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# Development, Selection, and Validation of Factors for the Evaluation of Airman Jobs

By

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AEROSPACE MEDICAL DIVISION
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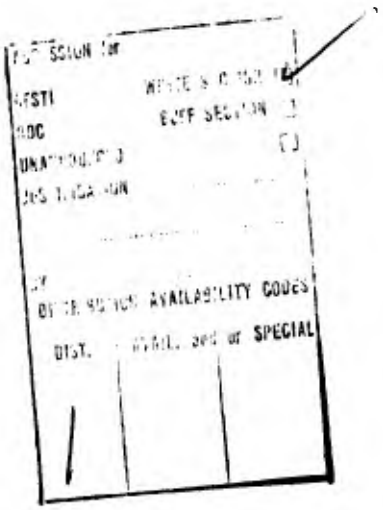


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PRL-TR-67-14 August 1967

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# FOREWORD

This report provides a detailed technical documentation of research on problems in the area of airman job evaluation completed under Project 7734, Development of Methods for Describing, Evaluating, and Structuring Air Force Occupations; Task 773402, Development and Appraisal of Methods for Job Evaluation. The reader who is not interested in the technical details of the investigation is referred to Section V. Summary and Conclusions for an overview of the work accomplished.

The research findings reported here are the first obtained in a continuing investigation of certain questions relevant to airman job evaluation in the United States Air Force. In this study an efficient and stable set of factors and weights for use in evaluating airman jobs was identified and evaluated. These results have direct relevance to future revisions of the Air Force job evaluation plan (AFM 35-2). However, attention is called to a practical constraint of the study, viz., the use of criterion sample of only 200 airman jobs. In view of the number and diversity of airman jobs, replication of the study with a larger job sample would be desirable before large-scale implementation of the present findings.

Appreciation is expressed to the persons in Personnel Research Laboratory (PRL) who assisted in the conduct of the study. The PRL judges who helped in the initial derivation, critique, and determination of the face validity of the job requirement factors included Dr. Leland D. Brokaw, Dr. Joseph E. Morsh, Dr. Llewellyn N. Wiley, Lt Col Ralph S. Hoggatt, and Lt Col Walter F. Murphy. Mr. Charles A. Greenway was the computer programmer, and Mr. Jimmy D. Souter was the computer program coordinator. Lt Col Murphy offered the investigator a great amount of assistance in interpreting the results of the extensive analyses. SMSgt Douglas K. Cowan's competence in handling all administrative matters was outstanding.

The assistance provided by Dr. Marion E. Hook is gratefully acknowledged. When reassignment of the investigator prevented his revising the preliminary draft of this report for publication, she accepted responsibility for reorganizing and redrafting significant portions of the original manuscript. Her efforts have contributed to the prompt publication of the research findings.

Many thanks also are extended to the senior NCOs and officers of the Laboratory who served as judges during the development of the job requirement factors, and to the 587 senior NCOs and officers in the field who volunteered to serve as raters to provide the criterion- and predictor-variable data.

This report has been reviewed and is approved.

James H. Ritter, Colonel USAF
Commander

J.W. Bowles
Technical Director

## ABSTRACT

The purpose of this study was to develop, select, and validate efficient and reliable sets of factors and weights for use in evaluating airman jobs. A representative sample of 200 incumbent-prepared airman job descriptions served as the criterion sample evaluated by senior NCOs, lieutenants, captains, and field-grade officers with respect to merited grade, merited pay, and 15 job requirement factors designed specifically for airman jobs. Various combinations of 37 predictor variables, including the 15 factors, were considered in 1,296 regression analyses (480 reported) made to derive and validate optimally weighted grade and pay policy equations. The grade policy equation, which involved eight variables, accurately predicted the grades awarded jobs in the criterion sample by the raters ($R^2 = .95$). The pay policy equation, which consisted of the same eight variables and one other, also accurately predicted raters' judgments of pay ($R^2 = .93$). Subsequent analyses with weights developed and cross-applied in 100-job subsamples indicated that both policy equations were very stable. Comparison of the overall-group grade policy equation with grade policy equations developed for each of the four rater groups which provided criterion and factor ratings revealed no important differences. The predictive efficiency of the policy equations and of all predictor combinations investigated was about the same for the four rater groups. Although the field-grade officers expressed significantly greater familiarity with airman jobs than the other rater groups, the actual mean differences in the ratings were judged to be of little practical consequence and too small to preclude having airman jobs evaluated by a composite group of senior NCOs, lieutenants, captains, and field-grade officers.

TABLE OF CONTENTS

## LIST OF TABLES

List of Tables (*Continued*)

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# DEVELOPMENT, SELECTION, AND VALIDATION OF FACTORS FOR THE EVALUATION OF AIRMAN JOBS

## I. INTRODUCTION

Job evaluation may be defined as the process of analyzing and assessing work demands and requirements in order to ascertain the relative values of different jobs. The general objective of many job evaluation systems is to maintain equitable compensation rates based on the principle of equal pay for equal work. In the Air Force, job evaluation is needed to determine the appropriate grade levels for different officer and airman jobs. These grade levels then are used to award pay rates to jobs.

Although there are many variations, four basic job-evaluation methods are in general use in business and in government. These are the point-rating, factor-comparison, job-ranking, and job-classification methods. In the most widely used method, point rating, several job requirement factors are selected, levels for each factor are established, and point values assigned to these levels. Jobs then are evaluated in terms of these factors.

The Air Force job evaluation plan, developed in 1949 and formally adopted in 1954, was intended for use with both officer and airman jobs. It was a modified point-rating system with 10 differentially weighted, job requirement factors, 9 of which were derived from industrial and governmental plans for evaluating wage jobs. Appropriate weights for the 10 factors were determined by pooling the judgments of high-ranking officers. This plan, with only minor revisions, is still the officially approved procedure. As described in the current revision of AFM 35-2 (10 Jan 63),[1] the rating system involves 10 differentially weighted factors for evaluating both officer and airman jobs.

## II. PROBLEM

### Background of Problem

Examinations of job evaluation plans have shown that industry and governmental agencies rarely use the same factors to evaluate wage jobs and executive-managerial jobs. Reviews of Air Force research on job evaluation (Christal & Madden, 1961; Office of Naval Research, 1961) also have indicated that the use of different factors and weights for evaluating airman and officer jobs is both feasible and desirable. Since officer jobs are mainly executive-managerial in nature and the AFM 35-2 factors are much like those used to evaluate hourly paid jobs, research was undertaken in the early 1960s to identify an efficient and reliable set of officer job requirement factors.

The 10 factors identified were subsequently used in the Officer Grade Requirements (OGR) study (Christal, 1965) which determined the distribution of officer grades (lieutenant through colonel) for the entire Air Force that would conform to the policy of a special Headquarters USAF board convened to establish appropriate grades for a representative sample of officer jobs. To facilitate operational use of the 10 OGR factors, Brokaw and

[1] Revisions of AFM 35-2, first published 1 Aug 54 (superseding AFR 35-706, 18 Aug 50), were issued 22 Jun 61 and 10 Jan 63.

Giorgia (1966) developed benchmark scales whereby factor levels are characterized by titles of Air Force jobs familiar to rating officers so that point evaluations have reference to established jobs as has been recommended (Madden, 1961).

As soon as an efficient set of job requirement factors for evaluating officer jobs had been identified, research was initiated to improve existing procedures for evaluating airman jobs. This work involved questions about the selection of raters and choice of criterion measures, as well as identification of suitable factors, definition of these factors and rating-scale levels, selection of an efficient set of factors, and determination of appropriate factor weights. Findings relevant to the initial questions have been reported. With respect to raters, Hazel and Cowan (1966) concluded that it is feasible to have a composite group of senior NCOs, company-grade officers, and field-grade officers serve as members of boards which evaluate airman jobs. Results of another study (Hazel, 1966) indicate that merited grade ratings are preferable to merited skill-level ratings as criterion measures.

### Statement of Problem

The threefold problem in the present study was (*a*) to develop a comprehensive group of job requirement factors suitable for evaluating airman jobs, (*b*) to select from this group efficient sets of factors which, appropriately weighted in mathematical equations, afford optimal prediction of ratings of the grade and pay appropriate for airman jobs, and (*c*) to validate these two equations. Merited grade was the criterion of principal interest since the procedure in AFM 35-2 relates to grade-level determination. However, the capability of predicting merited pay as well as appropriate grade was considered desirable for two reasons. The development of two equations, each having factors optimally weighted for predicting the ratings of one criterion variable, would permit examination of the need for different equations to evaluate airman jobs in terms of grade and pay. In addition, the equation for predicting merited pay would be available for future use in an evaluation plan if this criterion was of direct interest. Although both criteria were considered, attention was focussed on the grade criterion in order to avoid any loss in the efficiency of predicting grade ratings that might result from an effort to obtain a common set of factors for evaluating both merited grade and pay.

## III. DESIGN OF STUDY

The final selection of factors and assignment of weights for use in point-rating systems of job evaluation may be based directly on the judgment of "experts" or derived by statistical procedures. In the present study, the latter method was adopted. The experimental design used was similar in many respects to that for the first two phases of the OGR Project (Christal, 1965).

Once a comprehensive group of factors applicable to airman jobs had been developed, the general plan was to select the most efficient sets of factors and optimal factor weights by performing a series of multiple linear regression analyses (Bottenberg & Ward, 1963) to derive and validate the policy equations which most effectively predict ratings of appropriate grade and pay obtained for a sample of airman job descriptions. This plan required four steps.

1. Collection of merited grade and pay criterion data for a representative sample of airman jobs.
2. Collection of ratings for these jobs in terms of the job requirement factors under study.
3. Development of a comprehensive group of variables, hypothesized to have been considered by the raters who provided the criterion data, and evaluation of the jobs in terms of these variables.
4. Evaluation of the predictive efficiency of various combinations of variables to derive and validate the weighted regression equations which yield optimal prediction of the variance in the two criterion measures – the airman grade and pay policy equations.

## IV. DESCRIPTION OF STUDY

For convenience in exposition, the development of the job requirement factors investigated and the work done to develop and validate the two policy equations will be reported as four separate phases. In general, the presentation parallels the chronological sequence of the investigation. A description of each phase follows.

### Phase I: Development of Job Requirement Factors

The preliminary selection of job requirement factors for use in point-rating systems typically involves: (*a*) a survey of enough jobs to identify a substantial number of job requirements for the particular population to be evaluated, (*b*) a review of factors used in other plans designed for similar job populations, (*c*) construction of a comprehensive list of potentially useful factors identified in the preceding sources, which then is reduced to a manageable number, and (*d*) formulation of definitions for the factors retained and descriptions for each level considered necessary for quantifying the extent to which each factor is required by various jobs. This general plan was followed in making the preliminary selection of job requirement factors applicable to airman jobs. However, special attention was given to the definitions of factors and descriptions of levels in an effort to minimize differences in factor ratings attributable to ambiguous wording of these materials.

#### Preliminary Formulation of Factor Definitions

The purpose in making a preliminary list of factors was to derive a comprehensive set of job requirement factor definitions which, judged on an *a priori* basis, contained a substantial number of the dimensions (requirements) involved in all types and levels of airman jobs. Appropriate titles and descriptions for nine scale levels[2] were prepared at the same time that the factor definitions were formulated. The initial listing included,

[2] The decision to use nine scale levels for each factor was based on previous experience with nine levels for the factors used to evaluate officer jobs.

by intent, a greater number of factor definitions than was considered necessary in the final job-evaluation plan. In all, 24 definitions of "new" or "modified" airman job requirement factors were formulated (see Appendix I). These were based on the opinions of five judges in the Personnel Research Laboratory (PRL) who were familiar with the Air Force job-evaluation procedures and on experimental evidence in the following source materials.

*1. Airman job descriptions.* The basic source used to survey airman jobs was a sample of approximately 3,000 incumbent-prepared job descriptions collected from 11 major commands by Headquarters USAF, Office of Manpower & Organization, as part of a military pay survey concerning the linkage between military and civil-service jobs. These descriptions represented 694 of approximately 1,500 AFSC-by-UMD-authorized grade categories (above A3C) in effect when the survey was made. A subset of these survey materials was used in two recent studies (Hazel, 1966; Hazel & Cowan, 1966) relevant to this investigation. In addition to the job descriptions, the airman specialty descriptions in AFM 39-1 were reviewed.

*2. Job evaluation plans.* Various industrial, military, and governmental plans for evaluating the jobs of classified, salaried, hourly paid, and blue-collar workers were reviewed to identify factors potentially useful for airman jobs. This review included the plans of the National Electrical Manufacturing Association (1959), the United States Employment Service (1956), and various military services (Rose, 1966). Examination of several comprehensive reviews of job evaluation plans (International Labour Office, 1960; Madden, 1961; Patton & Littlefield, 1957; Rose, 1966) revealed that in most point-rating systems the factors for wage, or blue-collar, jobs may be grouped into four categories: (*a*) mental requirements such as knowledge, training, and alertness; (*b*) physical skill or effort; (*c*) responsibility for money or materials, safety or direction of others, or operations; and (*d*) job or working conditions and hazards. However, the subdivision of these categories varies greatly in the different plans. The actual number of factors used to evaluate jobs ranges from 3 or 4 to as many as 25 or 30, with an average of 10 or 11 factors. In some plans the number of levels is uniform for each factor, whereas in others the number of levels differs for each factor.

*3. Air Force research studies.* A careful examination of research involving airman jobs and specialties (Christal, et al., 1960; Hazel & Cowan, 1966; Madden, 1963a, 1963b; Thorndike, 1951) proved to be particularly helpful in formulating potentially useful factors. Fifteen of the 24 factor definitions given in Appendix I were derived from Air Force investigations.

### Definition of 15 Factors for Further Investigation

Since any set of job requirement factors designed for operational use must be of minimum length, an arbitrary decision was made to limit the investigation to 15 factors. Before these factors were defined, the 24 factor titles and definitions initially formulated underwent four revisions.

*First revision.* The 24 provisional definitions included multiple definitions of four factors (1 and 2; 6 and 7; 8, 9, and 10; 14 and 15). The hope was that consideration of more than one definition for these factors would improve the probability of specifying the dimensions most suitable for evaluating airman jobs. The initial group also included definitions of some factors that appeared somewhat less useful than others. Hence the following steps were taken to define the 15 job requirement factors for further study.

1. Coefficients of concordance ($W$) were computed (Seigel, 1956) for 18 factors in the original list to determine if each factor's nine scale levels represented a continuum on which raters could clearly differentiate various amounts of the factor. These coefficients were based on data provided by the five PRL judges and eight senior NCOs. Given 18 cards on which a factor definition and descriptions of the nine levels had been typed, these individuals were asked to read and independently rank-order the scale-level descriptions for each factor from 9, the highest amount of the factor, to 1, the lowest amount of the factor. The obtained $W$ coefficients ranged from .84 to .97, indicating high agreement among the judges upon the scale levels. The raters appeared to be applying the same standards in ranking the nine scale levels for these factors. Therefore the factor definitions and scale-level descriptions were judged to be unambiguous.

2. On the basis of the expressed preferences of the 13 individuals who served as raters, factor 10, Amount of Level of Supervision, was retained for further consideration; factors 8 and 9, the other two factors pertaining to supervision, were eliminated. In accordance with their recommendations, factors 6 and 7 were combined into a single factor entitled Decision Making which was defined without reference to the planning and judgment dimensions. Although the definitions of Knowledge (factor 1) and Special Training and Work Experience (factor 2) might be multiple definitions of a single factor, both were retained for further consideration since there was evidence of a difference in predictive efficiency (Madden, 1963a). The two definitions of Working Conditions (factor 13, without hazards; factor 15, with hazards) were retained in order to determine if separation of risk from job conditions was necessary.

3. Evaluation of the results of the two preceding steps by the five PRL judges led to the elimination of six more factor definitions (18, 20, 21, 22, 23, and 24). Factor 18 appeared to have considerable overlap with Job Criticality (factor 16) and to be too broad in scope for use in evaluating airman jobs. The remaining five definitions were eliminated for reasons of economy because there was experimental evidence suggesting that other factors were likely to be more useful in evaluating airman jobs or because others seemed to have greater face validity.

*Second revision.* The 15 factor definitions produced by the first revision included multidimensional factors such as Physical Skill and Effort, Supervision, and Working Conditions. These were rewritten in order to reduce the number of dimensions involved and to make the dimensions less difficult to interpret. The confidence dimension also was removed from the Familiarity and Confidence factor, leaving only the job-familiarity dimension for use as a check on rater-group differences. In addition, an effort was made to shorten the scale-level descriptions and to increase the consistency of the scale-level modifiers in all the factor definitions.

*Third revision.* After the PRL judges again reviewed the 15 factor definitions, the definitions and scale-level descriptions were reworded so as to make them more job-oriented and to avoid reference to incumbent's performance. An effort was made to use terminology that would be readily understood by raters and to keep the materials as brief as possible.

*Fourth revision.* Following the PRL judges' review of the products of the third revision, a few minor changes were made in the scale-level descriptions to increase the similarity of the modifiers used for each factor. The final factor definitions and descriptions of scale levels for each of the 15 factors selected for further investigation are given in Appendix II.

## Field Test of Final Factor Definitions and Scale-Level Descriptions

After the fourth revision had been made, coefficients of concordance ($W$) were computed for the 15 factors to ascertain how well judges would agree upon the ordering of the nine scale levels which described a continuum for each factor. The procedure was the same as that used in making the first revision. This time, nine senior NCOs, five company-grade officers, and five field-grade officers read the materials and rank-ordered the nine levels for each factor. As shown in Table 1, the obtained $W$ coefficient values indicate that these 19 judges were almost perfectly agreed upon the ranking of the nine levels for each of the 15 factors.

## Job Requirement Factor Sets A and B

A preliminary study (Hazel & Cowan, 1966) indicated that certain factors in the initial listing yielded moderate to high prediction of a merited-grade and a pay criterion. The five factors in the final group that had been derived from these factors, therefore, seemed likely choices for inclusion in an airman job evaluation plan. Accordingly, the 15 factors were divided into Set A and B so that each 10-factor set contained these 5 factors. In Set A, Working Conditions (Without Hazards) and Risk were treated as two separate factors; in Set B, they were combined. The set membership of each factor is shown in Table 1.

*Table 1.* **Titles, Set Memberships, and Coefficients of Concordance ($W$)[a] for 15 Job Requirement Factors**

| Title of Job Requirement Factor | Factor No. Within Set | | $W^a$ |
|---|---|---|---|
| | A | B | |
| Knowledge | A1 | | .99 |
| Dexterity, Coordination, & Discrimination | A2 | B2 | .99 |
| Adaptability & Resourcefulness | A3 | B3 | 1.00 |
| Responsibility for Money and Materials | A4 | B4 | .99 |
| Decision Making | A5 | B5 | 1.00 |
| Supervision | A6 | B6 | .99 |
| Communication | A7 | | .99 |
| Contact with Others | A8 | | 1.00 |
| Working Conditions (Without Hazards) | A9 | | .98 |
| Risk | A10 | | .99 |
| Special Training and Work Experience | | B1 | 1.00 |
| Job Criticality | | B7 | 1.00 |
| Attention | | B8 | .99 |
| Working Conditions (With Hazards) | | B9 | 1.00 |
| Job Familiarity | | B10 | 1.00 |

[a] From field test in which nine senior NCOs, five company-grade officers, and five field-grade officers rank-ordered the nine scale-level descriptions provided for each of the 15 job requirement factors (see Appendix II).

