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NAVY TOTAL FORCE MANPOWER

REQUIREMENTS HANDBOOK

NAVY MANPOWER ANALYSIS CENTER
MILLINGTON, TN

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FOREWORD

This Handbook provides an explanation of work measurement and methods study tools and techniques frequently used in conducting productivity improvement studies and determining manpower requirements. It also provides some reporting formats to guide the analyst in manpower requirements determination/staffing standards studies. We included only those tools and techniques our customers indicated would be of most use to them.

Study procedures used to determine manpower requirements and develop staffing standards should comply with governing military and civilian manpower and classification directives. The tools and techniques found in this document should be used in conjunction with established industrial engineering techniques, not as the sole authoritative source for conducting manpower requirements studies. This Handbook does not replace recognized industrial engineering techniques contained in many other sources. You should refer to various industrial engineering reference books for additional tools and techniques, as appropriate.

We strongly encourage you to submit recommendations to add or change any portion of the Handbook to include manpower study methods you have found to be successful. It is only through sharing our successes that we can ensure this document remains a useful tool to our customers. Submit your recommended changes to Navy Manpower Analysis Center (NAVMAC).

CHAPTER 1

THE FIVE STEPS TO PERFORMING A STUDY

100. General. When the decision is made to perform a manpower requirements determination study on a particular function, branch, or even an entire organization, the analyst needs to plan out what needs to be accomplished to ensure the validity of the study. Studies can be divided into 5 steps. How the analyst plans and executes each phase impacts the validity of the final output -- minimum manpower requirements needed to perform the activity's directed mission, functions, and tasks (MFTs).

101. Steps to Performing a Study

1. Step 1 - Planning. The following actions normally occur during this step:

a. Determine study dates.

b. Select and train study analysts.

c. Notify the appropriate activity or functional area of the study.

d. Begin background research of materials that will provide knowledge of the activity.

e. Identify points of contact (POCs).

f. Develop an initial study strategy.

g. Develop an initial Plan of Action & Milestones (POA&M).

2. Step 2 - Data Gathering. Although this steps starts during the planning process, this is where application of any of a number of tools and techniques occurs to conduct work measurement and methods studies. Most of the tools and techniques used during this phase require direct observation of the workers or access to work records and supervisors. The tools and techniques used may vary from component to component within the same activity. The following actions may take place during this step:

a. Assemble a library of working documents that will provide knowledge of the activity. This information will assist the analyst in determining or refining the relative scope, methodology, and strategy. The analyst also needs this information to identify organizational relationships. **It is during this step that the analyst validates an activity's peacetime and/or mobilization mission.** Data gathering should include, but is not limited to:

(1) Activity's current Activity Manpower Document (AMD).

(2) Pertinent directives for the purpose of answering questions such as:

(a) What directives, publications, documents, letters, agreements, etc., task the activity with its peacetime and/or mobilization mission?

(b) What is tasked to be done?

(c) Who, in the chain of command, tasked the activity?

(d) Who is resourcing the directed tasking?

(e) When and for how long must the tasking be done?

(f) For mobilization: Does the tasking and/or workload change as time progresses during an increased condition of readiness or increase or decrease from normal the peacetime tasking? Does the performance of how peacetime functions are accomplished change when there is an increased condition of readiness?

(3) Previous studies (e.g., Efficiency Review Report (ERR), audit reports).

(4) Past organizational or methods changes.

(5) Current methods of operation.

(6) Existing staffing standards.

(7) Commercial Activities (CA) Program status.

b. Validate the activity's mission to ensure all taskings are supported in writing from higher authority. This is important because it ensures only authorized, not assumed, taskings are used in determining manpower requirements. The analyst should validate any inferred tasking with the manpower claimant and initiate action to amend tasking directives prior to using the workload to support manpower requirements.

c. Evaluate the organizational structure for effectiveness with respect to the mission. Information gathered during the planning step will assist in this review. The activity's Standard Organizational Manual (SORM) will provide a current diagram of the organization's structure. Compare this structure to the governing directives as well as to other similar activities. Look for:

(1) Too many layers.

(2) Nonessential positions.

(3) Too many supervisors (narrow span of control).

(4) Duplicate functions or tasks.

(5) Multiple units of minimal size.

(6) Overly specialized units limiting flexibility.

(7) Misalignments with mission and/or functions.

(8) Excessive overhead.

(9) Paygrades too high.

(10) Deviations from normal career ladders.

(11) Confused lines of authority and/or responsibility.

(12) Too many deputy or staff positions.

If the study identifies a need for fewer people in an organizational component, investigate support areas for possible reductions to support manpower requirements. How to conduct an organization analysis is discussed in a later chapter.

d. Refine the Performance Work Statement (PWS) if used. The PWS is a valuable tool and is discussed in Chapter 2.

e. Evaluate applicable staffing standards identified during the planning step for potential application within each organizational component. The purpose of this evaluation is to determine whether the existing standard generates manpower requirements that are appropriate for an efficient operation. During this review, it will be necessary to gather and use current workload data in applying the equation. The analyst can use additives or subtractives to the standard to account for unique taskings. A later chapter deals with the development of staffing standards.

f. Conduct work measurement to ensure and validate personnel are fully productive and to provide unit times necessary in conducting methods improvement and predicting future workload requirements. Later chapters address some of the tools used to conduct work measurement or perform methods studies, as well as some data collection forms one can use when collecting and recording measured work-hour data.

g. Conduct a risk analysis to assess the risk associated with reducing or eliminating a tasking. This is valuable when asking what if questions. In analyzing a category, your prime concern is whether or not you can eliminate that category in its entirety. The analyst, in conjunction with the activity's managers and subject area experts, must establish the categories of risk. Appendix A provides a detailed explanation of how to complete the Risk Analysis Worksheet and conduct the analysis. The minimum risk levels should be:

(1) High - infers detrimental to national defense and/or mission essential (e.g., safety, health, etc.).

(2) Medium - effects the level of service; however, could function without detriment to the mission.

(3) Low - no adverse effects.

3. Step 3 - Data Analysis

a. Data gathering and data analysis go hand-in-hand and are generally done during the same time frame. When data gathering is done at a remote site, the analyst may postpone data analysis when possible, to conserve travel funds. The hazard here is the analysis may generate new questions for data

not gathered. If analysis is not to be performed on-site, take special care during the original work measurement and methods study to obtain data in sufficient detail to allow later analysis.

b. When considering an improvement in one organizational component, be sure to anticipate the potential impact on other components so as not to create new problems elsewhere. Carefully examine solutions to problems provided by activity personnel, particularly when the solution seems the obvious thing to do. There may be a reason why this solution has not been implemented. Analysts should try to find more than one source of information on a particular possibility. The more information obtained on a possible problem, the easier it will be to distinguish real problems from matters of individual bias.

c. Ensure you concentrate on truly significant improvement areas. It is easy to expend a lot of time and money investigating a problem that would not save any significant amount of time or money even if solved. Individuals must be given freedom to be innovative and creative in developing proposals for improving the organization. Senior management can weigh the potential impact or value of recommendations after all the facts are presented and considered .

d. It is extremely important to have credible documentation to back up any recommendation changing the organization or recommending increases/decreases in manpower. The analysis must be thorough enough so the basis for conclusions and improvements can be presented clearly and in a manner convincing enough to demonstrate their correctness.

e. Develop the Statement of Manpower Requirements (SMR) and/or Mobilization Statement of Manpower Requirements (MSMR) during this step. In general terms, the analyst develops the SMR/MSMR by calculating quantitative and qualitative manpower requirements based on work measurement and methods improvement data. The SMR/MSMR will reflect the skill and manpower mix requirements needed to support the activity's directed MFTs and associated workload. Be sure to include other manpower considerations that might impact the development of an SMR (e.g., contractor manpower, deprived ratings and Navy Enlisted Classifications (NECs), use of Temporary Additional Duty (TAD) and temporary/transient personnel, etc.). Take care to coordinate and balance changes made in each area to ensure the overall organization is effective and efficient. Use of the

following forms and resources will assist in development the SMR:

(1) The Minimum Manpower Computation Sheet provides a means to compute and document minimum manpower requirements and provides an audit trail for inclusion of required standby work-hours as a part of total productive work-hours on the Work-Hour Requirements Consolidation Sheet.

(2) The Work-Hour Requirements Consolidation Sheet provides a means to consolidate measured work-hours collected by multiple measurement techniques and to incorporate nonsampled overtime, minimum manpower requirements, and standby work-hours into total work-hour requirements.

(3) The Work Distribution Chart provides a means of associating minimum skill levels required to perform work (qualitative requirements) with work-hours identified by productive categories (quantitative requirements) to produce an SMR and/or MSMR baseline. Separate Manpower Distribution Charts should be prepared for each organizational component.

(4) Appendix B is a questionnaire designed to assist in determining the impact of additions, changes, and/or deletions to MFTs, workload, and manpower requirements.

(5) Use Human Resource Office assistance, Office of Personnel Management (OPM) Handbook of Occupational Groups and Families, and the DOD Manual 1312.1M (Occupational Conversion Manual) when determining civilian paygrades and job series. Use NAVPERS 15839I and NAVPERS 18068F when determining military skills.

4. Step 4 - Documentation and Reporting

a. Use backup data, including narratives of study findings and recommendations, to support the SMR/MSMR. Good record keeping will ensure program integrity, realization of expected benefits, and adherence to standards and performance criteria identified in the study.

b. At the conclusion of the study, the manpower claimant or activity should maintain a project file with all working papers, data collection forms, computer listings, and other data used and/or developed during the study. These files will assist in the review and approval process and should allow a reviewer not familiar with the study to follow the steps taken and

clearly understand the findings of the study. Clear and complete audit trails are very important and will greatly enhance future study efforts.

c. Manpower claimants determine how their activities are to summarize and report the outcome of the study; however, the analyst should present the results in a logical, easy-to-understand format.

5. Step 5 - Implementation. Complete and submit a Total Force Manpower Management System (TFMMS) or TFMMS Micro Manpower Change Application (TMMCA) package reflecting validated additions, changes, or deletions to the activity's SMR/MSMR. A study is not complete until the claimant approves the SMR/MSMR and supporting documentation and the AMD/TFMMS reflects the approved changes.

CHAPTER 2

PERFORMANCE WORK STATEMENT (PWS) AND WORKLOAD INDICATOR (WI) DEVELOPMENT

200. PWS Development

1. General

a. A PWS:

(1) Identifies authorized work to be done without stating how to do the work,

(2) Identifies authorized products or services (output) from individual departments, divisions, or the activity as a whole, and

(3) Establishes standards for quantity of output.

b. A PWS serves as a basis for work measurement, methods improvement, and other industrial engineering and management tools both within and outside the study process. It also provides information useful in budgeting, managing, and decision-making to continuously evaluate the resource and methods tradeoffs to enhance mission performance, quality, efficiency, and effectiveness.

2. When building the PWS, break down the activity into organizational components beginning with activity (mission), directorates or departments (functions) and on to the next lower levels (e.g., divisions and branches (subfunctions)). Continue this process until the subdivisions reflect groupings of personnel performing work in support of a common function/ subfunction, usually in a centralized area, and at a level of detail being considered for the outputs (authorized products and services) associated with the PWS.

3. A further systematic breakdown of the work performed within an organizational component into categories, tasks, subtasks, and even elements may be required to perform work measurement and/or methods study to determine work-hour requirements and/or improve processes and procedures. Appendix C provides a suggested PWS worksheet and instructions for its use.

4. It is extremely important that each category/task be distinct enough to be recognizable to the reader. Structure categories so they are independent and the reader can easily identify them with a WI(s) and manpower requirement skill. Recommend brief statements using a verb and noun to describe tasks, etc., for ease of use in work measurement and methods improvement. Add notes, when necessary, for clarity and to identify exactly what a particular task/subtask/element includes. Failure to define work specifically and clearly may inhibit data analysis and invalidate study results. The Required Functional Category (RFC) codes, found in the TFMMS Coding Directory, provide an excellent source of PWS descriptions.

5. Appendices C and D show, respectively, how to use the PWS Worksheet and examples of two levels of PWS detail:

a. Detailed. Provides a breakdown of functions/ subfunctions into categories and tasks. This breakdown of work is ordinarily required for organizational components where methods improvement or detailed application of work measurement techniques are going to be used. This does not mean that the final PWS will require this level of detail.

b. Condensed or macro. Used in areas where little or no methods improvement or detailed work measurement is considered necessary (i.e., the current methods and procedures and staffing appear to be efficient and the cost of detailed analysis might outweigh the potential for efficiencies to be gained).

201. WI Development

1. General. WIs are a characteristic of the output of a work process that can be measured against standards of performance in terms of production or service and can be used in measuring the effect of process improvements.

2. WIs are selected and contained within the PWS to quantify the output from each organizational component and can be used in measuring the effect of process improvements.

3. After the WI has been identified, the next step is to define an acceptable quality level for each WI to ensure performance is within acceptable levels and to help identify workload changes that are sufficient to drive a change to the SMR.

4. Ensure WIs represent final output rather than the work process. WIs must be readily identifiable and countable products or services and representative of the majority of the defined workload they are associated with in the PWS. Collectively, WIs constitute the measure of output for an organizational component, and when related to broader mission areas, the output of a Navy activity.

5. Whenever possible, use existing management information systems as a source for collecting information on WIs. Do not allow the collection, analysis, and monitoring of indicators and changes in workload to become so difficult they in themselves become excessive new workload.

CHAPTER 3

STAFFING STANDARDS AND MANPOWER ESTIMATING MODELS (MEMs)

300. Staffing Standards Development

1. General

a. Staffing standards are defined as Department of Defense (DOD) component-approved quantitative and qualitative expressions of personnel requirements needed to perform prescribed tasks at varying levels of workload. The objective of developing staffing standards is to articulate the mathematical relationship between a work center's SMR and its workload. Staffing standards are management tools for determining the equitable distribution of limited manpower resources. They may be used to support Program Objectives Memorandum/Planning, Programming, and Budgeting System/Future Years Defense Program (POM/PPBS/FYDP) manpower requirements; answer "what if" questions; project future manpower requirements; and speed up a shore manpower requirements determination study.

b. MEMs are macro-level models designed to provide "roughly right" manpower estimates. The "top-down" methodology used to develop macro-models is a less rigorous approach than the "bottom-up" approach used to develop manpower requirements at the work center level. Models are developed when there is a need for a higher level of aggregation, when a quick estimate is desirable, and/or when less precision is necessary or attainable.

2. Staffing Standards Development Process Milestones. Prior planning will facilitate the development of staffing standards. Recommend the following steps in conducting staffing standards studies. Subsequent paragraphs detail each step.

a. Develop a "standard" PWS for each staffing standard, including associated WIs (i.e., potential workload factors (WLFs) and work units). (Note: WIs and work units are potential WLFs for staffing equation development purposes and will be referred to when discussing staffing standards development as Potential WLFs regardless of their origin.)

b. Identify the potential universe of activities to be covered by the standard. If multiple RFCs are involved, identify the universe for each RFC.

c. Determine a representative sample of the work centers to be measured from the potential universe.

d. Select the appropriate work measurement methods for collecting manpower/work-hour requirements and associated potential WLFs.

e. Perform data gathering/analysis during studies.

f. Perform computations, using All Purpose Language Statistics (APLSTATS) or other computer software capable of performing statistical/regression/correlation analysis and select the best model based on guidelines provided herein.

g. Write a staffing standard report for each standard developed using the recommended report format provided.

3. PWS Development

a. Defining the work center for which a standard is to be developed is a critical step. This process of defining the work center assumes added significance because the standard is normally applicable at multiple locations and at varying workload volumes. Work centers must be defined in a manner that relates the associated manpower cost with WIs/WLFs. A work center is defined as a grouping of personnel using similar machines, processes, methods, operations, and performing homogeneous type work, usually located in a centralized area. The term is used to identify a relatively small activity within a broad functional segment. Personnel within a work center perform work that basically contributes to the same end product or result, and their duties are similar or closely related. Work centers are similar to organizational components. The PWS should isolate those categories/tasks that have a significant impact on the staffing requirement, but are not common to work centers at all locations, for separate treatment. To meet these requirements, analyze the various required tasks of the work center in detail. Identify and document tasks at a level of detail that best accommodates data gathering, analysis, and computation.

(1) Identify each task either as common to the work center at all locations or for separate treatment.

(2) The level of detail expressed in the PWS should ensure comprehensive and accurate data gathering.

(3) Select the best data gathering method for each category/task or for any given group of categories/tasks.

b. Figure 3-1 presents a condensed hypothetical example of a detailed analysis extending through basic motions. Although it is rarely necessary to use this amount of detail, the example illustrates an analysis that can be carried to the nth degree, if necessary, with the relative value of each task clearly evident from its position in the structure. With tasks arrayed in such a manner, potential variables in the work center can be isolated, and by analyzing subordinate subtasks, possible sources can be identified. The net result is a list of potential variables that must be separately quantified during the manpower requirements determination study to ensure successful development of a staffing standard that can be applied at applicable locations.

c. RFCs in the TFMMS Coding Directory provide an excellent source for PWS information.

d. Other Considerations

(1) Additives. During data gathering, unique work requirements (additives) may be identified at some activities. Credit these additive workload requirements only to those activities performing the additive task. Therefore, associated additive work-hours should be collected and processed as a separate entity. Since additive workload may fluctuate as activity taskings change, it is desirable to identify related WLFs to provide a realistic association with additive work-hours.

(2) Deviations. Data gathering may indicate significant time variations for performing functions or tasks. When significant variations are noted, data gathering should be accomplished as scheduled; however, analysts should research and analyze the reasons for time variations. Deviations are normally defined in terms of procedural, equipment, or climate differences; rather than any differences in the description of the work. When valid deviations do exist, single-point standards may be appropriate. When deviations are identified and analyzed, decide on the feasibility of implementing the staffing equation at the locations where deviations exist. In most instances, separate equations will be required.

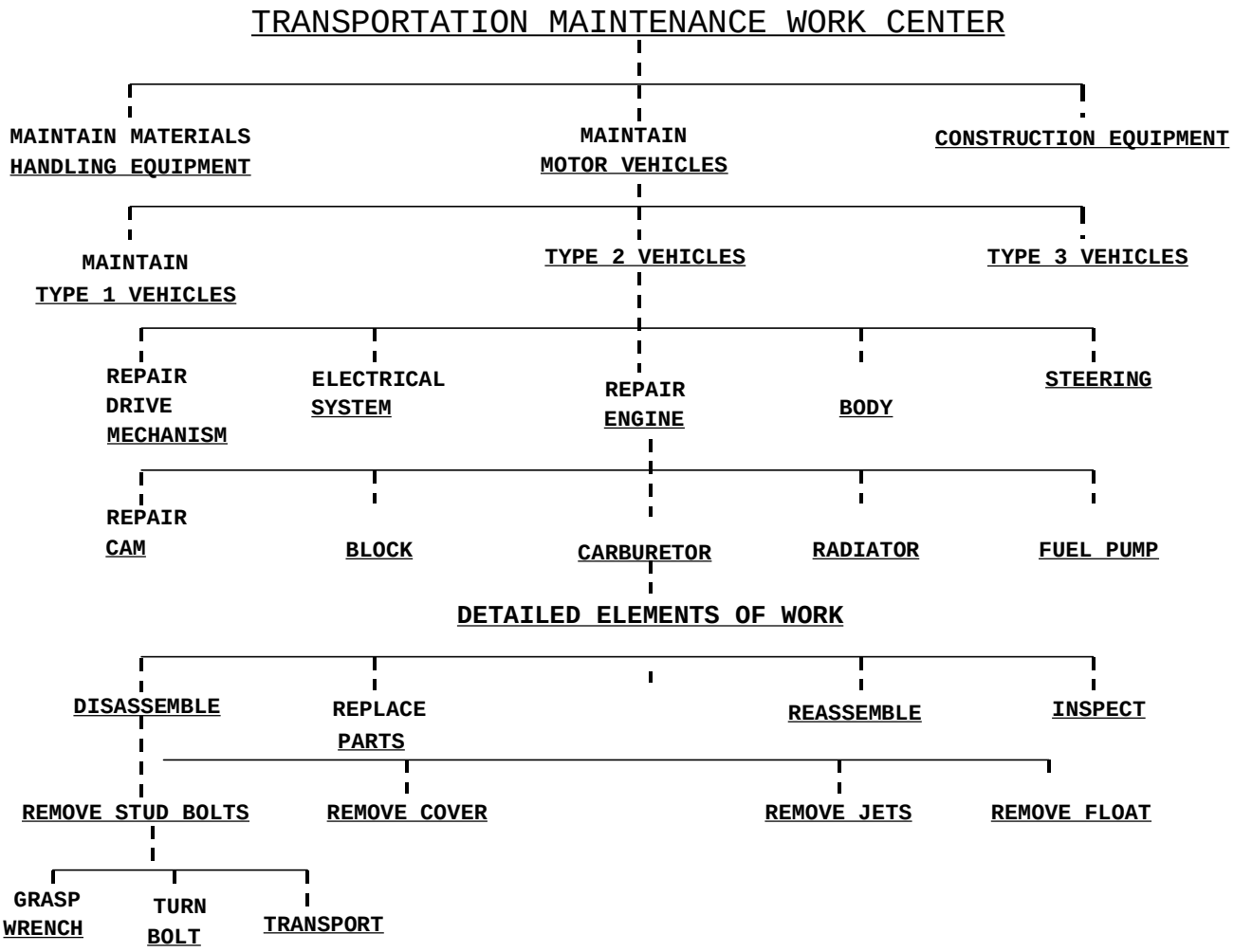


Figure 3-1. Example of Work Center Definition Process

(3) Exclusions. Identify and document categories/tasks not required at a specific activity, which are required and common to other like activities. Derive work-hours associated with exceptions caused by excluded workload from measurement at other like activities.

e. WIs, WLF, and Work Units (Potential WLFs)

(1) Identify potential WLFs for each category and major task of the PWS. This will make it possible to conduct a meaningful analysis of like category/task time variances during the initial steps of computation.

(2) Potential WLFs should be:

(a) Directly related to the time and effort expended on the associated task.

(b) Economical and convenient to report and use.

(c) Mutually exclusive, so as not to count any item/task under more than one work unit.

(d) Susceptible to audit, so the accuracy of the work count can be readily verified.

(e) Readily understood by those who plan, schedule, and control the work.

(f) Clearly identifiable when production is in progress or has been completed.

(g) Helpful in indicating specific opportunities for management improvement.

(h) Individually standardized in terms of the procedures required for their accomplishment.

(3) Identify potential WLFs for the staffing standard early in the study. A WLF is an index or unit of measure consistently relatable to the work required to accomplish the defined responsibilities of the work center. Since it is unlikely we can determine ahead of time which WLF will be best, it is necessary to identify and define all potential WLFs that may be used. There are three types of WLFs:

(a) Work Generator or External. These are factors beyond the control of the work center influencing the amount of

work required (e.g., station military population or monthly flying hours). These factors are likely to be predictable (programmable) and are probably already being reported.

(b) Production or Internal. These WLFs are a count of units of output physically produced by the work center (e.g., engines repaired or customers serviced). These factors may be more difficult to program or collect, but are usually highly related to direct work-hours expended.

(c) Equivalent. These WLFs are artificially constructed following measurement from weighted combinations of either external, internal, or both types of WLFs. An example is: equivalent acres of ground maintained (X_e); made up of improved grounds (X_i), semi-improved grounds (X_j), and unimproved grounds (X_k); the formula is: $X_e = X_i + .5X_j + .15X_k$. These factors eliminate or reduce the need for multivariate equations, and are particularly useful where all WLFs do not exist for all locations. Since relationships are seldom known prior to data gathering, potential equivalent WLFs are rarely encountered.

(4) The ideal WLF has two highly significant attributes:

(a) Relationship. A change in the WLF's value accurately predicts a corresponding change to the work-hour requirements generated by the staffing equation. Without this attribute, no relationship exists.

(b) Predictability. The value of the WLF can be predicted to make the standard useful as a programming tool. The study team must thoroughly investigate the PPBS process as it relates to the specific functional area. A list of predictable WLFs should result when careful attention is paid to facts that were used to support budget submission, FYDP development, and POM submissions. Tasking that is programmed over a five-year period is particularly important. This type of information will probably have to be obtained from the manpower claimant or functional sponsor.

(5) Every effort must be made to identify WLFs that are both predictable and relatable.

(6) Identify potential WLFs in a logical manner:

(a) Identify work generator or external WLFs first. These are probably already being reported in some form. When these WLFs cannot be identified or there is a low probability of

high correlation between WLFs and work-hours, identify production or internal WLFs.

(b) Additional potential WLFs may be obtained by analyzing lower levels of the work center structure.

(7) Evaluate WLFs by arranging them in order of development (i.e., the external type first). Eliminate those not readily identified or easily counted, and any that are relatively insignificant to the total work center cost. Those remaining are the potential WLFs for which a count should be obtained during data gathering. The source of this count should be specifically identified. For WLFs that are time dependent, specify the time period in the WLF definition. A minimum of three potential WLFs should be considered for each work center.

(8) Use terms that reflect an actual experience, not programmed workload (i.e., use "assigned" vice "authorized" strength for population factors and "hours flown" vice "hours programmed" for flying hour factors). After subsequent phases have accurately established the WLFs for the standard, revise the factor titles and definitions to reflect program terminology.

(9) Reference sources of WLF information that are projected for future time periods. These sources may include the Department of the Navy FYDP, Pilot Training Rates (PTR), and the Resource Analysis and Planning System (RAPS). Historical workload reports without workload projections are <u>not</u> sources of programmable data and must not be listed.

f. <u>Establishing a Work Count System</u>

(1) Develop the list of items to be counted during the identification of WIs and potential WLFs. Establish a procedure to obtain a count. This production count should be the activities' source of potential WLF parameter data. Preferably, the production count will be installed as early as possible so the work center personnel will become accustomed to the count. This procedure will facilitate incorporation of any necessary changes into reporting systems to ensure desired information will be obtained in an efficient and timely manner. Compare measured WLF counts against historical records/data during the on-site period to ensure the validity of data obtained.

(2) Analysts should carefully review existing workload reporting systems to determine whether the required items are already being reported. If the reported information differs

only slightly from that required, determine if it would be more economical to modify the existing report vice establishing an additional report.

(3) Recommend the following considerations to ensure an accurate and usable work count.

(a) Clearly specify what constitutes a unit of count. Reporting should include a cut off date, a specific reporting period, and clear identification of the work count.

(b) Identify/establish the source of count, or the point in a process at which a unit of count results. Citing a report title is not sufficient. Identify down to the exact section, line, or item in the source document so there is no room for misinterpretation.

(c) Report frequencies so they are compatible with the anticipated length of the on-site period. This is especially important if work sampling is prescribed.

(d) Establish safeguards that will minimize the possibility of duplicate or missed counts such as work performed at greater than 12-month intervals (e.g., a random external audit of the workload reports).

(4) Require a minimum of six months of work count data, in addition to the daily or short-term counts that may be made during the data gathering. Twelve months of work count data is preferable. This historical information will be of value later during computation.

4. Selection of Locations for Data Gathering

a. Sample Selection Requirements

(1) The primary requirement of any sample selected is that it be representative of the population (or universe) from which it is drawn. Stratified sampling is the recommended technique for selecting a representative sample. In stratified sampling, the population is divided into strata by some characteristic (i.e., size, potential WLF, or major work unit). Once the population has been stratified, activities are selected randomly from each stratum.

(2) The responsibility for selecting study locations rests with the claimant. Proper selection of locations for data gathering should satisfy these five basic conditions:

(a) Include a sufficient percentage of the work center locations in the sample to ensure adequate coverage across the range of each potential WLF. The percentage will vary due to conditions such as size of work center, type of work performed (repetitive or nonrepetitive), variance or anticipated variance in WLF volumes, etc. If ten or fewer activities are performing the function, measure all of the activities. If more than ten activities are performing the function, measure at least 15% (but not less than eight).

(b) Select representative locations in terms of workload (i.e., a proportionate number of locations from the universe with the lowest and highest workload volumes will normally be included except in those instances where a single-point standard is deemed more appropriate). This often occurs when there are activities at the extreme ends of the range of the universe. Select sample sites so the range of activities is evenly covered.

(c) Include activities considered to be unique in the sample selection.

(d) Select locations representative of the variations among work centers to ensure possible differences can be analyzed during the computation phase.

(e) Identify activities found to have variations in procedures in the selection of data gathering sites.

(3) Once sample sites have been approved, do not permit substitutions for reasons of convenience or nonavailability of funds or analyst resources, unless provision is specifically made in the basic sample design for acceptable alternatives. Select a minimum of one additional site over what is required for each stratum. List these sites in the sample selection and label them as an alternative. All alternate sites should be the last ones drawn. Where knowledge of the universe is limited or there is some reason to suspect changes may have to be made to the data gathering sites, the claimant will make a judgment to determine the appropriate number of alternate sites over and above the minimum stipulated above.

b. Alternate Sample Selection Process

(1) The following alternate sample selection process may reduce the time required to develop predictive staffing standards. This methodology is applicable to any activity/work center universe with a minimum of eight sites where homogeneous

organizations and/or functions exist.

(2) Some activities/work centers perform identical functions better than others. Therefore, they are using assigned personnel more efficiently to accomplish their assigned mission. Recognizing this fact provides potential for using the natural efficiencies already present in organizations/functions to improve the efficiency of other like activities/functions by modeling the homogeneous universe to reflect the characteristics of the best performing activity/work center. Identification of the best (model) activity or work center can be achieved by statistical analysis of questionnaire-acquired WI and associated manpower utilization data from all activities in a specific universe. After identification of the model activity/work center, identify the poorest performing site and conduct studies first at these two sites. Conduct additional studies at the smallest and largest activity/work center and other logically selected sites. This will ensure study sample sites span the full spectrum of the universe and will facilitate testing the application of the refined model activity/work center manpower productivity characteristics at other study sites. Upon completion of the studies for the sample sites, the data sets for all study sites should reflect the most efficient performance characteristics of the model activity/work center.

(3) The data collection questionnaire should consist of draft standard PWSs and standard WI data collection sheets including generic data collection sheets designed to collect additional information (i.e., number of personnel authorized, number of personnel assigned, number of borrowed work-hours of labor, number of official overtime work-hours, number of required training work-hours, or number of actual training work-hours per month). Ask activities in the universe to validate the PWS and provide current WI/generic data that may be reviewed, analyzed, and corrected prior to a computer assisted statistical analysis to determine the best (model) and poorest performing activity/work centers.

(4) The process is as follows:

(a) Identify activities and/or functional elements for predictive model development.

(b) Develop standard PWS(s) and WI(s) packages.

(c) Develop a data collection questionnaire package including:

1. PWS(s).

2. WI collection sheets.

3. Generic data collection element sheets.

(d) All activities in the universe validate the PWS(s), collect all required data using the data collection sheets provided, and submit data to appropriate claimant.

(e) Claimant analyze data and develop a data matrix.

(f) Claimant perform correlation and regression analysis to determine best performing and worst performing activity/work center(s), and designate them for on-site studies.

(g) Claimant select largest, smallest, and other sites for on-site studies.

(h) Claimant conduct top-down study at selected sample sites in the following order:

1. Best performing (model) activity/work center(s).

2. Worst performing activity/work center(s).

3. Smallest activity/work center(s).

4. Largest activity/work center(s).

5. Other selected activities/work centers.

5. Selecting the Appropriate Work Measurement Methods

a. Throughout study planning, continuously evaluate potential work measurement methods. The development of the PWS and the selection of work units depends to some extent on the work measurement methods employed. It may not be possible to obtain accurate and representative measurement of all tasks in the work center with a single measurement method. For example, in most work measurement situations, certain tasks either do not occur or occur at abnormal frequencies. In these situations, the Operational (Op) Audit technique can be used to support or modify other measurement methods. Selection of the measurement method depends on the following considerations:

(1) Nature of work being accomplished.

(2) Work center environment (i.e., layout, schedule, etc.).

(3) Shift requirements.

(4) Number of persons to be measured in the work center.

(5) Number of persons and amount of time available to do the measurement.

(6) Length of work cycle.

(7) Programmed changes in work center.

(8) Accuracy or type of standard desired

b. Select method or combination of methods to satisfy the above considerations and meet economic constraints. Economy and accuracy seldom go hand-in-hand. The study team may trade off some of the long-term benefits associated with precise and detailed measurement methods for the short-term economies of work sampling or Op Audit techniques. The PWS task structure previously described should serve as an excellent point of departure for selecting measurement methods.

6. Data Gathering/Analysis. Ensure consistency of data collection at each site data is gathered using standard PWSs and work measurement and methods study tools and techniques. Also, be alert for variations in tasking and technique to determine the need to address additives, deviations, and exclusions during the development of the standard.

301. Staffing Standards Computation

1. Computation Process

a. Scope of the Computation Process. Staffing standard studies involve a computation process resulting in a staffing equation. The computation process is the search for a sensible, useful, and reasonably accurate mathematical answer to the question: How does workload drive manpower? Although computation begins after the completion of data gathering, it is important to remember the computation process begins during study planning and continues through the life of the standard.

(1) The Computation Process During Study Planning. During study planning, the analyst should begin to ask the

question: How does workload drive manpower? The tentative answer to this question is a critical element in the development of the PWS, the choice of potential WLFs, the identification of the universe, the selection of a sample, and the overall approach to the study. Success or failure during computation depends on the quality of study planning as much as it does on the proper use of the computational methods described herein. The analyst should ensure:

(a) Computation considerations are addressed in the study planning process.

(b) Statistical analysis is performed on work-hour and/or workload data available during planning.

(2) The Computation Process During Data Gathering. During on-site data gathering, the computation process continues as the analyst receives information from on-site visits. Detailed analysis may be conducted throughout data gathering as this analysis may indicate the necessity to change the conduct of the study. Specifically, the analyst should:

(a) Begin a comparative spread sheet analysis upon receipt of the second site's input data.

(b) Generate and examine computer products as soon as input data from the sixth site is in hand.

(c) Be alert to evidence that analysts are not consistent with each other in their approach to data gathering and correct this situation immediately.

(3) The Computation Process During Implementation. It is possible (though unlikely, if the study has been conducted properly) the staffing equation may be found to be inappropriate for the universe during implementation. Should this be suspected, the analyst should reexamine the work done during computation and investigate alternative staffing equations.

(4) The Computation Process Throughout the Life of the Standard. Manpower claimants should examine standards and be alert to changes that may indicate the staffing equation has been rendered obsolete by changes in the work center's methods or mission. Conduct statistical analysis when appropriate to test the validity of staffing equations as workload levels change from year-to-year.

b. Approaches to Computation

(1) Multi-Point. Study results from a number of activities are used to develop a staffing equation using the multi-point approach. The method most commonly used to derive the equation is regression analysis. Other methods may be used if they provide sensible, useful, and reasonably accurate answers.

(2) Single-Point. This approach is used for unique activities and for functions where the number of activities is too small for regression to provide reliable answers.

c. Analysis of Input Data. A work center staffing standard reflects, as closely as possible, the manpower required to perform varying volumes of a defined workload. This should not be achieved by simply correlating bulk work-hours with workload counts reported for each data gathering point. Such a correlation may include unrecognized activity differences, resulting in a "standard" that averaged requirements but would not fit any one activity well or provide a predictor of future manpower requirements. With a comparative analysis of the input data, it is possible to identify true differences and alternative means of resolution. Analysts should analyze the collected data to identify what might be abnormal work center conditions. This information should be the basis for determining standard values and adjustments. The following procedures should facilitate an orderly and comprehensive analysis. The degree to which some of these procedures can be used will depend on how much data is available and the method by which collection was performed.

(1) Ensure data gathering is complete and accurate, required forms were completed, and calculations are correct.

(2) Note exceptions or variations to the PWS.

(3) Verify proper collection of data. Ensure the proper sites were measured, WLFs were collected from the correct source, and work-hours/workload data represent like time periods.

(4) Identify and justify the use of skills or grades not normally found in the work center.

(5) Perform comparative analysis using spread sheets, graphs, and various data arrays. Data should normally be

arrayed in ascending order of work-hours for comparative analysis, and should always be arrayed in ascending work-hour order for regression analysis.

(6) Resolve problems with inaccurate, incomplete, or questionable data by contacting the study team and/or the measurement site.

d. Comparative Analysis

(1) Work-hours. Data from various sites may be compared using numerous ratios such as the ratio of total productive, category, or task work-hours to total work-hours, or the ratio of one category's work-hours to another's. Plotting this information on a scatter diagram allows easy identification of problem sites. These ratios should indicate what is a normal range or pattern for the function under study. Measurement sites not following the pattern need to be studied closely to find the cause of the variance. (Note: In performing ratio analysis, remember if a curvilinear relationship exists between variables, these ratios will show a varying relationship in which the ratio will change from the smallest to the largest activity.) When problems are found, check input data for mistakes or to identify unrecognized differences in the function from site-to-site. Some things to check for are:

(a) Transposition errors.

(b) Proper treatment of additive work-hours.

(c) Proper treatment of multiple interviews.

(d) Treatment of standby hours.

(e) The effect of overtime on work-hours.

(f) Personal/fatigue allowance exceeding the norm.

(g) Unavoidable delay allowances - these must be clearly justified.

(h) Representation of the measurement period-compare monthly work-hours to the onboard counts for the previous 12 months.

(2) Workload

(a) For each site, examine historical counts

collected for each WLF. Use at least 12 months of workload (or a complete work cycle) for a meaningful analysis. Consider the variance in counts over the reporting period.

1. If large variations or no variations are reported from month-to-month, we need to understand the cause. This may indicate a problem in counting or reporting that, if not due to measurement error, may make the WLF a poor indicator of manpower requirements. However, if fluctuation is due to the work cycle or seasonal swings, the WLF should not be dismissed.

2. WLF values used in regression must be representative of the period for which work-hours were collected. If work-hours were collected for only one month, use only that month's workload count. If work-hours are a historical average for the year, workload should be also.

3. If an Op Audit was used to measure work-hours, then the workload level used for computation should agree with the workload level used to derive the work-hours on the Op Audit forms. Specifically, if WLFs were used as work units, their frequencies should correspond.

(b) Consider workload ratios: the ratio of one WLF to another and the ratio of a work unit to its related WLF. These ratios may be plotted on a scatter diagram to facilitate analysis.

(3) Work-hours per Unit of Workload. Examine the ratio of work-hours to workload. Figures used may be total productive, category, or task work-hours and associated workload. Analyze differences in the amount of time spent per unit of workload from site-to-site. Construct scatter diagrams to aid in this analysis. These plots will reveal:

(a) Whether a linear, curvilinear, or no relationship exists.

(b) The relationship of one activity to another.

(c) Potential data problems such as gaps or outliers.

Remember, scatter diagrams show the relationship of only one workload variable at a time to the work-hour figure depicted. The analyst should avoid jumping to conclusions on the basis of scatter diagrams when more than one WLF affects the depicted work-hours.

(4) Results of Comparative Analysis. Analysis of data in computation may indicate that one or more elements or paired values vary significantly from the rest of the data. Ascertain a logical, defensible reason for such variation and cite as justification for adjustments. Analysis can also cause measured work-hours, reported workload, or both to be reclassified or regrouped. All original data should remain intact with a single straight line drawn through the data to indicate an adjustment has been made. Enter the adjusted data to show an audit trail to their origin. Document each problem encountered, the subsequent action, and explanation of such action in detail and retain. Do not interpret this adjustment as a means to arbitrarily change raw input data.

(5) Returning to Comparative Analysis During Computations. While examining computer products, questions will arise requiring repeating some of the procedures discussed in this section. Comparative analysis is a vital part of the computation process and is useful in understanding a work center in all phases of standards development.

2. Regression Analysis. The purpose of this topic is to assist the team leader, or designated computation analyst, in understanding the concepts essential in performing regression analysis on input data. The reader is assumed to be familiar with the concept of least squares regression. Mathematical formulations for the measures of fit and prediction and the other statistical tests discussed are available from other sources and are not provided here.

a. Use of Statistical Techniques. A number of statistical techniques may be used to obtain, arrange, analyze, and present numerical work-hour and workload data. This section discusses the use of regression to identify, measure, and explain the relationship between workload and work-hours. Regression analysis is used primarily to develop manpower staffing equations with input data from selected activities. This technique provides useful information for decision making, but will not make a decision for you. For example, by logic it is determined in a supply activity the number of line items processed influences the number of work-hours required. Regression analysis will indicate the degree to which the number of required work-hours is mathematically dependent on the number of line items processed. If the decision is made that the degree of dependency is acceptable, then the number of line items processed could be used as a WLF. In this example, the number of required work-hours (the dependent variable) is said

to depend on the number of line items processed (the independent variable). The dependent variable will normally be a measure of work-hours required and the independent variable will be relatable either directly or indirectly to workload accomplished.

b. Starting Off on the Right Foot

(1) Statistics and Logic. It is important to remember that a staffing standard must be sensible and useful and that the best answer is not necessarily the best statistical answer. An acceptable outcome of regression analysis is a staffing equation that satisfies the “sensible and useful” test and the statistical test.

(2) Quality of Data. A regression equation is only as good as the quality of data used to construct the equation. A related concept is that the equation is a product of the data set; if new data were taken, the computation results could be quite different.

c. Model Selection. During the model selection process, the analyst is concerned with two things: which potential WLFs should be used in the staffing equation and what type of model is appropriate. All of the work that has gone into the study has been in preparation for this critical process, during which a model will be chosen to describe how workload drives work-hours.

d. WLFs. As computations begin, analysts may choose to eliminate from consideration certain potential WLFs that are now understood to be redundant, irrelevant, or impossible to count accurately.

(1) Sensibleness. A WLF may be called sensible when it logically drives a significant portion of the work center's required work-hours. Example: The number of purchase request cancellations in a supply work center provides excellent statistical correlation with work-hours. However, the work associated with cancellations is known to constitute only 1% of the work center's work-hours. Therefore, this WLF is not a significant driver of work-hours and should not be used to predict any significant portion of the total work-hours.

(2) Usefulness. A WLF is considered useful if it is able to be counted and reported with a reasonable degree of accuracy.

(3) Programmable WLFs. A WLF may relate to work-hours either directly or indirectly. Some indirect WLF are programmable for future years. Other considerations being roughly equal, develop staffing equations using programmable WLFs.

(4) Keeping or Eliminating WLFs. In most study efforts, not all workload variables measured in the data gathering phase are necessary. This is because there is usually some "overlap" in the workload variables in the way they influence work-hours. In other words, workload not only drives work-hours but, as far as the numbers are concerned, workload drives workload. For example, if five workload variables are measured, all the information necessary to describe work-hours adequately may be contained in just two or three of the measured WIs. This overlapping information is not necessary and is likely to be harmful. This condition is referred to as collinearity, discussed later in this section.

e. Types of Models. A mathematical model expresses the relationship between one or more workload variables (X) and monthly required work-hours (Y). During the computation process, consider various types of models. Some different types of regression models are:

(1) Bivariate Models

(a) Linear or Straight Line $Y_c = a + bX$

(b) Curvilinear Models

1. Parabolic $Y_c = a + bX + cX^2$

2. Hyperbolic (ratio) $Y_c = \frac{X}{a + bX}$

3. Log-log (geometric) $Y_c = aX^b$

(c) Nonlinear $Y_c = a + bX^g$

(2) Multiple Regression Models. Multiple linear regression models take the form:

$$Y_c = a + b_1 X_1 + b_2 X_2 + \ldots + b_k X_k$$

This is a regression model with two or more independent variables (Xs) and one dependent variable (Y), expressing a linear relationship.

f. Limits of Regression Analysis. Even though it is a valuable tool, be careful not to expect too much of regression analysis. Specifically, regression will produce unreliable or unusable results in these situations:

(1) Insufficient Error Degrees of Freedom. This means using too few data points to estimate too many coefficients. To calculate error degrees of freedom, subtract the number of terms in the model from the number of observations. Thus, if we are using data from 15 sites and considering a model of the form $Y_c = a + b_1X_1 + b_2X_2$, we are operating with 12 error degrees of freedom (# sites)(15) minus one for each term a, b_1, and b_2). The lower the error degrees of freedom, the less reliable the regression coefficients will tend to be. In order for a model with less than six error degrees of freedom to be acceptable, the staffing equation will have to be very sensible and useful, and should be supportable by other than statistical means.

(2) Too Many Independent Variables. Even with a high number of error degrees of freedom, regression analysis using many independent variables will often yield workload coefficients not workable in light of what is known about the work center. For example, a WLF that is known to account for the bulk of the workload may produce only a small portion of Y_c in the regression equation. Conversely, a WLF associated with only a small part of the overall workload may assume undue importance in the formulation of Y_c. Even worse, workload coefficients may be negative or the standard errors of the coefficients may be quite large. The larger the number of independent variables in the model, the more likely these things are to occur. Therefore, if a work center is defined such that manpower is driven by more than three different WLFs, each representing an important portion of the overall work, the analyst must be prepared for the possibility that regression analysis will yield unacceptable results and other methods will have to be used.

g. Measures of Quality. Some mathematical models are better than others. The best regression is the one combining two qualities, a good "fit" to the data collected and a capacity for good "prediction" or estimation of manpower for nonsampled activities in the universe. These qualities and other important considerations are described in this section.

(1) Measures of Fit

(a) Coefficient of Determination (r^2). This

statistic is derived from a ratio of the explained variation to the total variation of the dependent variable. The closer this figure approaches 1.0, the better the regression line. The coefficient of determination gives us the proportion of variation in "Y" explained by the variation in "X". If this value ranges from .7 to 1.0, the regression line is considered good; if it is as low as .5, that particular model is of questionable use, particularly in staffing equation development. In models with a forced zero intercept, the r^2 value is redefined and does not have the same statistical significance as the normal r^2. Exercise special care in using the redefined r^2 as a primary measure of quality.

(b) Coefficient of Correlation (r). Computing the square root of the coefficient of determination gives the coefficient of correlation, indicating the relative strength of the relationship between the independent and dependent variable. The quantity "r" can vary from +1 to -1. The signs "+" and "-" are used for positive and negative correlation, respectively. (Note: The "r" (as is r^2) is a dimensionless quantity (i.e., it does not depend on the units of measure employed). Despite the relative values of these two coefficients (the extent to which they approach but are less than +1), they do not determine the worth of the model by themselves.

(c) Standard Error of the Estimate (Sy.x). This statistic expresses, in units of work-hours, a measure of absolute "natural" dispersion around the regression line. In other words, Sy.x expresses what might be considered ordinary variation due to differences among activities (geographical, management, and philosophical differences) even after modeling is done. No model will fit the data perfectly. Sy.x is the standard deviation in manpower expected for activities within the workload range of the sample. It is important for this statistic to be low, with the ultimate criterion depending on size of activities in the sample. This naturally leads to the coefficient of variation.

(d) Coefficient of Variation (CV). This statistic measures dispersion (Sy.x) as a proportion of the mean of the work-hours in the sample. A small value implies a good regression equation. A figure of .10 (10%) or less is outstanding. Anything less than 30% is workable; anything exceeding 30% is of doubtful utility.

(2) Measures of Prediction. Even more important than fit is the ability of the model to predict or estimate manpower for nonsampled activities. The following measures are used to

assess the prediction capabilities of a model.

(a) Prediction Sum of Squares (PRESS). This measurement simulates prediction in that each observation in the sample is predicted using all other observations. A prediction residual is calculated for each observation, and these are squared and summed. The value of PRESS lies in the fact that a data point is not used in the prediction of itself. Within any given data set, the lower the PRESS statistic, the better the prediction capability of the model. PRESS statistics should not be compared for different data sets.

(b) Standard Error of Prediction. A model's ability to predict may be measured by using workload data from the universe to compute a standard error of prediction for each activity. The average standard error of prediction for the universe may be used to compare the prediction capability of candidate models.

(c) Confidence Limits. These limits are important in assessing the prediction errors in the model under consideration. Form a set of these limits or bounds for each data point. The limits are 95% confidence limits, and their interpretation is as follows: We say we are 95% confident that the mean manning for activities with this level of workload is contained within the bounds. A tight set of bounds indicates a standard with good capacity for prediction.

(3) Tests of Significance for a Regression Coefficient. Tests of significance are statistical measures determining acceptability of a given relationship or statistical value. They actually reflect the odds that an indicated relationship is due to chance. Each coefficient, including the intercept, has an associated t-value. This value equals the coefficient divided by its standard error. While the analyst is cautioned against thinking in terms of absolute cutoffs, a WLF or an intercept whose t-test results in an absolute value of less than 1.5 may be said to be contributing very little to the regression and is of doubtful value in a staffing equation.

(4) Realism and Economy Criteria. To be used as a staffing equation, a model should be realistic and economical.

(a) Realism. The staffing equation is considered realistic if manpower is positive for all values of workload greater than zero and there is no net loss of manpower for an increase in workload.

(b) Economy. Since manpower normally comprises the greatest portion of the budget dollar, economy of the model is an important issue. A staffing equation is considered economical if there is no increase in the manpower cost per unit of workload as workload increases.

(c) Possible Causes for a Lack of Realism or Economy in the Model

1. Incorrect or nonrepresentative input data.

2. Limited range of workload values.

3. Two or more levels of operation included in the data.

4. Non-standardization of the operation under study.

5. Inappropriate model selected.

(d) Waiver from Constraints. An equation with a negative intercept may be used if all values within the range of the standard are positive. If the study team desires to use a staffing equation that fails to satisfy the realism or economy criteria for reasons other than a negative intercept, a request for waiver from the constraints should include documentation of problems, attempted solutions, and rationale for using the model.

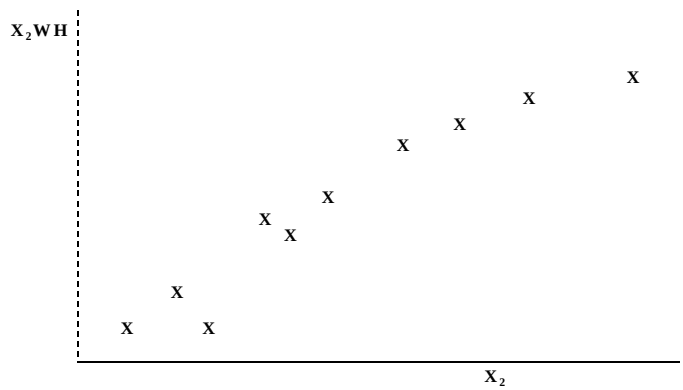
h. Nonlinear Modeling with Multiple Workloads. Normally, the first computer runs the analyst examines with multiple WLFs are linear regression models, such as $Y_c = a + b_1X_1 + b_2X_2$. If the WLFs X_1 and X_2 are sensible when used together, and if the model has at least passable measures of quality and is being considered for the staffing equation, then one of the first questions to consider is whether or not each workload variable is truly linear in relation to work-hours. If not, the measures of fit and prediction may improve considerably with a nonlinear model.

(1) Detecting a Nonlinear Relationship

(a) Scatter Diagrams. Suppose X_2 is truly nonlinear in terms of the work-hours associated with performing the work represented by X_2 (X_2WH). There are economies of scale in the performance of this work. In this case, a plot of X_2 vs X_2WH would show a curved pattern. It is quite possible that fit and

prediction will be enhanced by allowing this curved relationship to enter into the model, using the following:

$$Y = a + b_1 X_1 + b_2 X_2^g \text{ (where the exponent } g = < 1)$$



If the work-hour data can be split to isolate the work-hours associated with a particular WLF, scatter plots such as this one should be analyzed. If work-hour data cannot be broken down, it may still be instructional to examine the plot of X_2 vs. total work-hours. A plot showing a curved relationship may call for an exponent on X_2 .

(b) Residual Signs in Linear Model. Another clue indicating an analyst should pursue nonlinear modeling may be found by examining the signs of the residuals in the linear model. If all or most of the sites at the lower end of the spectrum in terms of work-hours have negative residuals (i.e., these sites are being overestimated by the model), it is possible a nonlinear model may produce better results.

i. Collinearity. In para 2d(4) above, we discussed the problem of overlapping information in multiple workload models. This condition is often referred to as collinearity. A high degree of correlation between two workload variables may indicate this problem. However, when more than two workload variables are used together, they may interact in such a way that multicollinearity is present even though the paired correlation coefficients are not extremely high. Suppose there are five workload variables and three of them adequately explain the variation in work-hours. It is quite likely using all five will result in a poorer estimation of the regression coefficients and will produce a standard that predicts manning

ineffectively. If two or more workload variables have a strong dependency among each other (as far as the data are concerned), the regression will be more effective if one or more is eliminated.

j. Influential Outliers. For a particular data point, the relationships among the variables used in the model may be significantly different from those relationships in the rest of the sample. This data point may be called an outlier. A problem occurs when such a point exerts a great deal of influence on the path taken by the regression line. (Note: An extreme value by itself does not make a data point an outlier, nor does it make it influential.)

(1) Detection of Influential Outliers. In bivariate situations, it is fairly easy to identify outliers and influence points using scatter diagrams. In multivariate situations, detection is more difficult.

(2) What to do About Influential Outliers. There are many possible causes for this condition and many possible solutions. (See Table 3-1)

TABLE 3-1

CAUSES OF INFLUENTIAL OUTLIERS

CAUSE	SUGGESTIONS TO THE ANALYST
Measurement error	Check for errors in math or definition
Poor choice of workload factors	Check models using other WLFs. Is the same site an influential outlier?
Differences in work center method, organization, or mission	Can differences be quantified? Is there any WLF that reflects them? The site may not belong in the universe.
Poorly defined work center	May need to split the work center apart into smaller ones or consolidate small work centers into one large one.
Wrong type of model is being tested	Consider curves, transformations, weighted WLFs

k. Transformations. At times, it may be appropriate to perform a mathematical transformation on workload variables and then use the transformed variable(s) in regression. For example, two workload counts may be added together to form a new one if it is known the work-hours associated with one unit of one WLF is about equal to the work-hours associated with one unit of the other. Another kind of transformation is to multiply two WLFs together. There should be a reason for doing this (e.g., the number of admissions multiplied by the average length of patient stay to form a variable that is an indicator of the patient population).

l. Weighted Workload. These WLFs are artificially constructed following measurement from weighted combinations of two or more WLFs. An example is: weighted acres of ground maintained (X_w) made up of improved grounds (X_i), semi-improved grounds (X_j), and unimproved grounds (X_k); and the formula is $X_w = X_i + .5X_j + .15X_k$. The implication is that per acre, semi-improved grounds require 50%, and unimproved grounds 15%, of the maintenance work-hours required for improved grounds. These factors eliminate or reduce the need for multivariate equations, and are particularly useful where all WLFs do not exist for all locations. The values of the weights may be based on measured data, accepted manpower accounting systems, or expert opinion. This technique may be useful when the study suffers from "too many independent variables," discussed previously in Limits of Regression Analysis.

m. Classification Variables. There may be data sets where the data points fall into two or more groups that are distinguished from each other by different relationships between workload and manpower. Distinctly different methods, differing levels of service, or different regulatory requirements are examples of factors that could split what is otherwise a homogeneous universe into two or more groups. (Warning: different data gathering teams could be another!) In these cases, a classification variable may support or contradict the hypotheses that there are two or more groups. The values for a classification variable are either one or zero: one if a member of the group is in question, zero if not. When used in multiple regression along with one or more WLFs, examine the classification variable for its significance (t-value). A high level of significance supports the hypotheses that there are two groups. If it is to be used in the staffing equation, first evaluate a classification variable for the sensibleness of its coefficient and the effect of its use in the application of the standard. Remember it becomes, in effect, a constant additive or subtractive.

