DOCUMENT RESUME

ED 084 378 CE 000 529

AUTHOR Harris, Alma P.; McCormick, Ernest J.
TITLE The Analysis of Rates of Naval Compensation by the Use of a Structured Job Analysis Procedure.
INSTITUTION Purdue Univ., Lafayette, Ind. Occupational Research Center.
SPONS AGENCY Office of Naval Research, Washington, D.C. Personnel and Training Research Programs Office.
REPORT NO TR-3
PUB DATE Sep 73
NOTE 113p.; For related document, see CE 000 530

EDRS PRICE MF-$0.65 HC-$6.58
DESCRIPTORS Behavior Standards; *Comparative Analysis; Enlisted Men; Factor Analysis; *Job Analysis; *Military Personnel; Questionnaires; Rating Scales; *Salary Differentials; Wages
IDENTIFIERS United States Navy

ABSTRACT

The study deals with the experimental application of a structured job analysis procedure to enlisted and officer billets in the Navy, with particular reference to its potential use in relating naval compensation for billet incumbents to compensation for civilian jobs with similar characteristics, and in assessing its utility for allocating naval billets to pay grades. The Position Analysis Questionnaire was used to analyze 607 enlisted and 249 officer billets in the study. Comparisons made between the naval compensation for the billet incumbents and the civilian job values revealed that naval compensation was systematically and substantially lower than civilian employees compensation on jobs with corresponding characteristics. An analysis of PAQ data as the potential basis for the allocation of billets as pay grades reflected reasonable promise for such use in the case of enlisted billets, but not in the case of officer billets. (Author/AG)

THE ANALYSIS OF RATES OF NAVAL COMPENSATION BY THE USE OF A STRUCTURED JOB ANALYSIS PROCEDURE

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Prepared for:

Personnel and Training Research Programs
Psychological Sciences Division
Office of Naval Research

Contractor:

Purdue Research Foundation
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Principal Investigator

Contract No. N00014-67-A-0226-0016
Contract Authority Identification Number NR 151-331

Report No. 3

September 1973

Unclassified
Security Classification

DOCUMENT CONTROL DATA · R & D
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author)
Occupational Research Center
Department of Psychological Sciences
Purdue University, West Lafayette, IN 47907

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b. GROUP
Not applicable

3 REPORT TITLE
THE ANALYSIS OF RATES OF NAVAL COMPENSATION BY THE USE OF A STRUCTURED JOB ANALYSIS PROCEDURE

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)
Technical Report #3

5 AUTHOR(S) (First name, middle initial, last name)
Alma F. Harris and Ernest J. McCormick

6 REPORT DATE
September, 1970

7a. TOTAL NO. OF PAGES
98

7b. NO. OF REFS
21

8a. CONTRACT OR GRANT NO.
N00014-67-A-0226-0016

b. PROJECT NO.
NR 151-331

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
Not applicable

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
Not applicable

10 DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited. Reporduction in whole or in part is permitted for any purpose of the United States Government.

11 SUPPLEMENTARY NOTES
Not applicable

12 SPONSORING MILITARY ACTIVITY
Personnel & Training Research Programs
Office of Naval Research (Code 458)
Arlington, VA 22217

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Unclassified
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Civilian compensation rates						
Factor analysis of job variables						
Fringe benefits						
Job analysis						
Job dimensions						
Job evaluation						
Job factors						
Job quantification						
Navy billet analysis						
Naval compensation rates						
Policy capturing of compensation practices						
Position Analysis Questionnaire (PAQ)						
Prediction of compensation rates						
Wage and salary administration						
Worker-oriented job variables						

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INTRODUCTION

This study deals with the experimental application of a structured job analysis procedure to enlisted and officer billets (i.e., jobs) in the navy. (A "structured" job analysis procedure involves the analysis of jobs in terms of the relevance of each of a number of specific job components, the analysis typically providing for indicating quantitatively the relevance of each such component.) The basic instrument used was the Position Analysis Questionnaire (PAQ) which had been used with reasonable effectiveness as the basis for the analysis of many civilian jobs. This study represented, in effect, an extension of the use of the PAQ to naval billets with particular reference to its potential use for the two-fold purposes of relating naval compensation for incumbents of naval billets to that of the compensation for civilian jobs with similar characteristics, and of assessing its utility for allocating naval billets to pay grades. For purposes of this study a navy version of the PAQ was used. (The development of this will be discussed later.)

Before describing the present study it would be useful to discuss the nature of the PAQ and to summarize briefly its applications to civilian jobs.

Position Analysis Questionnaire (PAQ)

McCormick (1959) proposed that descriptions of work activities could be categorized as either "job-oriented" or "worker-oriented." That is, activities could be described in terms of the technological processes or operations making up the job, or in terms of the human behaviors involved. The two classes of variables are illustrated with the following examples. We could say, for example, that a baker "bakes bread." This would be a statement of a job-oriented element. To express what the worker does, however, in terms which may also be used in describing corresponding activities on very different types of jobs, we must use other descriptive statements of a worker-oriented nature, such as, "manually pours ingredients into container," or "observes conditions of product in process."

Since worker-oriented job elements tend to characterize the basic types of "human behaviors" in jobs, they could be used as common denominators across jobs of many technologically-different types, to reflect similarities, or conversely differences, between and among jobs in terms of such human behaviors. Going one step further, it could be hypothesized that jobs that have in common some particular human behavior or combination thereof would also have in common--insofar as the specific behavior or combination is concerned--similar personnel requirements (such as aptitudes). Likewise one could hypothesize that they would impose common personal demands upon the incumbents, and that these common personal

demands, in turn, would warrant reasonably comparable compensation rates—at least with respect to the demands imposed by their common characteristics.

The PAQ in its present form (Form B) is the result of a series of previous instruments developed over several years (Palmer, 1958; McCormick, Cunningham, and Gordon, 1967; McCormick, Jeanneret, and Mecham, 1972).

The Nature of the PAQ

The PAQ consists of 194 job elements of a worker-oriented nature. Some of the job elements provide for characterizing human behaviors directly, such as "Color perception" or "Finger manipulation." Others do not characterize human behaviors directly, but rather do so by inference. For example, the job element "Operates keyboard devices," by implication suggests the human behaviors involved. Still others, such as job element "High temperature" tend to characterize job situations or contexts to which the incumbent must adapt or adjust, thus implying the form of human behavior (i.e., the adaptation or adjustment) that the job demands.

Generally, the elements have been selected to encompass the range of behaviors associated with an S-O-R (Stimulus-Organism-Response) model. The six PAQ division titles are listed below, along with a "question" that the analyst is to keep in mind while going through that particular division. It can be noted that the S-O-R paradigm is reflected in the first three divisions.

1. Information Input (Where and how does the worker get the information he uses in performing his job?)

2. Mental Processes (What reasoning, decision-making, planning, and information processing activities are involved in performing the job?)

3. Work Output (What physical activities does the worker perform and what tools or devices does he use?)

4. Relationships With Other Persons (What relationships with other people are required in performing the job?)

5. Job Context (In what physical and social context is the work performed?)

6. Other Job Characteristics (What activities, conditions, or characteristics other than those described above are relevent to the job?)

Various rating scales are provided for use with the PAQ, the scale used with a given job element being that which is considered to be most appropriate for use with that element. Five of these scales are used somewhat generally, each for a number of PAQ job elements, while more

specific, individual scales are provided for use with certain job elements, not readily amenable to rating with the "general" scales. Following are examples of two of the general scales:

Code	Extent of Use (U)
DNA	Does not apply
1	Nominal/very infrequent
2	Occasional
3	Moderate
4	Considerable
5	Very substantial

Code	Applicability (A)
DNA	Does not apply
1	Does apply

The remaining three general scales are entitled Amount of Time, Importance to the Job, and Possibility of Occurrence. The Position Analysis Questionnaire (PAQ) (actually the navy version--to be discussed later) is included in Appendix A; this shows the job elements and the rating scales used with them.

Previous Research with the PAQ

The research to date with the PAQ has been adequately reviewed elsewhere (McCormick, Jeanneret, & Mecham, 1969; 1972), so will not be repeated here. A few points, however, will be mentioned that apply rather directly to the present study.

First, as was mentioned in the discussion of the worker-oriented elements, much of McCormick's work has been based upon the hypothesis that there is some behavioral structure or order underlying the "domain" of human work. The concept of the worker-oriented element was developed and refined as an aid in the investigation and utilization of any such order. To further delineate any underlying structure, each of the previous instruments developed by McCormick and his associates has been factor analyzed (Palmer, 1958; McCormick, Cunningham, & Gordon, 1967; Jeanneret & McCormick, 1969). For the PAQ factor analysis, a sample of 536 job analyses was used, the analyses of these jobs having been performed in, and by, 70 participating organizations. Five factors were first obtained from the factor analysis of the entire PAQ, and 27 additional factors were obtained from separate factor analyses of the job elements within each of the six divisions of the instrument. These 32 PAQ factors are regarded as reasonably stable job "dimensions" which can be used to characterize the behavioral activities and related aspects of a broad variety of jobs, across a wide range of industries.

As implied above, it could be hypothesized that jobs that were reasonably equivalent in terms of any given job component would also be somewhat comparable in the demands made on the job incumbents, and that consequently they should be approximately equivalent in the wage or salary rates that would be relevant--insofar as that common component is concerned. Carried a step further this would suggest that the total job value might somehow be related to the composite of the behaviorally-characterized components of the jobs. In the research with the PAQ

the "components" dealt with are the job dimensions resulting from the factor analyses.

To test this hypothesis, 340 of the 536 jobs used in the PAQ factor analysis were divided into two subsamples. Then various combinations of the PAQ elements and dimension scores were used as predictors in a multiple regression analysis, within each of the subsamples, with actual job earnings as the criterion variable. This provided optimal weights, for certain statistically identified job dimensions and elements, for the prediction of the actual pay associated with the jobs in the sample. A double cross-validation procedure was then carried out, which involved taking the weights derived from one subsample and applying them to the jobs in the other and vice versa. The resulting "predicted" rates of pay were then correlated with actual rates in each cross-validation sample. This analysis process was repeated three times, using as predictors, first scores on the 5 overall dimensions, then scores on the 27 divisional dimensions, and finally the ratings given by analysts on each of a number of selected individual elements. The correlation coefficients obtained in the cross-validation samples ranged between .83 and .87 (Mecham, 1970; McCormick, et al., 1972).

A systematic method of deriving predicted job values has been developed which is based on the PAQ and the above research. Briefly, the job to be evaluated is analyzed with the PAQ; the factor score matrix, obtained as described above, is used to weight the elements for the derivation of the 32 dimension scores; and finally the regression weights, derived as described, are applied to the dimension scores of the job for those dimensions which had been found to be most predictive. The predicted job values resulting from this process can be viewed as reflecting the compensation structure found in the regression sample. That sample, as mentioned, contained analyses of 340 jobs, and these were obtained from 45 different organizations, located in many different geographical areas of the United States. All occupational categories in the Dictionary of Occupational Titles were represented, with the exception of category 4 (farming, fishing, forestry, and related occupations).

Thus it seems evident that job-related data based on the PAQ can be used as the basis for deriving predicted job values that are reasonably comparable to the actual rates of pay of jobs in the civilian labor market. This suggests that it may then be possible to derive job values directly from data based on structured job analysis procedures (such as the PAQ) without the need for conventional job evaluation procedures.

Purposes of Present Study

The present study was a probing, exploratory effort to use the PAQ with a sample of naval enlisted and officer billets directed toward the two principal objectives that were mentioned earlier. The first and primary objective was to compare the rates of pay that incumbents in various naval billets received with the pay that jobs with characteristics similar to those of the billets would command in the civilian

economy. This was to include a general comparison to obtain an overall notion of the relationship between the two pay rates, across a variety of billets, and, in addition, specific comparisons for certain enlisted rates and ratings. The second objective was to explore the possible relevance of the PAQ for use in the establishment of appropriate pay grades for naval billets. Since the two objectives in this study are somewhat distinct, the data relating to the two will be reported, at least in part, as two separate studies. The sample and the data collection procedures will be presented only once, but the procedures, analyses, and results of the two studies will be reported separately.

DATA COLLECTION

The data collection process for the present study involved the modification of the PAQ for naval application, and the use of the modified instrument in analyzing both naval enlisted and officer billets (Harris, 1973). As will be reviewed more extensively in the description of the sample and in the procedures and analysis sections, most of the enlisted billet analyses were done by project personnel at the actual location of the incumbents' work. For the officer billets, the naval version of the PAQ was used by the incumbents themselves to describe their own billets.

Naval Version of the PAQ

A naval version of the PAQ (Form B) was developed for the current study, which differed from Form B principally in that naval terminology was used as much as possible in defining the job elements, and in that some "examples" of jobs or job activities in the definitions that were considered to be more relevant to the navy were substituted for certain civilian examples. In addition, the descriptions of the job elements were simplified as much as possible.

In the revision process, every effort was made to avoid changing the basic meaning of the PAQ job elements, yet still to make them more readily applicable to the navy situation. Naval personnel were used in this process as much as possible. Twelve naval officers and enlisted men reviewed Form B, and their suggestions were incorporated into the first revision. This instrument, in turn, was submitted to seven additional naval personnel, and further changes were made on the basis of their comments. The revised instrument, as it was finally used, is included as Appendix A.

Sample

This study involved the analysis of two samples of naval billets. The first consisted of 607 enlisted billets on board three aircraft carriers and in six air squadrons, while the second consisted of 249 officer billets of various types.

The enlisted billets selected for analysis represent a roughly stratified random sample of all carrier and air squadron billets found in the Atlantic fleet. Particular naval ratings were chosen for sampling if they contained a sufficient number of billets to insure that one or more of them would be available for analysis on board the three carriers or in the six air squadrons included in the analysis project. The cut-off selected for this purpose was 50 billets in any single rate (pay grade) and rating. t was felt, however, that the purposes of the study would best be serve if a broad range of rates were sampled in each rating included in the sample. Therefore, if one or more rates within a rating were selected on the basis of the above criterion, then often other rates within that rating were also included which may have had fewer than 50 billets. For example, if certain rates within a rating contained 50 or more billets, those ratings were sampled. In addition, attempts were also made to sample other rates within that rating, although some might contain as few as 15 or 20 billets. One billet, then, was included in the sample for the first 50 billets in each rate and rating represented on board carriers or in air squadrons in the Atlantic fleet, with some exceptions as noted above. A second billet was included for the next 25, a third for the next 75, a fourth for the next 150, and one for each 200 thereafter. This process provided a tentative sample of 750 billets. In addition, for certain special analyses (to be described later), larger sample sizes were included for each of three selected ratings. The three were Aviation Electronics Technician (AT), Boilerman (BT), and Machinist Mate (MM). As the sample was originally planned, 100 billets were to be analyzed in each of these ratings.

Using the above guidelines, a proposed sample was developed which specified the number of billets in each rate and rating to be analyzed, on board the three carriers and separately in the six air squadrons. The incumbents required in the sample for each rate and rating were then selected at random from the carrier and air squadron rosters to have their jobs analyzed. Because of time limitations aboard the carriers and problems encountered in arranging interviews with some of the incumbents selected, it was not feasible to adhere rigidly to the tentative sample. Very few billets were analyzed that were not included in the sample, but it was not possible to analyze the full 750 billets that were included. The final number of billets analyzed was 607. This included 459 billet analyses in 47 separate ratings, and an additional 148 analyses in the three ratings sampled in depth. The total number of billets analyzed in each of the three concentrated ratings, including those in the "general sample" plus the 151 additional analyses mentioned above, was:

Aviation Electronics Technician (AT) . . .	78
Boilerman (BT)	54
Machinist Mate (MM)	79

The second sample consisted of 249 job analyses obtained from officers attending the Naval Postgraduate School and officers associated with the Naval Safety Center. Unfortunately this sample was not as representative as was desired. As the following table indicates,

the lower and higher ranks (Ensign, Lieutenant (Junior Grade), and Captain) were substantially underrepresented.

	Officer Pay Grades	Number Included in Sample
	Warrant Officer	2
0-1	Ensign	4
0-2	Lieutenant (Junior Grade)	12
0-3	Lieutenant	81
0-4	Lieutenant Commander	112
0-5	Commander	35
0-6	Captain	5

Procedure in Analyzing Billets

The analyses of most of the enlisted billets were performed by project personnel, with a few being done by military personnel hired from the ships' companies. Information for each analysis was obtained by interviewing the job incumbent and in some instances by also observing the incumbent performing his job. The average time required for an analysis was about one hour. It should be kept in mind, however, that there was considerable similarity in many of the billets analyzed, especially those within a given rating. Because of this, certain job elements were given the same rating as they applied to many billets. This similarity, of course, decreased the amount of time required for an average analysis.

The analyses in the officer sample were performed by the officers themselves as related to the assignments they held immediately prior to their Postgraduate School or Safety Center assignments. The reliability of analyses made by incumbents in supervisory and management positions was investigated in an earlier study with the PAQ (McCormick, Jeanneret, & Mecham, 19[illegible]), and it was found to average .84 and .89 in two samples. On the basis of this reliability it was felt that it would be satisfactory to have the officers analyze their own jobs.

STUDY ONE: THE COMPARISON OF COMPENSATION FOR INCUMBENTS OF NAVAL BILLETS WITH THAT FOR CIVILIAN JOBS WITH SIMILAR CHARACTERISTICS

The respectable correlations that have been obtained between predicted job values based on PAQ data and actual compensation rates (Mecham & McCormick, 1969; McCormick, et al., 1972) would suggest a number of tentative conclusions. First, substantial support has been provided for Mecham's (1970) hypothesis that the behaviorally-related job elements of the PAQ have an important and predictable relationship with rates of monetary compensation for jobs. Second, those relationships appear to be reasonably consistant across organizations, industries, and even geographical areas. Third, considerable evidence has been provided supporting the utility of McCormick's "worker-oriented" element concept as a descriptive device for use in deriving job values. In general, then, the method of deriving job values that has been developed with the PAQ seems to make it possible to "capture" and then to apply, the relationships existing between the PAQ job dimension "scores" of jobs and the compensation rates of jobs in the civilian economy.

If we accept these conclusions, it would appear that the available research relating to the PAQ could possibly have some relevance in navy wage and salary administration. In turn, it would seem that estimated values of navy billets, as based on the relationship between the PAQ dimensions and civilian compensation rates, might be considered as reflecting the rates of compensation that would be appropriate for civilian jobs having characteristics similar to those of the naval billets. Such values could conceivably be used operationally as the basis for comparing the compensation of naval billets with that for civilian jobs with similar characteristics.

Procedures and Analysis

The present study was directed toward providing the basis for such comparison, that is, the comparison of the compensation received by billet incumbents in the navy with the pay that would be appropriate for jobs with similar characteristics which exist in the civilian economy. The major aspect of this comparison involved all of the rates and ratings included in the combined enlisted and officer samples, and was concerned, generally, with obtaining an indication of the overall relationship between the naval and civilian values. The specific methods used in making the comparisons for this phase of the study will be reviewed later in some detail. Generally they involved comparing the estimated "civilian" job values of the billets within the combined officer and enlisted samples with the actual rates of compensation for the billet incumbents. This comparison was made primarily with respect to the naval personnel in various rates and ranks.

A secondary phase of the comparison was concerned with determining

if the billet characteristics associated with certain specific ratings would command significantly different rates of pay in the civilian economy. The civilian job values were derived for billets in the AT, BT, and MM ratings, and the means of these values for the various rates and ratings were then statistically compared to determine if the differences between them were significant.

Derivation of Civilian Job Values

The process used in obtaining the civilian job values for the naval billets was reviewed in the introduction in connection with the use of the PAQ for establishing compensation rates for jobs in the civilian economy. Very briefly, the factor score matrix obtained by Jeanneret and McCormick (1969) in a factor analysis of PAQ job analysis data for civilian jobs, was used to weight the PAQ element ratings of each navy billet analyzed. This resulted in 32 factor or job dimension scores for each billet. Regression weights, obtained on the basis of data derived from a sample of civilian jobs (Mecham & McCormick, 1969), were then applied to the scores of each billet on certain statistically identified dimensions to derive a predicted value for that billet. This value could be thought of as reflecting the compensation that would be appropriate for the individual billets if they were compensated in the same way as jobs in the civilian economy that have similar characteristics. This value will be referred to in the remainder of the study as the "civilian job value."