## Phase II: Collection of Criterion and Factor Ratings for a Representative Sample of Jobs

The plan to use multiple linear regression analysis to determine the predictive efficiency of the 15 job requirement factors selected for investigation required criterion and factor ratings for a representative sample of airman jobs. This phase of the work involved decisions with respect to (*a*) the sample of airman jobs selected for rating, (*b*) the selection of raters to provide the criterion and factor ratings, (*c*) the procedures for collecting grade and pay ratings, and (*d*) the procedures for collecting job requirement factor ratings. Each of these decisions is discussed.

### Selection of Job Sample

An essential requirement for this study was a sample of job descriptions representing all types and levels of airman jobs for use in obtaining the merited-grade and pay criterion ratings and the job requirement factor ratings. The 3,000 descriptions collected by Headquarters USAF, Office of Manpower & Organization, previously described, included so many AFSC-by-UMD-authorized grade categories that selection of a single case from each category would have produced a sample of 700 descriptions. Consequently, a sample of 200 descriptions from 189 different AFSC-by-UMD-authorized grade categories was selected by a procedure that maximized coverage of all types and levels of jobs in a sample of manageable proportions. Details of the selection of this job sample are described elsewhere (Hazel & Cowan, 1966). The number of job descriptions in UMD grades A2C (E-3) through CMSgt (E-9) were as follows: E-3, 35; E-4, 38; E-5, 30; E-6, 35; E-7, 36; E-8, 12; E-9, 14.

The job descriptions were collected on AF Form 1144, Air Force Officer Job Survey, with instructions adapted to airmen. Each incumbent used spaces provided on two pages to give in his own words the job title, the job context in the local structure, a list of duties and tasks performed, the requirements of the job, and a job summary. These two pages of the completed forms were suitable for reproduction for use by raters providing criterion and factor data for this study. Another page of the form contained various types of assignment information supplied by the incumbent and his immediate supervisor (see Appendix III).[3]

### Selection of Raters

The selection of raters was based on the results of the Hazel and Cowan study (1966) which showed no differences of practical significance among the mean ratings for airman jobs obtained from four groups, namely, senior NCOs, lieutenants, captains, and field-grade officers (majors and lieutenant colonels). Hence a decision was made to use criterion and factor ratings made by these four rater groups in nearly equal proportions (i.e., approximately five ratings from each group for each job). This would permit making certain group comparisons concerning the predictive efficiency of the job requirement factors. All raters were volunteer participants randomly selected from rosters of officers furnished by Headquarters USAF and rosters of senior NCOs from nine major commands.

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[3] The following items from this page were listed on the Job Information Sheets prepared for use by the raters: major air command, base or installation, organization, level of organization within Air Force, and level of the job within organization. Other items were used by the investigator in Phase III of the study.

The decision as to the number of raters needed to evaluate the 200 job descriptions in terms of the criteria and job requirement factors was based primarily on considerations of rating reliability. Results of a study by Christal, Madden, and Harding (1960) showed that 10 to 20 ratings per job were desirable in order to obtain highly reliable, or stable, mean ratings. Consequently the plan was to secure, for each job, 20 ratings on the merited-grade and pay criterion variables and on each set of job requirement factors. This plan required 600 raters.

### Collection of Criterion Data

The criterion observations for the sample of 200 job descriptions used in this study were the merited grade ratings and merited pay rankings obtained in November and December 1964 which have been reported elsewhere (Hazel & Cowan, 1966). Twenty grade ratings and 20 pay rankings per job were collected by mail from senior NCOs, company-grade officers, and field-grade officers so selected that each of the four rater groups had 50 members (see Table 2). For purposes of the mail administration, the 200 job descriptions were randomly sorted into 10 booklets in a manner designed to reduce rating-context effects. Each rater evaluated the 20 jobs described in the booklet assigned to him.

The information furnished raters as a basis for their grade and pay judgments consisted of reproductions of the two-page job descriptions prepared on AF Form 1144 by the incumbents and a Job Information Sheet which listed major command, organization, base or installation, level of organization within the Air Force, and level of the job within the organization for each job described. The rater's task was to evaluate the 20 jobs described with respect to grade, using a 9-point scale (9 = CMSgt, 1 = Airman Basic), and then to rank these jobs according to merited pay (1 = highest pay, 20 = lowest pay). An abbreviated version of the instructions for raters is given in Appendix IV. Each rater also completed a Rater Information Sheet (see Appendix IV). Raters were asked to complete the work and return the materials within five work days after receipt.

### Collection of Factor Ratings

The method used to obtain factor ratings through mail administration was based on experience gained in the OGR Project (Hazel, Christal, & Hoggatt, 1966) and in airman job evaluation studies (Hazel, 1966; Hazel & Cowan, 1966). This experience indicated that raters could evaluate 20 job descriptions within a reasonable time period (2 to 4 hours); so the 200 job descriptions were randomly sorted into 10 booklets containing 20 descriptions, as had been done for the criterion-data collection. The two-page job descriptions for these booklets were reproduced in sufficient copies to assure collection of all factor ratings during approximately the same time period. Multiple copies of Job Information Sheets, like those used in collecting the criterion data, also were prepared.

One new form was designed. This was the Job Evaluation Report form which had the identifying numbers of the 20 job descriptions in the rater's booklet, listed in a column on the left for rater convenience, and spaces for recording 10 factor ratings for each job listed. The instructions for rating the factors, designed for self-administration, contained five steps to be completed sequentially. The new form and instructions are shown in Apprendix V.

The method and materials to be used in collecting factor ratings were field-tested with five senior NCOs and five officers before the actual data collection began. Each rater evaluated a random sample of 20 job descriptions with one of the two sets of job requirement

factors. A critique of the field test indicated that these raters had experienced no particular difficulty in following the instructions or in providing the ratings; so materials were mailed to the field without delay.

The package sent each rater contained descriptions for a set of 10 job requirement factors and the nine scale levels for each factor, a booklet with 20 job descriptions, a Job Information Sheet, a Rater Information Sheet, a Job Evaluation Report form, and instructions for making the ratings. Raters were requested to complete and return their ratings within five work days after receipt. The ratings for both sets of factors were collected during the period November 1965 through April 1966. The number of raters in each of the four rater groups who provided data for Factor Sets A and B is given in Table 2.

*Table 2.* **Description of Rater Groups Which Provided Ratings of Criteria and Job Requirement Factors for 200-Job Sample**

| Variable Description | Rater Group | | | | Total |
|---|---|---|---|---|---|
| | NCO[a] | Lieutenant | Captain | Maj/Lt Col | |
| Merited Grade (criterion)[b] / Merited Pay (criterion)[b] | 50 | 50 | 50 | 50 | 200 |
| Factor Set A (predictors) | 50 | 48 | 46 | 50 | 194 |
| Factor Set B (predictors) | 50 | 49 | 44 | 50 | 193 |
| Total | 150 | 147 | 140 | 150 | 587 |

[a] NCO groups were composed of SMSgts and CMSgts.
[b] Ratings of the two criterion variables were obtained from the same individuals.

## Phase III: Development of Airman Grade and Policy Equations

### Hypothesizing Variables Considered in Making Grade and Pay Ratings

The high level of agreement of the four rater groups upon both grade ratings and pay rankings (Hazel & Cowan, 1966) indicated that members of these groups had considered the same or highly related variables in evaluating the jobs. One of the more critical tasks in the present study was the identification of the variables considered by those who provided the criterion measures. In designing the study, the possibility was recognized that variables other than the 15 job requirement factors might be useful in predicting the merited grade and pay criteria. This led to an examination of certain types of information that might have influenced the raters' evaluations of the 200 jobs in the sample. In hypothesizing predictor variables, particular attention was given to the following types of information.

*1. Assignment information.* Each rater received a Job Information Sheet on which was listed certain assignment-information items taken from AF Form 1144 (Appendix III). It was hypothesized that variables describing the relation of the job to the Air Force organizational structure might have influenced raters. It also seemed possible that the raters' fund of information was such that assignment-information items not given them (e.g., UMD-authorized grade for position, supervisor's judgment of appropriate grade for position) might be useful in predicting ratings. The final grade policy equation developed in the OGR Project (Christal, 1965) included three assignment-information variables (level of organization within Air Force, level of job within organization, and supervisor's judgment of appropriate job grade).

2. *Format of job descriptions and related materials.* The two-page job descriptions prepared by incumbents on AF Form 1144 were reproduced for raters' use. Some were handwritten, others typed; descriptions of the job context, duties and tasks performed, and job requirements differed in length and style. It was hypothesized that certain non-relevant variables in these materials might have influenced the ratings.

3. *Criticality of the specialty.* It was hypothesized that the relative contributions of various airman specialties to accomplishment of the Air Force mission might have a bearing on the grade and pay considered appropriate for jobs. Information on the relative criticality of 243 airman specialties, as judged by a representative sample of 300 majors and lieutenant colonels (Hook & Massar, 1965), was available to the investigator.

Descriptions of all the variables investigated are presented in Appendix VI. Variables 1 and 2 listed there are the criteria of interest. Although each could be used as a predictor of the other, attention was focussed on the remaining 37 variables as predictors of both criteria. For convenient reference, the source of information and the range of scores possible, as well as the mean score and standard deviation for each variable, are included in Appendix VI. The values for variables 1 through 27 were based on the total number of ratings obtained from all raters for all jobs; those for variables 28 through 39 were obtained by scoring each of the 200 job descriptions as described in Appendix VI.

The average number of ratings secured for each of the 200 jobs for variables 1 through 27 is given in Table 3. As shown there, 20 grade ratings and 20 pay rankings were obtained for each job. An average of 19.4 ratings per job was collected for the job requirement factors in Set A (variables 3 through 12), and an average of 19.3 ratings per job for those in Set B (variables 13 through 22). The five factors common to Sets A and B were of special interest, for they were similar to those previously found useful in predicting merited grade and pay ratings (Hazel & Cowan, 1966). Since Sets A and B were rated by independent groups, three versions of the five factors as predictor variables were considered (i.e., as predictors in Set A, as predictors in Set B, and as predictors in Sets A and B combined). An average of 38.7 ratings per job was available for the five combined-data factors (variables 23 through 27).

## Reliability of Job Requirement Factors

Since the ratings collected were to be used in deriving the grade and pay policy equations that would determine the selection of factors and weights for an airman job evaluation plan, it was important to demonstrate that these ratings were stable. The grade and pay ratings were known to be very stable (Hazel & Cowan, 1966), but analyses were needed to estimate the relative consistency of the ratings given the 200 jobs on each of the 15 job requirement factors. To obtain such estimates, intraclass reliability coefficients ($R_{11}$s)[4] were computed from the raw-score ratings obtained for each factor (see Table 3). The reliability coefficients for the 15 job requirement factors and information about the average number of ratings per job ($k$) on which the $R_{11}$ coefficients are based are presented in Table 4.

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[4] Intraclass correlation used as an indicator of reliability is recommended by Haggard (p. 11) and by Lindquist (p. 361). Haggard uses $R$ and Lindquist uses $r_{11}$ to denote intraclass correlation. The notation used here, $R_{11}$, for the reliability of a single measure, and $R_{kk}$, for the reliability of a mean of $k$ measures, was adopted in order to maintain the distinction between Haggard's notation for intraclass correlation and the conventional use of the same symbol to donote multiple correlation and to distinguish between Lindquist's notation for intraclass correlation and the conventional use of a similar notation to indicate elements of a correlation matrix.

*Table 3.* **Number of Ratings Obtained for Criterion and Job Requirement Factor Variables**

| Variable Number | Variable Description | Avg No. Ratings per Job ($\bar{k}$) | No. of Raters | Total No. of Ratings per Variable |
|---|---|---|---|---|
| 1 | Merited Grade | 20.0 | 200[a] | 20 x 200 jobs = 4000 |
| 2 | Merited Pay | 20.0 | 200[a] | 20 x 200 jobs = 4000 |
| 3 | Factor A1 | | | |
| . | . | | | |
| . | . | 19.4 | 194 | 19.4 x 200 jobs = 3880 |
| . | . | | | |
| 12 | Factor A10 | | | |
| 13 | Factor B1 | | | |
| . | . | | | |
| . | . | 19.3 | 193 | 19.3 x 200 jobs = 3860 |
| . | . | | | |
| 22 | Factor B10 | | | |
| 23 | Factor A2, B2 | | | |
| . | . | | | |
| . | . | 38.7 | 387 | 38.7 x 200 jobs = 7740 |
| . | . | | | |
| 27 | Factor A6, B6 | | | |

[a] The same 200 raters provided both the merited-grade and pay data.

*Table 4.* **Reliability Coefficients for Airman Job Requirement Factor Variables**

| Variable Number | Factor Number and Title | $R_{11}^{a,b}$ | $R_{kk}$ k=5 | k=10 | k=20 | k=40 |
|---|---|---|---|---|---|---|
| 3 | A1–Knowledge | .49 | .83 | .90 | .95 | .97 |
| 9 | A7–Communication | .51 | .84 | .91 | .95 | .98 |
| 10 | A8–Contact with Others | .46 | .81 | .90 | .95 | .97 |
| 11 | A9–Working Conditions (Without Hazards) | .50 | .83 | .91 | .95 | .98 |
| 12 | A10–Risk | .64 | .90 | .95 | .97 | .99 |
| 13 | B1–Special Training and Work Experience | .48 | .82 | .90 | .95 | .97 |
| 19 | B7–Job Criticality | .45 | .80 | .89 | .94 | .97 |
| 20 | B8–Attention | .32 | .70 | .82 | .90 | .95 |
| 21 | B9–Working Conditions (With Hazards) | .56 | .86 | .93 | .96 | .98 |
| 22 | B10–Job Familiarity | .10 | .35 | .52 | .69 | .81 |
| 23 | A2, B2–Dexterity, Coordination, & Discrimination | .30 | .68 | .81 | .90 | .94 |
| 24 | A3, B3–Adaptability & Resourcefulness | .34 | .72 | .83 | .91 | .95 |
| 25 | A4, B4–Responsibility for Money and Materials | .40 | .77 | .87 | .93 | .96 |
| 26 | A5, B5–Decision Making | .40 | .77 | .87 | .93 | .96 |
| 27 | A6, B6–Supervision | .50 | .83 | .91 | .95 | .98 |

[a] For Factor Set A, the average number of ratings per job, $\bar{k}$ = 19.4; for Set B, $\bar{k}$ = 19.3; for Sets A and B combined, $\bar{k}$ = 38.7 (see Table 3).

[b] $R_{11}$ values for five common factors in Set A: A2 = .32, A3 = .33, A4 = .37, A5 = .39, A6 = .50; for those in Set B: B2 = .28, B3 = .35, B4 = .42, B5 = .41, B6 = .51.

The $R_{11}$ values in Table 4 pertain to the overall relative homogeneity of the factor ratings given each of the 200 jobs. The $R_{kk}$ coefficient values included in this table were projected from the $R_{11}$ values, and reflect estimates of the stability of means based on a specified number of ratings per job, i.e., 5, 10, 20, and 40 ratings per job. Most of the estimated reliability coefficients based on 40 ratings per job approach the maximum $R_{kk}$ value of 1.00. The $R_{kk}$ values for 14 of the 15 job requirement factors indicate that job means based on 20 ratings have substantial reliability. Only Job Familiarity (variable 22), intended for use in conjunction with other factors, has a reliability coefficient below .90. These results indicate that a sufficient number of ratings per job were obtained to offer considerable assurance that the mean factor ratings (over the 200 jobs) were very stable.

**Overview of Multiple Linear Regression Analyses**

During the course of the study, 1,296 multiple linear regression problems were analyzed in order to determine the most efficient sets of predictors and weights for the airman grade and pay policy equations and to validate these equations. Of these only 480 selected problems are reported here. Those not described include 168 problems associated with one job requirement factor (Job Criticality, variable 19), which did not enter into the final policy equation for either grade or pay, and 648 problems associated with comparisons of the four rater groups with respect to the efficiency of certain combinations of variables for predicting the merited-grade and pay ratings. In general, the 816 unreported problems represent intermediate steps in implementing the general strategy adopted for deriving and validating the airman grade and pay policy equations.

A detailed discussion of the questions raised, hypotheses tested, and results obtained from the 392 regression analyses computed to derive the grade and pay policy equations did not seem feasible. The presentation here, therefore, is limited to an explanation of the systematic approach followed in evaluating combinations of predictors, identifying groups of predictors which warranted further investigation, and gradually narrowing the field or range of potentially useful predictors. However, information about these 392 problems has been organized in Appendix VII so that the purpose, essential elements, and results of each analysis can be ascertained. Since each analysis pertaining to the grade criterion was replicated for the pay criterion, the grade and pay problems involving the same predictor variables are shown together, e.g., problems 1 (for grade) and 201 (for pay). For many analyses, cross-reference is made to other problems. By comparing the models and squared multiple correlation coefficients ($R^2$s) for such problems, the effect of adding or removing certain predictor variables may be evaluated.

*Strategy of the analyses.* Examination of the problem sequences in Appendix VII indicates how subsets of predictor variables were extracted from the total number available and hypotheses about these variables tested. The process involved forming intuitive or logical groupings of variables, determining how much criterion variance could be predicted, then selecting one or more variables to be added to or removed from the initial group and determining the effect upon the prediction of criterion variance, i.e., the change in $R^2$ value. As more efficient subsets of variables were identified, the field or range of predictors to be considered for inclusion in the final equations was narrowed, new variable groupings were formed, and these new combinations of variables were examined. As an example, compare the $R^2$s (.91 and .91) obtained for problems 8 and 208, which involved the five combined common factors, with the $R^2$s (.90 and .91) for problems 15 and 215, which involved four of these factors. Omission of Dexterity (variable 23) resulted in a negligible loss in grade prediction and no change in pay prediction; so

further investigation of this factor in conjunction with the other four combined common factors seemed inefficient. The $R^2$s for these four variables, however, indicated that these predictors were highly efficient and appeared to warrant further consideration of them in conjunction with other predictors. Similar conclusions were suggested when $R^2$s for problems 11 and 211 were compared with those for problems 12 and 212, also when $R^2$s for problems 13 and 213 were compared with those for problems 14 and 214.

*Rationale for the analyses.* So many logical subsets of predictors were formed, analyzed, and evaluated that guidelines were established for selecting predictor sets which warranted further investigation. These guidelines also were considered in making the final selection of variables for the airman grade and policy equations. In brief, the five bases for retaining predictors for further study were (*a*) predictive efficiency, (*b*) economy (number of variables in set), (*c*) reliability of factors, (*d*) face validity of factors (logical relation to concepts involved in grade determination), and (*e*) positive validity coefficients and regression weights of variables. While economy needs no explanation, a brief discussion of the other guidelines will indicate more clearly how they were used.

*1. Predictive efficiency.* The fundamental basis for selecting one set of predictors in preference to another was the size of the squared multiple correlation coefficients ($R^2$s). However, when several sets of predictors had similar levels of predictive efficiency, selection of a set for further study was based on consideration of other guidelines. For example, $R^2$s of .95 were obtained for problem 7, which involved 15 job requirement factors, and for problem 10, which involved 12 factors. The latter set was preferred not only for reasons of economy but also because it did not include Job Familiarity, the factor with the lowest reliability ($R_{11}$ = .10) and face validity for grade determination.