302. Staffing Standard Report Preparation

1. Format for New Staffing Standard Reports

a. The staffing standard report documents the results of staffing standards development. Prepare a staffing standard report for each staffing standard using the format provided in Appendix E. Specific preparation instructions follow:

(1) Staffing Standard Cover Sheet. This should contain a general overview of the staffing standard report written primarily for the benefit of commanders and staff officers not in the manpower field. Appendix E presents an example page. Adjust this format to satisfy specific report situations.

(2) PWS

(a) Description of Work Center Responsibilities. Portray work center responsibilities at the category level. Identify work required to be accomplished to the maximum extent practicable without stating how work is performed. Define additive categories after the last category. See Appendix E for sample.

1. Additive. By using additive work-hours/ work-years and the associated WLF count, it is possible to develop an additive equation or coefficient that will be responsive to change in additive workload tasking. Additives may be developed and expressed in monthly work-hours or actual manpower requirements where no corresponding work count can be identified, or when the additive workload will remain relatively constant (See Figure 3-2). Before using, ensure that additives are indeed unique and required to support the mission of the activity.

2. Subtractives. Subtractives are simply the opposite of additives. Develop subtractives for activities having excluded workload situations. When work-hour intensive tasks are excluded or not performed by a portion of the universe, the manpower requirements for those activities will be over-estimated by the model unless a subtractive coefficient or work-hour subtractive is used to adjust the monthly required work-hours. Develop subtractives essentially the same way as additives and express as either a separate equation/coefficient, work-hour, or actual manpower space/requirements subtractives.

(b) WI(s)/WLF(s). List each WI/WLF used. Indicate title, definition, and corresponding source of count. The definition should identify the unit of measure and frequency and should be in sufficient detail to ensure complete understanding. The source of count should be as precise as possible to ensure correct values are obtained.

(c) Standard Staffing Equation/Applicability Statement. Indicate the staffing equation selected for use. The dependent variable (Y_c) may be reflected in weekly or monthly work-hours or work-years required. After the equation, state which was used, for example, "where Y_c = computed monthly work-hours required." Provide an applicability statement explaining the activity covered by the standard. Indicate additive manpower requirements (see Figure 3-2). Indicate where an algebraic expression is not determinable.

(3) Application Instructions

(a) Multivariate and Bivariate Staffing Equations with Additives. Provide staffing standard application instructions which will allow for computation of the total monthly work-hours/work-years required in the work center to include additives, deviations, and exclusions. The instruction format will facilitate the determination of individual work center requirements prior to entry into the staffing table. See Appendix E for sample.

(b) Bivariate Staffing Equation Without Additives. Required manpower increments are reflected in the staffing table in terms of "X" (WLF). WLF values may be read directly into the staffing table.

(c) Skill Distribution Table. When using a skill distribution table, include the appropriate application instructions for that work center in the report. Specific instructions are provided below.

(d) Transient Availability Factor. Some work centers use transient or other manpower with productive work-hour availability factors (WAFs) which are different from those used to develop the staffing or skill distribution tables. When this occurs, identify the factors along with instructions for their use. The analyst should fully document the rationale for the development and use of the factors in the report back-up data.

Treatment of Additive Manpower Requirements

Example 1: Work-hour Additive

"Total Additive Work-hours: NAVADCOM ORLANDO FL 88"

Example 2: Coefficient Additive

"X_a = Number of funeral/memorial services per month. Monthly average number of funeral and memorial services performed by Navy chaplain(s) providing service at the Arlington National cemetery Applies to NAVDIST WASHINGTON DC, only."

"ADDITIVE: + $5.8134X_a$. This additive term is to be used along with the above equation for NAVDIST WASHINGTON DC, only."

Example 3: Manpower Space Additive

"Whole manpower space additive for NAVHOSP Great Lakes, only:

1 RADIOL THERAP 2100/I 0135
1 CLINICAL NUC MED TECH HM2 8416"

Example 4: Additive Equation

"X_a = Visits per month. Monthly average number of outpatient and inpatient speech pathology visits for a twelve-month period."

"ADDITIVE EQUATION FOR SPEECH PATHOLOGY

$$Y_c = 1.3907X_a$$

APPLICABILITY: The additive staffing equation for speech pathology applies to all Naval hospitals/ clinics providing this additional service."

Figure 3-2. Examples of Treatment of Work Center Additives

(4) Staffing Table. The staffing table should follow the application instructions. (see Preparation of Staffing Tables below for Staffing Table preparation instructions.)

(5) Staffing Standard Universe Listing. List, by manpower claimant all activities in the universe, ensuring all activities have a consistent format with a geographical location listed. (If there are multiple RFCs included in the report, reflect the universe for each RFC.) Display the following information for each activity: activity title; geographical location; Unit Identification Code (UIC); and activity code. Identify activities where measurement was conducted with asterisks. See Appendix E for sample.

2. Preparation of Staffing Tables

a. Purpose and Composition of the Staffing Table. Develop a staffing table for each staffing standard depicting manpower required for various workload volumes. Each staffing table provides qualitative and quantitative information about the required number of manpower requirements for various workload volumes. See Appendix E for a sample.

b. Development of Qualitative Manpower Requirements for the Staffing Table

(1) Array the recommended specialties and skills from all data gathering sites onto a Manpower Distribution Chart (see Appendix F). In the second column, list all recommended qualitative manpower requirements. In succeeding columns, list the workload value and the staffing recommended for each manpower requirement, beginning with the smallest manpower requirement and progressing to the largest. This will aid in spotting any obvious inconsistencies.

(2) Plot a scatter diagram for each qualitative manpower requirement, with workload values on the X-axis and recommended staffing on the Y-axis. Fitting a regression line to the data will aid both in identifying "mavericks" and in selecting the phase points for increasing the staffing of each qualitative manpower requirement.

(3) Study the data array and the scatter diagrams to determine the workload values where significant changes are apparent in either specialty or skill requirements. Some examples of these are:

(a) the point where an officer requirement first occurs;

(b) the point at which a staff officer is first warranted;

(c) similar points for various skill level requirements; and

(d) the points where multiple requirements for any of the foregoing is first encountered.

Enter these requirements in the appropriate workload columns of the staffing table. Then, using these entries as firm "fixed", and referring to the trends indicated by the data array and scatter diagrams, complete the required entries in each workload column.

(4) When there is more than one skill involved, some subjective decisions may be necessary to solve fractional specialty problems. In many cases, specialties will have overlapping duty responsibilities.

(5) In the final analysis, analyst judgment will weigh heavily in integrating the recommendations, the results of data array analysis, and the specialty descriptions to develop the most realistic distribution of manpower requirements. The task cannot be taken lightly; it requires constant adherence to the principle that quality is just as important as quantity in the SMR/MSMR.

(6) Qualitative staffing standard recommendations made in the report should comply with policy and guidance contained in the OPNAVINST 1000.16 series. Identify civilian manpower requirements at the full-performance level.

(7) Show each listed manpower space listed as military when the space requires a military incumbent based on military essentiality and as civilian when the space does not require a military incumbent.

c. Staffing Table Qualitative Entries. Titles and associated qualitative requirements for each manpower requirement in the staffing table columns represent the actual specialty and skill level requirements of the work center. When more than one military skill or civilian series is appropriate, list the skills or series most frequently authorized and make a note at the bottom of the form. The note will provide any skill that can be

substituted for the skill or series listed in the table. Assign one skill level per line item in the staffing table.

(1) Requirement/ Position Title. Titles for officers shall conform with the Navy Officer Billet Classification (NOBC) title in Volume I, NAVPERS 15839I. Titles for enlisted personnel shall conform with the NEC title in Volume II, or, in the absence of an NEC, the rating title in Volume I, NAVPERS 18068F. Titles for civilians shall conform with OPM guidelines.

(2) Subspecialty Code. When an officer subspecialty code is required, the code should appear in brackets immediately after the billet title.

(3) Military Essentiality Code (MEC). Each military entry will include the appropriate MEC found in the TFMMS Coding Directory.

(4) Designator/Grade/Rating/Rate. Officer designator and grade, enlisted rating/rate, and civilian series and pay level should conform to those directives referenced in (1) above.

(5) NOBC/NEC/Additional Qualification Designation (AQD). All officer entries will include an NOBC. Enlisted entries shall include an NEC, when appropriate. When a secondary NOBC/NEC/AQD is required to properly identify the manpower requirement, indicate both the primary and secondary code respectively (e.g., 0234/0020).

(6) Functional Area Code (FAC). As required, each military entry will include the appropriate FAC (see TFMMS Coding Directory).

d. Development of Extrapolation Range for the Staffing Table

(1) Determine Range of Total Manpower Requirements. To establish an extrapolation range that is realistic, yet ensures the useful life of a standard, analyze the computed work-hour/work-year (y_c) or WLF value range. Also, consider factors such as type of model selected, projected tasking, universe additions and deletions, work center staffing range, and other factors that might impact future manpower requirements. Compute extrapolation values based on a percentage of the high and low computed work-hour or WLF values, dependent on the staffing equation and treatment of additive work-hours. For example, a bivariate equation with no additive work-hours will be extrapolated based on WLF values; all other situations should be

extrapolated based on work-hours. Once extrapolation values have been determined, establish the upper and lower limits of the staffing table to encompass the full range of the whole billet column bounding the extrapolated values. The lower extrapolation value will normally be the computed work-hour breakpoint of the previous whole manpower requirement plus .01 work-hours. Example (standard with work-hour breakpoints):

computed work-hour limits	4318.00 - 11,720.00
25% extrapolation range	3238.50 - 14,650.00
whole-billet columns bounding extrapolated work-hour limits of staffing table to encompass full range of 22/101 billet columns	(22) (101) 3120.43 & 14,731.30

(2) Compute Breakpoint Values. Reflect breakpoint values in terms of WLFs for bivariate models without work-hour additives and as work-hours/work-years in all other situations. Compute computation of breakpoints per the following paragraphs.

(3) Fractional Manning (FM)

(a) Overload factors are established based on the premise that separate criteria should be applied respectively to small and large work centers, as well as economic considerations in regard to breakpoint determinations. A maximum individual work overload is established at one-half hour per working day. The overload is cumulative until reaching a maximum equating to one-half manpower requirement. The cutoff point is the highest value to which the fractional manpower can equate before the manpower requirement is rounded to the next higher integer.

(b) Whenever possible, consolidate work centers to avoid over manning due to FM allowances.

(c) Table 3-2 reflects the fractional manpower cutoff points that coincide with whole manpower requirements (military and civilian).

(d) Sample calculation for Table 3-2 values are as follows:

$$FM = \frac{6 \times .5 \times 20.908 + 6(145.136)}{145.136} = 6.43217\ (6.432), \text{ where } N = 6$$

e. Manual Method for Developing the Staffing Table

TABLE 3-2

FRACTIONAL MANPOWER CUTOFF VALUES

REQUIRED MANPOWER	FRACTIONAL MANPOWER CUTOFF
(N)	(FM)
1	1.072
2	2.144
3	3.216
4	4.288
5	5.360
6	6.432
7	7.500
OVER 7	Required + .500 Requirements

(1) Develop qualitative requirements. (See subparagraphs b and c above.)

(2) Determine Military/Civilian Mix. Determine the military/civilian mix (number of military and civilian manpower requirements) with each increment in the staffing table.

(3) Distribute Total Requirements. Distribute total requirements to appropriate individual manpower requirements within each staffing increment.

(4) Compute Work-hour Breakpoints. Compute the work-hour breakpoints for each staffing interval per the formula specified. The monthly WAF for Continental United States (CONUS) military and civilian manpower requirements assigned to shore activities during peacetime for a 40-hour work week is 145.136.

Use: Y_c breakpoint = (FM)(145.136) (or see Appendix G for computed values)

Example: Compute the monthly work-hour breakpoints for a work center with 1-8 positions covered by the staffing equation.

Positions (c)	FMc	Yc Breakpoint
1	1.072	155.59
2	2.144	311.17
3	3.216	466.76
4	4.288	622.34
5	5.360	777.93
6	6.432	933.51
7	7.500	1088.52
8	8.500	1233.66

Y_c = (6.432)(145.136) = 933.5148 or 933.51, where N = 6

(a) Multivariate Equation and Bivariate Staffing Equation With Additive Work-hours. Enter the staffing table limits and computer manpower breakpoint (Y) values (carried to two decimal places) developed by the preceding procedures in the appropriate columns of the Staffing Table (Appendix E). Place computed breakpoint (upper value) in the bottom position of each column heading. The top number (lower value) in each column heading is found by increasing the last digit of the preceding upper value by one (for example, 1319.31 increased by one one-hundredth becomes 1319.32).

(b) Bivariate Staffing Equation. The work-hour breakpoints (Y) are computed for each staffing requirement's increment. The values of these same work-hour breakpoints are substituted for (Y) in the staffing equation that is then solved for the WLF (X). Enter the workload values for each manpower increment in the appropriate columns on the Staffing Table (Appendix E). The steps to use in solving common mathematical models for (X) in terms of (Y) are summarized in Table 3-3. Values will be reflected in whole numbers when whole requirement value ranges are 10 or over. Carry ranges less than 10 to two decimal places. Example: Assuming the simple linear equation of Y = 95.4364 + 5.4195X and a computed manpower breakpoint (Y) of 1474.8983:

$Y = a + bX$ (Solve for (X) in terms of (Y))

$$X = \frac{Y-a}{b}$$

$$X = \frac{1474.8983 - 95.4364}{5.4195} = 254.54 \text{ (which rounds to 255)}$$

When Y = 1474.8983, X = 255

f. Computerized Method for Developing the Staffing Table. Using the Lotus 123 "Staffing Table" software program available from NAVMAC:

(1) Develop qualitative requirements.

(2) Determine lower and upper extrapolation limits.

(3) Compute breakpoints using the computerized BREAKPOINTS program to determine the number of manpower requirements for the first and last columns of the staffing table.

(4) Complete Staffing Table Worksheet as follows (Figure 3-3):

(a) Billet Number: Number the billet titles consecutively, starting with number 1. Where you want to see a line skipped in the final report, skip a line on the worksheet.

(b) Billet/Position (Requirement) Title: Enter titles and associated qualitative information per Preparation of Staffing Tables paragraph above.

(c) Column 1: Complete the first column just as you would see it on the finished product. Make sure the number of manpower requirements in Column 1 is correct for the breakpoint range.

(d) Successive Columns: Fill in all the numbers.

(e) Jumps: A jump is a change in qualitative manpower requirements that does not affect the total number of requirements for the column. Indicate the number of requirements resulting from a jump. Remember, if there is a positive jump in a column, there must be a negative jump in the same column to compensate.

(f) Summary: The increments and jumps are summarized in the block at the bottom of the page. Enter the manpower requirement line number that increases for each column. Also, enter the billet line number for each positive and negative jump. This is the section from which the column changes are entered into the computer.

(g) Footnotes: The footnotes for the lower and upper extrapolation limits are automatic and you do not have to include them when running the STAFFING program. If there are other footnotes, include the symbol and verbiage in the footnote block. Remember to show the footnote symbol in the staffing table text where it belongs when you fill in your worksheet. If

you need more space, use the back of the page.

(5) Alternate Skill. The "Staffing" software program has the capability to display alternative skills (i.e., military and civilian equivalents) for use in reflecting skill mix possibilities during staffing table development. Do not reflect alternate skills on staffing tables included in a staffing standard report.

g. Skill Distribution Table. The development of staffing tables for work centers where the range of manpower requirements is extremely large becomes a very time consuming task. Rather than develop a large number of staffing table pages to deal with such work centers, a skill distribution table may be used for work centers requiring a large number (i.e., 65 or more) of manpower requirements to identify the distribution of total work-hours to specific skills over the range of the standard. When several individual skills are involved, use the normal staffing table procedures to cover the lower range of manpower requirements and introduce the skill distribution table format after incorporating all skills into the array of required manpower requirements. When including a skill distribution table for a given work center, document the rationale for its development. Decide and include the use of the skill distribution table in the application instructions for the work center.

(1) Development of the Skill Distribution Table

(a) Determine the fixed manpower requirements (i.e., requirements that do not change as the workload changes, within the range of the staffing equation (e.g., Department Head)).

(b) For each of the remaining specific skills, determine the percentage of the work-hours (less the manpower associated with fixed manpower requirements) associated with that skill. Repeat this step for each skill.

(c) Figure 3-4 provides an example of a properly prepared skill distribution table.

(2) Use of the Skill Distribution Table. When using a skill distribution table in the report, include the following instructions:

(a) Determine total monthly work-hours resulting from the use of the staffing equation.

TABLE 3-3

STEPS FOR DETERMINING WORKLOAD BREAKPOINTS OF STAFFING STANDARD CURVE FORMS

Step Description	**CURVE FORMS**				
	Linear	**Geometric (log-log)**	**Ratio (Hyperbola)**	**Parabolic**	**Non-linear**
Write general equation **Y =**	a +bX	aX^b	$\frac{X}{a+bX}$	$a + bX + cX^2$	$a + bX^g$
Solve equation for "X" term **X =**	$\frac{Y-a}{b}$	$\left(\frac{Y}{a}\right)^{\frac{1}{b}}$	$\frac{aY}{1-bY}$	$\frac{-b+\sqrt{b^2-4(a-Y)c}}{2c}$	$\left(\frac{Y-a}{b}\right)^{\frac{1}{g}}$
EXAMPLE: When Y = 10 authorized (i.e., 10.5 x 145.136 = 1523.928),					
solve for the corresponding values of X for each Y breakpoint value within the staffing standard range. **X =**	$\frac{1523.928-a}{b}$	$\left(\frac{1523.928}{a}\right)^{\frac{1}{b}}$ or log x = $\frac{\log(1523.928/a)}{b}$	$\frac{1523.928a}{1-1523.928}$	$\frac{-b+\sqrt{b^2-4(a-1523.928)c}}{2c}$	$\left(\frac{1523.928-a}{b}\right)^{\frac{1}{g}}$

STAFFING TABLE WORKSHEET PAGE 1 OF 2 BRANCH 612
RFC: ICS 04.001 BRANCH HEAD SIG:
TITLE: PROVIDE CONUS RELIGIOUS PROGRAM & CONSULTATIONS

COMPUTED LOWER EXTRAPOLATION LIMIT 149.44
LOWER LIMIT IF OTHER THAN COMPUTED
TYPE OF BREAKPOINTS: WH X WLF

IF WLF BREAKPOINTS: COEFF A __
How many decimal places? 0 1 2 COEFF B __
Model: LIN HYP LOG PARA NLIN COEFF C __

COMPLETE COL 1 THEN INDICATE ONLY INCREMENTS AND JUMPS FOR THE REST

BILLETS (do not count skipped lines)	BILLET/POSITION TITLE (MAX 32 CHARACTERS)		M C or E	DESIGNATOR/ GRADE/ RATE/ RATING	NOBC/ NEC/ AQD	COL 1	COL 2	COL 3	COL 4	COL 5	COL 6	COL 7
1	Supv Chaplain	C	M	4100/G	3740							1
2	Supv Chaplain	C	M	4100/H	3740				1	1	1	0
3	GEN Chaplain	C	M	4100/H	3701							1
4	GEN Chaplain	C	M	4100/I	3701	1	1	1	1	1	2	1
5	GEN Chaplain	C	M	4100/J	3701		1	1	1	1	1	1
6	Religious Program Specialist	F	M	RPC								1
7	Religious Program Specialist	F	M	RP1					1	1	1	1
8	Religious Program Specialist	F	M	RP2		1	1	1	0	1	1	1
9	Religious Program Specialist	F	M	RP3								
10	Religious Program Specialist	F	M	RPSN								
11	Clerk Typist		E	GS-322-5				1	1	1	1	1
					TOTAL	2	3	4	5	6	7	8

Footnotes:

ENTER BILLET NUMBER FOR:	Summary Increment							
		5	12	2	8	4	3	
	+Jump			7			1	6
	- Jump			8			2	4

Figure 3-3. Example of a Staffing Table Worksheet

STAFFING TABLE WORKSHEET (Continuation) PAGE 2 OF 2 BRANCH 612
RFC: ICS04.001

COLUMN NUMBER :	8	9	10	11														
FOOTNOTES: BILLET # → 1	1	1	1	1														
2																		
3	1	1	1	1														
4	1	1	2	2														
5	2	2	2	2														
6	1	1	1	1														
7	1	1	1	1														
8	1	1	1	1														
9		1	1	0														
10				1														
11	1	1	1	2														
TOTAL	9	10	11	12														
ENTER INCREMEN T	5	9	4	12														
BILLET NUMBER + JUMP				10														
FOR: - JUMP				9														

Figure 3-3. Example of a Staffing Table Worksheet (Continued)

(b) Multiply each fixed manpower requirement by the WAF and sum. (The report must indicate the availability factor used.)

(c) Subtract the sum of the fixed monthly work-hours from the total monthly work-hours. (d) Multiply the remaining work-hours by the percentage factor for each of the skills listed on the skill distribution table to determine the work-hours associated with each skill requirement.

(d) Multiply each fixed requirement by the work-hour availability factor and sum. (The report must indicate the availability factor used.)

(e) Divide each of the work-hour figures by the WAF to determine the manpower requirements for each skill. At this point, round to only one decimal point and total.

(f) If the decimal is .5 or over, round up to the next whole manpower requirement; if less than .5, round down. Sum and compare to the total obtained in paragraph (e) above.

(g) If the totals of paragraphs (e) and (f) are not the same after rounding the sum of paragraph (e), adjust them so they are equal by modifying the manpower requirement for the skill with the largest percentage factor by plus or minus one manpower requirement. Repeat this process, modifying the next and subsequent largest percentage factor until the totals of paragraphs (e) and (f) are the same. In no case should a manpower requirement be reduced to zero by this procedure.

3. Back-up Requirements. Organize working papers and computer listings, developed during the measurement and computation phases, into a project file at the conclusion of the standards development effort as part of the back-up documentation. Retain as a minimum, the following back-up items:

a. Measured work-hours and WI/WLF/work unit count sheets for each measurement site.

b. Spread sheets of measured work-hours and WLFs/work units developed during analysis of input data, including explanation of adjustments to input data.

c. Data arrays developed for determining qualitative requirements.

d. Computer printouts of models selected and models tested.

WORK CENTER STAFFING TABLE (PAGE 1 OF 1 PAGE(S)											
12. STAFFING TABLE WORK CENTER/RFC CODE: OPERATE A NAVAL TRNG CENTER DINING FACILITY (SUP04.014)											
BILLET/ POSITION TITLE	MEC	DESIGNATOR/ GRADE RATING/RATE	NOBC/ NEC/ AQD	FAC	BREAKPOINTS:						
					MANPOWER REQUIREMENTS						
SKILL DISTRIBUTION TABLE					% FACTOR						
FOOD SERVICE	F	3100/I	1130		1 FIXED						
FOOD SERVICE	F	7520/N	1130		1 FIXED						
COOK FOREMAN		WS-7404-12			1 FIXED						
COOK FOREMAN		WS-7404-10			2 FIXED						
COOK FOREMAN		WS-7404-09			.124						
SUPPLY CLERK		GS-2005-05			.116						
SUPPLY CLERK		GS-2005-04			.143						
SUPPLY CLERK		GS-2005-03			.177						
COOK LEADER		WL-7404-08			.212						
COOK LEADER		WL-7404-06			.228						

Figure 3-4. Example Of Skill Distribution Table

303. Peacetime MEMs

1. General. MEMs bridge the gap between functionally oriented staffing standards or claimant prepared activity studies and program oriented budget considerations. The bridging is done by relating manpower requirements to program oriented independent variables. It is a top-down approach which can cover several work centers or groups of organizations, depending on the level of aggregation desired. MEMs may be developed on the basis of completed studies, existing staffing standards, data available in TFMMS, data available in other systems/data bases, or data collected specifically for the development of a MEM.

2. Considerations for Developing a MEM

a. The relation of staffing standard equations and peacetime SMRs to MEMs is governed by the following considerations:

(1) MEMs usually cover several work centers and include multiple functions or subfunctions. They will normally be developed at the highest practicable level, which might be at the activity, mission area, or functional area levels or an aggregation thereof. This determination will be influenced by the level of aggregation desired or possible. Coverage by staffing equations or SMRs is not a prerequisite to coverage by a MEM. The MEM is used to determine the total manpower required by the combined work centers/organizational components for the programmed workload volume. MEMs can also be developed for individual work centers/organizational components. However, utility of such MEMs is limited since the PPBS and POM processes do not operate with a primary focus on that level of detail.

(2) MEMs can become either the primary or secondary method of determining manpower requirements. If staffing standards or completed studies do not exist, then a MEM may be a primary determinant of manpower requirements for a functional or mission area by directly relating manpower requirements to one or more program WIs. If staffing standards or completed studies exist, the MEM is the secondary method of determining manpower requirements.

(3) Staffing equations may be expressed solely in terms of programmable WLFs. In this case, the equation may be recomputed and expressed in terms of total manpower requirements vice work-hours. The resultant model may then be used as a MEM.

(4) Program Estimating Factors (PEFs) are program-oriented, independent variables used in an estimating relationship to forecast manpower requirements for the FYDP or for PPBS purposes. They are sometimes published in official planning and programming documents. However, there may be functions where no PEF exists. For these functions, the manpower requirements determined by studies, when completed, will be used to develop MEMs that could be used in predicting manpower requirements. The manpower predictions can then be used to determine manpower resource requirements in support of the PPBS/POM processes.

b. The chief goal of a MEM is to produce a credible, defensible link between standard-driven manpower requirements or SMRs and the budget that will be as accurate as the methodology permits, easy to build and use, and have broad user utility.

c. The following characteristics are worthy of consideration in model development. It is desirable for any model to have these characteristics:

(1) Theoretical Consistency. Since it is desirable to keep MEMs as simple as possible, some theoretical consistency must be sacrificed or remain untested (although it should not be ignored). To the extent possible, linear manpower models based on the fewest programmable variables are preferred. MEM development will primarily rely on simple linear relationships. In most cases this should not seriously impair the predictive ability of a MEM since MEMs are designed to provide "roughly right" results and quick turnaround estimates.

(2) Statistical Soundness. Good statistics is another desirable quality of a model, particularly to the extent that the statistics reflect the model's predictive ability. It is important, however, to guard against correlation pushing. A high correlation of determination (r^2) is desirable in the sense that it measures the dispersion from the estimated model line (the sum of residuals). However, if the hypothesis is based on prior knowledge and properly tested, a relatively low r^2 is not bad. The r^2 tells only part of the story. The PRESS, t-values test, confidence intervals, and other measures are also important.

(3) Predictive Ability. It is important that the MEM be a good predictor of manpower. A number of statistics serve to gauge predictive ability (e.g., PRESS and confidence intervals). However, no model can predict with 100% accuracy since the

future is uncertain. In addition, the following factors may also impede predictive accuracy:

(a) Data Limitations. The most accurate data source is desirable since it will generate a better predictor; however, data availability, timeliness, and cost effectiveness must also be considered. For example, if the most accurate data source is not available in a timely manner, it may be necessary to use a less accurate source.

(b) Cost Effectiveness. In addition to data costs, maintenance costs may also be a limiting factor to a model's usefulness. A less accurate model may be chosen over a more accurate model if the more accurate model requires excessive data collection and maintenance costs.

(c) Model Limitations. A model's usefulness is also limited when it is used for purposes for which it was not designed. In most cases, MEMs are of limited usefulness when estimating manpower requirements for a particular work center because that is not the purpose for which the model was designed. The "bottom line" for a MEM is its predictive ability. It must also be understood, however, that the above qualities are not mutually exclusive.

3. Steps in Developing a MEM. The following steps describe the general procedures recommended for developing a credible MEM.

a. Step 1. Define the area under study. Identify the potential universe and establish a relationship to study functions, if possible. This step would entail reviewing resources such as the RFCs listed in the TFMMS Coding Directory; Staffing Standard Reports; completed studies; and revised PWSs and TFMMS manpower authorizations. Obtain models developed by other office/organizations, reviewed, and evaluated for possible adaptation if available and economically feasible.

b. Step 2. Identify and establish contact with the resource sponsor for preliminary liaison and the potential MEM user. Procure the necessary documents identified in Step 1.

c. Step 3. Identify candidate WIs (e.g., PEFs/WLFs) as well as sources of the desired data.

d. Step 4. Identify potential problem areas and determine the economic feasibility of developing a model as it relates to the universe.

(1) Area Under Coverage. Determine functions that overlap with another area of coverage, commonality of functions for the activities in the universe, and reasons for variations.

(2) Parameters. Determine whether parameters are programmable. If parameters are programmable, verify their accuracy. If parameters are not programmable, select alternative variables.

(3) If it is determined that model development is not economically feasible, document the reasons and discontinue the study.

e. Step 5. Contact the Office of the Chief of Naval Operations (OPNAV) program/resource sponsor, functional sponsor, and/or manpower claimants to ascertain which WIs are currently used in the PPBS and POM processes and determine whether they meet the criteria for a historical time period for regression analysis purposes. Verify the official source of the variables for inclusion in the MEM Report. Since the selection of a variable and data availability are necessarily dependent, consider the following criteria:

(1) The ideal independent variable (WI) should be programmable and should be a manpower "driver."

(2) The data source must be available now as well as in the future, and must be timely.

(3) The most accurate data source should be chosen if it meets the above criteria and is cost effective to collect.

f. Step 6. Collect the data on the possible independent variables and the dependent variable (standard driven plus proxy requirements). Identify the time period and potential problems with the data. Note any problems with the data to aid in regression analysis and for future reference.

g. Step 7. Perform regression analysis.

(1) Use the Shore Manpower Document-Statistical (SHMD-STAT) software package.

(2) Enter the data.

(3) Run regressions and statistical tests.

(4) Analyze the results on the statistical printouts.

(5) Check the model's predictive ability.

(6) Identify problem areas.

(7) Select the best model.

h. Step 8. Prepare the MEM Report. The format for the MEM Report may vary to take into consideration the unique characteristics of each MEM, but the report will:

(1) Define the area under study.

(2) Specify the data sources and the applicable dates.

(3) Present the estimating equation along with the relevant statistics. (At a minimum, include the coefficient of determination, the coefficient of variation, and the standard error of the estimate with t-values in parentheses.)

(4) Provide examples of the application of the model in determining manpower requirements.

i. Step 9. Submit the MEM Report and statistical printouts to NAVMAC for review and comments.

j. Step 10. Revise the model/MEM Report considering the recommendations received. Adjudicate and refine the suggested changes as required until the MEM is logically valid.

k. Step 11. NAVMAC will forward MEM Reports to Chief of Naval Operations (CNO)(N12) for approval.

l. Step 12. Once approved, CNO (N12) will officially promulgate to potential users.

4. Maintaining Valid MEMs. In order to ensure the MEM remains a valid estimator of manpower requirements, solicit and receive feedback from MEM users on problems encountered in the use of the MEM and/or suggestions for improving the application of the MEM. Review and update the MEM on an annual basis, or as required.

5. Future MEM Efforts in Support of the Shore Manpower Requirements Determination Program (SMRDP) Process. Wherever

possible, concentrate on developing MEMs based on specific activity universes that have approved studies completed.

CHAPTER 4

GENERAL WORK MEASUREMENT AND METHODS STUDY TOOLS AND TECHNIQUES

400. General

1. Work Measurement. The primary work measurement techniques used to obtain work-hour data for establishment of manpower requirements baseline and/or development of staffing standards are Op Audit and Work Sampling.

2. Methods Study. Methods study is concerned with the analysis of methods and equipment used in job performance, design of an optimum method, and standardization of proposed methods. References such as Handbook of Industrial Engineering and Industrial Engineering Handbook describe additional techniques that are applicable for use in conducting manpower requirements and/or staffing standards studies.

401. Study Considerations

1. General

a. Study Preparation. The analyst should perform several preparatory tasks before beginning a work measurement and methods study. These preliminary tasks will add to the effectiveness of the study. Preparation is required to identify the PWS, WIs, work units (as appropriate), and standard practices/methodologies and to establish a production work count system.

(1) Obtain Cooperation. Establish a good working relationship with the individuals to be studied. Cooperation is most easily obtained by conducting an orientation session covering the following points.

(a) Purpose of the study.

(b) Procedures to be followed.

(c) General theory of technique(s)being used.

(d) Planned disposition of gathered data.

(e) Potential effect on those being studied

(2) Become familiar with the work situation.

(3) Inform those to be studied.

(4) Define Standard Practice. In some work situations, a written standard practice contains pertinent information describing, in some detail, the method used to produce the work units under study. The future value of a standard is enhanced tremendously if information exists showing how the work was performed at the time the standard was developed.

(5) Conduct interviews. Appendix H provides a detailed discussion on interviewing techniques.

(6) Establish a work count system.

b. Planning the Study

(1) Decide on the scope and level of the study, prepare a timetable with approximate starting and finishing dates, and determine proposed methods and techniques.

(2) Establish realistic deadlines that will minimize interference with the regular work of the components being studied.

(3) Make sure the analysis will neither overlap a recent study nor follow another so closely it will conflict with the successful installation of recommendations.

(4) Develop an atmosphere in which activity personnel can express their ideas on organizational problems.

c. Data Gathering

(1) Some general principles to observe while gathering study data are:

(a) Stay within the boundaries of the study and the time allotted.

(b) Follow the plan of approach closely but be flexible as to how, when, and where the facts are gathered.

(c) It is better to gather too many rather than too few facts.

(d) Organize working papers systematically. This will prevent important items from becoming buried and overlooked during the analysis phase.

(2) If some tasks found during the data gathering phase are not included in the common PWS and task definitions, they will be measured and recorded separately on all required forms. (Applies if multiple-activity staffing standards are being developed from study results.)

2. Total Force Manpower Management

a. Manpower Resourcing

(1) Contractor Manpower. Contract labor work-hours may be substituted for other forms of manpower if such a substitution is cost effective and considered to be in the best interest of the Navy, and if the manpower requirements are not needed to support military essentiality (see TFMMS Coding Directory).

(2) TAD Personnel

(a) Some aircraft squadrons are provided TAD assets to supplement the allowance of the ship or shore activity where the squadron is assigned. Identification of manpower requirements within Squadron Manpower Documents (SQMDs) varies with the category of squadron. For shore-based deployable squadrons, TAD billets labeled as “Integrated Services” and "Aircraft Intermediate Maintenance Deparment (AIMD)” are included under the squadron’s UIC. Carrier-deployable squadrons receive Integrated Services manpower requirements based solely on shipboard manpower requirements. Supporting AIMD manpower requirements are filled by personnel assigned to Sea Operational Detachment (SEAOPDET) components at the squadron’s home port naval air station. Detachment deployable squadrons are not normally provided with TAD billets. For non-deploying aircraft squadrons permanently based ashore, comparable TAD manpower requirements may be assigned to a separate aircraft operational detachment UIC as a component of the supporting naval air station. In computing manpower requirements for a naval air station or any other activity using squadron TAD resources, use the following procedures:

1. If an SQMD has been developed, use it to determine the number of manpower requirements available.

2. If no SQMD exists, use the current authorization for TAD manpower requirements or the authorization for the operational detachments to determine the number of manpower requirements available.

3. Subtract the average number of TAD manpower requirements available from the total manpower requirements for the appropriate component. Compute the average number of TAD manpower requirements using the following procedures:

a. Activities with aircraft operational detachments assigned, count 100% of manpower requirements as available.

b. Activities with shore-based deployable and carrier deployable squadrons assigned, count 33% of the assigned squadrons at home.

c. Activities that host visiting squadrons, count the historical assigned TAD for the past year.

(b) Some activities receive support from TAD personnel assigned to other activities (excluding squadrons). In this case, determine what portion of the workload of the functions in which TAD personnel are used should be accomplished by permanent duty station personnel and what portion should be accomplished by TAD personnel. In making this determination, assign the following categories of work to permanent duty personnel. The remainder of the work could be accomplished by TAD personnel.

1. All productive workload in support of base operations.

2. All supervision, other than working supervision.

3. Working supervision and productive workload requiring a skill which would not be provided by TAD personnel.

4. Workload associated with providing training and adequate continuity of operations.

5. Facilities maintenance workload, other than that which results directly from the presence of the

activities providing the TAD personnel.

(c) Care must be taken to ensure there are sufficient manpower requirements on the AMDs of the activities providing the TAD personnel to cover the workload assigned to them.

(3) Temporary/Transient Personnel. Under certain circumstance, valid workload may be accomplished by temporary or transient personnel. Maximum use of these personnel should be made within the guidelines of pipeline management.

b. Deprived Ratings and NECs. Ratings and NECs in paygrades E-5 through E-9 requiring additional shore manpower requirements to meet sea/shore rotation goals are designated as deprived ratings or NECs. Retention of shore duty manpower requirements for deprived ratings and NECs takes precedence over the substitution of other forms of manpower.

c. General/Administrative Manpower Requirements. General/administrative manpower requirements are paygrades E-5 through E-9 of a general military nature that require a qualitative rate level rather than a technical skill. Consider recommendations for establishment or adjustment of general/ administrative manpower requirements when developing the activity's manpower requirements baseline.

d. Civilian Position Classification. Civilian positions within the Navy are subject to the Classification Act unless specifically exempted. Civilian Personnel Instruction (CPI) 511 contains a complete list of exempted positions. Craftsmen and labor-type positions (blue-collar workers) are exempt from the Classification Act, they are covered by the Federal Wage System (PL 92-392).

402. Classification of Organizational Component Tasks

1. Task Analysis. When analyzing work center tasking, first determine if the work is required by a higher echelon directive. When a tasking directive exists, further analysis is then needed to determine if work tasked to the work center is or is not mission essential to the work center. Classify work-hours expended on tasks identified as mission essential productive. Classify non-essential tasks as nonavailable, not allowed, or assumed, depending on tasking language contained in pertinent higher echelon directives.

2. Proper Accountability of Tasks. Certain tasks may be confusing or difficult to classify. Some common areas of confusion are:

a. Intra-related Tasks

(1) Telephone calls are usually made in conjunction with doing another task; therefore, include time for telephone calls with the respective task.

(2) Work-oriented discussions are required between supervisors and workers. Include this discussion time with the respective task time.

(3) If travel between work centers or from the work center to the job site, or TAD travel with the purpose of doing official mission-oriented direct work is required to do a specific task, establish a subtask under the task for travel. If the travel is required to do two or more tasks in the same direct category, establish a separate task in the category for travel. If the travel is required to do tasks in two or more categories, establish a separate category for travel. (Ensure credit for travel is not double counted in the tasks or categories identified.)

(4) Include work-hours expended obtaining, documenting, or returning replacement parts or supplies in the respective direct task time.

(5) Establish a "management" category to contain those tasks necessary to support the subordinate work centers when two or more subordinate work centers are being managed. Management or overhead work centers can have both "management" and "supervision" categories. The "management" category will reflect tasks to support personnel in subordinate work centers while the "supervision" category will reflect tasks to support people inside the work center. Direct management tasks should be written clearly and not duplicate work described in other category descriptions. When using work sampling, measure the management and supervision categories using a two step system. Combine them into one category for work sampling to provide the time expended in the categories. Both categories should then be operationally audited to determine the percentage of time spent in each of the tasks. By applying this percentage to the work sampling results, an accurate figure for both categories can be obtained. When employing the Op Audit measurement method, the

PWS will be written to clearly define the specific tasks involved.

b. Training

(1) When personnel who are formally designated as apprentices or trainees are accomplishing direct tasks while receiving on-the-job training (OJT), associated work-hours should be credited to the direct task done. Work-hours expended on tasks performed by personnel receiving in-house proficiency training or qualification training in a classroom environment in lieu of numerous individual OJT sessions on one subject should be credited to an OJT productive indirect task. If the worker is "learning while producing", record his time in the appropriate productive category, whether it be direct or indirect, and not as OJT. On-the-job study of career development course materials, unless the course materials are being used as a reference for one of the aforementioned conditions of OJT, is considered non-productive, avoidable delay (idle).

(2) Job related TAD training is categorized in the PWS as such, and credited to the organizational component (using an Op Audit). Travel time associated with such training is included in the allowed work-hours for travel. Enroute TAD training is not credited to the work center.

(3) Time expended by a supervisor in providing OJT is also productive, but should be classified under the category of supervision, not OJT.

(4) General military training is included in nonavailable time.

3. Nonavailable Time

a. Some non-mission-related tasks that make people unavailable for assigned primary tasks are directed, approved, or recognized by Navy. These tasks impact on all activities. Associated work-hours are subtracted from assigned time to produce the available workweek.

b. The major groupings of nonavailable time for Navy military and civilian personnel are leave, holidays, training, and service diversions/special absences. Nonavailable time is not measured during an Op Audit because associated work-hours have been accounted for in the establishment of Navy standard

workweeks. Work sampling accounts for all work-hours including nonavailable time; however, the resulting nonavailable work-hours are not used in the work-hour equation, nor are nonavailable categories included in the PWS.

4. Collateral Duties

a. General. Determining whether work identified as "collateral duty" should be included as authorized workload and therefore measured/studied during work measurement or staffing standards development is an area of concern to study personnel because of the lack of precision in the term. The OPNAVINST 1000.16 series defines collateral duty as duty assigned to individuals by the Commander, Commanding Officer, or Officer-in-Charge and is in addition to the individual's primary duty. These duties are normally performed at the individual's permanent duty station. Almost every work center or organizational component has additional or collateral duties assigned by higher authority. These duties are assigned to achieve a wide variety of goals benefiting the command or uniform service as a whole, but do not necessarily directly support a work center or organizational component's primary mission. Collateral duties may in fact have little or no relationship to the mission of the work center or organizational component to which the tasked individual is assigned.

b. Under standard Navy manpower measurement methodology, collateral duties are classified as either productive or nonproductive. For purposes of workload measurement, these terms are defined as:

(1) Productive. Duties that are useful and essential to the command's mission and directly support the work center or organizational mission. The work hours expended performing these collateral duties are considered productive and should be measured and captured. Examples are: Automated Data Processing (ADP) Security Officer, Drug & Alcohol Program Advisor, Safety Officer, and Command Fitness Coordinator.

(2) Nonproductive. Duties that are not functionally related to a work center and, therefore, the SORM does not identify a specific work center or function to perform the work. While this work benefits the command, it does NOT directly support the work center or the organizational mission and therefore these work hours SHOULD NOT BE measured or captured. Nonproductive collateral duties are those associated with activities such as being a member of a Board or Committee. The

work hours expended on these duties have already been captured and incorporated in the Navy Standard Workweek under diversion. Examples are: Mess Audit Board Member, Planning Board for Training Member, Welfare & Recreation Committee Member, Safety Committee Member, and Special Courts-Martial Panel Member.

c. Capturing work hours. Work hours identified to support collateral duties established in OPNAVINST 3120.32 series or other directives published by higher authority shall be captured as productive work hours and used in the manpower requirements determination process as follows:

(1) Where the directive identifies a specific function or work center to perform the duty:

(a) Include the required tasks in the work center description and credit productive work hours accordingly.

(b) In some instances, the directive will specify a certain work center (e.g., personnel, administrative, training, etc.) to perform the collateral duty; however, there may be individuals' in other work centers performing some of the duties associated with the collateral duty. The directive does not identify these other work centers. When this dual tasking exists, measure and credit the work performed in the specified (primary) work center and count it as productive time for that specified (primary) work center. Do not credit the work hours expended by other work centers performing some of the associated duties. These work hours are included in the nonavailable work hour portion of assigned time (covered by the diversion allowance included in the Navy standard workweek.

(2) Some collateral duties, although productive, are not functionally related and therefore, OPNAVINST 3120.32 series does not identify a specific work center or function to perform the work. Although this work is performed in a specific work center, it is not essential to the accomplishment of that work center's mission, however, this productive workload must be identified and captured somewhere in the organization. Under these circumstances, capture these work hours as follows:

(a) Identify work hours expended and categorize it as nonavailable or nonproductive for the work center.

(b) Identify these productive work hours and combine them with other like work hours. Organizationally place these hours somewhere within the command (e.g., admin, staff,

etc.). NOTE: these hours are not intended to increase the manpower requirements within the work center credited with performing the work hours. They are captured to ensure the analyst identifies the work hours expended for productive collateral duties unassigned to a specific work center.

d. The OPNAVINST 1000.16 series provides the policies concerning collateral duties.

403. Application of Performance Rating and Allowances

1. Performance Rating

a. Measured productive time should be leveled (i.e., a leveling factor applied) whenever possible. In work sampling and Group Timing Technique (GTT), leveling is limited by the observed task. In an Op Audit, the use of leveling is further limited to one technique -- the Good Operator (actual timing) technique. Time values obtained with the Directed Requirement, Historical Experience, or Best Judgment techniques are not leveled. Some productive tasks for which rating is impractical will be encountered in nearly every work center/organizational component. If this is true of an entire productive category, do not apply the leveling factor.

b. The performance rating (leveling) method prescribed for manpower requirements studies is pace rating. This method is explained briefly in Appendix I. Appendix I also contains an explanation of how to compute an average leveling factor.

c. The number of performance ratings required varies with the work measurement method being used.

(1) Good Operator Op Audit Technique. Rate each time cycle.

(2) Work Sampling/GTT. Rate each worker at least four times per day. If the sampling schedule exceeds an average of four observations per hour, it is desirable that at least one performance rating be made for every four samples obtained.

d. Schedule pace rating training sessions for those analysts that will employ the method before measurement is to begin.

2. Allowances

a. Work center/organizational component time values include

appropriate allowances for personal, fatigue (rest), and unavoidable delay (PF&D). Total allowed time is leveled time plus PF&D allowances. If leveling is neither required nor feasible, allowed time is actual productive time plus necessary PF&D allowances, as appropriate. A recommended PF&D allowance factor (AF) of 1.15 (13%) for white collar workers and 1.17 (14.5%) for blue collar workers is considered realistic for most work centers. PF&D allowances used during work measurement may vary based on operations within the work center, working environment, or other conditions affecting the work situation. Under these circumstances, a PF&D AF other than that recommended may be appropriate. Compute the AF for PF&D with the equation:

$$AF = \frac{100\%}{100\% - PF\&D\%}$$, where percentages are expressed in terms of the total workday.

Example of an AF Computation

$$\text{White Collar AF} = \frac{100\%}{100\% - 13\%} = \frac{100\ \%}{87\%} = 1.15$$

$$\text{Blue Collar AF} = \frac{100\%}{100\% - 14.5\%} = \frac{100\%}{85.5\%} = 1.17$$

b. Selective application of allowances is provided for each measurement method used in manpower requirements baseline development. The degree of selectivity ranges from the element level of Op Audits to the category level in work sampling studies. As a general rule, PF&D allowances are added when the productive time value has been derived in a manner that definitely limits that value to purely productive time. Specific rules for applying allowances vary with the measurement method or technique and with the particular category or task involved. Rules for application, by method are:

(1) Work Sampling/GTT. Apply allowances to all appropriate productive categories. Some categories, because of the work involved, may be given a higher or lower AF than other productive categories in the same study. When this occurs, document an explanation of special allowances, indicating the AF used and reason for factor deviation for affected categories.

(2) Op Audit. Allowances are not applied to work-hours developed as directed manpower requirements. If the Good Operator (actual timing) technique is used, allowances are applied to observed time values. Application of allowances to time values developed with the Best Judgment technique is

appropriate only when time estimates are developed on the basis of detailed task/subtask or element analysis, with each task time being estimated and weighted to develop the standard time. Historical Experience time values are usually the result of work-hour accounting systems that either do not separate personal and rest time from productive time, or make accurate and confident identification of such values impossible. Therefore, the time values derived are considered to include personal and rest time, and no allowances are added.

c. The applied PF&D AF should be fully documented in the measurement back-up data. The DOD Manual 5010.15-1-M (Standardization of Work Measurements) provides information on the development of PF&D AFs.

404. Minimum Manpower Requirements and Standby Determination

1. Need For Minimum Manning and Standby. There are situations where measured work-hours, based on low workload volumes, may not provide the manpower required to support the work center/ organizational component's minimum staffing manpower requirements as driven by level of service and/or shift tasking. Management decisions often generate minimum manpower levels that drive standby time. Standby time should be documented when the dictated manpower requirement exceeds that required for the actual productive effort (i.e., productive work-hours that would result if all of the productive tasks were timed). Standby time that is mission essential is allowed in manpower studies; however, to merely explain the computations used to derive standby time is not sufficient. Since standby time is nonproductive and costly, all standby time included in manpower requirements determination studies and staffing standards should be justified. Management decisions leading to minimum manpower requirements and associated standby time should be validated.

2. Contributing Factors. Numerous factors contribute to establishing minimum manpower requirements. Some of these factors, often a result of management decisions, are: mission requirements, performance standards, machine design, facility limitations, hours of operation, shift size and necessity, crew size, post-manpower requirements, safety, and security. In certain situations, the manpower requirement is dictated by the necessity for one or more people to be present in the work area, although these personnel may not be continuously productive. For example, the identification-checker station in a commissary sales store must be manned during all open store hours, whether or not any customers are passing the check point. Certain base

utilities, such as small power production facilities or water plants, might require continuous surveillance to ensure uninterrupted service. Standby time can occur at any workload volume. Some work areas require standby time to maintain the capability to provide a given level of service other than that associated with establishing minimum staffing. Some examples are one hour turn-around-time for scheduled aircraft, ten minute response time for on-station taxi requests, and 30-minute response time to fill requests for parts. Determining the amount of standby time to be included in the total work-hour requirement involves analysis of many factors (e.g., acceptable customer waiting times, acceptable backlog level, work arrival rates and distribution, transferability of direct and indirect work, etc.). In these situations, required standby time is the difference between the allowed time associated with productive work (productive time plus PF&D) and allowed time required to satisfy a level of service constraints.

3. Evaluating Minimum Manpower Requirements

a. In some cases, minimum manpower requirements can be identified without a detailed measurement study. Required manpower may be determined by use of a Minimum Manpower Factor (MMF) in situations such as the continuous watchstanders (post manning) requirement. In other cases, a detailed study may be required to identify or verify the existence of a minimum manpower situation and/or to quantify actual standby time required.

b. Minimum manpower requirements can be identified by work measurement techniques as they are used to measure normal productive workload if the levels of service are properly defined before measurement. In many cases, standby time can be reduced by transferring productive work to replace measured standby work-hours. Shift Profile Analysis is an effective way to identify and minimize standby time by leveling workloads to economize on nonproductive standby periods.

c. Carefully check the requirement for minimum manpower. Question the basic need. Offer alternatives and clearly define the cost of such service. Study documentation must contain rationale to justify minimum manpower requirements. After confirmation of minimum manpower requirements, quantifying standby time is generally straightforward. Standby time can often be reduced or minimized through improved shift scheduling, reorganization, planning, and workload control techniques. The analyst must be prepared to show the manager how to meet the

required performance standards with minimum standby time. When standby time is minimized, the total manpower requirement is also minimized.

4. MMF Method

a. The MMF method uses predetermined manpower factors to compute manpower requirements for "post manning" type situations (e.g., continuous watchstanders). Component manpower requirements in these situations are usually supported totally by the minimum manpower requirement. The MMF method determines a component's quantitative manpower requirements with results in whole manpower requirements, without detailed work study.

b. Compute the factor by dividing the work-hours for position coverage by the appropriate the WAF. The WAF may have to be adjusted to allow for additional work-hours associated with position coverage. These additional work-hours fall into two categories.

(1) Category 1: Work-hours required for tasks that must be performed either before or after the position coverage starts. In the case of security guard posts, for example, the security personnel must obtain a weapon and ammunition from the armory and attend guard mount before assuming the post. Likewise, at the end of the shift, security personnel must turn in the weapon and ammunition to the armory. The time associated with these tasks is in addition to the time required for position (post) duty.

