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TECHNICAL RESEARCH STUDY 100

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AN OPERATIONAL MODEL FOR THE DEVELOPMENT OF AN OPTIMAL U.S. ARMY ENLISTED GRADE STRUCTURE THROUGH JOB EVALUATION

CHARLES H. ANDERSON, DANIEL B. CORTS
AND RAYMOND O. WALDKOETTER

OCTOBER 1967

EVALUATION & ANALYSIS BRANCH
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FORT BENJAMIN HARRISON
INDIANAPOLIS, INDIANA 46249

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SUMMARY

The U. S. Army Enlisted Evaluation Center has developed an operational model which utilizes weighted job factors for assigning appropriate enlisted grades to Army jobs. Working from job descriptions written by job analysts, a sample of 100 officers from courses at the U. S. Army Adjutant General School rated a sample of 100 jobs. Each of ten factors, judged to be important across all Army jobs, was rated on a six-point scale for each of the jobs. These factors were: Knowledge, Supervision of Personnel, Adaptability and Resourcefulness, Responsibility for Material Resources, Concentration and Attention, Physical Skills, Physical Efforts, Job Conditions, Freedom of Action, and Combat Exposure. A Job Evaluation Board, composed of 35 field grade officers and 15 senior NCO's in the grades of E-8 and E-9, had previously assigned what they considered to be the appropriate enlisted grades to the sample of 100 jobs.

Research has demonstrated that mathematical equations can be developed for predicting appropriate grade for Army jobs based upon accurate factor ratings for these jobs. Through multiple correlation techniques, it was found that, when the job factors were optimally weighted, they correlated with the Job Evaluation Board grade ratings $\underline{R} = .94$. Multiple regression equations have been developed from weights provided by the multiple correlation which will successfully predict the appropriate grade for any job in the Army for which accurate factor ratings are available. Mean factor ratings can provided for each job by job analysts, who have detailed knowledge of the job requirements of jobs in specific career groups.

It is believed that, with a properly controlled job evaluation system, this basic approach can be implemented to provide the Army with a valid tool for establishing and maintaining an optimal enlisted grade structure.

FOREWORD

The present study was designed and conducted to bring about a better understanding of how Army enlisted grades could be derived by means of more objective procedures. A fundamental need has existed to develop quantitative methods for indicating grade, even though much effort has been exerted in analyzing and reviewing duty requirements in the assignment of appropriate grades across the enlisted MOS structure. Providing an operational model to explore an optimal enlisted grade structure through job evaluation should markedly facilitate the Army's scientific approach to occupational research.

While the experimental development of job evaluation equations has shown the relative applicability of the approach, further verification of the equations is desirable before a final recommendation can be formulated. By examining the functioning of three basic equations suggested and two variations of these, and a revalidation from a larger data sample, the most acceptable version of the equation model can be defined. A special by-product of the present research has been the construction of a new factor comparison technique, in the Personnel Management Development Office (PMDO), Office of Personnel Operations (OPO, HQ, DA) using a point scoring method corresponding to the equation derived from the PMDO survey of job factor weights and related factor levels. The PMDO factor comparison technique may be accurately applied as an operational measure with the concurrent use and development of the submitted equations.

To acknowledge credit to everyone contributing to this study would be beyond the authors' capabilities, but specific citing of those most responsible for the planning, research coordination, and development of the project is the least that can be done to express the gratitude for the assistance and direction received. Particularly, Colonel Warren P. Davis, Special Project Coordinator (Chief, PMDO); Lieutenant Colonel Alan MacDonald, Project Action Officer (Chief, MOS Branch, PMDO); and their job analysis staff gave generously of their time and skill in the planning and organization of the research strategy. Vital assistance and advice were rendered by the following individuals:

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The authors' task of furnishing the primary research support and report composition was achieved for this study only because of the outstanding cooperation offered by PMDO and each individual participating in the project work. As the continued study of the PMDO factor comparison technique and equations progresses, further reports will be planned to give relative information regarding the major findings and their proposed application.

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AN OPERATIONAL MODEL FOR THE DEVELOPMENT OF AN OPTIMAL U. S. ARMY ENLISTED GRADE STRUCTURE THROUGH JOB EVALUATION

Introduction

For a number of years increasing emphasis has been attached to the study of job evaluation, which is fundamentally a systematic procedure of determining the relative worth of each job based on the level of skill, responsibility, and effort involved in each job. "Job evaluation insures that each work position is properly graded with respect to the requirements of the job and with respect to the grades (and total number of grades) that other positions receive in terms of the demands of these jobs" (U. S. Army Deputy Chief of Staff for Personnel, 1967, p. 15). All military services have become keenly aware of the tremendous need for adequate methods of evaluating jobs. This need is especially evident today as the military, particularly the Army, increases in complexity and the jobs become more and more specialized. In spite of the vast amount of research conducted on job evaluation by military, government and industrial organizations, historically relatively little empirical research has been done by the Army.

It is recognized that since World War II the Army has had various systems, policies, and guidelines for assigning enlisted grades to jobs (U. S. Army Combat Development Command, 1966; Hadley, 1961). However, rigorous examination of the available military literature (Yellen, 1967) on job evaluation does not disclose specifically and accurately which systems were used, and when they were implemented. On the other hand procedures and policies regarding benchmark duty positions, limits of grade assignment and relationships between supervisory and subordinate positions are more clearly defined and available.[1]

It has been recommended by U. S. Army agencies that job evaluation procedures should be used to revise and update the enlisted grade structure. The Department of the Army (DA) has established a Grade Structure Study Group in the office of the Deputy Chief of Staff for Personnel (DCSPER). One of the organizations working in this group has recently made the following comments:

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[1] An official document summarizing policies and procedures regarding the assignment of enlisted grades was received from the Personnel Management Development Office, Office of Personnel Operations on 8 June 1967.

1. "Career officers and enlisted personnel are deficient in understanding, appreciating, and applying the policies, procedures, and objectives of the enlisted personnel management system.

2. "In comparing occupational areas, grade inconsistencies are readily apparent when compared to responsibilities and/or requirements of positions.

3. "Though there is no lack of opinion on how deficiencies should be corrected, there is apparently very little being done about these deficiencies according to the responses being received.

4. "Job analysis and evaluation and standards of grade authorization areas need increased and continuing attention throughout the Army. A comprehensive one-time realinement of grades should be conducted for all MOS...using job evaluation as a basis." (U. S. Army Combat Development Command, 1966)

Recently, it has been stated by the office of the Deputy Chief of Staff for Personnel (1967, pp. 23-24) that: "While there is certain merit to the Army's current system of job evaluation, this somewhat subjective system is continually under attack because of the following deficiencies:

1. "It is based on insufficient accurate and up-to-date occupational data concerning Army jobs.

2. "It lacks definitive job evaluation factors and objective grading criteria.

3. "It does not possess adequate scales for measuring relative values of job evaluation factors."

In August, 1966, the U. S. Army Enlisted Evaluation Center (USAEEC) under the administrative and policy guidance of the Personnel Management Development Office (PMDO) undertook to develop an operational plan which would utilize job factors for assigning appropriate enlisted grades (ranks) to Army jobs. The information obtained through implementation of the plan could aid not only job analysts in the assignment of a correct grade to a specific job, but could also furnish valuable data for inclusion in the Military Occupational Information Data Bank (MOIDB) to supplement various personnel management systems. The Evaluation and Analysis Branch, USAEEC, was to be responsible for the plan and the development of job factor weights. By 30 November 1966, a developed and detailed research proposal, based partially upon methodology used by the U. S. Air Force (Christal, 1965), for job evaluation was submitted to the Chief, PMDO,

Office of Personnel Operations (OPO). This research plan included a systematic layout of steps needed in revising and updating the enlisted grade structure.

Basically, the purpose of job evaluation is to assign relative values to the results required of jobs within the Army, using a common set of criteria or standards. The objective of job evaluation is to establish appropriate grade in a manner which clearly recognizes differences in the results accomplished and skills required by each job in the Army. The basic procedure is to determine certain requirements that are common to all jobs. These requirements are defined as "job factors." The current enlisted grade structure was studied using 10 job factors selected from the most current research from government, military and industry.[2] Factors selected by OPO include nine of the 10 factors used by the U. S. Air Force. One factor was borrowed from the U. S. Marine Corps. Final selected job factors were common to all jobs, varied by degree across jobs, and permitted statistical weighting to provide an objective assessment of the appropriate grade for each job.

The emphasis of job evaluating procedures has been placed on identifying the basic processes of human judgment central to all job evaluation plans and the development of techniques for the elimination of bias and error. Job evaluation plans are inherently dependent upon subjective judgment, and there has been no satisfactory means devised to eliminate it entirely. However, it can be controlled, quantified, and, for practical purposes, eliminated. Currently, programs revolve about problems of proper statistical analysis, semantic problems in describing work behavior, the identification and weighting of job factors, and the conversion of job evaluation results to grade/money. The question ultimately is not whether to use job evaluation techniques, but rather how to apply the techniques and implement the findings.

The more sophisticated technique of weighting job factors is accomplished by statistical methods which capture the combined judgment of a policy board, or job evaluation board (JEB), in regard to appropriate grade. The knowledgeable and experienced JEB determines grades for jobs on the basis of expert military judgment. By quantitative procedures, weights can be calculated for job factors of a representative sample of jobs and then these weights may be applied to all jobs. Statistically, the result is the objective application of the combined JEB judgments to all jobs in terms of appropriate grade. The functional product of a job evaluation study is a "multiple regression equation," or mathematical

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[2] Personal communication with representatives from PMDO, OPO disclosed that one year's time was devoted to the selection of job factors, as a part of a larger plan being conducted by the Enlisted Personnel Directorate.

equation, which has the following important characteristics: (1) it captures the combined judgment of a JEB in regard to appropriate grade; (2) it is applicable across the job structure; and (3) the data generated by the equation can be machine processed.

Once the results of job evaluation studies are put into operation the following associated advantages can be: (1) better and more consistent determination of required promotion qualities; (2) more effective utilization of soldiers in available jobs; (3) improved selection of qualified enlisted personnel for specific jobs and in terms of training programs; (4) more specific definition of responsibility, authority, and promotion; and (5) greater efficiency by restructuring of jobs and functions based upon more accurate job data. After improvements are successfully implemented as a result of the ongoing job evaluation studies, the following results may be expected: (1) Army enlisted grades may more readily compare with grades for equivalent jobs in other military services; (2) Army enlisted grades will be more equitable for the various job categories; (3) Army enlisted men may be encouraged to re-enlist due to an improved overall morale heightened by a fair and objective system of establishing grades, thereby relieving the Army of some expense in the training of new men; (4) projection of grade needs to the future may be possible; and (5) improved career planning may result because research clearly isolated the differences in training, skills, and risks required for each job.

This long range research effort should result in an objective basis for the assignment of grades to enlisted jobs. The overall impact of the program should result in a major advance towards a more scientific and economical personnel management system. A conclusion of the Enlisted Grade Structure Study by the Deputy Chief of Staff for Personnel (1967, p. 26) regarding this study indicated that "Ongoing efforts by OPO in the field of job evaluation are sound and could conceivable lead to a proposal for adjustment in the number of enlisted ranks."

Method

Phase I: Job Descriptions of Duty Positions and Their Sampling.

The basis for the proposed program of job evaluation depended upon the degree of the availability of accurate, detailed, and organized knowledge for each of the existing duty positions included in the sample. The sample represents the entire enlisted MOS structure. Because of this, it was a prime necessity to obtain operationally accurate duty position descriptions. Hence, the first task was to obtain these descriptions.

Job analysts in the Military Occupational Specialty (MOS) Branch of PMDO, each of whom are specialists in certain career groups of MOS, provided the job descriptions for the present study. "Job analysis is the task of organizing and establishing the duties for each job within the Army" (U. S. Army Deputy Chief of Staff for Personnel, 1967, p. 15). There are essentially three methods for obtaining short, accurate job descriptions. These are: (1) literature review; (2) direct observation; and, (3) description by incumbents in duty positions. Frequently, combinations of these methods are used. In the present study, key elements of all three methods were used during the writing of the job descriptions.