The compensation rates upon which the regression weights were based were collected in 1968 and 1969, consequently an adjustment had to be applied to the "civilian job values" for approximated increases in rates of pay since that time. The amount of the adjustment was determined by comparing the "gross average weekly earnings" for production or nonsupervisory workers for January, 1969 with the same index for January, 1973 (U.S. Bureau of Labor Statistics, 1969, 1973b). This comparison indicated that earnings for such workers had increased 24.7% over that interval of time, for this particular category of workers. A similar survey, covering certain professional, administrative, technical and clerical workers, reflected a comparable increase (U.S. Bureau of Labor Statistics, 1973a).[1] The "civilian job value" obtained for each billet, then was increased by the 24.7% to reflect the average change in job values since 1969.

Comparisons Involving the Total Sample

Once obtained, the "civilian job values" were compared, in several different ways, with three indices of naval compensation, based on

[1]The average annual salary increase for the professional administrative, technical and clerical workers covered by this survey was 6.11% for the years 1968 through 1972, as compared with 5.38% for production, nonsupervisory workers over the same period of time. Since these differences were not appreciable, a decision was made to apply one adjustment to all jobs, namely that applying to production workers.

various combinations of the total direct pay and the monetary value of the fringe benefits that are granted to naval personnel. The first of the three was the naval compensation for each of the incumbents of the billets analyzed. As the name implies, basic compensation is the compensation rate for the incumbent, based exclusively upon his rate or rank and cumulative years of service. It does not include such additional compensation items as the subsistance or quarters allowances.

The second value, referred to as direct naval compensation, includes essentially the payments that are made directly to the incumbent plus an estimate of the value of the tax advantage accruing because of the exempt status of certain allowances. Specifically included in this index is the basic compensation plus the following additional items as they would be applicable to the individual; quarters allowance, subsistance allowance, sea duty pay, family separation allowance, and an estimate of the value of the tax advantage. Estimates of the value of the quarters and subsistance allowance are included in the computation of direct naval compensation, under certain conditions in which the incumbent does not receive these benefits in the form of direct payment.

The third compensation value, which is entitled total naval compensation, consists of the direct naval compensation, plus estimates of the value of retirement, medical care, commissary privileges, life insurance benefits, and an additional adjustment for tax savings. It represents a more global index of the estimated monetary value of the basic compensation to naval personnel plus most forms of indirect benefits such as fringe benefits.

Since the total naval compensation involves fringe benefits which were not included in the computations for the civilian job values of the naval billets, an adjustment was required to compensate for that difference before the two values could be compared. The most recent available survey, providing the information necessary for such an adjustment, was conducted in 1968 (U.S. Bureau of Labor Statistics, 1971). Employer expenditures for retirement, health, and insurance programs, as reflected by this survey, equaled 13.23% of the direct compensation paid to the employee. Consequently the civilian job values were increased by that amount before they were compared with total naval compensation.

A number of the allowances and benefits are not directly related to the requirements or responsibilities of the billets of the incumbents, but rather are determined by such factors as the dependency status of the incumbents, and their plans to remain or not remain in the service (which would influence the applicability of retirement benefits). Therefore the comparison of naval and civilian compensation rates would depend to a considerable extent on the assumptions one might make regarding the incumbents. This being the case, it was considered desirable to make the comparisons on the basis of three different sets of assumptions. These three sets of assumptions were established so that they might reflect compensation rates that would be "high" and "low" in terms of the variations in compensation that might be applicable to such benefits as the subsistance allowance and the quarters allowance. Provided below, in outline form, are the three sets of assumptions. The values of the various benefits and allowances under each are given

in Appendix D. The first set of assumptions provides the higher estimates for the applicable allowances, and the second and third sets of assumptions, which are based on slightly different combinations of compensation components, provide lower estimates. It was felt that these values would reflect the approximate "range" of compensation of billet incumbents as this range might be influenced by the "status" of different incumbents and their relevant allowances, benefits, etc.

Higher pay (A) assumptions.

1. Number of dependents:
   Pay grades E-2 and E-3 0
   E-4 1
   E-5 2
   E-6 through E-9 3
   O-1 1
   O-2 2
   O-3 through o-6 3

2. Incumbents performing sea duty.

3. Incumbents' families live off base in their own homes.

4. Incumbents' families use the PX and commissary extensively.

5. The incumbents are planning on a career in the navy with consequent eligibility for retirement benefits.

Lower pay (B) assumptions.

1. Number of dependents:
   All pay grades 0

2. Incumbents are performing sea duty.

3. The incumbents are planning on a career in the navy with consequent eligibility for retirement benefits.

Lower pay (C) assumptions.

1. Number of dependents:
   All pay grades 0

2. Incumbents performing sea duty.

3. The incumbents are not planning on a career in the navy, and will not receive retirement benefits.

Annual values for the various allowances and benefits, under the different assumptions, were extracted from a table of such values prepared especially for the present study by the office of the Director of Compensation Studies, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs). A breakdown of the values assigned to the allowances and benefits under each of the sets of assumptions is included as Appendix B. These, and all other naval compensation figures used, are based on the navy salary schedule in effect as of January 1, 1973.

It is recognized that these alternative assumptions would not be equally probable in the case of naval personnel in the various pay grades. For example, the proportions of personnel who are planning on a career in the navy differs for different pay grades--both for enlisted and officer personnel. With one exception, however, the assumptions were applied consistently to all pay grades in order to provide a reasonably consistent base for estimating "upper" and "lower" bound values for personnel in the various pay grades. The exception was that relating to number of dependents in the case of the "A" assumptions. For this factor the number of dependents "assumed" for the various pay grades was that which, on the basis of actuarial data, was most typical of those personnel in the various pay grades.

Two methods were used in comparing the civilian job values with the navy compensation rates. First, the estimated civilian rates (in dollars per month) were correlated with the monthly naval compensation rates of the incumbents of the billets. Separate correlation coefficients were computed, under the three sets of assumptions, for the enlisted, officer, and combined samples.

It will be recalled from the sample that was described earlier, that the range of ranks represented in the officer sample was somewhat restricted. The sample contained only four officers in pay grade 0-1 (Ensign), twelve in 0-2 (Lieutenant, Junior Grade) and five in 0-6 (Captain). It was felt advisable, therefore, to correct correlations involving the officer sample for restriction of range. The method outlined by Thorndike (1949, p. 174) was used for making this correction. It is recognized that some of the assumptions of the restriction of range correction may not be met, particularly the assumption regarding normal distributions of the population on the variables used (Guilford, 1965). For this reason the corrected results should be viewed somewhat tentatively.

The second comparison of civilian and navy job values consisted of a presentation of bar graphs to illustrate the relationship between the civilian and naval compensation rates for the incumbents in each rate or rank. The mean annual civilian job values were compared with the mean annual direct naval compensation and total naval compensation values. In the case of the comparison of the civilian job values with total naval compensation values, the civilian job values used included the addition of 13.23 percent for "fringe benefits" mentioned on page 10, since the total naval compensation values also included all forms of fringe benefits.

Comparisons Involving Only the AT, BT, and MM Ratings

It will be recalled from the sample description that a general sampling scheme was developed that would provide a roughly stratified random sample of enlisted billets. In addition, three ratings were selected for special analysis purposes, and therefore larger samples were drawn for these ratings. The total number of billets in these three ratings included 78 billets in the Aviation Electronics Technician (AT) rating, 54 in the Boilerman (BT) rating, and 79 in the Machinists Mate (MM) rating. Eight job analyses were pulled from the samples of these three ratings, however, because the incumbents' job responsibilities were not related to their ratings. As an example, one Boilerman 1st class, at the time his billet was analyzed, was acting as a ship's investigator. The final samples included 72 AT's, 52 BT's, and 79 MM's.

In beginning the analysis of these data, correlations were first computed, within each of the three ratings, between the civilian job value and total naval compensation. The latter was computed under assumption A.

The next two steps in the analysis of the data involved testing the significance of the differences between the civilian job values associated with various groupings of the AT, BT and MM billets. First the billets were grouped according to rating, without regard to pay grade. The difference between the civilian job values associated with each of the three ratings was tested for significance, using a single factor unweighted means analysis of variance (Winer, 1971, p. 218). Next the billets were grouped by rate and rating, and the differences between the mean values associated with the different groups were tested for significance, using Newman-Keuls tests (Winer, 1971, p. 191). The mean values within the AT rating were compared, then within BT, MM, and within pay grades E-3, E-4, etc. Table 1 provides the mean monthly civilian values for each rate or pay grade, and rating. Reference to the arrangement of the data in the table may provide some assistance in following the analyses described.

Results

In comparing naval compensation received by billet incumbents and civilian job values of billets, it will be recalled that several computations of naval compensation were used. First, three different combinations of naval compensation components, entitled basic compensation, direct compensation, and total compensation were considered. Each of these, in turn, was computed under three different sets of assumptions, which were developed to reflect approximate upper and lower bounds of compensation for incumbents in particular pay grades, depending on different assumptions regarding the status of the incumbents including dependents, intention to remain in the service, etc. The estimated values of the various naval allowances and benefits used in computing these different naval compensation rates are given in Appendix B. These were provided for this study by the Office of the Director of Compensation Studies, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs).

Table 1

Mean Civilian Job Values Appropriate to Personnel in Given Pay Grades Within AT, BT, and MM Ratings

	Rating		
Pay grade	AT	BT	MM
E-2	$ - (N=0)	$505 (N=5)	$538 (N=2)
E-3	568 (N=16)	543 (N=17)	589 (N-16)
E-4	590 (N=20)	594 (N=14)	658 (N=30)
E-5	640 (N=20)	688 (N=8)	719 (N=18)
E-6	771 (N=11)	918 (N=4)	708 (N=8)
E-7	872 (N=4)	814 (N=4)	889 (N=5)
E-8	727 (N=1)	- (N=0)	- (N=0)

Using the different assumptions and combinations of allowances and benefits, a total of nine naval compensation values was computed for the incumbents in each of the billets. In turn, these nine values, as computed for all billets, were then correlated with the civilian job values. Such correlations were computed separately for each of the enlisted, officer, and combined samples. The results are given in Table 2. The average correlations across all "assumptions" and computations of naval compensation for the three samples (enlisted, officer, and combined) were respectively .63, .28, and .83. When corrected for restriction of range, the average correlation in the officer sample was .35. As is evident from Table 2, the various correlations computed within the three samples were very similar. The different sets of assumptions, although substantially affecting the level of compensation, did not significantly affect the correlations between the civilian and naval compensation rates. Similarly, the addition or deletion of the various benefits and allowances had little effect on the basic correlations.

The second set of comparisons, which involved the complete enlisted and officer samples, is presented in Figures 1 and 2; the mean values used in preparing these figures are given in Appendix C. To briefly review the naval compensation values used, the direct naval compensation and total naval compensation represent two indices of naval compensation based upon two different combinations of naval allowances and benefits applicable to naval personnel. The direct naval compensation consists essentially of all direct monetary payments received by the incumbent plus some money equivalents in the form of subsistance and quarters allowances, and the value of certain tax advantages. The total naval compensation includes the direct naval compensation plus the value of all fringe benefits and additional allowances.

The graph in Figure 1 illustrates the relative levels of the mean direct naval compensation and mean civilian job value for each pay grade; (the mean civilian job values in this comparison did not include the adjustment for fringe benefits). In turn, the graph in Figure 2 similarly illustrates the relationship between mean total compensation rates and mean civilian job values, including the adjustment of 13.23 percent for fringe benefits. As can be observed in both of these figures the estimated civilian job values consistently increased with the incumbent's pay grade. The mean civilian job values were generally higher than the corresponding naval values for the enlisted rates and for the first two officer ranks, but tended to be lower for the other officer grades, especially O-5 and O-6. It should be noted, however, that the sample sizes were very small for the high and low officer pay grades, and little dependence should be placed in the results associated with these ranks.

Table 2

Correlations Between Civilian Job Value and Three Indices of Naval Compensation, Each Computed Under Three Sets of Assumptions Regarding the Billet Incumbents

Sample and type of compensation	"A" Assumptions	"B" Assumptions	"C" Assumptions
Enlisted sample			
Basic compensation	.63	.63	.63
Direct compensation	.65	.63	.63
Total compensation	.64	.63	.63
Officer sample			
Basic compensation	.28	.28	.28
Direct compensation	.29	.28	.28
Total compensation	.29	.28	.28
Combined sample			
Basic compensation	.83	.83	.83
Direct compensation	.84	.83	.83
Total compensation	.84	.83	.83

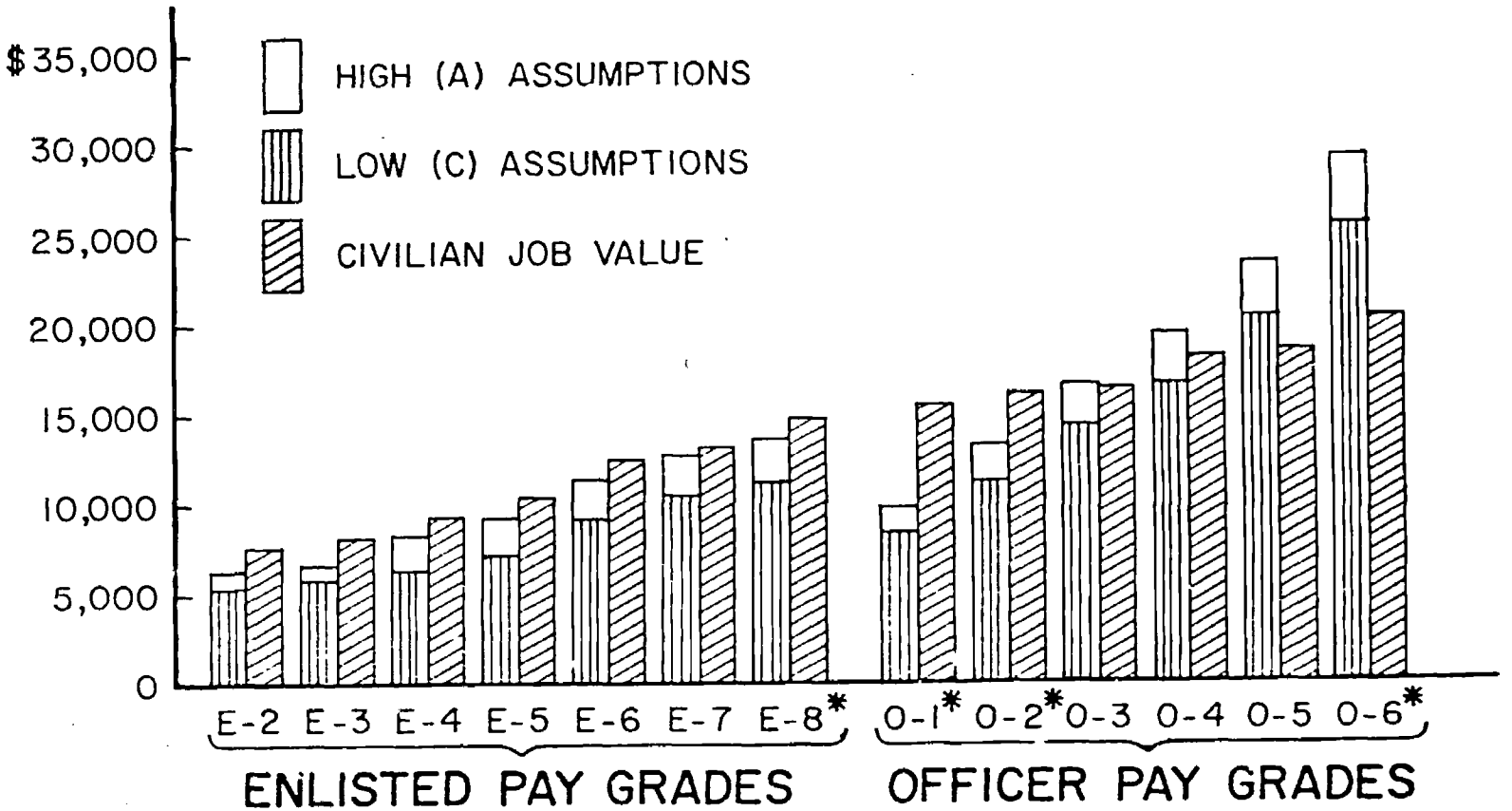

Figure 1

Mean Annual Direct Naval Compensation Rates Under High and Low (A and C) Pay Assumptions, and Mean Annual "Civilian Job Value" (Excluding Fringe Benefits) For Each Pay Grade

Note: Values in pay grades marked with an asterisk were based on between 4 and 12 job analyses.

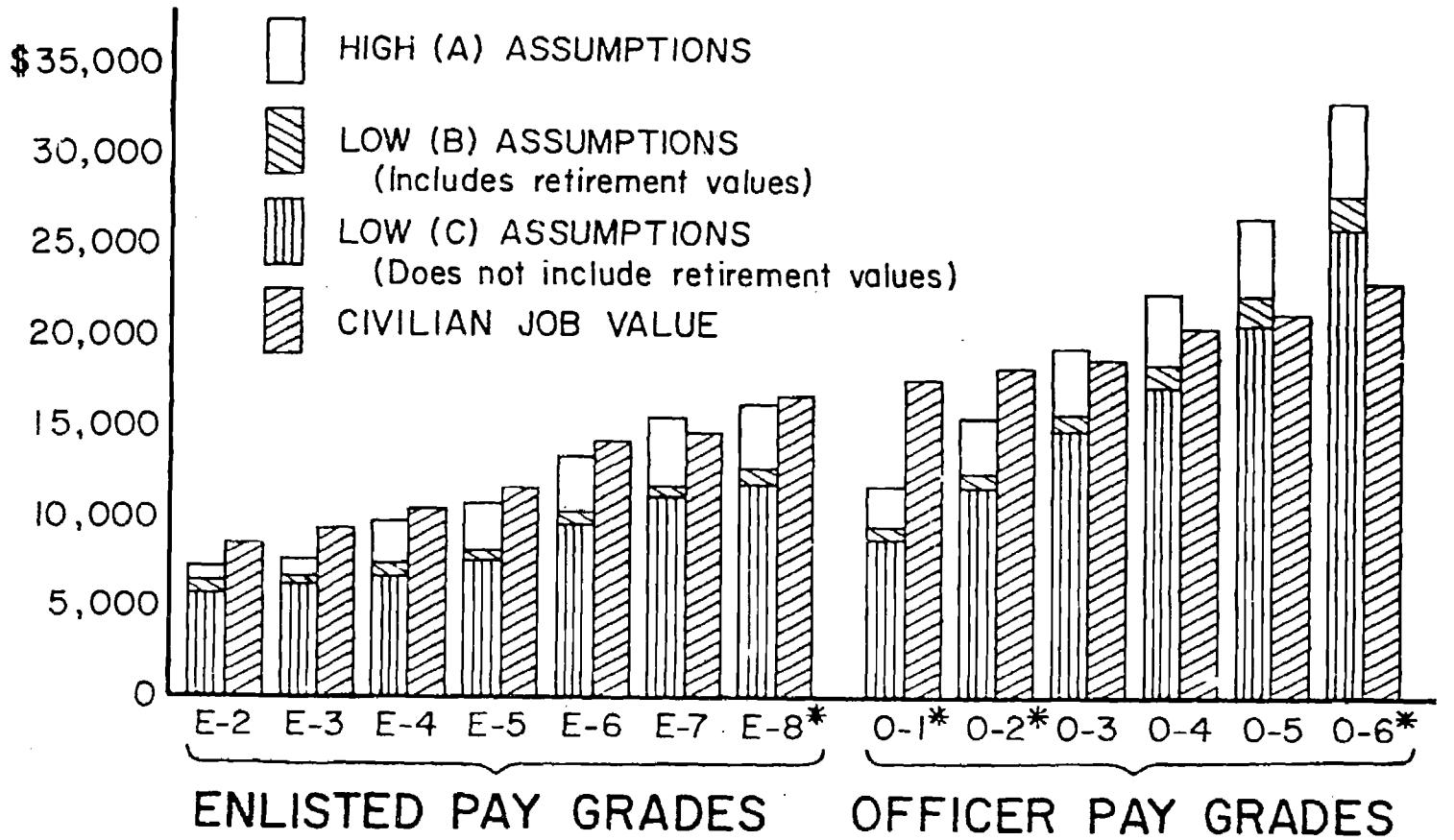

Figure 2

Mean Annual Total Naval Compensation Rates Under Varying (A, B and C) Pay Assumptions, and Mean Annual "Civilian Job Value" (Including Fringe Benefits) For Each Pay Grade

Note: Values in the pay grades marked with an asterisk were based on between 4 and 12 job analyses.