(2) Category 2: Recurring training time needed to keep an individual qualified to fill the position. This is training that cannot be received while the individual is actually on position duty. An example of this type of training is proficiency or refresher training required of all security personnel such as weapons training. Before developing a special allowance, make sure such training has not already been credited in the WAF.

c. When additional allowances are given for these two types of position-related work-hours, derive the work-hours used in computing the allowances from work measurement.

d. To compute required manpower, divide the position coverage in work-hours by the WAF. For example, a position requiring coverage 7 days a week, 24 hours a day by one individual generates a requirement for 730.464 available monthly

work-hours. If the work force is in CONUS and on a 5-day, 40-hour workweek, the manpower requirement is 5.033 (730.464/145.136). However, if the work force is military on a 6-day, 56-hour workweek, the manpower requirement is 3.00 (730.464/243.488). These numbers, 5.033 and 3.00, are MMF. Standby time is normally an inherent part of positions based on MMF application, such as security personnel assigned to a base access gate and fire fighters.

e. Use the following equation to compute MMFs:

$$\text{MMF} = \frac{(\text{Days/WK})(\text{HRs/Day})(4.348\ \text{WKs/MO})(\text{DRF*})}{\text{WAF}}\ (\text{Crew Size})$$

*The Directed Requirement Factor (DRF) is a constant work-hour requirement directed by higher headquarters policy in addition to duties for a minimum manpower situation. For example, if each person must receive 2.50 hours per month of proficiency or refresher training, and training cannot be received while on the job, then compute the DRF as follows:

$$\text{DRF} = 1 + [(T/(\text{WAF} - T)]$$

where WAF = work-hour availability factor, and

T = required training hours

If T = 2.5 and WAF = 145.136, then,

$$\text{DRF} = 1 + [2.5/(145.136 - 2.5)] = 1.018$$

The DRF is equal to 1.00 unless otherwise stated. In this case, the MMF value is the same as the post manning factor value.

f. Certain functions such as base security require adjustments to these procedures. In this case compute an MMF for each position, sum the MMFs, and refer to the fractional manpower cutoff values for the whole manpower requirement. For example, a small naval station has 3 gates. Main gate duties require two security personnel, 24 hours a day, 7 days a week. East gate duties require one security person, 8 hours a day, 5 days a week. West gate duties require one security person, 4 hours a day (all in one shift), 5 days a week. The east and west gates are closed for holidays (10 days a year). The base security work center having the mission of providing manpower for these gates is on a 5-day, 40-hour workweek. Position-coverage associated tasks require 0.669 hours per shift

and recurring training that cannot be performed while at the positions requires 5.40 hours per month per person. The total manpower requirement for these three gates is as follows:

(1) Calculate the DRF for training:

$$DRF = 1 + [T/(WAF - T)] = 1 + [5.40/(WAF - 5.40)]$$

Since the WAF for a CONUS 5-day, 40-hour workweek is 145.136, DRF = 1 + [5.40/(145.136 - 5.40)] = 1.0386

Apply this factor to the total work-hour requirements it takes to fill the post, that is, to both the basic position coverage and the position-coverage associated tasks. Since the main gate has three shifts, the total daily work-hours for position-coverage associated tasks is 3(0.669) = 2.007. Adding this result to the 24 work-hours of position coverage per day equals 26.007. This result (26.007) is the entry for the hours/day item in the MMF formula for the main gate:

$$MMF = \frac{(Days/WK)(HRs/Day)(4.348\ WKs/Mo)(DRF)}{WAF}\ (Crew\ Size)$$

$$MMF = \frac{(7)(26.007)(4.348)(1.0386)}{145.136}\ (2) = 11.329$$

(2) East gate duties require one security person, 8 hours a day, 5 days a week. Only one shift is involved, so the total entry for the hours/day item in the MMF formula is 8 + 0.669 = 8.669. But there is another problem. This position is not filled during holidays (10 days a year), and the conversion factor (4.348 weeks/month) will add unneeded work-hours to the position coverage because it includes holidays. Therefore, replace the 4.348 conversion factor with a new one that does not include the 10 holidays, as follows:

365.25 days/year (YR) - 10 days/YR = 355.25 days/YR

355.25 days/YR x 1 YR/12 MOs x 1 WK/7 days = 4.229 WKs/MO

Now the MMF formula for the east gate is:

$$MMF = \frac{(Days/WK)(HRs/Day)(4.229\ WKs/MO)(DRF)}{WAF}\ (Crew\ Size)$$

$$MMF = \frac{(5)(8.669)(4.229)(1.0386)}{145.136}\ (1) = 1.312$$

(3) West gate duties require one person, 4 hours a day, 5 days per week. The gate is closed on holidays. Although 4 hours is not a complete shift, 0.669 hours are still associated with the shift because the same tasks would apply to a partial shift as to a whole shift. The entry for the hours per day item in the MMF formula is 4.669, and MMF is calculated as follows:

$$\text{MMF} = \frac{(\text{days/WK})(\text{HRs/Day})(4.229\ \text{WKs/MO})(\text{DRF})}{\text{WAF}}\ (\text{Crew Size})$$

$$\text{MMF} = \frac{(5)(4.669)(4.229)(1.0386)}{145.136}\ (1) = 0.706$$

(4) To find total manpower required, add the three MMFs: 11.329 + 1.312 + 0.706 = 13.347. According to the fractional manpower cutoff value, 13.347 rounds to 13 manpower requirements.

g. When determining MMFs for multiple posts of identical make-up in hours of operation, crew size, DRF, etc.; compute the MMF for a single post and multiply the result by the number of posts authorized for the function under study.

5. Standby Determination with Work-hour Collection Methods

a. Study Design

(1) A well-designed study accurately identifies minimum manpower requirements and true standby time. Necessary standby work-hours cannot be identified during the staffing standards or manpower study development processes when they are grouped in with other nonproductive time and when the minimum manpower requirements have not been accurately documented.

(2) When the possibility of standby time exists, clearly define the method of determination. Normal data collection and work measurement procedures can be used to identify standby; however, some innovation is required with these methods. Do not simply state queuing or shift profile analysis will be used to quantify standby time; tell how to use these techniques. Standby time computed according to procedures of this section may be included as input to manpower study work-hours or to regression analysis when developing a staffing standard work-hour equation. If standby time does not exist at all locations of multiple-location standards studies, develop an additive standard for applicable locations.

b. Data Collection and Analysis Procedures. When work sampling or queuing is used and standby time exists, use the Work-hour Shift Profile Analysis to aid in minimizing standby time. Use of work-hour shift profile charts can aid in defining the minimum essential manpower levels by leveling workloads to economize on nonproductive standby periods and identifying minimum standby time based on the accepted level of service.

(1) Op Audit

(a) When an Op Audit is used as the primary work measurement method, include sufficient rationale in the study report to support the minimum manpower requirement. If the minimum manpower requirement represents the total work-hour universe, then it is not necessary to measure standby time. Justify and compute the minimum manpower requirement on the Minimum Manpower Computation Sheet.

(b) When the total work-hour universe is greater than the minimum manpower requirement, minimize and fully explain all standby allowed in the study. Developing a work-hour shift profile chart from Op Audit measurements may be difficult because task times are not associated with each hour of the duty day. Therefore, consider using short-cycle work sampling to collect work-hours for a work-hour shift profile chart. Use the work sampling as backup for the Op Audit work-hours.

(2) Queuing. Queuing analysis provides a means of determining manpower requirements necessary to accommodate various levels of service. After an acceptable level of service has been determined (e.g., the number of taxi drivers required to provide a 4-minute response time) the percentage of server time in productive work may be determined with the queuing utilization factor. Queuing also shows when servers are not busy, including standby time. Queuing data does not directly identify allowed standby time. If queuing is used, design the study to collect queuing data on standby time.

(3) Work Sampling

(a) Standby time can be identified during work sampling observation rounds when minimum manpower requirements are previously defined. For example, suppose a finance office requires that customers with pay inquiries be waited on within 30 minutes of customer arrival. It has been predetermined that two finance clerks are necessary to provide this level of

service at the finance counter between 0900 and 1500. When the analyst knows this information before the study begins, provisions can be made to isolate and identify the required standby time. On each observation round, the analyst records each worker in the respective category. The analyst may enter a maximum of two standby tallies during each observation round, but this would occur only if both service clerks were awaiting customers.

(b) Standby time thus collected represents the result of the minimum manpower requirement. Standby time derived in this manner can be used to show management the manpower cost of providing this level of service. Analysis of work sampling observation sheets and waiting time data (e.g., the time finance customers actually wait for service) may reveal that the specified level of service has been exceeded or that the second server is needed only during peak periods, such as pay days.

(c) Standby time collected in this manner represents adjusted or derived standby time required to support a predetermined level of service. However, if the level of service is not clearly defined, it is impossible to identify whether the worker should be sampled as idle or standby. When this is the case, conduct a Work-hour Shift Profile Analysis to determine required standby time. Show the standby time derived through this procedure on the Work Sampling Computation Sheet. Do not level or apply allowances to this time. Standby time may be used to reduce PF&D for other productive category work-hours.

6. Minimum Manpower Requirements Documentation

a. The Minimum Manpower Computation Sheet (Figure 4-1) is used to compute and document minimum manpower requirements and to provide an audit trail for inclusion of required minimum manning and standby work-hours on the Work-Hour Requirements Consolidation Sheet (Appendix F). No standard format would satisfy every possible minimum manpower computation. Any form used to compute minimum manpower requirements and standby work-hours should be supplemented with additional documentation as necessary to explain the development rationale.

b. When component manpower is supported totally by minimum manpower requirements, use the Minimum Manpower Computation Sheet to establish and document quantitative manpower (work-hour) requirements and determine qualitative requirements for the component by use of the Manpower Distribution Chart

(Appendix F). In these situations, the Work-Hour Requirements Consolidation Sheet is not necessary.

c. When the minimum manpower computation is not the sole measurement method for the organizational component, compute minimum required work-hours on the Minimum Manpower Computation Sheet, and enter the work-hour requirements on the Work-hour Requirements Computation Sheet, under the "Other" monthly allowed time column.

405. Instructions For Completing The Minimum Manpower Computation Sheet (Figure 4-1)

1. The Minimum Manpower Computation Sheet is provided to assist in computing minimum manpower requirements and standby work-hours. Complete the header information including the specific organizational component. Section I, Minimum Manpower Factor Computation, is designed to develop and use an MMF in establishing minimum manpower requirements. This method is normally used in situations where requirements within a component are supported totally by "post manning" type minimum manpower requirements.

2. Section I - Minimum Manpower Factor Computation

a. (Columns A - I). Enter specified data and compute the MMF. If more than one MMF is to be computed to cover minimum manpower situations within the component, use a separate line to show calculations for each and sum in the MMF column.

b. Round the resulting MMF total to whole manpower requirements based on fractional manpower cutoff values, and enter the "whole body" minimum manpower requirement. If the resultant requirements constitute the total component manpower requirement, reflect qualitative requirements on a Manpower Distribution Chart. If minimum manpower positions do not constitute the total component manpower requirement, accomplish actions in (3) and (4) below.

c. Enter the WAF, based on the activity's existing standard Navy productive workweek. (Normally 145.136 monthly work-hours for Navy activities ashore during peacetime.)

MINIMUM MANPOWER COMPUTATION SHEET DATE: 10/16/96 PAGE 1 OF 1

ORG. COMPONENT: PHYSICAL SECURITY OPERATIONS ANALYST: H. ROCKOE

UIC: XXX1X ACTIVITY: WETLANDS NAVAL STATION

SECTION I. MINIMUM MANPOWER FACTOR COMPUTATION

DAYS PER WEEK (A)	HOURS PER DAY (B)	WEEKS PER MONTH (C)	DIRECTED REQUIRE-MENT FACTOR (DRF) (D)	MONTHLY REQUIRED WORK-HOURS (A X B X C X D) (E)	WORK-HOUR AVAIL-ABILITY FACTOR (WAF) (F)	WORK-MONTHS E ---- F (G)	CREW SIZE (H)	MINIMUM MANPOWER FACTOR (MMF) (G X H) (I)
7	26.007	4.348	1.0386	822.103	145.136	5.6644	2	11.329
5	8.669	4.229	↓	190.382	↓	1.3117	1	1.312
5	4.669	4.229	↓	102.537	↓	.7065	1	.706
7	16.000	4.348	1.0000	486.976	↓	3.3553	1	3.355

NOTES: [For use in computing "Post manning" minimum manning rqmts.]

MINIMUM MANPOWER FACTOR TOTAL	16.702
MINIMUM MANPOWER REQUIREMENT	17
WORK-HOUR AVAILABILITY FACTOR	145.136
MINIMUM REQUIRED WORK-HOURS	2467

SECTION II. MINIMUM MANPOWER / STANDBY COMPUTATION

SHIFT PERIOD/NO. HOURS (J)	NUMBER PERSONS REQUIRED (K)	WORK-HOURS PER SHIFT (L)	DAYS PER MONTH (M)	MINIMUM MONTHLY WORK-HOURS (LxM) (N)	PRODUCTIVE WORK-HOURS AVAILABLE (MEASURED) (O)	STANDBY WORK-HOURS REQUIRED (N-O) (P)
0800-1600/8	2	16	30.438	487	839	0
0800-1600/8	2	16	20.908	335	317	18
					TOTAL	18

NOTES: For use in netting minimum manning rqmts and measured productive work-hours. Reflect Column P standby work-hours in Column G "other" of the Work-hour rqmts Consolidation Sheet and in the appropriate skill/skill grouping column on the Manpower Distribution Chart

Figure 4-1. Example Of Minimum Manpower Computation Sheet

d. Multiply the "whole body" minimum manpower requirement by the WAF and round to whole work-hours to establish minimum required monthly work-hours. Reflect these required work-hours in Column G, "Other" of the Work-Hour Requirements Consolidation Sheet and in a separate skill/skill grouping column on the Manpower Distribution Chart. Identify minimum manpower requirements not associated with a measured category by a category title such as "minimum manpower positions."

3. Section II - Minimum Manpower/Standby Computation

a. Section II, Minimum Manpower/Standby Computation, is provided to compute derived standby time when standby work-hours were not determined as part of the measurement of productive allowed time and there is an overlap between productive work-hours and minimum manpower requirements needed to achieve a specified level of service, mission requirement, shift posture, etc.

b. Make a separate line entry for each minimum manpower situation, e.g., two people required from 0800-1600, 7 days per week. If a third person is required on this same shift for only 5 days per week, a separate line entry is used to reflect that portion of the manpower requirement as a separate situation.

c. Column J, Shift Hours. Indicate shift period/number of hours.

d. Column K, Number Persons Required. Indicate number of personnel required on the shift.

e. Column L, Work-hours Per Shift. Multiply the number of hours in the shift by the number of personnel required to compute work-hours per shift.

f. Column M, Days Per Month. Indicate days per month.

g. Column N, Minimum Monthly Work-hours. Multiply work-hours per shift (Column L) by days per month (Column M) to compute minimum monthly work-hours. Reflect this figure in whole work-hours.

h. Column O, Productive Work-hours Available (Measured). Document what category of work is to be accomplished by what skills during minimum manpower shift hours. Determine and enter amount of allowed time from the Work-Hour Requirements Consolidation Sheet that can reasonably be accomplished during

indicated minimum manpower shift hours. When minimum manpower is based strictly on providing "open door" coverage, enter total allowed time generated by the appropriate shift.

i. Column P, Standby Work-hours Required. Compare productive allowed work-hours available (Column O) with minimum work-hour requirement (Column N) and establish the net difference between the two values. The amount by which minimum manning requirements exceed available productive allowed work-hours is derived standby time. Reflect Column P required standby work-hours in Column G, "Other" of the appropriate category lines on the Work-Hour Requirements Consolidation Sheet and in the appropriate skill/ skill grouping column on the Manpower Distribution Chart.

CHAPTER 5

OPERATIONAL (Op) AUDIT

500. General

1. Op Audit is a work measurement tool in where work-hours required to accomplish defined categories, tasks, and subtasks of work within a work center/organizational component are derived by identification and summation of frequencies of occurrence multiplied by their unit times. Discussion of general interview techniques to augment Op Audit skills may be found in Appendix H.

2. Op Audit integrates four techniques (Directed Requirement, Good Operator, Historical Experience, and Best Judgment) into a flexible, systematic work measurement method to attain unit time values and task frequencies. Use the technique providing the most accurate and realistic data to determine the value of each separate frequency or unit time. It is common to use one technique to determine frequency and another to determine unit time for a given task. The various techniques provide a broad range of data sources to use in gathering Op Audit data.

3. Essential to the proper application of Op Audit is the identification and definition of required MFTs and workload. Assumed and inferred taskings are not credited. All authorized work is included, even if not currently being accomplished.

4. The various techniques and multi-sourced nature of Op Audits give it a degree of flexibility not present in work sampling or time study. This method is especially useful in a supplementary role in work sampling, for example, to measure infrequently performed tasks (e.g., annual audits or inventories) not easily covered by work sampling.

501. Directed Requirement Technique

1. This technique recognizes that many activities have some manpower requirements that are directed by higher authority, and provides for incorporating the associated manpower requirements in the measurement. This technique saves time by precluding unnecessary measurement.

2. Whole manpower requirements may be documented with this technique, with no further study required, if the following conditions are met:

a. OPNAV, Chief of Naval Personnel (CHNAVPERS), or the manpower claimant directs the need for the manpower requirement in a written directive.

b. The manpower requirement is one of a kind in the work center and/or organizational component and driven by a requirement to perform a specific mission, function, or task (e.g., medical corpsman assigned to a SEAL (Sea, Air, Land) Team).

c. The manpower requirement cannot be one directed solely to establish responsibility.

502. Historical Experience Technique

1. This technique draws on documented historical data and experience. It serves in a contributory, subordinate capacity to the detailed audit process, and not as an independent work measurement method.

2. Evaluate both production and work-hour accounting records before using the data with this technique. Examine 6 to 12 months' worth of data. Discuss the work situation fully with the supervisor to find out whether changes were made in methods, products, or type of services during or since the period covered by the records, and what effect any changes may have had on the data. Give credit for work-hours and production measurements for the current and more efficient method of production.

503. Good Operator Technique. Time values are obtained with this technique by selecting a qualified individual (ideally one who works at a normal pace and with normal skill) and observing the amount of time taken by that person to perform a given task. The time is taken as representative of the time others would take to perform the same work. Because values obtained from actual timed observations are more readily accepted by managers than those obtained by less objective means, the Good Operator technique will be given maximum feasible usage in Op Audit studies.

504. Best Judgment Technique

1. In many cases, time values and frequencies may not be

attainable with any of the other Op Audit techniques. When this occurs, rely on best judgment estimates for the audit computations. Use best judgment estimates for activity frequencies only when no alternative data source is available. If used, attempt to verify occurrence by cross-referencing with other relatable task frequencies. The Best Judgment technique employs the combined experience and background of the manpower analyst, the worker, and functional supervisory personnel to derive time frequency estimates through use of personal interviews. The validity of data developed by the Best Judgment technique depends heavily on the familiarity of the analyst, supervisors, and workers with the factors and circumstances affecting the work center and/or organizational component, and their ability to systematically interpret and evaluate facts. Appendix H provides additional techniques for conducting fact-finding interviews.

2. Make time estimates at the highest level of work that will allow confidence in the validity of the estimate. For example, if a task time can be confidently estimated, there is no need to go into more detail.

3. To make best judgment standards more objective, determine estimated time values by obtaining three time estimates: the "most likely time" to do the job; the "pessimistic time" (i.e., if things go wrong); and the "optimistic time" (i.e., if everything goes well). The idea is to determine the estimated decimal percent occurrence for each time value, then find the average time by using the following formula:

$$Y = o(O) + m(M) + p(P) \qquad \text{where,}$$

o = Estimated % Occurrence - Optimistic	O = Optimistic time
m = Estimated % Occurrence - Most likely	M = Most likely time
p = Estimated % Occurrence - Pessimistic	P = Pessimistic time

4. In the absence of historical frequency records, rely heavily on the experience and judgment of the supervisor and workers to obtain estimates of frequencies. In some cases, however, it is possible to relate unknown frequencies to reliable indirect recorded data, and thus derive an estimate less subject to human error. For example, if there is no record in a work center and/or organizational component to show the frequency with which a particular part is replaced on a piece of equipment, a check of supply issue records might aid in the frequency determination. Explore any action that will incorporate the objective judgment of the analyst into the estimating process.

505. Special Instructions on Detailed Audits. The final values developed by detailed Op Audits reflect a summation of numerous frequency and time products; one product for each documented task, subtask, or element. Each product is only as accurate as the frequency and unit time value from which it was computed. In turn, the frequency and unit time values are only as accurate as the statement or definition of the task to which they apply. State tasks, subtasks, or element titles in terms that readily support a work unit count and that are in a singular unit form. Make every possible effort to use task, subtask, or element titles that are in singular unit form. This enhances the accuracy of the associated unit time and frequencies of occurrence. Titles stated in vague terms, or in a plural sense with undetermined quantity increase the chances for error in the associated frequency of occurrence and unit time values. Also, subsequent qualitative or quantitative analysis of the data will not be possible. Below are some examples of good and poor verbiage for stating tasks, subtasks, or elements:

Good	Poor
Make telephone call	Telephone calls
Type letter	Type letters
Check pump	Inspection
Sort incoming mail	Process mail
Draft RCS: XXX Report	Prepare reports

506. Development and Documentation of Op Audit Data

1. Work measurement data developed by Op Audit will be recorded and summarized by category on Operational Audit Data Sheets and summarized by minimum skill/grade requirements on the Operational Audit Skill Worksheet. Detailed instructions for preparing the Operational Audit Data Sheet and Operational Audit Skill Worksheet are provided below. Category work-hour totals from Op Audit will be combined with allowed work-hours from all other sources by use of the Work-Hour Requirements Consolidation Sheet. (See Appendix F for work-hour data consolidation procedures.) Minimum skill work-hour requirements, as reflected on the Operational Audit Skill Worksheet, are used in developing the Manpower Distribution Chart quantitative/qualitative matrix. This data array is then analyzed to establish the component's most efficient skill/grade mix.

2. Workload counts (potential WLFs and work units) should be collected and reported on workload collection forms designed for the specific study. If at all possible, on-site workload count

collection/verification should be done prior to the start of work-hour data collection. Historical counts should always be used to verify task frequency estimates.

507. Instructions for Preparing Operational Audit Data Sheet. Following the instructions below, use the Operational Audit Data Sheet (Figure 5-1) to document detailed work center/ organizational component workload data.

1. Complete header as required.

2. Category Number. Number each work category/task/subtask as listed in the PWS.

3. Category/Task Title (Column A). Enter categories/tasks/ subtasks involved in the audit. Number and letter categories and tasks exactly as shown on the PWS. Validate need for tasks found during measurement that are not included in the PWS.

4. Number of Personnel Required (Column B). If only one individual is required for each performance of a task, record the task frequency in column E with no entry in this column. In certain situations, two or more individuals must spend time concurrently to perform a certain task. For example, a safety directive requires a worker trouble-shooting high voltage equipment to be accompanied by a second worker; or two people are required to lift a heavy object. For these situations, enter the number of personnel required in column B.

5. Skill Level Requirement (Column C). Enter appropriate qualitative requirements for each task, including necessary military requirement classification subsystem qualifiers. List qualifiers only when required to accomplish the specified task. Absence of any qualifier will be interpreted as its being a nonessential consideration. The information entered will be sufficient to enable a determination of qualitative requirements on the Manpower Distribution Chart. All entries should reflect the minimum quality required to perform the specific task. Specificquality of incumbents or authorized manpower requirements will not be the sole determining factor. Take care to reflect minimum requirements for the specific task and not for the manpower requirement considered as a whole. The Analyst, prior to going onsite, should become familiar with the manuals and handbooks which will enable the assignment of qualitative personnel requirements to each task. For officer requirements, enter requirement designator and grade codes, NOBC, and where applicable, AQDs, subspecialties, and/or FAC.

For enlisted manpower requirements, enter rate, and where applicable, NEC and/or FAC. For civilian manpower requirements, enter position category, series, and grade.

6. Work Unit (Column D). Enter the work unit. If it is determined during the measurement phase that no data exists on the work unit, the analyst may select another work unit. Document all deviations in the back-up data.

7. Task Frequency (Column E)

a. Enter the whole number occurrences per time period which expresses the actual task/subtask frequency (e.g., 1/day, 2/WK, 3/MO. Use the symbols shown below for stating the frequency of occurrence in making these expressions.

If the frequency of occurrence is:	Use Symbol
Daily for a 5-day week.....	D1
Daily for a 6-day week.....	D2
Daily for a 7-day week.....	D3
Daily for a 4-day week.....	D4
Weekly.....	WK
Monthly.....	MO
Quarterly.....	QT
Saturday/Sunday only.....	SS
Yearly.....	YR
Holiday only.....	HO
Not applicable (activity not performed).....	NA

b. The task frequency reflects the expected natural rate of occurrence. For example, a monthly task should be expressed as 1/MO, not 12/YR. A quarterly report is shown as 1/QT, whereas a task which occurs at four random times throughout the year is shown as 4/YR. Generally, no effort will be made to adjust natural frequencies in this column. An exception is made for work which occurs less than once a year. For example, a task which occurs every two years should be shown as .5/YR. A second exception is made for tasks that occur 48 or more times a year and are not included in the cycles listed above. In these instances, multiply the yearly task frequency by .083, round the resulting monthly average to two decimal places, enter it with the "MO" symbol, (e.g., 3.98/MO) in Column E and use 1.000 for the conversion factor in Column F.

OPERATIONAL AUDIT DATA SHEET	ANALYST: H. ROCKOE	COMPLETION DATE: 9/15/98	PAGE 2 OF 4
UIC: XXX1X	ACTIVITY: WETLANDS NAVAL STATION	COMPONENT: LAW ENFORCEMENT OPERATIONS	

CAT. NO.	CATEGORY/TASK TITLE (A)	NO. PERS REQ (B)	SKILL LEVEL REQUIREMENT (C)	WORK UNIT (D)	FREQUENCY			ALLOWED WORK-HOURS		
					TASK FREQ (E)	CONVER FACTOR (F)	PER MO (E x F) (G)	PER ACCOMP (H)	PER MO BxGxH) (I)	CATEGORY TOTALS (J)
5	TRAFFIC LAW ENFORCEMENT									
5.1	OPERATE ROVING PATROL/VEH		GS-083-04	PATROL	3/D1	20.908	62.724	4.000	250.90	
5.2	CONDUCT TRAFFIC CONTROL		GS-083-03	STATION	4/D1	20.908	83.632	2.000	167.26	
	↓ ↓ ↓		↓	↓	2/SS	8.696	17.392	1.750	30.44	
5.3	COORDINATE CONVOY MGT		GS-083-06	CONVOY	10/MO	1.000	10.000	1.000	10.00	
5.4	PROVIDE CONVOY ESCORT		GS-083-04	↓	10/M0	1.000	10.000	1.500	15.00	
5.5	OPERATE SPEED DET EQUIP		↓	SHIFT	4/D3	30.438	121.752	.750	91.31	
5.6	IMPOUND ABANDONED VEH		↓	VEHICLE	1/WK	4.348	4.348	2.000	8.70	
				CATEGORY WORK-HOUR TOTAL					573.61	574
6	ARMS ROOM SERVICE									
6.1	CLEAN WEAPONS ROOM		GS-083-03	EVENT	1/D3	30.438	30.438	.667	20.30	
6.2	ISSUE/RECEIVE WEAP/AMMO		GS-083-04	ISSUE/RCV	40/D1	20.908	836.320	.033	27.60	
	↓ ↓ ↓ ↓		↓	↓	15/SS	8.696	130.440	.033	4.30	
6.3	PERFORM DAILY INSPECTION		GS-083-04	INVENTORY	1/D1	20.908	20.908	.250	5.23	
6.4	PERFORM ANNUAL INVENTORY		GS-083-06	↓	1/YR	.083	.083	5.000	.42	
6.5	PERFORM EQUIPMENT MAINT		GS-083-05	EVENT	10/WK	4.348	43.480	1.667	72.48	
				CATEGORY WORK-HOUR TOTAL					130.33	130
				COMPONENT WORK-HOUR TOTAL						2031

BSCs / PSCs COVERED:	INTERVIEWEES:
CIVILIAN: 00010-00045	LT H. GUNN, MR. LAW, MS. BYRD

Figure 5-1. Example Of Completed Operational Audit Data Sheet

c. Do not combine the natural task frequencies. For example, a task such as "make telephone call" will be shown as 15 per day at two minutes each, not as one per day at a half-hour duration. This allows valid comparisons of frequencies and unit times for the respective entries.

d. If a task is not performed, enter "NA" in the "Conversion Factor" column and leave the remaining columns blank.

e. When measurement requires more extensive documentation at the task, subtask, or element level than exists on preprinted measurement forms (staffing standards only) place an asterisk in the "Task Frequency" column. (This asterisk indicates that a page has been added for the purpose of clarifying work performed on the subject task, subtask, or element.) Using a blank Operational Audit Data Sheet, enter the task, subtask, or element number and complete the line entry. Total the "Allowed Work-Hours per Month" column, transfer that figure to the original page, and number the additional work measurement form with the next sequential number.

8. Frequency Conversion Factor (Column F)

a. Develop manpower requirement on monthly allowed work-hours. Use frequency conversion factors to convert time estimates based on natural task frequencies to monthly frequency values for use in computing monthly allowed work-hours.

b. Enter the applicable conversion factor from those listed in Table 5-1, or a compound value if the time is not listed.

TABLE 5-1

FREQUENCY CONVERSION FACTORS

Frequency of Occurrence	Conversion Factor	Frequency of Occurrence	Conversion Factor	Frequency of Occurrence	Conversion Factor
D1 (5 DAY WK)	20.908	WK (WEEKLY)	4.348	SAT/SUN ONLY	8.696
D2 (6 DAY WK)	25.256	MO (MONTHLY)	1.000	HOLIDAY ONLY	.833
D3 (7 DAY WK)	30.438	QT (QUARTERLY)	.333		
D4 (4 DAY WK)	16.560	YR (YEARLY)	.083		

c. Frequency conversion factors are based on the assumptions and development computations displayed in Table 5-2.

TABLE 5-2

FREQUENCY CONVERSION FACTOR COMPUTATIONS

ASSUMPTIONS:
365.25 days/YR (includes extra Leap Year day); 12 MOs/YR; 4 QTR/YR; 7 days/WK; 2 weekend days/WK; and 10 holidays/YR

COMPUTATIONS			CONVERSION FACTORS
A.	365.25 (DAYS/YR) / 7 (DAYS/WK)	= 52.179 WKs/AVERAGE YR	
B.	52.179 (WKs/YR) / 12 (MOs/YR)	= 4.348 WKS/AVERAGE MO	<---
C.	365.25 (DAYS/YR) / 12 (MOs/YR)	= 30.438 DAYS/AVERAGE MO	
D.	365.25 (DAYS/YR) / 30.438 (DAYS/MO)	= 11.999 (12) MOs/YR	
E.	12 (MOs/YR) / 12 (MOs/YR)	= 1.000 MOs IN AVERAGE MO	<---
F.	4 (QTRs/YR) / 12 (MOs/YR)	= .333 QTRs/MO	<---
G.	1 (YR) / 12 (MOs/YR)	= .083 (A MO's FRACTION of a YR)	<---
H.	COMPUTATION OF WORK DAYS PER AVERAGE MO (FIVE-DAY WORKWEEK)		
	365.25 (DAYS/YR) -104.358 (WEEKENDS 52.179 X 2) - 10.000 (HOLIDAYS) 250.892 (WORK DAYS/AVERAGE YR)		
	250.892 / 12	= 20.908 (WORK DAYS/AVERAGE MO)	<---

9. Frequency Per Month (Column G). Compute this column by multiplying the entries in Columns E and F. Enter the interim result, rounded to three decimal places in Column G. Leave the result of this computation in your calculator to continue calculation of Allowed Work-hours Per Month (Column I).

10. Allowed Work-hours Per Accomplishment (Column H)

a. Entries in this column will reflect the work-hours required for one person to accomplish the task/subtask. This is true even if an entry has been made in Column B. For example, if a two-man team required an elapsed time of one hour to accomplish a task, the correct entry in Column H is one work-hour.

TABLE 5-3

DECIMAL HOUR VALUES

SECONDS=HOURS		MINUTES=HOURS		MINUTES=HOURS		MINUTES=HOURS		MINUTES=HOURS	
10	.003	7	.117	21	.350	35	.583	49	.817
15	.004	8	.133	22	.367	36	.600	50	.833
30	.008	9	.150	23	.383	37	.617	51	.850
45	.013	10	.167	24	.400	38	.633	52	.867
60	.017	11	.183	25	.417	39	.650	53	.883
		12	.200	26	.433	40	.667	54	.900
MINUTES=HOURS		13	.217	27	.450	41	.683	55	.917
		14	.233	28	.467	42	.700	56	.933
1	.017	15	.250	29	.483	43	.717	57	.950
2	.033	16	.267	30	.500	44	.733	58	.967
3	.050	17	.283	31	.517	45	.750	59	.983
4	.067	18	.300	32	.533	46	.767	60	1.000
5	.083	19	.317	33	.550	47	.783		
6	.100	20	.333	34	.567	48	.800		

b. Enter the allowed time, expressed in units of hours, required for one occurrence of the task/subtask listed in Column A. Decimal hour values are provided in Table 5-3. If the time value as derived does not include allowances, multiply the time value by the appropriate AF before entering it, and identify it as a computed allowed time value by entering the letter "A" following the last digit. Express computed allowed times in units of hours and rounded to three decimal places.

11. Allowed Work-hours per Month (Column I)

a. This column will contain the product of the Column G value carried in your calculator, multiplied by Column B (when applicable), multiplied by Column H, rounded to two decimal places. This product will reflect the allowed work-hours per month required by the work center/organizational component to perform task/subtask listed in Column A.

b. Whole Manpower Requirements. Enter whole manpower requirements established by the directed manpower requirement technique directly into Column I in multiples of the appropriate available work-month.

12. Category Work-Hour Totals

a. (Column I). Enter category work-hour totals, rounded to two decimals, one space down from the last entry for that category.

b. (Column J). Enter whole work-hour totals in Column J. This total represents all the work-hours required to perform the audited category.

13. Grand Total. The final entry, the summation of all category work-hour totals, is the Monthly Allowed Work-hour Total.

14. Enter category work-hour totals and the component Work-hour total contained in Column J in Column F of the Work-Hour Requirements Consolidation Sheet.

508. Operational Audit Skill Worksheet. The Op Audit Skill Worksheet serves as a cover sheet for each set of Operational Audit Data Sheets and summarizes documented work-hours by category and minimum skill level requirements. Op Audit data may be summarized at various levels, e.g., geographic grouping of manpower requirements; component; or other logical and useful grouping. When worksheets are developed for groupings below the component level (level used in development of the Work-Hour Requirements Consolidation Sheet and Manpower Distribution Chart) a consolidated skill worksheet should be developed at the component level to facilitate subsequent data consolidation and analysis. (A skill worksheet and subsequent manpower distribution analysis may not be needed if the component consists of only a few positions or if very few tasks or skills are involved and appropriate grade/skill distribution is apparent without further analysis.)

509. Instructions for Preparing Operational Audit Skill Worksheet (Figure 5-2)

1. Complete header as required. When a component-level consolidated summary is prepared, the "analyst" block will reflect the person who prepared the consolidated skill worksheet.

2. Billet Sequence Codes (BSCs) Covered (Section A). Reflect range, on current AMD, of officer, enlisted, and civilian BSCs covered by summarized Op Audit data (e.g., Civilian: 00010-00045).

3. Minimum Skills Required (Category Totals)(Section B). Across the top of columns, reflect the inventory of skills identified as the minimum skill required to perform tasks reflected on Operational Audit Data Sheets.

4. Category Number (Column C). Enter category numbers (numbers reflected on the PWS) from Operational Audit Data Sheets.

5. Minimum Skill Work-hour Entries

a. Sum and enter work-hours by minimum skill and category work-hour total associated with each category number, as reflected on associated Operational Audit Data Sheets.

b. If nonbudgeted work-hours (TAD, Borrowed, Temporary Duty (TEMDU), etc.) are involved, reflect budgeted work-hours required to replace work-hours presently provided from nonbudgeted sources in a separate "minimum skill required" column and explain in the remarks section.

c. Monthly Allowed Work-hours Totals (Column D). Use totals in this column, reflected in whole work-hours, as a check against category totals reflected on the Operational Audit Data Sheets. Resolve any discrepancies and adjust rounding errors to the Operational Audit Data Sheet value.

6. Minimum skill work-hours, by category and minimum skill total, (rounded to whole work-hours and force balanced to Column D work-hour total) are carried forward to appropriate minimum skill level columns on the Manpower Distribution Chart.

7. Audit Checks (Section E). The Operational Audit Skill Worksheet will be signed by the team member(s) conducting the logic and math checks.

8. Remarks (Section F). Identify interviewee(s), along with any additional information that will be of assistance in clarifying data reflected on the skill worksheet.

510. Operational Audit Software Program. Use of automated Op Audit programs and consolidated spreadsheet software is

encouraged because it increases computation accuracy and reduces the volume of backup materials.

OPERATIONAL AUDIT SKILL WORKSHEET

ANALYST: H. Rockoe

DATE: 9/22/92

UIC: XXXXX

ACTIVITY: Wetlands Naval Station

COMPONENT/WORK AREA: Law Enforcement Operations

A. BSCs COVERED: Civilian: 00010 - 00045

NORMAL WORK HOURS: See Remarks

E. AUDIT CHECKS

LOGIC: I. R. Right (Signature) 9/23/92 (Date)

MATH: U. R. Wright (Signature) 9/24/92 (Date)

F. REMARKS

(1) Working Hours: GS-9 works normal (0800-1630) 5 day week. Remaining personnel work 8 hour shifts (0730-1400, 1330-2400, 2330-0800) based on duty schedule to provide 7 day, 24 hour coverage of patrol and crime prevention services.

(2) Measurement Categories: Categories 2, 7 and portions of 1 and 5 - 15 measured by work sampling. Category 3 developed by post manning computations.

(3) Interviews:
Mr. F. Farr GS-083-9
Ms. J. Byrd GS-083-6

C. CAT. NO.	B. MINIMUM SKILLS REQUIRED (CATEGORY TOTALS) GS-9 (083)	GS-6 (083)	GS-5 (083)	GS-4 (083)	GS-3 (083)		D. MONTHLY ALLOWED WORK-HOUR TOTALS
1	13.27	36.63	12.15	-	-		62
4	9.83	308.12	35.31	125.06	297.75		776
5	-	10.00	-	365.91	197.70		574
6	-	.42	72.48	37.13	20.30		130
8	75.20	121.07	-	-	-		196
9	2.96	18.02	3.05	5.17	7.37		37
10	-	6.72	2.65	9.25	18.51		37
11	-	-	-	2.33	12.40		15
12	25.32	32.10	8.14	7.35	5.15		78
13	8.40	24.32	2.35	3.16	4.18		42
14	3.41	11.90	5.35	16.24	18.15		55
15	-	6.63	1.65	6.63	13.93		29
TOTALS	138	576	143	578	596		2031

Figure 5-2. Example of Completed Operational Audit Skill Worksheet

CHAPTER 6

WORK SAMPLING

600. General

1. Work sampling is a work measurement tool rooted in the laws of probability and the Binomial Theorem. Work sampling is based on the principle that adequate random samples taken from a large group tend to exhibit the same distribution characteristics as the entire group. Conclusions are drawn about the whole population based on the sample. Statistical techniques which provide a selection of the degree of confidence and accuracy are used to determine the minimum size of the sample required.

2. In conducting a work sampling study, the analyst makes a number of random observations of personnel in a work area. At each observation, the analyst notes and tallies what each individual is doing according to previously identified categories. The ratio of the total number of observations made in any one category to the total number of observations made in all categories will be the percentage of time spent in random intervals over a period of several days revealed that that category. For example, if 1,000 observations made at a clerk was typing 500 times, filing 300 times, telephoning 100 times, and idle 100 times, it would be reasonably certain that the clerk's time during the period was distributed as follows: typing 50%, filing 30%, telephoning 10%, and idle 10%. The percentages listed for each category may not be true for any single day, but they will tend to be valid over a period of several days, providing the study was made during a period of normal activity for the work area. These percentages in conjunction with work-hours sampled can then be used to compute monthly work-hours and project manpower requirements.

601. Uses of Work Sampling

1. Work sampling is a widely used work measurement method. Results from work sampling have many uses including: developing manpower standards and product standards, evaluating equipment utilization, determining work-hours for work distribution analysis, determining areas of concentration for methods improvement studies, and establishing and verifying allowances and production standards. One main advantage that makes work sampling a flexible, multi-use tool is its methodology allows

"custom design" of the data collection for the particular purpose (use) of the study. Work sampling is particularly useful in components having irregular or nonrepetitive work, many different categories of work, or many workers in a relatively small area.

2. Work sampling can be applied to almost any type of work including indirect labor jobs, clerical work, maintenance, repair, warehousing, and facility maintenance, to name a few. However, some types of work have been difficult to sample such as: product analysis, closed-session counseling, and creative thinking. For components with a majority of one of these types of work, consider using productive and nonproductive sampling, as discussed later in this chapter.

602. Economic Desirability of Work Sampling

1. The economic desirability of measuring work with work sampling increases with the number of people to be sampled. It is especially efficient when applied to components with a large number of workers. Each analyst conducting the sampling ideally should measure a minimum of five workers. Generally, very small organizational components (less than 5 people) should be measured with Op Audit.

2. The measured work force should consist of personnel who expend most of their available time in a location that permits observation of the work by the analysts. See Procedures for Making Observations later in this chapter for procedures to account for work performed away from the immediate work area for extended periods.

603. Supplementing Work Sampling with Op Audit

1. Work sampling may be used in conjunction with other measurement methods to measure all the work of a component efficiently. For example, a portion of a component’s work not suitable for sampling could be measured with Op Audit. Also, normally, a supplemental Op Audit should be done in conjunction with work sampling to ensure all required work is measured. A representative sample period reduces the need for Op Audit, but an Op Audit may still be required to identify and report cyclical work that occurs less frequently than the normal work cycle (e.g., quarterly or annually).

2. Care should be taken not to overlap and measure the same work twice. Analysts must be cautious and realize there is a difference between work not occurring during the sampling period and work not observed. If a particular task was done but was not observed due to the randomness of the observation schedule, do not Op Audit time the task. Op Audit only those nonroutine required tasks occurring less frequently than the work cycle captured in work sampling. Be particularly careful when supplementing work sampling data for indirect tasks. For example, preparing annual reports may be a "wash" item since daily or monthly reports normally feed into annual reports and the sample may have captured a normal amount of time for report preparations. Required reports and meetings may need careful analysis.

604. Work Sampling Errors. There are three basic types of errors that occur in a work sampling study. Design and conduct each study in a manner that eliminates or minimizes their impact on the study results. They are:

1. Sampling Error. A sampling error is made when an inference is made about some characteristic of a population based only on measurement of an inadequate portion of the population. The only way to totally eliminate a sampling error is to measure the entire universe. The number of observations taken controls the sampling error. An important advantage of determining the number of observations statistically is that it permits the designer of the study to numerically specify a tolerable sampling error within a prescribed confidence level.

2. Bias. A bias exists when a given activity (category) is recorded at a different portion of the time than actually occurs due to the means by which the observations are made. In work sampling there are two kinds of bias:

a. Bias introduced by the work sampling team analysts. Common causes are: poorly defined or misunderstood category definitions, improper worker identification, nonadherence to observation schedule, tallies in improper categories, continuing study despite worker bias, not obtaining cooperation, not statistically evaluating results throughout the study for errors, and not recording special or unusual conditions or work counts.

b. Bias introduced by those being observed: Examples are: redoing work, signaling supervisor or workers when observer appears to ensure productivity, creating work not normally in

cycle, and not notifying analysts of work situation or process changes or abnormalities.

3. Nonrepresentative Sample. This situation exists when the period studied is not typical of the circumstances which prevail over an extended period of time, e.g., holidays, slow work period, training, etc. For the sample to be representative, a complete and normal work cycle must be observed. Days differ appreciably, so analysts cannot expect one day to be representative of all days. The same is possible of weeks, months, seasons, etc. General business activity, trends in DOD, budgetary ups and downs, and the like all cause random variations, cycles, and trends in production activity. Thus, the designer of a work sampling study must give careful attention to the representability of the sample. An attempt should be made to minimize nonrepresentative sample error by appropriate choice of when and how long to conduct the study. The period sampled should be typical of what is expected in the future.

605. Work-hour Accounting. Develop a system to show the time the workers to be observed are on the job and available for work during the study. Daily accounting on routine timekeeping records for leave and other nonavailable time for each worker during the course of the study is the usual method. The work-hour accounting system should account for all time expended by all members of the organizational component for the duration of the study. Transfer daily assigned work-hour totals to the Work Sampling Recap Sheet.

606. Work-hours Sampled. The hours to be sampled during the study consist of work-hours for available, nonavailable, borrowed, lunch, and overtime. Loaned work-hours are excluded. For the computations of the sampling results the “Work-hours Sampled” excludes nonavailable time. This maintains the integrity of the accuracy and percentage of occurrence results, which are determined from time available to perform the work, and also provides for the complete accounting of time. Document any nonsampled work-hours, such as nonsampled overtime, for later consolidation of organizational component required work-hours on the Work-Hour Requirements Consolidation Sheet.

607. Establishment of a Work Count System. Work-hours collected during work sampling studies represent only one part of the data needed. The other part is work counts. Establish a system to record workload volume on a daily basis. If conditions of the work center/organizational component preclude

compliance with this requirement, record the work unit count as frequently as the work is completed. Use a production report if it is available, but make periodic checks to ensure it is accurate. The period of the production report should correspond with the study. Give particular attention to recording correct values for work started before the study and work continuing after the study. Install the production count procedure prior to the actual study so the measured activity may become accustomed to it. This will also reveal if any system changes are necessary to ensure the desired information will be obtained. The system actually used during the course of the study should yield timely and accurate information regarding work units completed. Compare the count of work units completed during the study to historical records and/or performance to determine if production during the study confirms the study as a representative sample. Consider work units counted for use as quantity WIs in conjunction with the PWS. In any staffing standards development that uses results of work sampling, consider the work units counted as potential WLFs/WIs.

608. Work Sampling Categories of Work

1. The categories of work should reflect the productive categories from the PWS for the organizational component under study and be defined to facilitate observation during sampling. Clearly define each category being measured so proper discrimination between categories can be made at the moment of observation. The selection of categories should be such that the objective of the study can be met. Tasks and subtasks within categories may be “given category status” and listed to reflect the level of detail desired for separate analysis, realizing that categories cannot be divided to provide more detail during the study but, can be combined to provide less detail. However, care should be taken not to use unnecessary or confusing detail or any task not easily distinguishable during an instantaneous observation.

2. Categories should cover all required work and be clearly distinguishable, yet mutually exclusive. If categories are not clearly defined, percentages will be distorted and analysis of sampling data difficult.

3. Identify categories for time spent in available and nonavailable activities. Broadly described, available time may be productive or nonproductive. Nonavailable activities include any time a person is not available for productive effort (e.g. leave, sick call, TAD). See “Time” in the Glossary for further

definition of available/nonavailable and other time to aid in defining categories. Use one "Nonavailable" category to document all nonavailable time, while nonproductive categories such as "Personal/Break", "Idle/Avoidable Delay", "Unavoidable Delay", and "Lunch" are listed separately.

4. Use a "Standby" category to separately document necessary standby time when minimum manpower requirements are previously defined.

5. To avoid creating catchalls, do not use titles such as “Other” or “Miscellaneous” for nonproductive or any other categories.

6. Sample lunch to account for productive time expended during the lunch period and to account for nonproductive time taken for an extended lunch. Sampling of lunch eases the accounting of observations at the end of each sampling day. Be cautious when selecting random times and making observations during lunch period. Incorrect accounting of lunch observations affects other category percentages. The following example illustrates the need for caution:

- Assume three observations per hour are being taken and the lunch period for half the work center is 1100 to 1200. Assume the other half takes lunch from 1200 to 1300.

- Select random times so three observation times occur between 1100 and 1200 and three occur between 1200 and 1300. The sampling technician normally records three observations for lunch for each worker.

- However, if worker “A” (from the first group) was working at 1145 (observation time) and did not take his or her full lunch hour, then one productive observation and two lunch observations would be recorded.

- On the other hand, if worker “B” (from the second group) left for lunch at his or her regular time and was still on lunch break at 1310 (observation time), then three lunch observations and one idle or extended lunch observation would be recorded for worker “B”.

- If lunch periods are staggered or workers do not take scheduled lunch breaks, use stratified hourly sampling, sample lunch cautiously, and check the percentage of lunch observations daily and at the end of the study to verify representability.

7. An “Unscheduled” category is useful for maintaining accountability of observations. Establish this category when:

a. Shift changes are staggered during a multi-shift operation.

b. Workers are doing required work before the beginning or after the end of a scheduled shift.

609. Sampling Period. Work sampling should be conducted over a representative period or work cycle. A period of normal productivity under normal workload for at least one complete cycle is desirable. Sampling periods should consist of whole normal workdays. Sampling periods may range from five days to an entire month or more depending on the length of the work cycle. The more pronounced cycles such as the work week cycle (not based on workload) should be spanned by the study. If possible, work sampling should start and stop at the same point in the work cycle, especially when only one long cycle is studied. Use the experience of the studied component personnel to set up an average work cycle to pinpoint recurring periods of heavy productivity. Plotting these cycles against a time scale may reveal a pattern and its composite effect on the component. Observations required to meet accuracy requirements and observation schedules may also impact the duration of the study. Provide the minimum sampling period which will encompass a representative period or work cycle and provide a sufficient number of observations to meet the percent of absolute accuracy requirement.

610. Determination of Observations Required and Development of Observation Schedules

1. The purpose of sampling is to provide information about the population. Characteristics discovered in the sample are expected to exist in the population from which the sample is taken. The key to unbiased sampling is randomness of the sample. Several methods are available to ensure randomness. Two are discussed here.

a. Random Numbers Tables. Randomly pick a starting point in a random numbers table. Proceed horizontally, diagonally, or vertically and record the one-digit, two-digit, or three-digit numbers as they appear. Disregard numbers outside the needed range. For example, if you need two-digit random numbers ranging from 00 through 59, then disregard the two-digit numbers greater than 59. If a number appears again after it has

previously been recorded for use within a particular strata (hour or day), ignore its subsequent appearance. If it requires five minutes to make an observation round, disregard numbers within five minute increments of each other. Continue selecting numbers until you reach the desired sample size.

b. Random Numbers from Computers. When a computer is available, obtain a series of numbers with the required number of digits. Treat this series the same as with the random numbers table.

2. An observation is a single recorded status of one person during a round of observations at a preselected random time. An observation round yields a number of observations equal to the number of people observed. For example, a round made at 10:15 in a seven-person work center yields seven observations. Cycle length, desired accuracy, and number of people assigned to conduct the work sampling determine the number of observation rounds required.

3. In the application of work sampling for manpower requirements determination, a 95 percent confidence level within plus or minus three percent absolute accuracy is recommended (i.e., three percent of error to be allowed in the sample with accuracy set at 95%, regardless of the mean). To obtain an initial estimate of the required sample size (n), determine the estimated percentage of occurrence for the largest category (P). This may be obtained by running a small sampling study of 50 to 100 observations if no other confident estimates are available. The largest category percentage of occurrence (P value), when applied to the chart in Table 6-1, will provide an initial estimate of the total number of observations required for the study.

4. The following formula is an alternative method of determining the required number of observations:

$$N' = \frac{4(\bar{P} - \bar{P}^2)}{S^2}$$

Where N' = number of observations required

$\bar{P}$ = the largest category percentage of occurrence (decimal form)

S = desired degree of absolute accuracy expressed as a percentage (.03 for 3%)

TABLE 6-1

OBSERVATIONS REQUIRED (N) FOR A GIVEN DEGREE OF ABSOLUTE ACCURACY AT 95% CONFIDENCE LEVEL

$\bar{P}$	DEGREE OF ABSOLUTE ACCURACY +1%	+2%	+3%	+4%	+5%	+6%	+7%
.01/.99	396	99	44	25	16	11	9
.02/.98	784	196	87	49	31	22	16
.03/.97	1164	291	129	73	47	33	24
.04/.96	1536	384	171	96	61	43	32
.05/.95	1900	475	212	110	76	53	39
.06/.94	2256	564	251	141	90	63	47
.07/.93	2604	651	290	163	104	73	54
.08/.92	2944	736	327	184	118	82	61
.09/.91	3276	810	364	205	131	92	67
.10/.90	3600	900	400	225	144	100	74
.11/.89	3916	979	436	245	157	109	80
.12/.88	4224	1056	470	264	169	118	87
.13/.87	4524	1131	503	283	181	126	93
.14/.86	4816	1204	536	301	193	124	99
.15/.85	5100	1275	567	319	204	142	105
.16/.84	5376	1344	598	336	215	150	110
.17/.83	5644	1411	628	353	226	157	116
.18/.82	5904	1476	656	369	236	164	121
.19/.81	6156	1539	684	385	246	172	126
.20/.80	6400	1600	712	400	256	179	131
.21/.79	6636	1659	738	415	265	185	136
.22/.78	6864	1716	763	429	275	191	141
.23/.77	7084	1771	787	443	283	198	145
.24/.76	7296	1824	811	456	292	203	149
.25/.75	7500	1875	834	469	300	209	154
.26/.74	7696	1924	856	481	308	214	158
.27/.73	7884	1971	876	493	315	219	161
.28/.72	8064	2016	896	504	323	224	165
.29/.71	8236	2059	916	515	329	229	169
.30/.70	8400	2100	934	525	336	234	172
.31/.69	8556	2139	951	535	342	238	175
.32/.68	8704	2176	968	544	348	242	178
.33/.67	8844	2211	983	553	354	246	181
.34/.66	8976	2244	998	561	359	250	184
.35/.65	9100	2275	1012	569	364	253	186
.36/.64	9216	2304	1024	576	369	256	189
.37/.63	9324	2331	1036	583	373	259	191
.38/.62	9424	2356	1048	589	379	262	193
.39/.61	9516	2379	1058	595	381	265	195
.40/.60	9600	2400	1067	600	384	267	196
.41/.59	9676	2419	1076	605	387	269	198
.42/.58	9744	2436	1083	609	390	271	199
.43/.57	9804	2451	1090	613	392	273	201
.44/.56	9856	2464	1096	616	394	274	202
.45/.55	9900	2475	1100	619	396	275	203
.46/.54	9936	2484	1104	621	397	276	203
.47/.53	9964	2491	1108	623	399	277	204
.48/.52	9984	2496	1110	624	399	278	204
.49/.51	9996	2499	1111	625	400	278	204
.50	10000	2500	1112	625	400	278	205

5. The number of sampling observations determined is the estimated minimum required, based on preliminary information. More may be required to meet the limits established. As the study proceeds, use cumulative data (accumulated study totals) to recalculate the percentages of occurrence and use Table 6-1 or above formula to ensure the required number of observations have been or will be taken to meet the percent of absolute accuracy requirement. [Note: Developing the observation schedule to obtain no fewer than 1112 available observations (excluding lunch) in each work center ensures accuracy in all available categories for ± 3% absolute accuracy at the 95% confidence level (see Table 6-1) and eliminates the need to estimate the number of observations required.]

6. To develop an observation schedule:

a. Determine observations required per day by dividing the total number of observations required for accuracy by the number of days during which the study is to be conducted to capture the representative period or cycle.

b. Divide the number of observations required per day by the number of work area hours of operation to be sampled daily. This will determine the minimum number of observations required per hour.

c. Divide the minimum number of observations per hour by the number of observations to be recorded per observation round (one per worker) to determine the minimum number of rounds required per hour.