In terms of literature review, job descriptions in Army Regulations (AR) 611-201, the Manual of Enlisted Military Occupational Specialties are based upon previous analyses of Army jobs. These were available to job analysts and are kept operationally current by continual revision. In addition, information was taken from the following Army publication sources: Field Manuals, Technical and Training Manuals, Army Subject Schedules, Test Aids, and Test Outlines. This literature is also continually updated as the requirements of the jobs change.

Direct observational methods were used in the sense that job analysts had direct access to volumes of material assembled through personal contacts with job incumbents, instructors, and supervisors. This information was employed in the formulation of the job descriptions. Visits to major Army installations and service schools provided job analysts with information regarding job requirements. Frequently, job incumbents supplied information to assist in the writing of job descriptions. All jobs were analyzed with respect to mental requirements, physical requirements, and special requirements. A sample of the job descriptions provided by the job analysts may be seen in Appendix A.

The sampling technique was of key importance. "If all types (duty positions) are not included in the criterion sample, the mathematical equation developed to express the...policy board grade determinations could fail to include or improperly weight certain job evaluation or

requirements factors uniquely associated with any omitted job" (Hazel, 1965, p. 12). Jobs to be used in this study were selected randomly within certain limits: (1) certain benchmark positions, which are duty positions with a well-established grade, were included; (2) broad coverage in each career group was provided; and (3) since jobs in the middle grade range are most numerous, giving rise to most of the problems in grade determination, a defensible selection of these duty positions was considered essential. From the list of duty positions a stratified sample of 100 jobs was selected. The first criterion was to select duty positions representative of the occupational level, or MOS, within each occupational area. Secondly, all duty positions were proportionally representative across each occupational area. These two criteria minimized bias due to occupational area and occupational level. The final criterion was to have representative duty positions in terms of their population of enlisted men (EM). After determining the appropriate number of cases needed for each category, the sample was drawn from the job description file by using a table of random numbers. The sample of 100 jobs can be seen, by title and MOS, in Appendix B.

Phase II: Job Evaluation Board.

The objective of the JEB was to define a recommended Army policy concerning enlisted grade requirements. Essentially, the JEB was established to provide a criterion of what enlisted grade should be assigned to each job in the 100-job sample. Since each job was graded by 10 members of the board, who had ready access to all the key information about each job, it was presumed that a very accurate summary of grade requirements was produced. Such ratings were necessary to determine the mean authorized grade of each duty position for use in the subsequent development and evaluation of multiple prediction equations applicable to all duty positions in the MOS structure. Members of the JEB were selected so that their experience and career assignments optimally represented the requirements contained in the criterion duty position sample. The JEB members had extensive experience in a variety of career fields. Of the variety of career fields from which jobs were selected, at least one JEB member was currently assigned or had worked in each. Table 1 summarizes the composition of the JEB. The membership and composition of the board was as follows:

1. The JEB consisted of 35 field grade officers and 15 EM.

a. The officer portion of the JEB consisted of Majors, Lieutenant Colonels, and Colonels.

b. The enlisted membership consisted of senior NCO's in the grades of E-8 and E-9.

2. The general guidelines governing the selection of JEB members were as follows:

a. Rank or paygrade.

b. Command.

c. Primary field.

d. Secondary field.

e. Experience.

3. The JEB was convened under the authority of the Chief, Office of Personnel Operations, Department of the Army, Washington, D. C., in coordination with the Commanding General, U. S. Continental Army Command and the Commanding General, 101st Airborne Division, Fort Campbell, Kentucky.

The sample of 100 jobs was randomly subdivided into five groups of 20 jobs. This randomization of job descriptions was an effort to control for context effects (Madden, 1960). Ten JEB members were assigned to each of the five subgroups, and each rated 20 jobs. With each of the jobs receiving 10 ratings, the JEB produced a total of 1,000 ratings.

Since ratings provided by the JEB were to be the basis for establishing an experimental model of Army enlisted grade requirements, measures were taken to assure that ratings were reliable, valid, and unbiased. The degree of stability of the ratings was determined by the amount of agreement among board members concerning the appropriate grade requirements for particular jobs. It was known that the average of ratings from several independent judges is more reliable than a rating obtained from a single judge (Christal, Madden, & Harding, 1960). The confidence that the judges had in their ratings was identified through use of a three-point confidence scale. Determination was made concerning possible rater bias for or against jobs in various MOS codes or commands. There were additional statistical and research-oriented considerations affecting the composition and conduct of the JEB. The number and type of jobs in the sample to be rated by board members, and the number of independent ratings for each job in the sample, affected the size and composition of the JEB.

When the JEB was convened, several precautions with instructions and procedures were accomplished to reduce possible subjectivity on the part of board members. One of the principal precautions to assure that the policy expressed by the board was valid and unbiased was an explicit statement by the Chief, MOS Branch, PMDO (project action officer) concerning objective and impartial versus exaggerated or inflated ratings. The statement emphasized that the data collected for this project would be used to support decisions concerning an optimal grade structure for U. S. Army enlisted personnel. Based upon the importance of the project,

the JEB members were urged to be as objective and impartial as possible. Since the board was convened to make an accurate statement of U. S. Army enlisted grade requirements, it was important that members resist any tendency to exaggerate these requirements.

After the project action officer's address and introduction of personnel associated with the project, instructions were given to members of the board. In addition to instructions outlining the task to be accomplished, members were given letters describing and authorizing the project, a biographical overview of the members composing the JEB, and a work schedule. The rating instructions may be seen in Appendix C.

Prior to convening the board, rater identification numbers (1 through 50 were assigned to the 50 folders containing the duty position descriptions, so that each member could identify his folder over the three-day period (see Table 1). These numbers were also used to identify board members for consultation purposes.

In brief, the rating procedure was to read a duty position description, decide the most appropriate grade for that job, record the judgment using a seven-point grade scale; and then on a three-point scale, indicate the level of confidence associated with the grade judgment.

A specimen copy of a Job Evaluation Report used for recording grade and confidence ratings is presented in Appendix D. Members were instructed that if more information was needed about a job before rendering a judgment, they were to confer freely with fellow board members who were experienced in the career area for that job. Biographical information was available for identification of appropriate conferees. However, members were instructed <u>not</u> to ask any other board member the appropriate grade for a job.

The JEB was informed that the following sources of supplemental information could be made available on request:

1. The job analysts at PMDO, OPO and the USAEEC's staff research psychologists and test specialists, familiar with job requirements, were available for conference by telephone as desired.

2. The organizational level (e.g., section, branch) of a job within a unit (e.g., company, battalion), and the post or installation location of a job was furnished as requested.

3. The Army's field network of test project directors associated with the Army's major school and training installations could be made available immediately by telephone. Also, the Army's network of Test Control Officers at nearly every installation, who were available by

Table 1

Composition of the Job Evaluation Board by Army Branch and MOS

Control Number	Rank-Grade	MOS Branch	Control Number	Rank-Grade	MOS Branch	Control Number	Rank-Grade	MOS Branch
1	MAJ	ARTY	18	SGM	36C	35	SGM	12B
2	COL	CE	19	MAJ	CE	36	MSG	21H
3	LTC	ARTY	20	MAJ	ARTY	37	MAJ	ORD
4	MSG	51H	21	1SG	71L	38	MAJ	ARTY
5	LTC	MSC	22	MAJ	CE	39	SGM	71H
6	MAJ	ARTY	23	MSG	45Z	40	SGM	63Z
7	MAJ	INF	24	MAJ	INF	41	MAJ	TC
8	MAJ	ARTY	25	1SG	67Z	42	MSG	91Z
9	MAJ	ARTY	26	MSG	36G	43	MAJ	QMC
10	SGM	13Z	27	MAJ	SIGL	44	MAJ	INF
11	LTC	ARTY	28	LTC	MSC	45	MAJ	INF
12	MAJ	QMC	29	COL	QMC	46	MAJ	ARTY
13	MSG	11E	30	MAJ	ARMOR	47	LTC	AGC
14	MAJ	INF	31	SGM	11G	48	MAJ	ARTY
15	MAJ	INF	32	COL	INF	49	MSG	94Z
16	MAJ	ARTY	33	MAJ	MPC	50	MAJ	ARTY
17	MAJ	INF	34	MAJ	INF			

telephone, could contact job incumbents directly if any additional specific data concerning a job was desired by a board member.

While the preceding resources were available to members, they were not given knowledge of the current Standards of Grade Authorization or present grade of the incumbents for the jobs being rated. Figure 1 shows the members of the JEB at work.

After each member of the JEB completed rating all the duty position descriptions, his Job Evaluation Report was carefully screened for any rating omissions. Subsequent to the adjournment of the JEB, members were interviewed to solicit any opinions or criticisms concerning the Army Enlisted Grade Requirements Project. The mean grade rating assigned by the JEB to each of the 100 jobs in the sample may be seen in Appendix B.

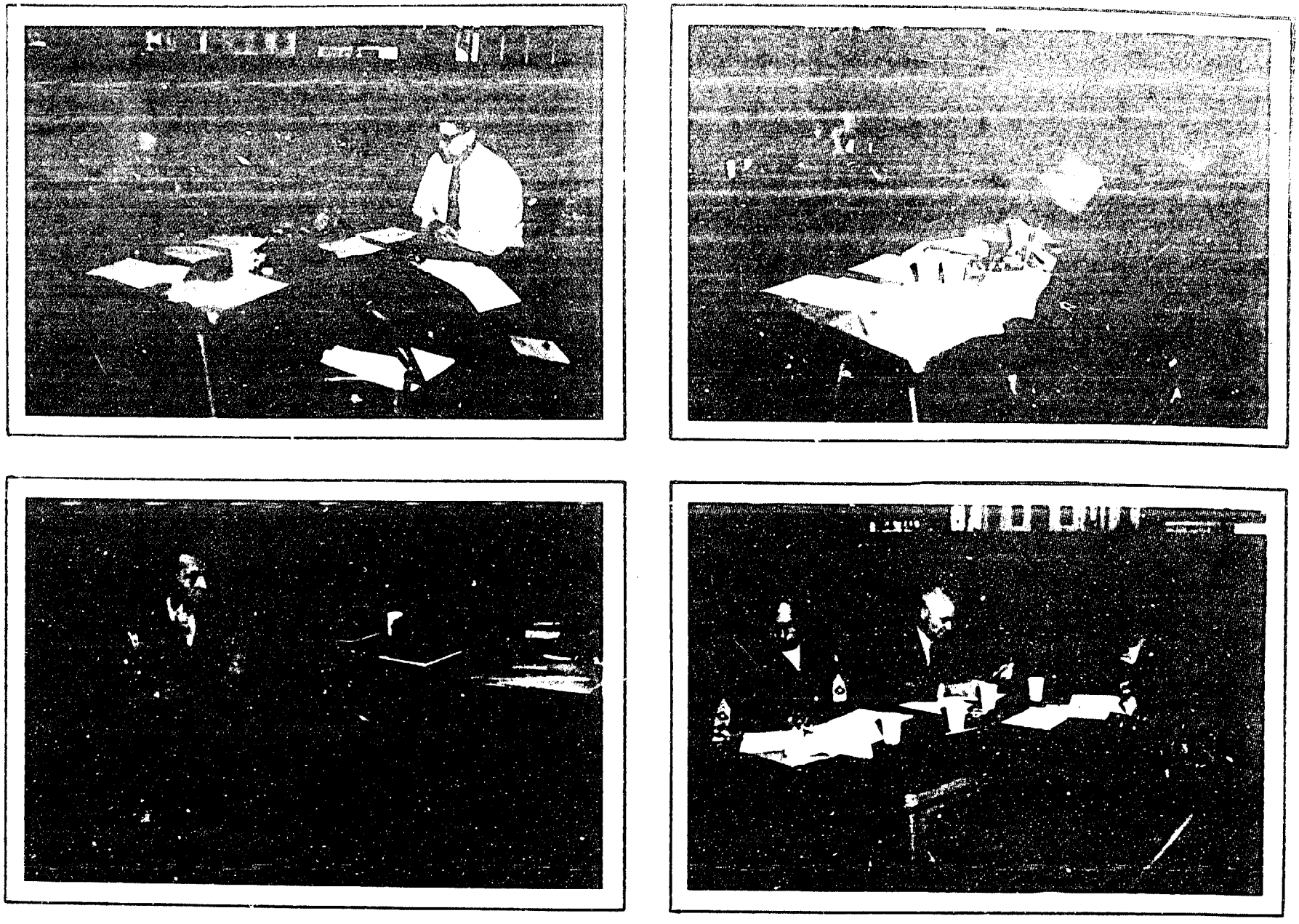

Fig. 1. Members of the Job Evaluation Board assigning grades to duty positions at Fort Campbell, Kentucky in March 1967.