*2. Reliability of job requirement factors.* This guideline was established on the basis of results obtained from analyses of models in which predictor selection was determined by the reliability coefficients of the variables ($R_{11}$ values in Table 4). The obtained $R^2$s suggested that factors with higher reliability are more efficient than factors with lower reliability (see problems 40 and 240 through 55 and 255). Consequently, in forming additional subsets of predictors for further investigation, an effort was made frequently to include the more reliable factors whenever appropriate.

*3. Face validity of the job requirement factors.* To obtain an estimate of the face validity of the factors, the five PRL judges who were familiar with Air Force job-evaluation procedures were asked to rank the 15 job requirement factors from 1 (highest) to 15 (lowest) with respect to their face validity for airman grade determination. Means and medians of these rankings were computed for each factor, and these values again ranked from highest to lowest face validity. The results are given in Table 5. With view to testing the hypothesis that factors with higher face validity are more efficient in predicting grade and pay levels, the rankings made by each judge and the rankings of the means and medians computed for the group were used to form a series of models for which factors were selected according to their estimated face validity (problems 113 and 313 through 149 and 349). The $R^2$s obtained for both criteria indicated that the eight factors with the highest face validity (variables 3, 9, 10, 13, 24, 25, 26, 27) were very efficient ($R^2$s about .93), and that the addition of factors with lower face validity produced little improvement in the efficiency of prediction. In subsequent analyses, a special effort was made to examine these eight factors in conjunction with others sets of predictors.

*Table 5.* **Rank-Orders of Means and Medians of Face Validity Estimates by 5 Judges for 15 Job Requirement Factors**

| Variable Number | Factor Number and Title | Mean | R-O of Mean | Mdn | R-O of Median |
|---|---|---|---|---|---|
| 3 | A1–Knowledge | 3.2 | 2 | 2.0 | 1.5 |
| 9 | A7–Communication | 5.6 | 4 | 5.0 | 4 |
| 10 | A8–Contact with Others | 6.6 | 6 | 6.0 | 5.5 |
| 11 | A9–Working Conditions (Without Hazards) | 13.5 | 15 | 13.0 | 14 |
| 12 | A10–Risk | 9.6 | 10.5 | 10.0 | 10 |
| 13 | B1–Special Training and Work Experience | 6.8 | 7 | 9.0 | 8 |
| 19 | B7–Job Criticality | 9.2 | 9 | 10.0 | 10 |
| 20 | B8–Attention | 9.6 | 10.5 | 10.0 | 10 |
| 21 | B9–Working Conditions (With Hazards) | 11.2 | 12 | 12.0 | 13 |
| 22 | B10–Job Familiarity | 12.6 | 14 | 15.0 | 15 |
| 23 | A2, B2–Dexterity, Coordination, & Discrimination | 11.4 | 13 | 11.0 | 12 |
| 24 | A3, B3–Adaptability & Resourcefulness | 5.8 | 5 | 6.0 | 5.5 |
| 25 | A4, B4–Responsibility for Money and Materials | 8.6 | 8 | 7.0 | 7 |
| 26 | A5, B5–Decision Making | 3.0 | 1 | 3.0 | 3 |
| 27 | A6, B6–Supervision | 3.4 | 3 | 2.0 | 1.5 |

*4. Positive validity coefficients and regression weights of variables.* Another guideline for the selection of variables for further study and for the final policy equations stemmed from the desire to avoid negative regression weights if at all possible because of the difficulty of explaining them to the layman. Anyone untrained in statistics is likely to have trouble understanding the negative weighting of a variable, especially if that variable has a high positive correlation with the criterion. Similar difficulty in understanding the positive weighting of a variable that is negatively correlated with the criterion was anticipated. Throughout the analyses, therefore, efforts were made to eliminate variables with negative validity coefficients, as well as those which consistently received negative weights, in order to avoid including them in the final policy equations. Fortunately, such variables made no substantial contribution to the efficiency of prediction, and it was possible to derive final equations in which all variables have positive validity coefficients and all regression weights are positive.

*Table 6.* **Grade and Pay Validity Coefficients of 37 Predictor Variables**

| Variable Number | Variable Description[a] | Validity Coefficient | |
|---|---|---|---|
| | | Grade | Pay[b] |
| 3 | Factor A1–Knowledge | .83 | .88 |
| 4 | Factor A2–Dexterity, Coordination, & Discrimination | -.03 | .07 |
| 5 | Factor A3–Adaptability & Resourcefulness | .78 | .83 |
| 6 | Factor A4–Responsibility for Money and Materials | .50 | .57 |
| 7 | Factor A5–Decision Making | .88 | .91 |
| 8 | Factor A6–Supervision | .89 | .88 |
| 9 | Factor A7–Communication | .86 | .81 |
| 10 | Factor A8–Contact with Others | .75 | .70 |
| 11 | Factor A9–Working Conditions (Without Hazards) | -.31 | -.21 |
| 12 | Factor A10–Risk | -.18 | -.08 |
| 13 | Factor B1–Special Training and Work Experience | .93 | .93 |
| 14 | Factor B2–Dexterity, Coordination, & Discrimination | .01 | .12 |
| 15 | Factor B3–Adaptability & Resourcefulness | .82 | .85 |
| 16 | Factor B4–Responsibility for Money and Materials | .52 | .58 |
| 17 | Factor B5–Decision Making | .89 | .89 |
| 18 | Factor B6–Supervision | .90 | .88 |
| 19 | Factor B7–Job Criticality | .49 | .55 |
| 20 | Factor B8–Attention | .61 | .65 |
| 21 | Factor B9–Working Conditions (With Hazards) | -.18 | -.09 |
| 22 | Factor B10–Job Familiarity | -.06 | .01 |
| 23 | Factor A2, B2–Dexterity, Coordination, & Discrimination | -.01 | .10 |
| 24 | Factor A3, B3–Adaptability & Resourcefulness | .82 | .86 |
| 25 | Factor A4, B4–Responsibility for Money and Materials | .52 | .58 |
| 26 | Factor A5, B5–Decision Making | .90 | .92 |
| 27 | Factor A6, B6–Supervision | .91 | .89 |
| 28 | Job Description Length | .42 | .40 |
| 29 | Job-Requirements Description Length | .35 | .37 |
| 30 | Job Description Legibility | .23 | .17 |
| 31 | Job Description Jargon & Abbreviation | .13 | .15 |
| 32 | Job-Context Description Length | .04 | .04 |
| 33 | UMD-Authorized Grade for Incumbent of Job | .80 | .74 |
| 34 | Present Grade of Job Incumbent | .78 | .71 |
| 35 | Grade of Incumbent's Immediate Supervisor | .31 | .28 |
| 36 | Level of Organization Within Air Force | .36 | .28 |
| 37 | Level of Job Within Organization | .30 | .25 |
| 38 | Supervisor's Judgment of Appropriate Grade for Job | .51 | .49 |
| 39 | Criticality of Specialty | .24 | .30 |

[a] Sources, score ranges, and descriptive statistics for all variables are presented in Appendix VI.

[b] Signs reflected to show correct interpretation (i.e., rank 1 = high pay, rank 20 = low pay).

*Trends observed as analyses progressed.* The merited-grade and pay validity coefficients for 37 predictor variables are given in Table 6. A review of these coefficients and careful examination of the regression weights given the variables in a large number of analyses led to observation of the following trends.

1. Variables with negative validity coefficients for grade or pay, or both, and consistently negative regression weights:

Factor A9 – Working Conditions (Without Hazards), variable 11
Factor B9 – Working Conditions (With Hazards), variable 21
Factor A10 – Risk, variable 12

Factor A2 – Dexterity, Coordination, & Discrimination, variable 4
Factor A2, B2 – Dexterity, Coordination, & Discrimination, variable 23

2. Variables with either positive or negative validity coefficients and low positive, zero, or frequently negative regression weights in various combinations of predictors:

Factor B7 – Job Criticality, variable 19
Factor B10 – Job Familiarity, variable 22
Criticality of Specialty, variable 39

3. Variables with positive validity coefficients and consistently positive regression weights:

Factor A7 – Communication, variable 9
Factor B1 – Special Training and Work Experience, variable 13
Factor A4, B4 – Responsibility for Money and Materials, variable 25
Factor A5, B5 – Decision Making, variable 26
Factor A6, B6 – Supervision, variable 27

*Computational stages in the analyses.* Early recognition that a large number of problems must be analyzed before factors and weights could be selected for an airman job evaluation plan led to the accomplishment of the analyses in four stages. Each stage represented a reduction or narrowing of the field of potentially useful predictors which appeared to merit inclusion in the final, optimally weighted policy equations. The 392 problems listed in Appendix VII are arranged according to the four computational stages. A brief description of each stage follows.

*1. Computational Stage 1 (problems 1 and 201 through 10 and 210).* This stage provided information about the predictive efficiency of the full models with 38 and 37 predictor variables as well as certain groups of variables, e.g., all or parts of Factor Sets A and B. In addition, the first intuitive grouping of the "best" subset of predictors was examined. This stage afforded information about variables which was useful in the next stage of the analyses.

*2. Computational Stage 2 (problems 11 and 211 through 156 and 356).* As a result of the emphasis placed upon identifying variables which produced some increase in the level of predictive efficiency and gaining some insight into variables with consistently negative regression weights, this was the most extensive series of analyses made. It involved investigation of a large number of predictor-variable combinations based on considerations such as face validity, reliability, and economy of factors. Models also were formed to study several methodological questions, including the predictive efficiency of variables with large and small standard deviations, the efficiency of factors with high validity coefficients, and the efficiency of certain factors that appeared early in the iterative solutions of the regression

problems. Toward the end of this computational stage, an effort was made to determine the predictive efficiency obtained by combining selected job requirement factors and assignment-information variables (e.g., problems 150 and 350 through 156 and 356).

3. *Computational Stage 3 (problems 157 and 357 through 185 and 385).* Most of the analyses made in this stage involved models formulated to re-examine the more promising variables identified in the preceding stage. Study of the predictive efficiency of various combinations of job requirement factors and assignment-information variables in Stage 2 indicated that eight predictors were consistently related to the grade and pay criteria.[5] Five job requirement factors were found to have consistently positive regression weights.[6] The predictive efficiency of the five common factors in combined form (variables 23 through 27) was slightly higher than that of these factors in Sets A and B. Since the means based on the combined data (approximately 40 ratings per job rather than 20 ratings per job as in Sets A and B) were more stable, a decision was made to use only the combined-data variables for any common factors included in the final policy equations. Accordingly, these factors and assignment-information variables were incorporated in several key models (e.g., problems 160 and 360, 165 and 365) which led to the final selection of factors to be included in the optimally weighted policy equations. In addition, a few factors given inconsistent regression weights (e.g., Job Criticality, variable 19) and three factors given negative weights (Working Conditions Without Hazards, variable 11; Risk, variable 12; Dexterity, Coordination & Discrimination, variable 23) were re-examined for further assurance that previous decisions about them were justified.

4. *Computational Stage 4 (problems 186 and 386 through 196, final airman grade policy equation, and 396, final airman pay policy equation).* At the end of Stage 3, seven variables had been selected for the grade policy equation and eight variables for the pay policy equation. The inclusion of other predictor variables produced little increase in predictive efficiency. However, Special Training and Work Experience, variable 13, entered the iterative solutions for several problems before Knowledge, variable 3, and these factors had certain semantic similarities. Hence the primary purpose of the analyses made in Stage 4 was to determine if both factors should be included in the final policy equations. Comparisons of the results of several analyses (e.g., problems 187 and 387 with problems 165 and 365) indicated that the Knowledge factor made a slight but consistent increase in predictive efficiency and was positively weighted. This was considered sufficient justification for including both factors in the final equations.

### Final Airman Grade and Pay Policy Equations

A review of the results of the regression analyses indicated that the $R^2$s for grade-criterion problems were slightly larger than those for pay-criterion problems and that fewer

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[5] These predictors were: Knowledge, variable 3; Contact with Others, variable 10; Attention, variable 20; Adaptability & Resourcefulness, variable 24; UMD-Authorized Grade for Incumbent of Job, variable 33; Level of Organization Within Air Force, variable 36; Level of Job Within Organization, variable 37; Supervisor's Judgment of Appropriate Grade for Job, variable 38.

[6] These factors were: Communication, variable 9; Special Training and Work Experience, variable 13; Responsibility for Money and Materials, variable 25; Decision Making, variable 26; Supervision, variable 27.

predictor variables were needed to account for a given proportion of the grade-criterion variance than for a similar proportion of the pay-criterion variance. However, there seemed to be a slight tendency for a greater number of positively weighted predictor variables to appear in solutions for pay problems than in those for grade problems. These observations give some support to the use of separate equations for merited grade and merited pay.

The final airman grade policy equation contained eight predictors which accurately reproduced the criterion grade ratings of the 200 jobs (problem 196, $R^2$ = .95). The final airman pay policy equation consisted of nine predictors which reproduced the criterion pay ratings of the 200 jobs almost as accurately (problem 396, $R^2$ = .93). The predictor variables and decimal-value regression weights in the two final policy equations are listed in Table 7.

*Table 7.* **Variables and Regression Weights Used in Airman Grade and Pay Policy Equations**

| Variable Number | Variable Description | Weight[a] | |
|---|---|---|---|
| | | Grade | Pay |
| 3 | Factor A1–Knowledge | .0809 | .9822 |
| 9 | Factor A7–Communication[b] | .1872 | .1771 |
| 13 | Factor B1–Special Training and Work Experience[b] | .2956 | .5418 |
| 25 | Factor A4, B4–Responsibility for Money and Materials | .0489[c] | .0860 |
| 26 | Factor A5, B5–Decision Making[b] | .0875 | .7305 |
| 27 | Factor A6, B6–Supervision | .2938 | .8527 |
| 36 | Level of Organization Within Air Force [b] | .0525 | .0755 |
| 37 | Level of Job Within Organization[b] | .0670 | .1700 |
| 38 | Supervisor's Judgment of Appropriate Grade for Job | .0000 | .0343[c] |

[a] Regression constants: Grade = .4619; Pay = 28.0880

[b] Descriptive title of variable is similar to that of one in final officer grade policy equation (Christal, 1965).

[c] Smallest regression weight for criterion.

The eight predictors in the final grade policy equation include 6 of the 15 airman job requirement factors initially defined (Appendix II) and two assignment-information variables associated with the organizational level of the job. The final pay equation includes these eight predictors and an assignment-information variable relevant to the immediate supervisor's judged grade level for the job. These results suggest that similar variables can be used in plans for evaluating airman jobs with respect to either merited grade or merited pay although different regression weights and constants are required to obtain optimal levels of predictive efficiency.

The great accuracy with which the criterion ratings can be predicted from the variables in the final grade and pay equations suggests that these predictors and weights are suitable for inclusion in an airman job evaluation plan. It would be difficult to prove that these particular variables were the ones considered by the raters who made judgments of the grade and pay merited by the 200 jobs. However, since these variables accurately predict the raters' judgments, the assumption is tenable that they are primary determiners of grade and pay requirements. Three

findings tend to support this assumption: (*a*) the final equations involve a relatively small number of positively weighted variables; (*b*) the six job requirement factors included in both equations are highly reliable ($R_{kk}$ > .95, with $k$ = 20, Table 4); and (*c*) these six job requirement factors have high face validity (Table 5).

Similarities and differences in the predictors and weights selected for the airman and officer grade policy equations also were of interest; so the grade policy equation derived in in this study was compared with the officer grade policy equation derived in the OGR Project (Table 1, Hazel, Christal, & Hoggatt, 1966). As indicated in Table 7, both equations include five job requirement factors that have similar titles. However, the definitions and scale levels for these factors are quite dissimilar in the two studies. The weights for all five factors also differ, the weights in the officer policy equation tending to be much larger than those in the airman policy equation. In addition, the officer policy equation contains two management-related factors, Management and Planning, whereas the airman policy equation has only one such factor, Supervision. These findings offer considerable support for the use of different plans in evaluating officer and airman jobs.

## Phase IV: Evaluation of Airman Grade and Pay Policy Equations and Integer Conversion of Weights

The number and diversity of airman jobs is so great that a criterion sample much larger than the 200-job sample used in this study would have been desirable if practical considerations had permitted. Therefore, although the policy equations provide highly accurate predictions of the raters' judgments of the grade and pay merited by the 200 jobs in the sample, caution must be exercised in making generalizations based on these results. Furthermore, the selection of 8 variables for the final grade equation and 9 variables for the final pay equation from 37 potentially useful predictor variables after computing 392 regression analyses suggests that the selection process may have involved a capitalization on chance relationships. To investigate this possibility and gain some evidence of the stability of the final equations, a series of analyses involving subsamples of airman jobs and rater groups were made.

### 100-Job Samples

One procedure used to examine the stability of the policy equations involved the random division of the criterion and predictor data for the 200 jobs in the original sample into two 100-job samples, A and B, by alternately assigning jobs to Sample A and Sample B. With mean values already computed for the predictors in the two final policy equations, least-squares weights for these variables were developed in Sample A and cross-applied to Sample B. Similarly, weights were developed in Sample B and cross-applied to Sample A. This procedure made it possible not only to compare the efficiency of grade and pay predictions in the two 100-job development samples with the efficiency of the predictions in the 200-job sample but also to examine the results of using least-squares weights developed in one 100-job sample to predict criterion ratings collected for jobs in the other 100-job sample.

*Table 8.* **Comparison of Predictive Efficiency ($R^2$) of Grade and Pay Policy Equations in 100-Job Development Samples and Cross-Application Samples**

| Development Sample | $R^2$ | No. Positive Weights | Cross-Application Sample | $R^2_{ca}$ | No. Positive Weights |
|---|---|---|---|---|---|
| **Criterion: Grade** | | | | | |
| A | .9361 | 8 | B | .9498 | 8 |
| B | .9575 | 7[a] | A | .9237 | 7 |
| **Criterion: Pay** | | | | | |
| A | .9206 | 8[b] | B | .9425 | 8 |
| B | .9514 | 8[c] | A | .9122 | 8 |

[a] Variable 26 (Decision Making) had zero weight.

[b] Variable 9 (Communication) had low negative weight.

[c] Variable 38 (Supervisor's Judgment of Appropriate Grade for Job) had zero weight.

The results of the analyses for the two 100-job samples are summarized in Table 8. The $R^2$ value for each development sample represents the percentage of variance in the criterion ratings for the jobs in the development sample that can be predicted by use of predictor weights developed in *this* sample. The $R^2_{ca}$ value for each cross-application sample represents the percentage of variance in the criterion ratings for the jobs in the application sample that can be predicted by use of predictor weights developed in the *other* sample.[7] In each instance, the number of positively weighted predictors is shown in order to reflect any differences from the numbers of variables used in the policy equations derived from the 200-job sample.

Examination of the data in Table 8 shows that the $R^2$ values obtained for grade and pay in both development samples were close to those obtained in the original 200-job sample (Grade, $R^2 = .95$; Pay, $R^2 = .93$). Comparisons of the results for both development and application samples indicate that a large proportion of the variance in the criterion grade and pay ratings can be predicted from either the development or the cross-applied weights. In the four comparisons for which data are available, the gain or loss of predictive efficiency in the cross-application samples is negligible. While the number of positively weighted variables in the equations for Samples A and B differs in some instances from the number in the equations for the 200-job sample, any loss or instability of weights probably is attributable to the reduced number of jobs in Samples A and B. In summary, the results of these analyses indicate that the final airman grade and pay policy equations are stable, and reveal no evidence that the equation-selection process has captialized on chance relationships among variables.