7. The length of time it takes to complete a single observation round may dictate the number of observations obtainable within an hour or day and thus may impact on number of analysts assigned or study duration.

8. Do not assign an analyst more observations than reasonable for the time allotted. Assigning too many workers or work stations to an analyst may not allow timely observations and resolve of questionable situations within the study and may bias the study data. Conversely, assigning too few workers for the analyst to observe may create idle time and lead to an unfavorable impression of the analyst, the study team, the work sampling study, and the end results.

9. In the majority of work sampling studies, it is desirable to ensure each hour of the day has equal representation in the

sample. Use stratified sampling in components where activity fluctuates hourly, where lunch periods are staggered, or where Shift Profile Analysis is to be conducted. In this procedure, determine the number of observation rounds needed per hour and randomly select observation times within the hour. Once sampling begins, analysts must consistently follow the predetermined schedule per hour until the completion of the sampling period. Ensure the number of observation times for lunch are representative prior to sampling. Observation time determination, differing somewhat from the simple random method, may be achieved as follows:

a. Divide the number of observations to be made daily by the number of hours the work area is to be observed each day. This provides the number of observations required each hour.

b. Divide the minimum number of observations per hour by the number of observations to be recorded per observation round (one per worker) to determine the minimum number of rounds required per hour.

c. Determine the observation times by selecting the required number of two-digit numbers from a table of random numbers, disregarding all those over 60, and equating the selected numbers to corresponding clock times of the hour.

d. Repeat step b for each working hour to be studied.

10. When an observation schedule cannot be met because of widely dispersed locations, develop a randomized location schedule. List the title of each location on tickets or cards. Draw cards randomly from a hat or box, record locations in the order drawn, replace the cards in the box, and then repeat the draw a second, third time, etc. Next, visit each location in the order recorded. Begin sampling at the start of the normal duty day and continue until the end of the normal duty day. Move from one location to another in the order previously recorded but on no prescribed schedule. Sample the location upon arrival. Follow the recorded order until enough observations are obtained to achieve accuracy, a complete cycle is sampled, and the sampling period is covered. Op Audit overtime when this method is used.

611. <u>Procedures for Making Observations</u>

1. Adhere to the scheduled times as closely as possible to protect the randomness of the sample data.

2. Enter the work area and record the observed categories without alerting or distracting the work force. If simply entering the work area could cause biased results, remain in the area between observation rounds.

3. Each sample should be the result of an instantaneous observation. When it is not possible to identify positively the proper category of the observation, indicate whether it is productive or nonproductive, if possible, and investigate later between rounds. Worker activity before and after the observation will usually provide clues to help proper classification. Trial sampling for familiarization will reduce questions and errors and help to identify and prevent potential problems before the actual study.

4. Be alert to identify "make work" and inferred or assumed tasking and record these observations separately. Inferred work will later be credited to the proper component and assumed or "make" work removed from allowed work-hours.

5. Record observations for every worker whose time is included in the Work-hours Sampled total. Whenever possible each productive observation should include performance rating of the worker or homogeneous skill group. Appendix I provides discussion on performance rating.

6. The measured work force should consist of personnel who spend most of their available time in a place that permits observation of work. Account for work performed away from the immediate work center for extended periods of time as follows:

a. Arrange for a sampling technician to observe the worker at the out-of-area location, or

b. If it is not feasible to observe the worker, designate the observations for this time under an "Out-of-Area" category on the daily observation sheet, treat the observations as nonavailable observations when calculating the work sampling results, and Op Audit this time.

612. Work Sampling Data Collection

1. There is no standard form for recording sampling observations during a work sampling study. Because of individual study differences, it is not possible to provide specific daily sampling guidelines for each situation, nor is it

practical to dictate the use of forms or formats for every work sampling data collection. This "custom design" of data gathered is an advantage which allows variances in format required to satisfy individual study requirements dictated by the intended use (purpose) of the study. Take care in the design of collection forms to ensure they provide for collection of all the necessary data. Also, forms should provide an area to record notes, or an indication that notes are recorded on the back of the form or on attached pages. Analysts should note any questionable events, methods, or procedures during actual observation of the work for later clarification or methods improvements.

2. The level of detail required in the data collected directly affects the design of collection forms and subsequently the complexity of their use. In addition to simply determining accurate work-hour requirements, work sampling studies may involve a component with several different skills or skill levels where skill changes or redistribution of work among skills is anticipated to develop the manpower requirements baseline. Such a study will require data that:

a. Provides a breakdown of work into categories that reflect tasks as transferable or nontransferable from skills/skill levels, and

b. Associates the existing skills/skill levels with the corresponding categories of work.

613. Preparation and Completion of Daily Work Sampling Observation Sheet (Figure 6-1). The example daily work sampling observation sheet provided in Figure 6-1 allows flexibility for tailoring observations to specific work centers, as discussed above. For example, columns are provided to record observation times and rows are provided to record names or codes, qualitative information, and daily category totals. Prepare enough daily observation sheets in advance to accommodate the entire sampling period.

1. Preparation of Observation Sheet

a. Complete the Header Information. Enter the actual period of time during the day that sampling observations will be taken in the "Sampling Period" block. Reflect the indicated hours as full normal workdays for the component/work area under study. When gathering work sampling data for use in development of functional staffing standards, indicate the appropriate RFC

DAILY WORK SAMPLING OBSERVATION SHEET

DATE: 9/14/96	SAMPLE DAY: 1	PAGE 1 OF 1

UIC: XXX1X	ORGANIZATIONAL COMPONENT: PHYSICAL SECURITY OPERATIONS	SAMPLING PERIOD: 0800-1630	ANALYST: H. ROCKOF

A. NAME/SKILL CATEGORY	B. OBSERVATIONS TIMES																	C. TOTALS
	08 04	0840	0900	0935	1010	1051	1115	1142	1210	1245	1305	1342	1410	1448	1516	1552	1618	
LT GUNN 1000J	1	1	12	12	P	1	1	L	1	8	8	8	1	1	P	1	12	17
N. LAW GS-082-9	2	2	1	7	7	P	12	2	L	7	2	12	7	P	2	13	1	17
C. HOKE GS-082-7	8	8	2	2	2	13	12	L	I	2	2	12	D	P	2	13	I	17
F. KELLY GS-083-6	2	2	2	p	2	2	12	I	L	2	2	2	P	D	14	2	P	17
K. NELSON GS-083-4	P	2	2	9	4	2	12	L	2	2	10	12	2	P	14	2	2	17
T. YOUNG GS-083-4	2	2	P	2	9	2	12	2	L	10	P	12	2	2	2	11	15	17
H. SISK GS-083-3	2	11	10	11	2	2	12	L	2	2	P	12	2	2	14	11	15	17
W. LEE GS-083-3	9	2	2	I	2	P	12	P	L	2	2	12	2	2	14	11	15	17
J. DAY GS-083-6	7	7	P	7	7	7	12	L	10	9	7	7	P	7	14	7	7	17
A. FURR GS-083-3	7	7	7	P	9	13	12	7	L	7	10	7	7	P	14	10	15	17
SEE NEXT PG FOR CATEGORIES																		
CATEGORY TOTALS:																		

NOTES:

WORK COUNTS:

Figure 6-1. Example of a Daily Work Sampling Observation Sheet

DAILY WORK SAMPLING OBSERVATION SHEET

DATE: 9/14/96	SAMPLE DAY: 1	PAGE 1 OF 1

UIC: XXX1X	ORGANIZATIONAL COMPONENT: PHYSICAL SECURITY OPERATIONS	SAMPLING PERIOD: 0800-1630	ANALYST: H. ROCKOE

A. NAME/SKILL CATEGORY	B. OBSERVATIONS TIMES																	C. TOTALS
	08 04	0840	0900	0935	1010	1051	1115	1142	1210	1245	1305	1342	1410	1448	1516	1552	1618	
1. MANAGEMENT	1	1	1			1	1		1				1	1		1	1	10
2. SECURITY GD SVS	4	5	4	2	4	4		2	2	5	4	1	4	3	3	2	1	50
7. RESOURCE PROTECT	2	2	1	2	2	1		1		2	1	2	2	1		1	1	21
8. SUPERVISION	1	1								1	1	1						5
9. ADMINISTRATION	1			1	3					1								6
10. SUPPLY			1						1	1	2					1		6
11. EQUIP MAINTENANCE		1		1												3		5
12. MEETINGS			1	1			9					6					1	18
13. TRAVEL						2										2		4
14. TRAINING															6			6
15. CLEAN UP																	4	4
P PERSONAL/REST/ BREAK	1		2	2	1	2		1			2		2	4	1		1	19
D DELAY													1	1				2
I IDLE				1				1	1								1	4
L LUNCH								5	5									10
N NON-AVAILABLE																		
CATEGORY TOTALS:	10	10	10	10	10			10	10			10	10			10	10	170

NOTES: Security Guard Posts and Supervision of 2nd and 3rd shift security force supervision work-hour requirements were developed using minimum manpower (post manning) computations. These positions within the security operations division are not included in work sampling. Work sampling includes Operations Division Head position (1000J). One-half hour allowed for lunch.

WORK COUNTS:
#1 45
#2 12

Figure 6-1. Example of a Daily Work Sampling Observation Sheet (Continued)

after the component title in the "Organizational Component" block.

b. Name/Skill and Category (Section A). Down the “Name/ Skill/Category" column, list the employees under study by name, requirement quality identifiers (i.e., series and grade; or rate, rank, NEC, NOBC, etc.), and working hours if irregular or overlapping shifts are involved. If a second sheet is required to list the employees under study, the "sampling period" and “observation times” will be the same as the sheet continued.

c. Observation Times (Section B). Log the observation round times across the top of the sheet; the first observation time at the top of the first column, the next observation time in the next column, and so on until the required observation times are entered. If a second sheet is required to log in the required number of observation times, the "Sampling Period" block on each sheet should reflect the correct time period for that particular sheet to avoid confusion between sheets.

d. List the categories of work from the PWS, plus a "Nonavailable" category in the "Name/Skill" column under a "Categories" heading following the last employee name, or, if insufficient lines are available on the sheet, on a separate observation sheet. Assign category numbers to all productive categories and alpha codes to all nonproductive categories and nonavailable. (Assignment of alpha codes to nonproductive categories and nonavailable makes these codes easily memorized and they can be accumulated by category at the end of the sampling day.)

2. Use of the Observation Sheet

a. The analyst will determine which category best describes each individual's activity at the instant of each observation and place the appropriate category number or letter code for each observation in the proper observation time column. Repeat this for each individual studied, ensuring each is observed and accounted for during each round of observations. Enter performance rating factors for productive observations, if used, above the code entry.

b. At the end of each observation round, enter the number of observations, by category, on appropriate lines of the observation round column. Enter the number of personnel observed during that round on the bottom row marked "Totals."

Use this figure to verify the number of entries per column and to help account for each worker during the course of the study.

c. At the end of the day, count the number of entries for each individual and enter the numbers in the "Total" column (Column C). The sum of this column of totals equals the total observations for the day. The total observations for the day should equal the number of observation times (rounds) multiplied by the number of employees observed, unless employees are on loan to another work center; borrowed from another work center; working overtime; or assigned to or transferred from the work center during the sampling period.

d. Transfer category observation totals to the appropriate daily column on the Work Sampling Recap Sheet.

e. When rating is used, compute a daily average performance rating factor for each productive category and enter in the form margin beside the corresponding category observation total.

f. Review of observation time letter and number code entry distribution on the observation sheet may indicate patterns for consideration during the analysis phase (e.g., long lunch periods, groupings of meetings, duplication of tasks, etc.).

g. The "Notes" block provides space to record such things as deviations from normal work center operations, explanation of nonsampled time periods, time allowed for lunch, need for further methods review, etc.

h. The "Work Count" block is provided to record information on workload volume completed during the study on a daily basis, such as name and volume of work units completed and status at the beginning or end of the daily sampling period. Reflect work counts for only the work completed during sampling hours. Include whatever data is necessary to feed the work count system previously established/identified.

614. Work Sampling Recap Sheet. The Work Sampling Recap Sheet (Figure 6-2) provides daily and accumulated category observation totals and productivity data for comparison and analysis and deletion of any abnormal daily data. It provides an orderly transition from the Daily Work Sampling Observation Sheets to the Work Sampling Computation Sheet. Use recorded data in developing control charts and during shift profile analysis.

WORK SAMPLING RECAP SHEET | DATE: 10/13/96 | SAMPLING PERIOD: 9/14 -- 10/9 | PAGE 1 OF 5

UIC: XXXXX | ORGANIZATIONAL COMPONENT: Physical Security Operations | ANALYST: JOHN DOE

A. PRODUCTIVE CATEGORIES	SAMPLING DAY (OBSERVATIONS/PERCENTAGES)																
	DAY 1	%	DAY 2	CUM	%	DAY 3	CUM	%	DAY 4	CUM	%	DAY [ ]	CUM	%	DAY 20	CUM	%
1. MANAGEMENT	10	.063	8	18	.056	7	25	.053	10	35	.056				6	148	.049
2. SEC GD SVS	50	.312	62	112	.350	56	168	.359	60	228	.368				48	1063	.353
7. RESOURCE PROJ.	21	.131	17	38	.119	22	60	.128	24	84	.135				12	403	.134
8. SUPERVISION	5	.031	8	13	.041	3	16	.034	8	24	.039				6	145	.048
9. ADMINISTRATION	6	.038	4	10	.031	9	19	.041	5	24	.039				3	112	.037
10. SUPPLY	6	.038	7	13	.041	5	18	.039	4	22	.036				4	96	.032
11. EQUIP MAINT	5	.031	3	8	.025	2	10	.021	4	14	.023				7	75	.025
12. MEETINGS	18	.112	14	32	.100	13	45	.096	6	51	.082				17	274	.091
13. TRAVEL	4	.025	7	11	.034	2	13	.028	4	17	.027				3	87	.029
14. TRAINING	6	.038	4	10	.031	9	19	.041	7	26	.042				8	128	.043
15. CLEAN UP	4	.025	3	7	.022	2	9	.019	4	13	.021				4	68	.023
B. TOTAL PRODUCTIVE	135		137	272		130	402		136	538					118	2599	
C. TOTAL $\bar{P}$ (B / I)	.844		.856	.850		.878	.859		.895	.868					.819	.864	
D. HIGHEST $\bar{P}$	.312		.388	.350		.378	.359		.395	.368					.333	.353	
E. PERSONAL/REST	19	.119	13	32	.100	11	43	.092	12	55	.089				20	276	.092
F. DELAY	2	.012	7	9	.028	5	14	.030	3	17	.027				2	73	.024
G. IDLE	4	.025	3	7	.022	2	9	.019	1	10	.016				4	60	.020
H. TOT NONPRODUCTIVE	25	.156	23	48	.150	18	66	.141	16	82	.132				26	409	.136
I. TOTAL AVAILABLE	160	1.000	160	320	1.000	148	468	1.000	152	620	1.000			1.000	144	3008	1.000
J. LUNCH	10		10	20		10	30		9	39					9	232	
K. NONAVAILABLE	-		-	-		12	12		9	21					17	152	
L. TOT OBSERVATIONS	170		170	340		170	510		170	680					170	3392	
M. ASSIGNED TIME	80.00		80.00			80.00			80.00						80.00		
N. SAMPLED(AVAIL) TIME	80.00		80.00	160		74.00	234		76.00	310					72.00	1528	
O. AVG LEVELING FACTOR	1.00		1.00	1.00		1.00	1.00		1.00	1.00					1.00	1.00	

Figure 6-2. Example Of A Work Sampling Recap Sheer

615. Preparation of the Work Sampling Recap Sheet

1. Heading. Complete the heading information. Indicate in the "Sampling Period" block the first and last day of work sampling. When gathering work sampling data for use in development of functional staffing standards, indicate appropriate RFC code after the component title in the "Organizational Component" block.

2. Sampling Day Column Headings. Enter sampling days 1 through 6 (as applicable) on the first page of the Work Sampling Recap Sheet. When sampling covers more than six days, enter "CUM" in place of the day number in the first column of continuation sheet(s) and continue numbering sampling days in the remaining five columns. Prepare sufficient pages to accommodate data recording for the entire sampling period.

3. Productive Categories (Column A). Enter productive categories, by category number and title, as displayed on the Daily Work Sampling Observation Sheet.

4. Daily Sampling Data Entries

a. Daily Observation Totals. Enter observation totals, by category, for all productive, nonproductive, and nonavailable categories from Column C (Total) of each day's Daily Work Sampling Observation Sheet. For Day 2 and subsequent sampling days, enter both a daily and cumulative observation count. Use the first "Sampling Day" column on the second and subsequent pages to enter the cumulative data from the last daily column of the previous page.

b. Category Totals. Total the daily and cumulative productive category observations on Line B; nonproductive observations on Line H; total available observations on Line I; and total observations on Line L.

c. Percentages

(1) Enter, in decimal form rounded to three decimal places, the percentage of observations by category, for individual productive and nonproductive categories in the appropriate "%" columns. This percentage is determined by dividing individual category observations by the total available observations reflected on Line I. As a check of computational accuracy, sum the P values for all available categories. The sum, with an allowance for rounding error, will equal 1.000. If

the sum figure is not 1.000, force round any other than the highest category percentage to eliminate the rounding error. Day 1 on the first page will be a reflection of that single day only. The first column of subsequent pages will reflect the cumulative percentages from the last daily column of the previous page.

(2) Enter Total Productive Percentage (Total P) for both daily and cumulative productive observation totals on Line C. (Computed by dividing Total Productive Observations (Line B) by Total Available Observations (Line I)).

(3) Enter the highest daily and cumulative productive category percentage (highest P) for each sampling day on Line D. (Daily value is computed by dividing the highest daily observation count by daily total available observations from Line I. Select highest cumulative category percentage from each day's cumulative category percentages.)

d. Assigned Time (Line M). Enter the assigned work-hour total for each sampling day from daily work-hour accounting forms, verified by sampling data reflected on the Daily Work Sampling Observation Sheet. (This figure will normally reflect the result of multiplying 8 hours times the number of work center personnel sampled.)

e. Sampled Time (Line N). Enter daily and cumulative sampled (available) work-hour totals for each sampling day. Compute sampled time by multiplying total available observations (Line I) by the relative weight of each observation. The relative weight is obtained for:

(1) Stratified Hourly Sampling: Divide "1" by the number of observation rounds per hour.

(2) Stratified Daily Sampling and Random Location Sampling: Divide "8" by the number of observation rounds per day.

f. Average Leveling Factor (Line O). When performance rating is accomplished, enter, in decimal form rounded to two decimal places, the arithmetic average of all performance ratings recorded each day and the cumulative average. Enter 1.00 when performance rating is not conducted.

5. End of Study Computations

a. At the conclusion of measurement, line out entries for any days to be excluded and reflect adjusted "end of study" cumulative data in "Sampling Day" column following the final "Sampling Day" entry. Exercise extreme caution in discarding data. Do not declare data unusable simply because a point falls beyond the established control limits. It is necessary to clearly establish cause for each day's data not used.

b. Transfer "end of study" cumulative data to the appropriate columns/rows of the Work Sampling Computation Sheet.

616. Control Charts

1. Use of Control Charting. Control charting in work sampling allows the analyst to monitor daily percentages or accumulated results of the study. If a plotted point falls outside the control limits of the control chart, this indicates some abnormal or unusual condition may have been present during that part of the study. Two-sigma limits (95%) are normally used to determine upper and lower control limits. There are approximately 46 chances out of 1000 that a point will fall outside these limits due to chance. An analyst can be confident that daily percentages of occurrence are within the degree of accuracy and confidence level required if daily percentages are between the control limits.

2. Development of Control Limits. Develop control charts using the following formula:

$$\text{Control limits} = \bar{P} \pm \frac{2\sqrt{\bar{P}(1-\bar{P})}}{n}$$

Where: $\bar{P}$ = Cumulative percentage of occurrence. (For the first day this would be nothing more than an estimate.)

n = Average daily number of observations

$$= \frac{\text{total number of observations (N)}}{\text{number of study days}}$$

3. Productivity Charting. Productivity charts are effective for determining representativeness of total daily productivity or productivity related to a particular category or categories. A productivity chart is a graph containing a center line, upper and lower control limits, and the daily productivity to be analyzed. The center line is the average productivity for the period the chart represents. Upper control limits (UCL) and lower control limits (LCL) are set by adding and subtracting two sigma from the center line.

4. Productivity Control Chart Preparation

a. Clearly label both vertical and horizontal axes to indicate what is being charted.

b. Scale the vertical axis to include the range of values to be charted.

c. Indicate with a broken line when an axis does not go all the way to zero.

d. Extend the horizontal axis to allow all of the data to be charted (both current data and data to be obtained in the future).

e. Draw a solid line to indicate the center line. Identify the value.

f. Place dotted lines for the UCL and LCL. Indicate the value of each.

g. Plot the points to be evaluated on the control chart.

h. Connect all of the points to aid the visual analysis by using a solid line between each of the points or by using a vertical line between each point and the X-axis. Example of this format is shown in Figure 6-3.

5. Interpretation of Control Charts

a. Prepare control charts for the largest productive category, total productive, and any other category that requires examination. Normally, control limits will be updated every third day as well as the first and last day. Using this procedure, the updated control limits are based on the average daily number of observations. The percentages of occurrence are plotted daily.

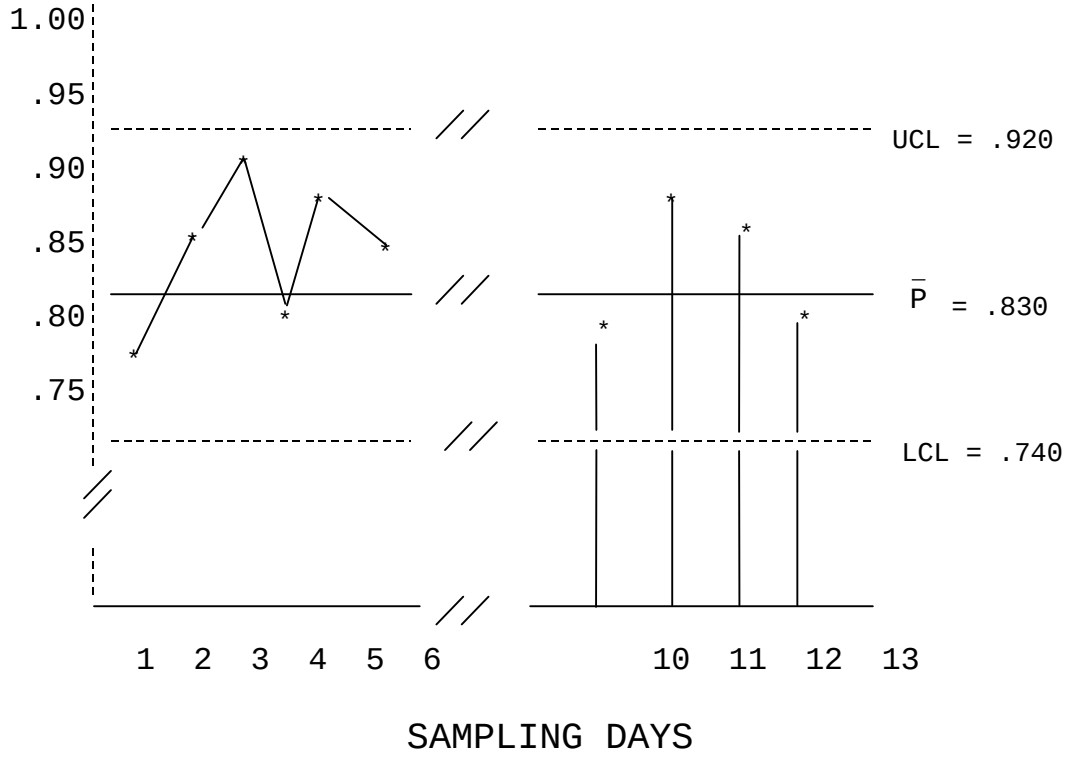


Figure 6-3. Example of Work Sampling Daily Productivity Control Chart For Total Productive Categories

b. There are several criteria to be used when analyzing control charts to decide if a day or the entire study is abnormal.

(1) <u>One or More Points Outside the Control Limits</u>. There is only a 4.6% probability that a plotted point will fall outside two-sigma limits due to chance. Study each such point to determine if there is an assignable cause. If the cause is an unusual occurrence, exclude that day's data.

(2) <u>One or More Points in the Vicinity of the Control Limits</u>. Assignable causes can create variations inside the control limits; therefore, if a daily plotted point falls near a control limit (especially if there is a large increase or decrease from the preceding day), examine that day's data at the end of the study to check its relationship to the final-day control limits. If it is still near the control limits, determine an assignable cause.

(3) A Run of Two or Three Days Outside of the Two-Sigma Control Limits. The work under study may be abnormal. Examine procedures to determine what is causing the abnormalities. If a cause is identified, document the cause, reschedule the study, or use an alternate work measurement technique.

(4) Cycles or Other Nonrandom Patterns. The work center may be abnormal and the procedures need to be studied as in (3) above.

617. Preparation of Work Sampling Computation Sheet (Figure 6-4). The work sampling computation sheet is used to reflect accumulated work sampling observation and work-hour data collected during work sampling and compute total measured, leveled, and allowed work-hour totals by category.

1. Heading. Complete the heading information. When gathering work sampling data for use in development of functional staffing standards, indicate appropriate RFC code.

2. Computations

a. Categories (Column A). Enter all productive and non-productive category titles in the space provided.

b. Number of Observations (Column B). Enter the study period total of observations recorded for each category, "Productive Total" (Line G), "Nonproductive Total" (Line H), and "Total Available Observations/(N)" (Line I). (Transfer final sampling day cumulative observation values from the Work Sampling Recap Sheet.)

c. Percent Occurrence (P) (Column C). Enter, in decimal form to three decimal places, the percent occurrence of each productive and nonproductive category and "Productive Total" (Line G), "NonProductive" (Line H), and "Total Available Observations" (Line I). (Transfer final sampling day cumulative percentage values from the Work Sampling Recap Sheet.)

d. Measured Time (Column D). To compute "Measured Time" for each category:

(1) Divide "Total Work-hours Sampled (Available)" (Block L) by "Total Available Observations/(N)" (Block I);

WORK SAMPLING COMPUTATION SHEET

DATE: 10-13-96

PAGE : 1 OF 1

UIC:	ORGANIZATIONAL COMPONENT:	RFC:
XXXXX	Physical Security Operations	SCB

A. CATEGORIES				TIME		
No.	TITLE	NUMBER OF OBSERVATIONS (B)	$\bar{P}$ PERCENT OCCURRENCE (C)	(L/ N x B) MEASURED (D)	LEVELED (E): 1.000	ALLOWED (F): 1.15
1	MANAGEMENT	148	.049	75.18	75.18	86
2	SECURITY GUARD SVS	1063	.353	539.98	539.98	621
7	RESOURCE PROTECTION	403	.134	204.72	204.72	235
8	SUPERVISION	145	.048	73.66	73.66	85
9	ADMINISTRATION	112	.037	56.89	56.89	65
10	SUPPLY	96	.032	48.77	48.77	56
11	EQUIPMENT MAINT	75	.025	38.10	38.10	44
12	MEETINGS	274	.091	139.19	139.19	160
13	TRAVEL	87	.029	44.19	44.19	51
14	TRAINING	128	.043	65.02	65.02	75
15	CLEAN UP	68	.023	34.54	34.54	40
(G) PRODUCTIVE TOTAL		2599	.864	1320.24	1320.24	1518
P	PERSONAL/REST/BREAK	276	.092	140.20		
D	DELAY	73	.024	37.08		
I	IDLE	60	.020	30.48		
(H) NONPRODUCTIVE TOTAL		419	.136	207.76		
(I) TOTAL AVAILABLE OBSERVATIONS		N=3008	1.000	1528		

(J) OBSERVATIONS REQUIRED	1024	(K) ABSOLUTE ACCURACY FOR LARGEST $\bar{P}$	1.74 %
(L) TOTAL WORK HOURS SAMPLED (AVAILABLE):	1528	ANALYST: JOHN DOE	

Figure 6-4. Example Work Sampling Computation Sheet

(2) Multiply the resulting factor by number of observations for each category (Column B) to determine measured time. Measured time figures will be in hours computed to two decimal places.

$$\text{Measured Time (D)} = \left(\frac{L}{I}\right) \times B$$

Where:
- D = Measured Work-hours
- L = Total Work-hours Sampled (Available)
- I = Total Available Observations
- B = Number of Observations (By Category)

(3) Check the computational accuracy by adding the individual category measured time figures. The sum, with reasonable allowance for rounding error, should equal "Total Work-hours Sampled (Available)". Measured time for "Productive" and "Nonproductive" totals is calculated similarly.

e. Leveled Time (Column E). Leveling of measured time should occur only when performance rating is done during the work sampling. Compute "Leveled Time" (to two decimal places) for each productive category by multiplying the "Average Leveling Factor" (cumulative rate reflected on Line "O" of the Work Sampling Recap Sheet for the last sampling day) times each category's "Measured Time" figure (Column D). Indicate the average leveling factor used in the space provided at the header for Column E. If leveling is considered inappropriate for any category, repeat the "Measured Time" entry in Column E. (See Appendix I for explanation of performance rating.) The "Productive Total" entry (Line G) is the sum total of the leveled time for all productive categories.

f. Allowed Time (Column F). Compute "Allowed Time" (to two decimal places) by multiplying the allowance factor deemed appropriate for the study times the "Leveled Time" (Column E) for each productive category. Indicate the Allowance Factor used in the space provided at the header for Column F. Normally, the PF&D allowance factor used will be 1.15 (white collar) or 1.17 (blue collar). Allowances applied in excess of these factors will be specifically justified in the measurement data input. If application of allowances to any category is considered inappropriate (PF&D is already reflected in the leveled data), simply repeat the "Leveled Time" in Column F.

The "Productive Total" entry (Row G) is the sum total of allowed time for all productive categories.

g. Observations Required (Block J). Determine this value from Table 6-1, using the largest percent of occurrence of a single category and $\pm$3% absolute accuracy. Ensure that the total number of observations obtained exceeds the observations required to achieve the desired degree of accuracy. To determine the observations required for a specified absolute accuracy of $\pm$3%, the following steps are necessary:

(1) Identify the largest single category $\bar{P}$ value; e.g., (.353) from Column C.

(2) Enter Table 6-1 with $\bar{P}$ = .353 and $\pm$3% Degrees of Accuracy. Table 6-1 reflects $\bar{P}$ values to two decimal places. When the $\bar{P}$ value falls between two-decimal values, select the higher of the two values. Therefore, the .353 $\bar{P}$ is rounded up to .36, which requires 1024 total observations at 3% accuracy.

h. Absoulte Accuracy for Largest $\bar{P}$ (Block K). Using cumulative data, enter the absolute accuracy, as a percentage figure, as found by applying the "N" obtained from Column B of Line "I" and the largest $\bar{P}$ for a single category to the formula:

$$S = \frac{2\sqrt{\bar{P}(1-\bar{P})}}{\sqrt{N}} \times 100$$

Where S = absolute accuracy as a percentage figure
$\bar{P}$ = largest percentage occurrence for a single category.
N = total number of observations obtained.

i. Values of the expression $2\sqrt{\bar{P}(1-\bar{P})}$ for given values of $\bar{P}$ may be obtained from Table 6-2. For example, to determine the absolute accuracy for a $\bar{P}$ value of .353, obtain the table value of 0.9558 for the expression $2\sqrt{\bar{P}(1-\bar{P})}$ from Table 6-2. Substitute 0.9558 into the above formula to obtain the absolute accuracy for the largest $\bar{P}$ value. (The resulting absolute percent should meet the percent of absolute accuracy requirement set at the onset of the study, which is normally $\pm$ 3% (i.e., 1.74% < +3% and > -3%).

$$S = \frac{0.9558}{\sqrt{3008}} \times 100 \; ; \quad \frac{0.9558}{54.845} \times 100 \; ; \quad S = 1.74\ \%$$

j. Total Work-hours Sampled (Available) (Block L). Transfer cumulative sampled work-hour value from the last column of Line N (Sampled (Avail) Time) on the Work Sampling Recap Sheet.

3. Consolidation of Work-Hour Data. Forward the Allowed Time reflected for each category from the total study Work Sampling Computation Sheet to the Work-Hour Requirements Consolidation Sheet for the organizational component. Use the Work-Hour Requirements Consolidation Sheet (see Appendix F) to adjust the allowed time to allowed monthly work-hours for the sampled group/component, to consolidate the measured work-hours from the work sampling study with work-hours collected in the component by other work measurement techniques, and to incorporate any nonmeasured overtime and/or standby/post manning minimum work-hours to establish the component's total work-hour requirement by category and aggregate.

618. Work Sampling Skill Worksheet. Individual Work Sampling Skill Worksheets (Figure 6-5) are used to summarize productive category observations for each person or skill grouping from the Daily Work Sampling Observation Sheets. Monthly work-hours, by category, for the skill group are calculated on the skill worksheet and transferred to the Manpower Distribution Chart along with skill/skill group work-hour requirements developed by other measurement methods. The Manpower Distribution Chart is then used to establish the manpower requirements baseline skill distribution (see Appendix F for instructions on development and use of the Manpower Distribution Chart). Work Sampling Skill Worksheets and subsequent manpower distribution analysis may not be needed if the component consists of only a few positions or if very few tasks/skills are involved and grade/skill distribution is apparent without further analysis. If skill distribution analysis is performed by use of the Manpower Distribution Chart without use of Work Sampling Skill Worksheets, allowed work-hour totals carried directly to the Manpower Distribution Chart from Adjust Work Sampling Observation Sheets to monthly work-hour values.

619. Instructions for Preparing Work Sampling Skill Worksheet (Figure 6-5)

1. Complete heading information.

TABLE 6-2

COMPUTED VALUES FOR THE EXPRESSION $2\sqrt{\bar{P}(1-\bar{P})}$

$\bar{P}$		Value	$\bar{P}$		Value	$\bar{P}$		Value	$\bar{P}$		Value
.010	.990	.1990	.050	.950	.4359	.090	.910	.5724	.130	.870	.6726
.011	.989	.2086	.051	.949	.4400	.091	.909	.5752	.131	.869	.6748
.012	.988	.2178	.052	.948	.4441	.092	.908	.5781	.132	.868	.6770
.013	.987	.2265	.053	.947	.4481	.093	.907	.5809	.133	.867	.6791
.014	.986	.2350	.054	.946	.4520	.094	.906	.5837	.134	.866	.6813
.015	.985	.2413	.055	.945	.4560	.095	.905	.5864	.135	.865	.6834
.016	.984	.2510	.056	.944	.4598	.096	.904	.5892	.136	.864	.6856
.017	.983	.2585	.057	.943	.4637	.097	.903	.5919	.137	.863	.6877
.018	.982	.2569	.058	.942	.4675	.098	.902	.5946	.138	.862	.6898
.019	.981	.2730	.059	.941	.4712	.099	.901	.5973	.139	.861	.6919
.020	.980	.2800	.060	.940	.4750	.100	.900	.6000	.140	.860	.6940
.021	.979	.2868	.061	.939	.4787	.101	.899	.6027	.141	.859	.6960
.022	.978	.2934	.062	.938	.4823	.102	.898	.6053	.142	.858	.6981
.023	.977	.2998	.063	.937	.4859	.103	.897	.6079	.143	.857	.7001
.024	.976	.3061	.064	.936	.4895	.104	.896	.6105	.144	.856	.7022
.025	.975	.3122	.065	.935	.4931	.105	.895	.6131	.145	.855	.7042
.026	.974	.3183	.066	.934	.4966	.106	.894	.6157	.146	.854	.7062
.027	.973	.3242	.067	.933	.5000	.107	.893	.6182	.147	.853	.7082
.028	.972	.3299	.068	.932	.5035	.108	.892	.6208	.148	.852	.7102
.029	.971	.3356	.069	.931	.5069	.109	.891	.6233	.149	.851	.7122
.030	.970	.3412	.070	.930	.5130	.110	.890	.6258	.150	.850	.7141
.031	.969	.3466	.071	.929	.5136	.111	.889	.6283	.151	.849	.7161
.032	.968	.3520	.072	.928	.5170	.112	.888	.6307	.152	.848	.7180
.033	.967	.3573	.073	.927	.5203	.113	.887	.6332	.153	.847	.7200
.034	.966	.3625	.074	.926	.5235	.114	.886	.6356	.154	.846	.7219
.035	.965	.3676	.075	.925	.5268	.115	.885	.6380	.155	.845	.7238
.036	.964	.3726	.076	.924	.5300	.116	.884	.6404	.156	.844	.7257
.037	.963	.3775	.077	.923	.5332	.117	.883	.6428	.157	.843	.7276
.038	.962	.3824	.078	.922	.5363	.118	.882	.6452	.158	.842	.7295
.039	.961	.3872	.079	.921	.5395	.119	.881	.6476	.159	.841	.7314
.040	.960	.3919	.080	.920	.5426	.120	.880	.6499	.160	.840	.7332
.041	.959	.3966	.081	.919	.5457	.121	.879	.6523	.161	.839	.7351
.042	.958	.4012	.082	.918	.5487	.122	.878	.6546	.162	.838	.7369
.043	.957	.4057	.083	.917	.5518	.123	.877	.6569	.163	.837	.7387
.044	.956	.4102	.084	.916	.5548	.124	.876	.6592	.164	.836	.7406
.045	.955	.4146	.085	.915	.5578	.125	.875	.6614	.165	.835	.7424
.046	.954	.4190	.086	.914	.5607	.126	.874	.6637	.166	.834	.7442
.047	.953	.4233	.087	.913	.5637	.127	.873	.6659	.167	.833	.7460
.048	.952	.4275	.088	.912	.5666	.128	.872	.6682	.168	.832	.7477
.049	.951	.4317	.089	.911	.5695	.129	.871	.6704	.169	.831	.7495

Factors for use in solving: $\pm\frac{2\sqrt{\bar{P}(1-\bar{P})}}{\sqrt{N}}$

Select the percentage value of $\bar{P}$. Corresponding numbers under the columns headed “value” are solutions of the expression $2\sqrt{\bar{P}(1-\bar{P})}$.

TABLE 6-2 (Continued)

COMPUTED VALUES FOR THE EXPRESSION $2\sqrt{\overline{P}(1-\overline{P})}$

$\overline{P}$		Value	$\overline{P}$		Value	$\overline{P}$		Value	$\overline{P}$		Value
.170	.830	.7513	.220	.780	.8285	.270	.730	.8879	.320	.680	.9330
.171	.829	.7530	.221	.779	.8289	.271	.729	.8890	.321	.679	.9337
.172	.828	.7548	.222	.778	.8312	.272	.728	.8900	.322	.678	.9345
.173	.827	.7565	.223	.777	.8325	.273	.727	.8910	.323	.677	.9352
.174	.826	.7582	.224	.776	.8338	.274	.726	.8920	.324	.676	.9360
.175	.825	.7599	.225	.775	.8352	.275	.725	.8930	.325	.675	9367
.176	.824	.7616	.226	.774	.8365	.276	.724	.8940	.326	.674	.9375
.177	.823	.7633	.227	.773	.8378	.277	.723	.8950	.327	.673	.9382
.178	.822	.7650	.228	.772	.8391	.278	.722	.8960	.328	.672	.9390
.179	.821	.7667	.229	.771	.8404	.279	.721	.8970	.329	.671	.9397
.180	.820	.7684	.230	.770	.8417	.280	.720	.8980	.330	.670	.9404
.181	.819	.7700	.231	.769	.8429	.281	.719	.8990	.331	.669	.9411
.182	.818	.7717	.232	.768	.8442	.282	.718	.8999	.332	.668	.9419
.183	.817	.7733	.233	.767	.8455	.283	.717	.9009	.333	.667	.9426
.184	.816	.7750	.234	.766	.8467	.284	.716	.9019	.334	.666	.9433
.185	.815	.7766	.235	.765	.8480	.285	.715	.9028	.335	.665	.9440
.186	.814	.7782	.236	.764	.8492	.286	.714	.9038	.336	.664	.9447
.187	.813	.7798	.237	.763	.8505	.287	.713	.9047	.337	.663	.9454
.188	.812	.7814	.238	.762	.8517	.288	.712	.9057	.338	.662	.9461
.189	.811	.7830	.239	.761	.8529	.289	.711	.9066	.339	.661	.9467
.190	.810	.7846	.240	.760	.8542	.290	.710	.9075	.340	.660	.9474
.191	.809	.7862	.241	.759	.8554	.291	.709	.9084	.341	.659	.9481
.192	.808	.7877	.242	.758	.8566	.292	.708	.9094	.342	.658	.9488
.193	.807	.7893	.243	.757	.8578	.293	.707	.9103	.343	.657	.9494
.194	.806	.7909	.244	.756	.8590	.294	.706	.9112	.344	.656	.9501
.195	.805	.7924	.245	.755	.8602	.295	.705	.9121	.345	.655	.9507
.196	.804	.7939	.246	.754	.8614	.296	.704	.9130	.346	.654	.9514
.197	.803	.7955	.247	.753	.8625	.297	.703	.9139	.347	.653	.9520
.198	.802	.7970	.248	.752	.8637	.298	.702	.9148	.348	.652	.9527
.199	.801	.7985	.249	.751	.8649	.299	.701	.9156	.349	.651	.9533
.200	.800	.8000	.250	.750	.8660	.300	.700	.9165	.350	.650	.9539
.201	.799	.8015	.251	.749	.8672	.301	.699	.9174	.351	.649	.9546
.202	.798	.8030	.252	.748	.8683	.302	.698	.9183	.352	.648	.9552
.203	.797	.8045	.253	.747	.8695	.303	.697	.9191	.353	.547	.9558
.204	.796	.8059	.254	.746	.8706	.304	.696	.9200	.354	.646	.9564
.205	.795	.8074	.255	.745	.8717	.305	.695	.9208	.355	.645	.9570
.206	.794	.8089	.256	.744	.8728	.306	.694	.9217	.356	.644	.9576
.207	.793	.8103	.257	.743	.8740	.307	.693	.9225	.357	.643	.9582
.208	.792	.8118	.258	.742	.8751	.308	.692	.9233	.358	.642	.9588
.209	.791	.8132	.259	.741	.8762	.309	.691	.9242	.359	.641	.9594
.210	.790	.8146	.260	.740	.8773	.310	.690	.9250	.360	.640	.9600
.211	.789	.8160	.261	.739	.8784	.311	.689	.9258	.361	.639	.9606
.212	.788	.8174	.262	.738	.8794	.312	.688	.9266	.362	.638	.9612
.213	.787	.8189	.263	.737	.8805	.313	.687	.9274	.363	.637	.9617
.214	.786	.8203	.264	.736	.8816	.314	.686	.9282	.364	.636	.9623
.215	.785	.8216	.265	.735	.8827	.315	.685	.9290	.365	.635	.9629
.216	.784	.8230	.266	.734	.8837	.316	.684	.9298	.366	.634	.9634
.217	.783	.8244	.267	.733	.8848	.317	.683	.9306	.367	.633	.9640
.218	.782	.8258	.268	.732	.8858	.318	.682	.9314	.368	.632	.9645
.219	.781	.8271	.269	.731	.8869	.319	.681	.9322	.369	.631	.9651

TABLE 6-2 (Continued)

COMPUTED VALUES FOR THE EXPRESSION $2\sqrt{\overline{P}(1-\overline{P})}$

$\overline{P}$		Value	$\overline{P}$		Value	$\overline{P}$		Value
.370	.630	.9656	.420	.580	.9871	.470	.530	.9982
.371	.629	.9661	.421	.579	.9874	.471	.529	.9983
.372	.628	.9667	.422	.578	.9878	.472	.528	.9984
.373	.627	.9672	.423	.577	.9881	.473	.527	.9985
.374	.626	.9677	.424	.576	.9884	.474	.526	.9986
.375	.625	.9682	.425	.575	.9887	.475	.525	.9987
.376	.624	.9688	.426	.574	.9890	.476	.524	.9988
.377	.623	.9693	.427	.573	.9893	.477	.523	.9989
.378	.622	.9698	.428	.572	.9896	.478	.522	.9990
.379	.621	.9703	.429	.571	.9899	.479	.521	.9991
.380	.620	.9708	.430	.570	.9902	.480	.520	.9992
.381	.619	.9713	.431	.569	.9904	.481	.519	.9993
.382	.618	.9718	.432	.568	.9907	.482	.518	.9994
.383	.617	.9722	.433	.567	.9910	.483	.517	.9994
.384	.616	.9727	.434	.566	.9912	.484	.516	.9995
.385	.615	.9732	.435	.565	.9915	.485	.515	.9995
.386	.614	.9737	.436	.564	.9918	.486	.514	.9996
.387	.613	.9741	.437	.563	.9920	.487	.513	.9997
.388	.612	.9746	.438	.562	.9923	.488	.512	.9997
.389	.611	.9750	.439	.561	.9925	.489	.511	.9998
.390	.610	.9755	.440	.560	.9928	.490	.510	.9998
.391	.609	.9759	.441	.559	.9930	.491	.509	.9998
.392	.608	.9764	.442	.558	.9932	.492	.508	.9999
.393	.607	.9768	.443	.557	.9935	.493	.507	.9999
.394	.606	.9773	.444	.556	.9937	.494	.506	.9999
.395	.605	.9777	.445	.555	.9939	.495	505	.9999
.396	.604	.9781	.446	.554	.9942	.496	.504	1.0000
.397	.603	.9786	.447	.553	.9944	.497	.503	1.0000
.398	.602	.9790	.448	.552	.9946	.498	.502	1.0000
.399	.601	.9794	.449	.551	.9948	.499	.501	1.0000
.400	.600	.9798	.450	.550	.9950	.500	.500	1.0000
.401	.599	.9802	.451	.549	.9952			
.402	.598	.9806	.452	.548	.9954			
.403	.597	.9810	.453	.547	.9956			
.404	.596	.9814	.454	.546	.9958			
.405	.595	.9818	.455	.545	.9959			
.406	.594	.9822	.456	.544	.9961			
.407	.593	.9825	.457	.543	.9963			
.408	.592	.9829	.458	.542	.9965			
.409	.591	.9833	.459	.541	.9966			
.410	.590	.9837	.460	.540	.9968			
.411	.589	.9840	.461	.539	.9970			
.412	.588	.9844	.462	.538	.9971			
.413	.587	.9847	.463	.537	.9973			
.414	.586	.9851	.464	.536	.9974			
.415	.585	.9854	.465	.535	.9975			
.416	.584	.9858	.466	.534	.9977			
.417	.583	.9861	.467	.533	.9978			
.418	.582	.9865	.468	.532	.9979			
.419	.581	.9868	.469	.531	.9981			

2. Person/Skill Group (Section A). Prepare a separate skill worksheet for each employee or group of employees identified as requiring a specific minimum skill. Identify the skill/skill group by grade, designator/rate, SSP, AQD/NEC, MEC, and any other qualifiers needed to reflect minimum skill requirement. Indicate the number of employees included in the skill group.

3. Category (Section B). Enter categories by number and title as reflected on the Work Sampling Observation Sheets.

4. Daily Productive Observations (Section C). Summarize, from the Work Sampling Daily Observation Sheets, the total daily count of productive observations, by category, recorded for the employee or group of employees making up the minimum skill grouping. Sum the daily productive category totals on the "Total Daily Productive Observations" line.

5. End Study Computations

a. Total Observations (Column D). Sum daily entries and enter total observations, by category and aggregate, for the skill or skill grouping.

b. Percent Observations (Column E). Compute individual category percentages of the component total productive observations. (The percentage is computed by dividing each category observation total (Column D) by the total productive observations for the study (Block H). Enter percentage, rounded to three decimal places, in Column E and retain result of computation in your calculator for calculation of Allowed Work-hours (Column F).

c. Allowed Work-Hours (Column F). Compute and enter Allowed Work-hours by category and productive observation total rounded to two decimal places in Column F and retain computed value in your calculator for computation of Monthly Work-hours (Column G). (Calculate allowed work-hours by multiplying the observation percentages retained in your calculator from previous calculation of Column E by the Total Productive Work-hours for the study (Block I).)

d. Monthly Work-hours (Column G)

(1) In the space provided in the column heading, enter the Adjustment Factor (three decimal place figure) applied to arrive at "Monthly Work-hours" on the Work-hour Requirements

WORK SAMPLING SKILL WORKSHEET	ANALYST: H. ROCKOE	DATE: 10/16/96	PAGE 1 OF 2

UIC: XXX1X	ORGANIZATIONAL COMPONENT: Physical Security Operations

A. PERSON/SKILL GROUP (GRADE, DESIGNATOR/RATE, SSP, AQD/NEC, MEC CODE) Examples below indicate category breakout for one LT, 1000, MEC E and one civilian GS-083-09.

B. CATEGORY		C. DAILY PRODUCTIVE OBSERVATIONS DAY																					TOTAL OBS D.	% OBS E. (D/H)	ALLOWED WORK-HOURS F. (E x I)	MONTHLY WORK-HOURS G. (1.045)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
NO.	TITLE																									
	LT 1000J(E) (1)																									
1	MANAGEMENT	8	6	5	7																5		125	.048	73.01	76
8	SUPERVISION	3	4		2																1		49	.019	28.62	30
12	MEETINGS	3	2	3	2																5		46	.018	26.87	28
13	TRAVEL	1	2	1	1																1		29	.011	16.94	18
	LT TOTAL	15	14	9	12																12		249	.096	145.44	152
	GS-082-09 (1)																									
1	MANAGEMENT	2	1	2	2																1		23	.009	13.43	14
2	SECURITY GUARD SVS	5	2	1	3																2		32	.012	18.69	20
7	RESOURCE PROTECTION	4	5	5	3																4		77	.030	44.98	47
8	SUPERVISION		2	3	2																3		54	.021	31.54	33
12	MEETINGS	2	2	2	1																2		30	.012	17.52	18
13	TRAVEL	1	1	1	2																1		17	.007	9.93	10
14	TRAINING		1	1	1																1		16	.006	9.35	10
	GS-09 TOTAL	14	14	15	14																14		249	.096	145.44	152

TOTAL DAILY PRODUCTIVE OBSERVATIONS	SEE INDIVIDUAL TOTAL LINES IN ABOVE EXAMPLES.
TOTAL COMPONENT INFORMATION	H. TOTAL PRODUCTIVE OBSERVATIONS: 2592 — I. TOTAL PRODUCTIVE WORK-HOURS: 1514

Figure 6-5. Example Of Completed Work Sampling Skill Worksheet

Consolidation Sheet. (See Appendix F for example Work-Hour Requirements Consolidation Sheet and explanation of adjustment factor development and application.)

(2) Multiply the value retained in your calculator from computation of Column F by this Adjustment Factor and enter the product, rounded to whole work-hours, in Column G.

6. Total Component Information

a. Total Productive Observations (Section H). Transfer the total number of productive observations for the study from Column "B" of the "Productive Total" line (Line G) on the Work Sampling Computation Sheet.

b. Total Productive Work-hours (Section I). Transfer the total productive allowed work-hours for the study from Column "F" of the "Productive Total" line (Line G) on the Work Sampling Computation Sheet. (This work-hour value includes adjustments made for leveling and allowance factors.)

7. Carry forward monthly work-hours (by category and skill total) from each Work Sampling Skill Worksheet to skill/skill grouping columns on the Manpower Distribution Chart.

620. Productive/Nonproductive Work Sampling. As stated in the paragraph on Uses of Work Sampling, some types of work have been difficult to sample such as: product analysis, closed-session counseling, creative thinking and research and development, to name a few. For organizational components where the work is of this type (where distinct tasks are not recognizable during an instantaneous observation) consider the use of productive and nonproductive sampling. Productive and nonproductive sampling simply means to use "Productive" and "Nonproductive" as the only two categories of work during the sampling study. These categories, used with a "Nonavailable" category, will account for all the time in the component. The results of the study will, if truly representative, show the required productive work-hours to determine the quantity of manpower requirements.

CHAPTER 7

GROUP TIMING TECHNIQUE (GTT)

700. General

1. Group Timing Technique (GTT) is a statistical sampling technique of work measurement which can be used to an advantage in studying a group of workers or machines involved in common work. Typical uses for GTT include:

a. Establishing performance time standards.

b. Determining delay allowances.

c. Evaluating workloads.

2. In using GTT, break work to be studied into elements or categories, in much the same manner as in short cycle time studies or work sampling. Then observe the work at fixed intervals and record a tally mark in the appropriate category for each worker or machine. The group may be as small as two or as large as 15. A stop watch runs continuously during the study and is used by the observer to maintain the desired interval between observations.

3. At the completion of the study, the percentage of tally marks in a given category represents the percentage of time spent in that category during the study. By considering the average rating factor, it is possible to develop a standard time per work unit. Later paragraphs of this section cover the procedure in detail.

4. Group Timing Technique studies appear very similar to work sampling studies. Both techniques involve obtaining and analyzing a sample for certain characteristics. What is found to be true of the sample is assumed to be true of the population from which the sample is drawn. As in any sampling procedure, however, characteristics of the sample differ from characteristics of the population. These differences are held within acceptable limits by obtaining a sample of the proper size and by following proper sampling procedures.

5. Group Timing Technique employs a fixed interval between observations. Computations relating to sampling error and the number of observations required are the same as those used in

work sampling. In applying GTT for manpower requirements determination, recommend a 95 percent confidence level within plus or minus 5% absolute accuracy (i.e., allow for 5% error in the sample with accuracy set at 95%, regardless of the mean).

6. Following are lists of advantages and disadvantages of GTT.

a. Advantages

(1) An observer can study up to approximately 15 workers or machines, if they are within visual range.

(2) Except for a slight loss of accuracy on short elements, GTT has all of the advantages of a conventional time study.

(3) Final results can be calculated in less time than required by a conventional time study.

(4) Normally, less time is required for a given level of accuracy than for work sampling.

(5) Except for performance rating, observers require only a brief period of instruction to make a good GTT study.

(6) Group Timing Technique studies tend to disturb the workers less than studies on individual workers.

b. Disadvantages

(1) Group Timing Technique does not encourage the observer to analyze and improve upon the present method as predetermined time systems do.

(2) The analyst may encounter difficulty, if required to move to several different locations to make observations. In these cases, work sampling may be more feasible.