Phase III: Factor Ratings.

Certain hypothesized job evaluation factors, such as the extent to which a job requires special knowledges or skills, or requires working under unusually difficult or risky conditions, or requires leadership or supervisory responsibilities, may have relevance for grade determinations. These factors can be measured only through the use of rating techniques. Extensive research by the U. S. Air Force and other governmental and industrial organizations has shown that 10 factors plus certain other variables unique to an organization are sufficient to account for almost all the variance in the prediction of grade across all military occupational specialties (Yellen, 1967). These job factors, which were used as a starting point for the development of a proportionately weighted set of factors to evaluate enlisted jobs in the U. S. Army, are defined in Appendix E. Ratings as to the importance of each job factor for determining authorized grade were obtained from commissioned officers in the grades of Captain through Major. A composite group of raters is supported by the research of Hazel and Cowan (1966).

In order to evaluate the criterion duty positions in terms of these selected job factors, a suitable method was required for obtaining factor ratings. Decisions to establish a rating scale with six levels for discrimination within the factors was supported by available military job requirement studies and rating scale methodology. Definitions of the rating scale levels, relating to each factor, may also be seen in Appendix E.

The collection of these ratings was accomplished using 100 officers in career and associate career courses at the U. S. Army Adjutant General School, Fort Benjamin Harrison, Indianapolis, Indiana. Each officer was asked to rate 20 duty positions, each independent of all others, on each of the job factors in terms of the six-point scale. The officers were instructed to rate all duty positions in order, determining the appropriate factor level on the six-point scale for all 10 factors. They rated all factors for the first job, then went on to the next, and continued until all 20 duty positions had been rated. These ratings provided the necessary information for the development of a proportionately weighted set of job factors for purposes of predicting duty position grade. Because of the incompleteness of some ratings returned by two field judges, 18 usable factor ratings were collected for each job. This number was further reduced to 10 factor ratings for each job to facilitate machine processing. It was found that 10 factor ratings per job were nearly as reliable as 18.

The complete package given to each officer included a booklet of 20 numbered duty position descriptions, a list of job requirement factors, a rating form, and a job information sheet which gave additional information about the duty positions such as the type of unit where each is employed. In addition, a cover letter explained the purpose and importance of the project.

The duty position descriptions were typed and numbered, omitting the present authorized grade data, and the raters were cautioned that knowledge of present grade data for the jobs would confound the objectives of the research. Selection of the 20 job descriptions to be given to each rater was accomplished by randomly sorting the job descriptions to control for context effects (Madden 1960). The raters were asked to complete and return their ratings within 10 working days after receipt.

The number of officers required to evaluate the 100 criterion jobs was based essentially on the number of jobs assigned per rater, and certain measures taken to insure reliable factor ratings. As mentioned earlier, the officers were asked to rate 20 duty positions each. Previous research on the reliability of ratings (Christal, Madden, and Harding, 1960) indicates that this number of ratings per job is sufficient to assure highly stable estimates of mean factor requirements. With each rater evaluating 20 duty positions, the 100 officers were considered adequate as an optimal size sample for this project.

One-way analyses of variance (Winer, 1962) were computed for each job factor to assure that an adequate level of reliability was secured in these ratings. These coefficients ranged from .73 to .93, with most falling in the range of the upper eighties to the low nineties.

Results

Phase IV: Development of Multiple Regression Equations for the Prediction of Enlisted Grades Assigned by the Job Evaluation Board.

In this investigation, the hypothesized job factors were used as predictors of the criterion grades assigned by the JEB. The criterion scores consisted of the mean grade rating by the JEB for each of the 100 duty positions in the criterion sample, and the predictor scores refer to mean job factor ratings rendered by the rating officers.

Multiple correlation (R), which indicates the relationship between one variable and two or more predictor variables taken together, was used in the development of multiple regression equations for the prediction of JEB grade ratings from the job factor ratings. The use of the multiple correlation model assumes a linear relationship between variables; this assumption is supported by review of the literature and past research in the field of industrial psychology and job evaluation.

The solution of the multiple regression equation requires the predictor intercorrelation matrix and the validity coefficients for each predictor. With 10 predictors or job factors, there are 45 intercorrelations and 10 validity coefficients. The data analyses provided means and variances for all variables, the multiple correlation (which indicates the accuracy of the prediction of the JEB grade ratings from the independent job factor ratings), and the standard partial regression coefficients (relative weight) for each job factor.

By inspection of standard partial regression coefficients and the content or face validity of the predictors, certain predictors can be dropped and new regression equations computed. This process can be continued until a set of predictors is determined which provides a statistically acceptable multiple regression equation. In most problems of this type, from five to 10 predictors will provide satisfactory levels of criterion prediction with little loss in the multiple R over the full set of predictors. In a more theoretical sense, predictors can be dropped or added more efficiently through use of the Wherry-Doolittle procedure (Wherry, 1940). However, experimental application of the job factors did not permit a parsimonious selection of these factors. The final multiple R itself indicates the degree of accuracy of the regression equation for the criterion sample. There will usually be some loss in predictive accuracy when the prediction equation is applied to a new sample.

The accuracy of the prediction equations was established by making

direct comparisons between the grades assigned by the JEB to the 100 criterion duty positions and the grades assigned by the prediction equations to the same 100 duty positions. These comparisons gave the amount of discrepancy between the JEB ratings and the assignments of grade by the prediction equations.

The prediction equation defines the best set of job factors and the precise weight that should be applied to each in order to obtain the most accurate grade level determination. Job factor ratings, therefore, constituted the information required for grade determination of any enlisted job or position in the Army.

The JEB, consisting of 35 field grade officers and 15 NCO's in the grades E-8 and E-9, was convened at Fort Campbell, Kentucky. These 50 experienced soldiers represented a cross section of the job fields corresponding to the jobs selected for rating. Each member of the JEB rated 20 job descriptions with respect to the appropriate enlisted grade which, in the light of their professional military judgment and broad experience, should be assigned to the job. Analysis of the JEB ratings demonstrated the following:

1. The JEB's grade ratings were found statistically to be highly reliable, which indicated a marked agreement among the raters. This reliability coefficient for the mean grade ratings across all jobs was .94 (Winer, 1962, pp. 105-139).

2. The standard error of estimate was .32 on a seven-point grade scale (E-3 to E-9). This was interpreted to mean that if many similar JEB's were convened, 68 percent of the mean grade ratings would be within plus or minus .32 of a grade level of the mean grade rating rendered by the JEB, and 95 percent would be within .64 (.32 x 2) of a grade level of the mean grade determination.

3. The confidence that the JEB expressed in their grade ratings was identified through the use of a three-point confidence scale. It was found that the raters expressed reasonable confidence in their grade ratings. This finding fell within desirable limits since a previous research study indicated that experienced military raters with either high or low confidence in their ratings tend to inflate or deflate their actual ratings (Waldkoetter, Urry & Martinson, 1965). Ninety-five percent of the jobs received confidence ratings of at least two on the three-point confidence scale. Thirty-three percent of the jobs received a mean confidence rating of at least 2.5. A summary of these ratings may be seen in Figure 2.

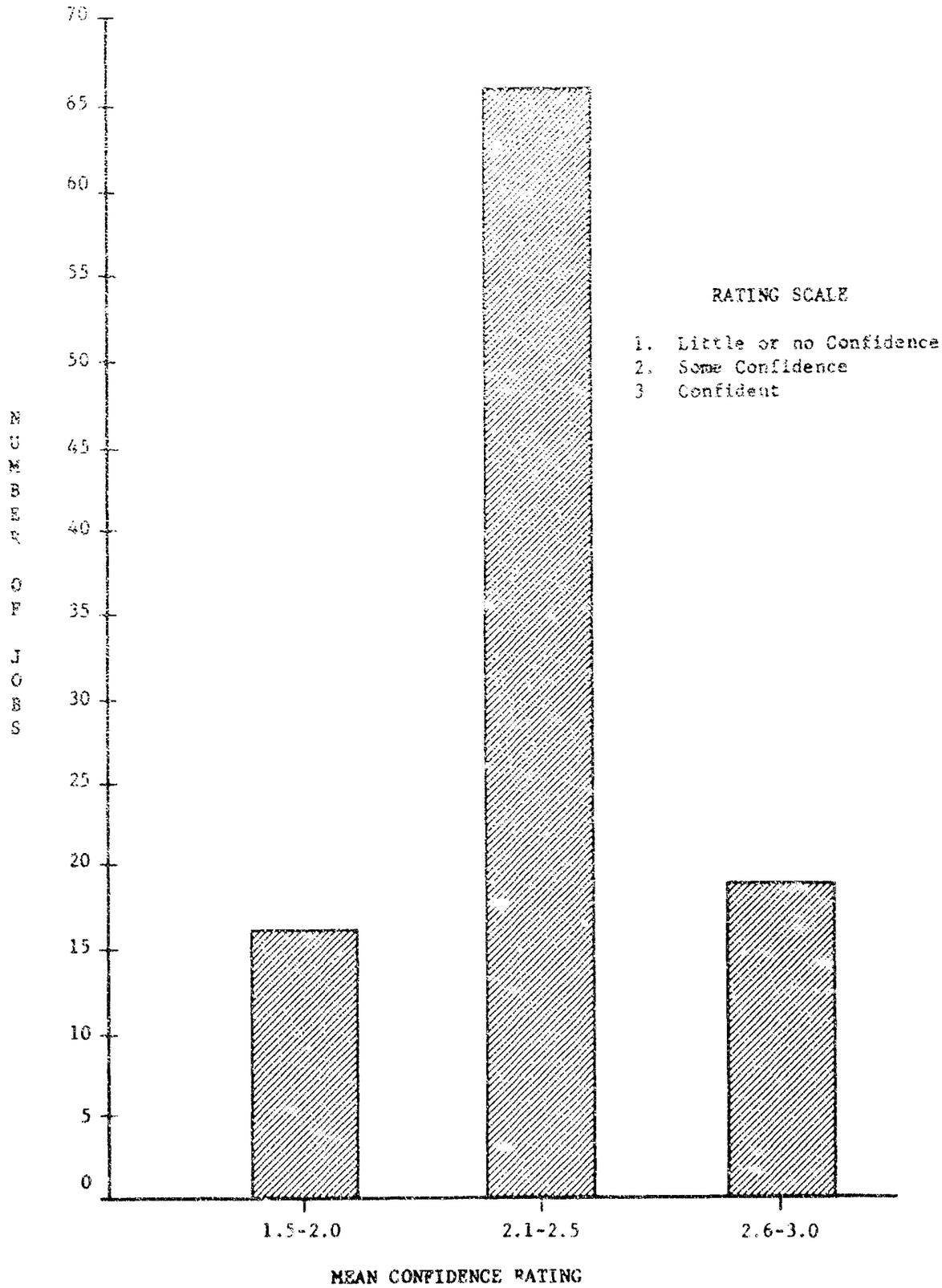

Fig. 2 Summary of confidence ratings of the Job Evaluation Board in the grades they assigned to the jobs in the sample.

Officers and noncommissioned officers of the JEB did not express a bias toward jobs in particular occupational areas. Values that would detect bias are presented in Table 2, and were computed by taking the difference between the average of ratings assigned by each rater on the seven-point grade scale to jobs in each occupational area from an average of ratings assigned by all raters to jobs in each occupational area. A value of 1.00 would indicate that a JEB member rated jobs in a particular area one grade higher than other members and a value of -1.00 would indicate a rating of one grade lower. This procedure was carried out according to the following formula.

$$D = \overline{X}_{AR} - \overline{X}_{ER}$$

Where: D = the differences between the mean of <u>each</u> rater's ratings on jobs within each of the 10 occupational areas, and the mean of <u>all</u> rater's ratings on jobs within that occupational area. This difference can be plus or minus.

$\overline{X}$ = mean, or average, ratings within an occupational area.

AR = all raters.

ER = each rater.