Comparison of Mean Direct Naval Compensation and Civilian Job Values

Differences in the civilian and naval compensation rates (both direct and total) were particularly pronounced for single enlisted personnel (B and C assumptions) who were assumed not to be receiving some of the allowances and benefits paid to personnel with dependents. The mean difference for this group between civilian job values (excluding fringe benefits) and direct naval compensation, across all rates, was $3,068 (as based on data in Appendix C, Table C1). As shown in Figure 1, the difference between the two mean values was relatively consistant across the rates.

For the enlisted personnel under the A assumptions the differences between civilian job values and naval direct compensation was considerably smaller, although the civilian rates still averaged $1,129 higher than the naval. The mean difference by rate for the enlisted sample, under the higher (A) assumptions, ranged from $1,364 for pay grade E-2 to $318 for pay grade E-7.

The differences in direct compensation were not as consistant for the officer ranks, although again this was probably due in large part to the very small sample sizes in the high and low officer ranks. The civilian job values, as mentioned, were considerably higher than the naval for the lower pay grades (O-1 and O-2) and substantially lower for the higher pay grades (O-5 and O-6). This was true under both the higher (A) and lower (C) assumptions.

Comparison of Mean Total Naval Compensation and Civilian Job Values

The comparison of mean annual civilian job values with mean total naval compensation included the fringe benefits for both values, and is based on data in Appendix C, Table C2. The pattern of differences (Figure 2) was similar to that noted in comparing the civilian and direct naval compensations. Again the civilian pay was generally higher than that for the enlisted billet incumbents, although under the A assumptions the difference was very small for the higher pay grades. In fact the mean total naval compensation associated with the E-7 pay grade was slightly higher ($358) than the corresponding civilian value, when computed under the A assumptions. Under the C assumptions, the difference increased substantially to an average of $4,348 per year for the enlisted pay grades.

The differences for officer pay grades followed approximately the same pattern as described for direct naval compensation. The civilian pay was again higher for pay grades O-1 and O-2, and lower for O-4, O-5 and O-6.

Comparisons of Naval and Civilian Job Values Within Selected Ratings

As was reviewed in the description of the sample, additional billets were selected for analysis from three ratings (AT, BT, and MM). The larger sample sizes in these ratings were obtained in order that statistical analyses, in addition to those performed on the total sample, might

be performed. The first of these consisted of correlating the total naval compensation, computed under A assumptions, with the civilian job values. This was done separately within each of the three ratings. The correlations obtained were:

AT	.73 (n=72)
BT	.66 (n=52)
MM	.46 (n=79)

The next series of analyses, involving these three ratings, was aimed at determining if there were significant differences in the civilian job values associated with billets in the different ratings, and if there were consistent significant differences between the civilian job values for billets in different rates (pay grades) within the same ratings. The analyses performed consisted of a single factor unweighted means analysis of variance and a number of Newman-Keuls tests.

The analysis of variance indicated no significant difference in the civilian job values associated with the billets, across the three ratings. In looking at Newman-Keuls tests, again across ratings (see Table 1), significant differences ($p < .05$) were found between the mean civilian job values in the E-4, E-5 and E-6 pay grades. No pattern of differences, however, was evident. There was no particular tendency for there to be significantly higher values in one rating than in another.

The results of the Newman-Keuls tests performed on the mean civilian job values of rates, within each of the ratings, indicated a pronounced pattern of significant differences, as would be expected. However, there were not regular, consistant differences between the means of the different pay grades. This is quite probably due in part to the small sample sizes in some of the rates and ratings. The significant differences that were found are shown in Appendix D. Within the AT rating, the differences in the mean civilian job values were significant between all pay grades except between levels E-3 and E-4. Results in the other two ratings were considerably more mixed.

Discussion

The correlations between the civilian job values derived for the billets, and various indices of the naval compensation received by the billet incumbents, were reasonably high in the present study, particularly within the combined sample. The average of the correlations obtained in the combined sample, using the three indices of naval pay, each computed under the three sets of assumptions, was .83. This would indicate that there is a substantial relationship between the compensation received by the billet incumbents and the compensation that would be appropriate for jobs in the civilian economy having characteristics similar to those of the billets. Correlations between the two values were very consistent, regardless of the particular index of naval compensation used, and they were not significantly affected by the various assumptions made regarding the incumbents.

The results of the study relating to the relative levels of civilian and naval compensation in the different pay grades were rather straightforward, and would not seem to require extensive elaboration. Within the enlisted sample, the mean civilian job values for the various pay grades were generally higher than the mean naval compensation values. This was consistently true with regard to the direct naval compensation and was also the case with the total naval compensation, with the exception of one pay grade (E-7, assumption A). The difference in levels was most pronounced, however, between the civilian values and direct compensation rates than with total compensation. The comparison of total compensation was made with civilian job values that also included an addition of 13.23 percent for fringe benefits. However, benefits and allowances for naval personnel represent a larger proportion of their "total" compensation than in the case of civilian personnel, thus tending to reduce the difference when a comparison is made on the basis of total compensation as contrasted with direct compensation.

The differences between either the direct or total mean compensation values and the mean civilian job values for the various ranks was, of course, greatest using the B and C assumptions, which were developed specifically to provide lower bound values for the different pay grades. However, using any one of the three sets of assumptions, civilian values were still generally higher than naval compensation rates.

Within the officer pay grades, the differences in civilian and naval compensation levels were not as consistent. As reviewed in the results section, the lower ranking officers received considerably less compensation than would have been received by job incumbents in the civilian economy working in jobs with characteristics similar to those of the officer billets. Higher ranking officers, on the other hand, received considerably higher compensation than did their civilian counterparts. The sample sizes associated with the high and low officer ranks, however, were very small, and very little significance should be attached to the comparison involving these pay grades.

In examining the results relating to only the AT, BT, and MM ratings, it was somewhat surprising to find that there were not significant differences in the civilian job values associated with the three. There was some anticipation that the Aviation Electronic Technician (AT) billets would command higher pay in the civilian economy than would the billets in the Boilerman (BT) and Machinists Mate (MM) ratings. The similarity of results may very probably have been related to the particular echelon of electronics maintenance performed in the air squadrons sampled. Only the lower echelons of maintenance were handled by the air squadron personnel. The electronics maintenance functions involved, principally, rather elementary tests on electronics equipment in aircraft, and the replacement of component modules. When defects were discovered, the modules (referred to as "black boxes") were simply taken out and sent to a higher echelon repair shop. Frequent comments were heard, during the billet analysis interviews, regarding the tediousness and simplicity of the maintenance functions. As one incumbent stated, "A trained monkey could do this work." The results could quite probably have been different had the AT billets been sampled from activities concerned with the higher echelons of maintenance.

STUDY TWO: THE RELEVANCE OF STRUCTURED JOB ANALYSIS PROCEDURES FOR THE ESTABLISHMENT OF PAY GRADES FOR NAVAL BILLETS

As indicated in the introduction, the second phase of the current research project was directed primarily at assessing the possible relevance of structured job analysis procedures (such as the PAQ) for the establishment of pay grades for naval billets. Previous studies have provided considerable evidence that job values can be derived from PAQ job analysis data that correlate highly with actual compensation rates in the civilian economy (Mecham & McCormick, 1969; McCormick, Jeanneret, & Mecham, 1972). However, to date there has not been an application of this procedure in the military service. A logical extension of the earlier research was therefore to apply similar procedures to a sample of military jobs in order to determine the relevance of such a procedure to the military complex. The present study, then, consisted of the application of the procedures developed by Mecham and McCormick to a sample of naval billets.

The rationale underlying this approach to the derivation of job values was reviewed in the introduction. A number of basic "dimensions" of work were delineated through the factor analysis of PAQ data, and these dimensions were used in characterizing the behavioral activities and contextual aspects of jobs. It was hypothesized that if the same "behavioral" dimensions were represented in a number of jobs, then those jobs should be reasonably equivalent in the demands made upon the incumbents. Further, to the extent that the same characteristics or dimensions existed in the different jobs, the jobs should warrant similar compensation rates.

The use of the PAQ for deriving job values has previously been outlined in some detail. It will be recalled that job dimension scores were derived for each job, as mentioned above, and that these were then used as predictors in a regression analysis, with compensation as the criterion variable. This provided the optimal weights for the dimensions, for the prediction of the pay rates in the sample of civilian jobs.

As pointed out by Mecham (1970), this regression approach to the weighting of the factors could in some ways be considered as a policy-capturing model. The procedures were designed, in a sense, to "capture" and consistantly apply the relationship existing between the job dimension scores of jobs in a sample, and actual compensation rates for the jobs in the sample. This differs somewhat from the common conception of "policy-capturing" in that in Mecham's procedures little emphasis is placed upon the delineation of policies, per se. Rather, interest is focused on determining, for one sample of jobs, the relationship between combinations of job dimension scores and going rates, and the application of data from that relationship to other jobs to predict their appropriate rates of pay. The usual connotation of the term, policy capturing, generally relates to decision rules associated with

individuals (Hazel, et al., 1966; Christal, 1967), whereas the present study might be viewed as dealing with prevailing wage and salary "practices" as reflected by going rates of pay for jobs, which presumably have been influenced largely by supply and demand factors. This distinction should be kept in mind in connection with the term, policy capturing, as it is used in this study.

In a sense it can be said that conventional methods of job evaluation can also be viewed in this same frame of reference--of combining the ratings of jobs on various factors in such a manner that, in combination, they reflect the prevailing "practices" in establishing compensation rates for jobs. Such systems, however, characteristically involve the process of "evaluation" of jobs, which consists of making judgments of the level of each of several factors on the basis of written job descriptions.

The possible use of a structured job analysis procedure as the basis for establishing compensation rates for jobs is predicated on the notion that common job components impose common job demands upon incumbents, with the implication that jobs that are equal in terms of certain components presumably should warrant comparable compensation insofar as those components are concerned. Given the ability to quantify such components (such as by the use of job dimension scores), it might then be possible to use such values as the direct basis for estimating compensation rates, via the "policy capturing" approach used by Mecham. If this can be done with acceptable validity, the conventional job evaluation processes might be eliminated. In other words, job values could be derived statistically on the basis of quantitative job data obtained by a structured job analysis procedure. This study consisted of the experimental application of this approach to a sample of naval billets, using the PAQ as the job analysis instrument.

Procedures and Analysis

The basic procedures for exploring the possible utility of the PAQ as the basis for determining appropriate pay grades for naval billets consisted of three features, as follows:

1. The statistical derivation for the naval billets of job values based on PAQ analysis of the billets (actually different procedures for doing this were used), these serving as predictors.

2. The estimation for hypothetical billet incumbents of three levels of compensation that would be appropriate for them as based on certain combinations of assumptions to be described later, these serving as criteria.

3. The determination of the relationships between the different sets of predictors, the PAQ-based job values mentioned in (1) above, and the three sets of criteria, the naval compensation values mentioned in (2) above.

The primary index used in the present study in assessing the degree of relationship was the correlation coefficient, although other statistical indices were also used, particularly in relation to one of the procedures for deriving the estimated PAQ-based job values. The validation process was complicated somewhat by the fact that there were a number of naval compensation values that were used as criteria, and there were also several variations on the policy capturing procedures used in deriving the job values. The various combinations of criteria and methods required separate validation.

The first two of the naval compensation values considered as criteria were both entitled total naval compensation. Included in the computation of these two values were all direct monetary payments to the billet incumbents plus the values of the various naval allowances and benefits. As discussed in Study 1, however, the values of the allowances and benefits that an incumbent receives are determined by a number of factors not directly related to his billet requirements. These include principally his dependency status and retirement plans. Therefore to facilitate the generalization of the results of this study, certain assumptions were made that would provide for the consistant application of the various benefits. Three such sets of assumptions were developed for Study 1, and two of them (provided below) were used in this study. The first (A assumptions) provides compensation values near the high end of the compensation range for a particular rate or rank and time in service. The second (C assumptions) results in values near the low end of the compensation range. Specific values for the various allowances and benefits under the two sets of assumptions are provided in Appendix C.

Higher pay (A) assumptions

1. Number of dependents:
   Pay grades E-2 and E-3 0
   E-4 1
   E-5 2
   E-6 through E-9 3
   O-1 1
   O-2 2
   O-3 3

2. Incumbents performing sea duty.

3. Incumbents' families live off base in their own homes.

4. Incumbents' families use the PX and commissary extensively.

5. The incumbents are planning on a career in the navy with consequent eligibility for retirement benefits.

Lower pay (C) assumptions.

1. Number of dependents:
   All pay grades 0

2. Incumbents performing sea duty.

3. The incumbents are not planning on a career in the navy, and will not receive retirement benefits.

The two total naval compensation values were computed using the two sets of assumptions given above. The first included the values of all applicable allowances and benefits computed under the "A" assumptions, and will be referred to in the remainder of the study as "total A" compensation. The second value was similarly computed, but under the "C" assumptions, and will be referred to as the "total C" compensation.

The third index of naval compensation used in this study was entitled basic compensation. It consists of the direct monetary compensation paid to the incumbent based upon the incumbent's rate or rank and time in service, and it does not include any benefit or allowance values.

It was felt that the correlations between each of these three values and the estimated job values obtained through various procedures using the PAQ data would provide a reasonable indication of the utility of this general approach to the establishment of pay grades for naval billets.

Procedures Used in Deriving and Validating Job Values

Three variations on the procedures developed by Mecham and McCormick (1969) were used in the present study in deriving job values from the PAQ billet analysis data. The methods were similar in that the job values were derived in all three by applying regression weights to factor or job dimension scores. They differed, however, in the derivation of the factor scores, and in the regression weights used.

Method 1. The first of the three procedures was reviewed in the introduction, and was used in Study 1 to derive what was entitled the "civilian job value" for billets. It involved, first, the weighting of the ratings received by the billets on the PAQ elements, using regression weights obtained in an earlier study to provide factor or job dimension scores for civilian jobs (Jeanneret and McCormick, 1969). The summation of the weighted ratings resulted in 32 dimension scores for each of the billets. In the next step, certain of these dimension scores were then weighted, using regression weights derived from the PAQ analyses of a sample of civilian jobs to predict compensation rates for jobs in the civilian economy (Mecham, 1970). The sum of the weighted dimension scores provided a job value for each billet which reflected the relationship between the weighted combination of job dimension scores and civilian compensation rates. These values were correlated with the two total naval compensation rates and with naval basic compensation of the billet incumbents within each of the enlisted, officer, and combined samples.

Method 2. The second method again required that the 32 dimension scores be computed for each billet in the same manner as in Method 1, but in this procedure rather than using the civilian regression weights in deriving job values, new "naval" regression weights were obtained. The dimension scores were used as predictors in three step-wise, build-up regression analyses in each of the enlisted, officer, and combined samples, with naval basic compensation and the two total naval compensation values used as the criterion variables. All 32 dimensions were used in the regression analyses performed in the enlisted and combined samples. In the officer sample, however, only five of the 32 dimensions were used as predictors because of the limited officer sample size (n=249). The five dimensions used were those labeled by Jeanneret and McCormick (1969) as JO 1 through JO 5. These had been derived, in the earlier study, through a factor analysis of all of the PAQ job elements, using the PAQ job analyses of the jobs in the civilian sample, discussed in the introduction. The remaining 27 of the 32 dimensions had been obtained by separately factor analyzing the six divisions of the PAQ (Jeanneret & McCormick, 1969).

To provide some indication of the shrinkage that would be obtained in the multiple correlations if the various sets of regression weights were to be applied to samples other than those in which they were derived, the enlisted sample was randomly divided (N=309 and N=308), and new regression weights were derived for predicting naval basic compensation in each subsample. These weights were then used in a standard double cross-validation procedure. The weights from each subsample were applied to the billets in the opposite subsample, and correlations were computed in each case between the actual and derived job values. In addition, a shrinkage formula (Burket, 1964, pp. 10-12), was used to predict the correlations in the cross-validation samples, and was also used to provide estimates of the cross-validated coefficients of the other sets of regression weights computed under the second method.[2]

Method 3. In the two previous methods of deriving job values from PAQ data, the required factor (i.e., job dimension) scores were computed through the use of a factor estimate matrix (matrix of regression weights) obtained from the earlier factor analysis of civilian PAQ job analysis data. In the third method, however, factor scores were derived through factor analyses of PAQ data from the samples of naval billets actually used in the study. The first such naval sample factor analyzed included 459 enlisted billets and 247 officer billets, which provided a combined sample of 706. The 148 "extra" billets, from the three ratings sampled in depth, were not included in this factor analysis sample. The sample for the second factor analysis consisted of only the 247 officer billet analyses.

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[2] $W = \frac{nR^2-p}{R(n-p)}$ W = weight validity in second or cross-validation sample
n = regression sample size
p = number of predictor variables used in the regression sample

The procedures used in the two factor analyses were essentially the same as those used by Jeanneret and McCormick (1969) in the factor analysis of PAQ data for a sample of civilian jobs. Jeanneret and McCormick separately factor analyzed each of the divisions of the PAQ, and then factor analyzed the entire PAQ, excluding only a few items. The divisional factor analyses provided 27 of the 32 factors or dimensions, as mentioned in regard to method 2, and the overall factor analysis provided the remaining 5. In the two samples of billets included in the factor analyses in this study, however, only the divisional factor analyses were performed. These were felt to be adequate for the present study, since the PAQ divisions are concerned with reasonably well defined and separate aspects of jobs, and also because the divisional factors were found in the Mecham and McCormick (1969) study to be as valid as were the overall factors as bases for establishing job values.

In the present study, one item, number 186, was included in all six of the divisional analyses as a marker variable, and several items were excluded from the analyses in two of the divisions. The marker variable (item 186) refers to the amount of structure in the billet being analyzed, and it was felt that the inclusion of this variable would aid in the interpretation of the factors. The items excluded from the analyses included 4 open-ended items (numbers 44, 60, 127 and 181), designed to obtain information for future revisions of the PAQ, and 15 dichotomous items (numbers 154 through 168), dealing with the type of clothing worn on the job, the regularity of the work, etc.

The particular factor analytic technique used was a principal components analysis, with 1.0's entered in the diagonal of the correlation matrix. The number of factors extracted in each of the divisional analyses varied between two and nine, as determined by setting the eigenvalue lower limit at 1 (Kaiser, 1960). The factors were rotated using a stepwise varimax procedure. The first two factors extracted were rotated, then the first three, and so on until all of the extracted factors were rotated. An examination was then made of the factors in the various rotations, and for the factor analysis of the combined sample, as many of the factors as could be meaningfully interpreted were retained. In four of the divisions this included all of the factors extracted, and in each of the two remaining divisions (1 and 4) it included seven of eight extracted factors. The total number of factors obtained from all of the divisions in the combined sample was 34.

In the smaller officer sample factor analyses, an effort was made to keep the number of factors retained down to a number that could reasonably be used in a regression analysis with that same sample. Consequently only 24 factors out of 38 initially extracted were utilized. The interpretation of the factors from these two samples and the factor loadings are given in Appendix E and Appendix F.

To derive the estimated job values under method 3, the 34 factors from the combined sample were used as predictors in regression analyses in the same manner as were the 32 dimensions in method 2. Separate regression analyses were performed within the enlisted and combined

samples, using the three naval compensation values, separately, as criteria. For the officer sample the 24 "officer" dimensions were similarly used as predictors in a regression analysis, and again the total A, total B, and basic naval compensation values were used as the dependent variables. After the multiple correlations were obtained, the shrinkage formula previously referred to was applied to provide estimates of the regression weight validities that would be expected in other samples.

Results

As discussed in the procedures and analysis section, job values were derived for all of the billets in the enlisted, officer, and combined samples, through the application of three separate procedures to PAQ billet analysis data. The validation of each of the procedures then consisted principally of correlating the various resulting job values with several indices of naval compensation, entitled total A naval compensation, total C compensation, and naval basic compensation. The standard error of estimate was also computed in relation to the results from certain of the procedures. The three procedures will be reviewed briefly, and the results will be presented with the particular procedure to which they apply.

Method 1

Regression weights derived from civilian samples were used in this procedure, to both weight the ratings received by the billets on the PAQ elements and also to weight the resulting dimensions. This provided a job value for each of the billets, based upon the relationship between the PAQ dimensions and civilian compensation rates. The correlations between this job value and each of the three indices of naval compensation, within the enlisted, officer, and combined samples, are given in Table 3.