(3) Work in which the level of activity varies on a weekly, monthly, or quarterly cycle may require a series of periodic substudies to ensure a representative sample is obtained.

701. Study Preparation

1. Select Work Units and Establish a Work Count System. Provide some means to count and record work units produced

during the course of the study. Since a GTT study is normally completed in much less time than a work sampling study, obtaining an accurate count on work units produced should be relatively simple. Hopefully, a formal production count procedure will be in existence when the study is made. If not, either the worker or the analyst can make the production count. In any event, the system used must yield timely and accurate information regarding the number of work units completed during the period the study is in progress. (See Chapter 2 discussion of PWS development for general information regarding selecting work units and establishing a work count system.)

2. Establish a Work-hour Accounting System. Group Timing Technique studies require information be available regarding the number of work-hours expended during the course of the study. Although the number of workers in the group being observed will most often remain constant while the study is being conducted, the analyst must stay alert for any changes. Since most studies are completed in much less time than a work sampling study, the need to rely on a formal work-hour accounting system is not as great as when using work sampling.

3. Define Work Categories

a. Each category should consist of a group of similar activities or a specific type of activity which may be recognized by sight and considered homogeneous for the purpose of the study. Selected categories should include all possible activities and be clearly defined to permit proper discrimination between categories at the moment of observation. When using several observers, category definitions are particularly desirable to ensure consistency in the classifications.

b. The level of detail represented by each category will depend largely on the nature of the study. Where a single product or end item is involved, it may be possible and desirable to establish standards at a level of detail roughly comparable to elements in a time study. A standard could be established for each category of work as well as a summary type of standard for the entire work unit. In other instances, the objective may be to establish a higher level standard requiring a more comprehensive work category. The analyst should keep in mind categories can always be combined at the end of the study, but cannot be divided. Therefore, it is often preferable to have more categories than is thought necessary rather than risk having too few. A short preliminary study is often the best way

of evaluating the appropriateness of the categories established.

4. Select Observation Interval. Selection of observation intervals is somewhat arbitrary. Generally, the larger the number of workers or machines to be observed, the longer the interval will be. Table 7-1 lists typical observation intervals for various numbers of workers or machines to be observed. However, several possible constraints, as listed below, must be considered.

a. The interval should be long enough so all workers/ machines can be observed without causing undue difficulty for the observer.

b. The interval should be shorter than the time required for the smallest category.

c. The fixed interval of sampling should not coincide with, or be a multiple of, any constant machine or process time inherent in the work.

TABLE 7-1

SUGGESTED OBSERVATION INTERVALS

Number of Workers or Machines	Interval Measured on Stop Watch	
	Decimal Hour Watch	Decimal Minute Watch
2	0.005 HR	0.5 MIN
3- 6	0.010 HR	1.0 MIN
7-10	0.020 HR	2.0 MIN
	0.030 HR	
11-15	0.040 HR	3.0 MIN
	0.050 HR	
OVER 15	Use 2 or More Observers	

5. Determine Number of Observations Required. Determination of the number of observations required for ± 5% absolute accuracy at the 95% confidence level is accomplished as in work sampling (see Chapter 6 for instructions). Group Timing Technique studies often include a category of particular interest. If there is such a "category of interest" to the study, observation requirements and accuracy calculations may be based on this special interest category rather than on the largest category,

which could result in less observations required and a reduction in study costs.

702. Study Length

1. The level of activity of some work fluctuates on a weekly, monthly, or quarterly cycle. To ensure a representative work period is covered in these instances, the study must be of sufficient length to cover at least one complete normal work cycle. The level of activity in the period studied should be representative of the level expected in the future; periods of abnormal activity and unusual conditions should be avoided. Study errors due to nonrepresentative study periods cannot be identified numerically, but they can be minimized by an appropriate choice of when and how long to conduct the study. A valuable device for use during a GTT study expected to last several days is a daily percentage occurrence chart. This chart monitors the daily and cumulative percentages of occurrence, and helps in evaluating the cyclic nature of the work and in determining a suitable study period. A daily percentage chart may be established for one or several categories in the study which may be of particular interest. Figure 7-1 provides an example daily percentage occurrence chart, consisting of four elements.

a. A horizontal line scaled for successive days of the study period.

b. A vertical line scaled for the percentage of occurrence.

c. A line connecting the plotted points representing the daily percentage of occurrence of the category.

d. A line connecting the plotted points representing the cumulative average percentage of occurrence.

2. For work that does not vary on a cyclical basis, the minimum number of observations required to meet statistical accuracy requirements will be the only factor affecting the duration of the study. In this case, the length of the study is found by multiplying the total number of observations required by the observation interval and dividing by the number of workers (or machines) in the group; or:

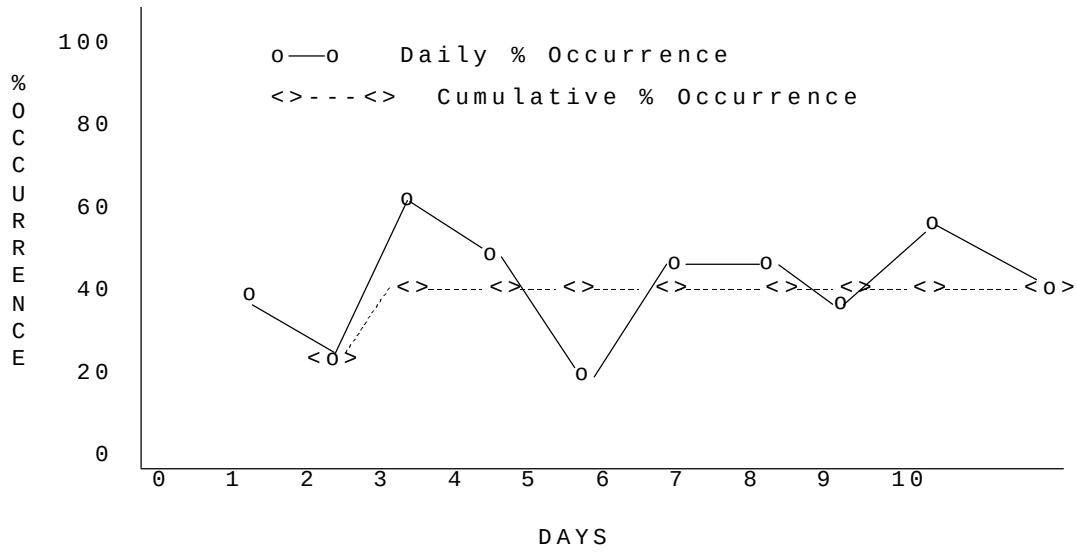


Figure 7-1. Example of Daily Percentage Occurrence Chart

Where: $L = \frac{Ni}{W}$

L = total length (time) of study
N = total number of observations required
i = observation interval
W = number of workers (or machines) in group

EXAMPLE: To compute length of study involving three workers and requiring 379 samples (based on estimated occurrence % of the largest category, which was also the "category of interest") with an observation interval of 1 minute, substitute in the above equation:

$$L = \frac{Ni}{W} = \frac{379(1)}{3} = 126 \text{ minutes, or } 2.10 \text{ hours}$$

703. Conduct of Study/Completion of GTT Forms

1. No one standard observation form is used for GTT studies. In any GTT form design, provision should be made for information intended to identify and describe certain aspects of the study. Typically, this information includes the names or numbers of the operations, workers, observation interval, study start and end times, date, study number, and the name of the observer. When the study begins, start the stop watch and allow it to run continuously. At each observation interval, record tally marks in the appropriate category as each worker is observed. If it

is necessary for the observer to move to different locations to observe certain workers, a constant time delay may be established between groups of observations for the convenience of the observer. As the study progresses, change the observation sheet hourly or daily as required to prevent undue crowding of the data. Record the time of the change on both the old and the new observation sheets. An example of a completed observation and summary form is illustrated later in this chapter.

2. Studies should account for the complete time of each worker during the period the study is conducted. To do so may require a series of categories such as start late, quit early, coffee break, idle, and meetings. If a worker is required to perform work normally not a part of his job, establish a special category denoting this type of activity. Use of such categories will tend to reduce errors and make the study easier to summarize.

704. Instantaneous Observations. A basic principle common to work sampling and GTT is that observations must be instantaneous (i.e., work being performed by the worker at the instant when first observed by the analyst is the work to be recorded). Occasionally, a worker will be observed at the time of transition from one category to another. These transitions require the analyst establish a policy of classifying the observation in either the category just ending or the category just beginning.

705. Performance Rating. Leveling of measured time should occur only when performance rating is done during the GTT study. (See Appendix I for an explanation of performance rating.) If leveling is considered inappropriate for any category, the rating factor for that category will be 1.00.

706. Study Accuracy. At the time the study is designed, lack of data may make it difficult to accurately estimate the cycle time and the time required for one occurrence of the critical category (or category of interest). Errors in either estimate may result in too many or too few observations. For this reason, it is necessary to compute the accuracy of the study after the analyst obtains the originally estimated number of observations. In the event accuracy requirements have not been realized, additional observations must be made. Chapter 6 contains the procedures for determining the total number observations needed to achieve the desired degree of accuracy.

707. Calculation of Allowed Time Per Unit

1. As mentioned previously, data from GTT studies may be collected on any of several different forms resulting in variations in the computation procedure. Generally, all procedures must compute the productive time, leveled time, and allowed time per unit. The exact steps will vary according to the data collection system used. The general procedure is as follows:

a. Three workers were observed during the study and a one minute observation interval was used. Required number of observations was 379, based on estimated percent of occurrence of the category of interest and the desired study accuracy of $\pm$ 5% at a 95% confidence level. Actually, 378 observations were made; 126 observation intervals with three workers observed after each interval. Study accuracy requirements were satisfied by the 378 observations.

b. The total number of observations in each productive category was converted into "actual work-hours" by multiplying the number of observations in each category by the observation interval and dividing by 60. The computation for category A is:

$$\text{Work-hours} = \frac{\text{No. Observations x Observation Interval}}{60} = \frac{44(1)}{60} = 0.7333$$

c. The normal time in each category was calculated by multiplying the actual work-hours by the rating factor for each category. Again, for Category A:

$$\text{Normal Time} = \text{Actual Work-hours x Rating Factor}$$

$$= 0.7333 \text{ x } 1.10 = 0.8066$$

d. Since the normal time in each category represents time expended on all the work units produced during the study, the prorated normal time (normal time per unit) is found by dividing the normal time values by the number of work units produced. Thus, for Category A:

$$\text{Prorated Normal Time} = \frac{\text{Normal Time}}{\text{No. Work Units}} = \frac{0.8066}{7} = 0.1152 \text{ hours}$$

e. Adding the values for the prorated normal time per category results in a total normal time per unit of 0.8249 hours. Since the allowance factor for this work had been

established from some earlier study, no use is made of the tallies collected for the delay categories other than including them in the total for the study. The allowed time per unit is found by multiplying the total normal time per unit by the allowance factor.

Allowed Time Per Unit = (Total Normal Time per Unit) x (Allowance Factor)
= 0.8249(1.20) = 0.9899 hours

2. Example results of a GTT study are shown in Figure 7-2.

GTT STANDARD CALCULATION SHEET | STUDY NO. 10 | DATE: 12/2/96 | WORKERS: SMITH, JONES, ANDERSON | SHEET 1 OF 1

DEPARTMENT: Widget & Gizmo Repair
OPERATION: 7
OBSERVATION INTERVAL: 1 MIN

WORK UNIT: Repair Widget
OBSERVER: H. Rockoe
TOTAL WORK-HOURS (STUDY LENGTH x NO WORKERS): 6:30

FINISH TIME: 0906
START TIME: 0700
ELAPSED TIME (Hrs): 2:10

CAT NO. (A)	CATEGORY DESCRIPTION (B)	TALLIES (C)	TOTAL TALLIES (D)	ACTUAL WORK-HOURS (E)	RATING FACTOR (F)	NORMAL TIME (G)	NO. OCCURR-ENCES (H)	PRORATED NORMAL TIME (I)
	PRODUCTIVE CATEGORIES							
1	(TITLE) A	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII	44	0.7333	1.10	0.8066	7	0.1152
2	B	𝍸 𝍸	140	2.3333	1.10	2.5667	7	0.3667
3	C	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	35	0.5833	1.10	0.6417	7	0.0917
4	D	𝍸 𝍸 II	12	0.2000	1.10	0.2200	7	0.0314
5	E	𝍸 𝍸 𝍸 III	18	0.3000	1.10	0.3300	7	0.0471
6	F	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 II	32	0.5333	1.10	0.5867	7	0.0838
7	G	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 IIII	34	0.5667	1.10	0.6233	7	0.0890
	DELAY CATEGORIES							
8	(TITLE) H	𝍸 II	7	0.1167				
9	I	𝍸 𝍸 𝍸 𝍸 I	21	0.3500				
10	J	𝍸 𝍸 IIII	14	0.2333				
	FOREIGN CATEGORIES							
11	(TITLE) K	𝍸 𝍸 IIII	14	0.2333				
12	L	𝍸 II	7	0.1167				
		TOTALS	378	6.300				

REMARKS:

(J) TOTAL NORMAL TIME PER UNIT: 0.8249
(K) ALLOWANCE FACTOR: 1.20
(L) ALLOWED TIME PER UNIT: 0.9899

Figure 7.2 Example OF GTT Study Results

CHAPTER 8

WORK DISTRIBUTION ANALYSIS

800. General. Work Distribution Analysis is spreadsheet display of tasks, grouped into categories, performed by each person in a work center/organizational component. It reflects, by work category, the specific work performed, who performs the work and work-hours of effort provided by each requirement in the organizational work center/component. This technique is most useful when the work center/organizational component consists of several people contributing to the same product or service. Any acceptable work measurement technique may be employed to determine individual workload. The Work Distribution Analysis model is designed to identify the aggregate of individual and component work-hour expenditures, and it displays data in a format that facilitates analysis of work-hour expenditures. It is the primary tool used to identify the quantity and quality of manpower assets needed to most effectively and efficiently perform the tasks assigned in the activity's MFTs.

801. Instructions for Preparing a Work Distribution Chart WDC). Preparation of the WDC is accomplished in several steps.

1. The analyst develops a task list and validates it with the activity's management/supervisory personnel. The task list is most often a derivative of the Work Measurement technique used to determine work-hours of effort for the personnel assigned in the organizational component. The Task list (Figure 8-1) is an itemized list of work being performed. It identifies those tasks being accomplished in order to fulfill the activity's MFTs. The analyst should include tasks that should be performed but are not because of uncontrollable circumstances (i.e., manpower or equipment shortages). Each task is numbered (1, 2, 3, etc.) in the left column to ensure separation between unique tasks. The right column (Category Number) will be used in the next phase of preparing the WDC. Ensure all tasks being performed are identified. Missing or invalid tasks will have a significant adverse impact on the validity of the WDC.

2. The task list must then be organized into a category list. The purpose is to reduce the task list, which is normally large, into a smaller number of elements that are easier to analyze. A category list is actually just a less detailed record of what

TYPE OF LIST: CATEGORY ____ TASK __X	DATE: 11 OCT 96	PAGE 1 of 1

UIC: 12345	WORK AREA: ADMIN DIV, PWD	SUPV: LT CLARK

NAME: E. ZONE	POSITION: CLERK	GRADE: YN2

No.	TASK	HOURS PER WEEK	WORK COUNT	CAT No.
1	Take and transcribe dictation	19	20	
2	File correspondence	2	-	
3	Post and dispatch supply requisitions	2	30	
4	Maintain personnel files/records	5	170	
5	Type weekly station work-completed reports	2	2	
6	Campaign-charities U/W, Red Cross, etc.	4	-	
	TOTALS	34	222	xxxxx

Figure 8-1. Example of a Category/**Task** List

takes place, covering an entire office rather than an individual. To develop a good category list, it is necessary to group related tasks from the task list into categories. There is no firm rule on how to do this. Generally, the analyst should go through the task list, pick out those tasks falling into similar categories, and identify each task to its appropriate category, using the furthermost right column on the Category/Task List. Simultaneously, identify and register major categories on the category list. When complete, a sum of like tasks will be reflected as a category on the Category List (Figure 8-2). These categories will be the data elements for the Work Distribution Analysis worksheet.

3. Using a pencil or computerized spreadsheet, prepare the WDC (Figure 8-3). The Category List provides the information needed to do the chart. If you properly and accurately arrange the information on the chart, you will have a clear picture of the way the work is presently distributed. It will be much easier to see where you can make improvements.

a. First, list the categories of work for the work center/organizational component in the left column of the chart. Also useful is the category description.

b. The top columns are for listing each person/requirement that has tasks summarized in the categories identified in the left column of the chart. For the purpose of analysis, list individuals performing the tasks in the first (left) column by grade, beginning with the person in charge.

c. Record hours per week spent by each person on each task in the proper column.

d. Sum hours spent by all workers on each category in the Totals column in the far right.

e. Sum hours spent by each worker on all their individual tasks in the bottom of the column directly beneath that worker's name.

f. The resultant WDC reflects the sum of work done by each individual, the sum of work performed in each category, and the total work-hours expended by the component as a whole.

802. <u>Work Distribution Analysis</u>

TYPE OF LIST: CATEGORY X TASK	DATE: 11 OCT 96	PAGE 1 of 1

UIC: 12345	WORK AREA: ADMIN Div, PWD	SUPV: LT CLARK

NAME:	POSITION:	GRADE:

No.	TASK	HOURS PER WEEK	WORK COUNT	CAT NO.
	Preparation of Correspondence			1
	Process Incoming Correspondence			2
	Maintenance of Central Files			3
	Administration of PWD Fund Accounts			4
	Work Progress Control and Reporting			5
	Preparation of Public Works Budget			6
	Preparation of Employee Time Reports			7
	Maintain Civilian Employee Personnel Records			8
	Supervision of Division Employees			9
	Reception of Phone Calls and Visitors			10
	Miscellaneous			11
	TOTALS			XXXXX

Figure 8-2. Example Of A **Category**/Task List

1. ORGANIZATIONAL COMPONENT ADMINISTRATIVE DIVISION, PUBLIC WORKS DEPT.	UIC	WORK DISTRIBUTION CHART	DATE	2. APPROVED BY A. R. CLARK, LT (SC), USN	PAGE __OF__

4. ☐ EXISTING ORGANIZATION ☐ RECOMMENDED ORGANIZATION	7. NAME A. R. CLARK	8. NAME E. F. GORDON	9. NAME H. I. JARMAN	10. NAME K. L. MOORE	11. NAME M. O. PETERS	12. NAME Q. R. SMITH
5. CHARTED BY A. R. CLARK, LT(SC), USN	a. POSITION ADMIN OFFICER b. GRADE LT (SC)	a. POSITION STENOGRAPHER b. GRADE GS-04	a. POSITION TYPIST b. GRADE YN3 (E4)	a. POSITION RECORD CLERK b. GRADE SW (E3)	a. POSITION CLERK TYPIST b. GRADE SN (E3)	a. POSITION RECEPTIONIST b. GRADE SA (E2)

a. CAT NO.	b. CATEGORY	c. Work count	d. Hours per week	c. TASKS	d. Wk Cnt	e. Hrs per wk	c. TASKS	d. Wk Cnt	e. Hrs per wk	c. TASKS	d. Wk Cnt	e. Hrs per wk	c. TASKS	d. Wk Cnt	e. Hrs per wk	c. TASKS	d. Wk Cnt	e. Hrs per wk	c. TASKS	d. Wk Cnt	e. Hrs per wk
1	Preparation of Correspondence	150	87	Screen, assign and review correspondence	50	15	Take and transcribe dictation	20	19	Type Correspondence	25	11	Type Correspondence	10	5	Take and transcribe Dictation	30	28	Type Correspondence	15	9
2	Process incoming correspondence	440	15	Screen and route correspondence	220	5										Sort Mail	220	5			
																Record/Maintain In & Out Mail Logs		3			
3	Maintenance of Central Files		9	Supervise maintenance of files		4	File Correspondence		2							Maintain Instruction/Notice file		3			
4	Administration of Public Works departmental FUND ACCOUNTS	65	36	Analyze, allocate & report on funds		3	Post and dispatch supply requisitions	30	2	Type Public Works requisitions	30	14	Prepare Daily labor reports	5	4						
				Maintain records of funds		3															
				Plan for and estimate P.W. funds		10															
5	Work Progress control and reporting	7	32	Answer inquiries and prepare weekly work report		11	Type weekly station work completed rpts	2	2	Type weekly station work competed rpts	5	7	Prepare work progress reports		4						
													Compute employee work measurement		5						
				Maintain/control Reports File		3							Data								
6	Preparation of P.W. Budget		2	Prepare Quarterly Budget		2															
7	Preparation of Employee Time Reports		23	Supervise/monitor employee timekeeping		1				Prepare employee Time reports		10	Prepare/distribute employee time cards		12						
8	Maintenance of Civilian Employee Personnel Records	170	7	Liasion with NAVSTA CivPers Office		2	Maintain Personnel files/records	170	5												
9	Supervision of Division Employees		6	General Supervision		6							Prepare Time Distribution Cards								
10	Reception of Phone Calls and visitors		13													Receives and route Visitors, answer		5	Receive and route Visitors, answer		10
																telephone inquiries			telephone inquiries		
11	Miscellaneous	20	20				Campaign-Charities U/W. Red Cross, etc.		4	Inventory, maintain Order office supplies		4	Sort & Distribute Savings Bonds	20	2	Perform P.W. messenger services		6	Sort and distribute payroll checks		4
	TOTAL (WORKHOURS)	852	250		270	65		222	34		60	46		35	32		250	50		15	23

Work Count data is optional

ANALYSIS: WHAT TAKES THE MOST TIME?..IS THERE MISDIRECTED EFFORT?..ARE SKILLS USED PROPERLY?..ARE THERE TOO MANY UNRELATED TASKS?..ARE TASKS SPREAD TOO THINLY?..IS WORK DISTRIBUTED EVENLY?

Figure 8-3. Work Distribution Chart

1. After completing an initial WDC, do a systematic analysis of the recorded findings. The following questions help in examining the detail.

a. Are skills being used properly? Is everyone being used in the best possible manner or are special skills and abilities being wasted? Persons with higher skills should not do tasks that can be done by lower skill levels.

b. Is work distributed evenly? Measure the relative importance of tasks assigned to persons engaged in similar tasks. For example, two clerks of equal ability and grade normally should be charged with similar volumes of work. Spread the urgent and important tasks as evenly as possible to make certain all work is done according to schedule.

c. Are tasks spread too thinly? Performances of the same task by many workers may mean duplication of effort. The assignment of a task to one person sets responsibility and enriches the job.

d. Are individuals doing too many unrelated tasks? Greater efficiency results if workers are assigned related tasks.

e. Is there misdirected effort? Is the work center/ organizational component spending too much time on relatively unimportant operations or unnecessary work? Instances of misdirected delegation of authority can restrict creativity and cause unnecessary delays.

f. Are there excessive supervision or consultation tasks? Resistance to delegation of authority can restrict creativity and cause unnecessary delays.

g. Which activities take the most time? Are they the ones which should take the most time? Normally, the largest total time is spent on what is considered the major activity in the organization.

2. The answers to the above questions help develop improvement proposals. Prepare a new responsibility chart or distribution chart showing recommended processes and division of work. This will best display proposed changes and compare them with present procedures. Display associated reduction in work-hour requirements to support the change.

CHAPTER 9

ORGANIZATION ANALYSIS

900. General. Organization Analysis is a method for evaluating an organization's structure. It examines structure development effectiveness with respect to the mission and includes development of a suitable organization.

901. Organization Analysis Studies

1. Basic Study Objectives. Organization Analysis studies are made for one or more of the following reasons:

a. To determine how effectively an activity and its organizational components are carrying out their mission, to prevent or resolve problems, and to discover and strengthen weak spots within the command/activity.

b. To determine quantitative and qualitative manpower requirements.

c. To develop improvements in organizational programs, methods, procedures, and policies.

d. To develop recommendations for constructive changes in the command such as adjustment of emphasis among functions.

e. To analyze specific problem areas and develop solutions.

f. To determine, from the components being surveyed, successful techniques that can be applied elsewhere.

2. When a Study is Needed. The items listed below may indicate the need for Organization Analysis.

a. Supervisor's relationship with subordinates is vague.

b. Shore manpower requirements determination study interviews reveal signs of organizational weaknesses.

c. Comparison of the organization to other similar organizations reveals shortcomings within the command.

d. Reports by the Inspector General and other auditors indicate noncompliance with regulations as a result of inefficient organizational structures.

902. Principles of Organization

1. General Principles

a. The Command's mission and tasking determine the work to be performed. Mission, function, and subfunction will be clearly stated and understood by those responsible for fulfilling them.

b. Simplify the command's organizational structure as much as possible and keep the number of functions and subfunctions at a minimum, consistent with needs of the command. No function should be set up unless there is a distinct job to perform.

c. The organizational structure will be flexible enough to meet new and changing conditions.

2. Assignment of Functions. Consider the following list regarding assignment of tasking:

a. Provide for every significant tasking within the command to ensure accomplishment of its mission.

b. Assign every tasking to a specific organizational component. Under normal circumstances, no single tasking will be assigned to more than one component.

c. Normally assign closely related or similar taskings to a single organizational component.

d. Clearly define responsibilities of two or more related components.

e. There will be no overlapping, duplication, or conflict among organizational components.

f. Assign tasking so as to minimize cross-relations among components.

g. Separate line functions from staff functions.

h. Assign tasking to promote balance and to preclude overemphasis of less important tasking.

3. Uniformity of Organization Structure. Whenever possible, apply consistent types of organization structure at each level of command. There are several reasons for adhering to a standard pattern. Some of these are:

a. To simplify organizational relationships and procedures by conforming the structure to a logical, homogeneous pattern based on one fundamental plan.

b. To standardize organizational structures at all levels, as much as possible, on the basis of the most effective pattern in keeping with applicable directives.

c. To provide a simple basis for a general understanding and recognition of the exact location of responsibilities throughout the organization.

4. Homogeneity of Assignment. The principle of homogeneity of assignment means grouping the tasking required to accomplish the mission by similarity in practice and assigning individuals to these groupings by their capabilities and interests.

5. Unity of Command

a. The principle of unity of command states that the final responsibility and authority for all work of the command at each level of operation rest with one person. Only one leader is required to unite the efforts of subordinate personnel. Unity of effort, consisting of direction, control, and coordination depends on principle. Normally, anyone under authority of more than one superior will have divided loyalty and confused actions.

b. Everyone in an organization will know to whom they report and who reports to them. At first glance, this seems obvious. However, one of the most common faults, especially in the lowest units, is the members lack of knowledge as to who their senior in command is, or who their subordinates are. This lack of knowledge leads to confusion in assigning duties and responsibilities. Also, unclear definitions of duties seriously hampers the best performance of a command's mission.

c. Under certain circumstances, strict adherence to the unity of command principle may not be possible, but where reporting relationships are clearly defined, no difficulty will be encountered.

6. Span-of-Control. The principle of span-of-control implies that the greater the number of people supervised by a person the more difficult it will be to supervise them effectively. The executive capacity of an individual is important in determining the number of people controlled. Consider the following limiting variables or phases concerning procedures that can be effectively installed and controlled particularly during the organizing process.

a. Number of Personnel Under Supervision

(1) The "scope of supervision" is an important consideration in organization. It ensures those in supervisory positions give adequate attention to subordinate functions and activities.

(2) No formula exists to indicate the number of personnel one person can direct effectively within various types of commands. This depends upon the character of work being done, the people being supervised, and the supervisor. The general recommendation is the scope of a superior's job should cover all that he can manage effectively. First line supervision of blue collar workers will often exceed 20 to 30 people. Another important factor is the number of organizational relationships among the supervised since they also exist among subordinates. In some situations, other factors having a bearing on number of personnel supervised are the spans of energy, personality, and knowledge of both superior and subordinates.

b. Distance Element. The second phase of span-of-control deals with the area or distance involved in supervision. The location of subordinates with relation to their superiors will be considered in making supervision easier. If activities to be supervised require frequent personal contact, the subordinates accessibility must be considered. The distance of these activities from the supervisor has an important bearing on supervisory effectiveness. Effectiveness is materially reduced when the distance between a superior and his subordinates is increased to a degree that energy and resources are wasted.

c. Time Element. The third phase of the span-of-control principle implies that superiors will have under their control only those activities for which they have the time to spend in supervision to accomplish all work required. This includes accomplishment of the basic management functions: planning, organizing, directing, coordinating, and controlling. The supervisor’s time can be divided into the following categories:

(1) Routine Work. That amount of work in every supervisory position which should be performed, insofar as possible, by subordinates.

(2) Regular Work. Duties associated with normal supervision of activities and subordinates and duties which can be performed only by the supervisor.

(3) Special Work. Work assigned to the supervisor by his/her superior or initiated by the supervisor and not related to the supervisor's regular work. An example of such work might be preparation of a report on a problem not immediately associated with the primary task.

(4) Creative Work. Work done to improve the quality and quantity of routine, regular, or special work. Creative work assures progress in an organization. Examples of creative work are: devising a method for improving relations among personnel in an organization, drawing up new policies and procedures to improve the general efficiency of the organization, and developing new and better methods.

7. Delegation of Authority. Delegate authority as far downward as possible within the organization. Assign individuals authority they are competent to assume and which they require to properly perform their duties. Delegation of authority is essential for organizational growth and efficiency, and for personnel development.

a. Authority Commensurate with Responsibility

(1) Responsibilities assigned to a specific individual or component will carry corresponding authority, and all statements of authority or limitations will be specific.

(2) Authority and responsibility for action will be decentralized to components and personnel responsible for actual performance, as much as possible, without loss of control over policy or procedures.

(3) Delegation of authority will be consistent with decentralization of responsibility but does not relieve an official in higher authority of his overall responsibility.

(4) Each individual or command component assigned specific responsibility will be held accountable for use of

resources and results.

(5) Overall responsibility cannot be delegated. A superior remains responsible for delegated tasks, even though the subordinate to whom the task is assigned is accountable to him.

(6) Heads of components will be concerned with important matters and delegate, to the maximum extent, ordinary details and routine.

(7) All duties assigned to subordinates must be within the scope of the supervisor's authority.

b. Guides for Effective Delegation

(1) Provide clearly stated guidelines to subordinates.

(2) Delegate authority and define job assignments to ensure proper job accomplishment.

(3) Select subordinates who can fulfill assigned responsibility.

(4) Maintain proper lines of communication.

(5) Set up proper controls.

(6) Give necessary help to subordinates.

(7) Evaluate results.

8. Layers of Management. The latest management philosophies stress the importance of keeping the number of layers in an organization to a minimum. One rule of thumb suggests there should be no more than five layers at the command/activity level, starting with the Commanding Officer and ending with the working level. Increased layers of management tend to impede communications and reduce productivity.

903. Basic Data Gathering Techniques

1. General. Study techniques vary widely, depending upon the type of study to be performed. The analyst is not restricted to the basic techniques described below and should constantly be on the alert to devise new fact-finding methods.

2. Existing Records. These will provide background information valuable in evaluating later findings. Instructions, organization charts, statistical reports, and correspondence files can be studied. However, do not draw final conclusions from records alone.

3. Interviews. Interviews aid in gathering additional information clarifying the organization questionnaire and in collecting other data which cannot be obtained from directives, manuals, and other publications. In addition, interviews often act as stimulators for the interviewee and the analyst. Their informality may help people discover facts which would not otherwise occur to them or which they might not submit in writing.

4. Organization Analysis Appraisal Sheet. The Organization Analysis Appraisal Sheet (See Appendix J) is designed to assist analysts in solving organization problems. Its use permits a thorough evaluation of strengths and weaknesses of various organizational aspects and a record of facts needed to develop solutions.

5. Other Analysis Tools. Flow Process, Horizontal Procedure, System Process, Work Distribution Charts, and other techniques can be used to graphically portray distribution and flow of work.

904. One-Level Organization Chart

1. The One-Level Organization Chart is used to identify an organization as it is currently structured and operated, as perceived by the employee. It also identifies problems in the organization, confused lines of authority, layering and poor supervision, misguided or misunderstood supervisory relationships, span-of-control, and the informal organization.

2. The One-Level Organization Chart (Figure 9-1) is given to supervisors to complete early in the data gathering phase. It provides the analyst an overall picture of how the employee sees himself within the organization. This tool provides an initial clue as to whether further organizational analysis may be required.

3. Instructions for preparing the One-Level Organization Chart (Figure 9-1) are as follows:

a. A One-Level Organization Chart should be completed personally by each supervisor.

b. Blocks 1-4 : Complete as indicated. Use abbreviations when necessary.

c. Block 5 (A-J): Enter, in separate blocks, the name, designator/grade/rating/rate and title of each person reporting directly to you only if that person has subordinate(s) reporting directly to them. Any person whose name appears in one of these blocks will also be preparing one of these One-Level Organization Charts.

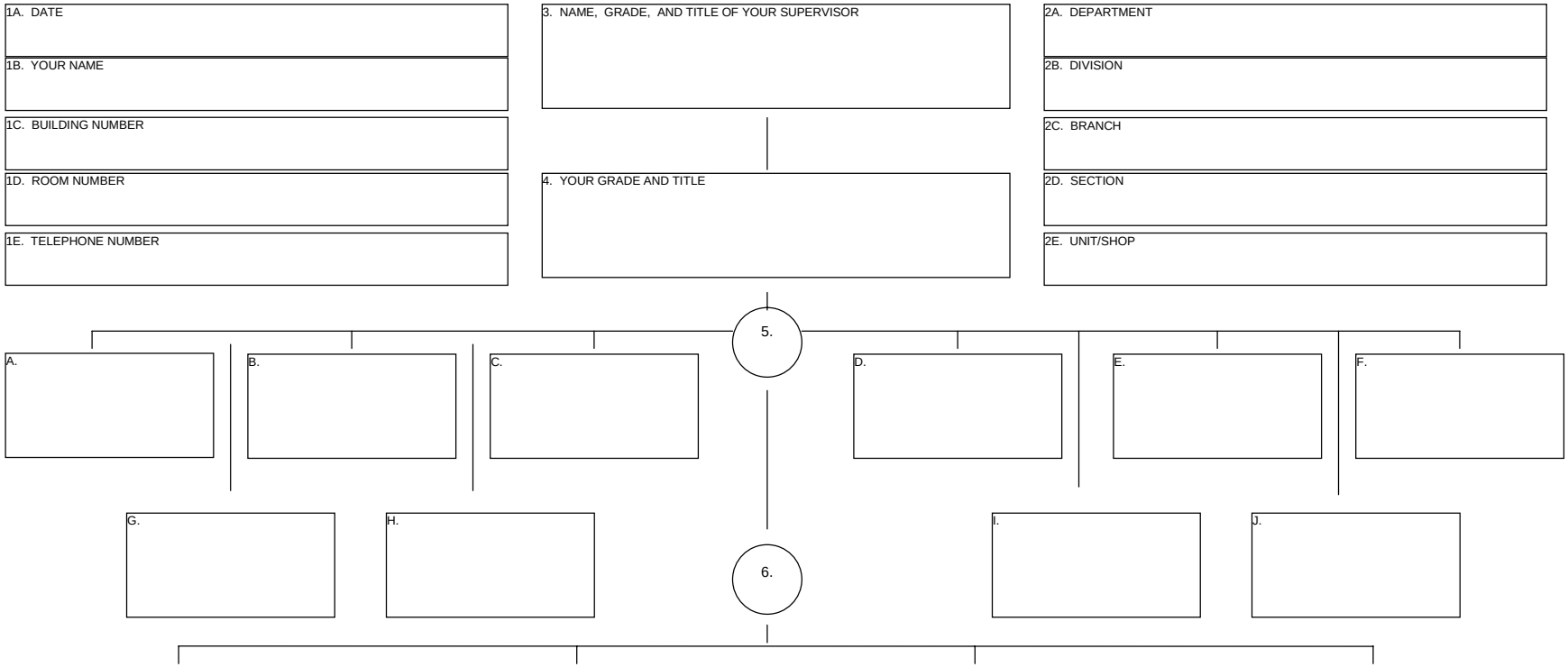
d. Block 6 (A-L): Enter the name, designator/grade/ rating/rate, and title of each person who reports directly to you but who does not have subordinate(s) reporting to them. Any person whose name appears in these spaces should not prepare a One-Level Organization Chart. (Note: There are spaces for 12 employees in this section. List additional names on reverse of form and identify as "6M, N, O", etc.)

e. Block 7 (A): Indicate title of job as shown in block 4 and percentage of time expended in this function.

f. Block 7 (B, C, D): List only those collateral duties which require a significant amount of time.

905. Responsibility Analysis Charting

1. General. Responsibility analysis charting provides a tool for analyzing organizational structures, job functions, and degrees of responsibility. This is a supplementary tool which should be used in conjunction with other organizational planning tools. It summarizes on one form many of the important organizational facts from official organization manuals and charts, gives a visual summary of functional and structural relationships among various components, and pinpoints responsibilities. It helps to quickly determine existing organizational relationships without referring to organization manuals or other lengthy written material. Some important uses of this chart are:



A.	D.	G.	J.
B.	E.	H.	K.
C.	F.	I.	L.

7. MANPOWER REQUIREMENT/POSITION TITLES	% TIME SPENT IN EACH
A. PRIMARY	
B. COLLATERAL	
C. COLLATERAL	
D. COLLATERAL	
TOTAL	

Figure 9-1. One-Level Organization Chart

a. Provides a tool for discovering organizational errors by showing the actual rather than ideal situation. This can indicate the need for an organizational study.

b. Provides a continuous check on personnel responsibilities by clearly pointing them out.

c. Shows whether senior personnel are devoting too much time to routine duties rather than delegating to subordinates.

d. Aids in conducting an organization study by showing nature and levels of responsibility and presenting organizational gaps.

2. Responsibility Analysis Chart Format

a. A Responsibility Analysis Chart (see Figure 9-2) is arranged in grid format as described below. The date of chart completion, UIC and name of the component being charted, and the analyst's name are at the top left. Productive categories of work for a component are shown on the left side of the chart. At the top of the chart, list as column headings, the requirement/position titles and grade/rate of personnel performing or having some degree of responsibility for accomplishing the work.

b. The responsibility symbols used on the chart indicate the following factors:

(1) Who performs the work?

(2) Who exercises direct supervision?

(3) Who exercises general or final supervision?

(4) Who exercises supervision with coordination?

(5) Who must be consulted before reaching a decision?

(6) Who will decide on specific points submitted?

(7) Who must be notified of actions taken?

(8) Who may give his viewpoints on a matter if called upon?

c. In completing the chart, place the proper symbol in the box where the requirement/position title and productive category intersect. This way, it is easy to see who is responsible for a certain task and to what degree. The number of symbols used depends on the type of command and its organization. The eight symbols appear to be standardized in private industry and are applicable for use in most Naval organizations.

3. Questions Answered Through Use of a Responsibility Analysis Chart. Many questions can be answered through use of a Responsibility Analysis Chart. Questions such as:

a. Is tasking properly assigned among personnel and components?

b. Is authority equal to responsibility and vice versa?

c. Is there duplication of effort in performance of specific categories of work among components?

d. Is decision-making assigned to proper levels?

e. Is work distributed evenly among components?

f. Is review and supervision of tasks commensurate with their complexity and significance?

g. Can any of the tasks/categories be eliminated or combined?

h. Are line-staff authority relationships contributing to mission accomplishment?

i. Are there too many organizational levels?

906. Interpreting Data and Developing Solutions. There are six distinct steps in this analytical process. They are:

1. Defining the Problem. In complicated organizational problems, the analyst may find it best to use the following approach:

a. Become thoroughly familiar with facts collected.

b. Summarize the existing situation so you can explain it to someone with little or no knowledge of the problem.

DATE: 11/21/96

UIC: 00000

COMPONENT: NAS Anywhere

ANALYST NAME: John Doe

PRODUCTIVE CATEGORIES	CO	XO	COMPTROLLER	SUPPLY OFF	MATERIAL OFF	CONTRACT SPECIALIST	SMALL PURCHASING	CLERK/LPO	SUPPLY CLERK			
Admin.Supply Allotment	C	G	A	B	H							
Coordinate Dept Budget	G	G	A	H	H							
Control Stock Adjustments			E	A	G			G				
Issue Servmart Supplies					C		B	A				
Maintain Payroll	H	C	A									
Maintain Inventory Control	H	C		B	A							
Supply Acquisition/Dist	B	G		B	A							
Printing Requisitions							B	A				
Prepare Travel Vouchers	G	C	B	B			A					
Schedule/Arrange Travel	G	C	B	B			A					
Assign Typewriters/Calculators					B		A					
Contractor Mgmt Eval						A						
Contractor Admin.						A						
Incoming Receipts					C		B	A				
Prepare Outgoing Reqs.					C		B	A				

LEGEND:

A - PERFORMS WORK
B - SUPERVISES DIRECTLY
C - SUPERVISES GENERALLY
D - SUPERVISES WITH COORDINATION
E - MUST BE CONSULTED
F - DECIDES ON POINTS SPECIFICALLY SUBMITTED
G - MUST BE NOTIFIED
H - MAY BE CALLED IN FOR INPUT

Figure 9-2. Example of a Responsibility Analysis Chart

c. Summarize and examine suggestions, criticisms, and complaints submitted.

d. Test the validity of each complaint.

e. Examine every aspect of the situation to reveal major organizational weaknesses as well as opportunities for improvements.

f. Finally, summarize major indicators of the problem.

2. Determining Causes of the Problem. With a clear understanding of the problem, the next step is to clarify conditions which have created and are sustaining the problem. Seek answers to such questions as:

a. How long has the problem existed?

b. When and where did it start?

c. Is the situation growing worse or better?

d. What are the basic causes today and what were they in the past? A detailed diagnosis of the problem is often the most important step in an analysis; when the causes are known, the solution may become obvious.

3. Determining Objectives of the Solution. Determine specific objectives of the proposed solutions. They can be identified in terms of:

a. End results to be achieved such as sound organizational structure, clearly defined missions, elimination of overlaps, proper spans-of-control, and authority delegated in line with responsibility.

b. The speed, financial expense, manpower, and skills required or allowable in achieving these results.

c. Any other limitations or goals involved in reaching a workable and acceptable solution.

4. Developing the Solution in Principle

a. Develop the solution, in principle, before filling in details.

b. Picturing the solution to a well-defined problem comes from the analyst's ability to apply knowledge and experience with creative imagination. Imagination is usually stimulated by commonplace, readily accessible ideas.

(1) Canvas all methods and procedures known. The practices of other commands may reveal the approach. Reading the experiences of others will help. Talking to the commanding officer and his staff often stimulates the imagination.

(2) Do not accept or reject any reasonable approach to a solution too quickly. Designing a solution frequently means fitting together fragments of ideas from several sources.

(3) Test, in some detail, the most promising answers. Before selecting an idea, even in principle, be sure it will work.

(4) Finally, broadly outline the solution, listing facts the commanding officer or department head must have to make a preliminary decision. These facts include:

(a) A picture of the present organization showing defects revealed by the study.

(b) A skeleton picture of major changes proposed.

(c) The specific advantages of the new plan which can be shown.

(d) The cost of installing or changing over to the new plan.

(e) The time required to install or convert to the plan.

(f) The chief steps required to place the plan in effect.

c. To develop a revised organizational structure, first make a rough draft of an organization chart (preferable a combined structural-functional chart based on information obtained from the questionnaire and other sources).

5. <u>Getting the Solution Accepted in Principle</u>

a. The main goal is to develop a solution upon which the command will act. Before perfecting the solution made in broad outline, the analyst will seek acceptance of the principles on which the solution is based. In most instances, it is desirable to prepare, as a basis of discussion, a summary of findings of the study and the basic proposals. A complete summary should:

(1) Explain the subject and scope of the study.

(2) Define the problem and its causes.

(3) Explain objectives which will be met by a satisfactory solution.

(4) Present and illustrate the solution in principle.

(5) Highlight advantages of the solution.

b. Since this presentation is made informally, findings and conclusions can be revised without embarrassment. The ability to compromise gracefully and intelligently is an important element in solving organizational problems. Organizational planning and analysis is not an exact science, thus, attempting to get an idea accepted is at least equal in importance to the idea itself. An intelligent compromise seeks to modify a solution by incorporating ideas which personnel contribute.

6. Designing the Most Efficient Organization. The final step in organization analysis brings out the technical ability of the analyst. This step requires extreme accuracy and painstaking attention to detail. It is essential that the detailed solution be understood and used. Develop the final most efficient organizational structure.

907. Organization Charting Techniques

1. General

a. An organization chart is a portrayal of formal organization relationships. It summarizes and presents the organizational structure indicating component parts and their interrelationships. The line organization and functional organization, two basic organizational structures, are presented in Appendix K.

b. An organization chart does not indicate the "human elements" involved in management. However, it does provide a

tool to assist personnel in better understanding the organization and furnishes information from which an improved program may be developed. Its effective use, however, is limited to factors whose relationships are subject to factual presentation, such as lines of authority and responsibility, span-of-control, and functionalism.

2. Purpose of Organization Charts. In general, the purpose of charting organizational structure is five-fold:

a. To present an overall picture of an existing or proposed organizational structure.

b. To provide a basis for planning.

c. To discover organization flaws such as:

(1) Confused lines of authority and responsibility.

(2) Duplication of functions.

(3) Inefficient allocation of personnel.

(4) Too extended a span-of-control.

(5) Lack of intermediate supervisory levels.

d. To discover organizational strengths useful in setting standards for a good structure.

e. To provide a basis for reorganization.

3. General Principles of Organization Chart Arrangement. When possible, standardize organizational charts. This creates a more unified appearance and permits easier and more accurate interpretation. An important factor in chart standardization is proper arrangement. Principle points in chart arrangement are completeness, simplicity, clarity, symmetry, and unity.

a. Completeness. A chart is a summary description of an organization. It should be as complete as possible. The main part will identify component relationships and the name of the command. The date approved and signature of the commanding officer will appear at the bottom.

b. Simplicity. An organization will be arranged to eliminate confusing or complicating elements. Too much or too

detailed information will not be present on any one chart. A complex chart may be the result of poor charting techniques or an involved organization plan.

c. Clarity. Clarity and simplicity in charting are closely related but not identical. For example, a chart can be simple if it has only a limited number of organizational components represented, with a small number of lines joining the blocks. However, if the lines are confused or the organization blocks are not labeled, the chart is not clear. Similarly, if the organization title is omitted, the chart lacks clarity. Often, the use of brief notes will clear up items which might be confusing.

d. Symmetry. Symmetry in charting means simply the best possible arrangement of the chart elements. Symmetry should not be forced into a chart, but the command organization should be presented in a well-balanced arrangement without clouding the structure.

e. Unity. Unity in charting means that each component is related to others on the chart, either by a connecting line or through other organizational components. In its simplest terms, this means that no branch, section, unit, or staff element can exist by itself, but must be clearly subordinated to command authority.

f. Organization Chart Construction Details. The following examples are provided to help in the preparation of meaningful organizational charts.

(1) Part-Time Splitting of Functions. When one individual occupies two or more requirements, place an asterisk in the appropriate boxes on the chart. This occurs particularly with staff assistants, weapons and deck forces, yeoman duties, and maintenance tasks. (See Figure 9-3)

(2) Staggering of Boxes. Numerous subdivisions on the same level of authority may be "staggered" as shown in Figure 9-4.

(3) Lines of Authority to a Number of Subordinate Units. See Figure 9-5.

(4) Standard and Special Boxes. For full-time subdivisions, the rectangle is a solid line box. Show subdivisions other than full-time as follows:

(a) Use a broken line box " - - - -" as a border around a solid line box or the element added to an existing box to show a permanent full-time subdivision to be created (future).

(b) Use dot-dot-dash line box ".._.._" as a border around a solid line box or the element to be deleted from an existing box to show a full-time subdivision to be abolished.

(c), Use a dot-dot-dot box "....." as a border to show inactive command components whose functions are currently being performed by another activity, or which will be manned upon mobilization.

(5) Achieving Simplicity in Organization Chart Layout. See Figure 9-6.

908. Organization Chart Format

1. Structural Organization Chart. A structural organization chart represents the most common and simplified method of presenting an organizational plan. Showing the structure of a command is most useful in outlining basic relationships among its various components. The size of the command shown by such a chart is immaterial. This can be used for the smallest or the largest and most complex component of command, or at any level in between.

2. Functional Organization Chart

a. A functional type of organization chart indicates the interrelationship of functions. The blocks on the chart include functional statements applicable to the component represented. The functional chart should not be confused with the functional organization. These terms represent two entirely different concepts. Functional charts indicate, in abbreviated form, the functions performed by various components, i.e., department, division, unit, and section. The functional type of organization is characterized by a decentralization of supervision to several functional supervisors.

b. Points to be emphasized in making functional charts are:

(1) Start at the lowest level at which it is desirable to show functions and relationships. An excessive number of blocks will be confusing and should be avoided.

A technique which can be used to indicate a part-time splitting of functions is as follows:

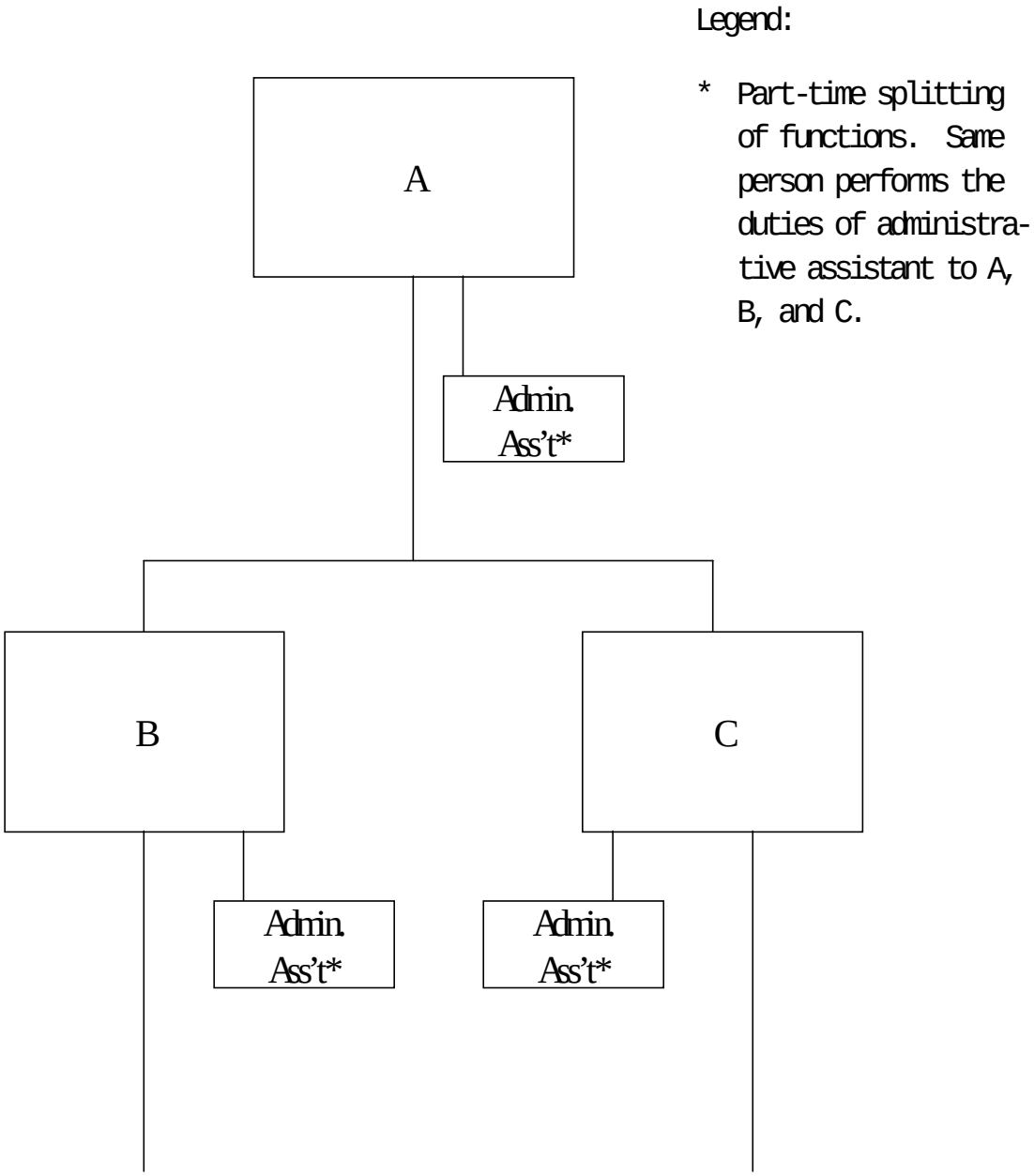


Figure 9-3. Example of Part-Time Splitting of Functions

Numerous subdivisions on the same level of authority may be staggered as follows to make the chart more compact, particularly where space is limited.