A summary of the data in Table 2 indicates that:

1. JEB members did not consistently undergrade or overgrade jobs in the various occupational areas.

2. As many JEB members undergraded jobs as overgraded jobs for all occupational areas.

There was little tendency on the part of the JEB to simply confirm presently authorized grades for the criterion job sample. This could be attributed in part to the experimental design of the study. (See comparison of mean JEB grades with currently authorized grades in Appendix B). Few jobs were believed to need downgrading; but approximately 40 percent were considered for upgrading. For the most part, jobs believed to require upgrading were in the technical, electronic, and maintenance MOS. The composite grade ratings of the JEB were to serve as the criterion for the multiple regression prediction equations to be calculated subsequently, based upon factor ratings for each job. The successful application of the results of this job evaluation study, or similar research efforts, depends upon acceptance of the enlisted grades assigned by the JEB to the sample of 100 Army jobs. Any other grade determinations

Table 2

Average Deviation of Each Board Member's Ratings by Occupational Area

Rater	Occupational Areas										
	Tactical Operations	Missile and Fire Control Electronics Maintenance	General Electronic Maintenance	Precision Maintenance	Auxiliary Services	Motors	Clerical	Graphics	General Technical	Special Assignments	All Jobs
	1	2	3	4	5	6	7	8	9	10	11
1	-.35	-.32	-1.16	-	.30	.67	.71	-.82	1.17	-.52	.00
2	-.15	.48	1.84	.73	-.30	1.27	-.29	.18	.17	.48	-.50
3	.65	.68	.84	-1.17	-	-.03	-1.29	.18	-.13	-	-.60
4	-	.48	.84	.23	-	-.53	-.79	.18	.37	-.52	.00
5	-.15	-	-2.16	-	.10	-1.03	.31	-	-.03	-1.52	-.70
6	-.75	-.32	-.16	-	-.30	-	.41	-	.17	2.48	.00
7	.45	-1.62	-	-.27	-1.70	-.03	-1.79	-.82	.37	-1.52	-.80
8	1.35	.88	-	-.27	-1.20	-.53	-1.79	-.82	-	-	-.50
9	-1.15	-.32	-.16	-.27	.80	-.03	-.29	-.82	-1.13	-.52	-.40
10	-1.65	-1.82	-.16	1.73	-	-.33	.71	-	-1.13	.48	-.90
11	-2.15	2.68	.84	1.73	.30	.47	-1.29	-.32	.57	.48	.00
12	1.15	.18	.84	-	1.00	-.03	.91	-	-.03	3.48	.10
13	1.35	-.32	-1.16	-.27	-.30	-.53	.41	-.82	1.67	1.46	.20
14	-.15	-1.12	-	-.77	-	-.73	1.71	-	-1.23	-.52	-.30
15	-1.35	.38	1.84	-.27	-.70	-.53	-1.79	.18	-.83	.48	-.20
16	-1.05	-.82	.34	-.23	-.70	-1.03	-1.99	-	-2.83	.48	-.70
17	-.65	-1.32	-	-	.10	-.53	.71	-.82	-.13	.48	-.30
18	.15	.68	.84	1.43	2.30	1.27	1.21	[illegible]		-.52	.90
19	-1.65	-1.12	-	-1.27	-1.70	-1.03	.71	-.82		1.52	-.10
20	.55	.68	-.66	-1.27	-	1.97	-1.29	.18	-1.23	-.52	-.10
21	1.85	.68	-	-.27	1.80	.67	.71	.18	.17	.48	.60
22	-.85	-1.32	-.16	.23	-1.00	.97	-.79	-	.67	-	-.20
23	1.35	-.02	.84	-.27	2.80	-.23	-.29	-.32	-	-	.40
24	-1.15	-.02	-1.16	-.27	-	-.53	-1.19	.18	-.43	.48	-.40
25	-.65	-.82	-1.16	-.27	.70	-	-.29	.18	.57	-.02	-.30

Table 2 (Continued)

Rater	Occupational Areas										
	Tactical Operations	Missile and Fire Control Electronics Maintenance	General Electronic Maintenance	Precision Maintenance	Auxiliary Services	Motors	Clerical	Graphics	General Technical	Special Assignments	All Jobs
	1	2	3	4	5	6	7	8	9	10	11
26	1.15	.68	-.16	.73	-.20	-	.71	-	.57	-	.60
27	-.65	-.82	.84	-	-.[illegible]	-.43	-.79	-	2.17	-1.02	-.10
28	.85	-1.32	-	-1.27	-.70	-.03	2.71	1.18	-.63	-.02	.00
29	.55	-	-2.16	-	-.30	-1.03	-.99	-.82	-.13	-	-.80
30	-.65	.48	1.84	-.27	-	.67	-.09	-	-	-	.50
31	-.15	-1.82	.84	-.07	-.70	-.93	-	-	-1.73	-	-.60
32	.55	-2.32	-.16	-	.30	-1.03	-1.29	-.82	-.43	1.22	-.70
33	-1.15	1.38	-1.16	.73	1.30	.03	.21	.18	1.37	-	.30
34	-1.15	.98	-1.16	-	-1.70	.17	-.09	-	.17	-1.52	-.90
35	.05	-.02	-.16	-.77	1.30	.47	-.29	.18	-.33	.98	.20
36	.05	.38	-	-	.30	-	.71	.18	.67	.48	.40
37	.35	1.68	.84	.73	.80	1.47	1.31	-	1.17	.48	1.10
38	-1.15	-.02	.34	.23	-.70	-.93	-	.18	.87	-	-.10
39	3.55	-.32	.84	.43	1.30	.67	1.71	1.18	.47	1.48	1.10
40	1.55	-1.32	-	.73	-.20	.17	-1.29	-	.97	-	.10
41	-1.35	-	-	-	1.30	-.53	-.79	-	-.03	.48	.70
42	2.35	1.18	1.84	1.73	.30	.03	.71	.68	.57	-.52	.90
43	-1.05	-.02	-	.73	-.70	-.03	1.71	1.18	-.03	-.02	.10
44	-	.38	.34	-.57	-.70	-	-.29	-	.67	-.52	.10
45	1.05	.18	.34	.73	-.70	.17	.71	-.32	-.83	-	.10
46	1.85	-.32	-.46	-.47	-.20	-.03	.71	-	.17	.48	.30
47	-1.15	-.32	.84	-	-1.20	-.03	.51	.18	.97	-	.00
48	.85	1.18	2.16	-	.30	.17	.71	-	-.43	-.52	.10
49	.05	.38	-	-	.30	-.53	-.99	.68	-.53	1.48	.00
50	.85	1.18	-	.03	1.00	.97	-.29	.18	.17	-1.52	-.20

for additional job samples made by redefined JEB membership, e.g., job analysts, should accept the same assumptions as were adopted in this study.

Independent factor ratings for the 10 factors on a six-point scale, based upon the relative importance of each of the 10 factors for a specific job, were collected from a sample of 100 officers in career courses at the U. S. Army Adjutant General School. The job factors' scores for each job were based upon a mean of 10 ratings. These officers rated the 10 factors for each job on the basis of the same job descriptions used by the JEB. The job factor ratings were subsequently correlated with the JEB grade ratings to determine the extent to which the variance in the grade ratings could be accounted for by variance in job factor ratings. Validity of each factor was established using Pearson product moment correlation between each of the 10 factors and grades assigned by the JEB. These validity coefficients may be seen in Table 3. Table 3 shows that seven of the factors were significantly related to grade. For a more thorough treatment of the validity of the factors, see the linear regression analysis in Appendix F.

Additional statistical analyses of the obtained data were based upon multiple correlation techniques, with the following results. The multiple correlation between the mean composite factor ratings for each of the 100 jobs and the mean enlisted grade assigned by the JEB to each job was exceptionally valid as indicated by the correlation coefficient ($\underline{R}$ = .94). This indicates that appropriate enlisted grades for Army jobs can probably be generated statistically based upon reliable job factor ratings for each of the jobs by several qualified judges. On the basis of the favorable correlational relationship reported above, three multiple regression equations, with varying degrees of accuracy, were developed. These equations predict enlisted grades for any job in the Army for which accurate factor ratings are available. The model for the equations takes the following form:

$$GEI = a + b_{I}\bar{X}_{I} + b_{II}\bar{X}_{II} + b_{III}\bar{X}_{III} + b_{IV}\bar{X}_{IV} + b_{V}\bar{X}_{V} + b_{VI}\bar{X}_{VI}$$

$$b_{VII}\bar{X}_{VII} + b_{VIII}\bar{X}_{VIII} + b_{IX}\bar{X}_{IX} + b_{X}\bar{X}_{X}$$

Where: a = constant

b = constant multiplier for each factor weight ($\bar{X}$)

$\bar{X}$ = factor weight provided by job analysts for the specific job being evaluated

Roman numerals correspond to the factor numbers given in Table 3.

Table 3

Pearson Product Moment Correlation Coefficients
Showing Validity of the Ten Job Factors

	Factor	Validity
I	Knowledge	.84**
II	Supervision of Personnel	.82**
III	Adaptability and Resourcefulness	.86**
IV	Responsibility for Material Resources	.50**
V	Concentration and Attention	.68**
VI	Physical Skills	.16*
VII	Physical Effort	-.35
VIII	Job Conditions	-.23
IX	Freedom of Action	.87**
X	Combat Exposure	-.14

* Significant at the .05 level
** Significant at the .01 level

The yield of this equation is a grade evaluation indicator (GEI) which will lend objective, scientific assistance to those responsible for assignment of enlisted grades.

1. The first equation was calculated using beta weights for all 10 factors, although statistical results indicated that only seven of the factors were predicting grade significantly. This 10-factor equation, based upon the multiple correlation of $\underline{R}$ = .9378, accounts for 88 percent of the variance required for perfect prediction of enlisted grade assigned to jobs by the JEB. Only 12 percent of the variance is not accounted for on the basis of information given about the jobs in the 10 factor ratings. A shrunken multiple correlation coefficient (Guilford, 1965) was computed to determine what decrease in correlation could be expected if the multiple regression equation were applied to a

different sample of Army jobs. Empirical evidence bearing upon this procedure, as an estimate of the multiple correlation to be obtained in a cross-validation, can be seen in Foley (1966). The shrinkage was nonsignificant ($_cR$ = .9305) indicating that the sample size of 100 jobs was adequate, and that the equation would probably be effective if applied to jobs outside the sample. The standard error of multiple estimate was .39, indicating that 68 percent of predicted grades will probably fall within .39 of the grade assigned by the JEB, and that 95 percent will be within .78 of the JEB grade. The equation was applied, using the same independent job factor ratings by the officers in the U. S. Army Adjutant General School, with the following results:

Predicted JEB grade exactly	12%
Within .10 to .30 of JEB grade	55%
Within .60 to .80 of JEB grade	12%
Greater than .80 of JEB grade	4%

Since the GEI yields grade by number (6 = E-6, which means Staff Sergeant by title), it can be observed that the 10-factor multiple regression equation predicts the correct JEB assigned enlisted grade in 84 percent of the cases since, for example, numbers ranging from 4.5 to 5.4 would round to 5 (E-5). In any job evaluation situation, the above results would be considered excellent prediction. As a final check on the accuracy of the multiple regression equation, the enlisted grades predicted for the sample of 100 jobs by the 10-factor equation were correlated with the grades assigned to the job sample by the JEB. This correlation coefficient of r = .9381 was equivalent, within rounding error, to the multiple correlation of R = .9378, indicating that the equation predicted with the high degree of accuracy indicated by the multiple correlation coefficient. Grades predicted with this equation for each of the 100 jobs in the sample may be seen in Appendix B.