As shown in Table 3, rather low correlations were obtained between derived and actual job values within the officer sample. The average correlation between the derived job value and the three naval compensation rates was .28, with negligible difference between the three coefficients. Correlations were somewhat higher in the enlisted sample, averaging .63, and higher still in the combined sample with its additional range (.83 average).

Method 2

This method again used civilian regression weights to derive job dimension scores for each of the billets, but in this instance the estimated job values were derived from the dimension scores through the use of regression weights obtained within the enlisted, officer, and combined samples, rather than from the earlier Mecham and McCormick (1969) study. Again the three indices of naval compensation were used as criteria in the regression analyses performed within each sample. The resulting multiple correlations are shown in Table 4, along with estimates of "shrunken" correlations that would be obtained using the

Table 3

Correlations Between Job Values Derived Under Method 1, and Three Indices of Naval Compensation*

	Naval compensation index		
Sample used	Basic compensation	Total A compensation	Total C compensation
Enlisted sample (n=607)	.63	.66	.63
Officer sample (n=247)	.28	.29	.28
Combined sample (n=854)	.83	.84	.83

*Method 1 utilized factors or job dimensions, and also regression weights, derived from a sample of civilian jobs, in establishing job values.

Table 4

Multiple Correlations Obtained Under Method 2, with Three Indices of Naval Compensation Used as Criterion Variables*

	Naval compensation index		
Sample and statistic	Basic compensation	Total A compensation	Total C compensation
Enlisted sample (n=603; p=32)**			
Obtained correlation	.77	.79	.78
Shrunken correlation***	.74	.76	.75
Officer sample n=247; p=5)**			
Obtained correlation	.31	.32	.31
Shrunken correlation***	.25	.26	.25
Combined samples less AT, BT, and MM billets (n=706; p=32)**			
Obtained correlation	.89	.89	.89
Shrunken correlation***	.88	.88	.88
Enlisted sample less AT, BT, and MM billets (n=459; p=32)**			
Obtained correlation	.80	.80	.78
Shrunken correlation***	.77	.77	.74

*Method 2 utilized factors or job dimensions derived from a civilian sample of jobs and regression weights derived from the samples of naval billets, in the establishment of job values.

**n = number of cases in sample; p = number of dimensions used as predictors in regression equations.

***Estimated validity expected in cross-validation sample, obtained through the use of shrinkage formula.

derived regression weights in cross-validation samples. The latter coefficients were derived through the application of the shrinkage formula given in the procedures and analysis section. Also given in Table 4 are the multiple correlations obtained using the combined and enlisted samples, but excluding the 148 "excess" billet analyses from the AT, BT, and MM ratings. (As explained in the sample description, a disproportionate number of billets were analyzed from these three ratings to permit certain statistical analyses in Study 1.)

The pattern of correlation coefficients in Table 4 is very similar to that found in Table 3 regarding method 1. All of the correlations obtained under method 2 are slightly higher than those obtained under method 1, but again the correlations were relatively low in the officer sample (average .31), considerably higher in the enlisted sample (average .78), and higher still in the combined sample (average .89). There was not a significant difference between the correlations obtained in the full sample and those from the samples from which certain of the AT, BT, and MM billets were excluded.

Table 5 gives the results of the double cross-validation performed within the enlisted sample, using the procedures of method 2 with naval basic compensation as the criterion variable. It can be noted that the estimated correlations provided through the use of the shrinkage formula are very similar to those obtained using the actual cross-validation procedures. The shrinkage was found to be relatively small, using either method.

Method 3

This procedure involved the derivation of job values through the use of both factor scores and regression weights derived wholly from the naval data. The factor scores were obtained through the factor analysis of the combined sample, and then separately the officer sample. These were then weighted to provide the estimated job values in the same manner as in method 2. The 34 factors or dimensions, derived from the combined sample, were used as predictors in regression analyses within the combined and enlisted samples, and the 24 factors derived from the officer sample were similarly used in the officer sample regression analyses. The titles given to the factors derived in the combined and in the officer samples are provided in Appendices E and F, along with a listing of the elements that loaded heavily on each of the factors.

The multiple correlations associated with method 3 are given in Table 6. Those obtained in the combined enlisted and officer samples, and in the enlisted sample alone, were very comparable to corresponding coefficients obtained using method 2. The averages of the coefficients in the combined and enlisted samples, under method 3, were respectively .89 and .78 as compared with .88 and .75 under method 2. In the officer sample the multiple correlations were somewhat higher than were those under method 1 or method 2, averaging .35 across the three indices of naval compensation.

As under the preceeding two methods, the differences between the multiple correlations associated with naval basic pay, total A naval

Table 5

Multiple Correlations, Cross-Validation Coefficients and Estimated Cross-Validation Coefficients* Obtained Using Method 2, with Naval Basic Compensation as the Criterion Variable For Sample of Enlisted Personnel

Statistic	Subsample A (n=304)	Subsample B (n=303)
Multiple correlation	.81	.77
Cross-validation coefficient of correlation	.74	.71
Shrunken coefficient of correlation	.75	.71

*Estimated validity expected in cross-validation sample, obtained through the use of shrinkage formula.

Table 6

Multiple Correlations Obtained Under Method 3, with Three Indices of Naval Compensation Used as Criterion Variables*

Sample and statistic	Naval compensation index: Basic compensation	Total A compensation	Total C compensation
Enlisted sample (n=459; p=34)**			
Obtained correlation	.77	.80	.78
Shrunken correlation***	.73	.76	.75
Officer sample (n=247; p=24)**			
Obtained correlation	.51	.52	.51
Shrunken correlation***	.35	.37	.35
Combined sample (n=706; p=34)**			
Obtained correlation	.90	.90	.90
Shrunken correlation***	.89	.89	.89

*Method 3 utilized factors and regression weights, both derived in the naval samples of billets, in the derivation of job values.

**n=number of cases in sample; p=number of dimensions used as predictors in regression equations.

***Estimated validity expected in cross-validation sample, obtained through the use of shrinkage formula.

compensation, and total B naval compensation, within the various samples, was negligible.

Discussion

The results of study two provide reasonable support for the potential utility of a structured job analysis procedure such as the PAQ for the establishment of pay grades for naval billets, at least in the case of enlisted billets. The average multiple correlations obtained in the combined enlisted and officer samples, using methods 1, 2, and 3 were respectively .83, .88, and .89, after the application of Burket's (1964) shrinkage formula. These coefficients are in line with those previously reported by Mecham and McCormick (1969) in connection with the use of the PAQ for estimating job values for a wide variety and range of jobs in the civilian economy. In that earlier study, the correlations obtained between estimated and actual compensation rates in cross-validation samples ranged between .83 and .87. Similarly the correlation between job values derived through the use of the PAQ and compensation rates for a sample of jobs in an insurance company was .93 (McCormick, Jeanneret, & Mecham, 1972).

It is interesting to note that although the validity coefficients became somewhat larger, in going from method 1 to method 2 and then to method 3, the differences were not as great as might have been expected. Method 1, it will be recalled, utilized the factor structure obtained in a sample of civilian PAQ job analyses, and also regression weights from the same source. The fact that the method 1 validity coefficients were reasonably comparable to those obtained under method 2, which used the same factor structure but regression weights derived from the naval samples, would seem to indicate considerable similarity in the relative monetary values attached to various job characteristics in the civilian economy and in the military service.

Exploring the similarity in the validity coefficients obtained using the three methods a little further, the comparability of the multiple correlations obtained under methods 2 and 3 would seem to have some general implications regarding the characterization of jobs using the 32 dimensions derived by Mecham and McCormick (1969). Method 2 used the 32 dimensions in regression analyses, and obtained almost identical results to those obtained under method 3, in which factors or dimensions derived from naval samples were used. This would seem to provide support for McCormick, Jeanneret, and Mecham's (1972) characterization of the 32 factors as basic dimensions of work, useful in characterizing the behavioral activities and related aspects of a broad spectrum of jobs.

In looking at the validity coefficients associated with the three different computations of naval compensation used as criteria in the various regression analyses, it is quite clear, as one might expect, that the methods used to derive job values are equally effective using any of the three indices of compensation as criteria. The validity coefficients obtained using the three indices of naval compensation were almost identical. These indices, to review briefly, were entitled

naval basic compensation, total A naval compensation, and total B naval compensation. They differed in the allowances and benefits included in their computation, and in the assumptions made regarding the billet incumbents. The assumptions involved principally the incumbents' dependency status and retirement plans.

The similarity in the correlation coefficients obtained when the different indices were used as criteria is probably in large part accounted for by the differences in the values of the benefits and allowances for different pay grades and years of service. Some of the allowances, such as sea duty pay, are constant across pay grades for enlisted personnel, but most vary with pay grade and time in service. An examination of the sum of these allowances and benefits, as computed under any of the sets of assumptions, indicates that they are roughly proportional to the basic pay. Including these in the computation of the naval compensation would thus have approximately the effect of multiplying the criterion by a constant, which would not affect the correlation coefficient. The standard errors of estimate associated with the different indices of naval compensation, however, did vary.

As would be expected, the correlations for the subsamples of enlisted and of officer billets are lower than for the combined sample because of the restricted ranges of values in the subsamples. In the case of the enlisted billets the correlations are reasonably respectable, being in the mid- to upper-70's. These values reflect promise for the use of a structured job analysis procedure as the basis for the allocation of enlisted billets to pay grades.

In the case of the officer billets, however, the correlations were quite low. In part these correlations probably can be attributed to small samples in certain pay grades, especially the lower and higher pay grades (O-1, O-2, and O-6). For practical purposes the officer sample was concentrated in only three pay grades (O-3, O-4, and O-5). This restriction, however, would not account entirely for the low correlations. Rather, there appear to be two other factors that probably come into play. In the first place, it is probable that the duties and responsibilities of officers in various ranks actually overlap to a very substantial degree, especially in the case of officers in adjacent ranks. (In this regard it was noted by the investigator during the data collection phase that there were substantial similarities in the duties and responsibilities of officers of different ranks, especially adjacent ones.) To the extent that these delineations are not very clear, the prediction of the criterion (i.e., the pay grades of billet incumbents) on the basis of billet-related data would of course be restricted. (To the extent that this "overlapping" does in fact exist, it could be argued that the designation of specific billets for officers of specified ranks may not in practice be made on the basis of relevant billet-related considerations.)

In the second place--and to the extent to which "true" criterion differences do exist between and among pay grades of officers in various billets--it may be that the PAQ as such (as one form of structured job analysis questionnaire) is not sufficiently "sensitive" to differentiate

the billet-related distinctions that do exist between and among billets held by officers of different ranks. That the PAQ does reflect some such differences is obvious from the significant, albeit rather low, correlations. In reflecting about the possible use of structured job analysis procedures for this purpose, it is suggested that some specially designed such procedure might ultimately provide a more "sensitive" basis for reflecting the valid billet-related distinctions between and among billets that are appropriately designated for officers of different ranks.

CONCLUSION AND DISCUSSION

On the basis of the results of study one, it seems that a structured job analysis questionnaire (such as the PAQ) can be used as the basis for comparing the compensation rates of personnel in naval billets with the rates for jobs in the civilian economy that have similar characteristics.

The results of such a comparison as resulting from the study, indicate rather systematic differences in the compensation for naval personnel with that for their civilian counterparts, with the civilian counterparts having significantly higher rates of compensation. (The magnitude of the difference varies with the "basis" of the comparisons--in particular the inclusion or exclusion of fringe benefits--with pay grade, and with the "assumptions" one makes about the hypothetical incumbents such as dependency status, career intentions, etc. In the case of enlisted personnel the mean differences range from a somewhat minimum estimate of about $1,129 per year to a somewhat maximum estimate of $4,348.

On the basis of study two, it seems reasonable to believe that a structured job analysis questionnaire could be used as the basis for allocating billets to pay grades at least in the case of enlisted billets. The possible application of such a procedure to officer billets is somewhat more questionable, but might in part depend upon the development of a specialized structured job analysis questionnaire that would be more sensitive to whatever valid differences there actually might be between billets that are appropriate for officers of different ranks.

Since both studies deal with the use of a structured job analysis questionnaire as related to compensation for naval billets, a point should be made in this frame of reference as contrasted with corresponding analyses as they might relate to civilian jobs. In the case of civilian jobs, the compensation to the incumbent typically is specifically related to the job in question, in some instances with modest variability being based on merit and seniority. In the case of naval personnel, however, the compensation is more definitely associated with the individual (especially his pay grade, but in part his dependency status, length of

service, and other "personal" factors), rather than with his billet. Optimally, the billets to which individuals are assigned should be those which are appropriately designated for personnel of the pay grade in question, but the overall accuracy of this matching would depend upon two factors: (1) the validity of the allocation of billets to various pay grades; and (2) the consistency with which individuals of specified pay grades are in fact assigned to billets which have been allocated for personnel of the pay grade in question.

The fact that naval compensation is dominantly a function of the individual (especially his pay grade) rather than being directly related to his billet probably has had some effect upon the results of both studies reported here, as contrasted with the admittedly hypothetical situation in which (as actually is the case in the civilian economy) compensation would be directly linked to the job. Although the magnitude of this possible effect is not known, it is probably that it has been in the direction of attenuating or minimizing the magnitude or clarity of the relationships reported here.

Despite this possible modifying influence, it is felt that the results of these studies suggest the potential practical utility of structured job analysis procedures as the basis for providing "quantified" data about naval billets for use in various compensation-related contexts.

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APPENDIX A

Position Analysis Questionnaire (PAQ) (Navy Edition)

POSITION ANALYSIS QUESTIONNAIRE (PAQ)

(Navy Edition)

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Instructions for Completing PAQ for Naval Billets

As part of a research project sponsored by the Office of Naval Research you are being asked to use the Position Analysis Questionnaire (PAQ) to describe certain characteristics of the billet you occupied in your last Naval duty assignment. In describing your billet consider your primary duties and any particularly significant collateral duties. (Do not consider incidental collateral duties that occupied only a nominal proportion of your time.)

Identification: To be entered on PAQ Record Form (B) (White IBM form with red ink)

1. Side 1 (front). On the top of the PAQ Record Form are 2 rows of boxes. Print the following information in those boxes, entering an asterisk (*) between items of information:

   SHIP OR STATION*BILLET TITLE*DEPT. (OR OTHER ORGANIZATIONAL UNIT)*DATE* YOUR NAME

   When entering this information, consider the second row of boxes as a continuation of the first. For date, enter today's date in sequence day, month, and year, with a slash between these, as illustrated in the example below:

Example

PAQ No. 20012	*	U	S	S		R	A	N	G	E	R	*	U	P	N	S		O	F	F	I	C	E	R
*	E	N	G		O	E	P	T	*	2	8	/	1	1	/	7	2	*	J	O	H	N		D	O	E		

2. Side 2 (back)--top of page. Enter your name (in space "Name of Incumbent"). As the PAQ analyst, mark box "Job incumbent himself." Write a brief description of your billet in the space provided, including reference to significant collateral duties.

Rating PAQ Job Elements

First, be sure that you are familiar with these instructions and with the PAQ Record Form. Instructions and a rating scale are provided for use with each job element (item) in the PAQ. Determine the appropriate response for each element after considering the concept reflected in the job element itself, and the scale provided for use with that element. Notice that different scales are used with the various job elements, as follows:

Letter	Rating Scale
U	Extent of Use
I	Importance to Billet
T	Amount of Time
P	Possibility of Occurrence
A	Applicability
S	Special Code (when this type of code is used, it applies only to the job element of which it is a part.) Note that certain "Special" (S) rating scales do not have a "Does not apply" answer because the statement applies in some degree to every billet.

Following are three particular points that you should keep in mind when analyzing your billet:

1. The examples given for many job elements in the PAQ serve only to illustrate the intended concept or scope of the job element, and do not indicate the complete range of possible content. Several of the examples are from "civilian" types of jobs, but they may have their counterparts in naval activities. You should interpret the concept of each job element as it relates to your billet.

2. There will be many job elements that do not apply to your billet. In such instances simply mark "DNA" (Does not apply). Some of the job elements relate primarily to civilian jobs, and would seldom, if ever, be applicable.

3. When analyzing your billet, always refer to the description of each job element in the PAQ itself, and then record your response on the Record Form, as the Record Form includes only the title of each job element without any description or illustrations.

Recording Ratings of PAQ Job Elements

Begin with element 1 (on following page), and mark your ratings on the Record Form (B), as in the following example:

Example

1(U) Written materials (as sources of information)

"DNA" "1" "2" "3" "4" "5"

This letter refers to the rating scale to be used for this element. These scales are listed at the beginning of each section of the PAQ and also at the top of the PAQ Record Form (B). In this example, scale value "1" has been marked to indicate the "very infrequent" use of written materials.

POSITION ANALYSIS QUESTIONNAIRE (PAQ)

Code	Extent of Use (U)
DNA	Does not apply
1	Nominal/very infrequent
2	Occasional
3	Moderate
4	Considerable
5	Very substantial

1 INFORMATION INPUT

1.1 Sources of Job Information

Rate each of the following items in terms of how much it is used by the worker as a source of information in performing his billet.

1.1.1 Visual Sources of Job Information

1(U) Written materials (books, reports, office notes, job instructions, logs, signs, etc.)

2(U) Quantitative materials (materials which deal with quantities or amounts, such as graphs, accounts, specifications, tables of numbers, etc.)

3(U) Pictorial materials (pictures or picture-like materials used as sources of information for example, drawings, blueprints, diagrams, tracings, charts, photographic film, X-ray films, TV pictures, etc.)

4(U) Patterns/related devices (templates, stencils, patterns, etc., used as sources of information when observed during use; do not include here materials described in item 3 above)

5(U) Visual displays (dials, gauges, signal lights, radar scopes, speedometers, clocks, graphic displays, monitors, etc.)

6(U) Measuring devices (rulers, calipers, scales, thickness gauges, pipettes, thermometers, protractors, etc., used to obtain visual information about physical measurements; do not include here devices described in item 5 above)

7(U) Mechanical devices (tools, equipment, machinery, and other mechanical devices which are sources of information when observed during use or operation)

8(U) Materials in process (parts, materials, objects, etc., which are sources of information when being modified, worked on, or otherwise processed, such as bread dough being mixed, workpiece being turned in a lathe, etc.)

9(U) Materials not in process (parts, materials, objects, etc., not in the process of being changed or modified, which are sources of information when being inspected, handled, packaged, distributed, or selected, etc., such as items or materials in inventory, storage, or distribution channels, items being inspected, etc.)

10(U) Features of nature (geological formations, vegetation, cloud formations, and other features of nature which are observed or inspected to provide information)

11(U) Man-made features of environment (structures, ships, buildings, dams, highways, bridges, docks, and other "man-made" or altered aspects of the indoor or outdoor environment which are observed or inspected to provide job information)

12(U) Behavior (observing the actions of people or animals; for example, in teaching, supervising, etc., where this behavior is a source of job information)

13(U) Events or circumstances (those events the worker visually observes and in which he may participate, such as movement of ships, movement of materials, airport control tower operations, etc.)

14(U) Art or decor (artistic or decorative objects or arrangements used as sources of job information; for example, visual aids, paintings, interior decoration, etc.)

Code	Extent of Use (U)
DNA	Does not apply
1	Nominal/very infrequent
2	Occasional
3	Moderate
4	Considerable
5	Very substantial

1.1.2 Non-visual Sources of Job Information

15(U) Verbal sources (verbal instructions, orders, requests, conversations, interviews, discussions, formal meetings, etc.; consider only verbal communication which is relevant to job performance)

16(U) Non-verbal sounds (for example, noises, engine sounds, sonar, whistles, musical instruments, signals, horns, etc.)

17(U) Touch (pressure, pain, temperature, moisture, etc.; for example, feeling texture of surface, etc.)

18(U) Odor (odors which the worker needs to smell in order to perform his job; do not include odors simply because they happen to exist in the work environment)

19(U) Taste (bitter, sour, sweet, or salty qualities which are sources of job information; for example, cooks, stewards, etc.)