[7] In this study, the subscript *ca* is used to identify $R^2$s or *r*s which involve obtained criterion values and predicted criterion values computed from *cross-applied* weights.

## Rater Groups

Since the criterion and factor ratings used in the study were obtained from four rater groups (senior NCOs, Lieutenants, Captains, and Majors/Lieutenant Colonels), additional information about the stability of the final policy equations could be derived from analyses designed to disclose certain consistent group differences. In a previous study (Hazel & Cowan, 1966), no significant group differences in mean criterion ratings were found. In this study, additional analyses were made to examine the possibility of group differences in policy equations and in the predictive efficiency of certain combinations of predictor variables. Another analysis concerned group differences in degree of expressed familiarity with the 200 airman jobs.

*Comparison of rater-group grade policy equations with overall-group grade policy equation.* The results of the analyses made to determine if the merited-grade policy equations expressed by the four rater groups were essentially the same as the grade policy equation derived for the overall group are given in Table 9. In order to make these comparisons, the criterion data and ratings of the eight predictors included in the final grade policy equation obtained from each group were analyzed to develop an optimally weighted, grade policy equation for each of the four rater groups. As indicated by the $R^2$ values in Table 9, the predictive effectiveness of the four equations differs very little. While these $R^2$s are smaller than the $R^2$ for the overall group equation, the difference in predictive efficiency probably is attributable to the fact that the mean values used for rater-group computations were based on fewer ratings per job ($n \tilde{=} 5$) than the means for the overall group ($n \geq 20$).

*Table 9.* **Comparison of Grade Policy Equations of Four Rater Groups with Airman Grade Policy Equation of Overall Group**

| Computed Value | Rater Group | | | | Overall Group |
|---|---|---|---|---|---|
| | NCO | Lt | Capt | Maj/Lt Col | |
| $R^2$ | .83 | .81 | .84 | .85 | .95[a] |
| $R$[b] | .9094 | .8974 | .9160 | .9212 | |
| $r_{ca}$[c] | .9091 | .8868 | .9044 | .9187 | |
| $(R\text{-}r_{ca})$ Difference | .0003 | .0106 | .0116 | .0025 | |

[a] The predictive efficiency ($R^2$) of the grade policy equation of the overall group is given in Appendix VII (problem 196).

[b] Multiple correlation coefficient ($R$) values reflect the extent of the relationship between grade ratings obtained from a rater group and predicted grade ratings based on weights in this group's policy equation.

[c] Product-moment correlation coefficient ($r_{ca}$) values reflect the extent of the relationship between grade ratings obtained from a rater group and predicted grade ratings based on cross-application of weights in overall-group policy equation.

The multiple correlation coefficients ($R$s) for the four rater groups, given in Table 9, reflect the degree of relationship between the criterion grade scores and predicted grade scores for the 200 jobs based on the weights given the eight predictor variables in each rater-group policy equation. Pearson product-moment correlations ($r_{ca}$s) between the criterion grade scores and predicted grade ratings for the 200 jobs based on cross-application of the weights given these eight predictors in the overall-group policy equation also were computed for each rater group. Thus some estimate of the differences between the overall-group and rater-group grade policies could be obtained by comparing the correlations ($r_{ca}$s) based in overall-group weights with those ($R$s) based on rater-group weights. As indicated by the small differences in these correlations ($R-r_{ca}$ in Table 9), the differences between the overall-group grade policy equation and the four rater-group grade policy equations appear to be trivial.

*Group differences in the predictive efficiency of certain predictor combinations.* To examine group differences in the level of predictive efficiency of certain combinations of predictor variables, nine grade problems and nine pay problems, which had been analyzed in the course of developing the final grade and pay policy equations, were replicated for each of the four rater groups. These 18 problems, described in Appendix VII as problems 1-8 and 10 (grade criterion) and problems 201-208 and 210 (pay criterion), include full models with 38 and 37 predictors, models with various groupings of the job requirement factors, and the first intuitive selection of the most efficient set of factors. These problems involved predictor combinations of particular interest; and replication of the analyses using the mean criterion and predictor values of the 200 jobs computed for each of the four independent rater groups seemed likely to reveal any group differences in the predictive efficiency of the predictor combinations that might exist.

The $R^2$s computed for the four groups for the 18 selected problems are given in Appendix VIII. Also included are group-difference values which show the maximum difference in the four rater-group $R^2$s for each problem. The small values obtained suggest that there was little difference between groups in the levels of predictive efficiency for these combinations of predictor variables.

*Group differences in expressed familiarity with airman jobs.* An interesting question posed by the use of different rater groups was whether the four groups differed in their expressed familiarity with airman jobs. For this reason, Job Familiarity, (variable 22) was included in the list of 15 job requirement factors investigated. Inclusion of this factor made it possible to compare the mean familiarity ratings of the four groups to get additional information concerning the feasibility and desirability of using senior NCOs to evaluate airman jobs.

*Table 10.* **Multiple-Range Test of Differences in Mean Ratings of Job Familiarity[a] for Four Rater Groups**

| Group Mean[b] | | | |
|---|---|---|---|
| 3 (Capt) | 1 (NCO) | 2 (Lt) | 4 (Maj/Lt Col) |
| 4.09 | 4.18 | 4.22 | 4.62 |

[a] Factor 15, defined in Appendix II and described as Variable 22 in Appendix VI.

[b] Shortest significant ranges: $R_4 = .30$, $R_3 = .29$, $R_2 = .28$. Means underscored by the same line are not significantly different ($P \geq .01$).

To investigate group differences in expressed familiarity, a multiple-range test (Edwards, 1960, p. 136), based on the means of the raw-score job-familiarity ratings for each group (see Table 3), was computed. Results of this analysis are given in Table 10. As shown in this table, the field-grade officers expressed a significantly higher ($P < .01$) level of familiarity with airman jobs than the senior NCOs or company-grade officers. While these differences are statistically significant, the small differences between means appear to be of little practical consequence.

When the present findings are considered in the context of previous results indicating group differences in expressed confidence in airman job grade ratings (Hazel & Cowan, 1966), the conclusion appears warranted that field-grade officers' expressed familiarity with airman jobs and confidence in ratings are significantly greater than those expressed by the three other groups. From a practical viewpoint, however, the actual differences found in both studies seem too small to indicate that the use of a composite group of senior NCOs, company-grade officers, and field-grade officers to evaluate airman jobs is not feasible.

### Integer Conversion of Decimal Predictor Weights

In a previous study concerned with officer job evaluation (Brokaw & Giorgia, 1966), a system of integer weights was developed to facilitate the manual application of regression weights in a field situation. In order to make the officer and airman procedures for application of weights consistent and to facilitate the hand-application of weights to airman jobs, an integer conversion of the regression weights developed in the present study was accomplished.

*Table 11.* **Integer Weights for Variables in Final Airman Grade and Pay Policy Equations**

| Variable Number | Variable Description | Integer Weight | |
|---|---|---|---|
| | | Grade | Pay |
| 3 | Knowledge | 2 | 29 |
| 9 | Communication | 4 | 5 |
| 13 | Special Training and Work Experience | 6 | 16 |
| 25 | Responsibility for Money and Materials | 1 | 3 |
| 26 | Decision Making | 2 | 21 |
| 27 | Supervision | 6 | 25 |
| 36 | Level of Organization Within Air Force | 1 | 2 |
| 37 | Level of Job Within Organization | 1 | 5 |
| 38 | Supervisor's Judgment of Appropriate Grade for Job | —[a] | 1 |

[a] Not applicable; airman grade policy equation included only eight variables.

To produce integer weights for the variables in the final grade and pay policy equations, the decimal weights for grade and pay (listed in Table 7) were divided by the smallest regression weight for their respective criteria (i.e., by the weight of variable 25 for Grade and by the weight of variable 38 for Pay). These values then were rounded to form the integer weights

shown in Table 11. To determine if conversion of regression weights from decimal to integer values had any effect on the levels of predictive efficiency of the policy equations, grade and pay $R^2$s based on both types of weights were computed and compared. For grade, the $R^2$s based on decimal and integer values were identical; for pay, the $R^2$s differed by .0001. These results indicate that the predictive efficiency of the policy equations was not reduced when the decimal regression weights were converted to integer values.

## V. SUMMARY AND CONCLUSIONS

As initially established, the Air Force job evaluation plan (AFM 35-2) was intended for use with both officer and airman jobs. Through a five-year research program which culminated in the Officer Grade Requirements Project, an efficient set of officer job requirement factors was identified. The present study represents the first research effort to define job requirement factors appropriate for airman jobs and to select and validate efficient sets of factors for use in evaluating airman jobs.

A special effort was made to identify and define job requirement factors that are particularly appropriate for evaluating airman jobs. Definitions for 15 new or modified, potentially useful, airman job requirement factors were formulated with the help of five judges after an extensive literature search, review of relevant job evaluation plans, and survey of airman jobs had been made. The procedure used to develop definitions and scales for these factors, as well as various analyses relating to the scaling, reliability, and face validity of the factors, are reported.

The selection of stable and efficient sets of factors and weights for an airman job evaluation plan was based on the development and validation of two multiple linear regression equations – the policy equations – which would provide optimal prediction of criterion ratings obtained for a representative sample of airman jobs. Merited grade was the criterion of primary interest, but merited pay also was investigated in order to determine if similar sets of factors could be used to evaluate airman jobs on both criteria. During the course of this study, 1,296 regression problems were analyzed; results from 480 analyses are reported.

To derive optimally weighted policy equations which accurately predicted merited-grade and pay criterion judgments for a sample of airman jobs, the following actions were accomplished: (*a*) grade and pay criterion measures were obtained for a representative sample of 200 airman jobs from a composite group of senior NCOs, lieutenants, captains, and field-grade officers; (*b*) ratings for this job sample in terms of the 15 job requirement factors were collected from a similar composite group of senior NCOs, lieutenants, captains, and field-grade officers; (*c*) a comprehensive list of 37 predictor variables hypothesized to have been considered by the criterion raters was formulated; and (*d*) 392 multiple linear regression problems were analyzed to determine the predictive efficiency of many combinations of variables in order to derive the two policy equations.

The final airman grade policy equation contained eight variables which accurately predicted the criterion grade ratings of the 200 jobs ($R^2$ .95). This equation consisted of six job requirement factors and two variables concerning job location in the organizational structure. The final airman pay policy equation, which accurately predicted the criterion pay ratings for these jobs ($R^2$ - .93), included the eight variables in the grade policy equation and a variable representing the immediate supervisor's recommended job grade level.

Although it would be difficult to prove that the variables selected were the ones considered by the raters in making their grade and pay judgments, the obtained levels of predictive efficiency suggest that these predictors may be assumed to be primary determiners of grade and pay requirements for airman jobs. Additional support for this assumption comes from the following findings: (*a*) the six job requirement factors were highly reliable and had face validity for airman jobs; (*b*) all the predictor variables had positive validity coefficients and regression weights; and (*c*) the number of variables in the final policy equations was relatively small.

To investigate the stability of the final grade and pay policy equations, the data for the 200 jobs were randomly divided into two 100-job subsamples; regression weights for the policy-equation variables were developed on both subsamples and then were cross-applied. Comparisons of the results obtained from the use of development and cross-applied weights to predict the same criterion ratings revealed very little difference in levels of predictive efficiency. Since criterion and factor ratings were obtained from four independent groups of raters, additional analyses were made to examine rater-group differences in policy equations and levels of predictive efficiency. Results of these analyses indicated that the four rater-group grade equations were very similar to the overall-group grade policy equation and that the levels of predictive efficiency attained for the policy equations and all combinations of variables investigated were approximately the same in all four groups.

When the rater groups' expressed familiarity with airman jobs was analyzed, statistically significant differences were found between the mean ratings of field-grade officers and the three other groups. However, these differences were of insufficient magnitude to appear of practical consequence. These results support previous findings concerning the feasibility of having a composite group of senior NCOs, company-grade officers, and field-grade officers evaluate airman jobs.

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## *APPENDIX I.* INITIAL FORMULATION OF TITLES AND DEFINITIONS OF JOB REQUIREMENT FACTORS FOR AIRMAN JOBS

The 24 provisional titles and definitions of job requirement factors listed here were formulated on the basis of available experimental evidence and the opinions of five judges in the Personnel Research Laboratory who were familiar with Air Force job evaluation procedures. Descriptions of nine scale levels also were prepared for each definition. These titles, definitions, and scale levels represented the first step in the development of a comprehensive set of factors applicable to airman jobs.

| No. | Factor Title | Factor Definition and Source |
|---|---|---|
| 1 | Knowledge | The amount of general academic, technical, or specific knowledge required to successfully perform the job. Consider knowledge gained through formal education, special training courses, work experience, or any combination of these methods. Also the complexity and range of knowledge and amount of time and effort needed to obtain the knowledge. (Source: AFM 35-2) |
| 2 | Special Training and Work Experience | The amount of special training and work experience required to effectively perform the job. Consider the knowledge and skills gained through special training courses, OJT, work experience, or any combination of these methods. (Sources: Madden, 1963a; Christal, 1965) |
| 3 | Physical Skill and Effort | The degree of physical dexterity, muscular coordination, sensory acuity, and physical effort required to successfully perform the work. Consider how much precision in making movements is needed, the level of ability to detect or discriminate objects and signals, the variety of responses, and reaction time required. (Sources: AFM 35-2; Hazel, 1966) |
| 4 | Adaptability and Resourcefulness | The degree of versatility and initiative required to perform the job. Consider the need for adjustment to changing situations, conditions, and procedures, the amount of flexibility or shifting from different work activities, and the demand for ingenuity or new ideas and methods to solve problems. (Sources: AFM 35-2; Madden, 1963a) |

Appendix I. (*Continued*)

| No. | Factor Title | Factor Definition and Source |
|---|---|---|
| 5 | Responsibility for Money and Materials | The extent of responsibility for handling and control of money, materials, and equipment. Consider the loss or consequences of defects in work performance or misuse of resources. (Source: AFM 35-2) |
| 6 | Decision Making and Planning | The amount of judgment, decision making, and planning required by the job. Consider the scope and impact of decisions, the length of time for which plans are made, and the guidance available for making alternative decisions. (Source: Madden, 1963a) |
| 7 | Judgment and Decision Making | The amount of judgment and decision making required by the job. Consider the scope and impact of decisions, the time period covered, the guidance available for making alternative choices, and the degree of independent or final authority exercised. (Source: Christal, 1965) |
| 8 | Amount of Supervision | The amount of supervision required in performance of the work. Consider the number of persons supervised, degree of supervisory responsibility involved, and closeness of supervision exercised. (Source: AFM 35-2) |
| 9 | Complexity of Supervision | The type and level of supervisory responsibilities which are required in the job. Consider the variety of activities under direct supervision and the skill levels of the persons supervised. (Source: AFM 35-2) |
| 10 | Amount and Level of Supervision | The extent to which supervisory responsibilities are required in work performance. Consider the variety of activities, skill levels of persons supervised, number of persons, and closeness of supervision required. (Sources: AFM 35-2; Christal, 1965; Hazel, 1966) |
| 11 | Communication Skill | The degree of communication skill required by the job. Consider the amount of oral and written communication required, the kind of information transmitted, and the audience, agency, or individuals receiving the information. (Sources: Madden 1963a; Christal, 1965) |

Appendix I. *(Continued)*

| No. | Factor Title | Factor Definition and Source |
|---|---|---|
| 12 | Contact with Others | The extent to which the job requires skill in dealing with the people. Consider the degree of contact with others, and the need for such traits as self-control, tact, cooperation, and capacity to impress or persuade people. (Sources: Christal, et al., 1960; Christal, 1965) |
| 13 | Working Conditions (Without Safety and Health Hazards) | The extent to which the job involves uncomfortable or unpleasant working conditions. Consider the environment in which work is performed, the degree and duration of discomfort, isolation, monotony, and irregular hours. Do not include personal safety or health hazards. (Source: Christal, 1965) |
| 14 | Risk | The extent to which the job requires risk of death or severe injury. Consider the severity and the possibility of disease, injury, or death resulting from health and safety hazards associated with the job. (Source: Christal, 1965)<br><br>Note.—A dimension concerning military and combat conditions (Factor 10, AFM 35-2) was excluded from this definition on the assumption that markedly different plans are necessary for peace and wartime. |
| 15 | Working Conditions (With Safety and Health Hazards) | The physical environment in which work must be performed. Consider the degree, duration, and continuity of physical discomfort as well as the likelihood and severity of injury or disease resulting from exposure to the work conditions. (Sources: AFM 35-2; Madden, 1963a) |
| 16 | Job Criticality | The criticality of work performed toward accomplishment of the Air Force mission. Decide the relative importance of the jobs evaluated to what you consider the primary Air Force mission. Consider the consequence if the contribution made by the job were not available. (Sources: Christal, et al., 1960; Thorndike, 1951) |

Appendix I. *(Continued)*

| No. | Factor Title | Factor Definition and Source |
|---|---|---|
| 17 | Attention | The amount of diligence, attentiveness, or mental alertness required in performance of the work. Consider how much and for how long a period sustained concentration or attention is demanded to work effectively. (Source: AFM 35-2) |
| 18 | Availability of Qualified Personnel | The proportion of airman personnel who can be successfully trained to do the job. Consider how many airmen are capable of learning to perform the duties and tasks required in the job. (Sources: Christal, et al., 1960; Thorndike, 1951) |
| 19 | Familiarity and Confidence | The degree of familiarity with the jobs evaluated and the level of confidence in the factor ratings assigned. (Sources: Christal, et al., 1960; Hazel, 1966) |
| 20 | Job Status | The extent of social prestige attached to the job by military personnel. Consider the amount of glamour or chances of special recognition. (Source: None. *New factor)* |
| 21 | Enlistment Appeal | The extent to which the job has appeal for new Air Force enlistees. (Source: None. *New factor)* |
| 22 | Operator–Supervisor | The extent to which job involves the operation or application of equipment *versus* the supervision or management of people. High scale values should reflect primarily supervisory jobs and low values primarily operator jobs. (Source: None. *New factor)* |
| 23 | Information Specificity | The extent to which highly detailed or specific data, techniques, or procedures must be recalled in order to perform the job. (Source: None. *New factor)* |
| 24 | Independent Activity | The nature and amount of instructions under which the work is performed. Consider the degree of final authority exercised, frequency of work inspection, and number of guidelines or directives for making decisions. (Source: Christal, 1965 – extensively modified) |

## *APPENDIX II.* DEFINITIONS AND SCALE LEVELS OF THE 15 JOB REQUIREMENT FACTORS INVESTIGATED

### FACTOR 1. KNOWLEDGE

**Definition.** The amount of specific knowledge required to effectively perform the job. Consider the technical knowledge needed, and the length of time typically required to obtain the knowledge.