2. A second multiple regression equation was calculated using the beta weights derived from the seven factors which were statistically significant from zero. Theoretically, all of the variance in the prediction of enlisted grade can be covered by seven of the 10 factors, as shown by the multiple correlation of R = .9365, which is based upon the intercorrelation of the seven factors with the grades assigned by the JEB. The amount of predictive variance covered by the seven factors is .8769. A shrunken multiple correlation coefficient was also computed for this equation to determine what decrease in correlation might be expected if the multiple regression equation were applied to a different sample of Army jobs. The shrinkage of the multiple correlation was again nonsignificant ($_cR$ = .9314), indicating that the sample size of

100 jobs was adequate, under the conditions of this study, and that the equation should probably give effective prediction of grade if applied to jobs outside the sample. The standard error of multiple estimate was .3950, indicating that 68 percent of predicted grades will be within .3950 of the grade assigned by the JEB, and that 95 percent will fall within .79 of a grade. It should be noted that the predictive statistics of the seven-factor equation are nearly identical to those of the 10-factor equation, which indicates that no significant gain is achieved in prediction of grade through the use of the three nonvalid factors--at least for this sample of 100 jobs. It is possible that one or more of the three factors could cover valid variance in Army jobs outside the experimental sample, which is in favor of the use of the 10-factor equation. The seven-factor equation was applied, again using the same independent job factor ratings collected at the U. S. Army Adjutant General School. The results were as follows:

Predicted JEB grade exactly	11%
Within .10 to .30 of JEB grade	57%
Within .40 to .50 of JEB grade	15%
Within .60 to .80 of JEB grade	14%
Greater than .80 of JEB grade	3%

In that the GEI yields by number, it is seen that the seven-factor multiple regression equation predicts the correct JEB assigned enlisted grade in 83 percent of the cases. Again, excellent prediction is achieved. As a final check on the accuracy of this multiple regression equation, the enlisted grades predicted for the sample of 100 jobs by the seven-factor equation were correlated with the grades assigned to the job sample by the JEB. The resulting correlation coefficient of $\underline{r}$ = .9378 was equivalent, within rounding error, to the multiple correlation of $\underline{R}$ = .9365. This analysis indicated that the equation predicted with the high degree of accuracy indicated by the multiple correlation coefficient. Grades predicted with this equation for each of the 100 jobs in the sample may be seen in Appendix B.

3. A survey was conducted by PMDO, OPO, of Army general-grade officers, staff officers, and senior NCO's to determine what weight should be given to each of the 10 factors in the determination of enlisted grade. This procedure amounted to dividing up 100 points between the 10 factors for establishing their relative importance. The rounded off recommended weights were:

I	Knowledge	23
II	Supervision of Personnel	15
III	Adaptability and Resourcefulness	12
IV	Responsibility for Material Resources	9
V	Concentration and Attention	8
VI	Physical Skills	6
VII	Physical Effort	5
VIII	Job Conditions	5
IX	Freedom of Action	9
X	Combat Exposure	8

An auxiliary analysis was undertaken to evaluate the predictive efficiency of the survey weights. These weights were standardized to the criterion (converted to a standard scale of measurement) and an equation was developed to establish whether enlisted grades assigned to the 100 job sample by the JEB could be predicted on the basis of subjective determination of factor importance. GEI's were produced for the job sample and the Pearson product moment correlation coefficient between the predicted grades and the JEB grades was .8195. (The correlation of sums technique (Guilford, 1965), using the raw PMDO survey weights, produced a comparable multiple correlation of .8301). Although this is moderately high correlation, it accounts for only 67.16 percent of the variance for successfully predicting enlisted grades. No correction for shrinkage was calculated for this equation since it was only based partially upon multiple correlation. However, since it is based upon the same sample of 100 jobs as the previous two equations reported, it is reasonable to assume that the shrinkage of this equation would also be nonsignificant. The loss of valid variance accounts for the reduced efficiency in prediction, which is reflected in the percentages below:

Predicted JEB exactly	8%
Within .10 to .30 of JEB grade	26%
Within .40 to .50 of JEB grade	22%
Within .60 to .80 of JEB grade	25%
Greater than .80 of JEB grade	19%

Only 56 percent of grades predicted using this equation could be rounded to the grades assigned by the JEB, which does not compare favorably with the 84 percent associated with the 10-factor equation and the 83 percent associated with the seven-factor equation, reported previously. The yield of this equation could be considered adequate prediction; however, the two more powerful mathematical equations reported earlier have been provided. Grades predicted on each of the 100 jobs in the sample using this prediction equation can be seen in Appendix B. A summary of the predictive power of the three equations is presented in Table 4 for purposes of comparison.

Table 4

Predictive Power of Three Multiple Regression Equations for Predicting Enlisted Grades Assigned to 100 Army Job Sample by the Job Evaluation Board

PREDICTIVE POWER OF EQUATIONS	MULTIPLE REGRESSION EQUATION		
	Ten Factor Optimal Weights	Seven Factor Optimal Weights	Ten PMDO Weights Based Upon Survey
Predicted JEB grade exactly	12%	11%	8%
Within .10 to .30 of JEB grade	55%	57%	26%
Within .40 to .50 of JEB grade	17%	15%	22%
Within .60 to .80 of JEB grade	12%	14%	25%
Greater than .80 of JEB grade	4%	3%	19%
Predicts JEB grade when rounded to whole number	84%	83%	56%

4. A fourth multiple regression equation was developed at the request of PMDO. This equation was calculated to see how well the 10 optimal factor multipliers would predict the presently authorized enlisted grades on the sample of 100 jobs. It was found that the optimal weights based upon 10 factors correlated with the criterion of currently authorized enlisted grades (R = .83). The multiple correlation of .83 accounts for 68.89 percent of the valid variance for prediction of

currently authorized enlisted grades. This multiple correlation, reduced with respect to the .94 associated with the 10-factor equation and the .93 associated with the seven-factor equation reported previously was expected, since the results of the JEB grade determination indicated that approximately 40 percent of enlisted jobs in the 100 job sample should be upgraded. Thus, the optimal weighting of 10 factors could not predict the current grade structure with much accuracy. This equation should not be favored as a tool for assigning enlisted grade unless it is desirable to maintain the current enlisted grade structure.

Discussion

Phase V: Utilization and Implementation of Job Evaluation Results

In order to apply the prediction equation to an Army-wide job evaluation program, job analysis information as described in Phase I would be required for all duty positions in the MOS structure. Again it must be emphasized, the validity of the entire program depends primarily on the accuracy and completeness of the basic job description data. The scope of this program requires a sizeable complement of professional individuals to insure the adequate collection of data and necessary research support. The establishment of the MOIDB, mentioned in the introduction of this study, can provide the required information about Army jobs to successfully support an ongoing job evaluation system.

As soon as job description data become available, job factor ratings can be obtained from job analysts approximately as described in Phase III. When the job factor rating data are determined to be accurate and complete, these data would be entered into the regression equation(s) and the GEI immediately calculated by computer. The job evaluation program can be implemented on a trial basis whenever duty position descriptions can be generated and job analysts determine reliably the mean job factor scores.

In addition to grade determination the data could permit grade distributions within specified MOS categories to be projected to obtain population values by computing a weight for each grade level. The weight is defined as the population N divided by the sample N, e.g., if the weight were seven, each job in the sample represents seven jobs in the population. Thus, the weight times the sample frequency would give the projected frequency in the population. By this procedure (Christal, 1965), any sample distribution could be projected to a population distribution. Similar projections could also be made to future time periods by computing adjusted population weights. These projections will permit comparisons between present authorized grade distributions and projected distributions resulting from the job evaluation study.

The U. S. Army Job Evaluation program can provide specific grade levels for duty positions. It should again be emphasized that the multiple regression equations are applicable to all enlisted jobs in the Army. The weights based on the sample of 100 jobs are those which most closely approximate the best weight of each factor for predicting enlisted grade for all jobs. The emphasis in interpreting results, however, should not be the changing of grade levels for specific duty positions where such changes are indicated but rather a review by the Department of the Army of the existing authorized grade structure as a whole. While grade level adjustments may be recommended where needed, the principal value of the program can be to provide continual research guidelines for the determination and maintenance of an Army-wide grade

distribution system which can contribute optimally to an integrated personnel management system. The building up of an overall grade distribution system would be a gradual process which ultimately would be reflected in authorized strength requirements, organizational tables, and DA budget requirements.

In the short run, many grade level adjustments which may be indicated by the program could be accommodated within existing policy and regulations. If possible, any grade level adjustments should be made without adverse effects on incumbents. Grade levels may be reduced in cases where the incumbent presently holds a lower grade. Grade levels can be increased to some extent within the limits of existing policy and regulations. Where reduction in grade is recommended, it may be possible to transfer incumbents to other duty positions, or to delay grade level changes until normal turnover rate and separations have removed the majority of incumbents from over-graded duty positions. Desirable changes required in the Army grade-level structure cannot be accomplished immediately. The process should be gradual without undue reduction of efficiency, and with every attempt made to avoid downgrading duty position incumbents.

Application of the results of the equations will be limited to the extent that certain grades for specific jobs are determined by existing Army policy and MOS structure considerations. For example, an infantry battalion Sergeant Major is going to be an E-9 in spite of the fact that the JEB and three equations indicate that this job should be downgraded (see Appendix B). Also, if the structure of infantry rifle platoons requires that the platoon sergeant be in the grade of E-7, then most, or all, of the other grades in the platoon are determined. That is, logic dictates that the squad leaders would be E-6 and E-5's would lead the fire teams. The equations would not be particularly useful, when applied to these types of jobs; but would probably support the grade structure within the rifle platoons because the job requirements are reflected in the ten job factors. The real value of the equations lies in the prediction of grades for jobs where precedents have not been established or are unknown and the hierarchal structure is obscure. These jobs tend to be in the highly technical fields where duty positions are new and are being created rapidly.

Based upon the technical procedures employed in this study, the value of the equations corresponds with their order of presentation. The strongest recommendation can be made for using the 10-factor equation based upon optimal weights generated from the multiple correlation technique. When the jobs were factor rated by the rating officers, the psychological set, attitude, or frame of reference, was established by the analysis and rating of 10 individual factors--named and described. The seven-factor equation may be adopted for efficient use, provided the rating officers, job analysts, and/or job incumbents, who are furnishing mean factor ratings for the jobs, make ratings for the jobs on the basis

of all 10 factors. If the factor rating procedure were reduced to seven factors, some considerations concerning the missing factor traits would be lumped into one of the remaining factors and the validity of the equation would be severely affected. If the Army system were to adopt only the seven valid factors, it would require a new study and computation of new multiple regression equations. It is also believed that all 10 factors should be retained in use because the nonfunctioning factors may come into play when jobs outside the 100 job sample are analyzed with these statistical and mathematical procedures. New equations computed on the basis of additional job information would reflect any increase or decrease in the functioning of the factors.

Since these equations are designed to provide job analysts with objective, scientific assistance in determining enlisted grades, a strong case can be made for generating three GEI's for each enlisted job, using the first three equations reported. This recommendation is based upon the fact that this preliminary study provides three equations which are subject to a certain amount of error. They are valuable mathematical tools designed to assist job analysts in assigning correct grades to Army jobs. At times, error in prediction could occur in one equation which may not occur in one of the other equations. When inconsistencies in prediction occur with regard to a job under reevaluation, this may be an indication to those responsible for the assignment of grade to investigate more closely the job factors, the job description, or some other reasonable cause, to determine reasons for the inconsistency. With ongoing prediction and job evaluation studies, enough information will be gained to serve as cross-validation, which will establish the stability of the weights used in the prediction equations. Nonsignificant shrinkage of the multiple correlation coefficients has provided estimates supporting the probable safety of applying the equations outside the experimental sample of 100 jobs. Valuable information can be gained from intercomparison of the results of utilization of the three methods. The same factor means would serve in all three equations, so economy and utility would not be major considerations. It is believed that, with a properly controlled, ongoing job evaluation and research system, this basic approach can be developed to provide the Army with a highly valid process for establishing and maintaining an optimal enlisted grade structure.

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APPENDICES

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JOB DESCRIPTION

JOB NUMBER 14

LEVEL OF ASSIGNMENT

Launching Platoon Headquarters

JOB SUMMARY

Supervises and assists in the preparation and installation of Nike Hercules missiles.

DUTIES AND TASKS

a. Supervises and assists in the preparation and installation of missile.

(1) Prepares aft body section by systematic uncrating of components, inspection and assembly of components.

(2) Performs assembly area electrical and Radio Frequency (RF) checks, and Accessory Power Supply (APS) servicing by using Missile Test Set in order to assure that these missile components are ready for use.

(3) Installs rocket motor by uncrating, inspecting and installing components and wiring harnesses.

(4) Installs and checks out warhead by visually inspecting and utilizing Special Weapons test Set (T4014).

(5) Joins missile and booster positioning booster on rail and connecting cables and other pertinent assemblies.

b. Supervises and assists in the performance of periodic maintenance by spot checking some procedures, keeping continuous check on other activities assisting personnel in the performance of periodic maintenance and troubleshooting as required.