20(S) Near visual differentiation (using the code below, rate the amount of detail the worker must see to adequately obtain job information from objects, events, features, etc., within arm's reach)

Code	Degree of Detail
DNA	Does not apply (worker is blind or works in total darkness)
1	Very little detail (for example, that required in moving boxes, dumping trash, opening desk drawers, etc.)
2	Limited detail (for example, that required in crating, grinding hamburger, etc.)
3	Moderate detail (for example, that required in painting, reading typed letters, reading dials and gauges, etc.)
4	Considerable detail (for example, reading small blueprints, gauge calibration, etc.)
5	Extreme detail (for example, that required in assembling small electrical transistors; repairing chronometers, electronic circuits, etc.; miniature and microminiature optical work; etc.)

Note on rating "Importance to Billet":

Each of the items in the questionnaire which uses the "Importance to Billet (I)" scale is to be rated in terms of how important the activity described in the item is to the completion of the job, as compared with the other activities which are part of this job. Consider such factors as amount of time spent, the possible influence on overall job performance if the worker does not properly perform this activity, etc.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

21(I) Far visual differentiation (seeing differences in the details of objects, events, or features beyond arm's reach; for example, operating a vehicle, lookout watch, air controller, etc.)

22(I) Depth perception (judging the distance from the observer to objects, or the distances between objects as they are positioned in space, as in operating a crane, manual gun sighting, handling and positioning objects, etc.)

23(I) Color perception (differentiating or identifying objects, materials, or details thereof on the basis of color; for example, identifying running lights, etc.)

24(I) Sound pattern recognition (recognizing different patterns, or sequences of sounds; for example, those involved in Morse code, heart beats, engines not functioning correctly, etc.)

25(I) Sound differentiation (recognizing differences or changes in sounds in terms of their loudness, pitch, and/or tone quality; for example, sonar operation, etc.)

26(I) Body movement sensing (sensing or recognizing changes in the direction or speed at which the body is moving without being able to sense them by sight or hearing; for example, as in flying aircraft, working in internal compartments aboard ship, etc.; in the case of shipboard personnel, rate in terms of the extent to which it is required in actual performance of duties)

27(I) Body balance (sensing the position and balance of the body when body balance is critical to job performance, as when climbing high masts, walking on slippery decks or on narrow gangplanks, aircraft refueling, hazardous types of maintenance jobs such as side cleaning, etc.)

1.3 Estimation Activities

In this section are various operations involving estimation or judging activities. In each case consider activities in which the worker may use any or all of the senses; for example, sight, hearing, touch, etc. Continue using the "Importance to Billet" scale.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

28(I) Estimating speed of moving parts (estimating the speed of the moving parts associated with stationary objects; for example, the revolutions per minute of a motor, the speed at which a lathe turns, etc.)

29(I) Estimating speed of moving objects (estimating the speed of moving objects or materials relative to a fixed point or to other moving objects; for example, the speed of vessels or aircraft, materials on a conveyor belt, etc.)

30(I) Estimating speed of processes (estimating the speed of on-going processes or a series of events while they are taking place; for example, chemical reactions, assembly operations, timing of food preparation in galley, etc.)

31(I) Judging condition/quality (estimating the condition, quality, and/or operational readiness of electronic systems, engineering systems, weapon systems, etc.; judging value of surplus items to be liquidated; etc.)

32(I) Inspecting (inspecting products, objects, materials, etc., either one's own workmanship or that of others, in terms of established standards; for example, identifying defects, classifying by grade, etc.; do not include here activities described in item 31 above)

33(I) Estimating quantity (estimating the quantity of objects without direct measurement, including weight, number, volume, etc.; for example, of foodstuffs, supplies on hand, etc.)

34(I) Estimating size (estimating the dimensions of objects without direct measurement, including length, thickness, etc.; for example, estimating the height of a tree, judging sizes of boxes in loading a hold, etc.)

35(I) Estimating time (estimating the time required for past or future events or work activities; for example, judging the amount of time to make a delivery, estimating the time required to service a worn machine part or piece of equipment, judging the length of time required to set up a lathe, etc.)

2 MENTAL PROCESSES

2.1 Decision Making, Reasoning, and Planning/Scheduling

36(S) Decision making (indicate, using the code below, the level of decision making typically involved in the billet, considering: the number and complexity of the factors that are taken into account; the variety of alternatives available; the consequences and importance of the decisions; the background experience, education, and training required; the precedents available for guidance; and other relevant considerations. The examples given for the following codes are only suggestive.)

Code	Level of Decision
1	Low ("decisions" such as those in selecting parts in routine cleaning, shelving items in a storeroom, etc.)
2	Below average ("decisions" such as those in operating or dispatching vehicles, lubricating a truck, etc.)
3	Average ("decisions" such as those in setting-up machine tools for operation, diagnosing mechanical disorders of aircraft, ordering office supplies several months in advance, etc.)
4	Above average ("decisions" such as those in making personnel decisions such as promotions and disciplinary actions, determining flight plan, etc.)
5	High ("decisions" such as those in recommending major surgery, determining battle strategy, etc.)

37(S) Reasoning in problem solving (indicate, using the code below, the level of reasoning that is required of the worker in applying his knowledge, experience, and judgment to problems)

Code	Level of Reasoning in Problem Solving
1	Low (use of common sense to carry out simple, or relatively uninvolved, instructions; for example, sweeper, messenger, stores working party, etc.)
2	Below average (use of some training and/or experience to select from a limited number of solutions the most appropriate action or procedure in performing the billet; for example, issuing clerk, mess stewards, etc.)
3	Average (use of relevant principles to solve practical problems and to deal with a variety of concrete variables in situations where only limited standardization exists; for example, draftsman, carpenter, ship navigation, non-routine repair of mechanical equipment, etc.)
4	Above average (use of logic or scientific thinking to define problems, collect information, establish facts, and draw valid conclusions; for example, individual with major responsibilities for diagnosis and repair of complex electronic and weapon systems, aeronautical engineering officer, etc.)
5	High (use of principles of logical or scientific thinking to solve a wide range of intellectual and practical problems; for example, commanding a vessel, research scientists, etc.)

38(S) Amount of planning/scheduling (indicate, using the code below, the amount of planning/scheduling the worker is required to do which affects his own activities and/or the activities of others)

Code	Amount of Planning
DNA	Does not apply (has no opportunity to plan even his own activities; the specific activities of the worker are virtually predetermined for him)
1	Very limited (has limited opportunity to plan or schedule his own activities; for example, mess cook, side cleaner, etc.)
2	Limited (some planning is required, typically of one's own work activities; for example, the planning that would be done by a radio operator, etc.)
3	Moderate (a moderate amount of planning of his own or other activities is required; for example, a carpenter who must plan the best way to build a structure, a dispatcher, etc.)
4	Considerable (a fairly large amount of planning/scheduling is required; for example, a leading petty officer who must plan the activities of his subordinates, an instructor who must prepare lectures or lesson plans, planning/scheduling the arrival and distribution of materials, etc.)
5	Extensive (substantial amount of planning/scheduling is required; for example, a department head, an executive officer who must plan the activities of different work groups, contingency planning, etc.)

2.2 Information Processing Activities

In this section are various human operations involving the "processing" of information or data. Rate each of the following items in terms of how important the activity is to the completion of the job.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

39(I) Combining information (combining, synthesizing, or integrating information or data from two or more sources to establish new facts, hypotheses, theories, or a more complete body of related information; for example, integrating intelligence information, a pilot flying aircraft, a weatherman using information from various sources to predict weather conditions, radarman, signalman, etc.)

40(I) Analyzing information or data (for the purpose of identifying underlying principles or facts by breaking down information into component parts; for example, interpreting intelligence reports, diagnosing mechanical disorders or medical symptoms, ECM operators, etc.)

41(I) Compiling (gathering, grouping, classifying, or in some other way arranging information or data in some meaningful order or form; for example, preparing reports of various kinds, filing correspondence on the basis of content, selecting particular data to be gathered, preparing lesson plans, etc.)

42(I) Coding/decoding (coding information or converting coded information back to its original form; for example, "reading" Morse Code, translating foreign languages, or using other coding systems such as shorthand, mathematical symbols, computer languages, drafting symbols, replacement part numbers, etc.; TTY; cryptography; etc.)

43(I) Transcribing (copying or posting data or information for later use; for example, copying gauge readings in a record book, keeping a bell log, recording weather, etc.)

44(I) Other information processing activities (specify in margin of PAQ Record Form)

2.3 Use of Learned Information

45(I) Short-term memory (learning and retaining job-related information and recalling that information after a brief period of time, for example, cook, telephone operator, helmsman, messenger, etc.)

46(S) Education (indicate, using the code below, the level of education generally or typically required by persons who are selected for this occupational field; include education in elementary, high school, colleges, etc.; do not include training in naval schools, or technical or vocational school training--see item 48)

Code	Education (given level or equivalent)
DNA	Does not apply (little or no formal education required)
1	Less than high school diploma
2	High school diploma
3	Some college education (some college but not a 4-year college degree)
4	College degree (degree requiring 4 years or more to complete; for example, B.A., B.S., etc.)
5	Advanced degree (M.S., Ph.D., M.D., L.L.D., etc.)

47(S) Job-related experience (indicate, using the code below, the amount of all previous job-related experience in other related or lower-level jobs or billets generally required by persons selected for the billet; do not include formal education as described in item 46)

Code	Job-related Experience
DNA	Does not apply (no experience required)
1	Less than 1 month
2	Over 1 month up to and including 12 months
3	Over 1 year up to and including 3 years
4	Over 3 years up to and including 5 years
5	Over 5 years

48(S) Training (indicate, using the code below, the total amount of training generally required for persons who have had no prior job training to learn to perform adequately in this billet; consider all types of required job-related training except for education described in item 46; include training at Class A, B, and C schools, as well as striker, on-the-job, off-the-job, and orientation training, etc.)

Code	Training
DNA	Does not apply or very limited — no more than one day's training required)
1	Over 1 day up to and including 30 days
2	Over 30 days up to and including 6 months
3	Over 6 months up to and including 1 year
4	Over 1 year up to and including 3 years
5	Over 3 years

49(S) Using mathematics (indicate, using the code below, the highest level of mathematics required by the billet)

Code Level of Mathematics

DNA Does not apply
1 Simple basic (counting, addition and subtraction of 2-digit numbers or less)
2 Basic (addition and subtraction of numbers of 3-digits or more, multiplication, division, etc.)
3 Intermediate (calculations and concepts involving fractions, decimals, percentages, etc.)
4 Advanced (algebraic, geometric, trigonometric, and statistical concepts, techniques, and procedures, usually applied in standard practical situations)
5 Very advanced (advanced mathematical and statistical theory, concepts, and techniques; for example, calculus, topology, vector analysis, factor analysis, probability theory, etc.)

3 WORK OUTPUT

3.1 Use of Devices and Equipment

3.1.1 Hand-held Tools or Instruments

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

Consider in this category those devices which are used to move or modify work pieces, materials, products, or objects. Do not consider measuring devices here.

Manually-powered

50(I) Precision tools/instruments (that is, tools or instruments powered by the user to perform very accurate or precise operations; for example, the use of engraver's tools, watchmaker's tools, surgical instruments, etc.)

51(I) Non-precision tools/instruments (tools or instruments powered by the user to perform operations not requiring great accuracy or precision; for example, hammers, wrenches, trowels, knives, scissors, chisels, putty knives, strainers, hand grease guns, etc.; do not include long-handle tools here)

52(I) Long-handle tools (hoes, rakes, shovels, picks, axes, brooms, mops, etc.)

53(I) Handling devices/tools (tongs, ladles, dippers, forceps, etc., used for moving or handling objects and materials; do not include here protective gear such as asbestos gloves, etc.)

Powered (manually controlled or directed devices using an energy source such as electricity, compressed air, fuel, hydraulic fluid, etc., in which the component part which accomplishes the modification is hand-held, such as dentist drills, welding equipment, etc., as well as devices small enough to be entirely hand-held)

54(I) Precision tools/instruments (hand-held powered tools or instruments used to perform operations requiring great accuracy or precision, such as dentist drills, soldering irons, welding equipment, saws, etc., used for especially accurate or fine work)

55(I) Non-precision tools/instruments (hand-held, energy-powered tools or instruments used to perform operations not requiring great accuracy or precision; for example, power saws, drills, sanders, clippers, etc., and related devices such as electrical soldering irons, spray guns or nozzles, welding equipment, etc.)

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

3.1.2 Other Hand-held Devices

56(I) Drawing and related devices (instruments or devices used in writing, sketching, illustrating, drafting, etc.; for example, pens, pencils, drawing instruments, artist's brushes, drafting equipment, etc.; do not include measuring instruments here, see item 58)

57(I) Applicators (brushes, rags, paint rollers, etc., which are hand-held and used in applying solutions, materials, etc.; do not consider devices covered by items 50-55 above)

58(I) Measuring devices (rules, measuring tapes, micrometers, calipers, protractors, squares, thickness gauges, levels, volume measuring devices, etc.)

59(I) Technical and related devices (cameras, stopwatches, slide rules, etc.)

60(I) Other hand-held tools and devices (specify in margin of PAQ Record Form)

3.1.3 Stationary Devices

61(I) Machines/equipment (used to generate power, or to process, fabricate, or otherwise modify parts, objects, materials, etc.; use this category in addition to indicating the controls used in the subsection which follows)

3.1.4 Control Devices (on any equipment operated or used)

62(I) Activation controls (hand or foot operated devices used to start, stop, or otherwise activate energy-using systems or mechanisms; for example, light switches, electric motor switches, ignition switches, etc.)

63(I) Fixed setting controls (hand or foot operated devices with distinct positions, detents, or definite settings; for example, TV selector switch, gear-shift, etc.)

64(I) Variable setting controls (hand or foot operated devices that can be set at the beginning of operation, or infrequently, at any position along a scale; for example, TV volume control, thermostat, rheostat, etc.)

65(I) Keyboard devices (typewriters, adding machines, calculators, pianos, keypunch machines, etc.)

Frequent adjustment controls (used in making frequent adjustments of mechanisms)

66(I) Hand-operated controls (controls operated by hand or arm for making frequent, but not continuous, adjustments; for example, hand controls on a crane or bulldozer, valve controls, helm of ship, etc.)

67(I) Foot-operated controls (controls operated by foot or leg for making frequent, but not continuous, adjustments; for example, automobile brakes, etc.)

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

Continuous controls (used continuously in operation or use)

68(I) Hand-operated controls (controls operated by hand and used continuously for adjusting to changing, or possible changing, situations; for example, use of steering wheel, controls on a "tracking" device, etc.)

69(I) Foot-operated controls (controls operated by foot and used continuously for adjusting to changing, or possibly changing, situations; for example, accelerator, etc.)

3.1.5 Transportation and Mobile Equipment

70(I) Man-powered vehicles (bicycles, rowboats, punts, etc.)

71(I) Powered highway/rail vehicles (vehicles intended primarily for highway or railroad transportation; for example, automobiles, trucks, buses, trains, etc.)

72(I) Powered mobile equipment (movable vehicles not primarily intended for highway use; for example, warehouse trucks, fork lifts, road graders, tractors, etc.)

73(I) Powered water vehicles (ships, submarines, small boats, etc.)

74(I) Air/space vehicles (planes, helicopters, balloons, gliders, rocketships, etc.)

75(I) Man-moved mobile equipment (hand trucks, wheel barrows, floor polishers and buffers, etc.)

76(I) Operating equipment (cranes, hoists, elevators, etc.)

77(I) Remote-controlled equipment (conveyor systems, etc.)

3.2 Manual Activities

This section describes manual activities in which tools may or may not be used.

78(I) Setting up/adjusting (adjusting, calibrating, aligning and/or setting up of machines or equipment; for example, setting up a lathe or drill press, adjusting an engine carburetor, adjusting, calibrating, and aligning electric circuitry, etc.)

79(I) Manually modifying (using hands directly to form or otherwise modify materials or products; for example, kneading dough by hand, folding letters, etc.)

80(I) Material-controlling (manually controlling or guiding materials being processed; for example, in operating sewing machine, jig saws, etc.)

81(I) Assembling/disassembling (either manually or with the use of hand tools putting parts or components together to form more complete items, or taking apart or disassembling items into their component parts)

82(I) Arranging/positioning (manually placing objects, materials, etc., in a specific position or arrangement; for example, in displays, in stocking shelves, positioning patients for certain medical and dental procedures, etc.; do not include here arranging/positioning which is a part of the operations listed in items 78-81)

83(I) Feeding/off-bearing (manually inserting, throwing, dumping or placing materials into or removing them from machines or processing equipment; this category is not to be used in describing operations in which the worker manually guides or controls the materials or parts during processing, as in item 80)

84(I) Physical handling (physically handling objects, materials, human beings, etc., either manually or with nominal use of aiding devices, for example, in certain warehousing activities, loading/unloading conveyor belts or trucks, packaging, hospital procedures, etc.; typically there is little requirement for careful positioning or arrangement of objects; include here relatively uninvolved handling operations not provided for in items 78-83)

3.3 Activities of the Entire Body

85(I) Highly skilled body coordination (activities involving extensive, and often highly-learned coordination activities of the whole body, such as characterized by athletic activities)

86(I) Balancing (maintaining body balance or equilibrium to prevent falling when standing, walking, running, crouching, etc., on narrow, slippery, steeply inclined or erratically moving surfaces; for example, walking on narrow elevated plank, during underway replenishment, etc.)

3.4 Level of Physical Exertion

87(S) Level of physical exertion (indicate, using the code below, the general level of body activity, considering the frequency and effort required to perform job tasks involving pushing, pulling, carrying, lifting, etc., during an average work day)

Code	Level of Physical Exertion
1	Very light (occasionally walking or standing and/or occasionally moving light objects, materials, etc., such as yeoman, draftsman, radio operator, etc.)
2	Light (frequently walking or standing and/or frequently exerting force equivalent to lifting up to approximately 10 pounds and/or occasionally exerting force equivalent to lifting about 20 pounds)
3	Moderate (frequently exerting forces equivalent to lifting up to approximately 25 pounds and/or occasionally exerting forces equivalent to lifting up to approximately 50 pounds; for example, light engine mechanic, bus driver, etc.)
4	Heavy (frequently exerting forces equivalent to lifting up to approximately 50 pounds and/or occasionally exerting forces equivalent to lifting up to approximately 100 pounds; for example, general laborer, bulldozer operator, heavy equipment mechanic, etc.)
5	Very heavy (frequently exerting forces equivalent to lifting over 50 pounds and/or occasionally exerting forces over that required to lift 100 pounds; for example, stevedores, etc.)

Code	Amount of Time (T)
DNA	Does not apply (or is very incidental)
1	Under 1/10 of the time
2	Between 1/10 and 1/3 of the time
3	Between 1/3 and 2/3 of the time
4	Over 2/3 of the time
5	Almost continually

3.5 Body Positions/Postures

Indicate by code the approximate proportion of working time the worker is engaged in the following activities (nos. 88-92)

88(T) Sitting

89(T) Standing (do not include walking)

90(T) Walking/running

91(T) Climbing (for example, painter, telephone lineman, etc.)

92(T) Kneeling/stooping (kneeling, stooping, crawling, crouching, and other related body positions which may be uncomfortable or awkward)

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

3.6 Manipulation/Coordination Activities

Rate the following items in terms of how important the activity is to completion of the job.

93(I) Finger manipulation (making careful finger movements in various types of activities; for example, fine assembly, use of precision tools, repairing watches, use of writing and drawing instruments, operating keyboard devices, etc.; usually the hand and arm are not involved to any great extent)

94(I) Hand-arm manipulation (the manual control of manipulation of objects through hand and/or arm movements, which may or may not require continuous visual control; for example, repairing engines, semaphore signalling, etc.)

95(I) Hand-arm steadiness (maintaining a uniform, controlled hand-arm posture or movement; for example, using a welding torch, performing surgery, etc.)

96(I) Eye-hand/foot coordination (the coordination of hand and/or foot movements where the movement must be coordinated with what is seen; for example, driving a vehicle, operating a sewing machine, operating winch, tuning radar, using electronic test equipment for alignment, etc.)

97(I) Limb movement without visual control (movement of body limbs from one position to another without the use of vision; for example, reaching for controls without looking, touch typing, etc.)

98(I) Hand-ear coordination (the coordination of hand movements with sounds or instructions that are heard; for example, tuning radio receivers, piloting aircraft by control tower instructions, etc.)

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

4 RELATIONSHIPS WITH OTHER WORKERS

This section deals with different aspects of interaction between people involved in various kinds of work.

4.1 Communications

Rate the following in terms of how important the activity is to the completion of the billet. Some jobs may involve several or all of the items in this section.