LEVEL:

9. Demands an extremely high degree of varied technical knowledge, gained from a great many years of training and work experience.
8. Demands a very high degree of varied technical knowledge, gained from a very long period of training and work experience.
7. Demands a high degree of technical knowledge, gained from a long period of training and work experience.
6. Demands a moderately high degree of technical knowledge, gained from a moderately long period of training or work experience.
5. Demands a moderate degree of intermediate technical knowledge, gained from a period of training or work experience of moderate duration.
4. Demands a moderately low degree of intermediate technical knowledge. Requires a moderately short period of training or work experience.
3. Demands a low degree of semi-technical knowledge. Generally requires limited training or work experience.
2. Demands a very low degree of specific knowledge. Requires only a brief training period.
1. Demands an extremely low degree of specific knowledge. Requires no more than a short demonstration of the work.

### FACTOR 2. DEXTERITY, COORDINATION, & DISCRIMINATION

**Definition.** The degree of finger and manual dexterity, muscular coordination, and sensory discrimination required to perform the work. Consider the accuracy and speed of movement and the keenness in detecting or discriminating cues and signals.

LEVEL:

9. Requires an extremely high degree of dexterity, coordination, and sensory discrimination. Involves extremely rapid responses to barely detectable sensory signals.
8. Requires a very high degree of dexterity, coordination, and sensory discrimination. Involves very rapid responses to signals which are very difficult to detect.
7. Requires a high degree of dexterity, coordination, and sensory discrimination. Involves rapid responses to signals which are difficult to detect.
6. Requires moderately high dexterity, coordination, and sensory discrimination. Involves fairly rapid responses to signals which are rather difficult to detect.
5. Requires moderate dexterity, coordination, and sensory discrimination. Involves responding with moderate speed to readily detectable signals.
4. Requires moderately low dexterity, coordination, and sensory discrimination. Involves moderately slow responses to distinct signals.
3. Requires a low degree of dexterity, coordination, or sensory discrimination. Involves slow responses to very distinct signals.
2. Requires a very low degree of dexterity, coordination, or sensory discrimination. Involves very slow responses to easily detected signals.
1. Requires an extremely low degree of dexterity, muscular coordination, or sensory discrimination. Involves extremely slow repetitive responses.

FACTOR 3. ADAPTABILITY & RESOURCEFULNESS

**Definition.** The degree of versatility, initiative, and ingenuity required to perform the job. Consider the need for flexibility or adjustment to changing situations and procedures and the demand for new ideas and methods to solve problems.

LEVEL:

9. Requires an extremely high degree of versatility, initiative, and creative ability. Demands continuous adjustment to changing situations and the constant application of novel ideas, inventiveness, or research.
8. Requires a very high degree of versatility, initiative, and ingenuity. Demands very frequent adjustment to changing situations and the application of new approaches and methods.
7. Requires a high degree of versatility, initiative, and ingenuity. Demands frequent adjustment to new procedures and techniques, and resourcefulness in resolving problems.
6. Requires moderately high versatility, initiative, and ingenuity. Demands considerable initiative and flexibility in adapting to new methods.
5. Requires moderate versatility, initiative, and ingenuity. Involves moderate resourcefulness on duties which often change.
4. Requires moderately low versatility, initiative, and resourcefulness. Involves moderately low initiative to meet steadily changing situations.
3. Requires a low degree of adaptability or resourcefulness. Involves occasional adjustment to slowly changing situations.
2. Requires a very low degree of adaptability or resourcefulness. Involves slight need for adjustment to a small number of clearly specified activities.
1. Requires no adaptability or resourcefulness. Involves only a few set procedures or sequences.

FACTOR 4. RESPONSIBILITY FOR MONEY AND MATERIALS

**Definition.** The extent of responsibility for the use or control of money, material, or equipment. Consider the loss or waste that may result from defects in work or misuse of resources.

LEVEL:

9. Involves extremely high responsibility. Requires development and implementation of controls over resources of extremely great value. Misuse or mistakes require extremely costly and extensive corrective actions.
8. Involves very high responsibility. Demands extensive control over resources of very great value. Mistakes are very expensive and difficult to correct.
7. Involves high responsibility. Requires use or control of materials or equipment of great value. Mistakes require extensive corrective action.
6. Involves moderately high responsibility. Requires use of material or equipment of considerable value. Mistakes may result in moderately high loss or damage.
5. Involves moderate responsibility. Requires use or handling of equipment of moderate value. Work defects may result in moderate loss or waste.
4. Involves moderately low responsibility. Requires use or handling of materials or equipment of below medium value. Work defects may lead to a moderately small loss.
3. Involves low responsibility. Requires use of material or equipment of limited value. Work defects may result in a small loss.
2. Involves very low responsibility. Requires use of inexpensive material or equipment. Work defects may result in negligible loss.
1. Involves no responsibility. Requires handling of material or equipment of insignificant value.

FACTOR 5. DECISION MAKING

**Definition.** The degree of decision making required in the job. Consider the scope of decisions made and amount of guidance available for making alternative choices.

LEVEL:

9. Requires an extremely high degree of decision making. Constantly demands broad, critical decisions with very little or no guidance.
8. Requires a very high degree of decision making. Very frequently demands difficult decisions with a minimum of guidance.
7. Requires a high degree of decision making. Frequently requires independent decisions with only a few general guidelines available.
6. Requires a moderately high degree of decision making. Requires a number of independent decisions not covered by established procedures or published directives.
5. Requires a moderate degree of decision making. Occasionally requires independent decisions where established guidelines or published directives are not available.
4. Requires a moderately low degree of decision making. Demands some independent judgment or interpretation in applying established directives which cover most activities performed.
3. Requires a low degree of decision making. Situation allows limited opportunity for independent decisions or judgment in working out job problems.
2. Requires a very low degree of decision making. Situation provides specific instructions with considerable inspection of work performed.
1. Requires an extremely low degree or no decision making. Involves activities which are fixed and preset with very close inspection of work performed.

FACTOR 6. SUPERVISION

**Definition.** The level of supervisory responsibility required in the job. Cooperation with others should **not** be considered as supervision.

LEVEL:

9. Requires an extremely high level of supervision. Involves functioning as superintendent at the highest level.
8. Requires a very high level of supervision. Involves functioning as superintendent.
7. Requires a high level of supervision. Involves functioning as highest level senior supervisor.
6. Requires a moderately high level of supervision. Involves functioning as senior supervisor.
5. Requires a moderate level of supervision. Involves functioning as first-line supervisor.
4. Requires a moderately low level of supervision. Involves direction of several activities.
3. Requires a low level of supervision. Involves direction of a small number of activities.
2. Requires a very low level of supervision. Involves direction of one or two activities.
1. Requires no supervision or direction.

FACTOR 7. COMMUNICATION

**Definition.** The amount of oral and written communication required in the job. Consider the kind of information transmitted and the audience receiving the communication.

LEVEL:

9. Requires an extremely high level of oral and written communication. Involves preparation and presentation of highly technical material to staff meetings, VIPs, and very large audiences.
8. Requires a very high level of oral and written communication. Involves preparation and presentation of very technical material to staff officers, unit commanders, and large groups.
7. Requires a high level of oral and written communication. Involves preparation and presentation of technical material to training classes or relatively large groups.
6. Requires a moderately high level of oral or written communication. Involves preparation of technical and semi-technical reports for presentation to moderately large groups.
5. Requires a moderate amount of oral or written communication. Involves preparation of military correspondence and semi-technical reports for presentation to medium sized groups.
4. Requires a moderately low level of oral or written communication. Involves preparation of non-technical written material for limited distribution to small groups.
3. Requires a low level of oral or written communication. Involves preparation of a few routine reports with communication limited to very small groups.
2. Requires a very low level of oral or written communication. Involves a small amount of oral communication with a few persons.
1. Requires an extremely low level or no oral or written communication. Involves no more than infrequent conversation with one or two persons.

FACTOR 8. CONTACT WITH OTHERS

**Definition.** The extent of the requirement for dealing with other people. Consider the need for such traits as tact, cooperation, and self-control in the job.

LEVEL:

9. Demands an extremely high degree of contact with others. Involves continuous work in situations where an extra-high level of diplomacy, cooperation, self-control, and ability to influence people is essential.
8. Demands a very high degree of contact with others. Involves very frequent work in situations where a very high level of tact, cooperation, self-control, and ability to impress others is necessary.
7. Demands a high degree of contact with others. Involves frequent work in situations where a high level of tact, cooperation, and self-control is necessary.
6. Demands a moderately high degree of contact with others. Involves a substantial amount of tact, cooperation, and self-control in dealing with others.
5. Demands a moderate degree of contact with others. Involves a moderate amount of tact, cooperation and self-control in dealing with others.
4. Demands a moderately low degree of contact with others. Requires sufficient cooperation and self-control to work smoothly with several members of immediate work groups.
3. Demands a low degree of contact with others. Requires only sufficient cooperation and self-control to deal with a few members of immediate work group.
2. Demands a very low degree of contact with others. Requires only limited cooperation with one or two co-workers.
1. Demands an extremely low degree of contact with others. Deals mostly with objects and things.

FACTOR 9. WORKING CONDITIONS

**Definition.** The extent to which the job involves uncomfortable or unpleasant working conditions. Consider the environment in which work is performed (outside or inside, extremes of heat or cold, noise, vibration, isolation, monotony, etc.) and the duration of discomfort arising from such conditions.

LEVEL:

9. Involves an extremely high degree of discomfort and unpleasantness for very prolonged periods.
8. Involves a very high degree of discomfort or unpleasantness for extensive periods.
7. Involves a high degree of discomfort. Requires either excessive discomfort for temporary periods or high discomfort for long periods.
6. Involves moderately high discomfort. Requires either moderately high discomfort for temporary periods or moderate discomfort for long periods.
5. Involves moderate discomfort for periods of moderate duration.
4. Involves moderately low discomfort. Requires either moderate discomfort for short periods or moderately low discomfort for long periods.
3. Involves a low degree of discomfort. Requires either moderately low discomfort for short periods or slight discomfort for long periods.
2. Involves a very low degree of discomfort. Requires little more than mild discomfort for brief periods.
1. Involves no discomfort. Involves generally pleasant and comfortable working conditions.

FACTOR 10. RISK

**Definition.** The extent to which the job requires exposure to risk of death, injury, or disease in peacetime. Consider the possibility and the severity of damage or impairment associated with the health and safety hazards of the job.

LEVEL:

9. Requires extremely high risk. Involves constant possibility of death or extremely serious injury.
8. Requires very high risk. Involves very frequent exposure to dangerous situations that may result in severe injury or possibly death.
7. Requires high risk. Involves frequent exposure to dangerous situations that may result in severe injury or permanent impairment.
6. Requires moderately high risk. Involves some exposure to dangerous situations that may result in severe injury.
5. Requires moderate risk. Involves some exposure to moderately dangerous situations.
4. Requires moderately low risk. Involves some exposure to slightly dangerous situations.
3. Requires low risk. Involves infrequent exposure to slightly dangerous health and safety hazards.
2. Requires very low risk. Involves very infrequent exposure to slightly dangerous health and safety hazards.
1. Requires extremely low risk. Involves safe conditions with little or no exposure to health or safety hazards.

FACTOR 11. SPECIAL TRAINING AND WORK EXPERIENCE

**Definition.** The amount of special training and work experience required to effectively perform the job. Consider the knowledge and skills gained through special training courses, OJT, work experience, or any combination of these methods.

LEVEL:

9. Requires an extremely large amount of training and work experience. Typically, over ten years are needed.
8. Requires a very large amount of training and work experience. From nine to ten years are typically needed.
7. Requires a large amount of training and work experience. From seven to eight years are typically necessary.
6. Requires a moderately large amount of training and work experience. From five to six years are typically necessary.
5. Requires a moderate amount of training and work experience. From three to four years are typically necessary.
4. Requires a moderately small amount of training and work experience. From two to three years are typically necessary.
3. Requires a small amount of training or work experience. From one to two years is generally sufficient.
2. Requires a very small amount of work experience. Less than one year is usually adequate.
1. Requires an extremely small amount of training or work experience. A short demonstration or brief introduction to the work is adequate.

FACTOR 12. JOB CRITICALITY

**Definition.** The criticality of the work performed to accomplishment of the primary Air Force mission or function. While all airman jobs are important under certain conditions some jobs may be more critical than other jobs. Consider the consequences if the contribution made by each job were not available.

LEVEL:

9. An extremely critical job to the Air Force mission. Job is absolutely indispensable under any circumstances.
8. A job of very high criticality to the Air Force mission. Very serious consequences would result if the contribution of this job was not available.
7. A job of high criticality to the Air Force mission. Makes a contribution of high priority.
6. A job of moderately high criticality to the Air Force mission. Makes a contribution of moderately high priority.
5. A moderately critical job to the Air Force mission. Provides a contribution which would definitely reduce mission effectiveness if not available.
4. A job of moderately low criticality to the Air Force mission. Provides a contribution which would hamper mission effectiveness if not available.
3. A job of low criticality to the Air Force mission. Provides a contribution which would detract slightly from mission effectiveness if not available.
2. A job of very low criticality to the Air Force mission. Provides a desirable contribution but not particularly critical to mission accomplishment.
1. A job of lowest criticality. Provides some advantages if available.

FACTOR 13. ATTENTION

**Definition.** The amount and duration of mental alertness required in the performance of the work. Consider how much and for how long a period that concentration or attention is demanded in the job.

LEVEL:

9. Requires an extremely high degree of intense mental effort and attention for extremely long periods.
8. Requires a very high degree of intense concentration for very long periods.
7. Requires a high degree of close attention for prolonged periods.
6. Requires a moderately high degree of attention for long periods.
5. Requires a moderate degree of mental alertness for periods of moderate duration.
4. Requires a moderately low degree of mental alertness for short periods.
3. Requires a low degree of mental alertness for very short periods.
2. Requires a very low degree of mental alertness.
1. Requires an extremely low degree of mental alertness.

FACTOR 14. WORKING CONDITIONS

**Definition.** The extent to which the job involves uncomfortable working conditions and exposure to health and safety hazards. Consider the environment in which work is performed, and the duration of exposure to unpleasant conditions or hazardous situations.

LEVEL:

9. Involves an extremely high degree of discomfort and hazardous exposure for extremely prolonged periods.
8. Involves a very high degree of discomfort or hazardous exposure for very long periods.
7. Involves a high degree of discomfort or hazardous exposure for long periods.
6. Involves a moderately high degree of discomfort or hazardous exposure for rather long periods.
5. Involves a moderate degree of discomfort or hazardous exposure for periods of moderate duration.
4. Involves a moderately low degree of discomfort or hazardous exposure for periods of moderately short duration.
3. Involves a low degree of discomfort or hazardous exposure for short periods.
2. Involves a very low degree of discomfort or hazardous exposure for very brief periods.
1. Involves an extremely low degree of discomfort. Safe conditions with no exposure to health or safety hazards.

FACTOR 15. JOB FAMILIARITY

**Definition.** The degree of your familiarity with the jobs evaluated. Consider the level of acquaintance or knowledge you possess concerning each job.

LEVEL:

9. Have an extremely high degree of familiarity. Work in the same career field and have knowledge of practically all the duties performed in this job.
8. Have a very high degree of familiarity. Work in closely related career area and have a substantial amount of knowledge concerning jobs of this type.
7. Have a high degree of familiarity. Work in a career area which frequently involves dealing with jobs in this career field.
6. Have a moderately high degree of familiarity. Have general knowledge about jobs in this career field.
5. Have a moderate degree of familiarity. Have some acquaintance with a few jobs in this career area.
4. Have a moderately low degree of familiarity. Have occasional contact with a few jobs in this or related career fields.
3. Have a low degree of familiarity. Have limited contact with jobs in this or related career fields.
2. Have a very low degree of familiarity. Have very little information concerning jobs in this or related career fields.
1. Have practically no information about jobs in this area except the data given in the job description.

*APPENDIX III.* SAMPLE COPY OF PAGE 4, AF FORM 1144 (AF AIRMAN JOB SURVEY)

## ASSIGNMENT INFORMATION

| LAST NAME | FIRST NAME | M.I. |
|---|---|---|
| DOE | JOHN | – |

**ORGANIZATION:** Hq X Aerosp Def Div

**BASE OR INSTALLATION:** XXX AFB, Colorado

**AF SERVICE NUMBER:** AF 0 0 0 0 0 0 0 0

**YOUR PRIMARY AFSC:** 7215 0

**MAJOR COMMAND:** AAC ACC [X] AFLC AFCS AFSC ATC AU CSAFA ESC HQ USAF MATS OAR PACAF SAC TAC USAFA USAFE USAFS

**UMD AUTHORIZED GRADE FOR YOUR POSITION** (24)

| | |
|---|---|
| OVERAGE | A |
| E-1 | 1 |
| E-2 | 2 |
| E-3 | 3 |
| E-4 | 4 |
| E-5 | [X] 5 |
| E-6 | 6 |
| E-7 | 7 |
| E-8 | 8 |
| E-9 | 9 |

**YOUR PRESENT GRADE** (25)

| | |
|---|---|
| E-1 | 1 |
| E-2 | 2 |
| E-3 | 3 |
| E-4 | 4 |
| E-5 | [X] 5 |
| E-6 | 6 |
| E-7 | 7 |
| E-8 | 8 |
| E-9 | 9 |

**GRADE OF YOUR IMMEDIATE SUPERVISOR** (26)

| | |
|---|---|
| E-2 | 2 |
| E-3 | 3 |
| E-4 | 4 |
| E-5 | 5 |
| E-6 | 6 |
| E-7 | 7 |
| E-8 | 8 |
| E-9 | 9 |
| W/O | 10 |
| 2/LT, 1/LT | [X] 11 |
| CAPT | 12 |
| MAJOR | 13 |
| L/C | 14 |
| COL | 15 |
| GEN | 16 |

**YOUR DUTY AFSC:** 7215 0

**TOTAL MONTHS IN YOUR DUTY AFSC (ENTRY PLUS FULLY QUALIFIED):** 45

**TOTAL MONTHS IN YOUR PRESENT JOB ASSIGNMENT:** 15

**TOTAL MONTHS IN YOUR PRESENT GRADE:** 19

**LEVEL OF YOUR ORGANIZATION** (43)

| | |
|---|---|
| COD, HQ USAF | |
| HQ MAJ AIR COMD | |
| NUMBERED AF (OR EQUIV) | |
| AIR DIVISION (OR EQUIV) | [X] |
| WING (OR EQUIV) | |
| GROUP (OR EQUIV) | 4 |
| SQUADRON (OR EQUIV) | |
| DETACHMENT (OR EQUIV) | |
| OTHER (SPECIFY) | |

**LEVEL OF YOUR JOB WITHIN YOUR ORGANIZATION** (44)

| | |
|---|---|
| COMMAND ELEMENT | |
| DIRECTORATE, DEPT, OFFICE (OR EQUIV) | [X] |
| DIVISION (OR EQUIV) | |
| BRANCH (OR EQUIV) | 4 |
| SECTION (OR EQUIV) | |
| UNIT (OR EQUIV) | |
| OTHER (SPECIFY) | |

**HIGHEST LEVEL OF YOUR EDUCATION** (45)

| | |
|---|---|
| NON-HIGH SCHOOL GRAD | [X] |
| HIGH SCHOOL GRAD | |
| 1 YEAR COLLEGE | |
| 2 YEARS COLLEGE | 4 |
| 3 YEARS COLLEGE | |
| BACHELOR'S DEGREE | |
| SOME POST-GRAD WORK | |
| MASTER'S DEGREE | |
| DOCTORAL DEGREE | |