(1) Troubleshoots malfunctions found by Launcher Section during daily and weekly checks by localizing troubles, removing defective chassis, and sending it to support maintenance shop for repair or replacement.

(2) Corrects imbalanced power supply by using multimeter and null meter and adjusting potentiometers on the power supply.

(3) Checks cables for stray voltage.

c. Participates in unit training by performing and assisting in the performance of classroom instruction and acting a LCO (Launcher Control Officer) during Operational Readiness Checks.

(1) Performs classroom instruction in training of personnel by delivering lectures, conducting discussions, performing demonstrations, and administering examinations.

(2) Performs as LCO during Operational Readiness Checks coordinating the activity of the launcher area within itself and with the Fire Control Center.

d. Supervises maintenance by spot-checking activity of subordinates and launcher section to assure that corrective action is taken to maintain a ready-to-fire status.

(1) Supervises launcher section by spot-checking work, reviewing check sheets, and assuring that corrective action is taken.

DUTIES AND TASKS (CONTINUED)

(2) Supervises correction of malfunctions by insuring that operating procedures are followed as set forth in technical manuals and check sheets.

e. Maintains assembly section records and technical publications.

(1) Maintains missile log, warhead log, and inspection records by filing in appropriate section, making entries where necessary and deleting outdated records.

(2) Maintains correspondence for launcher platoon by transmitting reports to other commands as required, writing battery memos, and transmitting work order to proper destination.

(3) Acts as classified documents custodian keeping security on classified documents, entering changes, ordering new material, and arranging for disposal of outdated documents.

(4) Maintains library of technical manuals used by assembly section.

JOB REQUIREMENTS

a. Successful completion of Nike Electronic Maintenance Course (24 weeks) or possess equivalent training or experience.

b. Must know:

(1) Fundamentals of electronics.

(2) Purpose and utilization of electrical test equipment.

(3) Techniques and procedures for malfunction diagnosis of Nike Hercules launcher control and missile electronic systems.

(4) Description, nomenclature, and operating characteristics of Nike Hercules launcher area equipment.

c. Must have manual dexterity of an electronic technician and physical capability to move and manhandle components weighing up to 60 pounds.

APPENDIX B

Sample of 100 Jobs by Job Title Showing Currently Authorized Enlisted Grade, Grade Assigned by the JEB and the Grades Assigned Through Use of Three Multiple Regression Prediction Equations

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMDO Survey Weights
TACTICAL OPERATIONS							
1	Automatic Rifleman	11B20	E-4	4.0	4.4	4.3	5.1
2	Mortar Gunner	11C20	E-4	4.3	4.1	4.0	4.9
3	Tank Driver	11E20	E-5	4.2	3.9	4.0	5.2
4	Bn Sergeant Major (Armor)	11E50	E-9	8.9	8.6	8.6	7.3
5	Bn Sergeant Major (Inf)	11G50	E-9	8.3	8.3	8.2	7.2
6	Combat Construction Spec	12B20	E-4	4.6	4.5	4.4	4.9
7	Gunner	13B40	E-5	5.7	5.2	5.3	5.9
8	Launcher Crewman	13D20	E-4	4.3	4.8	4.8	5.2
9	Boom Operator	15B20	E-4	4.7	4.9	4.9	5.2
10	Firing Set Operator	15B30	E-5	5.3	5.1	5.1	5.4
11	Firing Panel Operator	16B20	E-4	4.3	4.5	4.5	4.8
12	Searchlight Crewman	17E20	E-3	3.9	4.2	4.2	4.6
13	Engine Mechanic	17J20	E-4	4.4	4.4	4.4	4.7
MISSILE AND FIRE CONTROL ELECTRONIC MAINTENANCE							
14	Hercules Electronics Maint. Sect. Dr.	22F40	E-6	7.3	7.3	7.3	6.9
15	Missile-Launcher Mechanic	22J20	E-5	5.5	5.8	5.8	6.1
16	Chief Missile-Launcher Mechanic	22J40	E-7	6.5	7.1	7.1	6.8

-continued-

APPENDIX B (continued)

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMDO Survey Weights
17	Hercules Fire Control Mechanic	23G20	E-5	5.3	6.3	6.3	6.3
18	Chief Fire Control Mechanic	23G40	E-7	6.5	6.4	6.4	6.3
19	Nike Track Radar Repairman	23N20	E-5	6.6	6.2	6.1	6.6
20	Hawk Continuous Wave Radar Repairman	23T20	E-5	6.6	6.8	6.7	6.5
21	Nike Maintenance Chief	23W50	E-8	8.3	7.4	7.5	6.8
22	Integrated Data Link Repairman	25C20	E-5	5.9	5.5	5.4	5.7
23	Airborne Sensor Specialist	26E20	E-5	5.5	5.3	5.3	6.2
24	Defense Acquisition Radar Mech.	26J20	E-5	5.3	5.1	5.1	5.6
25	Microwave Radio Repair Supv.	26L40	E-7	6.6	6.8	6.9	6.7
GENERAL ELECTRONIC MAINTENANCE							
26	Field Radio Repair Supervisor	31E40	E-6	6.8	6.9	6.9	6.4
27	Teletypewriter Equipment Repairman	31J20	E-4	5.4	5.1	5.1	5.3
28	General Cryptographic Repair Supv.	31K40	E-6	6.8	6.7	6.8	6.3
29	Field Radio Relay Equipment Repairman	31L20	E-5	5.0	5.2	5.2	5.5
30	Fixed Receiver Station Supervisor	32B40	E-6	6.8	6.6	6.7	6.3

-continued-

APPENDIX B (continued)

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMDO Survey Weights
PRECISION MAINTENANCE							
31	Office Machine Repairman	41J20	E-5	5.0	5.1	5.1	5.0
32	Cost Specialist	42B20	E-5	5.3	5.3	5.2	5.0
33	Orthopedic Brace Specialist	42C20	E-5	5.9	5.4	5.3	5.2
34	Optical Laboratory Specialist	42E20	E-5	5.5	5.4	5.4	5.4
35	Machinist	44E20	E-5	4.6	4.6	4.6	5.0
36	Field Artillery Repairman	45C20	E-4	4.7	4.5	4.5	4.7
37	Turret Artillery Mechanic	45G20	E-4	5.9	5.1	5.1	5.3
AUXILIARY SERVICES							
38	Structures Specialist	51C30	E-4	4.5	4.3	4.3	4.8
39	Refrigeration Specialist	51L20	E-4	4.9	5.4	5.3	5.6
40	Multipurpose Power Generator Operator/Mech.	52B30	E-4	4.8	4.8	4.7	5.4
41	Process Control Surveyor, Monitor	52L20	E-6	6.0	6.1	6.2	6.0
42	Oxygen-Acetylene Production Spec.	53B20	E-4	5.3	4.6	4.5	4.7
43	Smoke Generator Operator	54C20	E-4	3.7	4.2	4.2	4.5
44	Explosive Ordnance Disposal Spec.	55D30	E-5	5.3	5.3	5.4	6.2
45	Petroleum Storage Specialist	56C20	E-4	3.8	3.9	3.9	4.3
46	Subsistence Storage Specialist	56D20	E-4	3.9	4.0	3.9	4.2
47	Memorial Activities Specialist	57F20	E-4	4.8	5.3	5.3	4.4

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APPENDIX B (continued)

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMTO Survey Weights
MOTORS							
48	Seaman	61A10	E-3	4.4	4.3	4.3	4.9
49	Marine Engineer	61C20	E-4	4.8	4.9	4.9	5.4
50	Crane-Shovel Operator	62F30	E-5	4.3	4.6	4.5	5.2
51	Powderman	62G30	E-4	5.6	5.6	5.6	6.2
52	Tracked Vehicle Mechanic	63C20	E-4	4.6	4.7	4.7	5.1
53	Fuel and Electrical Systems Repairman	63G20	E-4	4.8	5.2	5.2	5.5
54	Light Vehicle Driver	64A10	E-3	4.0	3.7	3.7	4.3
55	Truckmaster	64C40	E-6	6.8	6.9	7.0	6.3
56	Senior Brakeman	66C20	E-4	4.7	4.7	4.7	4.7
57	Multi-Engine Command (U-8) Airplane Mech.	67G20	E-4	5.3	5.4	5.1	5.8
58	CH-21 Helicopter Crew Chief	67S20	E-6	5.7	5.8	5.8	6.7
59	Aircraft Electrician	68F20	E-4	4.3	5.5	5.4	5.9
CLERICAL							
60	Court Reporter	71E20	E-6	5.3	5.4	5.4	4.9
61	Admission-Disposition Spec.	71G20	E-4	4.0	4.4	4.5	3.9
62	Broadcast Specialist	71R20	E-4	8.2	7.0	7.0	6.1
63	Senior Switchboard Operator	72C20	E-4	4.1	4.2	4.4	4.7
64	Pay Specialist	73C20	E-4	4.5	4.9	4.9	4.5
65	Console Operator	74E20	E-5	5.1	5.5	5.6	6.0
66	Programming Specialist	74F20	E-6	6.4	6.2	6.2	5.8

-continued-

APPENDIX B (continued)

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMDO Survey Weights
67	Principal Programmer	74F40	E-8	7.3	8.1	9.0	6.9
68	Engineer Supply and Parts Spec.	76C20	E-4	4.5	4.6	4.6	4.8
69	Quartermaster Supply Spec.	76E20	E-4	3.8	4.0	3.9	3.9
70	Signal Supply and Parts Spec.	76G20	E-4	4.9	4.9	4.9	4.9
GRAPHICS							
71	Cartographic Draftsman	81C20	E-4	5.0	4.9	5.0	4.8
72	Illustrator	81E20	E-5	4.6	5.2	5.3	5.3
73	Topographic Surveyor	82D20	E-5	5.2	5.9	5.9	5.8
74	Linotype Operator	83B30	E-4	4.5	4.7	4.7	4.9
75	Still Photographer	84B20	E-4	4.8	5.4	5.5	5.5
GENERAL TECHNICAL							
76	Clinical Specialist	91C20	E-5	5.9	6.4	6.3	5.9
77	Chief Operating Room Spec.	91D40	E-7	6.6	6.[illegible]	6.4	6.2
78	Physical Therapy Spec.	91J20	E-5	4.6	4.9	4.8	4.8
79	X-Ray Specialist	91P20	E-5	5.2	4.8	4.8	4.8
80	Chief Pharmacy Specialist	91Q40	E-7	6.9	6.7	6.7	6.0
81	Preventive Medicine Spec.	91S20	E-5	6.4	6.1	6.2	5.3
82	Ear, Nose and Throat Spec.	91U20	E-5	4.7	5.3	5.3	5.2
83	Hematology Specialist	92B30	E-6	5.8	5.2	5.2	4.8
84	Air Traffic Controller	93B20	E-5	6.8	6.1	6.1	6.1
85	Chief Controller	93B50	E-8	7.9	7.9	8.0	7.0
86	Senior Meteorological Observer	93E20	E-5	4.9	5.0	5.1	5.1
87	Weather Forecaster	93E20	E-6	7.1	6.1	6.1	5.5
88	Meteorological Shift Supervisor	93E40	E-6	5.1	4.8	4.9	4.7

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APPENDIX B (continued)

Job Control Number	Job Title	MOS Code	Current Authorized Grade	JEB Assigned Grade	10-Factor Optimal Weight Equation	7-Factor Optimal Weight Equation	10-Factor PMDO Survey Weights
89	First Cook	94B20	E-5	5.4	5.5	5.5	5.2
90	Baker	94D20	E-4	4.5	4.1	4.1	4.0
91	Senior Military Policeman	95B20	E-4	4.2	4.4	4.5	4.8
92	Assistant Criminal Investigator	95D20	E-6	6.2	5.9	5.9	5.6
93	Order of Battle Specialist	96B20	E-5	6.0	5.3	5.4	5.0
94	Senior Interrogator	96C3L	E-6	6.6	6.7	6.6	5.9
SPECIAL ASSIGNMENT							
95	Senior Recruiter	00E40	E-6	6.7	6.5	6.5	5.4
96	Trombone Player	02E20	E-3	4.9	5.1	5.1	5.1
97	Entertainment Specialist	03B20	E-4	6.6	7.0	6.9	5.8
98	Translator	04B2L	E-5	6.0	6.2	6.2	5.3
99	Radio Operator	05B20	E-3	4.3	4.5	4.5	4.9
100	Radio Teletypewriter Operator	05C20	E-4	4.6	4.4	4.5	4.7

APPENDIX C

INSTRUCTION SHEET

1. The packet which you have received should contain 20 different job descriptions; 20 score sheets, one for each job description; and a set of ten job factors. Before you start work, check to see that your packet contains these items and that the job numbers listed on the job descriptions correspond to those on the score sheets.

