pursuit of their personal education, avocation or other goals; excludes Code C enrollees.
X	Non-EAD Retirement Point Credit: Personnel in categories A, C, B, and D who desire to complete VREs only for retirement point credit; excludes those who wish to complete course exams (Code C).
OTH	Other - Enrollees not coded A, C, L, N or X.

APPENDIX II: Format and Sample of CDC Costing Data for Course Development and Revision (provided by ATC/TTSS, November 22, 1977)

1. CDC 29150

2. Telecommunications Operations Specialist

3. Revision, Activated August 1973

4. Number of Volumes: Three

5. Course Control Document Costs

	Grade	Man-Hours	Hourly Rate	Cost
a. Plan of Instruction (POI)	MSgt	80	$5.28	$ 422.40
	GS-12	4	$8.65	34.60
	Total Cost			$ 457.00*
b. Course Chart	MSgt	10	$5.28	$ 52.80
	GS-12	2	8.65	17.30
	Total Cost			$ 70.10*

c. Other Costs: None

6. CDC Volume Costs:

Volume 1

a. Writing and Editing	MSgt	407	$5.28	$ 2,148.96
	GS-11	132.5	7.25	960.63
	Writing and Editing Costs			$ 3,148.96
b. Reviewing	GS-12	12	$8.78	$ 104.80
	Writing, Editing, and Reviewing Costs			$ 3,253.76

Volume 2

a. Writing and Editing	MSgt	393	$5.28	$ 2,075.04
	Ssgt	73	3.99	291.27
	Writing and Editing Costs			$ 2,366.31

		Grade	Man-Hours	Hourly Rate	Cost
b.	Reviewing	GS-12	16	$8.52	$ 135.80
		GS-11	4	7.25	29.00
	Writing, Editing, and Reviewing Costs				$ 2,531.11
	Volume 3				
a.	Writing and Editing	MSgt	326	$5.28	$ 1,721.28
		SSgt	82	3.99	327.18
	Writing and Editing Costs				$ 2,048.46
b.	Reviewing	GS-12	30	$8.61	$ 261.15
		GS-11	6	8.30	49.80
	Writing, Editing, and Reviewing Costs				$ 2,359.41
7.	CDC Change Costs				
a.	Writing	MSgt	50	$5.28	$ 264.00
b.	Editing	GS-12	5	9.25	46.25
	Change Costs				$ 310.25*
8.	CDC Support Costs				
a.	Artwork/Illustrations (Including photo work)	GS-7	243.5	$4.50	$ 1,102.62
b.	Typing	GS-3	279	3.41	926.20
c.	Manuscript postage				Unknown
d.	Other costs (TDY, etc.)				None
e.	Correspondence				None
	Total Support Costs				$ 2,028.82
	Total Cost of 29150 CDC Writing, Editing, Reviewing, Changes, Artwork/Illustrations, and Typing				$11,010.45**

*This is an estimate. Records are not available on the costs of POI, Course Chart or changes.

**Add also: GS-13, 1 hour; and GS-3, 1 hour; for HQ ATC Management and Administrative costs.

APPENDIX I: References

Chapter 1

1. Department of the Air Force, Headquarters USAF, Cost Analysis - USAF Cost and Planning Factors, Vol. 1, AFR 173-10, Washington, D.C., 18 June 1976.

2. Department of the Air Force, Headquarters USAF, Manpower - Air Force Manpower Standards, AFM 26-3, Washington, D.C., 15 November 1972.

3. Department of the Air Force, Headquarters USAF, Training - On-The-Job Training, AFM 50-23, Washington, D.C., 15 August 1974.

Chapter 2

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