**YOUR MAJOR FIELD OF STUDY** (46)

| | |
|---|---|
| EDUCATION | |
| PHYSICAL SCIENCE | |
| ARTS, HUMANITIES | |
| ENGINEERING | |
| BUSINESS, MANAGEMENT | |
| MEDICAL, LEGAL | |
| SOCIAL SCIENCE | |
| MILITARY SCIENCE | |
| OTHER (SPECIFY) | |

**SUPERVISOR'S JUDGMENT OF MOST APPROPRIATE GRADE FOR THIS JOB** (47)

| | |
|---|---|
| E-1 | 1 |
| E-2 | 2 |
| E-3 | 3 |
| E-4 | 4 |
| E-5 | [X] 5 |
| E-6 | 6 |
| E-6 | 7 |
| E-8 | 8 |
| E-9 | 9 |
| OFFICER | 10 |

**COMPLETED BY:**

| S/ John Doe | XX XXXX | 1 Jan 64 |
|---|---|---|
| SIGNATURE | DUTY PHONE | DATE |

**REVIEWED BY:** *SUPERVISOR CHECK ONE* ▸

| S/ Joe Doeks | 7924 | 1 Jan 64 |
|---|---|---|
| SIGNATURE OF IMMEDIATE SUPERVISOR | DAFSC | DATE |



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*APPENDIX IV.* RATER INFORMATION SHEET AND ABBREVIATED VERSION OF INSTRUCTIONS USED TO COLLECT GRADE AND PAY CRITERION OBSERVATIONS

## RATER INFORMATION SHEET

| AIRMAN JOB EVALUATION STUDY | DATE | CASE CONTROL NUMBER (1-4) (LEAVE BLANK) |
|---|---|---|

LAST NAME – FIRST NAME – MIDDLE INITIAL

PRESENT GRADE (5)

7 M/SGT □ 8 SM/SGT □ 9 CM/SGT □ 2 LT □ 3 CAPT □ 4 MAJ □ 5 LT COL □

AIR FORCE SERVICE NUMBER
PREFIX (7-8) NUMBER (9-16)

PRIMARY AFSC
PREFIX (18) NUMBER (19-23) SUFFIX (24)

ORGANIZATION

DUTY AFSC
PREFIX (25) NUMBER (26-30) SUFFIX (31)

BASE OR INSTALLATION (32-35)

DUTY PHONE NUMBER

PREFERRED MAILING ADDRESS

WHEN DID YOU MAKE YOUR RATINGS?
PRIMARILY DURING DUTY HOURS 1 □
PRIMARILY AFTER DUTY HOURS 2 □ (36)

AREA
DO NOT WRITE IN THIS SPACE (37-38)

HOW MUCH TIME DID YOU SPEND MAKING YOUR RATINGS?
TOTAL NUMBER OF MINUTES (39-41)

DUTY TITLE

MAJOR AIR COMMAND (6)

| | | | |
|---|---|---|---|
| AAC | □ | A | |
| ACIC | □ | G | |
| ADC | □ | C | |
| AFAFC | □ | E | |
| AFCS | □ | Y | |
| AFLC | □ | F | |
| AFSC | □ | H | |
| ATC | □ | J | |
| AU | □ | K | |
| CONAC | □ | M | |
| HQ COMD | □ | P | |
| HQ USAF | □ | N | |
| MAC | □ | Q | |
| OAR | □ | X | |
| PACAF | □ | R | |
| SAC | □ | S | |
| TAC | □ | T | |
| USAFA | □ | B | |
| USAFE | □ | D | |
| USAFSO | □ | L | |
| USAFSS | □ | U | |

REMARKS

(SIGNATURE)

AFPT 80-042, 1 Apr 66

(See reverse side for Job Evaluation Report)

Appendix IV. *(Continued)*

## ABBREVIATED VERSION OF INSTRUCTIONS USED TO COLLECT GRADE AND PAY OBSERVATIONS

You have been provided the following materials: (1) a folder containing 20 airman job descriptions, (2) a Job Information Sheet, (3) a Job Evaluation Report, (4) ~~a sheet with descriptions of 5 job requirement factors~~, (5) a Rater Information Sheet, and (6) a return envelope addressed to PRL.

Successful completion of the project is dependent on prompt action from each participant. You are asked to return your completed materials within 5 working days.

Please perform the following 7 steps. It is important that you proceed with each step in the order listed.

Step 1. Fill in the Rater Information Sheet.

Step 2. Read the 20 job descriptions. It is essential that you acquaint yourself with all 20 job descriptions before you make any ratings. Notice each job description is identified by a 4-digit number written at the top of the page. This number is also typed on the Job Evaluation Report. The numbers on the Job Evaluation Report are in exactly the same order as the job descriptions in your folder.

The 20 job descriptions are the primary source of information on which to base your judgments. The inclosed Job Information Sheet lists the organization, base or installation, level of organization, job level within the organization, and major air command for each of the 20 jobs. You may also use additional sources such as AFM 39-1, or other persons with specialized knowledge of a particular job. However, all ratings must reflect your personal estimates.

Step 3. Enter your name on the Job Evaluation Report. Then read the grade level scale. You are to use the 1 to 9 grade code in recording your judgment of the most appropriate grade level for each of the 20 jobs. To do this, re-read the first job description, judge the most appropriate grade level, and record the code number in the Grade Code block. Then proceed to judge the grade of the second job description, and so on until you have recorded a grade code for each of the 20 jobs.

Do not try to make your ratings conform to any preconceived notion of what the distribution of grades should be. Rate each job on its own merits. Your grade rating should be based on all information in the job description and not necessarily the job title.

Steps 4 & 5. These steps omitted since the data were applicable to the present study. Step 4 was concerned with rater confidence in grade ratings. Step 5 involved five experimental job requirement factors.

Step 6. Rank the 20 jobs according to the pay each job merits. Find the job which you believe should be paid the most and enter a 1 in the Pay Rank column opposite that job. Enter a 2 in the Pay Rank column opposite the job you believe should receive the next highest pay. Continue this ranking until you have entered a 20 opposite the job which you feel should be paid the least amount.

Step 7. After you have finished your ratings and ranking of the 20 jobs, check your Job Evaluation Report to be sure your entries are legible and that all blocks are filled. Place all materials in the addressed envelope and return everything to the Personnel Research Laboratory.

**Note:** For the 9-point grade rating scale, 9 = CMSGT, 8 = SMSGT, 7 = MSGT, 6 = TSGT, 5 = SSGT, 4 = A1C, 3 = A2C, 2 = A3C, 1 = AB.

## APPENDIX V. INSTRUCTIONS AND JOB EVALUATION REPORT FORM USED TO COLLECT RATINGS FOR JOB REQUIREMENT FACTOR SETS A AND B

### INTRODUCTION

As you were recently informed, the Air Force is developing a comprehensive program for scientifically determining the most appropriate airman grade structure. The study in which you have agreed to participate is part of an effort to improve the job evaluation methods prescribed in AFM 35-2. This project is approved by Hq USAF (AFPDP-4) and is being conducted by the Personnel Research Laboratory (AFPT 80-070 dtd 1 Nov 65).

### INSTRUCTIONS

The objective of the present study is to determine the most efficient set of job requirement factors for evaluating airman jobs. Briefly, you are requested to rate certain airman jobs on 10 job requirement factors. For this purpose, you have been provided the following materials: (1) a Rater Information Sheet and Job Evaluation Report, (2) a folder containing 20 airman job descriptions, (3) a Job Information Sheet, (4) a list of Job Requirement Factors, and (5) a return envelope addressed to the Personnel Research Laboratory.

Successful completion of this project depends on prompt action from each participant. You are asked to complete and return the inclosed material within **five working days.**

Please perform the following five steps **in the order listed.**

**Step 1.** Fill in the Rater Information Sheet.

**Step 2.** Read the 20 job descriptions. It is essential that you acquaint yourself with all 20 job descriptions before you make any ratings. Notice that each job description is identified by a 4-digit number at the top of the page. This number also appears on the Job Evaluation Report. The numbers on the Job Evaluation Report are listed in the same order as the job descriptions in your folder.

The 20 job descriptions are the primary source of information on which to base your judgments. The Job Information Sheet gives the organization, base or installation, level of organization, job level within the organization, and major air command, for each of the 20 jobs. You may also use additional sources such as AFM 39-1, or other persons with specialized knowledge of a particular job. However, all ratings must reflect your personal estimates.

**Step 3.** Read the ten job requirement factors on the inclosed list. Each factor consists of a definition and nine levels describing various amounts or degrees of that factor. You are to rate each job description on each factor, using the 9-point rating scale. Rate each job on its own merits. Your ratings should be based on all information in the job description and not merely on the job titles.

**Step 4.** Look at the Job Evaluation Report which is on the **reverse side** of the Rater Information Sheet. You are now ready to judge the appropriate factor level for each job, and record the level number of your judgment on the Job Evaluation Report.

First, rate all 20 jobs on Factor 1. Second, rate all 20 jobs on Factor 2. Continue rating all 20 jobs on one factor at a time, until you have used all 10 factors to rate all 20 jobs.

**Step 5.** After you have finished your ratings of the 20 jobs on the ten factors, check your Job Evaluation Report to be sure your entries are legible and that all blocks are filled. Enter the time spent making your ratings on the Rater Information Sheet, and review all documents for completeness. Place all materials in the addressed envelope and return everything to the Personnel Research Laboratory

Thank you for your participation in this project.

Appendix V. *(Continued)*

| JOB EVALUATION REPORT | FOLDER NUMBER 10 |
|---|---|

To complete this form, follow these steps:

Read the 20 job descriptions

Read the 10 job requirement factors

First, rate all 20 jobs on Factor 1. Second, rate all 20 jobs on Factor 2, etc.

Check this report to insure all blocks are filled

| JOB NUMBER | FACTOR NUMBER | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 0888 | | | | | | | | | | |
| 0341 | | | | | | | | | | |
| 0348 | | | | | | | | | | |
| 0911 | | | | | | | | | | |
| 0912 | | | | | | | | | | |
| 0482 | | | | | | | | | | |
| 0373 | | | | | | | | | | |
| 0879 | | | | | | | | | | |
| 0254 | | | | | | | | | | |
| 0966 | | | | | | | | | | |
| 0838 | | | | | | | | | | |
| 0869 | | | | | | | | | | |
| 0732 | | | | | | | | | | |
| 0651 | | | | | | | | | | |
| 0946 | | | | | | | | | | |
| 0641 | | | | | | | | | | |
| 0725 | | | | | | | | | | |
| 0634 | | | | | | | | | | |
| 0317 | | | | | | | | | | |
| 0549 | | | | | | | | | | |

## *APPENDIX VI.* SOURCES, SCORE RANGES, AND DESCRIPTIVE STATISTICS FOR VARIABLES USED IN REGRESSION ANALYSES

| Source | Variable Number | Variable Description | Score Range | Mean | S.D. |
|---|---|---|---|---|---|
| Criterion Data (See Hazel & Cowan, 1965; App IV) | 1 | Merited Grade Rating | 1, 2, . . ., 9 | 5.62 | 1.81 |
| | 2 | Merited Pay Rank | 1, 2, . . ., 20 | 10.49 | 5.76 |
| Job Requirement Factors, Set A (See App II; App V) | 3 | Factor A1—Knowledge | 1, 2, . . ., 9 | 5.62 | 1.75 |
| | 4 | Factor A2—Dexterity, Coordination, & Discrimination | 1, 2, . . ., 9 | 4.93 | 1.91 |
| | 5 | Factor A3—Adaptability & Resourcefulness | 1, 2, . . ., 9 | 5.19 | 1.87 |
| | 6 | Factor A4—Responsibility for Money and Materials | 1, 2, . . ., 9 | 5.37 | 2.08 |
| | 7 | Factor A5—Decision Making | 1, 2, . . ., 9 | 4.60 | 1.93 |
| | 8 | Factor A6—Supervision | 1, 2, . . ., 9 | 4.23 | 2.39 |
| | 9 | Factor A7—Communication | 1, 2, . . ., 9 | 4.41 | 2.12 |
| | 10 | Factor A8—Contact with Others | 1, 2, . . ., 9 | 5.14 | 2.04 |
| | 11 | Factor A9—Working Conditions (Without Hazards) | 1, 2, . . ., 9 | 2.72 | 1.97 |
| | 12 | Factor A10—Risk | 1, 2, . . ., 9 | 2.70 | 2.19 |
| Job Requirement Factors, Set B (See App II; App V) | 13 | Factor B1—Special Training and Work Experience | 1, 2, . . ., 9 | 5.16 | 2.07 |
| | 14 | Factor B2—Dexterity, Coordination, & Discrimination | 1, 2, . . ., 9 | 5.04 | 1.91 |
| | 15 | Factor B3—Adaptability & Resourcefulness | 1, 2, . . ., 9 | 5.05 | 1.91 |
| | 16 | Factor B4—Responsibility for Money and Materials | 1, 2, . . ., 9 | 5.51 | 2.00 |
| | 17 | Factor B5—Decision Making | 1, 2, . . ., 9 | 4.66 | 1.93 |
| | 18 | Factor B6—Supervision | 1, 2, . . ., 9 | 4.18 | 2.37 |
| | 19 | Factor B7—Job Criticality | 1, 2, . . ., 9 | 5.19 | 2.12 |
| | 20 | Factor B8—Attention | 1, 2, . . ., 9 | 5.29 | 1.55 |
| | 21 | Factor B9—Working Conditions (With Hazards) | 1, 2, . . ., 9 | 2.86 | 2.12 |
| | 22 | Factor B10—Job Familiarity | 1, 2, . . ., 9 | 4.28 | 2.34 |
| Job Requirement Factors Common to Sets A and B (combined) | 23 | Factor A2, B2—Dexterity, Coordination & Discrimination | 1, 2, . . ., 9 | 4.99 | 1.91 |
| | 24 | Factor A3, B3—Adaptability & Resourcefulness | 1, 2, . . ., 9 | 5.12 | 1.89 |
| | 25 | Factor A4, B4—Responsibility for Money and Materials | 1, 2, . . ., 9 | 5.44 | 2.04 |
| | 26 | Factor A5, B5—Decision Making | 1, 2, . . ., 9 | 4.63 | 1.93 |
| | 27 | Factor A6, B6—Supervision | 1, 2, . . ., 9 | 4.21 | 2.38 |
| Job Description & Related Materials from AF Form 1144 (See Hazel & Cowan, 1965) | 28 | Job Description Length[a] | 1, 2, . . ., 9 | 2.76 | 1.57 |
| | 29 | Job-Requirements Description Length[b] | 1, 2, . . ., 5 | 2.89 | 1.29 |
| | 30 | Job Description Legibility | 1, 2 | 1.86 | .35 |
| | 31 | Job Description Jargon & Abbreviation[d] | 1, 2, 3 | 1.89 | .70 |
| | 32 | Job-Context Description Length[e] | 0, 1, 2 | 1.19 | .51 |
| Assignment Information from AF Form 1144 (See App III) | 33 | DMD-Authorized Grade for Incumbent of Job[f] | 1, 2, . . ., 9 | 5.46 | 1.80 |
| | 34 | Present Grade of Job Incumbent[g] | 1, 2, . . ., 9 | 5.07 | 1.79 |
| | 35 | Grade of Incumbent's Supervisor[h] | 2, 3, . . ., 16 | 6.83 | 4.12 |
| | 36 | Level of Organization Within Air Force[i] | 1, 2, . . ., 9 | 4.23 | 1.66 |
| | 37 | Level of Job Within Organization[j] | 1, 2, . . ., 7 | 3.33 | .96 |
| | 38 | Supervisor's Judgment of Appropriate Grade for Job[k] | 1, 2, . . ., 10 | 5.53 | 2.24 |
| Specialty Criticality Data (See Hook & Massar, 1965) | 39 | Criticality of Specialty[l] | 1, 2, . . ., 54 | 26.61 | 11.33 |

[a] Scoring: 1 (one paragraph) through 9 (two pages, or more).

[b] Scoring (estimated percentage of available space utilized): 1 (no entry) through 5 (space completely filled).

[c] Scoring: 1 (handwritten); 2 (typed).

[d] Scoring: 1 (none); 2 (limited use); 3 (frequent or recurrent use).

[e] Scoring (estimated percentage of available space utilized): 0 (no entry); 1 (brief statement); 2 (extensive description).

[f] Scoring: 1 (E-1, AB) through 9 (E-9, SMSgt).

[g] Scoring: 1 (E-1, AB) through 9 (E-9, SMSgt).

[h] Scoring: 2 (E-2, A3C), . . ., 9 (E-9, SMSgt), 10 (Warrant Officer), 11 (2d Lt or 1st Lt), . . ., 16 (General).

[i] Scoring: 9 (DOD or Hq USAF); 8 (Hq Major Air Comd); 7 (Numbered AF or equiv); 6 (Air Division or equiv); 5 (Wing or equiv); 4 (Group or equiv); 3 (Squadron); 2 (Detachment or equiv); 1 (Other).

[j] Scoring: 7 (Command element); 6 (Directorate, Department, Office, or equiv); 5 (Division or equiv); 4 (Branch or equiv); 3 (Section or equiv); 2 (Unit or equiv); 1 (Other).

[k] Scoring: 1 (E-1, AB), 2 (E-2, A3C), . . ., 9 (E-9, SMSgt), 10 (Officer).

[l] Scores for the 200 jobs are mean rank values for the duty specialties of job incumbents. These values were extracted from a study (Hook & Massar, 1965) in which the relative contributions of 243 airman specialties to accomplishment of the Air Force mission were established on the basis of the judgments of a representative sample of 300 officers. Each judge ranked 54 specialties, and mean rank values for each specialty were based on approximately 6[illegible] rankings per specialty.