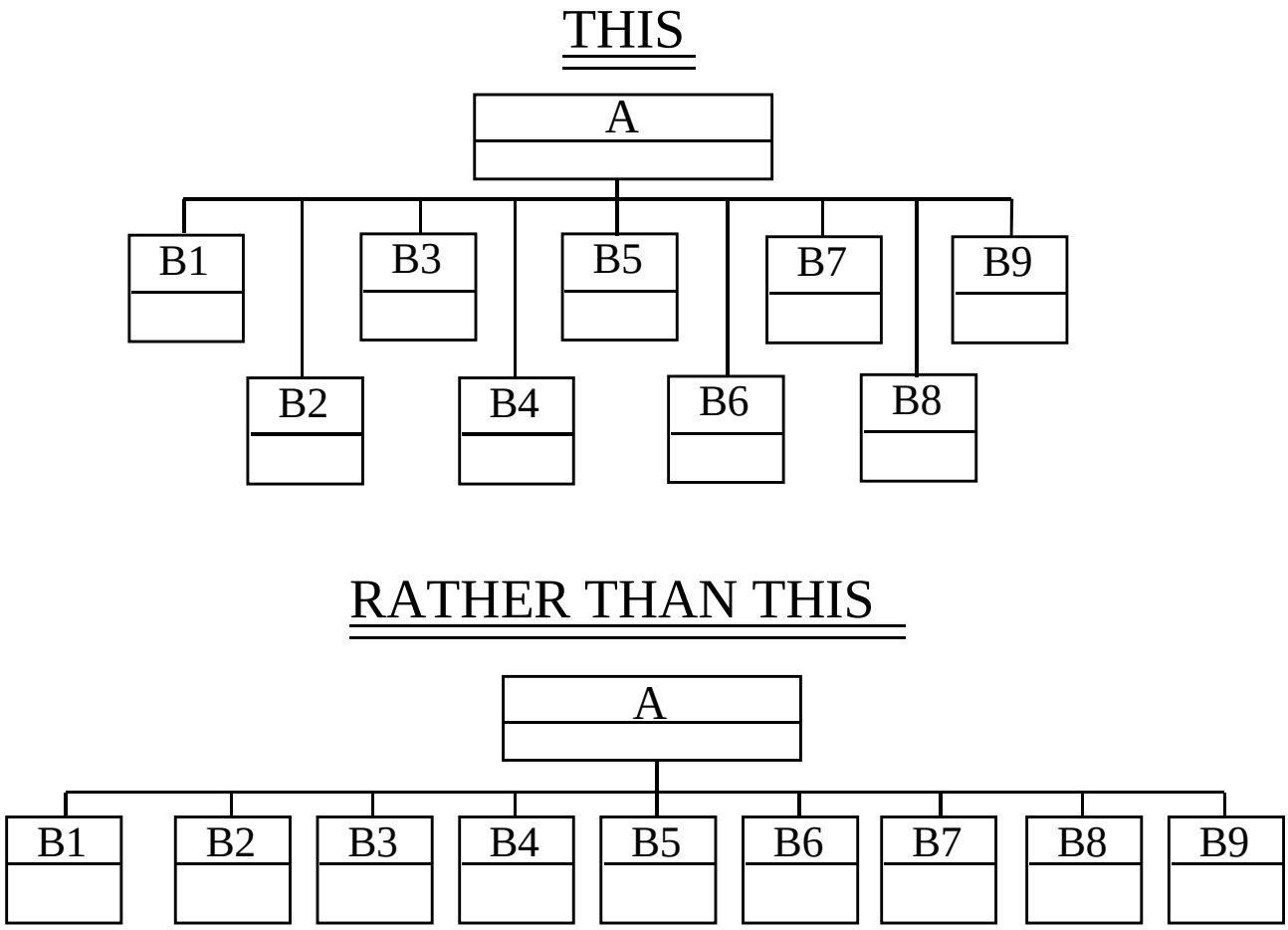
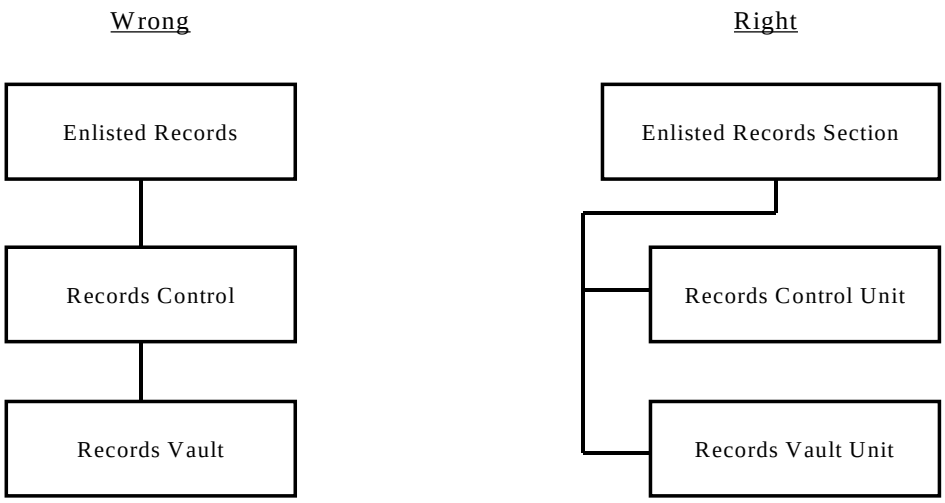


Figure 9-4. Example of Staggering of Boxes



EXPLANATION

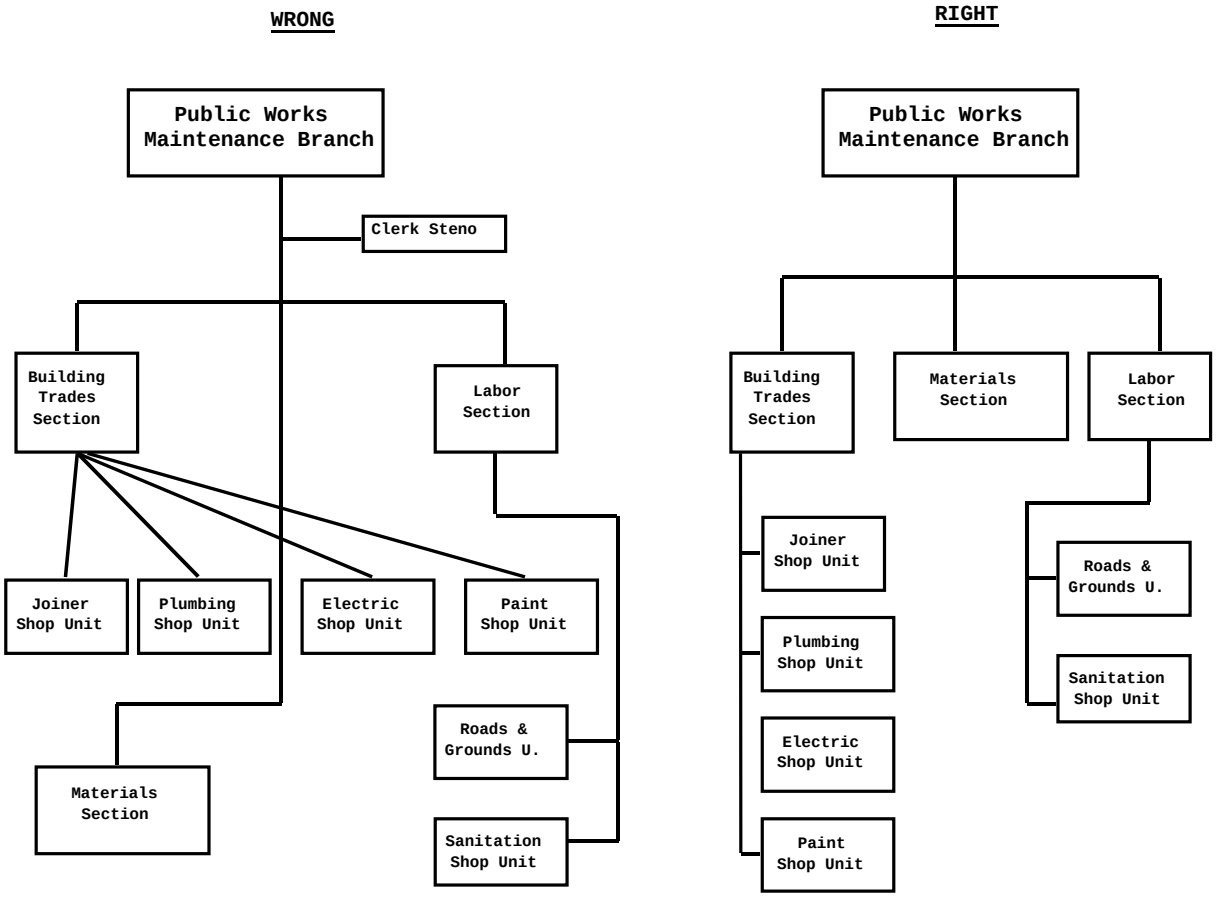
1. Chart at left is wrong because head of Records Vault Unit does not report to head of Records Control Unit. Chart at right presents correct picture.

2. Organizational designation (“Section” and “Unit”) should be shown.

3. Note preferred method of drawing line of authority.

4. Smaller “Boxes” for units aids interpretation.

Figure 9-5. Example of Lines of Authority to a Number of Subordinate Units



EXPLANATION

1. Clerk-Steno should not be shown as a separate component.

2. Sections, when space permits, should be drawn on the same horizontal plane.

3. Diagonal lines should not be used.

4. Avoid crossing lines of authority.

5. Note preferred method for drawing lines of authority for "Units", when drawn vertically under the Section.

Figure 9-6. Example of Achieving Simplicity in Organization Chart Layout

(2) Include all organizational units having a close connection with each other to show points where all units are interrelated.

(3) Omit introductory statements such as "The function of the department is..."

(4) Omit functions common to all components shown on the chart.

(5) Functional statements will be clear, as complete as possible, written in the present tense, and start with action verbs.

(6) Describe the actual day-to-day functions; not theoretical occasional functions.

c. An example of a simple functional organization chart is shown in Figure 9-7.

3. Requirement or Position Assignment Organization Chart

a. Requirement or position assignment charts show the various requirements/positions required in the organizational components. These charts may be of one or two types, each serving a different purpose:

(1) One type of chart shows names, requirements/ positions, and titles or grades of personnel as they fit into the current organization plan.

(2) The other type shows the requirement/position titles and grades of a planned setup, but does not include names of personnel. Manning tables for new organizations are similar to this. One important thing to remember is that, in chart making, a requirement/position on a chart indicates relationship, not status.

b. An example of a requirement or position assignment chart is shown in Figure 9-8.

4. Combination

a. The purpose for preparing the chart will indicate the kind of chart needed. In many instances, as in an organization survey, combinations of these charts will be used. For example, it is possible, if the organization is small and simple, to

combine all three (structural, functional, and billet assignments) into one chart. However, combining too much information into a single chart may tend to result in a chart too complex for effective use. A combination chart will be preferred by most larger organizations for picturing their subordinate components.

b. If the basic chart is a structural type, the combined structural-functional type may be best used in portraying all necessary details of the subordinate components. The top block will contain the functional designation of the component represented and a brief statement of its functions. Greater detail can be shown on additional charts of the subordinate components as required. Do not omit any details which point out close relationships between functions. An abbreviated outline of such a chart is shown in Figure 9-9.

NOTES:

MILITARY PERSONNEL DEPARTMENT

Plans, directs, and coordinates a centralized military personnel program which includes such functions as processing of recruits, receipt, transfer, classification, maintenance of officer and enlisted records, personnel accounting, and information and education.

CLASSIFICATION DIVISION

Administers basic battery tests to recruits and special tests to selected personnel. Scores tests and records grades.
Presents orientation lectures for recruits on such topics as enlisted naval career programs, training, and duty assignments.
Interviews recruits, and on the basis of test scores, education, and work experience, recommends assignment to general duty, service school, or special assignment.
Informs recruits, whose test scores or educational background qualify them, of their opportunities in commissioning programs. Prepares, processes, and transmits applications.

PERSONNEL ACCOUNTING AND RECORDS DIVISION

Compiles, by machine methods, a variety of personnel reports for Training Center and Bureau of Naval Personnel use, such as personnel diaries, classification listings, and allowances.
Maintains enlisted personnel records for recruits and ship's company.
Furnishes information from service records to departments upon request.
Prepares and logs identification, liberty, and mess cards.
Prepares and forwards claims for personal and dependents' travel, and moving personal effects.

EDUCATIONAL AND INSURANCE SERVICES DIVISION

Administers educational programs designed for the general educational advancement of military personel (e.g., USAFI courses) and the professional development of military personnel (e.g., naval correspondence in rating).
Administers high school and college GED tests.
Provides educational guidance for recruits and ship's company personnel.
Administers the government insurance program.
Provides guidance on such subjects as settlement options, cash surrenders, premium waivers, and other phases of insurance.

RECEIPT, TRANSFER, AND SEPARATION DIVISION

Receives and verifies orders, service and other records; prepares necessary forms and endorsements; logs in incoming enlisted personnel.
Transmits pay, medical, and service records to cognizant departments; initiates action to secure missing papers and documents.
Collects necessary records and prepares TAO, TAD, inter- and intra-station transfer orders for enlisted personnel.
Processes and records discharges, releases, retirements, and reenlistments.
Maintains change of address file for 2 years in order to answer personal and official inquiries.

Approved	Date:	Activity: Training Activity	Branch:	Chart No.
		Department: Personnel	Section:	
		Division:	Unit:	

Figure 9-7. Example of a Functional Organization Chart

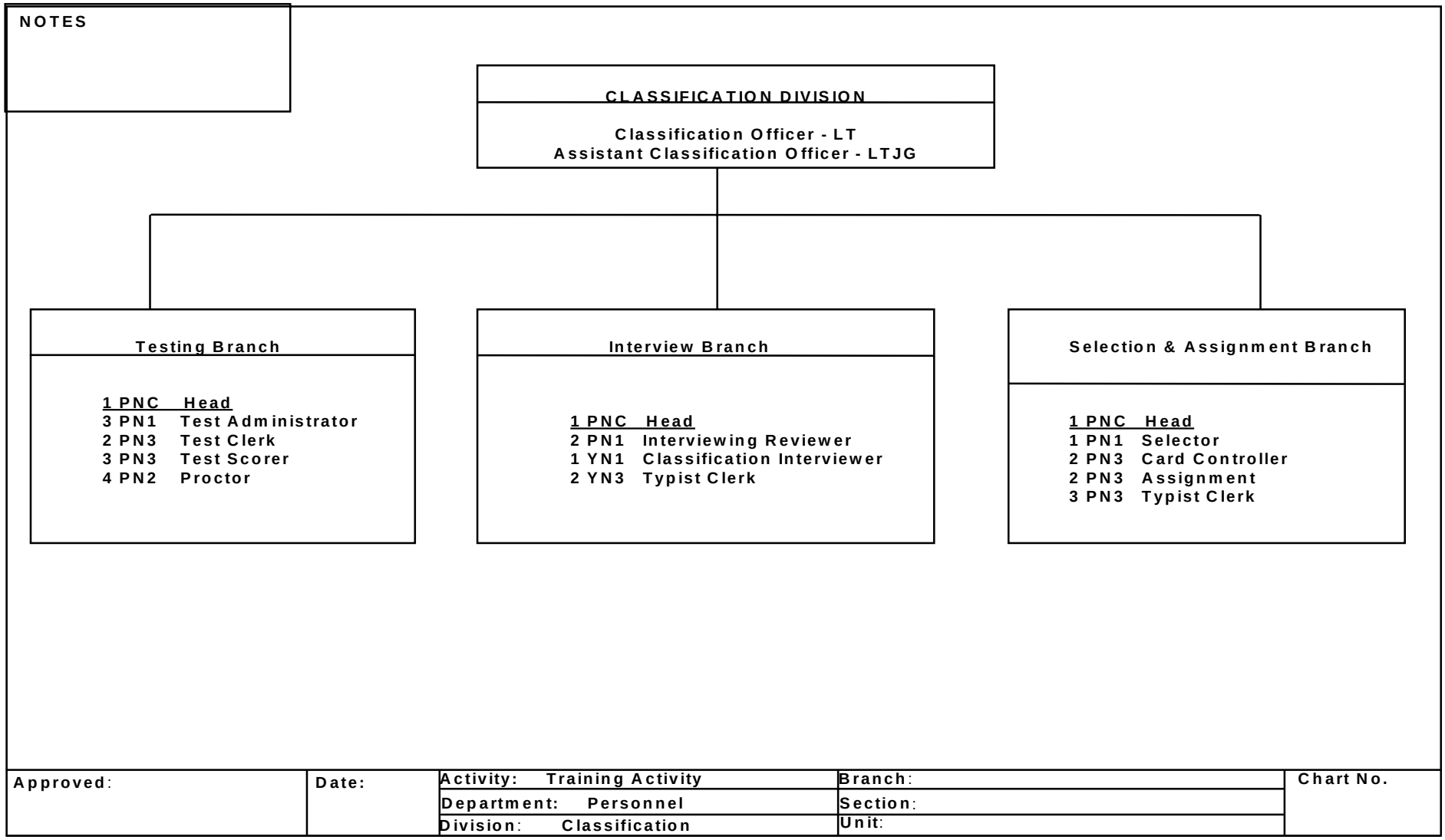


Figure 9-8. Example of a Requirement or Position Assignment Organization Chart

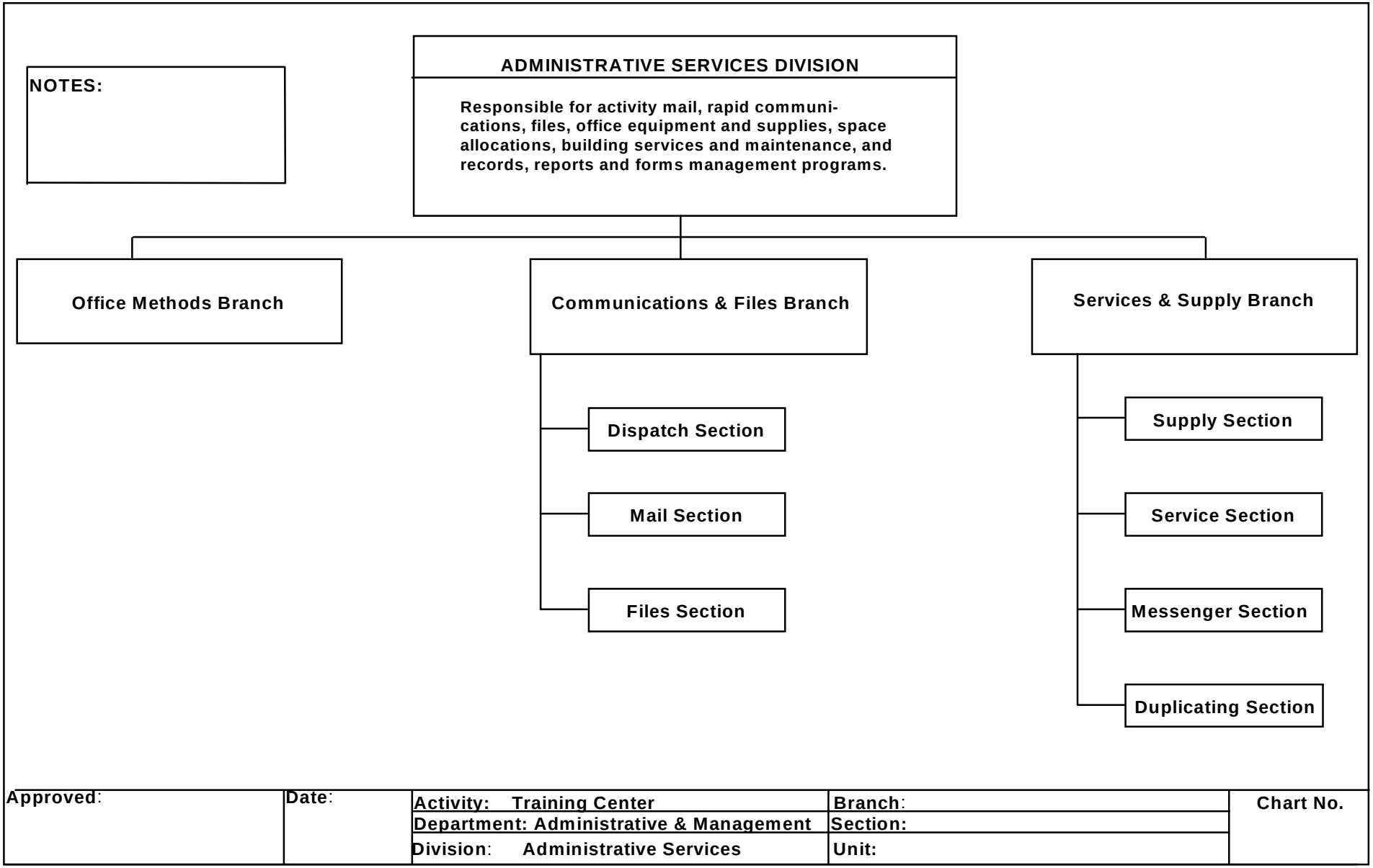


Figure 9-9. Example of a Combined Organization Chart

CHAPTER 10

BENCHMARKING

1000. General. This chapter addresses the basic tenets of What, Why, When, Where, and How to assist in gaining a perspective about Benchmarking and how it can and should be applied to your organization to achieve maximum efficiency and effectiveness.

1001. What is Benchmarking?

1. Benchmarking is:

a. A business practice that leads to increased competitiveness. Competition goes beyond just building a customer base. As soon as one individual or organization realizes there is someone else doing the same thing but better, it becomes a "competitive necessity for survival" to learn why and how and then take steps to change.

b. A process of continuously comparing our performance against recognized leaders. Ascertaining what makes them leaders is a key factor in your own initiative.

c. A measurement and analysis process. A detailed internal look is important and necessary to stay healthy.

d. A business practice that complements continuous process improvement because complacency is a sure step toward self-destruction.

e. An effort of continuous improvement toward customer satisfaction. Keeping existing customers is more important than trying to attract new ones.

2. To bring all of this into perspective, we can define benchmarking as "A continuous process of identifying, understanding, comparing, measuring, and adapting the best practices from organizations anywhere to help your organization improve its performance and be more focused toward customer satisfaction."

1002. Benchmarking is not:

1. A Program -- it is a process with solid philosophical credentials.

2. A Quick/Easy Fix -- it is a process that requires extensive planning, measurement, comparison, and analysis that upon implementation yields long term results.

3. A Performance Appraisal Tool -- although there is a certain air of competitiveness created during the process, the elements of openness, teamwork, and trust do not lend benchmarking to be used as a measure of individual performance.

4. A Substitute for Other Quality Improvement Initiatives -- it is a very enhancing complement to any quality improvement initiative.

5. Just Data Collection and Analysis -- it is a complete process having a beginning (vision), a middle (planning, measurement, comparison, and analysis), an ending (implementation of recommendations), and on-going maintenance (continuous improvement review).

6. Industrial Tourism, Spying, or Espionage -- it is a two-way process involving exchange of information, open viewing, etc., benefiting all participants.

7. Competitive Copying or Catch-up -- it is a process of "adapting" not "adopting."

8. Cheap -- it requires a substantial manpower resource investment and potential capital investment for implementation.

1003. Why do Benchmarking?

1. To provide an opportunity to understand your own processes and to assess respective performance.

2. To assist in identifying, developing, and validating realistic goals and objectives.

3. To create a sense of urgency and the motivation to improve, which is critical for survival.

4. To stimulate improved management/operational processes reflecting increased efficiency and effectiveness.

5. To provide opportunities for innovations and breakthroughs to be implemented which contribute to becoming the "Best of the Best."

6. To facilitate managed change. Managed change is changing what needs changing based on purpose and avoiding unnecessary changes (i.e., those with no value added purpose).

7. To provide managers and supervisors with the knowledge to manage change.

8. To take middle management and supervisors beyond their traditional roles as participants in the total effort.

9. To provide an opportunity to "see outside the box" and to witness firsthand how others perform similar processes in different environments.

10. To provide opportunities to learn from others and determine their activity's place in the industry.

11. To promote understanding of "world class performance" and what it takes to be there.

12. To provide focus to customer needs and desires. When these issues are taken into consideration and successfully addressed, then you have satisfied customers and a satisfied customer is the best public relations image any activity can have.

1004. <u>When to do Benchmarking?</u>

1. There is not a specific/designated point when benchmarking should occur. However certain indicators should be the signal to "let the games begin."

2. A strong indicator you are not an industry leader and changes are required is when it becomes apparent others are doing the same thing, only better. This is the starting point for a benchmarking initiative.

3. An indicator that efficiency, effectiveness, and purpose have been lost is when you realize your operations and processes have become so complex that the relationships and interactions, as they contribute to the whole, can’t be easily explained or understood. This should indicate it is time to conduct an extensive review of core processes and evaluate where changes should occur.

4. An indicator that complacency has replaced initiative, enthusiasm, and pride is when it is determined that quantum changes or improvements are needed because customer satisfaction is below the established level of acceptance. This should stimulate an extensive review and survey of customer needs and expectations and determine corrective measures to get back into a competitive posture.

5. It is important not to start any benchmarking initiative unless there is a **total commitment from the top-down** that they will implement changes and improvements. Also, no initiative can be effective without sufficient resources identified and dedicated to the effort.

6. Benchmarking is part of a long-term quality strategy requiring extensive planning and commitment. The following assessment provides guidelines to successful benchmarking.

a. Does the organization have a vision and a strategic plan?

b. Does the organization have long-range supporting goals?

c. Is everyone in the organization aware of and able to discuss the vision and long-range goals in relation to the organizational operations?

d. Have major organizational systems and processes been identified and prioritized?

e. Is process management an active business practice in the organization?

f. Have Process Action Teams been chartered and empowered with implementation authority?

g. Does the organization have a quality improvement implementation plan?

h. Were all levels of management involved in developing the plan?

i. Are there other active work or problem-solving teams?

j. Are all levels within the organization actively practicing or planning quality improvement training?

k. Have customers and suppliers been included in related quality improvement processes?

l. Are the strategic and tactical plans used rather than just updated?

m. Does the organization have customer-based WIs identified?

n. Has the quality improvement system been reviewed within the last six months?

o. Are plans and activities communicated to all levels of the organization?

p. Have adequate resources been identified and allocated to execute plans?

q. Does the organization have an active award system? Does it reward risk taking as well as quality?

r. Does the organization's appraisal system recognize customer-oriented performance?

s. Is top management actively committed to supporting and encouraging innovation, change, and improvement?

t. Is the organization willing to share information "in-kind" with a benchmarking partner?

7. If any of the above questions were given a "no" answer, then a review of the quality improvement system should be conducted before implementing a benchmarking process. Each "no" response should be evaluated with the objective of making changes/ corrections in order to get a positive answer. Depending on the issue/question and where it may fall in the system, benchmarking may proceed while the issue is being reviewed.

1005. Where to do Benchmarking?

1. Determine where benchmarking should be done within an organization by identifying areas of strategic importance. Outputs of each system or process for critical impact on quality, cost, or cycle time should be reviewed. Starting at the systems level, processes are identified and prioritized in terms of output relevance to service or product delivery (i.e.,

critical success factors are evaluated for meeting the goals and objectives of satisfactory mission completion).

2. Most organizations can be divided into two major systems: a management system which includes executive, administrative, and technical functions, and a business system that includes all other functions (i.e., those directly involved in product or service output). Some questions to consider in systems review are:

a. What processes/programs are related to the success of the organization?

b. What areas are causing problems? Internal bottlenecks? Customer complaints?

c. What performance measures often get the most attention because the organization is not meeting them?

d. Are the performance measures related to any critical success factors?

3. The following represents a general list of critical success factors that have application to most organizations. Each organization may identify additional factors that have a more direct relationship to their operations.

a. New product development cycle time.

b. Customer service systems.

c. Distribution and delivery.

d. Capital investment decisions.

e. Maintenance practices.

f. Strategic planning process.

g. Minimization of administrative costs.

4. It is important to note benchmarking can be done at any level and multiple benchmarking projects can occur simultaneously. The number of project processes selected for benchmarking will be determined by the willingness of top management’s support and the commitment of resources. Apply the

following evaluation criteria for each project selected in preparation for the start of the actual benchmarking initiative.

a. What is the output?

b. Why is it critical to the organization?

c. Who is (are) the customer(s)?

d. Where does it begin?

e. Where does it end?

f. What are the success measurements (performance factors)?

g. Who established these measurements?

h. How were they determined/established?

i. Do they actually measure the success of the process?

1006. How to Benchmark

1. The benchmarking philosophy, as has been stated, has many variations when it comes to actual application. A critical and essential element of a successful benchmarking initiative is to follow a rigorous and structured process as if it were a road map from your point of origin to your destination. The most commonly used is a four phase process known as the Shewart Cycle based on the Deming cycle of Plan-Do-Check-Act (PDCA), fundamental in Total Quality Management (TQM).

2. In the Shewart model, the phases are called Plan, Do, Check, Analysis, and Act. The primary elements of each are as follows:

a. Plan

(1) Prepare the benchmarking study plan which includes a data gathering plan, a location visit plan, and an implementation plan.

(2) Select the team to include subject matter experts, those with vested interests (those involved in the process), interested "third party" (those outside the process) participants, management, and an "owner" (generally the person in the organization who is responsible for the process to be studied).

(3) Select a benchmarking partner, establish contact, and formalize partnership guidelines.

(4) Discuss and analyze proposed plan for familiarization and refinement.

b. Do (Collect)/Check

(1) Do data gathering per the benchmarking study plan.

(2) Do preliminary analysis to determine if all measurement/data gathering is complete, accurate, and thorough.

c. Analysis

(1) Compare measured data to partner's data.

(2) Identify "gaps" (where is your partner ahead and why?)

(3) Identify changes to be made and develop a POA&M.

(4) Revise/complete implementation plan to incorporate POA&M.

d. Act

(1) Begin implementation.

(2) Monitor progress.

(3) Plan for continuous improvement in terms of new goals and new opportunities.

APPENDIX A

INSTRUCTIONS FOR COMPLETING THE RISK ANALYSIS WORKSHEET

Use the Risk Analysis Worksheet (Figure A-1) to assess the risk associated with reducing or eliminating tasking.

1. Header Blocks. Complete header information, as appropriate.

2. Category Code. Cross-reference categories to PWS.

3. Job Titles. Enter all the job titles responsible for performing the category/task being considered for elimination or reduction. Under each position title, indicate the percentage of total time or work-hours that the incumbent of the position spends on the category/task.

4. Category/Task/Description. Enter a brief description of the category/task performed by the employee(s) at each position. This description should focus on the sequence of work steps the employee takes to complete the category/task. Use brief action verbs and nouns where possible.

5. R/D (Reduce/Delete)

a. The R/D column designates whether the risk described in the next column refers to reducing or deleting all hours. Enter a “D” if the risk listed is associated with deleting all hours allocated by the position to perform the category tasking, thus, the incumbent would no longer perform the tasking.

b. Enter an “R” if the risk listed is associated with reducing the hours allocated by the position to perform the subfunction. Hours can be reduced by:

(1) Reducing total hours allocated across all categories/tasks (indicate percent or work-hour reduction).

(2) Eliminating specific tasks, but not all tasks (indicate specific tasks).

c. Infrequently, it is advisable to increase the effort devoted to a category or task in order to realize improvements in cost, service, or quality. If this is the case, enter an “I” in the R/D column and describe the benefit associated with the increase in the “Risk of Reduction/Deletion” column.

RISK ANALYSIS WORKSHEET

UIC:	COMPONENT:	ANALYST:	DATE:	PAGE ____ OF ____

CAT. CODE	JOB TITLE	CATEGORY/TASKDESCRIPTION	R/ D	RISK OF REDUCTION/DELETION	AREAS IMPACTED BY CHANGE

Figure A-1. Risk Analysis Worksheet

6. Risk of Reduction/Deletion. Enter the risk associated with deleting, reducing, or modifying a category or task (high, medium, or low). This is then followed by a brief narrative discussion of the risk. The following is required for each position listed on the form:

a. Assess the risk of reducing the time expended by that position on the category through either eliminating tasks or reducing total time allocation. When eliminating tasks, indicate those tasks being deleted. When reducing time allocation, indicate the percent or work-hour reduction in activity. If the risk associated with deletion is low, simply note that the risk for reducing is the same.

b. Provide a brief description of the risk of deletion. Deletion is the removal of all time allocated by that position to the category. Deleting does not necessarily imply the elimination of the category in its entirety.

c. Provide a brief description of improvement ideas (I.I.) which can reduce time expended, improve work flow, or enhance quality or service. This should be the last description in the "Risk of Reduction/Deletion" column and it should be identified by an “I.I.”.

7. Areas Impacted by Change

a. Enter areas in the command or organizational component/work center that will be impacted by the change. Identify those areas affected by the change in procedures, work flow, or work-hour allocation (if appropriate).

b. When analyzing more than one category on a page, separate categories by drawing a double line below category code. Within a category, draw a single line after each position.

8. Analysis

a. Analysts, supervisors, and department heads need to review and challenge the risk values assigned to each category and determine the advisability of implementing the reductions, eliminations, and improvement opportunities presented. To assess risk, the following questions should be considered:

(1) Does the category/task contribute to the operational objectives of the organization?

(2) Is the category/task needed for the decision-making process?

(3) Is the category/task required for control or accountability?

(4) Is the category/task required for quality control?

(5) Is the category/task needed to maintain acceptable levels of service?

(6) Does the category/task contribute to the competitive position of the organization (e.g., shipyards, public works, etc.)?

b. A second part of the analysis is to look for operating improvement opportunities. These are identified from two sources: productivity increases and work simplification. Productivity addresses the output of employees. Work simplification addresses how, what, and where activities are being performed.

9. Summary. Risk Analysis is a very powerful tool for developing and presenting the key arguments often needed by the decision maker to determine the merits of methods improvement proposals. By use of Risk Analysis, coupled with the use of Organization Analysis and Work Distribution Analysis, an analyst can quickly collect, analyze, and display high payback potential opportunities for consideration.

APPENDIX B

MISSION, FUNCTIONS, TASKS (MFTs) QUESTIONNAIRE

1. This questionnaire is a tool designed to assist the analyst in determining the impact of additions, changes, and/or deletions to an activity's MFTs, workload, and manpower requirements. It can also be used to assist with preparation for inspections by outside agencies such as Naval Audit Service, Navy Inspector General, and the General Accounting Office.

2. The questionnaire is divided into the following categories: mission, functions, tasks, methodology workload, requirements, skills, and supporting documentation. The purpose of the columns is:

a. Column 1 – provides the questions to be answered under each category.

b. Column 2 – indicates whether the response applies to peacetime (PT) – check yes or no.

c. Column 3 – indicates whether the response applies to mobilization (WT) – check yes or no.

d. Column 4 – comments, self-explanatory.

MISSION, FUNCTIONS, TASKS (MTFs) QUESTIONNAIRE

MISSION **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Does your current mission statement provide a clear, concise statement of the goals and objectives of the activity?					
Is the current mission statement supported by appropriate regulations?					
Is the requested change in mission statement (addition, modification, deletion) supported by appropriate documentation (e.g., regulation, instruction, policy letter, etc.)?					
Which mission is affected by the change?					
Does the change in mission result in a change to workload?					

FUNCTIONS **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Does the manpower study clearly list basic functions?					
Are current functions stated as broad areas of required work?					
Do current functions support the mission statement?					
Does the change in function(s) affect the peacetime or mobilization mission?					
Is there a proposed increase in function(s) required to be performed?					

FUNCTIONS **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Is the increase in function(s) supported by sufficient justification?					
Is there a proposed decrease in function(s) required to be performed?					
Will the activity's mission be adversely affected if the proposed function(s) is not performed?					
Is the function performed at a like activity?					
Are the functions related to a major output product or service?					
Is a standardized function statement applicable?					

TASKS **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Does the change in task(s) affect the peacetime and/or mobilization mission?					
Do current tasks describe what is to be done or what actions are to be taken to complete a particular function?					
Are current tasks described to the major task level?					
Do the tasks adequately define the described function?					
Is there an increase in the number of tasks of a function?					

TASKS **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Is the increase supported by sufficient justification?					
Is there a decrease in the number of tasks of a function?					
Is the decrease supported by sufficient justification?					
Will the activity's mission be adversely affected if the task(s) is not performed?					
Is this task performed at a like activity?					
Is a standardized task statement applicable?					

WORKLOAD **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Were workload indicators (WIs) used as part of the methodology?					
If so, are the WIs clearly defined, easily collectible, and relatable to the mission/functions?					
Is there a change in workload?					
Does the change require a new WI?					
Is the change directly related to a mission or program change?					

WORKLOAD **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Is the nature of the change documented?					
If the workload tends to vary over time, is sufficient historical data provided?					
Does the change in workload support the requested increase or decrease in requirements?					
Are there standardized WIs?					
REQUIREMENTS **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Is there an increase in requirements?					
Is there a decrease in requirements?					
Is the increase/decrease tied to a change in MFTs or workload?					
If requirements were increased, was a formal work measurement technique used and documented?					
Are the increased work-hour/manpower costs properly documented?					
Are the work-hour/manpower savings properly documented?					
Is there a matrix that shows the difference between the baseline requirements and the updated requirement?					

MANPOWER TYPE MIX/SKILL INFORMATION **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Can the requirement be filled by a civilian?					
Can the requirement be filled by a contractor?					
Does the requirement require military skills based on military essentiality codes?					
Are military skills supported by an appropriate occupational classification code (e.g., NEC, AQD)?					
Do military skills reflect minimum levels required?					

METHODOLOGY/SUPPORTING DOCUMENTATION **QUESTIONS TO BE ANSWERED**	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Was a formal work measurement technique used?					
If so, was it properly documented?					
If a work measurement approach was not used, what was the methodology employed?					
Was it properly documented?					
Is the alternate methodology logical, supportable, and easily tracked?					
Does the supporting documentation support the manpower requirements with an RI code of "E" in the AMD?					

METHODOLOGY/SUPPORTING DOCUMENTATION QUESTIONS TO BE ANSWERED	**PT**		**WT**		**COMMENTS**
	Y	**N**	**Y**	**N**	
Are there approval letters on file for shore manpower requirements determination studies that were postponed (i.e., those to be completed after the initial baseline deadline (30 Sep 95)?					
Are there approved waivers on file for requirements that were exempted from the shore manpower requirements determination process?					
Is there a matrix that shows the difference between baseline authorizations and measured requirements?					
Do the results show a savings?					
Is there a mechanism in place to review and update the activity's manpower requirements?					
Where is the supporting documentation for manpower requirements determination studies filed?					
Is the documentation filed in an organized manner?					
Who is responsible for maintaining these studies/reports.					

APPENDIX C

PERFORMANCE WORK STATEMENT (PWS) WORKSHEET

1. General. The PWS Worksheet (Figure C-1) is suggested for use in describing tasking elements accomplished at the activity under study in PWS format. The form is designed for multiple uses at the various stages of PWS development.

a. Use it during the planning phase in developing the study strategy to identify the organizational components of the activity. Do this by recording the mission statement on the form and systematically breaking the mission into functions and subfunctions until organizational components are defined.

b. Use it during the data gathering phase in refining the PWS to document the further systematic breakdown of the work performed within each organizational component. This generally involves dividing subfunctions into categories, tasks, subtasks, and elements as required to reach the level of detail needed to conduct work measurement and methods study in each component.

c. Use it during the data analysis phase in preparing the final PWS and WIs prior to writing the shore manpower requirements determination study report.

2. Instructions For Use of the PWS Worksheet

a. Complete the header as required. Use separate forms for each function during the planning phase breakdown. During data gathering, use separate forms for each organizational component.

b. Complete the Code column using a system similar to that shown in the example of a detailed PWS in Appendix D, or any alpha/numeric coding system which clearly distinguishes levels of detail. It may be possible to use existing organizational codes for function and subfunction breakdown.

c. The Description column should describe tasking in short verb and noun statements. When necessary for clarity, add notes, clarifiers, etc., to the verb/noun statements. This is often necessary to distinguish one category or task from another.

d. Use the WI column to record the qualitative, quantitative, and timeliness WIs associated with the desired level of PWS (function or subfunction) for which measurable data is available for monitoring changes in workload. Use this column also to identify all directives from higher authority that support/justify the tasking for the areas covered on the form.

ACTIVITY/COMPONENT NAME: Scientific Investigations Department, NDRI		
UIC:00000	ANALYST NAME: ADAM T. SPLIT	DATE: 3-15-96
CODE	DESCRIPTION	WORKLOAD INDICATORS & TASKING DIRECTIVES
1.	Medical Research and Development	
1.1.	I. Prepare and submit plans and objectives for five year plan (FYP)	
1.1.1.	A. Analyze the strategic requirements from an operational standpoint	EXPERIMENTS/INVESTIGATIONS CONDUCTED
1.1.2.	B. Identify the strategic goals and objectives	
1.1.2.1.	1. Obtain research background material	QUANTITY: 40 PER MO
1.1.2.2.	2. Review research background material	QUALITY: ACCEPTABILITY RATE OF 90% OR HIGHER
1.1.3.	C. Identify the scientifically relevant principles and ideas	
1.1.4.	D. Reformulate the goals and objectives in terms of the principles and ideas	TIMELINESS: CONDUCT IN 4 HOURS OR LESS
1.1.5.	E. Apply the principles of scientific research design in formulating FYP	(BUMED 00000.00)
1.1.6.	F. Identify the research techniques	
1.1.7.	G. Identify the general area of research experiments to be used to test the hypotheses	
1.1.8.	H. Determine equipment requirements	
1.1.9.	I. Establish mid and long-range project schedules, milestones, and objectives	
1.2	II. Develop the research proposal for the short term	
1.2.1.	A. Analyze the problem from an operational standpoint	
1.2.2.	B. Identify the scientifically relevant principles and ideas	RESEARCH PROPOSAL SUBMITTED
1.2.2.1.	1. Obtain research background material	
1.2.2.2.	2. Review research background material	QUANTITY: 8 PER YR
1.2.3.	C. Reformulate the problem in terms of the scientifically revelant principles and ideas	QUALITY: ACCEPTABILITY RATE OF 75% OR HIGHER
1.2.4.	D. Apply the principles of scientific research design in the formulation of the proposal	TIMELINESS:COMPLIANCE WITH POA MILESTONES
1.2.5.	E. Identify the research techniques	(BUMED 0000.01)
1.2.6.	F. Identify the general area of research experiments to be used to test the hypotheses	
1.2.7.	G. Determine equipment requirements	

Figure C-1. Example of Performance Work Statement (PWS) Worksheet

APPENDIX D

EXAMPLES OF A

DETAILED (SECTION ONE) AND CONDENSED (SECTION TWO) PWS

SECTION ONE

PERFORMANCE WORK STATEMENT

SCIENTIFIC INVESTIGATIONS DEPARTMENT

1 Medical Research and Development.

1.1 Prepare and submit plans and objectives for Future Year Defense Program (FYDP).

1.1.1 Analyze the strategic requirements from an operational standpoint.

1.1.2 Identify the strategic goals and objectives.

1.1.2.1 Obtain research background material.

1.1.2.2 Review research background material.

1.1.3 Identify the scientifically relevant principles and ideas.

1.1.4 Reformulate the goals and objectives in terms of the scientifically relevant principals and ideas.

1.1.5 Apply the principles of scientific research design in the formulation of the FYDP.

1.1.6 Identify the research techniques.

1.1.7 Identify the general area of research experiments to be used to test the hypotheses.

1.1.8 Determine equipment requirements.

1.1.9 Establish mid and long-range project schedules, milestones, and objectives.

1.2 Develop the research proposal for the short term.

1.2.1 Analyze the problem from an operational standpoint.

1.2.2 Identify the scientifically relevant principles and ideas.

1.2.2.1 Obtain research background material.

1.2.2.2 Review research background material.

1.2.3 Reformulate the problem in terms of the scientifically relevant principles and ideas.

1.2.4 Apply the principles of scientific research design in the formulation of the proposal.

1.2.5 Identify the research techniques.

1.2.6 Identify the general area of research experiments to be used to test the hypotheses.

1.2.7 Determine equipment requirements.

1.2.8 Establish mid and long-range project schedule, milestones, and objectives.

1.3 Obtain funds.

1.3.1 Prepare and submit DD 1498 Research and Technology Work Unit Summary.

1.3.2 Prepare and submit out-year research narratives.

1.3.3 Conduct liaison with program managers.

1.4 Refine the research proposal.

1.4.1 Review existing literatures in the research area.

1.4.2 Discuss the proposal with other research scientists.

1.4.3 Review related experiments.

1.4.4 Identify specific scientific methods to be used.

1.4.5 Put together specific or series of experiments.

1.4.6 Determine and develop computer programs.

1.4.6.1 Write flow process charts.

1.4.6.2 Write program code.

1.4.6.3 Test and debug program.

1.4.6.4 Write documentation.

1.5 Obtain laboratory equipment and materials.

1.5.1 Engage in consultation regarding equipment requirements, availability, reliability, maintenance, and compatibility.

1.5.2 Design laboratory equipment, instruments, and systems.

1.5.3 Develop/fabricate laboratory equipment, apparatus, and prototype models.

1.5.4 Provide graphs, sketches, blueprints, and diagrams of the equipment.

1.5.5 Modify laboratory equipment.

1.5.6 Evaluate test equipment.

1.5.7 Determine materials required.

1.5.8 Initiate equipment and material procurement action.

1.6 Conduct experiments/investigations.

1.6.1 Locate and designate experimental subjects with the necessary skills, knowledge, etc., to be used as participants.

1.6.2 Prepare materials and equipment.

1.6.3 Conduct tests/experiments.

1.6.4 Provide photographic scientific documentation for the research project.

1.6.5 Collect data.

1.7 Analyze and interpret data.

1.7.1 Organize the data.

1.7.2 Determine the completeness of data.

1.7.3 Enter data into the supporting ADP system.

1.7.4 Apply statistical/mathematical techniques.

1.7.5 Analyze data.

1.7.6 Draw conclusions.

1.8. Prepare reports.

1.8.1 Write reports of test results and project accomplishments.

1.8.2 Review test and project reports.

1.8.3 Determine need for additional experiments.

1.8.4 Publish findings.

1.8.5 Make presentations at scientific meetings (to include providing exhibits in support of research).

Workload Indicators: Medical Research and Development

Indicator: Experiments/Investigations Conducted

Standard:
- Quantity: 40 per month
- Quality: Experiments/Investigations resulting in acceptability rate of 90% or higher
- Timeliness: Conduct Experiment/Investigation in 4 hours or less

Indicator: Research Proposals Submitted

Standard:
- Quantity: 8 per year
- Quality: Proposal acceptability rate of 75% or higher
- Timeliness: Submitted in compliance with POA milestones

SECTION TWO

PERFORMANCE WORK STATEMENT

SCIENTIFIC INVESTIGATIONS DEPARTMENT

1. Medical Research and Development. Prepare and submit plans and objectives for Future Year Defense Program (FYDP); develop the research proposal for the short term; obtain funds; refine the research proposal; obtain laboratory equipment and materials; conduct experiments/investigations; analyze and interpret data; and prepare reports.

Workload Indicators. Scientific Investigations Department

Indicator: Experiments/Investigations Conducted

Standard:

Quantity:	40 per month
Quality:	Experiments/Investigations resulting in acceptability rate of 90% or higher
Timeliness:	Conduct Experiment/Investigation in 40 hours or less

Indicator: Research Proposals Submitted

Standard:

Quantity:	8 per year
Quality:	Proposal acceptability rate of 75% or higher
Timeliness:	Submitted in accordance with POA milestones

APPENDIX E

SAMPLE STAFFING STANDARD REPORT

"SAMPLE ONLY"

STAFFING STANDARD
FOR
PROVIDE CONSOLIDATED LAW ENFORCEMENT/PHYSICAL SECURITY SERVICES

1. Below summarizes attached staffing standard information.

a. Performance Work Statement. Indentifies what work is required to be accomplished to the maximum extent practicable without stating how to do it; Provides workload indicator (WI) definitions and source(s) of count (and where appropriate, applicable ranges). It also provides the staffing equation(s) and applicability statement.

b. Application Instruction. Provides instructions for using the staffing equation in computing total manpower required in a work center to accomplish assigned tasking and workload as identified by individual work center WIs, to include additives, deviations, and exclusions, if applicable.

c. Staffing Table(s). Shows the quantitative and qualitative increments of officer, enlisted, and civilian required manpower for the applicable range of the staffing standard. Civilian grades shown are for manpower planning only, and should not be used as a basis for assigning grades to individual positions.

d. Staffing standard universe listing. Lists activities tasked with the functional responsibilities reflected in the Performance Work Statement (PWS) and covered by the applicability statement.

"SAMPLE ONLY"

PERFORMANCE WORK STATEMENT

WORK CENTER TITLE:	WORK CENTER ID CODE:
Provide Consolidated Law Enforcement/ Physical Security Services	SEC02.001

DESCRIPTION OF WORK CENTER RESPONSIBILITIES (By Productive Categories):

DIRECT

1. Management. Plan, direct, and administer the operation of the Law Enforcement/Physical Security (LEPS) Department; apply policies and directives prescribed by higher authority; provide advice and assistance; review, verify, and approve required reports; review and endorse incoming and outgoing correspondence; maintain liaison; manage training program; develop and maintain a physical security plan; conduct physical security survey; prepare and submit Post Validation forms; serve on the Physical Security Review Committee (PSRC); serve on the Physical Security Review Board (PSRB); prepare security modification Plan of Action and Milestones (POA&M) report; prepare and submit security department budget; prepare request for waiver of security requirement; prepare request for exception to a security standard; monitor the Loss Prevention Program; manage the Integrated Security Management Information System; manage the crisis response force program for the anti/counter-terrorism and other potential threats; and serve on the LEPS boards and committees as required.

2. Security Guard Service. Perform guard watch commander duty; perform security guard supervisor duty; provide base entry/exit control; provide security of base; perform Intrusion Detection System (IDS) watch; and perform harbor patrol duty.

3. Post Related Duties: Obtain weapon, ammunition, and equipment; travel to watch briefing; travel to post; assume and relinquish post; travel from post; turn in weapon, ammunition and equipment; and review daily log.

4. Central Control and Dispatch Duties: Perform shift supervisor duties; and perform dispatcher duties.

5. Police Services. Perform crime prevention and crime detection in assigned patrol area; perform specialized patrol; ensure enforcement of installation regulations; perform game warden services; operate temporary detention cell; provide armored car service; perform watch command duty; and perform patrol supervisory duty.

6. Traffic Law Enforcement. Perform traffic law enforcement; conduct traffic control; provide information; coordinate convoy movement; provide convoy escort, operate speed detection equipment; operate breath tester/breath analyzer; issue traffic citation; enforce parking regulations; and impound abandoned vehicles.

7. Preliminary Vehicle Accident Investigation. Respond to scene of accident; provide aid to injured personnel; secure accident scene; provide traffic control; examine driver credentials; interview and question personnel; apprehend and detain criminal suspect; restore roadway scene to normal traffic flow; and provide input for motor vehicle accident report.

8. Arms Room Service. Operate and maintain an arms room; provide clearing pit or drum; maintain weapon cleaning area; issue and receive weapon, ammunition, and equipment; perform inventory maintenance of equipment; and provide other arms room services.

9. Resource Protection Program. Schedule inspection; inspect resource protection program; administer resource protection training; participate in conference; inspect fund security; inspect weapon and ammunition security; inspect security of precious metal storage area; maintain resource protection files; and process resource protection waiver or exception.

10. Key Security and Lock Control. Maintain central key room; conduct inventory of all issued keys; rotate and maintain security locks, padlocks, and/or lock cores; issue keys for security locks and padlocks; approve procurement of all security locks and padlocks; and control and account for placement of entrance seals.

11. Patrol Dog Service. Perform patrol on validated military working dog post; provide funds escort; assist with riot and crowd control; assist with civil disaster; protect distinguished visitor; conduct proficiency training; and conduct proficiency demonstration.

12. Drug Detector Dog Service. Conduct search; apprehend offender; conduct proficiency training; conduct proficiency demonstration; and maintain training aid.

13. Explosives Detector Dog Service. Conduct explosives inspection, investigation, or search; report explosives alert to proper authority; respond to bomb threat to include handler and spotter personnel; conduct proficiency training; and conduct proficiency demonstration.

14. Kenneling. Provide dog care; maintain kennel facility and equipment; maintain kennel sanitation; and provide kennel security.

15. Personnel Identification Badges. (Other than identification cards for active duty or retired personnel and dependents.) Receive and review application; transcribe descriptive data; take fingerprint and photograph; obtain authenticating signature; laminate and trim identification badge; complete accountability record; control and protect unissued passes and badges; and monitor losses of identification passes and badges.

16. Personnel Identification Passes. Receive and review request; transcribe descriptive data; obtain authenticating signature; and complete accountability record.

17. Limited/Exclusion Security Area Entry Control. Provide inspection and control point; and perform pass/badge exchange entry control. Note: applies only to security post separately established for the purpose of controlling entry into security areas.

18. Vehicle Registration. Receive and review application form; and issue decal.

19. Driver Record. Maintain driver record; purge file; and issue government driver's license.

20. Non-NIS Investigations. Conduct command legal claim investigation; conduct command security investigation; conduct command criminal and related incidents investigation; assist with other investigation upon request; gather evidence at the crime scene; prepare and process Incident Complaint Report (ICR); conduct surveillance and make apprehension; maintain liaison with civil and military law enforcement authorities; provide testimony at judicial proceeding; provide crime laboratory services; and perform evidence control custodian duty.

INDIRECT

21. Standard Indirect Support. Provide work center supervision and administration; maintain supply account and obtain expendable/nonexpendable supplies; maintain operator equipment; attend and conduct meetings; perform local and TAD travel; conduct and receive training; and perform cleanup.

ADDITIVE

A1. Provide VIP Escort/Protective Guard Services. Provide Escort/Protective Guard for VIP personnel arriving/traveling in and around/departing the activity.

WORKLOAD INDICATORS (Workload Factors/Definitions and Source of Count

INDICATOR: X_1 = Number of Units. The claimant computed number of validated post requirements.

Standard: The number of claimant computed Validated Units.

"SAMPLE ONLY"

Quantity: _____Average number.

Source: Claimant Certified and approved Post Validation worksheets.

$$X_1 = \frac{(4.5727\ (\text{validated post work-hours per week}))}{145.136}$$

This value must be computed by the claimant using the staffing standard application instructions provided in article 203 of this report.

Staffing Standard Equation:

$$Y_C = 232.7609\ (X_1)^{.9435}$$

Where Y_C = Computed monthly work-hours required.

APPLICABILITY: The Provide Consolidated Law Enforcement/ Physical Security Staffing Standard applies to all activities consolidating physical security functions as described by SECNAV MSG 202050Z JAN 97 with the exception of Naval Facility Subic Bay, R.P., which is covered in SEC07.

"SAMPLE ONLY"

APPLICATION INSTRUCTIONS

203. Staffing Standard Application Instructions

a. When directed by major manpower claimant, the installation's Consolidated Law Enforcement/Physical Security Department will complete Post Validation Worksheets provided by Appendices D, E, and G of this report and forward them to the major manpower claimant. Use the following definitions to assist in completion of the post validation forms:

(1) Post. AA position or location at which one or more personnel are required to be present whether or not work is being accomplished. Examples might be a telephone switchboard, a service desk, or a retail facility. Examples of post for security purposes might be an entry gate, a vehicle, or a dispatch desk. Three types of posts are required.

(2) Fixed Posts. AThose posts which require law enforcement or security personnel to remain at one point or within a specific area. These will include posts at gates, towers, traffic control posts, etc.