4.1.1 Oral (communicating by speaking)

95(I) Advising (dealing with individuals in order to counsel, and/or guide them with regard to problems that may be resolved by legal, financial, scientific, technical, clinical, spiritual, and/or other professional principles)

100(I) Negotiating (dealing with others in order to reach an agreement or solution; for example, negotiating procurement contracts, diplomatic relations, etc.)

101(I) Persuading (dealing with others in order to influence them toward some action or point of view; for example, public relations officers, etc.)

102(I) Instructing (the teaching of knowledge or skills, either in an informal or formal manner, to others; for example, instructor, petty officer teaching a striker, etc.)

103(I) Interviewing (conducting interviews directed toward some specific objective; for example, interviewing applicants in recruiting office, career counseling, etc.)

104(I) Routine information exchange (the giving and/or receiving of information of a routine or simple nature; for example, radio operator, receptionist, information clerk, etc.)

105(I) Non-routine information exchange (the giving and/or receiving of information of a non-routine or complex nature; for example, engineers discussing shipyard overhaul, officers' call, CIC to OOD, lookout to OOD, etc.)

106(I) Public speaking (making speeches or formal presentations before relatively large audiences; for example, lecturing, radio/TV broadcasting, delivering a sermon, etc.)

4.1.2 Written (communicating by written/printed material)

107(I) Writing (for example, writing or dictating letters, reports, etc., writing notices, writing instructions, etc.; do not include transcribing activities described in item 42)

4.1.3 Other Communications

108(I) Signaling (communicating by some type of signal; for example, hand signals, semaphore, whistles, horns, bells, lights, etc.)

109(I) Code communications (telegraph, cryptography, shorthand, etc.)

4.2 Miscellaneous Interpersonal Relationships

110(I) Entertaining (performing to amuse or entertain others; for example, on stage, TV, clubs, etc.)

111(I) Serving/catering (attending to the needs of, or performing personal services for, others; for example, mess cook, barbers, sick-bay attendant, etc.)

4.3 Amount of Job-required Personal Contact

112(S) Job-required personal contact (indicate, using the code below, the extent of job-required contact with others, individually or in groups; for example, contact with patients, students, the public, superiors, subordinates, fellow shipmates, official visitors, etc.; consider only personal contact which is definitely part of the billet)

Code	Extent of Required Personal Contact
1	Very infrequent (almost no contact with others is required)
2	Infrequent (limited contact with others is required)
3	Occasional (moderate contact with others is required)
4	Frequent (considerable contact with others is required)
5	Very frequent (almost continual contact with others is required)

4.4 Types of Job-required Personal Contact

This section lists types of individuals with whom the worker must have personal contact in order to perform his job. Indicate by code the importance of contact with each of the types of individuals listed below. Consider personal contact not only with personnel within the organization, but also with personnel from other organizations, if contact with them is part of the billet.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

113(I) Executives/officials (flag officers, squadron commanders, commanding officers, executive officers, etc.)

114(I) Middle management/staff personnel (department and division officers, other staff officers, etc.)

115(I) Supervisors (those personnel who have immediate responsibility for a work group; for example, leading petty officers, etc.)

116(I) Professional personnel (doctors, lawyers, scientists, engineers, professors, teachers, consultants, etc.)

117(I) Semi-professional personnel (technicians, draftsmen, designers, photographers, surveyors, and other personnel who are engaged in activities requiring fairly extensive education or practical experience but which typically involve a more restricted area of operation than that of professional personnel)

118(I) Clerical personnel (personnel engaged in office work, such as yeoman, personnel men, dispersing clerks, etc.)

119(I) Manual and service workers (personnel in skilled, semi-skilled, unskilled, and related types of work, such as deck crew, engine room crew, etc.)

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

120(I) Sales personnel

121(I) Buyers (purchasing agents, not public customers)

122(I) Public customers (as in ship service stores, base cafeterias, etc.)

123(I) The public (not including customers or persons in other specified categories; include the "public" as contacted by, for example, shore patrolmen and masters at arms, etc.)

124(I) Students/trainees/apprentices

125(I) Clients/patients/counselees

126(I) Special interest groups (fraternal and service organizations, minority groups, wive's groups, property owners, etc.)

127(I) Other individuals (include here types of persons not described in items 113-126 above, but, whenever possible, use one of the above categories) (Specify in margin of PAQ Record Form)

4.5 Supervision and Coordination

4.5.1 Supervision/Direction Given

128(S) Supervision of non-supervisory personnel (indicate, using the code below, the number of persons directly supervised who are actually involved in the repairing of equipment, in maintenance, in service activities, etc., and do not supervise others; this item would apply, for example, to most "first line" supervisors, most division officers, leading petty officers, etc.

Code	Number of Non-supervisory Personnel Supervised
DNA	Does not apply
1	1 or 2 workers
2	3 to 5 workers
3	6 to 8 workers
4	9 to 12 workers
5	13 or more workers

129(S) Direction of supervisory personnel (indicate, using the code below, the number of supervisory personnel--those who have responsibility for the supervision or direction of others--who report directly to the person holding this position; this item would apply to most department heads, etc.)

Code	Number of Supervisory Personnel Directed
DNA	Does not apply (does not direct supervisors)
1	1 or 2 supervisory personnel
2	3 to 5 supervisory personnel
3	6 to 8 supervisory personnel
4	9 to 12 supervisory personnel
5	13 or more supervisory personnel

130(S) Total number of personnel for whom responsible (indicate, using the code below, the total number of personnel for whom the person holding this job is either directly or indirectly responsible; for example, a commanding officer would be responsible for all personnel under his command; and department, division, and leading petty officers would be responsible for all within their sphere of command; use this item in addition to 128 and/or 129)

Code	Total number of personnel for whom responsible
DNA	Does not apply (not responsible for other personnel)
1	10 or fewer workers
2	11 to 50 workers
3	51 to 250 workers
4	251 to 750 workers
5	751 or more workers

4.5.2 Other Organizational Activities

This subsection includes activities of a coordinating, staff, or supervisory nature.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

131(I) Supervises non-employees (students, patients, etc.)

132(I) Coordinates activities (coordinates, monitors, or organizes the activities of others to achieve certain objectives, but does not have line management authority; for example, special services officer, club committee chairman, etc.)

133(I) Staff functions (advises, consults, or gives other types of assistance to line officers; for example, legal officer, intelligence officer, etc.)

4.5.3 Supervision Received

134(S) Supervision received (indicate, using the code below, the level of supervision the worker typically receives)

Code	Level of Supervision Received
1	Immediate supervision (receives close supervision relating to specific work activities, including assignments, methods, etc.; usually receives frequent surveillance over job activities)
2	General supervision (receives general supervision relating to work activities)
3	General direction (receives only very general guidance relating to job activities, primarily guidance with respect to general objectives; has rather broad latitude for determining methods, work scheduling, how to achieve objectives, etc.; for example, department and division officers, etc.
4	Nominal direction (receives only nominal direction or guidance in job, as in the case of a manager of an organization or a major subdivision thereof, and is therefore subject only to very broad policy guidelines; for example, commanding officers, etc.

5 JOB CONTEXT

5.1 Physical Working Conditions

This section lists various working conditions. Rate the average amount of time the worker is exposed to each condition during a typical work period.

Code	Amount of Time (T)
DNA	Does not apply (or is very incidental)
1	Under 1/10 of the time
2	Between 1/10 and 1/3 of the time
3	Between 1/3 and 2/3 of the time
4	Over 2/3 of the time
5	Almost continually

5.1.1 Outdoor Environment

135(T) Out-of-door environment (susceptible to changing weather conditions)

5.1.2 Indoor temperatures (do not consider indoor temperature conditions that are simply a function of the weather; for example, heat in summer)

136(T) High temperature (conditions in which the worker might experience severe discomfort or heat stress, such as in boiler rooms, around furnaces, etc.; typically this would occur in a dry atmosphere at about 90° F. and in a humid atmosphere at about 80° F. or 85° F.)

137(T) Low temperature (conditions in which the worker is exposed to low temperatures which are definitely uncomfortable even though clothing appropriate for the conditions may be worn, such as refrigerated rooms, etc.)

5.1.3 Other Physical Working Conditions

138(T) Air contamination (dust, fumes, smoke, toxic conditions, disagreeable odors, etc.; consider here air contamination or pollution which is an irritating or undesirable aspect of the billet)

139(T) Vibration (vibration of whole body or body limbs; for example, driving a tractor or truck, operating an air hammer, etc.)

140(T) Improper illumination (inadequate lighting, excessive glare, etc.)

Code	Amount of Time (T)
DNA	Does not apply (or is very incidental)
1	Under 1/10 of the time
2	Between 1/10 and 1/3 of the time
3	Between 1/3 and 2/3 of the time
4	Over 2/3 of the time
5	Almost continually

141(T) Dirty environment (an environment in which the worker and/or his clothing easily becomes dirty, greasy, etc.; for example, environments often associated with engine rooms, foundries, highway construction, furnace cleaning, etc.)

142(T) Awkward or confining work space (conditions in which the body is cramped or uncomfortable)

143(S) Noise intensity (indicate, using the code below, the typical noise level to which the worker is exposed)

Code	Noise Intensity
1	Very quiet (intensive care ward in hospital, photo lab, etc.)
2	Quiet (many private offices, libraries, etc.)
3	Moderate (office where typewriters are used, light automobile traffic, ship service store, etc.)
4	Loud (heavy traffic, machine shops, carpenter shops, etc.)
5	Very loud (close to jet engines, large earth-moving equipment, riveting, etc.)

Code	Possibility of Occurrence (P)
No	No possibility
1	Very limited
2	Limited
3	Moderate
4	Fairly high
5	High

5.2 Physical Hazards

The four items which follow describe accidents or illnesses which may result from exposure to hazards. Rate the possibility of the occurrence of each of the types of accidents/illnesses to the typical worker in this billet. In making the ratings consider the safety/accident record of workers in this billet, and/or the possibility of accidents due to such factors as: traveling at high speeds, being in high places, working with machinery, sharp tools, hot or very cold materials, exposure to falling objects, dangerous chemicals, explosives, toxic fumes, nuclear and radio frequency radiation, high voltages, etc.

144(P) First-aid cases (minor injuries or illnesses which typically result in a day or less of "lost" time and are usually remedied with first-aid procedures)

145(P) Temporary disability (temporary injuries or illnesses which prevent the worker from performing his job from one full day up to extended periods of time but which do not result in permanent disability or impairment)

146(P) Permanent partial impairment (injuries or illnesses resulting in the amputation or permanent loss of use of any body member or part thereof, or permanent impairment of certain body functions)

Code	Possibility of Occurrence (P)
No	No possibility
1	Very limited
2	Limited
3	Moderate
4	Fairly high
5	High

147(P) Permanent total disability/death (injuries or illnesses which totally disable the worker and permanently prevent his further gainful employment; for example, loss of life, sight, limbs, hands, radiation sickness, etc.)

5.3 Personal and Social Aspects

This section includes various personal and social aspects of jobs. Indicate by code the importance of these aspects as a part of the billet.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

148(I) Civic obligations (because of the job the worker assumes, or is expected to assume, certain civic obligations or responsibilities, as might be the case with certain public relations officers, commanding officers, etc.)

149(I) Frustrating situations (job situations in which attempts to deal with problems or to achieve job objectives are seriously obstructed or hindered, and may thus contribute to frustration on the part of the worker)

150(I) Strained personal contacts (dealing with individuals or groups in "unpleasant" or "strained" situations; for example, certain aspects of shore patrol work, handling certain mental patients, MAA, etc.)

151(I) Personal sacrifice (being willing to make particular personal sacrifices while being of service to other people or the objectives of an organization; for example, chaplains, etc.; do not consider physical hazards here)

152(I) Interpersonal conflict situations (job situations in which there are virtually inevitable differences in objectives, opinions, or viewpoints between the worker and other persons or groups of persons, and which may "set the stage" for conflict; for example, supervisors who must enforce an unpopular policy, etc.)

153(S) Non-job-required social contact (indicate, using the code below, the opportunity to engage in informal, non-job-required conversation, social interaction, etc. with others while on the job; for example, barber, receptionist, member of working party, etc.; do not include here the personal contacts required by the job as described in item 112)

Code	Opportunity for Non-job-required Social Contact
1	Very infrequent (almost no opportunity)
2	Infrequent (limited opportunity)
3	Occasional (moderate opportunity)
4	Frequent (considerable opportunity)
5	Very frequent (almost continual opportunity)

6 OTHER JOB CHARACTERISTICS

6.1 Apparel Worn

Code	Applicability (A)
DNA	Does not apply
1	Does apply

For each item mark DNA if the item does not apply, a one (1) if the item applies. Note: One or more items in this section may be applicable.

154(A) Business suit or dress (expected to wear, when appropriate, presentable civilian clothing such as tie and jacket, street dress, etc.)

155(A) Specific uniform/apparel (service dress uniforms; mark "does apply" except in unusual circumstances)

156(A) Work clothing (dungarees, etc.)

Code	Applicability (A)
DNA	Does not apply
1	Does apply

157(A) Protective clothing or gear (clothing or equipment worn as a regular part of the job to protect the worker; for example, safety helmets, goggles, noise suppressors, safety shoes, insulated gloves or clothing, protective masks, etc.; this item does not apply if only worn occasionally or rarely)

158(A) Informal attire (sports wear, etc.; mark "does not apply" except in very unusual circumstances)

159(A) Apparel style optional (style totally optional; mark "does not apply" except in unusual circumstances)

6.2 Licensing

160(A) Licensing/certification required (to be restricted to such fields as medicine, nursing, law, etc.)

6.3 Work Schedule

Code	Applicability (A)
DNA	Does not apply
1	Does apply

6.3.1 Continuity of work (as relevant to total year)

161(A) Regular work (special instructions in analyzing naval billets: mark "1" for this item)

162(A) Irregular work (special instructions in analyzing naval billets: mark "DNA" for this item)

In each of the following two groups of items, mark one (1) for the item that most nearly applies, and mark DNA for all other items in that group.

6.3.2 Regularity of working hours

163(A) Regular hours (same basic work schedule every week)

164(A) Variable shift work (work shift varies from time to time)

165(A) Irregular hours (works variable or irregular hours, depending on requirements of the service)

6.3.3 Day-night schedule

166(A) Typical day hours

167(A) Typical night hours (including evening work)

168(A) Typical day and night hours (works some days and some nights, depending on work shifts, job demands, schedules, or other job factors)

6.4 Job Demands

This section lists various types of demands that the job situation may impose upon the worker, usually requiring that he adapt to these in order to perform his work satisfactorily. Rate the following items in terms of how important they are to the billet.

Code	Importance to Billet (I)
DNA	Does not apply
1	Very minor
2	Low
3	Average
4	High
5	Extreme

169(I) Specified work pace (as on a controlled assembly line; this would seldom apply to a naval billet)

170(I) Repetitive activities (performance of the same physical or mental activities repeatedly, without interruption, for periods of time)

171(I) Cycled work activities (performance of a sequence or schedule of work activities which typically occurs on a weekly, daily, or hourly basis and which typically allows the worker some freedom of action so long as he meets a schedule; for example, a security guard patrolling his beat, preparing scheduled reports, etc.; do not include here activities more nearly described as repetitive activities in item 170 above)

172(I) Following set procedures (need to follow specific set procedures or routines in order to obtain satisfactory outcomes; for example, following check-out list to inspect equipment or vehicles, following procedures for changing a tire, performing specified laboratory tests, etc.)

173(I) Time pressure of situation (meal hours in mess hall, urgent time deadlines, rush jobs, etc.)

174(I) Precision (need to be more than normally precise and accurate)

175(I) Attention to detail (need to give careful attention to various details of one's work, being sure that nothing is left undone)

176(I) Recognition (need to identify, recognize, or "perceive" certain objects, events, processes, behavior, etc., or aspects, features, or properties thereof; this item is primarily concerned with "recognition" of that which is "sensed" by vision, hearing, touch, etc.)

177(I) Vigilance: infrequent events (need to continually search for very infrequently occurring but relevant events in the job situation; for example, look-out watch, observing instrument panel to identify infrequent change from "normal," etc.)

178(I) Vigilance: continually changing events (need to be continually aware of variations in a continually or frequently changing situation; for example, driving in traffic, controlling aircraft traffic, continually watching frequently changing dials and gauges, etc.)

179(I) Working under distractions (telephone calls, interruptions, disturbances from others, etc.)

180(I) Updating job knowledge (need to keep job knowledge current, being informed of new developments related to the billet)

181(A) Special talent (using the code above, indicate if a billet requires some particularly unique talent or skill that is not covered by other items; typically this item would apply to billets in which the very unique skill or characteristic of the worker is clearly dominant, as in certain entertainment activities; the item may be used, however, in certain other kinds of situations, but only where there is some distinctly unique or special skill or talent involved) (If "1" is marked, write the special talent in the margin of the PAQ Record Form.)

Code	Applicability (A)
DNA	Does not apply
1	Does apply

182(T) Travel (indicate by code the proportion of a typical year in which the incumbent would be away from his place of residence)

Code	Amount of Time (T)
DNA	Does not apply (or is very incidental)
1	Under 1/10 of the time
2	Between 1/10 and 1/3 of the time
3	Between 1/3 and 2/3 of the time
4	Over 2/3 of the time
5	Almost continually

6.5 Responsibility

This section includes types of responsibility which may be associated with the decisions and actions of the worker. Indicate by code the degree of each type of responsibility involved in the billet.

183(S) Responsibility for the safety of others (indicate, using the code below, the degree to which the work requires diligence and effort to prevent injury to others; do not include hazards beyond the control of the individual concerned with the billet)

Code	Degree of Responsibility for the Safety of Others
DNA	Does not apply
1	Very limited (worker has minimum responsibility for the safety of others; for example, he may only use small hand tools, non-hazardous machines, etc.)
2	Limited (worker must exercise reasonable care in order to avoid injury to others; for example, operating lathes, punch presses, and similar equipment)
3	Intermediate (worker must be especially careful in order to avoid injury to others; for example, operating overhead cranes, driving vehicles, etc.)
4	Substantial (worker must exercise constant and substantial care in order to prevent serious injury to others; for example, handling dangerous chemicals, using explosives, insuring that recoil area of guns is clear, etc.)
5	Very substantial (the safety of others depends almost entirely on the correct action of the worker; for example, piloting an aircraft, performing major surgery, etc.)

184(S) Responsibility for material assets (indicate, using the code below, the degree to which the worker is directly responsible for waste, damage, defects, or other loss of value to material assets or property, such as materials, products, parts, equipment, cash, etc., that might be caused by inattention or inadequate job performance)

Code	Degree of Responsibility for Material Assets
1	Very limited (for example, a few dollars)
2	Limited (for example, up to about one hundred dollars)
3	Intermediate (for example, a few hundred dollars)
4	Substantial (for example, one or two thousand dollars)
5	Very substantial (for example, more than two thousand dollars)

185(S) General responsibility (indicate, using the code below, the degree of "general" responsibility associated with this billet in terms of the extent to which the worker is "responsible" for any of a number of activities such as: accounting, analyzing, composing, developing, designing, evaluating, forecasting, initiating, planning, programming, proposing, scheduling, sponsoring, staffing, writing, etc.; do not consider here responsibility for the safety of others or responsibility for assets as described in items 183 and 184)

Code	Degree of General Responsibility
1	Very limited
2	Limited
3	Intermediate
4	Substantial
5	Very substantial

6.6 Job Structure

186(S) Job structure (indicate, using the code below, the amount of "structure" of the billet, that is, the degree to which the billet activities are "pre-determined" for the worker by the nature of the work, the procedures, or other billet characteristics; the more highly-structured billets permit less deviation from pre-determined patterns, and little if any need for innovation, decision making, or adaptation to changing situations)

Code	Amount of Job Structure
1	Very high structure (virtually no deviation from a pre-determined job "routine," for example, routine assembly work, etc.)
2	Considerable structure (only moderate deviation from pre-determined work "routine" is possible; for example, disbursing clerk, stock handler, etc.)
3	Intermediate structure (considerable change from a "routine" is possible; work activities change considerably from day to day or even from hour to hour, but usually within some reasonable and expected bounds; for example, carpenter, mechanic, machinist, etc.)
4	Limited structure (relatively little routine work; the job is characterized by considerable opportunity for improving methods devices, etc., and the necessity for making decisions; for example, public relations officer, investigators, etc.)
5	Very low structure (virtually no established "routine" of activities; the position involves a wide variety of problems which must be dealt with; the solutions to these problems allows for unlimited resourcefulness and initiative; for example, major responsibility for research and development activities, etc.)