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*Appendix VII.* **Regression Problems Computed to Derive Airman Grade and Pay Policy Equations**

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 1 | | | | | | |
| 1 | 201 | 38 | 2–39 | Full Model: In Problem 1, merited pay, all Factor Set A, all Factor Set B, 5 combined Common Factors, all Description Format variables, all Asgn Info variables, Specialty Criticality; in Problem 201, merited grade, all Factor Set A, all Factor Set B, 5 combined Common Factors, all Description Format variables, all Asgn Info variables, Specialty Criticality | .97 | .96 |
| 2 | 202 | 37 | 3–39 | In Problem 2, variables considered in Problem 1 excluding merited pay; in Problem 202, variables considered in Problem 201 excluding merited grade | .95 | .94 |
| 3 | 203 | 25 | 3–27 | All Factor Set A, all Factor Set B, 5 combined Common Factors | .95 | .94 |
| 4 | 204 | 20 | 3–22 | All Factor Set A, all Factor Set B | .95 | .94 |
| 5 | 205 | 10 | 3–12 | All Factor Set A | .92 | .92 |
| 6 | 206 | 10 | 13–22 | All Factor Set B | .93 | .90 |
| 7 | 207 | 15 | 3, 9–13, 19–27 | 5 Unique Factors in Set A, 5 Unique Factors in Set B, 5 combined Common Factors | .95 | .93 |
| 8 | 208 | 5 | 23–27 | 5 combined Common Factors | .91 | .91 |
| 9 | 209 | 12 | 28–39 | All Description Format variables, all Asgn Info variables, Specialty Criticality | .73 | .65 |
| 10 | 210 | 12 | 3, 9–13, 20, 23–27 | 1st intuitive estimate of "best" set of factors for efficient prediction: 5 Unique Factors in Set A, Unique Factor B8–Attention, 5 combined Common Factors | .95 | .93 |

APPENDIX VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 | | | | | | |
| 11 | 211 | 5 | 4–8 | 5 Common Factors in Set A | .88 | .89 |
| 12 | 212 | 4 | 5–8 | 4 Common Factors in Set A (Common Factor A2–Dexterity, Coordination, & Discrimination, omitted) | .87 | .89 |
| 13 | 213 | 5 | 14–18 | 5 Common Factors in Set B | .89 | .88 |
| 14 | 214 | 4 | 15–18 | 4 Common Factors in Set B (Common Factor B2–Dexterity, Coordination, & Discrimination, omitted) | .89 | .88 |
| 15 | 215 | 4 | 24–27 | 4 combined Common Factors (combined Common Factor A2, B2–Dexterity, Coordination, & Discrimination, omitted) | .90 | .91 |
| 16 | 216 | 7 | 9, 13, 26–27, 36–38 | Unique Factor B1–Special Training & Work Experience and predictors similar to those in OGR equation: Unique Factor A7–Communication, combined Common Factor A5, B5–Decision Making, combined Common Factor A6, B6–Supervision, Level of Organization, Level of Job Within Organization, Supervisor's Judgment of Grade | .94 | .92 |
| 17 | 217 | 6 | 9, 13, 26–27, 36–37 | Variables considered in Problems 16 and 216 excluding Supervisor's Judgment of Grade | .94 | .92 |
| 18 | 218 | 5 | 9, 13, 26–27, 36 | Variables considered in Problems 17 and 217 excluding Level of Job Within Organization | .94 | .92 |
| 19 | 219 | 4 | 9, 13, 26–27 | Variables considered in Problems 18 and 218 excluding Level of Organization | .94 | .92 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 20 | 220 | 7 | 3, 9, 26–27, 36–38 | Unique Factor A1–Knowledge and predictors similar to those in OGR equation: Unique Factor A7–Communication, combined Common Factor A5, B5–Decision Making, combined Common Factor A6, B6–Supervision, Level of Organization, Level of Job Within Organization, Supervisor's Judgment of Grade | .94 | .93 |
| 21 | 221 | 6 | 3, 9, 26–27, 36–37 | Variables considered in Problems 20 and 220 excluding Supervisor's Judgment of Grade | .94 | .93 |
| 22 | 222 | 5 | 3, 9, 26–27, 36 | Variables considered in Problems 21 and 221 excluding Level of Job Within Organization | .94 | .93 |
| 23 | 223 | 4 | 3, 9, 26–27 | Variables considered in Problems 22 and 222 excluding Level of Organization | .93 | .93 |
| 24 | 224 | 5 | 28–32 | All Description Format variables: Job Description Length, Job Requirements Length, Job Description Legibility, Job Description Jargon & Abbrevs, Job Context Length | .25 | .23 |
| 25 | 225 | 4 | 29–32 | Variables considered in Problems 24 and 224 excluding Job Description Length | .17 | .17 |
| 26 | 226 | 3 | 30–32 | Variables considered in Problems 25 and 225 excluding Job Requirements Length | .07 | .05 |
| 27 | 227 | 3 | 28–29, 32 | Variables considered in Problems 26 and 226 excluding Job Description Jargon & Abbrevs | .22 | .21 |
| 28 | 228 | 2 | 30–31 | Job Description Legibility, Job Description Jargon & Abbrevs | .07 | .05 |
| 29 | 229 | 7 | 33–39 | Specialty Criticality and all Asgn Info variables: UMD Grade, Present Grade of Incumbent, Grade of Supervisor, Level of Organization, Level of Job Within Organization, Supervisor's Judgment of Grade | .68 | .59 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 30 | 230 | 6 | 34–39 | Variables considered in Problems 29 and 229 excluding UMD Grade | .65 | .57 |
| 31 | 231 | 5 | 35–39 | Variables considered in Problems 30 and 230 excluding Present Grade of Incumbent | .41 | .38 |
| 32 | 232 | 4 | 36–39 | Variables considered in Problems 31 and 231 excluding Grade of Supervisor | .39 | .37 |
| 33 | 233 | 3 | 37–39 | Variables considered in Problems 32 and 232 excluding Level of Organization | .34 | .34 |
| 34 | 234 | 2 | 38–39 | Variables considered in Problems 33 and 233 excluding Level of Job Within Organization | .30 | .32 |
| 35 | 235 | 6 | 33–38 | All Asgn Info variables: UMD Grade, Present Grade of Incumbent, Grade of Supervisor, Level of Organization, Level of Job Within Organization, Supervisor's Judgment of Grade (Variables considered in Problems 29 and 229 excluding Specialty Criticality) | .66 | .56 |
| 36 | 236 | 3 | 36–38 | Variables considered in Problems 35 and 235 excluding Present Grade of Incumbent and Grade of Supervisor | .34 | .28 |
| 37 | 237 | 2 | 36–37 | Level of Organization, Level of Job Within Organization | .17 | .11 |
| 38 | 238 | 2 | 36, 38 | Level of Organization, Supervisor's Judgment of Grade | .33 | .28 |
| 39 | 239 | 2 | 37–38 | Level of Job Within Organization, Supervisor's Judgment of Grade | .29 | .26 |
| 40 | 240 | 2 | 12, 21 | Set A and Set B Factors with $R_{11} >$ .55: Unique Factors A10–Risk, B9–Working Conditions (With Hazards) | .03 | .01 |
| 41 | 241 | 6 | 8–9, 11–12, 18, 21 | Set A and Set B Factors with $R_{11} \geq$ .50 (See Table 4) | .90 | .84 |
| 42 | 242 | 10 | 3, 8–13, 18–19, 21 | Set A and Set B Factors with $R_{11} \geq$ .45 (See Table 4) | .94 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 43 | 243 | 12 | 3, 8–13, 16–19, 21 | Set A and Set B Factors with $R_{11} \geq .40$ (See Table 4) | .94 | .93 |
| 44 | 244 | 15 | 3, 6–13, 15–19, 21 | Set A and Set B Factors with $R_{11} \geq .35$ (See Table 4) | .94 | .93 |
| 45 | 245 | 18 | 3–13, 15–21 | Set A and Set B Factors with $R_{11} > .30$ (See Table 4) | .94 | .93 |
| 46 | 246 | 19 | 3–13, 15–22 | Factors considered in Problems 45 and 245, also Unique Factor B10–Job Familiarity | .95 | .93 |
| 47 | 247 | 10 | 4–7, 14–17, 20, 22 | Set A and Set B Factors with $R_{11} < .45$ (See Table 4) | .82 | .80 |
| 48 | 248 | 5 | 4–5, 14, 20, 22 | Set A and Set B Factors with $R_{11} < .35$ (See Table 4) | .52 | .50 |
| 49 | 249 | 8 | 4–7, 14–15, 20, 22 | Set A and Set B Factors with $R_{11} < .40$ (See Table 4) | .75 | .75 |
| 50 | 250 | 14 | 3–7, 10, 13–17, 19–20, 22 | Set A and Set B Factor with $R_{11} < .50$ (See Table 4) | .92 | .91 |
| 51 | 251 | 18 | 3–11, 13–20, 22 | Set A and Set B Factors with $R_{11} < .55$ (See Table 4) | .95 | .93 |
| 52 | 252 | 2 | 26–27 | 2 combined Common Factors with highest $R_{11}$ coefficients: A5, B5–Decision Making, A6, B6–Supervision | .90 | .90 |
| 53 | 253 | 3 | 25–27 | 3 combined Common Factors with highest $R_{11}$ coefficients: Factors considered in Problems 52 and 252, also A4, B4–Responsibility for Money & Materials | .90 | .90 |
| 54 | 254 | 2 | 23–24 | 2 combined Common Factors with lowest $R_{11}$ coefficients: A2, B2–Dexterity, Coordination, & Discrimination, A3, B3–Adaptability & Resourcefulness | .77 | .78 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 55 | 255 | 3 | 23–25 | 3 combined Common Factors with lowest $R_{11}$ coefficients: Factors considered in Problems 54 and 254, also A4, B4–Responsibility for Money & Materials | .78 | .80 |
| 56 | 256 | 3 | 24–26 | 3 of 5 combined Common Factors (excluding those with highest and lowest $R_{11}$ coefficients): A3, B3–Adaptability & Resourcefulness, A4, B4–Responsibility for Money & Materials, A5, B5–Decision Making | .81 | .84 |
| 57 | 257 | 11 | 3, 9–12, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factor B1–Special Training & Work Experience | .94 | .93 |
| 58 | 258 | 11 | 9–13, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factor A1–Knowledge | .94 | .92 |
| 59 | 259 | 10 | 3, 9–10, 12, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factors A9–Working Conditions (Without Hazards), B1–Special Training & Work Experience | .94 | .93 |
| 60 | 260 | 10 | 3, 9–11, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factors A10–Risk, B1–Special Training & Work Experience | .94 | .93 |
| 61 | 261 | 10 | 3, 9–10, 20–21, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factors A9–Work Conditions (Without Hazards), A10–Risk, B1–Special Training & Work Experience, and adding Unique Factor B9–Working Conditions (With Hazards) | .94 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 62 | 262 | 9 | 3, 9–10, 20, 23–27 | Factors considered in Problems 61 and 261 excluding Unique Factor B9–Working Conditions (With Hazards) | .93 | .93 |
| 63 | 263 | 10 | 9–10, 12–13, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factors A1–Knowledge, A9–Working Conditions (Without Hazards) | .94 | .92 |
| 64 | 264 | 7 | 9–10, 12–13, 20, 23–24 | Factors considered in Problems 63 and 263 excluding combined Common Factors A4, B4–Responsibility for Money & Materials, A5, B5–Decision Making, A6, B6–Supervision | .91 | .89 |
| 65 | 265 | 9 | 9–10, 13, 20, 23–27 | Estimated "best" factor set considered in Problems 10 and 210 excluding Unique Factors A1–Knowledge, A9–Working Conditions (Without Hazards), A10–Risk | .94 | .92 |
| 66 | 266 | 10 | 9–10, 13, 20–21, 23–27 | Factors considered in Problems 65 and 265, also Unique Factor B9–Working Conditions (With Hazards) | .94 | .92 |
| 67 | 267 | 8 | 3–7, 9–11 | Set A Factors considered in Problems 5 and 205 excluding 2 factors with highest SD: Unique Factor A10–Risk, Common Factor A6–Supervision (See Appendix VI) | .89 | .90 |
| 68 | 268 | 8 | 4, 6–12 | Set A Factors considered in Problems 5 and 205 excluding 2 factors with lowest SD: Unique Factors A1–Knowledge, A3–Adaptability & Resourcefulness (See Appendix VI) | .92 | .92 |
| 69 | 269 | 4 | 23–26 | Combined Common Factors considered in Problems 8 and 208 excluding factor with highest SD: A6, B6–Supervision (See Appendix VI) | .83 | .84 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 70 | 270 | 4 | 23, 25–27 | Combined Common Factors considered in Problems 8 and 208 excluding factor with lowest SD: A2, B2–Dexterity, Coordination, & Discrimination (See Appendix VI) | .90 | .91 |
| 71 | 271 | 3 | 23–24, 26 | Combined Common Factors excluding 2 factors with highest SD: A4, B4–Responsibility for Money & Materials, A6, B6–Supervision (See Appendix VI) | .83 | .84 |
| 72 | 272 | 3 | 25–27 | Combined Common Factors excluding 2 factors with lowest SD: A2, B2–Dexterity, Coordination, & Discrimination, A3, B3--Adaptability & Resourcefulness (See Appendix VI) | .90 | .90 |
| 73 | 273 | 2 | 23–24 | Combined Common Factors excluding 3 factors with highest SD: A4, B4–Responsibility for Money & Materials, A5, B5–Decision Making, A6, B6–Supervision (See Apprendix VI) | .77 | .78 |
| 74 | 274 | 2 | 25, 27 | Combined Common Factors excluding 3 factors with lowest SD: A2, B2–Dexterity, Coordination, & Discrimination, A3, B3--Adaptability & Resourcefulness, A5, B5–Decision Making (See Appendix VI) | .84 | .83 |
| 75 | 275 | 2 | 13, 27 | First 2 factors to enter iterative solution of Problem 7 | .92 | .90 |
| 76 | 276 | 3 | 9, 13, 27 | First 3 factors to enter iterative solution of Problem 7 | .94 | .90 |
| 77 | 277 | 4 | 9, 13, 26–27 | First 4 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .94 | .92 |
| 78 | 278 | 5 | 9, 11, 13, 26–27 | First 5 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .94 | .92 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 79 | 279 | 6 | 9, 11, 13, 25–27 | First 6 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity exluded) | .94 | .92 |
| 80 | 280 | 7 | 9–11, 13, 25–27 | First 7 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .94 | .92 |
| 81 | 281 | 8 | 3, 9–11, 13, 25–27 | First 8 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .94 | .93 |
| 82 | 282 | 9 | 3, 9–11, 13, 24–27 | First 9 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .95 | .93 |
| 83 | 283 | 10 | 3, 9–11, 13, 19, 24–27 | First 10 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .95 | .93 |
| 84 | 284 | 11 | 3, 9–11, 13, 19, 23–27 | First 11 factors to enter iterative solution of Problem 7 (Unique Factor B10–Job Familiarity excluded) | .95 | .93 |
| 85 | 285 | 12 | 3, 9–13, 19, 23–27 | Factors considered in Problems 84 and 284, also Unique Factor A10–Risk (zero wgt) | .95 | .93 |
| 86 | 286 | 13 | 3, 9–13, 19–20, 23–27 | Factors considered in Problems 85 and 285, also Unique Factor B8–Attention (zero wgt) | .95 | .93 |
| 87 | 287 | 14 | 3, 9–13, 19–21, 23–27 | Factors considered in Problems 86 and 286, also Unique Factor B9–Working Conditions (With Hazards) (zero wgt) | .95 | .93 |
| 88 | 288 | 9 | 3, 11–12, 20, 23–27 | Air Force factors selected as similar to those used by other military services (See Rose, 1966) | .93 | .93 |
| 89 | 289 | 8 | 11–12, 20, 23–27 | Factors considered in Problems 88 and 288 excluding Unique Factor A1–Knowledge | .92 | .91 |
| 90 | 290 | 7 | 12, 20, 23–27 | Factors considered in Problems 89 and 289 excluding Unique Factor A9–Working Conditions (Without Hazards) | .92 | .91 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 91 | 291 | 6 | 20, 23–27 | Factors considered in Problems 90 and 290 excluding Unique Factor A10–Risk | .91 | .91 |
| 92 | 292 | 1 | 13 | Uncombined Factor with highest validity coefficient for grade criterion: Unique Factor B1–Special Training & Work Experience (See Table 6) | .87 | .87 |
| 93 | 293 | 2 | 12–13 | Unique Factors B1–Special Training & Work Experience, A10–Risk (Selected for low correlation with Factor B1) | .88 | .87 |
| 94 | 294 | 2 | 11, 13 | Unique Factors B1–Special Training & Work Experience, A9–Working Conditions (Without Hazards) (Selected for low correlation with Factor B1) | .88 | .87 |
| 95 | 295 | 3 | 11–13 | Unique Factors B1–Special Training & Work Experience, A10–Risk, A9–Working Conditions (Without Hazards) (See Problems 93, 94 and 293, 294) | .88 | .87 |
| 96 | 296 | 2 | 4, 13 | Unique Factor B1–Special Training & Work Experience, Common Factor A2–Dexterity, Coordination, & Discrimination (Selected for low correlation with Factor B1) | .88 | .87 |
| 97 | 297 | 3 | 4, 12–13 | Unique Factors B1–Special Training & Work Experience, A10–Risk, Common Factor A2–Dexterity, Coordination, & Discrimination (See Problems 93 and 293) | .88 | .87 |
| 98 | 298 | 3 | 4, 11, 13 | Unique Factors B1–Special Training & Work Experience, A9–Working Conditions (Without Hazards), Common Factor A2–Dexterity, Coordination, & Discrimination (See Problems 94 and 294) | .88 | .87 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 99 | 299 | 4 | 4, 11–13 | Unique Factors B1–Special Training & Work Experience, A9–Working Conditions (Without Hazards), A10–Risk, Common Factor A2–Dexterity, Coordination, & Discrimination (See Problems 98 and 293) | .88 | .87 |
| 100 | 300 | 6 | 4, 6, 11–14 | Unique Factors B1–Special Training & & Work Experience, A9–Working Conditions (Without Hazards), A10–Risk, Common Factors A4–Responsibility for Money & Materials, A2– also B2–Dexterity, Coordination, & Discrimination | .89 | .88 |
| 101 | 301 | 1 | 18 | Uncombined Factor with second highest validity coefficient for grade criterion: Common Factor B6–Supervision (See Table 6) | .82 | .77 |
| 102 | 302 | 2 | 4, 18 | Common Factors B6–Supervision, A2–Dexterity, Coordination, & Discrimination | .83 | .81 |
| 103 | 303 | 2 | 12, 18 | Common Factor B6–Supervision, Unique Factor A10–Risk | .82 | .77 |
| 104 | 304 | 2 | 14, 18 | Common Factors B6–Supervision, B2–Dexterity, Coordination, & Discrimination (See Problems 102 and 302) | .82 | .81 |
| 105 | 305 | 3 | 4, 11, 18 | Common Factors B6–Supervision, A2–Dexterity, Coordination, & Discrimination, Unique Factor A9–Working Conditions (Without Hazards) (See Problems 102 and 302) | .85 | .82 |
| 106 | 306 | 3 | 11, 14, 18 | Common Factors B6–Supervision, B2–Dexterity, Coordination, & Discrimination, Unique Factor A9–Working Condition (Without Hazards) | .84 | .81 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 107 | 307 | 3 | 12, 14, 18 | Common Factors B6–Supervision, B2–Dexterity, Coordination, & Discrimination, Unique Factor A10–Risk (See Problems 104 and 304) | .84 | .81 |
| 108 | 308 | 3 | 4, 6, 18 | Common Factors B6–Supervision, A2–Dexterity, Coordination, & Discrimination, A4–Responsibility for Money & Materials | .83 | .82 |
| 109 | 309 | 3 | 6, 11, 18 | Common Factors B6–Supervision, A4–Responsibility for Money & Materials, Unique Factor A9–Working Conditions (Without Hazards) | .87 | .83 |
| 110 | 310 | 3 | 6, 12, 18 | Common Factors B6–Supervision, A4–Responsibility for Money & Materials, Unique Factor A10–Risk | .86 | .83 |
| 111 | 311 | 6 | 4, 6, 11–12, 14, 18 | Common Factors B6–Supervision, A4–Responsibility for Money & Materials, A2– also B2–Dexterity, Coordination, & Discrimination, Unique Factors A9–Working Conditions (Without Hazards), A10–Risk | .88 | .85 |
| 112 | 312 | 2 | 13, 18 | 2 uncombined Factors with highest validity coefficient for grade criterion: Common Factor B6–Supervision, Unique Factor B1–Special Training & Work Experience | .91 | .89 |
| 113 | 313 | 10 | 3, 9–10, 12–13, 21, 24–27 | PRL Judge 1: 10 factors with highest face validity for grade criterion | .94 | .93 |
| 114 | 314 | 10 | 3, 9–10, 12–13, 19–21, 24, 26 | PRL Judge 2: 10 factors with highest face validity for grade criterion | .93 | .92 |
| 115 | 315 | 10 | 3, 9–10, 13, 20, 22, 24–27 | PRL Judge 3: 10 factors with highest face value for grade criterion | .95 | .93 |
| 116 | 316 | 9 | 3, 9–10, 13, 20, 24–27 | Problems 115 and 315 excluding Unique Factor B10–Job Familiarity | .94 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 117 | 317 | 10 | 3, 9–10, 12–13, 19, 23–24, 26–27 | PRL Judge 4: 10 factors with highest face validity for grade criterion | .94 | .93 |
| 118 | 318 | 10 | 9–10, 13, 20–21, 23–27 | PRL Judge 5: 10 factors with highest face validity for grade criterion, including B1–Special Training & Work Experience | .94 | .92 |
| 119 | 319 | 10 | 3, 9–10, 20–21, 23–27 | PRL Judge 5: 10 factors with highest face validity for grade criterion, including A1–Knowledge | .94 | .93 |
| 120 | 320 | 10 | 9–13, 20, 24–27 | PRL Judge 5: 10 factors with highest face validity for grade criterion, including B1–Special Training & Work Experience, A9–Working Conditions (Without Hazards), A10–Risk | .94 | .92 |
| 121 | 321 | 10 | 3, 9–12, 20, 24–27 | PRL Judge 5: 10 factors with highest face validity for grade criterion, including A1–Knowledge, A9–Working Conditions (Without Hazards), A10–Risk | .94 | .93 |
| 122 | 322 | 14 | 3, 9–10, 12–13, 19–27 | 14 factors with highest face validity, based on rank-order of means (See Table 5) | .95 | .93 |
| 123 | 323 | 13 | 3, 9–10, 12–13, 19–21, 23–27 | 13 factors with highest face validity, based on rank-order of means (See Table 5) | .94 | .93 |
| 124 | 324 | 12 | 3, 9–10, 12–13, 19–21, 24–27 | 12 factors with highest face validity, based on rank-order of means (See Table 5) | .94 | .93 |
| 125 | 325 | 11 | 3, 9–10, 12–13, 19–20, 24–27 | 11 factors with highest face validity, based on rank-order of means (See Table 5) | .94 | .93 |
| 126 | 326 | 10 | 3, 9–10, 12–13, 19, 24–27 | 10 factors with highest face validity, based on rank-order of means (See Table 5) | .94 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 127 | 327 | 9 | 3, 9–10, 13, 19, 24–27 | 9 factors with highest face validity based on rank-order of means (See Table 5) | .94 | .93 |
| 128 | 328 | 8 | 3, 9–10, 13 | 8 factors with highest face validity based on rank-order of means (See Table 5) | .94 | .93 |
| 129 | 329 | 7 | 3, 9–10, 13, 24, 26–27 | 7 factors with highest face validity based on rank-order of means (See Table 5) | .94 | .93 |
| 130 | 330 | 6 | 3, 9–10, 24 | 6 factors with highest face validity based on rank-order of means (See Table 5) | .93 | .93 |
| 131 | 331 | 5 | 3, 9, 24, 26–27 | 5 factors with highest face validity based on rank-order of means (See Table 5) | .93 | .93 |
| 132 | 332 | 4 | 3, 9, 26–27 | 4 factors with highest face validity based on rank-order of means (See Table 5) | .93 | .93 |
| 133 | 333 | 3 | 3, 26–27 | 3 factors with highest face validity based on rank-order of means (See Table 5) | .91 | .93 |
| 134 | 334 | 2 | 3, 26 | 2 factors with highest face validity based on rank-order of means (See Table 5) | .82 | .87 |
| 135 | 335 | 1 | 26 | A5, B5–Decision Making: Factor with the highest face validity, based on rank-order of means (See Table 5) | .81 | .84 |
| 136 | 336 | 14 | 3, 9–13, 19–21, 23–27 | 14 factors with highest face validity, based on rank-order of medians (See Problems 122 and 322) | .95 | .93 |
| 137 | 337 | 13 | 3, 9–10, 12–13, 19–21, 23–27 | 13 factors with highest face validity, based on rank-order of medians (See Problems 123 and 323) | .94 | .93 |
| 138 | 338 | 12 | 3, 9–10, 12–13, 19–20, 23–27 | 12 factors with highest face validity, based on rank-order of medians (See Problems 124 and 324) | .94 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 139 | 339 | 11 | 3, 9–10, 12–13, 19–20, 24–27 | 11 factors with highest face validity, based on rank-order of medians (See Problems 125 and 325) | .94 | .93 |
| 140 | 340 | 10 | 3, 9–10, 12–13, 20, 24–27 | 10 factors with highest face validity, based on rank-order of medians (See Problems 126 and 326) | .94 | .93 |
| 141 | 341 | 9 | 3, 9–10, 13, 20, 24–27 | 9 factors with highest face validity, based on rank-order of medians (See Problems 127 and 327) | .94 | .93 |
| 142 | 342 | 8 | 3, 9–10, 13, 24–27 | 8 factors with highest face validity, based on rank-order of medians (See Problems 128 and 328) | .94 | .93 |
| 143 | 343 | 7 | 3, 9–10, 24–27 | 7 factors with highest face validity, based on rank-order of medians (See Problems 129 and 329) | .93 | .93 |
| 144 | 344 | 6 | 3, 9–10, 24, 26–27 | 6 factors with highest face validity, based on rank-order of medians (See Problems 130 and 330) | .93 | .93 |
| 145 | 345 | 5 | 3, 9–10, 26–27 | 5 factors with highest face validity, based on rank-order of medians (See Problems 131 and 331) | .93 | .93 |
| 146 | 346 | 4 | 3, 9, 26–27 | 4 factors with highest face validity, based on rank-order of medians (See Problems 132 and 332) | .93 | .93 |
| 147 | 347 | 3 | 3, 26–27 | 3 factors with highest face validity, based on rank-order of medians (See Problems 133 and 333) | .91 | .93 |
| 148 | 348 | 2 | 3, 27 | 2 factors with highest face validity, based on rank-order of medians (See Problems 134 and 334) | .89 | .91 |
| 149 | 349 | 1 | 3 | A1–Knowledge: Factor with highest face validity, based on rank-order of medians (See Problems 135 and 335) | .68 | .77 |
| 150 | 350 | 16 | 9–13, 23–27, 33–38 | 2nd intuitive estimate of "best" 10 factors and all Asgn Info variables | .95 | .93 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 2 (*Continued*) | | | | | | |
| 151 | 351 | 15 | 9–13, 23–27, 34–38 | Variables considered in Problems 150 and 350 excluding UMD Grade | .95 | .93 |
| 152 | 352 | 14 | 9–13, 23–27, 35–38 | Variables considered in Problems 151 and 351 excluding Present Grade of Incumbent | .95 | .93 |
| 153 | 353 | 13 | 9–13, 23–27, 36–38 | Variables considered in Problems 152 and 352 excluding Grade of Supervisor | .95 | .93 |
| 154 | 354 | 12 | 9–13, 23–27, 37–38 | Variables considered in Problems 153 and 353 excluding Level of Organization | .95 | .93 |
| 155 | 355 | 11 | 9–13, 23–27, 38 | Variables considered in Problems 154 and 354 excluding Level of Job Within Organization | .94 | .92 |
| 156 | 356 | 10 | 9–13, 23–27 | Variables considered in Problems 150 and 350 excluding Asgn Info variables (See Problems 10 and 210) | .94 | .92 |
| Stage 3 | | | | | | |
| 157 | 357 | 26 | 3, 9–13, 19–20, 22–39 | 14 factors and Description Format, Asgn Info, and Specialty Criticality variables with positive or negative weights in Problems 2 and 202 | .95 | .94 |
| 158 | 358 | 25 | 9–13, 19–20, 22–39 | Variables considered in Problems 157 and 357 excluding A1–Knowledge | .95 | .93 |
| 159 | 359 | 11 | 9–10, 13, 20, 24–27, 36–38 | Intuitive estimate of "best" set of factors, based on predictive efficiency, face validity, and reliability data | .95 | .92 |
| 160 | 360 | 5 | 9, 13, 25–27 | 5 factors with consistently positive weights | .94 | .92 |
| 161 | 361 | 8 | 9–10, 13, 20, 24–27 | 5 factors with consistently positive weights, 3 factors with low or zero weights | .94 | .92 |
| 162 | 362 | 7 | 9, 13, 20, 24–27 | Variables considered in Problems 161 and 361 excluding A8–Contact with Others | .94 | .92 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 3 (*Continued*) | | | | | | |
| 163 | 363 | 7 | 9–10, 13, 20, 25–27 | Variables considered in Problems 161 and 361 excluding A3, B3–Adaptability & Resourcefulness | .94 | .92 |
| 164 | 364 | 7 | 9–10, 13, 24–27 | Variables considered in Problems 161 and 361 excluding B8–Attention | .94 | .92 |
| 165 | 365 | 8 | 9, 13, 25–27, 36–38 | 5 factors with consistently positive weights, also 3 Asgn Info variables (See Problems 160 and 360) | .94 | .92 |
| 166 | 366 | 9 | 9, 13, 24–27, 36–38 | Variables considered in Problems 165 and 365, also A3, B3–Adaptability & Resourcefulness | .94 | .92 |
| 167 | 367 | 9 | 9–10, 13, 25–27, 36–38 | Variables considered in Problems 165 and 365, also A8–Contact with Others | .95 | .92 |
| 168 | 368 | 9 | 9, 13, 20, 25–27, 36–38 | Variables considered in Problems 165 and 365, also B8–Attention | .94 | .92 |
| 169 | 369 | 9 | 9, 13, 23, 25–27, 36–38 | Variables considered in Problems 165 and 365, also A3, B3–Dexterity, Coordination, & Discrimination | .94 | .92 |
| 170 | 370 | 10 | 9, 13, 20, 24–27, 36–38 | Variables considered in Problems 159 and 359 excluding A8–Contact with Others | .94 | .92 |
| 171 | 371 | 10 | 9–10, 13, 20, 25–27, 36–38 | Variables considered in Problems 159 and 359 excluding A3, B3–Adaptability & Resourcefulness | .95 | .92 |
| 172 | 372 | 10 | 9–10, 13, 24–27, 36–38 | Variables considered in Problems 159 and 359 excluding B8–Attention | .95 | .92 |
| 173 | 373 | 12 | 9–10, 13, 19–20, 24–27, 36–38 | Variables considered in Problems 159 and 359, also B7–Job Criticality | .95 | .92 |
| 174 | 374 | 12 | 9–10, 13, 20, 22, 24–27, 36–38 | Variables considered in Problems 159 and 359, also B10–Job Familiarity | .95 | .92 |
| 175 | 375 | 9 | 9, 13, 25–27, 33, 36–38 | Variables considered in Problems 165 and 365, also UMD Grade | .95 | .92 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 3 (*Continued*) | | | | | | |
| 176 | 376 | 8 | 10–12, 19–20, 22–24 | Factors with low, zero, or negative weights | .84 | .82 |
| 177 | 377 | 7 | 10–11, 19–20, 22–24 | Variables considered in Problems 176 and 376 excluding A10–Risk | .83 | .82 |
| 178 | 378 | 12 | 9–11, 13, 22–23, 25–27, 36–38 | Variables considered in Problems 165 and 365, also A8–Contact with Others, A9–Working Conditions (Without Hazards), B10–Job Familiarity, A2, B2–Dexterity, Co-ordination, & Discrimination | .95 | .92 |
| 179 | 379 | 11 | 9–11, 13, 23, 25–27, 36–38 | Variables considered in Problems 178 and 378 excluding B10–Job Familiarity | .95 | .92 |
| 180 | 380 | 11 | 9–10, 13, 22–23, 25–27, 36–38 | Variables considered in Problems 178 and 378 excluding A9–Working Conditions (Without Hazards) | .95 | .92 |
| 181 | 381 | 13 | 9–11, 13, 19, 22–23, 25–27, 36–38 | Variables considered in Problems 178 and 378, also B7–Job Criticality | .95 | .92 |
| 182 | 382 | 10 | 9–10, 13, 20, 24, 26–27, 36–38 | Variables considered in Problems 159 and 359 excluding A4, B4–Responsibility for Money & Materials | .94 | .92 |
| 183 | 383 | 8 | 9, 11, 13, 19, 24–27 | Variables considered in Problems 160 and 360, also B7–Job Criticality, A3, B3–Adaptability & Resourcefulness A9–Working Conditions (Without Hazards) | .94 | .92 |
| 184 | 384 | 10 | 9, 11–13, 19–20, 24–27 | Variables considered in Problems 183 and 383, also A10–Risk, B8–Attention | .94 | .92 |
| 185 | 385 | 10 | 9, 11, 13, 19–20, 23–27 | Variables considered in Problems 183 and 383, also B8–Attention, A2, B2–Dexterity, Coordination, & Discrimination | .94 | .92 |