(3) Mobile/Roving Patrol Posts. AThose posts which require security or law enforcement personnel to provide surveillance over large areas such as station perimeters, large ammunition storage areas, etc. Personnel may be on foot or motorcycle, in a vehicle or boat, or in some other conveyance. (Note: while walking patrols around a building or within a fenced compound may properly be classified as either fixed or mobile, the classification does not affect the workload factor used in the standard.)

(4) Administration Posts. AAll fixed or one-of-a-kind positions and all post requirements not classified as either fixed or mobile/roving patrol posts required to provide Law Enforcement/Physical Security Services. Normally, these are posts associated with management and control functions such as Shift Supervisors, Dispatchers, Intrusion Detection System (IDS) monitors, etc. It should be noted that the true definition of a post is violated in this definition. This was done intentionally to include supervisory positions. The dispatcher, IDS monitors, and field supervisors are true post requirements.

The Shift/Watch Supervisor, Operations Officer, Chief of Police, etc., are examples of fixed requirements.

b. Total Consolidated Law Enforcement/Physical Security requirements are determined by computation of the model:

$$Y_C = 232.7609(X_1)^{.9435}$$

The first step in the computation is to determine the value of X_1.

$$X_1 = \frac{4.5727 \text{ (validated post work-hours per week)}}{145.136}$$

Computation of X_1 by Claimant (EXAMPLE)

(1) Claimant list each approved validated post separately and include for each a statement indicating the number of personnel per shift, the number of shifts required per day, the number of days the post must be manned each week, and whether post-related duties (see below) are required. Post-related duties are defined as those duties required to be performed incident to assuming and/or relinquishing a post, including obtaining a weapon, ammunition, and other equipment, traveling to pre-watch briefing, attending pre-watch briefing, reviewing daily log, traveling to post, assuming and relinquishing the post, traveling from the post back to the assembly area, turning in the weapon, ammunition, and other equipment.

Post #1 (patrol): 1 person, 24 hours, 7 days, 3 shifts per day requiring post-related duties.

Post #2 (patrol): 1 person, 24 hours, 7 days, 3 shifts per day requiring post-related duties.

Post #3 (gate): 1 person, 10 hours, 5 days, 2 shifts per day requiring post-related duties.

Post #4 (gate): 1 person, 2 hours, 5 days, 1 shift per day, no post-related duties.

Post #5 (gate): 2 persons 16 hours, 7 days, 2 shifts per day requiring post-related duties.

"SAMPLE ONLY"

Post #6 (gate): 1 person, 8 hours, 2 days, 1 shift per day requiring post-related duties.

Post #7 (dispatcher): 1 person, 24 hours, 7 days, 3 shifts per day requiring post-related duties.

Post #8 (field supervisor): 1 person, 24 hours, 7 days, 3 shifts per day requiring post-related duties.

(2) Using the post computation format below, compute the weekly work-hours required to staff each post and include a standard allowance of .5 work-hours per person, per watch, when post related duties are necessary.

A POST #	B NO. PERS REQD	C POST HRS/DAY	D POST-RELATED DUTIES	E TOTAL HRS/DAY (C+D)	F DAYS/ WEEK	G HOURS WEEK (BxExF)
1	1	24	1.5	25.5	7	178.5
2	1	24	1.5	25.5	7	178.5
3	1	10	1.0	11.0	5	55.0
4	1	2	0.0	2.0	5	10.0
5	2	16	1.0	17.0	7	238.0
6	1	8	.5	8.5	2	17.0
7	1	24	1.5	25.5	7	178.5
8	1	24	1.5	25.5	7	178.5

Validated Post Work-hours per week = 1034.0

(3) Compute total validated weekly work-hours for all posts and apply the result to the formula:

$$\frac{4.5727 \text{ (validated Post Work-hours per week)}}{145.136}$$

using example data, the correct computation for X_1 is:

$$\frac{4.5727\ (1034)}{145.136} = \frac{4728.17}{145.136} = 32.58$$ Claimant report value of X_1 to NAVMAC

X_1 = 32.58, now substitute the value of X_1 into the manpower model and solve for Y_C.

Sample Manpower Model Computation

$$Y_C = 232.7609\ (X_1)^{.9435}$$

$$Y_C = 232.7609(32.58)^{.9435}$$

$$Y_C = 232.7609\ (26.7590)$$

Y_C = 6228.45 required monthly work-hours

(4) Enter the staffing table for Provide Consolidated Law Enforcement/Physical Security Services (SEC02.001) with the 6228.45 total required monthly work-hours figure. Using the appropriate column for the value computed for Y_C , the manpower requirements and associated skills are displayed in that column.

"SAMPLE ONLY"

12. STAFFING TABLE WORK CENTER/RFC CODE: PROVIDE CONSOLIDATED LAW ENFORCEMENT AND PHYSICAL SECURITY (SEC02.001)

MANPOWER REQUIREMENT/ POSITION TITLE	MEC	DESIGNATOR GRADE/RATE/ RATING/CIV PAYPL-SERIES-GR	NOBC NEC/ AQD	FAC	BREAKPOINTS: COMPUTED MONTHLY WORK-HOURS						
					*3555.84 3700.97	3700.98 3846.10	3846.11 3991.24	3991.25 4136.38	4136.39 4281.51	4281.52 4426.65	4426.66 4571.78
					MANPOWER REQUIREMENTS						
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000H ** GS-080-13	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000I ** GS-080-12	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000J ** GS-080-11	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000K ** GS-080-09	2775		1	1	1	1	1	1	1
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000L ** GS-080-09	2775								
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACM GS-08X-11									
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACS GS-08X-09									
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MAC*** GS-08X-07			1	1	1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MA1*** GS-08X-06			5	5	5	5	5	5	5
MASTER-AT-ARMS (OR) SECURITY FORCE		MA2*** GS-08X-05			1	1	1	1	1	1	1
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-04	954X		8	8	9	9	10	10	11
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-03	954X		8	9	9	10	10	11	11
YEOMAN (OR) CLERK-TYPIST		YN1 GS-322-06			1	1	1	1	1	1	1
YEOMAN (OR) CLERK-TYPIST		YN2 GS-322-05									
YEOMAN (OR) CLERK-TYPIST		YN3 GS-322-04									
YEOMAN (OR) CLERK-TYPIST		YNSN GS-322-03									
TOTALS					25	26	27	28	29	30	31

* LOWER EXTRAPOLATION LIMIT

** MAY BE FILLED BY EQUIVALENT GRADE LDO/CWO DESIGNATOR 649X/749X.

*** MAY BE FILLED BY EQUIVALENT PETTY OFFICER WITH APPROPRIATE 954X NEC.

"SAMPLE ONLY"

12. STAFFING TABLE WORK CENTER/RFC CODE: PROVIDE CONSOLIDATED LAW ENFORCEMENT AND PHYSICAL SECURITY (SEC02.001)

MANPOWER REQUIREMENT/ POSITION TITLE	MEC	DESIGNATOR GRADE/RATE/ RATING/CIV PAYPL-SERIES-GR	NOBC NEC/ AQD	FAC	BREAKPOINTS: COMPUTED MONTHLY WORK-HOURS						
					4571.79 4716.92	4716.93 4862.06	4862.07 5007.19	5007.20 5152.33	5152.34 5297.46	5297.47 5442.60	5442.61 5587.74
					MANPOWER REQUIREMENTS						
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000H ** GS-080-13	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000I ** GS-080-12	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000J ** GS-080-11	2775							1	1
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000K ** GS-080-09	2775		1	1	1	1	1		
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000L ** GS-080-09	2775							1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACM GS-08X-11									
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACS GS-08X-09					1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MAC*** GS-08X-07			1	1	1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MA1*** GS-08X-06			5	5	5	5	5	5	5
MASTER-AT-ARMS (OR) SECURITY FORCE		MA2*** GS-08X-05			1	2	2	2	2	2	2
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-04	954X		11	11	11	11	12	12	12
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-03	954X		11	11	11	12	12	12	13
YEOMAN (OR) CLERK-TYPIST		YN1 GS-322-06			1	1	1	1	1	1	1
YEOMAN (OR) CLERK-TYPIST		YN2 GS-322-05									
YEOMAN (OR) CLERK-TYPIST		YN3 GS-322-04									
YEOMAN (OR) CLERK-TYPIST		YNSN GS-322-03			1	1	1	1	1	1	1
TOTALS					32	33	34	35	36	37	38

* LOWER EXTRAPOLATION LIMIT

** MAY BE FILLED BY EQUIVALENT GRADE LDO/CWO DESIGNATOR 649X/749X.

*** MAY BE FILLED BY EQUIVALENT PETTY OFFICER WITH APPROPRIATE 954X NEC.

"SAMPLE ONLY"

12. STAFFING TABLE WORK CENTER/RFC CODE: PROVIDE CONSOLIDATED LAW ENFORCEMENT AND PHYSICAL SECURITY (SEC02.001)

MANPOWER REQUIREMENT/ POSITION TITLE	MEC	DESIGNATOR GRADE/RATE/ RATING/CIV PAYPL-SERIES-GR	NOBC NEC/ AQD	FAC	BREAKPOINTS: COMPUTED MONTHLY WORK-HOURS						
					5587.75 5732.87	5732.88 5878.01	5878.02 6023.14	6023.15 6168.28	6168.29 6313.42	6313.43 6458.55	6458.56 6603.69
					MANPOWER REQUIREMENTS						
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000H ** GS-080-13	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000I ** GS-080-12	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000J ** GS-080-11	2775		1	1	1	1	1	1	1
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000K ** GS-080-09	2775								
LES OFF SHRACT (OR) SUPV PHYSICAL SECURITY SPEC		1000L ** GS-080-09	2775		1	1	1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACM GS-08X-11									
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MACS GS-08X-09			1	1	1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MAC*** GS-08X-07			1	1	1	1	1	1	1
MASTER-AT-ARMS (OR) SECURITY FORCE SUPERVISOR		MA1*** GS-08X-06			5	5	5	5	5	5	6
MASTER-AT-ARMS (OR) SECURITY FORCE		MA2*** GS-08X-05			2	2	3	3	3	3	3
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-04	954X		13	13	13	14	14	14	14
PETTY OFFICER (OR) SECURITY FORCE		PO3 GS-08X-03	954X		13	14	14	14	14	15	15
YEOMAN (OR) CLERK-TYPIST		YN1 GS-322-06			1	1	1	1	1	1	1
YEOMAN (OR) CLERK-TYPIST		YN2 GS-322-05									
YEOMAN (OR) CLERK-TYPIST		YN3 GS-322-04							1	1	1
YEOMAN (OR) CLERK-TYPIST		YNSN GS-322-03			1	1	1	1	1	1	1
TOTALS					39	40	41	42	43	44	45

** MAY BE FILLED BY EQUIVALENT GRADE LDO/CWO DESIGNATOR 649X/749X.

*** MAY BE FILLED BY EQUIVALENT PETTY OFFICER WITH APPROPRIATE 954X NEC.

"SAMPLE ONLY"

UNIVERSE LISTING FOR CONSOLIDATED
LAW ENFORCEMENT/PHYSICAL SECURITY (SEC02.001)

COMMAND	UIC	ACTIVITY CODE
Chief of Naval Operations (OP-09BF)		
WAR COLLEGE NEWPORT RI	00124	7932033300
*HEADQUARTERS NAVDIST WASH NAVSUPPACT DC	33355	3397093522
*NAVAL ACADEMY ANNAPOLIS MD	42082	7010020005
POST GRADUATE SCHOOL MONTEREY CA	62271	7685016600
NAVAL OBSERVATORY WASHINGTON DC	62285	4467000100
Chief of Naval Research		
NAVAL RESEARCH LABORATORY WASHINGTON DC	00173	3860010000
Commander Naval Medical Command		
*NAVAL HOSPITAL PORTSMOUTH VA	00183	3435072000
Commander Naval Air Systems Command		
NAVAVIONCCEN INDIANAPOLIS IN	00163	1316002500
NAVAL AIR TRAINING CENTER PATUXENT RIVER MD	00421	1472070000
NAVAL AIR STATION PT MUGU CA	0429A	1452074000
PACIFIC MISSILE RANGE FACILITY BARKING SANDS HI	0534A	2320000700
NAVAL AIR PROPULSION CENTER TRENTON NJ	62376	1472060000
Commander Naval Supply Systems Command		
SHIP PARTS CONTROL CENTER MECHANICSBURG PA	00104	5852000200
*NAVAL SUPPLY CENTER OAKLAND CA	00228	6170065000
*NAVAL SUPPLY CHEATHAM ANNEX NORFOLK VA	60138	6170050006
Commander Naval Sea Systems Command		
PORTSMOUTH NAVAL SHIPYARD PORTSMOUTH NH	00102	5867065000
NAVAL WEAPON STATION YORKTOWN VA	00109	6035005000

* DATA COLLECTION SITES

"SAMPLE ONLY"

UNIVERSE LISTING FOR CONSOLIDATED
LAW ENFORCEMENT/PHYSICAL SECURITY (SEC02.001)

COMMAND	UIC	ACTIVITY CODE
NAVAL WEAPON SUPPORT CENTER CRANE IN	00164	3052000500
NAVAL ORDNANCE STATION INDIANHEAD MD	00174	4621000900
NORFOLK NAVAL SHIPYARD PORTSMOUTH VA	00181	5867065100
NAVAL WEAPONS STATION CHARLESTON SC	00193	6035000500
NAVAL ORDNANCE STATION LOUISVILLE KY	00197	4621001100
HUNTERS POINT NAVAL SHIPYARD SF CA	00217	5867080000
PUGET SOUND NAVAL SHIPYARD BREMERTON WA	00251	5867015000
NAVUSEAWARENGSTA KEYPORT WA	00253	6303060000
NAVAL WEAPONS STATION CONCORD CA	60036	6035001000
NAVAL WEAPONS STATION EARLE NJ	60478	6035007000
NAVAL WEAPONS STATION SEAL BEACH CA	60701	6035003000
Commander Naval Facilities Engineering Command		
CONSTRUCTION BATTALION CENTER DAVISVILLE RI	62578	2506010000
CONSTRUCTION BATTALION CENTER PT HUENEME CA	62583	2506060000
CONSTRUCTION BATTALION CENTER GULFPORT MS	62604	2506019800
Director Strategic Systems Project Office		
SUBMARINE BASE KINGS BAY GA	42237	6078065000
STRATEGIC WEAPONS FACILITY PACIFIC SILVERDALE WA	63402	4111001000
Commander in Chief U.S. Atlantic Fleet		
SUBMARINE BASE NEW LONDON GROTON CT	00129	6078060000
*NAVAL AIR STATION JACKSONVILLE FL	00207	1452043600
*NAVAL AIR STATION KEY WEST FL	00213	1452048400
NAVAL AIR STATION GUANTANAMO BAY CUBA	00306	1452038800
NAVAL STATION ROOSEVELT ROADS PUERTO RICO	00389	6029066500
NAVAL FACILITY BERMUDA	57038	1089000100
NAVAL FACILITY ANTIGUA	57049	1089001200
NAVAL FACILITY ARGENTIA NEW FOUNDLAND CANADA	57075	1089005000
NAVAL AIR STATION BRUNSWICK ME	60087	1452020800
*NAVAL AIR STATION OCEANA VIRGINIA BEACH VA	60191	1452065900

"SAMPLE ONLY"

UNIVERSE LISTING FOR CONSOLIDATED
LAW ENFORCEMENT/PHYSICAL SECURITY (SEC02.001)

COMMAND	UIC	ACTIVITY CODE
NAVAL AIR STATION CECIL FIELD JAX FL	60200	1452025000
*NAVAL STATION MAYPORT FL	60201	6029052000
NAVAL STATION GUANTANAMO BAY CUBA	60514	6029028400
*NAVAL STATION CHARLESTON SC	61165	6029021000
NAVAL STATION BROOKLYN NY	61174	6029004700
NAVAL STATION PHILADELPHIA PA	61189	6029061800
NAVAL AMPHIBIOUS BASE LC NORFOLK VA	61414	1536040000
COMMANDER NAVAL BASE NORFOLK VA	61463	1860050000
NAVAL AIR STATION BERMUDA	62481	1452018400
NAVAL STATION KEFLAVIK ICELAND	63032	6090410000
NAVAL STATION RODMAN PANAMA CANAL PANAMA	66833	6029005000
NAVAL FACILITY RAF BRAWDY WALES UK	68165	1089002200
NAVAL STATION NEW ORLEANS LA	82268	6029056800
Commander in Chief U.S. Naval Forces Europe		
NAVAL SUPPORT ACTIVITY NAPLES GAETA ITALY	30829	3051000807
*NAVAL SUPPORT ACTIVITY HOLY LOCH SCOTLAND UK	46126	3051000501
NAVAL SUPPORT ACTIVITY SOUDA BAY CRETE GREECE	46127	3051094501
NAVAL SUPPORT OFFICE LA MADDALENA ITALY	46128	3048001201
NAVAL STATION ROTA SPAIN	46129	6029067002
NAVAL SUPPORT ACTIVITY NAPLES ITALY	46130	3051000801
NAVAL AIR STATION SIGONELLA SICILY ITALY	46131	1452091001
NAVAL ACTIVITIES LONDON ENGLAND UK	62585	3050050000
Chief of Naval Education and Training		
ADMINISTRATION COMMAND NAVTRACEN GL IL	00128	1095030000
*NAVAL AIR STATION PENSACOLA FL	00204	1452073600
*NAVAL AIR STATION CORPUS CHRISTI TX	00216	1452029200
*FLEET COMBAT TRAINING CENTER DAM NECK VA	00281	6135002000
NAVAL AIR STATION MEMPHIS MILLINGTON TN	00639	1452056700
ADMINISTRATION COMMAND NAVTRACEN SD CA	0414A	1095060000

APPENDIX F

DATA CONSOLIDATION AND SKILL DISTRIBUTION

1. General. This appendix provides instructions for using the Work-Hour Requirements Consolidation Sheet to consolidate measured/required work-hours into quantitative manpower requirements and using the Manpower Distribution Chart to determine qualitative manpower requirements. An overview of the data consolidation and skill distribution process is provided in Figure F-1.

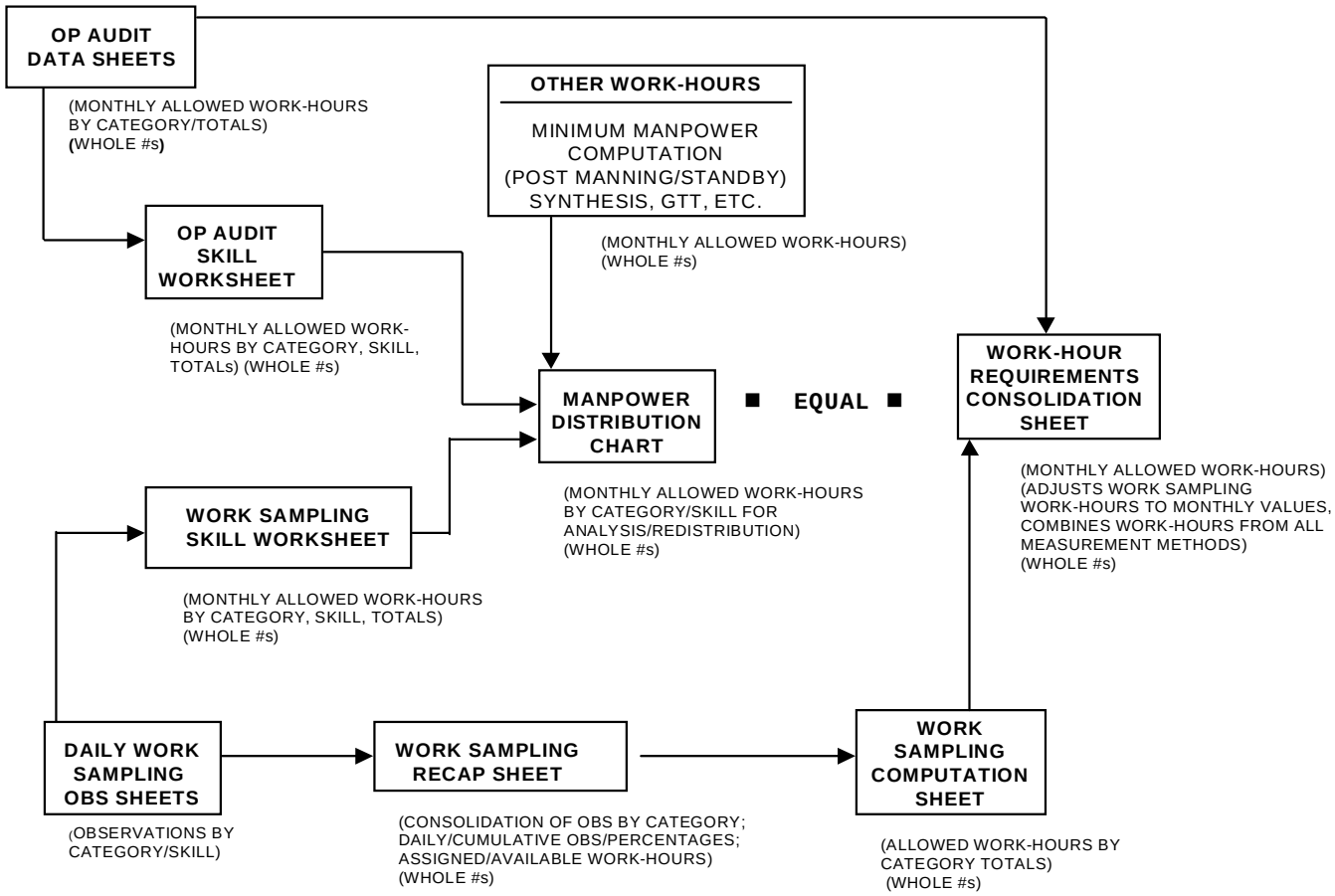


Figure F-1. Overview of Data Consolidation and Skill Distribution Process

2. Work-Hour Requirements Consolidation Sheet. Shore required manpower baselines and staffing standards are based on allowed work-hours per month. In most cases, work-hour data will have been measured or collected by more than one method, and must be consolidated by category and reflected in allowed monthly work-hours before the final computation process can proceed. Work-hour data developed by Op Audit will already be in this form. Data developed by work sampling, however, will have to be adjusted to reflect an average work month. Use the Work-Hour Requirements Consolidation Sheet to aggregate monthly allowed work-hours obtained from work sampling, Op Audit, and other specialized work measurement, and to combine validated minimum manning and standby requirements with the measured work-hours. The form also provides for conversion of total monthly allowed work-hours to quantitative requirements.

3. Instructions For Preparing The Work-Hour Requirements Consolidation Sheet (Figure F-2). Figure F-2 is a properly completed Work-Hour Requirements Consolidation Sheet. Instructions for preparing this form are as follows:

a. Complete the header information, including the specific organizational component.

b. Compute "Total Monthly Allowed Time" for each category and for the complete work center.

(1) Column A. Enter the productive categories of work, preferably in the order listed on the PWS.

(2) Column B. Enter the allowed work-hours for each category taken from Column F of the Work Sampling Computation Sheet.

(3) Column C. Enter nonsampled overtime recorded during the sampling study, by category and total.

(4) Column D. Enter the sum of entries in Column B and C for each category and total.

(5) Column E. In the space provided in the heading, enter the adjustment factor (three decimal place figure), computed as follows:

$$\text{Adjustment Factor} = \frac{\text{Average number of working days/month}}{\text{Number of sampling days included in study}}$$

WORK-HOUR REQUIREMENTS CONSOLIDATION SHEET	DATE: 10/19/96
ORG. COMPONENT: BASE SECURITY OPERATIONS DIVISION	ANALYST: H. ROCKOE
UIC: XXXXX	ACTIVITY: WETLANDS NAVAL STATION

NO.	PRODUCTIVE CATEGORIES (A)	ALLOWED TIME FROM WORK SAMPLING (B)	ALLOWED TIME FROM NONSAMPLED OVERTIME (C)	SUBTOTAL (B+C) (D)	MONTHLY ADJUSTED ALLOWED (1.045)xD (E)	MONTHLY ALLOWED FROM OP AUDIT (F)	MONTHLY ALLOWED FROM OTHER (G)	TOTAL MONTHLY ALLOWED TIME [E+F+G] (H)
1	MANAGEMENT	86		86	90	62		152
2	SECURITY GUARD SERVICES	621	10	631	659			659
3	POST RELATED DUTIES						2467	2467
4	POLICE SERVICES					776		776
5	TRAFFIC LAW ENFORCEMENT					574		574
6	ARMS ROOM SERVICE					130		130
7	RESOURCE PROTECTION	235		235	246		18	264
8	SUPERVISION	85		85	89	196		285
9	ADMINISTRATION	65		65	68	37		105
10	SUPPLY	56		56	59	37		96
11	EQUIPMENT MAINTENANCE	44		44	46	15		61
12	MEETINGS	160		160	167	78		245
13	TRAVEL	51		51	53	42		95
14	TRAINING	75		75	78	55		133
15	CLEAN UP	40		40	42	29		71
	TOTAL	1518	10	1528	1597	2031	2485	6113

NOTES: (1) 20 days work sampling
(2) "Other" monthly allowed work-hours from Minimum Manpower Computation Sheet.

TOTAL WORK-HOURS REQUIRED	6113
FRACTIONAL MANPOWER (TOTAL/145.136)	42.119

Figure F-2. Example of Work-Hour Requirements Consolidation Sheet

Example. A five-day work week with 20 sampling days included in the data:

$$\text{Adjustment Factor} = \frac{20.908}{20} = 1.045$$

Multiply each figure in Column D by this adjustment factor and enter the product rounded to whole work-hours in Column E and total.

(6) Column F. Enter the allowed time from operational audit by category and total from Column J of the Operational Audit Data Sheet.

(7) Column G. Enter justified monthly allowed work-hours by category from other supporting work-hour documentation/ measurement determinations, including minimum manpower computation, time study, GTT, and queuing theory. These work-hour sources should be identified in the "Remarks" block at the bottom of the form.

(a) If the work center/component includes "post manning" requirements validated by use of a Minimum Manpower Computation Sheet, enter minimum required work-hours from Column J of that sheet in Column G. If work-hours are not associated with a measured category, add an additional category, "Minimum Manning Positions" in Column A and enter the necessary minimum manpower requirement work-hours in Column G.

(b) If the work center/component requires standby time, enter the necessary standby work-hours in Column G of the category associated with the standby requirement.

(8) Column H. Enter the sum of the entries in Column E, F, G, and total.

(9) Convert to fractional manpower by dividing Column H total by 145.136 and indicate fractional manpower required at the bottom of the form.

c. When using the Work-Hour Requirements Consolidation Sheet to consolidate measurement data for staffing standard development, prepare a separate form to reflect work-hour data for each additive category/task. (Measurement instructions will dictate reporting requirements.)

3. Manpower Distribution Chart

a. Use the Manpower Distribution Chart to consolidate monthly work-hours by work category and qualitative (skill) requirements. Prepare separate charts for each organizational component. Column headings show minimum skill levels required to perform the work. Military billet column headings will show appropriate military title, quality designators, and MECs; civilian column headings will reflect appropriate civilian title, series, and grade.

b. Use assistance from the Human Resources Office and various OPM position classification guidelines in determining civilian pay grades and job series. Use NAVPERS 15839I and NAVPERS 18068F for military skills.

4. Instructions For Use Of The Manpower Distribution Chart (Figures F-3 and F-4)

a. Spread required work-hours gathered through work measurement for each productive category, as modified by methods improvement, from the Operational Audit Skill Worksheet, Work Sampling Skill Worksheet, and any appropriate supporting worksheets. Enter derived standby, as computed by use of a Minimum Manpower Computation Sheet or shift profile analysis, in the appropriate skill requirement columns of the category generating standby work-hours. (Study back-up should include justification for any standby time.) Enter required work-hours reflecting "post manning" whole minimum manpower requirements in appropriate productive category skill columns and "box in" entries. If a category includes like skill work-hours in addition to the post manning requirement, reflect multiple line entries for that category. Identification of these work-hours as separate entries will ensure their retention as whole manpower requirements following manpower distribution analysis. Whole manpower requirement adjustments may be considered within the post manning requirement total. Complete the Manpower Distribution Chart. (Check "Existing" block (see Figure F-3).) Monthly work-hour totals, with allowance for rounding error, must agree with "Total Monthly Allowed Time" reflected in Column "H" of the Work-Hour Requirements Consolidation Sheet.

b. To compute requirements for each skill level, divide the total monthly work-hours for each column by the monthly WAF of 145.136 work-hours and round to two decimals. Leave the total requirements for the component blank. c. Using a second Manpower Distribution Chart (check "Recommended" block (see Figure F-4)), show the results of moving transferable workload

to other skills/skill levels to bring the total work-hours for each column as close as possible to the fractional cutoff value associated with a whole number multiple of the 145.136 hours per month WAF. The total number of skills/skill levels may be less than the number on the original Manpower Distribution Chart. All improvements and study results that affect skills/skill levels within the component should be reflected on the "Recommended" chart. If there is workload that is definitely not transferable, some columns may still add up to slightly more or less than a whole number of manpower requirements. "Post manning" minimum manpower requirements will be carried forward from the "Existing" Manpower Distribution Chart without adjustment other than internal to this work-hour block, as discussed above in paragraph 4a.

d. Sum "Total Monthly Work-hours" values across the bottom to obtain the total required work-hours and cross check against sum of Monthly Work-hour Totals column. This total should be the same as on the "Existing" Manpower Distribution Chart and on the Work-Hour Requirements Consolidation Sheet.

e. Divide total monthly work-hours for each column by 145.136 work-hours and determine whole requirements based on the following fractional manpower cutoff values:

Required Manpower	Fractional Manpower Cutoff
1	1.072
2	2.144
3	3.216
4	4.288
5	5.360
6	6.432
7	7.500
Over 7	+ .500

f. Total the number of requirements across the bottom to determine the final number of manpower requirements needed for total required work-hours. Total manpower requirements cannot exceed whole manpower requirements supported by the Total Recommended Work-hours value (with fractional manpower cutoff value considered). The final skill requirement numbers represent the manpower mix required to accomplish current workload.

g. Total activity manpower requirements are built, by UIC, from the organizational component "Recommended" Manpower Distribution Charts and forwarded as a total activity reorganization by TFMMS.

MANPOWER DISTRIBUTION CHART	ANALYST: H. ROCKOE	DATE: 10/22/96	PAGE 1 OF 2

EXISTING X RECOMMENDED	UIC: XXX1X	REQUIREMENT/POSITION TITLE, GRADE/RATE, NOBC, NEC, AQD, AND MEC CODE

COMPONENT:

BASE SECURITY, OPERATIONS DIVISION

NO.	PRODUCTIVE CATEGORIES	LES OFFICER SHORE ACTE 1001 2775 HOURS	PHYSICAL SEC SPEC GS-0082-09 HOURS	PHYSICAL SEC SPEC GS-0082-07 HOURS	SUPRY POLICE OFCR/DETECT GS-0083-09 HOURS	SUPRY POLICE OFCR/DETECT GS-0083-06 HOURS	SUPRY POLICE OFF/DETECT GS-0083-05 HOURS	POLICE OFCR GS-0083-04 HOURS	POLICE OFCR GS-0083-03 HOURS	HOURS	MONTHLY WORK-HOUR TOTALS
1	MANAGEMENT	76	14		13	37	12				152
2	SECURITY GUARD SVS		20	78		162		218	181		659
3	POST RELATED DUTIES						487	924	1056		2467
4	POLICE SERVICES				10	308	35	125	298		776
5	TRAFFIC LAW ENFORCEMENT					10		366	198		574
6	ARMS ROOM SVS						73	37	20		130
7	RESOURCE PROTECT		47			117		18	82		264
8	SUPERVISION	30	33	26	75	121					285
9	ADMINISTRATION				3	30	3	39	30		105
10	SUPPLY					17	3	29	47		96
11	EQUIPMENT MAINTENANCE							16	45		61
12	MEETINGS	28	18	18	25	51	8	45	52		245
13	TRAVEL	18	10	14	8	24	2	3	16		95
14	TRAINING		10	14	4	28	5	35	37		133
15	CLEANUP					7	2	17	45		71
TOTAL MONTHLY WORK-HOURS		152	152	150	138	912	630	1872	2107		6113
TOTAL REQUIREMENTS/POSITIONS		1.05	1.05	1.03	.95	6.28	4.34	12.90	14.52		

Figure F-3. Example of "Existing" Manpower Distribution Chart

MANPOWER DISTRIBUTION CHART	ANALYST: H. ROCKOE	DATE: 10/22/96	PAGE 1 OF 2

EXISTING ____ RECOMMENDED ___X	UIC: XXX1X	REQUIREMENT/POSITION TITLE, GRADE/RATE, NOBC, NEC, AQD, AND MEC CODE

COMPONENT: BASE SECURITY, OPERATIONS DIVISION		LES OFCR	SHORE ACTE	1000J 2775	PHYSICAL SEC	SPEC	GS-082-09	PHYSICAL SEC	SPEC	GS-082-07	SUPRY POLICE	OFCR/DETECT	GS-083-09	SUPRY POLICE	OFCR/DETECT	GS-083-06	SUPRY POLICE	OFCR/DETECT	GS-083-05	POLICE OFCR	GS-083-04		POLICE OFCR	GS-083-03					
NO.	PRODUCTIVE CATEGORIES	HOURS			HOURS			HOURS			HOURS			HOURS			HOURS			HOURS			HOURS			HOURS			MONTHLY WORK-HOUR TOTALS
1	MANAGEMENT	79			17						25			31															152
2	SECURITY GUARD SVS				20			78						191						189			181						659
3	POST RELATED DUTIES																487			924			1056						2467
4	POLICE SERVICES										15			308			39			210			204						776
5	TRAFFIC LAW ENFORCEMENT													10						366			198						574
6	ARMS ROOM SVS																73			37			20						130
7	RESOURCE PROTECT				47									117						18			82						264
8	SUPERVISION	30			33			31			75			116															285
9	ADMINISTRATION										3			30			3			39			30						105
10	SUPPLY													17			3			29			47						96
11	EQUIPMENT MAINTENANCE																			16			45						61
12	MEETINGS	28			18			18			25			51			8			45			52						245
13	TRAVEL	18			10			14			8			24			2			3			16						95
14	TRAINING				10			14			4			28			5			35			37						133
15	CLEANUP													7			2			17			45						71
TOTAL MONTHLY WORK-HOURS		155			155			155			155			930			622			1928			2013						6113
TOTAL MANPOWER REQUIREMENTS/POSITIONS		1			1			1			1			6			4			13			14						1

Figure F-4. Example of "Recommended" Manpower Distribution Chart

APPENDIX G

TABLE OF BREAKPOINT VALUES

BREAKPOINT VALUE (FM) X (145.136)		BREAKPOINT VALUE (FM) X (145.136)		BREAKPOINT VALUE (FM) X (145.136)		BREAKPOINT VALUE (FM) X (145.136)	
RQMT	WORK-HOURS	RQMT	WORK-HOURS	RQMT	WORK-HOURS	RQMT	WORK-HOURS
1	155.59	40	5878.01	79	11538.31	118	17198.62
2	311.17	41	6023.14	80	11683.45	119	17343.75
3	466.76	42	6168.28	81	11828.58	120	17488.89
4	622.34	43	6313.42	82	11973.72	121	17634.02
5	777.93	44	6458.55	83	12118.86	122	17779.16
6	933.51	45	6603.69	84	12263.99	123	17924.30
7	1088.52	46	6748.82	85	12409.13	124	18069.43
8	1233.66	47	6893.96	86	12554.26	125	18214.57
9	1378.79	48	7039.10	87	12699.40	126	18359.70
10	1523.93	49	7184.23	88	12844.54	127	18504.84
11	1669.06	50	7329.37	89	12989.67	128	18649.98
12	1814.20	51	7474.50	90	13134.81	129	18795.11
13	1959.34	52	7619.64	91	13279.94	130	18940.25
14	2104.47	53	7764.78	92	13425.08	131	19085.38
15	2249.61	54	7909.91	93	13570.22	132	19230.52
16	2394.74	55	8055.05	94	13715.35	133	19375.66
17	2539.88	56	8200.18	95	13860.49	134	19520.79
18	2685.02	57	8345.32	96	14005.62	135	19665.93
19	2830.15	58	8490.46	97	14150.76	136	19811.06
20	2975.29	59	8635.59	98	14295.90	137	19956.20
21	3120.42	60	8780.73	99	14441.03	138	20101.34
22	3265.56	61	8925.86	100	14586.17	139	20246.47
23	3410.70	62	9071.00	101	14731.30	140	20391.61
24	3555.83	63	9216.14	102	14876.44	141	20536.74
25	3700.97	64	9361.27	103	15021.58	142	20681.88
26	3846.10	65	9506.41	104	15166.71	143	20827.02
27	3991.24	66	9651.54	105	15311.85	144	20972.15
28	4136.38	67	9796.68	106	15456.98	145	21117.29
29	4281.51	68	9941.82	107	15602.12	146	21262.42
30	4426.65	69	10086.95	108	15747.26	147	21407.56
31	4571.78	70	10232.09	109	15892.39	148	21552.70
32	4716.92	71	10377.22	110	16037.53	149	21697.83
33	4862.06	72	10522.36	111	16182.66	150	21842.97
34	5007.19	73	10667.50	112	16327.80	151	21988.10
35	5152.33	74	10812.63	113	16472.94	152	22133.24
36	5297.46	75	10957.77	114	16618.07	153	22278.38
37	5442.60	76	11102.90	115	16763.21	154	22423.51
38	5587.74	77	11248.04	116	16908.34	155	22568.65
39	5732.87	78	11393.18	117	17053.48	156	22713.78

BREAKPOINT VALUE (FM) x (145.136) RQMT	WORK-HOURS	BREAKPOINT VALUE (FM) x (145.136) RQMT	WORK-HOURS	BREAKPOINT VALUE (FM) x (145.136) RQMT	WORK-HOURS	BREAKPOINT VALUE (FM) x (145.136) RQMT	WORK-HOURS
157	22858.92	196	28519.22	235	34179.53	274	39839.83
158	23004.06	197	28664.36	236	34324.66	275	39984.97
159	23149.19	198	28809.50	237	34469.80	276	40130.10
160	23294.33	199	28954.63	238	34614.94	277	40275.24
161	23439.46	200	29099.77	239	34760.07	278	40420.38
162	23584.60	201	29244.90	240	34905.21	279	40565.51
163	23729.74	202	29390.04	241	35050.34	280	40710.65
164	23874.87	203	29535.18	242	35195.48	281	40855.78
165	24020.01	204	29680.31	243	35340.62	282	41000.92
166	24165.14	205	29825.45	244	35485.75	283	41146.06
167	24310.28	206	29970.58	245	35630.89	284	41291.19
168	24455.42	207	30115.72	246	35776.02	285	41436.33
169	24600.55	208	30260.86	247	35921.16	286	41581.46
170	24745.69	209	30405.99	248	36066.30	287	41726.60
171	24890.82	210	30551.13	249	36211.43	288	41871.74
172	25035.96	211	30696.26	250	36356.57	289	42016.87
173	25181.10	212	30841.40	251	36501.70	290	42162.01
174	25326.23	213	30986.54	252	36646.84	291	42307.14
175	25471.37	214	31131.67	253	36791.98	292	42452.28
176	25616.50	215	31276.81	254	36937.11	293	42597.42
177	25761.64	216	31421.94	255	37082.25	294	42742.55
178	25906.78	217	31567.08	256	37227.38	295	42887.69
179	26051.91	218	31712.22	257	37372.52	296	43032.82
180	26197.05	219	31857.35	258	37517.66	297	43177.96
181	26342.18	220	32002.49	259	37662.79	298	43323.10
182	26487.32	221	32147.62	260	37807.93	299	43468.23
183	26632.46	222	32292.76	261	37953.06	300	43637.57
184	26777.59	223	32437.90	262	38098.20		
185	26922.73	224	32583.03	263	38243.34		
186	27067.86	225	32728.17	264	38388.47		
187	27213.00	226	32873.30	265	38533.61		
188	27358.14	227	33018.44	266	38678.74		
189	27503.27	228	33163.58	267	38823.88		
190	27648.41	229	33308.71	268	38969.02		
191	27793.54	230	33453.85	269	39114.15		
192	27938.68	231	33598.98	270	39259.29		
193	28083.82	232	33744.12	271	39404.42		
194	28228.95	233	33889.26	272	39549.56		
195	28374.09	234	34034.39	273	39694.70		

APPENDIX H

INTERVIEWING TECHNIQUES

1. General. The interview is one of the main methods the analyst uses in gathering facts about the present operation. The purpose of an interview is to elicit frank and complete answers from the respondent. The interviewer faces an individual who will react both to the personality of the interviewer and to the subject matter discussed. The interviewer must consider the goals, attitudes, beliefs, and motives of the respondent to make the most efficient use of the interview. The interview also has other objectives. These more subtle, but equally important, objectives are selling the idea of progressive improvement in operations and the acceptance of possible future changes. These objectives are realized by providing the interviewees a perspective of their activity in relation to the total problem area and identifying them with the solution through the involvement of their suggestions and ideas.

2. Types of Interviews

a. The general plan of an interview is tailored to the specific problem, and to some extent, to the subject of each individual interview. Manager and worker interviews are similar except in level of information sought and the request for full cooperation and participation from managerial personnel to interview their subordinates.

b. Managers usually provide summary information about their areas, leaving detailed processing steps for explanation by their subordinates. The workers' interests in the organization and system are usually centered around individual roles and the possible personal impact of any change resulting from the study. The managers' interests center in the roles of assigned managerial responsibility in the operation, except in the case of their personal participation in the area, where their interests are quite similar to the workers.

3. Interview Phases. The interview process can be divided into four phases:

a. Prior Planning Phase. Prior planning ensures the maximum benefit will be realized from the interview. The analyst should decide on the type of information desired and major points to be covered. Obtain a general knowledge of the area by researching

the system and organization from manuals, directives, or instructions. Scheduling interviews in advance will allow the respondent to consider and collect any background information or examples that should be presented.

b. Opening Phase. The opening phase should start with an introduction of the analyst and the reason for the interview, followed by a statement defining and detailing the study. Review the role of the interviewee in the problem area to provide an overall perspective, the type of information desired, and how the information should be used.

c. Discussion Phase. The major portion of the interview falls in the discussion phase. In addition to asking questions, observe the physical layout and note any equipment used and logic of workflow. Take notes of major points presented for later consideration and study. Obtain and record key facts regarding document volumes, processing times, routing sequence, types of problems, data entries, work steps, etc.

d. Close Phase. This phase of the interview is a time for gradual phase out. The objective is to effectively terminate the interview. Review data gathered with the interviewee to be sure the information provided was understood and add any additional data believed necessary. Arrange with the interviewee to return and get additional information if necessary. Express appreciation for assistance and cooperation.

4. Advantages of Interviewing. Many analysts prefer interviewing to other fact finding techniques because of the flexibility involved. They recognize that meaning is conveyed between individuals not only by word, but by phrasing and emphasis, and by silence, action, or inaction. In personal interviews, the analyst can observe these subtleties and adjust the approach to fit the situation. Other advantages and special uses of the interviewing method are:

a. Interviews are necessary to secure information not recorded anywhere except in the mind of the person interviewed.

b. An interview with a manager or supervisor is often the best way to evaluate their general attitude, how they think, how close they are to the job, and their knowledge of the people who work for them.

c. An interview of an employee is often the best way to secure information on how well the organization and systems

function, how well workers are trained, their qualifications, what they do, how well they understand policies and instructions given to them, what they do that is not covered by procedure, and what ideas they have.

d. Interviews are often thought as stimulators for the person interviewed and the interviewer. The informality of an interview may motivate people to give information that otherwise would not occur to them or which they would hesitate to submit in written form.

5. Limitations. While the interview is a legitimate fact gathering technique, it has definite and sometimes overlooked limitations.

a. People interviewed are sometimes asked to give information without having had an opportunity to thoroughly check the facts or consider what is said. They may, therefore, give inaccurate information unintentionally, or may be so cautious they withhold information because they are not absolutely positive of its accuracy.

b. When people are interviewed, they often feel they should know the answers to all the questions. They may, therefore, answer questions with "guesses" rather than admit their ignorance.

c. The interviewer should keep a record of the facts learned. This record may be hastily written and incomplete due to the pressure of time, and errors may result. Even if notes are complete and accurate, the person interviewed may deny or modify statements made.

d. Some people unconsciously try to answer questions the way they believe the interviewer wants them answered instead of stating the facts or their true beliefs.

e. An interviewer is likely to get a collection of work exceptions rather than normal job situations. Unusual, humorous, or impressive incidents are more enjoyable to talk about than everyday routines.

f. A person may unwittingly allow emotional consideration to obscure factual issues. Analysts must learn to distinguish between emotionally motivated statements and actual facts.

6. Guides for the Interviewer

a. Make adequate preparations before interviews take place.

(1) Use care in selecting the people to be interviewed and the order of the interviews. The client supervisor/manager can determine who is best informed and guide the order employees are to be contacted. An initial orientation of the overall organization/system with a walk-through of the office space, in the same sequence as major work flows, aids in subsequent individual interviews.

(2) Know the kind of information wanted and the general approach for obtaining it. The interview can be somewhat structured by using some key questions to be asked of everyone for selected information areas.

(3) Sufficiently familiarize yourself with the subject matter to understand terminology and technical explanations likely to be given. Learn organization codes, document acronyms, work related terms, etc. prior to interviewing.

(4) Make definite arrangements for the time and pace of the interview. Job-site interviews are best for understanding the operations. Privacy is important. Make arrangements so the interview is private and free from distractions.

(5) Before the interview, give the person to be interviewed an idea of the subject matter to be discussed and the general type of information needed.

b. Conduct interviews in as informal a manner as possible consistent with the needs for an organized and planned result.

(1) Take notes during interviews in such a manner as to minimize formality.

(2) Conversation, although controlled and directed to some extent, should be natural and informal.

c. Limit the purpose of the interview to information gathering.

(1) Do not try to promote ideas or concepts or to argue with statements believed, or known to be, incorrect.

(2) Control conversations on social matters, mutual acquaintances, etc. The interview will be regarded as "a conversation with a road map".

(3) Do not imply or specify the selection of any recommendation or course of action, even though tentative ideas may have been formed.

d. Ensure accurate interpretation and recording of information obtained. Repeating, in a summarized form, back to the interviewee what was understood to be said for agreement is a good way to better understand the situation as well as confirm the accuracy of comments.

(1) Verify confusing or doubtful points by asking questions, repeating back, or actually observing the operation in question. Drafting an illustration of the situation also helps in understanding some areas.

(2) Either take complete notes during the interview or amplify them shortly after the interview.

(3) When the information given during the interview relates to specific forms or reports, obtain and attach samples of these documents to the interview notes.

e. It is sometimes advisable to review and digest the information gained form one interview before staring another. Systems studies that involve "paperwork chains" require a knowledge of previous or more elementary phases to completely understand the subsequent process.

7. Some Hints For Effective Interviewing

a. Plan. The lack of adequate planning is the greatest single fault. A written outline of important points is very helpful; even noting typical questions may be useful. CAUTION: Reliance on a programmed questioning approach is often disconcerting to the interviewee, and may lead to stereotyped answers. Suggest a time limit by referring to the next scheduled interview.

b. Build Rapport. The tone of the interview should convey helpfulness, friendliness, interest, concern, and confidentiality (i.e., nonattribution!). Put interviewee at ease. Jotting small bits (small only) of information not only

helps in reconstructing the interview, but compliments the interviewee by recognizing that their input is valuable.

c. Guide the Conversation. Since the interviewee is sensitive to the interviewer's actions and reactions, use this and steer the conversation along the most productive path. By repeating phrases already expressed, the interviewee may expand details on a relevant issue. Semi-verbal responses such as "Umm..." are often useful; the interviewee receives them as they want to, and therefore may emphasize a point as they see fit. A summary or "mirroring" of information clarifies the communication.

d. Develop Information. Questions are the interviewer's tools, use them with care and dispatch. Gain information, but also consciously but discreetly guide the conversation. Avoid "double negatives" interrogation. "YES" "NO" questions should be reserved for the very last part of the interview, if you use them at all.

e. Allow for Silence. Although the inexperienced interviewer fears this, it can be useful. Pace yourself, don't hurry. Pauses may elicit vital bits of information. During silence, ask yourself, "What is that person really trying to tell me?"

f. Listen. Judicious application of active listening is appropriate but, don't process the dickens out of the interviewee. Always be aware that you are normal, that you will hear what you want to hear. If this occurs, you are not being an effective consultant. If you take up potential silence periods with your conversation, you run the risk of projecting your ideas into the interviewing process. You may in fact filter out the interviewee's responses.

g. Analyze Data. Overwhelmingly conventional responses may be suspect (i.e., "My Division Officer doesn't like me") and not valid. Investigate with further questioning to see if there is an underlying issue. If the interviewee is impervious to interruption, it may indicate a need to relate the facts in a predetermined pattern (may never be able to reassemble the parts). Investigate. Fill in voids, gaps, and illogical sequences with further questioning. Conflicting times or facts merit careful attention. Nonverbal responses are the purest kind of response. Assess how the feelings or attitudes of the interviewee influence the information.

h. Conclude the Interview. The final 10% of the interview may be the most productive in terms of volume of information. Be ready. A summary of the information will be useful to both parties in knowing what has just taken place. Reassert the practice of nonattribution. Offer to show the interviewee any notes that have been taken. Let them examine for potential attribution.

REMEMBER, YOUR OWN BIASES AND ATTITUDES WILL AFFECT THE INFORMATION GATHERED.

APPENDIX I

PERFORMANCE RATING

1. The Pace Rating System. Pace rating is used in conjunction with direct observation work measurement to adjust time values up or down to compensate for the observed pace being too slow or too fast. In the pace rating system, the analyst relates the observed pace, speed, or tempo of work performance to a predetermined concept of normal pace that also considers the performance for the type of work involved. During this process, the analyst also mentally adjusts the work performance to compensate for inherent job difficulties. It is recognized that all jobs are not performed at the same pace, speed, or tempo. The analyst will use a number of concepts of "normal," depending on the type of work being observed. The best method an analyst can use to mentally imprint a concept of normal pace is to observe a number of workers and their performance over several work cycles during a period of time. Unity (1.00) is envisioned as the numerical value for normal pace and all ratings are given a value in relation to it. For example, the analyst may assign a rating of .95 for a particular person. This rating, assigned in conjunction with a sample, indicates that at the time observed, the worker was performing at a speed 5% slower than normal for the activity observed. If the worker was rated 1.05, he was performing at a speed 5% faster than normal.

2. Rater Proficiency. Training of the type required to help analysts develop a "mental image" of normal and to rate consistency, is a never-ending process. An analyst should not attempt to rate pace without having received proper training in this technique and undergoing refresher training on pace rating within one month of use by viewing films or performing practice sessions. The analyst must develop many concepts of normal since they are involved in studying a wide variety of jobs. While it is virtually impossible to provide the rater with every possible "norm" that might be encountered, some point-of-departure norms can be used. The following are suggested for this purpose:

a. Various films, showing a wide range of tasks, are available which are helpful in establishing a good point of reference for normal pace. The Institute of Industrial Engineers (IIE) and the Society for Advancement of Management (SAM) have single and multi-image pace rating training films available for purchase or rent. These are excellent films and

were designed to solve the pace rating problems of "establishing the point of reference for norm" and "consistency of ratings." Select a film that shows a task most resembling the tasks being observed.

b. A less reliable technique is to deal playing cards. Deal 52 playing cards in four piles in .50 minutes. To deal the cards hold the deck in the left hand (if right-handed), and with the thumb, displace and advance the top card each time; with the right hand, grasp the prepositioned corner of the top card between the thumb and first finger, and carry it to the proper pile. This training method requires at least three people: the trainee, the card dealer, and a person with a stop watch. The dealer deals the cards, the person with the stop watch times the operation, and the trainee rates the operation. The true rating is determined by dividing the known normal time (.50 minute) by the stop-watch reading. For example:

$$\frac{\text{Normal Time}}{\text{Stop Watch Time}} = \frac{0.50}{0.40} = 1.25 \ (125\%)$$

Comparing the true rating with those given by the trainee is an excellent way to show where the trainee is rating in relation to the actual pace of the dealer.

c. In some cases, it will be necessary to identify (with assistance of the supervisor) an employee performing the given task at a normal or average pace to serve as the benchmark for comparison.

3. Computing an Average Pace Rating. Work measurement studies that involve pace rating invariably result in a number of separate ratings. It is important to rate as often as necessary in order to obtain a good evaluation of demonstrated performance. At the conclusion of the study, determine the average of these ratings and use it to compute leveled time. The simplified example below illustrates the computation of an average rating factor from six separate pace rating values.

Average Pace Rating Computation

Rating No.(N)	Pace Rating (R)
1	.95
2	.90
3	.95
4	1.05
5	.90
6	.95
N = 6	R = 5.70

$$\text{Average Pace Rating } (\bar{R}) = \frac{\bar{R}}{N} = \frac{5.70}{6} = .95$$

4. Leveled and Allowed Time. Once average pace is determined for the day/study period, multiply the measured time for each category of work by the decimal average pace rating to determine leveled time. Leveled time must be further adjusted to account for personal, fatigue and delay allowances (multiplied by an allowance factor of 1.15 for most white collar jobs and 1.17 for most blue collar jobs) to derive the allowed time. Allowed time is what is used to calculate manpower requirements.

APPENDIX J

ORGANIZATION ANALYSIS APPRAISAL SHEET

PREPARED BY: _____ DATE: _____

l. Activity: _____

2. Organizational Component: _____

Department: _____ Division: _____

Branch: _____ Section: _____

3. Suggestions for more appropriate title:

(l) _____ (2) _____

4. Name of person in charge: _____

5. Billet title of person in charge: _____

6. Is there an organization chart for the component concerned?

Yes _____ No _____

If so, is it adequate? Yes _____ No_____

7. Is the mission of the organizational component adequately defined?

Yes _____ No _____

If so, where? _____

If not adequately defined, how should it be revised?

_____

_____

_____

_____

_____

8. Appraise the organization in regard to the following principles of organization. (NOTE: If any of these questions are answered in the negative, explain in the space provided following each question.)

a. Is every necessary function provided for to ensure accomplishment of the total mission?