2. Carefully read the first job description in your packet. Next read the description of Job Evaluation Factor I (Knowledge) and the descriptions of the six levels within that factor. Make a determination as to which level within Job Evaluation Factor I best describes this particular job. Using the score sheet which has the same number as the job description you are working with, place an X in the box marked with the appropriate level (A through F) opposite the factor. Proceed in the same manner with your evaluation of the job until you have placed an X in the appropriate level opposite each of the 10 Job Evaluation Factors.

3. If you feel that you need more information about the job to rate it accurately, you are free to consult with any other members of the board. You may also use other sources which could give you information about the job. You may ask any questions you desire about the job EXCEPT QUESTIONS DESIGNED TO FIND OUT WHAT GRADE OR GRADES OR JOB TITLES ARE CURRENTLY ASSOCIATED WITH THAT JOB.

4. When you have completed this phase, answer questions 1 and 2 below the double line on the score sheet. For question 1 give YOUR INDEPENDENT EVALUATION as to what grade the job should be. The fact that you may know or suspect the current grade for the job in the Army is immaterial and should not influence your answer to this question. After you have answered question 1 check the block in question 2 which shows the degree of confidence you have in the answer you have just given. Your degree of confidence may be based on knowledge which you personally have of the job from other sources, your previous military experience, or a combination of these things.

5. At the bottom of the score sheet fill in your grade, branch, your present duty assignment, and your total number of years active service in the Army.

6. When you have completed scoring the first job proceed with the remaining jobs in a similar manner. Your completed score sheets and packet will be picked up at the close of the session.

APPENDIX D

JOB NUMBER: LEVEL OF ASSIGNMENT:

	Levels					
	A	B	C	D	E	F
I. KNOWLEDGE						
II. SUPERVISION OF PERSONNEL						
III. ADAPTABILITY & RESOURCEFULNESS						
IV. RESP. FOR MATERIAL RESOURCES						
V. CONCENTRATION & ATTENTION						
VI. PHYSICAL SKILLS						
VII. PHYSICAL EFFORTS						
VIII. JOB CONDITIONS						
IX. FREEDOM OF ACTION						
X. COMBAT EXPOSURE						

1. What grade do you believe should be assigned to this position? (Check one block only).

E-3 ☐ E-4 ☐ E-5 ☐ E-6 ☐ E-7 ☐ E-8 ☐ E-9 ☐

2. What confidence do you have in your ability to assign the grade which you have given in the preceding question:

Confident ☐ Some Confidence ☐ Little or No Confidence ☐

RATER INFORMATION

Grade _____ Branch Duty Assignment _____ Branch _____

Number of Years of Active Army Service _____

APPENDIX E

FACTOR I

KNOWLEDGE

This factor is used to evaluate the level of knowledge required for successful performance in the job. It includes the complexity and range of knowledge needed and the time and energy required to obtain the knowledge regardless of how the knowledge was obtained. This factor is not based on formal training alone. Equivalent knowledge gained informally through on-the-job training, work experience, and self education must also be considered.

Level A

Requires minimum reading and writing ability and some knowledge of simple arithmetic; knowledge of basic military subjects acquired in basic combat training; knowledge which is sufficient for performing simple unskilled tasks involving primarily physical effort.

Level B

Requires ability to read and write and follow simple instructions and knowledge of basic arithmetic; knowledge of basic military subjects acquired in basic combat training plus limited specialized knowledge acquired in training center or comparable courses, or in a short period of on-the-job training. Knowledge required is sufficient to perform simple tasks under general supervision or tasks of slight complexity under close supervision.

Level C

Requires moderate ability to understand reading material such as basic technical manuals, simple charts, drawings, diagrams and other instructions, and to perform elementary mathematical computations with limited formal or on-the-job training. Requires knowledge of the use and employment of basic military weapons and tactics to perform effectively as a leader of a fire team or of a simple crew-served weapon, or as a crew member of a more complicated weapon or equipment system. Requires knowledge to interpret and execute instructions pertaining to slightly complex operations, to operate mechanical equipment, to use hand tools, to perform semi-skilled work or to perform relatively simple clerical work. Requires knowledge to instruct others in basic functions and to serve as an apprentice for more highly skilled work.

Level D

Requires intermediate technical knowledge with considerable formal and informal training. Requires knowledge to perform moderately complex individual combat assignments, to direct others in the performance of simple unit assignments, or to serve as chiefs of the more complicated crew-served weapon and equipment systems, to perform moderately complex administrative or technical duties; to understand more complicated instructions; to interpret more complicated drawings, diagrams, technical manuals and similar written material; to perform skilled work requiring knowledge acquired through formal school training or extensive on-the-job training.

Level E

Requires a high degree of technical knowledge acquired by rather extensive formal and informal training. Requires knowledge sufficient to direct or instruct others in complex and varied unit combat assignments including use and employment of all related weapons; to understand, interpret and issue complex instructions; to perform a variety of relatively complex administrative or technical assignments such as comprehensive office work, repair and maintenance of complex material, or to perform the instruction, direction and supervision of others in such work.

Level F

Requires a very high degree of complex and varied knowledge acquired through extensive formal and informal training for satisfactory performance in combat operations, technical, scientific or other complicated fields of work. Requires knowledge to act independently as the leader of a unit in combat, administrative or technical assignments, or to act as the principle enlisted assistant for the more complex of such assignments. Requires the most comprehensive knowledge of the military, administrative or technical facets of a particular MOS which can be expected of an enlisted man. In addition, he is required to have knowledge of related specialties to instruct, direct and supervise the activities of others engaged in a common or related effort requiring the use of a group of occupational specialities.

FACTOR II

SUPERVISION OF PERSONNEL

This factor evaluates the degree of supervisory responsibilities inherent in the performance of a job. It considers the complexity and variety of the work under supervision or control, the degree to which the supervisor is required to plan the work of his subordinates, to outline and assign tasks, specify work methods, check on work progress

to include attainment of quantitative and qualitative goals, to train, assign, organize, evaluate, coordinate and control human resources.

Level A

Requires no supervision of others.

Level B

Requires as a primary job responsibility, the personal close supervision of a small number (1 - 5) of soldiers of the same or allied MOS performing work of a simple nature.

Level C

Requires as a continuous and primary job responsibility, moderate supervision of a group of soldiers who know the routine of their jobs. Responsible for maintaining satisfactory performance on assigned tasks. Group supervised is of moderate size (5 - 10), members of which have the same or allied MOS. Does not exercise supervision through subordinate supervisors.

Level D

Requires the supervision of a group of personnel who know the routine of their jobs. The group being of moderate size (10 - 25) and composed of somewhat dissimilar MOS. They may be engaged in performing relatively complex tasks. In some cases will exercise supervision through subordinate supervisors.

Level E

Requires as a continuous and primary function, general supervision primarily by coordinating the activities of subordinates who perform supervisory functions over group performing generally similar tasks.

Level F

Requires broad or indirect supervision over several subordinate units or groups performing varying tasks involving a variety of skills. Assigns tasks to subordinate supervisors in terms of mission to be accomplished rather than setting specific tasks and methods to be used. This level represents the highest degree of supervision exercised by an enlisted man.

FACTOR III

ADAPTABILITY AND RESOURCEFULNESS

This factor evaluates the degree of versatility, initiative, ingenuity, judgment and creative ability required to perform a job. It involves the requirement of mental and emotional adjustments to changing situations and conditions; it does not consider requirements for physical adaptability.

Level A

Requires very little adaptability or resourcefulness. Work is limited to performance of routine or repetitive activities, under stable conditions. Makes no decisions himself. No particular need for expediency or aggressiveness. No creative ability required.

Level B

Requires some versatility and the occasional exercise of judgment on simple matters. Creative ability is not a requirement.

Level C

Worker is given limited opportunity for expression of own ideas, so must possess some creative ability. Must occasionally formulate a method for own work. Works under relatively stable conditions. Requires a moderate degree of versatility, initiative, and ingenuity. Aggressiveness is desirable.

Level D

Requires a moderate degree of versatility, initiative, and ingenuity. The exercise of judgment on moderately complex matters under changing conditions is also required. Does mostly own work but occasionally consults others for information. Worker must frequently initiate action and must contribute own ideas for the improvement of the work. Aggressiveness required.

Level E

Requires a moderately high degree of versatility, initiative, and ingenuity. He must have sufficient judgment to enable him to make complicated decisions based on a variety of factors under frequently changing conditions. Because he encounters frequent changes in working conditions, methods, or assignments, the individual must be emotionally stable and be adaptable to changing conditions. Must be creative and take the initiative in carrying out action from new ideas.

Level F

Requires a high degree of versatility, initiative, and ingenuity; also requires the exercise of judgment for making complicated decisions based on a variety of complex, interacting factors. Job incumbent must be highly creative since he must formulate ideas as he adds new programs and procedures and expands old ones. The individual must possess a high degree of emotional stability and be highly adaptive, since he must be able to perform various types of work under widely varying conditions. Must be highly aggressive.

FACTOR IV

RESPONSIBILITY FOR MATERIAL RESOURCES

This factor evaluates the degree to which there is responsibility for use, misuse, waste, savings and loss of money, material and equipment. It considers loss and gain which may result through the control exercised by the soldier including the likelihood of loss of material and time relative to the value of such loss. The loss of service and the disruptive effect on operations resulting from such loss indicates the degree to which this factor is found in a position. In addition this factor incorporates responsibilities pertaining to proper storage, handling, distribution and estimating supply requirements.

Level A

Requires only routine control of materials of limited value. Includes care for inexpensive individual equipment issued to or used by a soldier, or hand tools and equipment used for unskilled jobs which if improperly maintained, misplaced or lost would result in no disorganization of effort.

Level B

Requires control of money, materials, or equipment of moderate value and offers some opportunity for reducing waste and damage. Improper maintaining, misplacing or losing material or equipment would result in only slight, if any, disorganization of effort.

Level C

Requires control of money, materials, or equipment of considerable value, and offers a definite opportunity for effecting savings or avoiding waste. Requires more than routine care, attention, supervision or surveillance to maintain effective use, to prevent damage, or to maintain or operate without damage.

Level D

Requires as an essential job responsibility, frequent application of measures designed to effect savings or avoid waste of valuable materials or equipment. Demands considerable conscientiousness on the part of the job incumbent, since loss or damage to the material or equipment could have a definite, temporary disorganizing effect.

Level E

Must exercise continuous measures designed to conserve very valuable materials or equipment. Demands a great deal of conscientiousness and planning on the part of the job incumbent since loss, damage, or misoperation of equipment would have a definite, long range disorganizing effect upon the mission.

Level F

Requires as a primary job responsibility, continuous application of complex and varied controls involved in the management and conservation of resources of extremely great value. This level includes those duties involving operation, maintenance or supervision of equipment or material which if lost or damaged would result in serious consequences. This level identifies the greatest responsibility carried by enlisted personnel for the care and maintenance of material and monetary resources.

FACTOR V

CONCENTRATION AND ATTENTION

This factor evaluates the frequency, degree of intensity, level and duration of mental alertness and concentration required in the performance of a job. It includes how often and for how long a period of concentration the job demands; the need to shift attention in response to changing conditions of circumstances and the need to attend to and be consciously aware of information signals, conditions of performance and consequent action required for performing satisfactorily on the job. Sensory alertness (visual, auditory, touch, taste and smell) is included as well as attention to muscular responses.

Level A

Requires attention to a few simple, well-defined details; rarely demands shifts of attention. Duties are routine and automatic. Flow of work and nature of duties require minimum concentration on the job tasks.

Level B

Requires occasional periods of concentration; attention to a few simple details; occasionally demands shifts of attention to changing conditions.

Level C

Requires a moderate degree of concentration or attention on an intermittent basis. Concentration demanded may at times be intense and require the exclusion of all irrelevant factors, but such intense demand is infrequent and not lengthy.