Appendix VII (*Continued*)

| Regression Problem No. for Criterion | | Number of Predictor Variables Considered | Predictor Variable Number[a] | Description of Model | $R^2$ for Criterion | |
|---|---|---|---|---|---|---|
| Grade | Pay | | | | Grade | Pay |
| Stage 4 | | | | | | |
| 186 | 386 | 12 | 3, 9, 13, 19, 25–27, 35–39 | Full Model: Variables considered in Problems 165 and 365, also A1–Knowledge, B7–Job Criticality, Grade of Supervisor, Specialty Criticality | .95 | .93 |
| 187 | 387 | 9 | 3, 9, 13, 25–27, 36–38 | Variables considered in Problems 165 and 365, also A1–Knowledge | .95 | .93 |
| 188 | 388 | 10 | 3, 9, 13, 19, 25–27, 36–38 | Variables considered in Problems 165 and 365, also A1–Knowledge, B7–Job Criticality | .95 | .93 |
| 189 | 389 | 10 | 3, 9, 13, 25–27, 35–38 | Variables considered in Problems 165 and 365, also A1–Knowledge, Grade of Supervisor | .95 | .93 |
| 190 | 390 | 10 | 3, 9, 13, 25–27, 36–39 | Variables considered in Problems 165 and 365, also A1–Knowledge, Specialty Criticality | .95 | .93 |
| 191 | 391 | 9 | 9, 13, 19, 25–27, 36–38 | Variables considered in Problems 165 and 365, also B7–Job Criticality | .94 | .92 |
| 192 | 392 | 9 | 9, 13, 25–27, 35–38 | Variables considered in Problems 165 and 365, also Grade of Supervisor | .94 | .92 |
| 193 | 393 | 9 | 9, 13, 25–27, 36–39 | Variables considered in Problems 165 and 365, also Specialty Criticality | .94 | .92 |
| 194 | 394 | 11 | 3, 9, 13, 19, 25–27, 35–38 | Variables considered in Problems 165 and 365, also A1–Knowledge, B7–Job Criticality, Grade of Supervisor ((See Problems 186 and 386) | .95 | .93 |
| 195 | 395 | 10 | 9, 13, 19, 25–27, 35–38 | Variables considered in Problems 165 and 365, also B7–Job Criticality, Grade of Supervisor | .94 | .92 |
| 196 | – | 8 | 3, 9, 13, 25–27, 36–37 | Final airman grade policy equation | .95 | – |
| – | 396 | 9 | 3, 9, 13, 25–27, 36–38 | Final airman pay policy equation | – | .93 |

[a] See Appendix VI for description of criterion and predictor variables including score range, mean, and standard deviation for each variable.

## *APPENDIX VIII.* RATER-GROUP DIFFERENCES IN PREDICTIVE EFFICIENCY LEVELS ($R^2$s) FOR SELECTED REGRESSION PROBLEMS

| Regression Problem No.[a, b] | $R^2$ for Rater Group | | | | Maximum $R^2$ Difference |
|---|---|---|---|---|---|
| | NCO | Lt | Capt | Maj/Lt Col | |
| 1 | .93 | .93 | .93 | .94 | .01 |
| 2 | .89 | .83 | .88 | .88 | .06 |
| 3 | .87 | .82 | .86 | .86 | .05 |
| 4 | .87 | .82 | .86 | .86 | .05 |
| 5 | .81 | .81 | .78 | .81 | .03 |
| 6 | .82 | .73 | .83 | .80 | .10 |
| 7 | .85 | .81 | .85 | .86 | .05 |
| 8 | .78 | .77 | .77 | .80 | .03 |
| 10 | .85 | .81 | .84 | .85 | .04 |
| 201 | .88 | .93 | .91 | .93 | .05 |
| 202 | .83 | .84 | .84 | .88 | .05 |
| 203 | .81 | .83 | .81 | .87 | .06 |
| 204 | .81 | .83 | .81 | .87 | .06 |
| 205 | .75 | .81 | .76 | .81 | .06 |
| 206 | .77 | .73 | .75 | .81 | .08 |
| 207 | .80 | .81 | .81 | .86 | .06 |
| 208 | .76 | .76 | .75 | .82 | .07 |
| 210 | .80 | .81 | .81 | .86 | .06 |

[a] See Appendix VII for explanation of problems.

[b] Problems 9 and 209 omitted because values for variables, e.g., job assignment information, were the same for all four rater groups.

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13. ABSTRACT

The purpose of this study was to develop, select, and validate efficient and reliable sets of factors and weights for use in evaluating airman jobs. A representative sample of 200 incumbent-prepared airman job descriptions served as the criterion sample evaluated by senior NCOs, lieutenants, captains, and field-grade officers with respect to merited grade, merited pay, and 15 job requirement factors designed specifically for airman jobs. Various combinations of 37 predictor variables, including the 15 factors, were considered in 1,296 regression analyses (480 reported) made to derive and validate optimally weighted grade and pay policy equations. The grade policy equation, which involved eight variables, accurately predicted the grades awarded jobs in the criterion sample by the raters, ($R^2$ = .95). The pay policy equation, which consisted of the same eight variables and one other, also accurately predicted raters' judgments of pay.($R^2$ = .93). Subsequent analyses with weights developed and cross-applied in 100-job subsamples indicated that both policy equations were very stable. Comparison of the overall-group grade policy equation with grade policy equations developed for each of the four rater groups which provided criterion and factor ratings revealed no important differences. The predictive efficiency of the policy equations and of all predictor combinations investigated was about the same for the four rater groups. Although the field-grade officers expressed significantly greater familiarity with airman jobs than the other rater groups, the actual mean differences in the ratings were judged to be of little practical consequence and too small to preclude having airman jobs evaluated by a composite group of senior NCOs, lieutenants, captains, and field-grade officers.

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| airman jobs | | | | | | |
| job evaluation | | | | | | |
| job requirement factors | | | | | | |
| airman grade | | | | | | |
| airman pay | | | | | | |
| regression analyses | | | | | | |
| reliability analyses | | | | | | |
| job familiarity | | | | | | |
| policy-capturing models | | | | | | |
| multiple range tests | | | | | | |
| rater groups | | | | | | |
| point rating systems | | | | | | |
| integer weight conversion | | | | | | |