Yes _____ No _____

Remarks: _____

_____

_____

Note: This appraisal form is designed so it can be applied at any level of command (activity, department, division, etc.). The questions have been phrased so they may be used with any organization.

b. Is each function assigned to only one component of the organization?

Yes _____ No _____

Remarks: _____

_____

_____

c. Are the assigned responsibilities specific and clear cut?

Yes _____ No _____

Remarks: _____

_____

_____

d. Have consistent methods of organizational structure been applied at each level of the organization?

Yes _____ No _____

Remarks: _____

_____

_____

e. Does each member of the organization know (l) to whom he/she reports and (2) who reports to him/her?

Yes _____ No _____

In addition, is there only one supervisor at each controlling level?

Yes _____ No _____

Remarks: _____

_____

_____

f. Are the functions required to accomplish the mission grouped according to similarity and practice, and are individuals assigned to these groupings according to their abilities and backgrounds?

Yes _____ No _____

Remarks: _____

_____

_____

g. Is the responsibility for a function matched by the authority necessary to perform that function?

Yes _____ No _____

Remarks: _____

_____

_____

h. Is the span-of-control of each supervisor correct?

Yes _____ No _____

Remarks: _____

_____

_____

i. Are channels of command violated by staff units?

Yes _____ No _____

Remarks: _____

_____

_____

j. Is authority and responsibility for action decentralized, to the greatest extent practicable, to components and individuals responsible for actual performance of operations?

Yes _____ No _____

Remarks: _____

_____

_____

k. Has the organization become so elaborate as to hinder work accomplishment?

Yes _____ No _____

Remarks: _____

_____

_____

9. Appraise the organization with regard to the following specific organizational aspects:

a. Do excessive unwritten procedures and informal organization hamper defined organization?

(l) Unwritten Procedures: Yes _____ No _____
(2) Informal Organization: Yes _____ No _____

Remarks: _____

_____

_____

b. Are there rules and regulations which hamper flexibility of the organization? (If yes, explain)

Yes _____ No _____

Remarks: _____

_____

_____

c. Is centralization or concentration of authority too great? (If yes, explain)

Yes _____ No _____

Remarks: _____

_____

_____

d. Is the relationship of formal and informal organization compatible? (If not, explain) Note: This may require superimposing channels of contact, as a result of informal relationships, on the current organization chart.

Yes _____ No _____

Remarks: _____

_____

_____

e. Does each organizational component make a logical contribution to the basic mission of the command? (If not, explain)

Yes _____ No _____

Remarks: _____

_____

_____

f. Are all functions of the organization carried out in conformance with assigned responsibilities? (If not, explain)

Yes _____ No _____

Remarks: _____

_____

_____

g. Are there any misunderstandings on the part of individuals in key jobs as to their responsibilities and authority? (If yes, explain)

Yes _____ No _____

Remarks: _____

_____

_____

10. List any other aspects not covered in preceding sections which should be considered in appraising the organization.

APPENDIX K

BASIC ORGANIZATIONAL STRUCTURES

1. Line Organization

a. The line organization is the simplest form of structure. It is the basic organization framework and provides for an unbroken chain of authority within the command (see Figure K-1). Pure line organization structure is found mainly in small organizations. In a line organization, the head of each organizational component has complete responsibility for all tasking required to accomplish the mission.

b. Line structure is frequently referred to as the military or hierarchical type of organizational structure. It is based upon relative authority and responsibility rather than the nature of the various functions performed by the command.

c. A second characteristic of a line organization (not always obvious on an organization chart) is that all departments or divisions immediately under the Commanding Officer are concerned with primary or line objectives of the command. Thus, the term "line" indicates the succession of authority and responsibility and hence, the chain-of-command. It indicates functions that contribute directly to accomplishing the primary objective of the command.

d. Advantages of a line structure are that it facilitates rapid action and decision making, discipline is easily maintained, and it permits clear lines of communication, authority, and responsibility. Disadvantages are that it is inflexible (increases in size and complexity will cause management tasks to exceed the capacity of the line managers), it may be operated on a dictatorial basis, and it may not operate efficiently in large commands.

2. Line and Staff Organization

a. Many organizations, including military, are of the line and staff organizational structure. The line elements perform the tasking directly related to the mission, and staff elements furnish technical guidance and services in specialized areas such as personnel, comptroller, and legal (Figure K-2). Both derive authority from the same command.

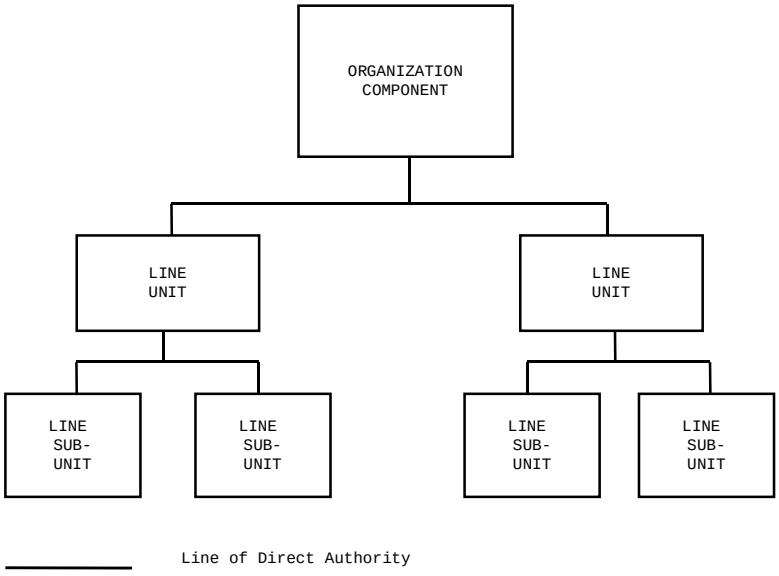


Figure K-1. Example of a Line Organization

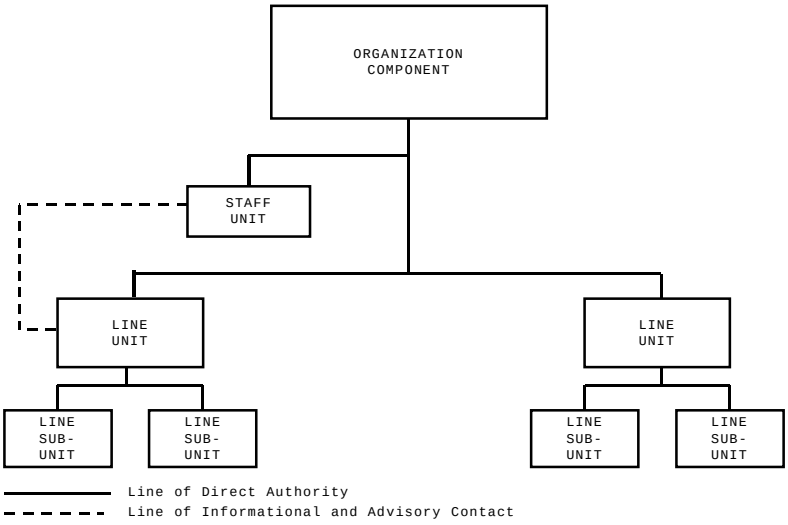


Figure K-2. Example of a Line and Staff Organization

b. Staff units do not stand one above the other in descending order. Some persons are assigned to do "planning" or "service" type tasking while others are assigned to "doing" type tasking. Thus, line and staff units are not rival systems of organization. A staff unit performs services to avoid duplication and provides an economy in grouping like tasks into one organizational component. One characteristic of this structure is that the head of the component, in receiving specialized advice and assistance from the staff, may accept or reject it. Another is that each person reports to one supervisor, yet each person receives specialized assistance and advice from various experts and technicians responsible to other supervisors. Naturally, each staff component must have a line organization within itself for discipline and continuity. A complete organization of a command or other unit of organization will embody the principles of both line and staff for best results.

c. Advantages of this type structure are: it provides for increased operational proficiency, undivided authority and responsibility, and it permits line personnel to concentrate on functions related to the prime objective, while permitting the staff to specialize.

d. Disadvantages include decreased effectiveness of the organization to accomplish its mission because the staff may lack authority to carry out its functions. The line may fail to back the staff's recommendations, giving rise to confusion as to the duties and responsibilities of the staff members unless these are clearly written out. Line supervisors may see the presence of staff as interfering in their functions.

e. Channels of command will not be violated by staff units. Violation of this principle is one of the administrative errors that causes great confusion in an organization. All staff personnel should clearly understand the relationship of their authority and responsibility.

f. Staff specialists are often described as planners or developers of ideas; line supervisors implement policies and procedures developed by the staff. The staff of a command is removed from the line of action so it may counsel and lend technical assistance to the line. It is the responsibility of the staff to get facts upon which decisions or appropriate actions may be based.

g. Organizational relationships between line and staff may hamper the effectiveness of the command unless duties and responsibilities of staff are made known and clearly indicated by charts, instructions, or directives. Characteristics of a sound line-staff relationship are:

(1) Line functions are accountable for the mission of a command and will have final authority in this attainment.

(2) Staff functions provide advice and assistance to line components in performance of their duties. Staff has no command authority over line.

(3) Staff should offer its services where needed without waiting for line request. It should think ahead concerning line operating problems.

(4) Line will adequately consider staff advice and services. Staff may possess more information on certain matters than is available to line.

(5) Line may accept, reject, or change staff advice or service.

(6) When disagreement arise, line and staff have the right to appeal to higher line authority.

3. Functional Organization

a. In the functional organization structure, the authority of the staff unit goes further. It has power to place its recommendations into effect under the concept of delegated "functional authority" in which the staff unit maintains control through policies and implementing directives.

b. In a completely functional organization structure each functional supervisor would have authority throughout the organization for performance of the function. This is based on the functional supervisor having superior knowledge of the function. The supervisor gives orders to line personnel concerning the specific function and ensures that recommendations are carried out. The functional type of organization structure represents the farthest advance that management has made under the principle of providing the services of specialists. It is an extension of the assistance supplied the line organization by the staff.

c. Experience has shown that completely functional structures do not operate satisfactorily. Nevertheless, functional supervision has a place in a command's organization when the amount and scope of authority and responsibility are well defined and there is a strong line and staff organization structure (See Figure K-3). For example, aboard ship, certain personnel under direction of Weapons Officers and Engineering Officers are assigned to do supply tasks. In doing the work, they follow the policies and procedures prescribed by the Supply Officer (what is to be done). While it appears that this violates the principle of unity of command in taking orders from two officers at the same time, this is not the case if the authority and responsibility relationships are clear-cut and written out.

d. The functional type of organization structure provides for both direct line supervision and the expert services of staff specialists. It is conducted in a line and staff structure and requires strong lines of authority and responsibility where each person knows to whom he/she is responsible for performance of each specific task and each individual knows exactly where supervision begins and ends.

e. Advantages of the functional structure are that it makes use of expert knowledge and maintains functional efficiency of personnel. Disadvantages are a potential lack of organizational stability, conflicts in authority, difficulty in fixing responsibility and accountability, stifled initiative, and complicated routines.

4. Composite Organization. In many cases a command may be a composite of line, line and staff, and functional structures. The nature of operations at each level is usually the determining factor. Questions involving special skill or knowledge and degree of coordination and control are considerations. For example, at a large Naval Air Station a line and staff relationship may exist at the activity level, a functional structure at the departmental level, and line structures at the division and branch levels. It is usually impractical to have more than one type structure at any one level.

5. Departmentalization

a. Organization components may be divided horizontally, sometimes referred to as departmentalization, and structured vertically into levels of authority. Departmentalization is

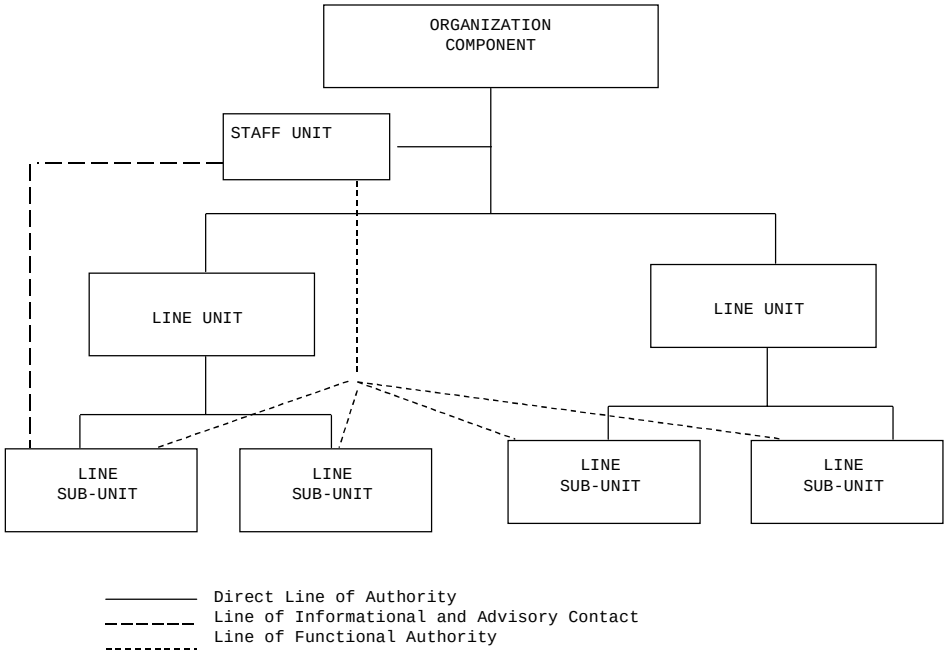


Figure K-3. Example of Functional Organization

a horizontal grouping of common functions. It relates to decisions concerning logical divisions of work to be done. These divisions are usually by function, product, and geographical location. They are found at various levels of the vertical structure.

b. Functional Departmentalization. This follows the lines of a functional organizational structure on a command component basis. It is the setting up of components by specific functions necessary to mission performance, and placing qualified personnel at their head. Functional departmentalization becomes necessary when a supervisor's time capacity is exceeded in managing the increasing number of specialized functions requiring appropriate training and abilities.

c. Product or Service Departmentalization. This consists of separation of activities on the basis of product, product lines, or service. It occurs when skills and knowledge concerning a particular product or service are of paramount importance. A supervisor will have charge of all functions relating to that product within a single group so that they may be properly coordinated. Additional basis for departmentalization include

process, commodity, customer, or service as the primary unit of organizational separation.

d. Geographic Departmentalization. This grouping of command activities is in terms of geographic locations of field installations and/or the area to be served. When a large command has many subsidiary activities at various locations, and when similar operations occur in different territories it may be desirable to have a geographic structure to secure adequate coordination and control.

e. Departmentalization Combinations. Combinations of the three structures mentioned above exist in some commands. This enables them to meet special problems by adapting their organizational structures accordingly, thus maintaining flexibility. They are desirable only when these combinations will most effectively contribute to mission achievement.

APPENDIX L

ACRONYMS

This appendix provides a list of acronyms used in this Handbook. Acronyms are words formed from the initial letter or letters of each of the successive parts or major parts of a compound term for Navy programs, processes, equipment, etc.

Acronym	Term
ADP	Automated Data Processing
AF	Allowance Factor
AIMD	Aircraft Intermediate Maintenance Department
AMD	Activity Manpower Document
APLSTATS	All Purpose Language Statistics
AQD	Additional Qualification Designation
BSC	Billet Sequence Code
CA	Commercial Activities
CHNAVPERS	Chief of Naval Personnel
CNO	Chief of Naval Operations
CONUS	Continental United States
DMC	Defense Mission Code
DOD	Department of Defense
DON	Department of the Navy
DRF	Directed Requirement Factor
ERR	Efficiency Review Report
FAC	Functional Area Code
FM	Fractional Manning
FY	Fiscal Year
FYDP	Future Year Defense Plan
GTT	Group Timing Technique
HO	Hour/Hourly
IIE	Institute of Industrial Engineers
LCL	Lower Control Limit

Acronym	Term
MEC	Military Essentiality Code
MEM	Manpower Estimating Model
MFT	Mission, Functions, and Tasks
MMF	Minimum Manpower Factor
MO	Month/Monthly
MSMR	Mobilization Statement of Manpower Requirements
NAVMAC	Navy Manpower Analysis Center
NEC	Navy Enlisted Classification
NOBC	Navy Officer Billet Classification
OJT	On-the-Job Training
OPM	Office of Personnel Management
Op Audit	Operational Audit
OPNAV	Office of the Chief of Naval Operations
PDCA	Plan, Do, Check, Act
PE	Program Element
PEF	Program Estimating Factor
PF&D	Personal, Fatigue, and Delay
POA&M	Plan of Action and Milestone
POC	Point of Contact
POE	Projected Operational Environment
POM	Program Objectives Memorandum
PPBS	Planning, Programming, and Budgeting System
PRESS	Prediction Sum of Squares
PTR	Pilot Training Rates
PWS	Performance Work Statement
QT	Quarter
QTR	Quarterly
R/D	Reduce/Delete
RAPS	Resource Analysis and Planning System
RFC	Required Functional Category
ROC	Required Operational Capabilities
SAM	Society for Advancement of Management
SEAL	Sea, Air, Land
SEAOPDET	Sea Operational Detachment

Acronym	Term
SECDEF	Office of the Secretary of Defense
SECNAV	Office of the Secretary of the Navy
SHMD-STAT	Shore Manpower Document-Statistical
SMC	Subordinate Manpower Claimant
SMR	Statement of Manpower Requirements
SMRDP	Shore Manpower Requirements Determination Program
SORM	Standard Organizational Manual
SQMD	Squadron Manpower Document
TAD	Temporary Additional Duty
TEMDU	Temporary Duty
TFMMS	Total Force Manpower Management System
TMMCA	TFMMS Micro Manpower Change Application
TPPH	Transients, Patients, Prisoners, and Holdees
TQM	Total Quality Management
UCL	Upper Control Limit
UIC	Unit Identification Code
U.S.	United States
WAF	Work-hour Availability Factor
WDC	Work Distribution Chart
WI	Workload Indicator
WK	Week/Weekly
WLF	Workload Factor
YR	Year/Yearly

APPENDIX M

GLOSSARY OF TERMS AND STANDARD SYMBOLS

ABSOLUTE ACCURACY: Size of error to be allowed in the sample when accuracy is set at a specified amount, regardless of the mean. Absolute accuracy is used primarily in Work Sampling. See Desired Accuracy.

ACTIVE DUTY: Full-time duty in the military service of the U.S. (other than active duty for training purposes).

ACTIVITY: A unit, organization, or installation performing a specific mission or function and established under a commanding officer, officer in charge, etc. (e.g., Naval Air Station, Naval Shipyard, Naval Station, a specific air squadron, ship, etc.).

ACTIVITY CODE: A ten-digit code identifying each activity. The first four numbers represent the type of activity (i.e., 1452: Naval Air Station), the next four numbers are unique to a specific activity, and the last two numbers indicate a parent-component activity relationship (00: parent activity, 01 - 99: component activity of the parent).

ACTIVITY MANPOWER DOCUMENT: The qualitative and quantitative expression of manpower requirements (military, civilian, and contractor) and authorizations (military) allocated to a Naval activity to perform the assigned MFTs or Required Operational Capabilities/Projected Operational Environment (ROC/POE). It has the following uses and applications:

a. As an expression of manpower needs of an activity, it is the authority used by CHNAVPERS and the applicable Enlisted Personnel Distribution Office to provide requisite military personnel distribution and Naval Reserve recall.

b. It is the basic document for current and future peacetime and mobilization Navy military manpower planning in the areas of personnel strength planning, recruiting, training, promotion, personnel distribution, and Naval Reserve recall.

c. It is the single official statement of organizational manning and manpower authorizations.

ACTUAL TIME: See Time.

ADDITIVE STANDARD: A manpower standard for additive workload.

ADDITIVE WORKLOAD: See Workload.

ADJUSTMENT FACTOR: Ratio of the appropriate monthly conversion factor to the number of sampling days used to measure productivity to adjust the sampling period to monthly work-hours.

ALLOWANCE FACTOR: A coefficient, which when applied to productive time (leveled time, if appropriate), results in the total allowed time.

ALLOWANCES (PF&D): Work-hours added to leveled or base time to provide for personal needs, fatigue, and unavoidable delay. (Usually applied as a percentage of the leveled, normal, or adjusted time.)

a. Personal - Allowance included in a standard to permit the worker to attend to personal necessities such as obtaining water, making trip to rest room, etc.

b. Fatigue - Allowance included in the production standard to allow for decreases or losses in production that might be attributed to fatigue (includes coffee breaks).

c. Delay - Allowance for unavoidable delay due to actions beyond the control of the worker or supervisor.

ALLOWED TIME: See Time.

APPROPRIATION: An annual authorization by an Act of Congress to incur obligations for specified purposes and to make payments out of the Treasury. Appropriations are subdivided into budget activities, subheads, programs, projects, etc.

ASSIGNED TIME: See Time.

ASSUMED WORKLOAD/ASSUMED TASKING: Work being accomplished which is not normally tasked or required of the work center/ organizational component (i.e., no identifiable tasking document). Assumed workload should not be used to support manpower requirements. (See Inferred Workload.)

AUTHORIZATION: A funded manpower requirement.

AVAILABLE TIME: See Time.

AVERAGE MONTHLY WORKLOAD: The arithmetical average of the actual monthly workload volumes.

AVOIDABLE DELAY: An unnecessary delay, regardless of source, that causes work stoppage. Time lost to avoidable delay will not be included in staffing standards or productive workload.

BACKLOG: An accumulated workload volume, not yet accomplished. It is the difference between work input and output.

BASELINE: A point of reference which is used as a benchmark for comparing manpower requirements and authorizations to present conditions. For example, the officer and enlisted manpower authorizations reflected in the most recent AMD will serve as the baseline for military manpower.

BIAS: The amount by which the long run observed mean value of a set of measurements differs from the true value of the quantity.

BILLET: A specific military manpower space, the manpower requirement and authorization, which is assigned qualifiers that define the duties, tasks, and functions to be performed and the specific skills and skill level required to perform these functions.

BILLET FILE: Manpower data base containing all quantitative and qualitative information on all manpower requirements and authorizations including those required for mobilization, and SELRES manpower requirements.

BILLET SEQUENCE CODE (BSC): A five-digit, ascending sequence of numbers determined by manpower claimants and/or activities to organizationally structure manpower requirements, organizational headers, and billet notes within an activity's AMD.

BILLET TITLE: A descriptive title that indicates the primary function of a specific requirement. Organizational titles and billet titles conform to the organization structure approved by the cognizant command, bureau, or office.

BORROWED TIME: See Time.

BUDGETING: A plan for accomplishing an organization's program objectives through planning, decision-making and management control for a specified period of time.

CAPABILITY: The ability to execute a specified course of action.

CATEGORY: A major subdivision of the PWS at the level analysis is performed. Each category represents a number of associated tasks. The sum of all categories should equal all work authorized and required to be performed by the work center.

CHAIN OF COMMAND: The succession of offices from a superior to a subordinate through which command is exercised.

CIVILIAN FULL-PERFORMANCE LEVEL: The typical working level in a function for an occupation that is not considered a trainee or developmental level. It is the grade level that best represents the permanent on-going duties performed in a function. The full performance grade level can be the target grade level up to which a trainee or developmental position progresses, any intermediate grade level described in an occupation, a journeyman grade level, or a premium journeyman grade level depending upon the nature of the non-trainee duties performed within a function.

COLLATERAL DUTY: Duty assigned to an individual by the commanding officer which is in addition to the individualəs primary duty. These duties are normally performed at the individual's permanent duty station.

COLLINEARITY: A condition of correlation among two or more independent variables. Collinearity causes least squares regression to become unstable.

COMBAT MANPOWER: Manpower associated with ships and aircraft squadrons. Combat manpower is all manpower associated with units included in the Strategic Forces and General Purpose Forces Defense Mission Codes (DMCs).

COMBAT READINESS:

a. When applied to organizations or equipment it means availability for combat operations; or

b. When applied to personnel it means qualified to carry out combat operations in the unit to which they are assigned.

COMMERCIAL ACTIVITIES (CA): A function either contracted or operated by a Navy field or headquarters activity that provides a product or service obtainable from a commercial source.

COMPONENT: A sub-unit of a parent activity established to permit separate accounting and management due to remote location, a different program element, or to support special personnel management. Identified by last two digits of the activity code and a separate UIC.

CONFIDENCE LIMITS: These limits are important in assessing the prediction errors in the model that is being considered. A set of limits or bounds is formed for each data point. When the limits are set at 95% confidence limits, their interpretation is as follows: We say we are 95% confident that the mean manning for activities with this level of workload is contained within the bounds. A tight set of bounds indicates a standard with good capacity for prediction.

CONTRACT WORK-YEAR EQUIVALENT: The number of work-years required if the contract were performed in-house at the same workload and level of performance as by the contractor.

CONTROL LIMITS: Values that prescribe the probable range from the original population within which the sample results will lie.

CORRELATION ANALYSIS: The process of determining the relationships that exist between independent variables or between independent and dependent variables.

CURVILINEAR: A relationship of plotted data that approximates a curved line.

CYCLE:

a. An interval or space of time in which one round of elements that recur regularly and in the same sequence is completed.

b. An interval or space of time during which a representative composition and amount of work is performed in a work center.

DATA ELEMENT: A basic unit of information having a unique meaning, which has subcategories (data items) of distinct units or values; e.g., pay grade, race, geographic location. In manpower, each item on the AMD is a distinct data element.

DEPARTMENT OF THE NAVY (DON): DON is composed of SECNAV; CNO;

the Headquarters, Marine Corps; the entire operating forces, including naval aviation, of the Navy and the Marine Corps, and the reserve components of those operating forces; all field activities, headquarters, forces, bases, installations, activities, and functions under the control or supervision of SECNAV; the Coast Guard when it is operating as a Service in the Navy. (Public Law 99-433)

DELAY ALLOWANCE: A time increment included in a time standard to compensate for unavoidable delays.

DEPRIVED RATING: Ratings and NECs in paygrades E-5 through E-9, requiring additional shore manpower requirements to meet CNO sea/shore rotation ratio goals.

DESIGNATOR: The primary specialty qualification category of an officer.

DESIRED ACCURACY: The maximum amount of error acceptable in a sample. This is stated as absolute accuracy or relative accuracy.

DIRECT TIME: See Time.

DIRECTED FUNCTION: A manpower requirement that has been established by a written directive from higher authority (CNO or SECNAV). Such positions are not automatically added to the validated manpower requirements of a work center; the overall work center manpower requirements are first determined, and the directed function is then identified within the total. In other words, the total workload and associated work-hours will be measured and equated to needed requirements. Every attempt should then be made to ensure that the directed manpower requirements are included with the total manpower requirements and not simply added to the total manpower requirement.

DISESTABLISHMENT: To eliminate an activity from DON. In this sense, the term usually applies to the elimination of shore (field) activities and thus cease to exist as separate activities.

DOWNGRADE: To lower the paygrade assigned to a manpower requirement and/or authorization.

DUTY: The assignment of an individual, usually for a 24-hour period, which requires his presence on board the activity to meet any demands with respect to security, safety, or mission

fulfillment, especially during periods which are other than normal working hours (i.e., weekends and the hours from 1630 one day until 0800 the following day).

ELEMENT: A group of fundamental hand and body motions which when grouped together form a division of work of sufficient length to be conveniently timed.

END STRENGTH: The funded number of active-duty military and civilian personnel in the Navy on the last day of the accounting period. This number includes those Navy military personnel serving with the Marine Corps, and those for whom reimbursement is received from other agencies or foreign nations. It does not include Navy military personnel paid from RPN appropriation funds.

EQUIVALENT (WEIGHTED) WORKLOAD FACTOR: A single constructed WLF value which is derived through a weighting of multiple work units. The weighting process is accomplished by selecting one unit as the "prime" work generator, assigning it a value of 1.00, and giving all other applicable work units a weighted value in relation to that prime factor.

ESTIMATED "N": The calculated minimum number of samples required to ensure a specified statistical accuracy and confidence in Work Sampling, GTT, and Time Studies.

EXCEPTION TO STANDARD: Any one of the following conditions causing noncompliance with a multi-point staffing standard: additive workload, excluded workload, or a deviation.

EXTRAPOLATION: Extension of the regression line beyond range of input data to increase standard's utility, to expand standard's applicability, and to prevent rapid obsolescence due to workload changes.

FATIGUE: A physical and/or mental weariness, real or imaginary, existing in a person, adversely affecting the ability to perform work.

FATIGUE ALLOWANCE: See Allowances (PF&D).

FORCE: An aggregation of military personnel, weapon systems, and necessary support or combination of such elements.

FORCE STRUCTURE: The aggregation of units and personnel associated with the fleet and shore establishment required for

sustained performance of the defense mission. Force structure does not include manpower associated with TPPH, students, midshipman, and officer candidates.

FRACTIONAL MANPOWER: Manpower requirements to do a specific workload, expressed in fractional parts of whole manpower requirements.

FRACTIONAL MANPOWER CUT OFF VALUES: Highest value to which fractional manpower can equate before the manpower requirement is rounded to the next higher integer.

FUNCTION: The aggregation of occupationally related tasks within a mission.

FUNCTIONAL AREA CODE (FAC): A one-position alpha-numeric code used to identify additional manpower requirement and/or authorization information, special consideration in detailing personnel, and provides for automated tracking of certain categories of manpower authorizations.

FUNCTIONAL SPONSOR: An official at the OPNAV, manpower claimant, or Subordinate Manpower Claimant (SMC) level having technical knowledge of or cognizance over specific mission and/or functional areas. Functional sponsors provide assistance in manpower requirements determination.

FUNCTIONS: The appropriate responsibilities or assigned duties, responsibilities, missions, or tasks of an individual office or organization. The first organizational breakdown of the mission into its organizational levels. The function often corresponds to the departmental level.

FUTURE YEARS DEFENSE PLAN (FYDP): The official program that summarizes Office of the Secretary of Defense (SECDEF) approved plans and programs for DOD. The FYDP is published at least annually. The FYDP is also represented by a computer data base which is updated regularly to reflect budget decisions and reprogramming actions.

GRADE: A step or degree in a graduated scale of military rank or civilian grade that has been established by law or regulation.

GROUP TIMING TECHNIQUE (GTT): A work measurement technique that can be used to advantage in studying a group of workers or machines involved in producing a common work unit. It is a

statistical sampling technique similar to Work Sampling.

HORIZONTAL PROCEDURE CHART: A methods tool which provides a graphic representation of the flow of information. Its principal use is in administrative functions where the product consists of information, usually in the form of paperwork.

INCUMBENT: The individual assigned to a particular manpower requirement.

INDIRECT TIME: See Time.

a. TPPH

(1) TRANSIENTS. This category contains only the transient program element, and consists of active duty military personnel in travel, leave in route, or temporary duty status (except for training) while on Permanent Change of Station orders.

(2) PATIENTS, PRISONERS, AND HOLDEES. This category contains only the Personnel Holding Account program element consisting of active duty military personnel dropped from the assigned strength of an operational or training unit for reasons of medical, disciplinary, or separation non-availability.

b. STUDENTS, TRAINEES, AND CADETS/MIDSHIPMEN. This category contains active service officer students, active enlisted students, active enlisted trainees, Service Academy Cadets and Midshipmen, and active officer accession students not assigned to a specific unit or activity.

INDUSTRIAL ENGINEERING:

a. The art and science of utilizing and coordinating personnel, equipment, and materials to attain a desired quantity and quality of output at a specified time at an optimum cost. This may include gathering, analyzing, and acting upon facts pertaining to buildings and facilities, layouts, personnel organizations, operating procedures, methods, processes, schedules, time standards, wage rates, wage payment plans, costs, and systems for controlling the quantity and quality of goods and services.

b. The design, improvement, and installation of integrated systems of personnel, materials, and equipment. It draws upon specialized knowledge and skill in mathematical, physical, and

social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems.

INFERRED WORKLOAD/INFERRED TASKING: Workload being performed by a person in a given work center/organizational component, but which is defined as the responsibility of another work center/organizational component or is not specifically tasked to a work center/organizational component but is "inferred" by the general tasking. It can be treated by transferring either the workload (prior to measurement), or the time expended on that workload (after measurement), to the appropriate work center/organizational component. If not specifically tasked, the workload should be validated with the manpower claimant prior to using to support manpower requirements.

LEVELED TIME: See Time and Leveling.

LEVELING: Process whereby an analyst evaluates observed operator performance in terms of a concept of normal performance. Synonym: performance rating.

LINEAR: A relationship of plotted data that approximates a straight line.

MACRO MODELS: Manpower estimating models which use various data sources to produce roughly right predictions of manpower requirements. Emphasis is placed on utilization of programmable variables which can be used in the PPBS/POM process. See Manpower Estimating Models (MEMs).

MANAGEMENT INFORMATION SYSTEMS (MIS): Existing data bases which should be used when possible as a source of input for developing staffing standards, MEMS, and other manpower related studies/ information.

MANNING: The specific inventory of personnel at an activity in terms of numbers, grades, and occupational groups.

MANPOWER CLAIMANT: In the Resource Management System, the major commanders or bureaus that are authorized manpower resources directly by CNO for the accomplishment of the assigned missions and tasks.

MANPOWER ESTIMATING MODEL (MEM): Estimators that relate total manpower requirements to program oriented independent variables. MEMs permit Navy to predict out-year manpower requirements.

(See Macro Models.)

MANPOWER MANAGEMENT: The methodical process of determining, validating, and using manpower requirements as a basis for budget decisions; determining manpower authorization priorities based on available funding and personnel inventory; and the ability to
link all these factors together.

MANPOWER MODELS: Mathematical equations which best describe the relationship between the independent workload variable(s) and manpower requirements.

MANPOWER REQUIREMENT: The minimum quantitative and qualitative resource needed to perform a specific mission, function, or task.

MANPOWER RESOURCES: Human resources available that can be applied against manpower requirements.

METRIC: A standard measure of mission/function performance that may be used for analysis of activity-based costing and/or equitable distribution of associated resources (may be a programmable work generator or a production output count).

MINIMUM MANPOWER FACTOR: Fractional manpower value that shows the work-hours a requirement must be manned. These work-hour values are dictated by the need for one or more individuals to be on duty although they may not be continuously productive.

MILITARY ESSENTIALITY CODE (MEC): A code to denote the reason for military staffing (i.e., combat readiness, law, training, discipline, or military background).

MILITARY SKILL: Skill associated with a military paygrade as opposed to occupational specialties. Defined for enlisted personnel under the Naval Standards section of the Occupational Standards.

MISSION: The highest generalized level of descriptive official tasking by higher authority required to accomplish the Navyэs assigned war fighting and support capability.

MOBILIZATION: The act of assembling and organizing national resources to support national objectives in time of war or other emergencies. This includes activating all or part of the reserve components, as well as assembling and organizing

personnel, supplies, and material.

MULTILINEAR: A mathematical term which is applied to a multi variate equation and is limited to linear relationships.

MULTIVARIATE: A mathematical term used to designate an equation that consists of two or more independent variables and one dependent variable. The equation may be either linear or curvilinear.

MUTUALLY EXCLUSIVE: Occurrences or outcomes of an event which cannot happen at the same time.

NAVY STANDARD WORKWEEKS: The total times expressed in average hours per week, that are available per person to accomplish the required workload (including watches) of the various types of Navy units. Navy standard workweeks are key elements in the calculation of Navy manpower requirements.

NONAVAILABLE TIME: See Time.

NONBUDGETED MANPOWER: Manpower resources used by an activity which are not included in the activity's budget line (e.g., TAD, transient, nonappropriated funded, reserves, military students, marines, borrowed, and other (miscellaneous) support such as volunteers, civilian student aids, interservice support received categories).

NONPRODUCTIVE TIME: See Time.

OBSERVATION: In work sampling and GTT, the act of noting what the people in a work area, or a specific portion of a work area, are doing at a specific instant. Such an observation yields a number of samples equal to the number of people observed.

OCCUPATIONAL STANDARDS: Standards that express the Navy's minimum requirements for enlisted occupational skills.

ON-THE-JOB-TRAINING (OJT): Generally means the process of learning while producing.

OPERATIONAL AUDIT (OP Audit): The process of measuring work by personal interview/questionnaire, using either one to gather and verify work center work-hours and production workload. Op Audit can use any one or a combination of Historical Experience, Good Operator, Best Judgment, and Directed Requirement techniques.

ORGANIZATION ANALYSIS: A method for evaluating organizational structure. It examines structure effectiveness and economy with respect to the mission and includes development of a suitable organization.

ORGANIZATIONAL COMPONENT: Grouping of personnel performing work in support of a common function/subfunction, usually in a centralized area. Similar to Work Center.

ORGANIZATIONAL CONCEPT: Division of an activity into small physical units which become work centers irrespective of function or functions performed.

OUTLIERS: A term used to describe data points that do not conform to the general pattern or trend described by a data array or scattergram. For example, data points beyond established control limits or significantly divergent from an otherwise apparent trend.

OUTPUT: The amount of something produced by a system or process during a given span of time.

OVERTIME: See Time.

PACE RATING: A method of rating a worker's performance that judges the speed or pace of an operation relative to an established concept of normal speed for the type of work observed. The rating is given as a performance percentage at above, below, or normal; and the ratio or factor is applied to the actual time to compute leveled or normal time. See Leveling.

PARAMETER. A characteristic or property of a population. The analogous measure for a sample is a statistic. One system of notation is to use Greek letters for parameters and the corresponding Roman letters for statistics. However, capital letters are generally used for parameters and lower case letters are used for statistics.

PERFORMANCE WORK STATEMENT (PWS): Identifies what work is to be done to the maximum extent practicable without stating how to do it. It identifies standards of performance to be met in measurable terms of quality, quantity and timeliness.

PERSONNEL ASSIGNED: A tabulation of all officer and enlisted personnel charged to an activity. This information is presented in the unit's ODCR and EDVR.

PERSONNEL INVENTORY: Numbers of personnel available by occupational classification, paygrade, and distribution category.

PLANNING, PROGRAMMING, AND BUDGETING SYSTEM (PPBS): Assists the CNO and SECNAV in making decisions regarding the allocation of Navy resources. A formalized procedure by which strategy is developed in consideration of the threat. Force requirements are developed to support the strategy; programs are developed to provide over a period of time the ships, aircraft, weapons systems and manpower for the force requirements. Programs are reviewed for execution, estimates are refined and funds are budgeted to obtain the required manpower and weapons systems. At the DON level the system produces inputs to the DOD planning process, the DON POM, DON budget estimates and DON input to the President's budget.

PROCEDURE CHART: A graphic display showing the flow of material or information in an organization. It reflects the flow of information between work stations and between work areas, shows decisions made, and actions.

PRODUCTIVE TIME: See Time.

PROGRAM:

a. A combination of program elements designed to express the accomplishment of a definite objective which specifies the time-phasing of required actions and the means proposed for its accomplishment. Programs are aggregations of PEs based upon the first two numbers in the PE code, and in turn, aggregated to the total FYDP.

b. A plan or scheme of action designated for the accomplishment of a definite objective which is specific as to the time-phasing of the work to be done and the means proposed for its accomplishment, particularly in quantitative terms, with respect to manpower, material, and facilities' requirements. The program provides a basis for budgeting.

PROGRAM ELEMENT (PE): Identifies and allocates resources to a specific Navy warfare and/or supportive program. Resources include Navy personnel, equipment, and facilities.

PROGRAMMING: The process of translating planned force

requirements into time-phased manpower over the FYDP.

PROGRAM OBJECTIVES MEMORANDUM (POM): Document in which each military department and Defense agency recommends and describes biannually its total resource and program objectives. Program objectives are fiscally constrained. To allow flexibility for each service to develop balanced programs, reallocation of funds is permitted between major mission and support categories unless specifically stated otherwise in SECDEF's Fiscal Guidance Memorandum.

PROGRAM YEAR: A fiscal year in the FYDP that ends not earlier than the second year beyond the current calendar year. Thus, during the calendar year l997, the first program year is FY99.

PROJECTED WORKLOAD: An amount of work proposed or anticipated in the future to meet the requirements of a program/function.

PROJECTED OPERATIONAL ENVIRONMENT (POE): The environment in which the ship or squadron is expected to operate, including the military climate (e.g., at sea, at war, capable of continuous operations at readiness Condition III).

QUALITY: The skill, grade, and experience associated with the manpower requirement and/or authorization.

QUALITY CONTROL: Those actions taken by the performing organization to control the production of goods or services so that they will meet the requirements of the PWS.

RANDOM NUMBER TABLE: A table of numbers arranged in a random fashion used to make random times for observation in Work Sampling and GTT studies.

RANDOM SAMPLE: A sampling method whereby each item/output in a lot has an equal chance of being selected.

RANDOM SAMPLING: A method of looking at a few individual items in a lot to determine the quality of that lot against a standard.

RATE: Identifies enlisted personnel occupationally by paygrades E-1 through E-9.

RATING: A broad enlisted career field identifying an occupational specialty that encompasses related aptitude, training experience, knowledge, and skills for the purpose of

career development and advancement.

REGRESSION ANALYSIS: The process of determining, from a series of data sets, a functional relationship between a dependent variable and one or more independent variables.

REQUIRED OPERATIONAL CAPABILITY (ROC): Statements prepared by mission and warfare sponsors which detail the capabilities required of ships and squadrons in various operational situations. The level of detail sets forth which weapons will be ready at varying degrees of readiness (e.g., perform Anti-Air warfare with full capability condition of readiness I; partial capability in condition of readiness III).

REQUIREMENT: A specific manpower space which is assigned qualifiers that define the duties, tasks, and functions to be performed and the specific skills and skill level required to perform the delineated functions.

RESERVE UNIT IDENTIFICATION CODE: UIC for a drilling reserve unit.

RESOURCE SPONSOR: OPO responsible for an identifiable aggregation of resources which constitute inputs to warfare and supporting tasks. The span of responsibility includes interrelated programs or parts of programs located in several mission areas.

RISK ANALYSIS: A technique for assessing the risk associated with reducing or eliminating functions/sub-functions. This is accomplished by assigning a priority code to all functions/ subfunctions. Impact statements for lowest priority work are developed for use by management in deciding whether to eliminate or reduce low priority tasking.

ROUNDING: The elimination of unwanted numbers in computation after intermediate calculations.

SAMPLE: A sample consists of one or more items/outputs drawn from a lot, the outputs being chosen at random. The number of outputs in the sample is the sample size.

SCATTER DIAGRAM: A two-dimensional chart on which known values of two variables are plotted. Examination of the chart indicates the form of the relationship which may exist between the variables (e.g., linear or nonlinear).

SEA/SHORE ROTATION RATIO: This ratio represents the number of years that are required at sea, on average, for a certain number of years of shore duty.

SERVICE DIVERSIONS: Service diversions are actions required of personnel by regulations or standard routine which must be accomplished during working hours and which detract from an individual's availability to do productive work.

SHORE MANPOWER REQUIREMENTS: Claimant-approved quantitative and qualitative manpower requirements for a naval shore activity.

SPAN OF CONTROL: A concept of the scope of supervision required to provide effective management, subject to such variants as the number and kind of personnel reporting directly to a supervisor, the type of supervision required, the kind of work performed, the distance at which the work is performed, and the effect this distance has on the reaction time required.

SPONSOR: A broad term covering responsibilities assigned a command, bureau, or office in support of a designated project. Sponsor responsibility may include: justification of funds, program objectives, technical guidance, procurement, manpower, training, and other matters.

STAFFING STANDARD: Depicts the quantitative and qualitative manpower required to accomplish a specific function(s) from the lowest to the highest workload values.

STANDARD: An acknowledged measure of comparison.

STANDARD, PRODUCTION: A measure of time allowed to accomplish a specific unit of work. It is based on an average trained, skilled, and experienced operator working at a normal pace, plus PF&D allowances to accomplish work by using a standardized process or method.

STANDARD TIME: See Time.

STATEMENT OF MANPOWER REQUIREMENTS (SMR): For shore activities, displays an activityэs approved quantitative and qualitative peacetime manpower requirements.

SUBFUNCTION: A further breakdown of the functions supporting an activity's mission until groupings of personnel are identified as an organizational component. See organizational component.

SUBORDINATE MANPOWER CLAIMANT: A command or activity immediately subordinate to the manpower claimant.

SUPPORT MANPOWER: Shore manpower associated with shore activities. Support manpower is all manpower associated with units included in categories not included in combat manpower.

SYSTEM: A group of interacting, interrelated, or interdependent elements forming a collective entity.

TASK: A subdivision of work within a particular category.

TASKING DIRECTIVE: Any document from higher authority which generates a requirement to perform work.

TIME: The various classifications or categories of time are listed together under this major heading to facilitate selection of the precise term required.

a. Accountable Time. The total work-hours for which the work center supervisor is held accountable in determining productive or operational efficiency. It equates to assigned time plus borrowed time plus overtime minus nonavailable time minus loaned time. Accountable time consists of productive time (direct and indirect categories) and nonproductive time (environmental effects, personal, PF&D, idle, and standby).

b. Actual Time. The time taken to complete a defined amount of work. In Time Study, it is the observed time recorded from the watch readings. In Work Sampling, it is the portion of total sampled time that has been expended on each sampling category.

c. Allowed Time. The leveled time plus allowances for personal fatigue and unavoidable delays. If leveling is neither required nor feasible, the allowed time is the actual productive time plus necessary allowances for PF&D, as appropriate.

d. Assigned Time. The total work-hours assigned to the work center. (NOTE: Borrowed personnel are not classified as assigned for purposes of this computation. See Borrowed Time.)

e. Available Time. The total hours assigned personnel are available to the work center to perform work. It equates to assigned time minus nonavailable time.

f. Borrowed Time. Time on loan from other work centers.

g. Direct Time. Productive time expenditure which can be identified with and assessed against a particular end product (work unit, WLF, etc.) or group of products accurately and without undue effort and expense.

h. Idle Time. Any time expended by the worker in either an avoidable delay status, or accomplishing unnecessary work, when assigned work is available. It does not include time for PF&D. Idle time is not included in a staffing standard. An individual going to the base exchange, etc., with the above conditions met, would be classified as being in an idle time status.

i. Indirect Time. Time that is expended in work categories necessary to production, but which cannot be specifically assessed against a particular product or group of products accurately or without undue effort and expense.

j. Leveled Time. Actual productive time adjusted to account for differences in pace on the part of the workers observed.

k. Loaned Time. Time loaned to other work centers. This time is not accountable to the work center providing the loaned time.

l. Nonavailable Time. Work-hours assigned to a work center but not available for productive effort for reasons which are essentially beyond the control of the work center supervisor (e.g., absences for leave, sick call or hospitalization, general military training, and administrative duties such as special cleanup details (external to the work center), taking a physical examination, verifying personnel records, and taking advancement exams).

m. Nonproductive Time. Accountable time expended in either personal, rest, unavoidable delay, standby, or idle (avoidable delay) status.

n. On Call Time. A nonproductive category of time in which an off-duty worker can be contacted by telephone or other means at a prearranged location other than the work station. Only the productive time performed by the worker in the work center or at the work location, including necessary associated travel, is to be credited to the work center. Examples are: a photographer needed to periodically take photos after duty hours or a maintenance specialist who is needed infrequently to repair or replace a critical item of equipment.

o. Overtime. Time worked in excess of regularly scheduled working time.

p. Productive Time. Time expended performing work that is useful and essential to the mission of the work center (see Direct Time, Indirect Time).

q. Sampled Time. The total work-hour population from which samples are drawn in a Work Sampling study. It is the sum of the hours each individual was subject to observation during the study.

r. Standard Time

(1) Time that is considered necessary for a qualified workman, working at a normal pace ordinarily used under capable supervision and experiencing normal fatigue and delays, to do a defined amount of work of specified quality when following the prescribed method.

(2) The normal or leveled time plus allowances for fatigue and unavoidable delays.

s. Standby Time. A category of time in which the worker is required to be present, in a ready status to perform work, but is prevented from performing work because none is available. Time can be classified as standby only when it is essential to mission accomplishment and no work can be done or made available during that period. Examples of standby are: a Plane Captain awaiting return of his aircraft from a mission; transient alert personnel awaiting arrival or departure of transient aircraft; and a commissary cashier awaiting customers to enter the check out line.

TIME STUDY: A work measurement technique using a stop watch to determine actual elapsed time for performing tasks. It is primarily used in areas which have highly standardized and repetitive tasks.

TRAINING: Instruction which provides the learner with knowledge and skills required for immediate application in the accomplishment of a specific task or combination of tasks.

TRAINING REQUIREMENT:

a. A requirement to train personnel in a specified quantity

to perform identified duties and thereafter be available for assignment to the duties at a specified time.

b. A requirement for a training or educational program which will produce trained personnel for an identified purpose.

c. The performance which is required of a person in order to be effective in a given situation. Thus, the jobs to which individuals are assigned have performance connotations, which are training requirements in the sense that the individuals must be trained to perform as required.

d. A need, established by the training organization, for support of specified nature.

TRANSIENT AVAILABILITY FACTOR: The factor used to adjust normal productive time to account for the actual availability of transients to do work.

TRANSIENTS, PATIENTS, PRISONERS & HOLDEES (TPPH). (See Individuals Account.)

UNAVOIDABLE DELAY: An occurrence which is essentially outside the worker's control or responsibility that prevents him from doing productive work.

UNAVOIDABLE DELAY ALLOWANCE: See Delay Allowance.

UNIVERSE: The total activities considered as performing a function for staffing standards development and application.

UNIT IDENTIFICATION CODE (UIC): A five position numeric or alpha-numeric code assigned by the Comptroller of the Navy (NAVCOMPT) to ships, aircraft, units, shore activities, divisions of shore activities, commands, bureaus and offices, contractors' plants, and in some instances to functions or the specialized elements for identification. By use of this code, programming decisions can be related to organizational units and to commands, bureaus and offices responsible for administering funds affecting those units.

WATCH: That period during a duty day wherein an individual is assigned and required to be at a specific place to carry out such functions as security, safety, and communications. Normally, this period will be of four hours' duration and will fall between the hours at the end of one work day and the beginning of the next. Total work-hours expended in the watch

category are counted as productive work in the computation of the minimum manpower requirements.

WORK: A series of actions, changes, or functions that bring about an end result.

WORK AREA: The physical location in which work is accomplished.

WORK CENTER: A grouping of personnel using similar machines, processes, methods, operations, and performing homogeneous type work, usually located in a centralized area. The term is used to identify a relatively small activity within a broad functional segment. Personnel within a work center perform work that basically contributes to the same end product or result, and their duties are similar or closely related.

WORK COUNT: A summation of the number of work units completed during a specified time period.

WORK CYCLE: That time required, from start to finish, to produce a completed work unit (product).

WORK-DAY: A unit of work equal to the productive effort of one person working one normal, 8-hour workday.

WORK-HOUR: A unit of work equal to the productive effort of one person working one hour.

WORK-HOUR AVAILABILITY FACTOR (WAF): The average number of work-hours per month an assigned individual is available to perform primary duties. Required work-hours are divided by the WAF to determine the manpower requirements.

WORK-WEEK: A unit of time that relates to a normal workweek per individual (e.g., one workweek per 10 employees = 10 work-weeks).

WORK-YEAR: A unit of work equal to the productive effort of one person working eight hours per day, five days per week for a period of 1 year, adjusted to include paid leave and holidays.

WORK DISTRIBUTION ANALYSIS: A technique to improve production that helps find out what work is being done, how much time is spent on it, and who is doing it.

WORK MEASUREMENT: A technique employed independently or in

conjunction with cost accounting for the collection of data on work-hours and production by work units, so that the relationship between work performed and work-hours expended can be calculated and used as the basis for manpower planning, scheduling, production, budget justification, performance evolution, and cost control.

WORK SAMPLING: Work Sampling is a work measurement tool based on the laws of probability and consists of taking observations at random intervals. Inferences are drawn, from the proportion of observations in each category, concerning the work area under study.

WORK UNIT: The basic identification of work accomplished or services performed. Work units should be easy to identify, convenient for obtaining productive count, and usable for scheduling, planning, and costing.

WORKLOAD: An expression of the amount of work, identified by the number of work units or volume of a WLF, that a work center has on hand at any given time or is responsible for performing during a specified period of time.

a. Additive Workload. Work requirements of a specific activity which are in addition to work requirements common to other like activities.

b. Excluded Workload. Work not required at a specific activity which is required and common to other like activities.

c. Deviation. Procedural, equipment, or climate differences that cause significant time variations in common tasks at like activities.

WORKLOAD FACTOR (WLF): An index or unit of measure which is consistently relatable to the work required to accomplish the defined responsibilities of the work center.

a. Work Generator (External). WLFs beyond the control of the work center which influence the amount of work required. Examples are station military population or monthly flying hours. These factors are likely to be predictable (programmable) and are probably already being reported.

b. Production (Internal). Units of output physically produced by the work center. Common examples are engines repaired or customers served. These factors may be more

difficult to program or collect, but are usually highly related to direct work-hours expended.

c. Equivalent (or Weighted). WLFs which are artificially constructed following measurement from weighted combinations of either external, internal, or both types of WLFs. These factors eliminate or reduce the need for multivariate equations, and are particularly useful where all WLFs do not exist for all locations. Since relationships are seldom known prior to measurement, potential equivalent WLFs are rarely encountered.

WORKLOAD INDICATOR (WI): A broad index used to measure work and establish a relationships between workload and manpower requirements.

ZERO BASE REVIEW: An analysis of the Navy's capabilities to provide certain services as compared to the Navy's total requirements to provide these same services. As applied to manpower, the Zero Base Review is a tool used to determine the location, the total number, and grade of the requirements needed to produce these services.

STANDARD SYMBOLS

f = Frequency

g = (gamma) Exponent on an X value

LCL = Lower control limit

N = Total samples or observations

n' = Average daily samples

p = Percent occurrence - estimated

p' = Percent occurrence - daily

$\bar{P}$ = Percent occurrence - actual

R = Rating(s)-individual

$\bar{R}$ = Rating(s)-average

r = Coefficient of correlation

r^2 = Coefficient of determination

s = Accuracy of a sample (absolute)

$Sy.x$ = Standard error of estimate

UCL = Upper control limit

CV = Coefficient of variation

X = Independent variable

$\bar{X}$ = Arithmetic mean of "X" values

Y = Dependent variable

$\bar{Y}$ = Arithmetic mean of "Y" values

Yc = Computed value of dependent variable

Σ = (Sigma) Sum of

Sy = Standard deviation (dependent variable)

y = Estimated dependent variable