6.7 Criticality of Position

187(S) Criticality of position (indicate, using the code below, the degree to which inadequate billet performance by the worker in this position is critical in terms of possible detrimental effects on the organizational operations, assets, reputation, etc., or on the public or other people; consider the duration of such consequences, whether immediate or long-term, their seriousness, and the extent to which they have restricted or widespread effects)

Code	Degree of Criticality of Position
1	Very low
2	Low
3	Moderate
4	High
5	Very high

188-194 Pay/income (Do not use these items.)

APPENDIX B

Allowances and Benefits Used in Computing "Direct" and "Total" Naval Compensation

Appendix Table B1

Naval Allowances and Benefits Used in Computing "Direct" and "Total" Compensation 1/

Pay grade	Number of dependents	Basic allowance for quarters	Basic allowance for subsistence	Sea duty pay 2/	Family separation allowance 3/
Higher (A) assumptions					
E-8	3	$2,066.40	$602.25	$270.00	$360.00
E-7	3	1,936.80	602.25	270.00	360.00
E-6	3	1,800.00	602.25	240.00	360.00
E-5	2	1,663.20	602.25	192.00	360.00
E-4	1	1,458.00	602.25	156.00	360.00
E-3	0	867.60	602.25	108.00	360.00
E-2	0	766.00	602.25	96.00	360.00
0-6	3	3,099.60	574.56	-	360.00
0-5	3	2,865.60	574.56	-	360.00
0-4	3	2,584.80	574.56	-	360.00
0-3	3	2,347.20	574.56	-	360.00
0-2	2	2,109.60	574.56	-	360.00
0-1	1	1,169.20	574.56	-	360.00
Lower (B and C) assumptions					
E-8	0	216.00	602.25	270.00	-
E-7	0	216.00	602.25	270.00	-
E-6	0	216.00	602.25	240.00	-
E-5	0	216.00	602.25	192.00	-
E-4	0	216.00	602.25	156.00	-
E-3	0	216.00	602.25	108.00	-
E-2	0	216.00	602.25	96.00	-

Appendix Table B1 cont.

Pay grade	Number of dependents	Basic allowance for quarters	Basic allowance for subsistence	Sea duty pay 2/	Family separation allowance 3/
Lower (B and C) assumptions (cont.)					
0-6 to 0-1	0	672.00	574.56	-	-

1/ Values for the allowances and benefits were extracted from a table of such values prepared especially for this study by the Director of Compensation Studies, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs).

2/ Sea duty pay is payable to enlisted personnel only.

3/ Family separation allowance is payable to personnel with dependents who are separated from their families due to exigencies of service.

Appendix Table B2

Additional Naval Allowances and Benefits Used in Computing "Direct" and "Total" Compensation 1/

Pay grade	Tax advantage 2/	Retirement	Medical care	Commissary	Life Insurance benefits	Additional tax advantage
Higher (A) assumptions						
E-8	$ 574.71	$1,005.24	$846.00	$393.00	$175.00	$172.70
E-7	489.04	893.42	846.00	393.00	154.00	121.77
E-6	476.93	783.49	846.00	348.00	108.00	-14.14
E-5	483.53	619.44	846.00	261.00	65.00	-19.12
E-4	436.47	539.18	846.00	162.00	29.00	24.00
E-3	348.38	458.02	432.00	-	18.00	22.99
E-2	321.14	436.39	432.00	-	11.00	18.30
0-6	1,823.59	2,114.67	846.00	393.00	251.00	93.12
0-5	1,290.69	1,695.70	846.00	393.00	212.00	111.70
0-4	1,017.38	1,393.61	846.00	393.00	182.00	66.57
0-3	796.76	1,129.07	846.00	393.00	127.00	63.72
0-2	518.63	822.86	846.00	295.00	86.00	40.71
0-1	489.38	669.79	846.00	197.00	39.00	-36.78
Lower (B) assumptions						
E-8	220.80	884.61	432.00	-	175.00	0
E-7	209.50	786.21	432.00	-	154.00	5.86
E-6	239.75	689.47	432.00	-	108.00	-13.65
E-5	236.97	545.11	432.00	-	65.00	-19.46
E-4	191.94	474.48	432.00	-	29.00	6.69
E-3	191.94	458.02	432.00	-	18.00	0
E-2	191.94	436.39	432.00	-	11.00	0

Appendix Table B2 cont.

Pay grade	Tax advantage 2/	Retirement	Medical care	Commissary	Life Insurance benefits	Additional tax advantage 2/
Lower (B) assumptions (cont.)						
O-6	$ 831.04	$1,877.93	$432.00	$ -	$ 8.00	$ -
O-5	662.39	1,499.21	432.00	-	8.00	19.75
O-4	530.96	1,226.67	432.00	-	8.00	12.75
O-3	406.52	986.38	432.00	-	7.00	29.22
O-2	324.75	708.49	432.00	-	7.00	-2.46
O-1	344.04	586.87	432.00	-	7.00	9.48
Lower (C) assumptions						
E-8	220.80	-	432.00	-	175.00	0
E-7	209.50	-	432.00	-	154.00	5.86
E-6	239.75	-	432.00	-	108.00	-13.65
E-5	236.97	-	432.00	-	65.00	-19.46
E-4	191.94	-	432.00	-	29.00	6.69
E-3	191.94	-	432.00	-	18.00	0
E-2	191.94	-	432.00	-	11.00	0
O-6	831.04	-	432.00	-	8.00	-
O-5	662.39	-	432.00	-	8.00	19.75
O-4	530.96	-	432.00	-	8.00	12.75
O-3	406.52	-	432.00	-	7.00	29.22
O-2	324,75	-	432,00	-	7.00	-2.46
O-1	344.04	-	432.00	-	7.00	9.48

1/ Values for the allowances and benefits were extracted from a table of such values prepared especially for this study by the Director of Compensation Studies, Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs).

2/ Tax advantage accrues in military pay because basic allowances for quarters and subsistence are not subject to federal income tax.

APPENDIX C

Mean "Direct" and "Total" Naval Compensation Under Varying (A, B and C) Assumptions, and Mean "Civilian Job Value" For Each Pay Grade

Appendix Table C1

Mean "Direct" Naval Compensation Under Varying (A, B and C) Assumptions, and Mean "Civilian Job Value" For Each Pay Grade 1/

Pay grade	Sample size	High (A) assumptions	Low (B) assumptions	Low (C) assumptions	Civilian job value
E-2	44	$ 6,201	$ 5,521	$ 5,521	$ 7,566
E-3	161	6,702	5,894	5,894	8,059
E-4	171	8,240	6,393	6,393	9,266
E-5	117	9,214	7,160	7,161	10,315
E-6	66	11,275	9,904	9,904	12,452
E-7	34	12,802	10,441	10,441	13,120
E-8	9	13,793	11,229	11,229	14,824
O-1	4	9,919	8,386	8,386	15,490
O-2	12	13,209	11,217	11,217	16,005
O-3	81	16,731	14,305	14,305	16,593
O-4	110	19,467	16,708	16,708	18,070
O-5	35	23,396	20,215	20,215	18,668
O-6	5	29,289	29,289	25,509	20,288

1/ These values were used in preparing Figure 1, and do not include fringe benefits

Appendix Table C2

Mean "Total" Naval Compensation Under Varying (A, B and C) Assumptions, and Mean "Civilian Job Value" (Including Fringe Benefits) For Each Pay Grade 1/

Pay grade	Sample size	High (A) assumptions	Low (B) assumptions	Low (C) assumptions	Civilian job value
E-2	44	$ 7,094	$ 6,400	$ 5,964	$ 8,557
E-3	161	7,633	6,802	6,344	9,126
E-4	171	9,840	7,335	6,861	10,492
E-5	117	10,987	8,183	7,638	11,679
E-6	66	13,216	10,309	9,620	14,100
E-7	34	15,210	11,819	11,033	14,856
E-8	9	16,385	12,721	11,836	16,786
O-1	4	11,634	9,421	8,834	17,540
O-2	12	15,299	12,362	11,654	18,123
O-3	81	19,290	15,760	14,774	18,788
O-4	110	22,348	18,388	17,161	20,461
O-5	35	26,655	22,174	20,675	21,138
O-6	5	32,986	27,826	25,949	22,973

1/ These values were used in preparing Figure 2.

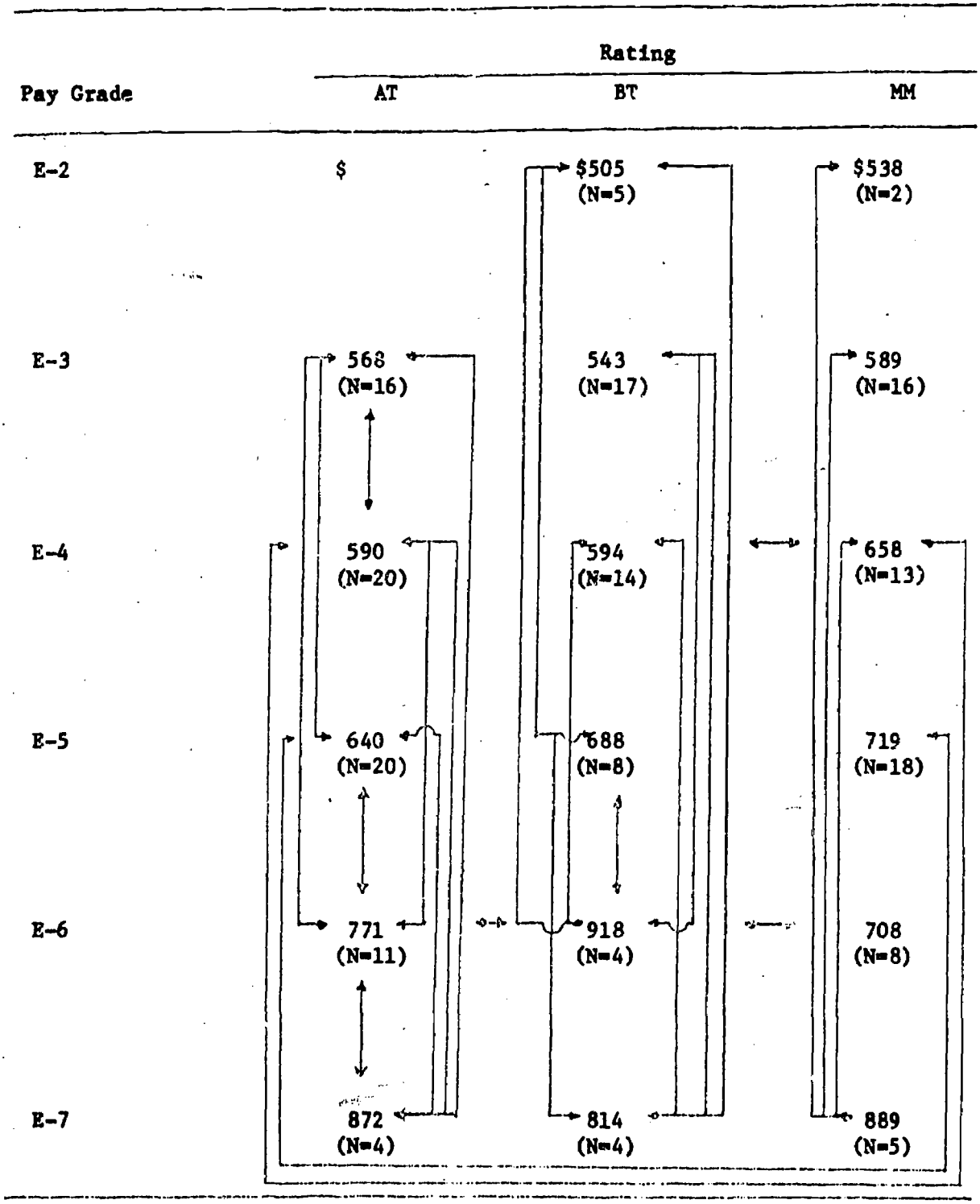
2/ Adjusted to include the value of fringe benefits.

APPENDIX D

Mean Civilian Job Values and Sample Sizes by Pay Grade and Rating (Job Family) For Selected Ratings

Appendix Table D1

Mean Civilian Job Values and Sample Sizes
by Pay Grade and Rating (Job Family)
For Selected Ratings



Note: Mean values connected by arrows were found to be significantly different, using Newman-Keuls tests.

APPENDIX E

Job Dimensions Based on Component Analysis of Job Analysis Data from Combined Enlisted and Officer Samples

Job Dimensions Based on Component Analysis of Job Analysis Data: Information Input

	Job Dimension	Rotated Loading N=710
Dimension 1:	Perceptual Acuity, Discrimination, and Evaluation	
22	Depth perception	.820
29	Estimating speed of moving objects	.759
21	Far visual differentiation	.753
26	Body movement sensing	.733
27	Body balance	.635
34	Estimating size	.538
23	Color perception	.523
28	Estimating speed of moving parts	.522
10	Features of nature	.493
13	Events or circumstances	.439
11	Man-made features of environment	.421
25	Sound differentiation	.413
24	Sound pattern recognition	.387
16	Non-verbal sounds	.303
Dimension 2:	Information from Graphic/Written and Related Materials	
3	Pictorial materials	.718
2	Quantitative materials	.711
1	Written materials	.585
4	Patterns/related devices	.572
20	Near visual differentiation	.499
6	Measuring devices	.365
23	Color perception	.337
14	Art or decor	.337
Dimension 3:	Sensing in Relation to Operations and Processes	
19	Taste	.807
18	Odor	.704
8	Materials in process	.539
17	Touch	.499
30	Estimating speed of processes	.476
28	Estimating speed of moving parts	.322
14	Art or decor	.318
33	Estimating quantity	.212

Job Dimension	Rotated Loading N=710
Dimension 4: Information from Mechanical Equipment	
24 Sound pattern recognition	.728
16 Non-verbal sounds	.727
25 Sound differentiation	.710
5 Visual displays	.691
7 Mechanical devices	.650
6 Measuring devices	.482
31 Judging condition/quality	.353
17 Touch	.329
18 Odor	.325
Dimension 5: Information from Materials and Objects in Immediate Environment	
9 Materials not in process	.780
11 Man-made features of environment	.487
7 Mechanical devices	.377
8 Materials in process	.341
1 Events or circumstances	.323
Dimension 6: Estimating/Inspecting Activities	
33 Estimating quantity	.699
35 Estimating time	.690
32 Inspecting	.623
34 Estimating size	.518
31 Judging condition/quality	.432
30 Estimating speed of processes	.372
Dimension 7: General environmental awareness	
186 Job structure	.688
12 Behavior	.651
13 Events or circumstances	.590
15 Verbal sources	.548
1 Written materials	.488
10 Features of nature	.486
11 Man-made features of environment	.427
14 Art or decor	.418
2 Quantitative materials	.325
31 Judging condition/quality	.324

Job Dimensions Based on Component Analysis of Job Analysis Data: Mediation Processes

	Job Dimension	Rotated Loading N=710
Dimension 8:	Decision Making	
37	Reasoning in problem solving	.863
36	Decision making	.862
38	Amount of planning/scheduling	.853
46	Education	.826
186	Job structure	.796
39	Combining information	.764
40	Analyzing information or data	.723
47	Job-related experience	.719
41	Compiling	.694
49	Using mathematics	.689
48	Training	.635
Dimension 9:	Information Processing	
43	Transcribing	.833
45	Short-term memory	.632
42	Coding/decoding	.593
41	Compiling	.391
40	Analyzing information or data	.372

Job Dimensions Based on Component Analysis of Job Analysis Data:
Work Output

Job Dimension	Rotated Loading N=710
Dimension 10: Physical Activity Level	
90 Walking/running	.740
89 Standing	.638
91 Climbing	.616
92 Kneeling/stooping	.560
87 Level of physical exertion	.539
86 Balancing	.495
57 Applicators	.435
51 Manually powered non-precision tools	.413
81 Assembling/disassembling	.358
94 Hand-arm manipulation	.346
84 Physical handling	.343
52 Long-handle tools	.317
88 Sitting	-.702
65 Keyboard devices	-.451
Dimension 11: Control Operation/Manipulation	
68 Continuous controls: hand-operated	.796
67 Frequent adjustment controls: foot-operated	.793
69 Continuous controls: foot-operated	.790
98 Hand-ear coordination	.688
85 Highly skilled body coordination	.677
66 Frequent adjustment controls: hand-operated	.653
64 Variable setting controls	.505
97 Limb movement without visual control	.480
63 Fixed setting controls	.464
74 Air/space vehicles	.443
96 Eye-hand/foot coordination	.442
62 Activation controls	.413
95 Hand-arm steadiness	.364
Dimension 12: Handcraft and Related Activities	
78 Setting up/adjusting	.789
64 Variable setting controls	.689
81 Assembling/disassembling	.687
63 Fixed setting controls	.680
62 Activation controls	.666

Job Dimension	Rotated Loading N=710
Dimension 12: Handcraft and Related Activities (cont'd.)	
54 Powered precision tools	.656
50 Manually powered precision tools/instruments	.630
51 Manually powered non-precision tools/instruments	.598
55 Powered non-precision tools/instruments	.570
66 Frequent adjustment controls: hand-operated	.498
58 Measuring devices	.444
95 Hand-arm steadiness	.431
61 Stationary machines/equipment	.364
53 Handling devices/tools	.335
59 Technical and related devices	.324
94 Hand-arm manipulation	.317
84 Physical handling	.310
77 Remote-controlled equipment	.300
Dimension 13: Manual Handling and Manipulation	
83 Feeding/off-bearing	.671
80 Material-controlling	.652
79 Manually modifying	.647
82 Arranging positioning	.603
84 Physical handling	.513
53 Handling devices/tools	.483
61 Stationary machines/equipment	.424
57 Applicators	.373
52 Long-handle tools	.362
65 Keyboard devices	.303
186 Job structure	-.320
Dimension 14: Body Member Manipulation/Control	
93 Finger manipulation	.709
97 Limb movement without visual control	.648
96 Eye-hand/foot coordination	.563
94 Hand-arm manipulation	.561
95 Hand-arm steadiness	.481
Dimension 15: Skilled/Technical Activities	
59 Technical and related devices	.660
56 Drawing and related devices	.599
58 Measuring devices	.548

Job Dimension	Rotated Loading N=710
Dimension 15: Skilled/Technical Activities (cont'd.)	
186 Job structure	.468
71 Powered highway/rail vehicles	.316
84 Physical handling	-.310
52 Long-handle tools	-.309
Dimension 16: Mobile and Operating Equipment Operations	
72 Powered mobile equipment	.687
76 Operating equipment	.525
74 Air/space vehicles	.402
51 Manually powered non-precision tools/instruments	.375
87 Level of physical exertion	.349
55 Powered non-precision tools/instruments	.338
52 Long-handle tools	.323
82 Arranging/positioning	.313
57 Applicators	.311
75 Man-moved mobile equipment	.302
65 Keyboard devices	-.343
89 Standing	-.320
Dimension 17: Unnamed	
73 Powered water vehicles	.771
52 Long-handle tools	.407
75 Man-moved mobile equipment	.389
86 Balancing	.336
61 Stationary machines/equipment	.300
Dimension 18: Vehicle/ Unnamed Equipment Operations	
70 Man-powered vehicles	.669
77 Remote-controlled equipment	.489
71 Powered highway/rail vehicles	.481
85 Highly skilled body coordination	.352
76 Operating equipment	.324

Job Dimensions Based on Component Analysis of Job Analysis Data: Interpersonal Activities

Job Dimension	Rotated Loading N=710
Dimension 19: Executive/Staff Functions	
99 Advising	.857
101 Persuading	.855
107 Writing	.816
113 Executives/officials	.813
100 Negotiating	.806
103 Interviewing	.752
114 Middle management/staff personnel	.746
186 Job structure	.744
105 Non-routine information exchange	.735
134 Supervision received	.707
116 Professional personnel	.705
106 Public speaking	.676
129 Direction of supervisory personnel	.669
118 Clerical personnel	.659
130 Total no. of personnel for whom responsible	.653
117 Semi-professional personnel	.648
133 Staff functions	.578
102 Instructing	.542
112 Job-required personal contact	.534
126 Special interest groups	.481
123 The public	.439
125 Clients/patients/counselees	.349
124 Students/trainees/apprentices	.319
120 Sales personnel	.315
119 Manual and service workers	-.305
Dimension 20: Public/Related Contact	
122 Public customers	.797
121 Buyers	.784
120 Sales personnel	.735
123 The public	.465
111 Serving/catering	.439
126 Special/interest groups	.330