Level D

Requires prolonged periods of concentration, close attention to a variety of complex details, and frequently demands shifts of attention under changing conditions. These requirements are not great enough to cause excessive fatigue, however. Requires intense concentration or attention intermittently.

Level E

Requires prolonged periods of intense mental effort; close attention to a variety of complex and interacting details; demands frequent shifts of attention to rapidly changing conditions, often resulting in fatigue. Errors due to lack of concentration are very difficult to detect and correct.

Level F

Requires prolonged periods of intense mental effort; very close attention to highly complex and interacting details under conditions where even brief lapses of attention are conductive to errors having serious consequences; demands frequent shifts of attention to rapidly changing conditions. Fatigue is common and is often excessive.

FACTOR VI

PHYSICAL SKILLS

This factor evaluates the physical dexterities, muscular coordination and sensory discriminations required to successfully perform the job. Accuracy and precision of movements, finger dexterity, including the variety of responses to sensory cues, and the complexity of coordination and speed of responses to movement patterns which tend to be automatic are considered to be on a lower level than varied complex motions. Examples of physical skills evaluated by this factor are dexterity of fingers, hands and arms, feet and legs, and the coordination of muscular functions such as eye-hand coordination. This factor does not rate the amount of physical strength or effort required to do a job.

Level A

Requirements for muscular coordination, dexterity, precision, or reaction time are not considered important.

Level B

Requires primarily, large-muscle coordination. Rapid movements in response to sensory cues are normally not required, and only limited requirements for dexterity, precision or coordination of fine movements are necessary. Normal reaction time is required to meet situations created by movement of machines and action of other workers, which remain at a relatively constant and expected speed.

Level C

Requires accurate large-muscle coordination and slightly above normal reaction time in response to changing sensory cues. This level frequently requires moderately complex physical coordination, skill, and dexterity which become almost entirely automatic.

Level D

Requires considerable dexterity, precision, and coordination of movements in response to sensory cues. Above average reaction time is necessary in responding to moderately complex and irregularly appearing sensory cues.

Level E

Requires a high degree of dexterity, precision, and coordination of complex patterns. A very high level of reaction time is required under the burden of irregular, uncontrollable and unexpected sequences of sensory cues.

Level F

Requires a very high degree of dexterity, precision, and coordination of extremely varied and complex movement patterns in rapid response to a variety of frequently shifting, sensory cues. For example, the degree of manual dexterity or precise muscular control necessary in performing complex and difficult and intricate precision maintenance and repair work. Extremely fast reaction time is absolutely essential to meet unforeseen, unexpected, and unpredictable situations.

FACTOR VII

PHYSICAL EFFORT

This factor evaluates the amount of physical energy required to perform the work. Includes weight of loads handled, speed required, strenuousness, frequency and duration of physical effort.

Level A

Requires little or no physical effort or tiring movement.
Examples: Desk work, tasks associated with many administrative activities.

Level B

Requires slight physical exertion.
Examples: Walking, observing, performing light jobs sitting or standing, operating light controls, using light hand tools.

Level C

Requires moderate physical exertion.
Examples: Working heavy controls either sitting or standing, occasionally working with heavy hand tools, climbing, manually handling materials of moderate weight and average size.

Level D

Requires substantial physical exertion with considerable discomfort due to position.
Examples: Continuously using heavy hand tools, wrenches, heavy hammers, picks, shovels, crowbars, laying and finishing cement.

Level E

Requires extended and continuous physical exertion including severe elements of bending, kneeling, and cramped positions. Makes continuous demands on physical condition.
Examples: Moving, dragging or lifting heavy materials without power driven equipment.

Level F

Requires very severe physical exertion and topnotch physical condition.
Examples: Continuously lifting heavy materials, taking long hikes with full field gear, forced marches over rough terrain, other activities approaching limit of normal capacity.

FACTOR VIII

JOB CONDITIONS

This factor describes the physical environment in which work must be performed. Includes the degree, duration, and continuity of physical discomfort as well as the likelihood and severity of injury or disease resulting from exposure to the job conditions. Combat as well as non-combat environmental conditions are evaluated by this factor, with the only exception being amount of exposure to hostile fire, which is not here since it is considered in Factor X.

Level A

Requires no more than temporary mild discomfort and very little or no exposure to conditions that are dangerous to health or safety. If inside, well heated, lighted and ventilated, clean working conditions.

Level B

Requires occasional brief periods of moderate discomfort or infrequent exposure to conditions that are undesirable. A person in this type position may occasionally confront minor annoyances such as noise, slightly unclean working conditions, poor temperature and humidity controls, or other minor inconveniences. The annoyances are insignificant to a degree that they rarely, if at all, have an effect upon work output.

Level C

Requires occasional periods of moderate discomfort or infrequent and brief exposure to conditions that are somewhat hazardous to health or safety. However, only normal safety precautions need be taken by the individual. Special equipment such as gloves, goggles, or masks may occasionally be needed.

Level D

Requires frequent periods of moderate discomfort or frequent but brief exposure to conditions that are hazardous to health or safety. Some of these conditions are: wetness, oil and grease, sulphur, ammonia or other disagreeable fumes, smoke and gas, extreme heat, steam, cold, noise, and "all weather" conditions. Appreciable expense is necessary in providing protective clothing, safety devices, or special equipment since injury could be severe.

Level E

Requires frequent and somewhat prolonged periods of discomfort or frequent exposure to physical elements or conditions that are very hazardous to health and safety. Some definite element of disagreeableness is continuously present in an unusual degree or intermittently present in an intensive degree, such as: wetness, oil and grease, sulphur, ammonia or other very disagreeable fumes, smoke and gas, extreme heat, steam, cold, noise, and/or "all weather" conditions. The individual must remain alert to avoid injury since he works in close proximity to a known hazard.

Level F

Encounters severely uncomfortable activities or extensive exposure to physical elements or conditions that are extremely hazardous to health and safety. Exposure to accident is a well recognized, and ever-present characteristic of the job.

FACTOR IX

FREEDOM OF ACTION

This factor reflects the extent to which independence in choice of action in the performance of the assignment is required. Consider here the kinds and importance of decisions to be made, and the frequency with which decisions are required.

It is necessary to consider the limitations on action and decision imposed by common military practice, by regulation, and by accepted standard procedures. One aspect of this factor is shown by the amount and kind of instructions received and the closeness with which the work is inspected or checked during process and after completion.

Level A

Very limited freedom of action. Decisions to be made are based on clearly applicable and known procedures. Assignment is performed under detailed instructions as to how it is to be done and result expected. Foreseeable events or conditions are covered in detail in initial instructions. Supervision is immediate.

Level B

Assignment requires the making of elementary decision under close control of superiors. Assignments are short term and results expected are specific. Standard procedures govern the decisions to be made and independent action is allowed very infrequently.

Level C

Assignment requires the making of non-complex decisions under moderately close supervision. Independent action concerning decision-making occurs occasionally (weekly). Interpretations or adaptation of standard procedures, rules, and instructions are required frequently.

Level D

Assignments require the making of decisions of sufficient complexity as to require some judgment or analytical thinking ability by the job incumbent. The person is given general supervision and consults with superiors daily, but is relied upon to make a number of decisions himself.

Level E

Receives general assignments, relatively long term assignments, or assignments on a project basis. Results expected of the work are indicated in terms of results desired for major phases of the work. Plans work where only general methods are available. Frequently makes decisions on the basis of technical practices and on precedent actions which serve as unwritten guides. Assignments frequently involve new approaches or application in new situations. Supervision received is, more often than not, concerned with end results rather than with procedures during work progress.

Level F

Requires continuous exercise of judgment, making the most involved decisions that may be required of enlisted personnel. Frequently the judgments or decisions called for are not covered in detail by regulations or custom. Scope of action at this degree involves maximal freedom with almost no direct control or supervision. Control and supervision are present in terms of the over-all task or goal to be accomplished with infrequent reference to higher supervision. Review or inspection of work is only in terms of the end product.

FACTOR X

COMBAT EXPOSURE

This factor evaluates the degree of exposure to enemy fire. Consider the amount and frequency of fire received. Also, consider types of fire received such as direct (small arms, crew served weapons and cannons), indirect (artillery, mortars, and missiles), and aircraft (rockets, bombs, and strafing). This factor measures exposure to hostile fire. It does not include other disagreeable elements and hazards associated with the job, since they are considered in Factor VIII.

Level A

Relatively safe and secure situation. No possibility for direct fire. Only very remote possibility of receiving fire from aircraft or missiles.

Level B

Rare, if any, exposure to either direct or indirect fire. May encounter occasional (once or twice a month) exposure to fire from aircraft or long range missiles.

Level C

Occasional (once or twice monthly) exposure to direct fire; exposure to indirect fire weekly.

Level D

Weekly exposure to direct fire; exposure to indirect fire and/or fire from aircraft 2 or 3 times weekly.

Level E

Less than daily exposure to direct fire, but daily exposure to indirect fire such as artillery and mortar, and/or fire from aircraft.

Level F

Daily exposure to both direct and indirect fire and frequent exposure to aircraft delivered fire.

APPENDIX F

*SUMMARY OF REGRESSION ANALYSIS

	FACTOR	SLOPE	LINEARITY	SIGNIFICANCE
I	Knowledge	0.70	2.27	47.83
II	Supervision of Personnel	.64	1.69	75.42
III	Adaptability and Resourcefulness	.75	2.10	50.96
IV	Responsibility for Material Resources	.81	6.21	54.34
V	Concentration and Attention	.62	2.35	19.34
VI	Physical Skills	.26	20.46	9.07
VII	Physical Effort	-0.12	2.71	.55
VIII	Job Conditions	-0.04	4.54	.13
IX	Freedom of Action	.85	25.27	60.86
X	Combat Exposure	-0.01	.79	.01

1. Slope

a. The slope measures how strongly grade is a function of the factor.

b. If the slope is large, grade increases considerably as level increases. If the slope is negative, grade tends to decrease as level increases.

c. All factors except 7,8, and [illegible] ive a substantial positive slope.

2. Linearity

a. This ratio of mean squares (group variation about line to within group mean squares) measures whether or not a line is a good model of the relationship between grade and factor.

b. The lower the value, the better the linear model is.

c. Good fit to a linear model with one factor cannot be expected, since we consider grade a function of several factors.

*Linear regression analysis was computed by First Lieutenant Malcolm S. Scott, Jr.

d. Factors 9, 3, and 10 conform well to a linear model.

3. Significance

a. This ratio of mean squares (slope sum of squares to pooled estimate of variance) signifies how much variance is explained by the line. It is the principal test in this analysis as to validity of a factor.

b. When the value is high, we can infer that change in grade is due to change in level, not just change fluctuation.

c. Factors 7, 8, and 10 are not significant. Factor 6 is significant, but not as markedly as the other six.

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13. ABSTRACT

The U. S. Army Enlisted Evaluation Center has developed an operational model which utilizes weighted job factors for assigning appropriate enlisted grades to Army jobs. Working from job descriptions written by job analysts, a sample of 100 officers from courses at the U. S. Army Adjutant General School rated a sample of 100 jobs. Each of ten factors, judged to be important across all Army jobs, was rated on a six-point scale for each of the jobs. These factors were: Knowledge, Supervision of Personnel, Adaptability and Resourcefulness, Responsibility for Material Resources, Concentration and Attention, Physical Skills, Physical Efforts, Job Conditions, Freedom of Action, and Combat Exposure. A Job Evaluation Board, composed of 35 field grade officers and 15 senior NCO's in the grades of E8 and E9, had previously assigned what they considered to be the appropriate enlisted grades to the sample of 100 jobs.

Research has demonstrated that mathematical equations can be developed for predicting appropriate grade for Army jobs based upon accurate factor ratings for these jobs. Through multiple correlation techniques, it was found that, when the job factors were optimally weighted, they correlated with the Job Evaluation Board grade ratings R = .94. Multiple regression equations have been developed from weights provided by the multiple correlation which will successfully predict the appropriate grade for any job in the Army for which accurate factor ratings are available. Mean factor ratings can be provided for each job by job analysts who have detailed knowledge of the job requirements of jobs in specific career groups.

It is believed that, with a properly controlled job evaluation system, this basic approach can be implemented to provide the Army with a valid tool for establishing and maintaining an optimal enlisted grade structure.

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