Job Dimension	Rotated Loading N=710
Dimension 21: Required Interpersonal Interaction	
104 Routine information exchange	.758
112 Job-required personal contact	.414
132 Coordinates activities	.379
118 Clerical personnel	.301
Dimension 22: Signaling/Coding	
108 Signaling	.744
109 Code communications	.708
110 Entertaining	.528
Dimension 23: Supervisory/Instructional Functions	
128 Supervision of non-supervisory personnel	.753
102 Instructing	.506
130 Total no. of personnel for whom responsible	.427
132 Coordinates activities	.394
129 Direction of supervisory personnel	.340
131 Supervises non-employees	.317
Dimension 24: Interaction with Non-employees	
131 Supervises non-employees	.677
124 Students/trainees/apprentices	.633
125 Clients/patients/counselees	.632
106 Public speaking	.399
126 Special interest groups	.388
123 The public	.387
103 Interviewing	.353
110 Entertaining	.351
116 Professional personnel	.311
Dimension 25: Contact with Supervisors/Manual Workers	
119 Manual and service workers	.720
115 Supervisors	.620
104 Routine information exchange	.319

Job Dimensions Based on Component Analysis of Job Analysis Data:
Work Situation and Job Context

Job Dimension	Rotated Loading N=710
Dimension 26: Hazardous Working Conditions	
146 Permanent partial impairment	.929
147 Permanent total disability/death	.903
145 Temporary disability	.899
144 First-aid cases	.732
143 Noise intensity	.588
135 Out-of-door environment	.554
141 Dirty environment	.457
142 Awkward or confining work space	.380
Dimension 27: Stressful Interpersonal Environment	
152 Interpersonal conflict situations	.835
150 Strained personal contacts	.804
151 Personal sacrifice	.793
149 Frustrating situations	.719
186 Job structure	.680
148 Civic obligations	.677
144 First-aid cases	-.361
Dimension 28: Undesirable Physical Environment	
138 Air contamination	.719
136 Indoor: high temperature	.718
139 Vibration	.679
140 Improper illumination	.666
141 Dirty environment	.623
142 Awkward or confining work space	.594
137 Indoor: low temperature	.493
Dimension 29: Out-of-door vs. Social Environment	
153 Non-job-required social contract	.807
136 Indoor: high temperature	.351
135 Out-of-door environment	-.418

Job Dimensions Based on Component Analysis of Job Analysis Data: Miscellaneous Aspects

Job Dimension	Rotated Loading N=710
Dimension 30: General Responsibility/Criticality of Position	
180 Updating job knowledge	.810
187 Criticality of position	.773
185 General responsibility	.760
175 Attention to detail	.704
174 Precision	.680
186 Job structure	.679
179 Working under distractions	.454
170 Repetitive activities	-.440
Dimension 31: Recognition/Vigilance/Attention Requirements	
176 Recognition	.857
177 Vigilance: infrequent events	.772
178 Vigilance: continually changing events	.759
175 Attention to detail	.422
172 Following set procedures	.347
183 Responsibility for the safety of others	.337
174 Precision	.319
Dimension 32: Structured Work Activities	
171 Cycled work activities	.768
172 Following set procedures	.655
170 Repetitive activities	.482
182 Travel	.433
174 Precision	.400
186 Job structure	-.350
Dimension 33: Time/Work Situation Pressures	
169 Specified work space	.656
173 Time pressure of situation	.513
179 Working under distractions	.467
170 Repetitive activities	.411
182 Travel	-.472

Job Dimension	Rotated Loading N=719
Dimension 34: Material/Safety Responsibility	
183 Responsibility for the safety of others	.722
184 Responsibility for macerials assets	.577
177 Vigilance: infrequent events	.378
178 Vigilance: continually changing events	.342
185 General responsibility	.312
186 Job structure	.300

APPENDIX F

Job Dimensions Based on Component Analysis of Job Analysis Data from Officer Sample

Job Dimensions Based on Component Analysis of Job Analysis Data: Information Input

	Job Dimension	Rotated Loading N=247
Dimension 1:	Perceptual Acuity, Discrimination, and Evaluation	
22	Depth perception	.880
29	Estimating speed of moving objects	.874
26	Body movement sensing	.868
21	Far visual differentiation	.856
24	Sound pattern recognition	.828
23	Color perception	.820
25	Sound differentiation	.778
27	Body balance	.768
5	Visual displays	.675
16	Non-verbal sounds	.652
10	Features of nature	.645
28	Estimating speed of moving parts	.574
13	Events or circumstances	.569
11	Man-made features of environment	.456
34	Estimating size	.419
17	Touch	.402
18	Odor	.376
31	Judging condition/quality	.330
6	Measuring devices	.307
Dimension 2:	Sensing in Relation to Operations and Processes	
19	Taste	.704
18	Odor	.678
8	Materials in process	.668
17	Touch	.619
9	Materials not in process	.609
7	Mechanical devices	.478
28	Estimating speed of moving parts	.375
Dimension 3:	Information from Graphic/Written and Related Materials	
3	Pictorial materials	.769
2	Quantitative materials	.729
4	Patterns/related devices	.656
6	Measuring devices	.584
1	Written materials	.583
7	Mechanical devices	.445

Job Dimension	Rotated Loading N=247
Dimension 3: Information from Graphic/Written and Related Materials	
5 Visual displays	.341
20 Near visual differentiation	.331
Dimension 4: General Environmental Awareness	
12 Behavior	-.643
186 Job structure	-.544
13 Events or circumstances	-.526
15 Verbal sources	-.526
14 Art or decor	-.477
11 Man-made features of environment	-.404
Dimension 5: Estimating/Inspecting Activities	
33 Estimating quantity	.745
35 Estimating time	.667
34 Estimating size	.644
32 Inspecting	.623
30 Estimating speed of processes	.597
31 Judging condition/quality	.531
28 Estimating speed of moving parts	.310

Job Dimensions Based on Component Analysis of Job Analysis Data:
Mediation Processes

	Job Dimension	Rotated Loading N=247
Dimension 6: Reasoning/Planning/Decision Making		
37	Reasoning in problem solving	.737
47	Job-related experience	.659
39	Combining information	.596
40	Analyzing information or data	.595
36	Decision making	.584
38	Amount of planning/scheduling	.559
186	Combining information	.544
49	Using mathematics	.530
48	Training	.492
46	Education	.409
41	Compiling	.336
Dimension 7: Information Processing		
43	Transcribing	-.798
42	Coding/decoding	-.741
45	Short-term memory	-.533
40	Analyzing information or data	-.521
41	Compiling	-.464
39	Combining information	-.365
36	Decision making	-.308

Job Dimensions Based on Compenent Analysis of Job Analysis Data:
Work Output

Job Dimension	Rotated Loading N=247
Dimension 8: Tool/Equipment Utilization	
52 Long-handle tools	.855
53 Handling devices/tools	.822
54 Powered precision tools/instruments	.779
55 Powered non-precision tools/instruments	.775
57 Applicators	.735
81 Assembling/disassembling	.719
76 Operating equipment	.711
84 Physical handling	.647
72 Powered mobile equipment	.643
83 Feed/off-bearing	.641
75 Man-moved mobile equipment	.632
61 Stationary machines/equipment	.630
51 Manually powered non-precision tools/instruments	.629
80 Material-controlling	.606
50 Manually powered precision tools/instruments	.581
77 Remote-controlled equipment	.565
78 Setting up/adjusting	.499
82 Arranging/positioning	.491
79 Manually modifying	.468
58 Measuring devices	.357
71 Powered highway/rail vehicles	.327
63 Fixed setting controls	.325
62 Activation controls	.318
Dimension 9: Control Operation/Manipulation	
68 Continuous controls: hand-operated	-.878
97 Limb movement without visual control	-.843
98 Hand-ear coordination	-.832
66 Frequent adjustment controls: hand-operated	-.828
96 Eye-hand/foot coordination	-.827
69 Continuous controls: foot-operated	-.805
67 Frequent adjustment controls: foot-operated	-.798
64 Variable setting controls	-.792
94 Hand-arm manipulation	-.765
74 Air/space vehicles	-.757
85 Highly skilled body coordination	-.756
63 Fixed setting controls	-.752
62 Activation controls	-.738

Job Dimension	Rotated Loading N=247
Dimension 9: Control Operation/Manipulation (cont'd.)	
87 Level of physical exertion	-.451
86 Balancing	-.421
Dimension 10: General Body Activity	
91 Climbing	.732
92 Kneeling/stooping	.723
90 Walking/running	.659
89 Standing	.534
70 Man-powered vehicles	.468
86 Balancing	.311
Dimension 11: Activities Involving Finger/hand Manipulation	
56 Drawing and related devices	.664
93 Finger manipulation	.640
65 Keyboard devices	.587
79 Manually modifying	.528
82 Arranging/positioning	.455
59 Technical and related devices	.329
58 Measuring devices	.325
Dimension 12: Technical/Related Activities	
59 Technical and related devices	-.590
58 Measuring devices	-.531
99 Advising	-.446
73 Powered water vehicles	-.413
51 Manually powered non-precision tools/instruments	-.398
86 Balancing	-.387
56 Drawing and related devices	-.363
Dimension 13: Association With Vehicles/Heavy Equipment	
71 Powered highway/rail vehicles	.483
99 Advising	.454
72 Powered mobile equipment	.410
76 Operating equipment	.304

Job Dimension	Rotated Loading N=247
Dimension 13: Association With Vehicles/Heavy Equipment (cont'd.)	
78 Setting up/adjusting	-.455
79 Manually modifying	-.322

Job Dimensions Based on Component Analysis of Job Analysis Data:
Interpersonal Activities

Job Dimension	Rotated Loading N=247
Dimension 14: Executive/Staff Functions	
101 Persuading	.684
107 Writing	.678
99 Advising	.676
113 Executives/officials	.630
100 Negotiating	.615
105 Non-routine information exchange	.581
114 Middle management/staff personnel	.560
112 Job-required personal contact	.510
186 Job structure	.510
103 Interviewing	.447
118 Clerical personnel	.400
106 Public speaking	.398
116 Professional personnel	.392
134 Supervision received	.389
102 Instructing	.365
117 Semi-professional personnel	.354
104 Routine information exchange	.343
133 Staff functions	.317
Dimension 15: Public/Related Contact	
120 Sales personnel	-.733
121 Buyers	-.729
122 Public customers	-.707
117 Semi-professional personnel	-.548
123 The public	-.486
116 Professional personnel	-.465
126 Special interest groups	-.383
133 Staff functions	-.304
Dimension 16: Signaling/Coding/Related Activities	
109 Code communications	-.706
108 Signaling	-.645
110 Entertaining	-.546
128 Supervision of non-supervisory personnel	-.519
132 Coordinates activities	-.499
104 Routine information exchange	-.494

Job Dimension	Rotated Loading N=247
Dimension 16: Serving/Instructing Activities	
111 Serving/catering	-.408
102 Instructing	-.324
119 Manual and service workers	-.309
124 Students/trainees/apprentices	-.308
Dimension 17: Supervisory vs. Staff Functions	
130 Total no. of personnel for whom responsible	-.729
129 Direction of supervisory personnel	-.677
115 Supervisors	-.576
119 Manual and service workers	-.571
102 Instructing	-.373
103 Interviewing	-.324
133 Staff functions	.539
Dimension 18: Interaction with Non-employees	
131 Supervises non-employees	.650
124 Students/trainees/apprentices	.620
125 Clients/patients/counselees	.615
103 Interviewing	.460
106 Public speaking	.444
126 Special interest groups	.426
123 The public	.387
102 Instructing	.381

Job Dimensions Based on Component Analysis of Job Analysis Data:
Work Situation and Job Context

Job Dimension	Rotated Loading N=247
Dimension 19: Hazardous Working Conditions	
146 Permanent partial impairment	.945
147 Permanent total disability/death	.934
145 Temporary disability	.897
144 First-aid cases	.719
143 Noise intensity	.571
139 Vibration	.456
135 Out-of-door environment	.444
142 Awkward or continuing work space	.434
Dimension 20: Stressful Interpersonal Interactions	
150 Strained personal contact	-.824
152 Interpersonal conflict situations	-.791
149 Frustrating situations	-.779
151 Personal sacrifice	-.627
148 Civic obligations	-.487
153 Non-job-required social contract	-.439
186 Job structure	-.387
Dimension 21: Undesirable Physical Working Conditions	
141 Dirty environment	-.792
138 Air contamination	-.744
140 Improper illumination	-.741
136 Indoor: high temperature	-.728
142 Awkward or confining work space	-.559
137 Indoor: low temperature	-.496
139 Vibration	-.491
135 Out-of-door environment	-.363
144 First-aid cases	-.319
143 Noise intensity	-.307

Job Dimensions Based on Component Analysis of Job Analysis Data:
Miscellaneous Aspects

Job Dimension	Rotated Loading N=247
Dimension 22: Vigilance/Recognition Requirements	
177 Vigilance: infrequent events	-.879
178 Vigilance: continually changing events	-.843
183 Responsibility for the safety of others	-.778
176 Recognition	-.757
184 Responsibility for material assets	-.557
182 Travel	-.505
172 Following set procedures	-.415
Dimension 23: Responsibility/Criticality of Position	
175 Attention to detail	-.697
180 Updating job knowledge	-.696
185 General responsibility	-.686
174 Precision	-.656
187 Criticality of position	-.649
173 Time pressure of situation	-.603
186 Job structure	-.497
179 Working under distractions	-.454
Dimension 24: Repetitive/Structured Work Activities	
170 Repetitive activities	-.708
171 Cycled work activities	-.696
172 Following set procedures	-.602
169 Specified work pace	-.594
173 Time pressure of situation	-.391
174 Precision	-.318
186 Job structure	.384

APPENDIX G

Standard Errors of Estimate Obtained Under Methods 2 and 3 with Three Indices of Naval Compensation Used as Criterion Variables

Appendix Table G1

Standard Errors of Estimate Obtained Under Methods 2 and 3 with Three Indices of Naval Compensation Used as Criterion Variables

Method and sample	Naval compensation index: Basic pay	Total A compensation	Total C compensation
Method 2			
Enlisted sample (n=607, p=32)*	77.32	126.02	82.41
Officer sample (n=247, p=5)*	199.05	291.39	238.70
Combined sample (n=854, p=32)*	150.48	228.33	181.19
Method 3			
Enlisted sample (n=459, p=34)*	86.25	133.79	90.58
Officer sample (n=247, p=24)*	218.26	271.45	224.61
Combined sample (n=706, p=34)*	174.07	229.86	182.13

*n=number of cases in sample, p=number of dimensions used as predictors in regression equations.

APPENDIX H

Regression Analysis Data for PAQ Job Dimension Scores Used to Predict Total (A) Naval Compensation

Appendix Table B1

Regression Weights for Certain of the PAQ Dimensions Selected as Final Predictors of Total A Naval Compensation

PAQ Dimensions	Combined Sample	Enlisted Sample	Officer Sample
Division Job Dimensions			
A- 1 Watching devices/materials for information	96.28	-151.24	
A- 2 Interpreting what is heard or seen	62.30	-119.97	
A- 3 Using data originating with people	35.36	-14.20	
A- 4 Watching things from a distance	-31.29	-87.24	
A- 5 Evaluating information from things	34.46	-120.88	
A- 6 Being aware of environmental conditions	-15.81	-83.29	
A- 7 Being aware of body movement and balance	2.93	-47.88	
B- 8 Making decisions	171.94	-2.04	
B- 9 Processing information	34.68	-28.51	
C-10 Controlling machines/processes	71.01	-173.27	
C-11 Using hands and arms to control/ modify	35.43	-198.69	
C-12 Using feet/hands to operate equip/ vehicles	.40	-141.63	
C-13 Performing activities requiring general body movement	-67.01	-213.16	
C-14 Using hands & arms to move/position things	-52.22	-171.92	
C-15 Using fingers vs. general body movement	-23.87	-52.45	
C-16 Performing skilled/technical activities	49.21	-54.28	

Appendix Table H1 cont.

	PAQ Dimensions	Combined Sample	Enlisted Sample	Officer Sample
D-17	Communicating judgments, decisions, information	-122.95	-26.78	
D-18	Exchanging job-related information	-28.41	-24.19	
D-19	Performing staff/related activities	-8.17	-40.58	
D-20	Contacting supervisor or subordinates	-25.95	-2.13	
D-21	Dealing with the public	-20.36	-17.61	
E-22	Being in a hazardous/unpleasant environment	-77.68	-124.00	
E-23	Engaging in personality demanding situations	-24.21	-25.95	
F-24	Engaging in businesslike work situations	-	31.20	
F-25	Being alert to detail/changing conditions	-8.93	-76.37	
F-26	Performing unstructured vs. structured work	22.45	-.59	
F-27	Working on a variable vs. regular schedule	.3[illegible]	12.70	
	Overall Job Dimensions			
0-28	Having decision making, commun, & social resp	400.92	185.66	209.36
0-29	Performing skilled activities	-350.07	457.28	-14.30
0-30	Being phys active/related environ condition	45.17	462.82	-88.77
0-31	Operating equipment/vehicles	14.41	265.56	-14.87
0-32	Processing information	-45.22	-17.70	-12.95
	Constant	991.42	790.26	1479.26

Appendix Table H2

Regression Weights for PAQ Officer Sample Factors Selected as Final Predictors of Total A Naval Compensation

Factors Derived in Officer Sample	Officer Sample Regression Weights
1 Perceptual acuity, discrimination, and evaluation	-14.73
2 Sensing in relation to operations and processes	9.52
3 Information from graphic/written and related materials	7.66
4 General environmental awareness	-39.30
5 Estimating/inspecting activities	7.11
6 Reasoning/planning/decision making	113.47
7 Information processing	-20.12
8 Tool/equipment utilization	19.48
9 Control operation/manipulation	37.61
10 General body activity	-41.41
11 Activities involving finger/hand manipulation	-3.36
12 Technical/related activities	-
13 Association with vehicles/heavy equipment	17.39
14 Executive/staff functions	25.07
15 Public/related contact	-
16 Signaling/coding/related activities	-6.93
17 Supervisory vs. staff functions	15.51
18 Interaction with non-employees	-6.16
19 Hazardous working conditions	-51.42

Appendix Table H2 cont.

Factors Derived in Officer Sample	Officer Sample Regression Weights
20 Stressful interpersonal interactions	37.25
21 Undesirable physical working conditions	-36.89
22 Vigilance/recognition requirements	-14.48
23 Responsibility/criticality of position	-44.10
24 Repetitive/structured work activities	10.96
Constant	1802.63

Appendix Table H3

Regression Weights for PAQ "Combined Sample" Factors Selected as Final Predictors of Total A Naval Compensation

Factors Derived in Combined Sample	Combined Sample Regression Weights	Enlisted Sample Regression Weights
1 Perceptual acuity, discrimination, and evaluation	-8.56	-26.64
2 Sensing in relation to operations and processes	5.42	-25.89
3 Information from graphic/written and related materials	3.99	-25.51
4 General environmental awareness	17.72	5.37
5 Estimating/inspecting activities	6.37	-4.84
6 Reasoning/planning/decision making	-	-18.10
7 Information processing	-12.98	-3.29
8 Tool/equipment utilization	202.17	59.61
9 Control operation/manipulation	12.70	3.02
10 General body activity	-12.76	-5.84
11 Activities involving finger/hand manipulation	14.18	11.83
12 Technical/related activities	-49.08	7.73
13 Association with vehicles/heavy equipment	-67.17	-37.40
14 Executive/staff functions	21.00	-18.18
15 Public/related contact	13.13	-11.67
16 Signaling/coding/related activities	-	42.76

Appendix Table B3 cont.

Factors Derived in Combined Sample	Combined Sample Regression Weights	Enlisted Sample Regression Weights
17 Supervisory vs. staff functions	-39.48	-14.89
18 Interaction with non-employees	-20.91	9.65
19 Hazardous working conditions	224.18	95.81
20 Stressful interpersonal interactions	37.28	-4.25
21 Undesirable physical working conditions	-24.41	-12.69
22 Vigilance/recognition requirements	34.39	-2.23
23 Responsibility/criticality of position	9.97	61.08
24 Repetitive/structured work activities	24.40	1.43
Constant	1175.89	935.78

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