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DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL F--ETC(U)
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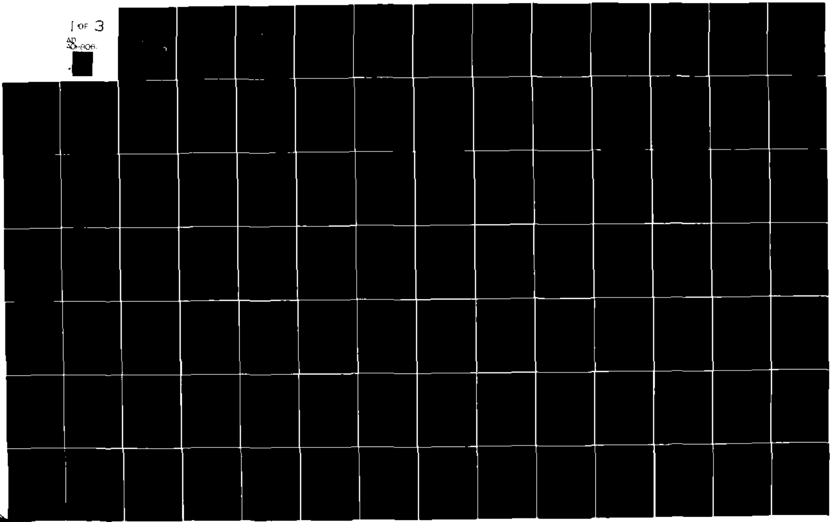

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A preliminary effort was made to generate a survey-supported model which would (1) permit periodic evaluation of the performance effectiveness of an Air Force maintenance squadron and (2) highlight equipment and human resource factors which are contributing either positively or negatively to maintenance squadron performance. The model is generated from survey data, collected from a stratified sample of maintenance technicians and their shift supervisors, and processed by means of a stepwise, linear multiple regression statistical package to provide a performance prediction equation. Factors which surface

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) as significant in the equation indicate positive and negative contributions to squadron performance effectiveness. The modeling effort is based on studies with the 82nd Air Training Command Wing at Williams AFB and the 405th Tactical Air Command Wing at Luke AFB, both in Arizona. The model was validated using immediate supervisor ratings of maintenance technician performance in speed and quality of work, averaged across a squadron. Based on the analyses and results of studies covering two maintenance squadrons at Williams AFB and three maintenance squadrons at Luke AFB, the model provides excellent predictions of squadron performance effectiveness and highlights significant contributing factors.

It is recommended that the study be extended to other Air Force bases and squadrons, with the end goal of achieving one or more survey-supported models which could periodically be used to evaluate squadron performance and target areas for improvement. The model may also be useful in evaluating individual technician performance within a squadron and in developing life-cycle costing for maintenance activity on particular end-item equipments maintained by particular Air Force Wings and squadrons.

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DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL FOR AIR FORCE MAINTENANCE ORGANIZATIONS

by

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GLOSSARY OF TERMS

ASCENDANCY TRAIT - Assertive in relationship with others; desire to assume an active role.

AFSC - Air Force Specialty Code

ASSIGNMENT LOCALITY - Location, climate, community atmosphere.

EMOTIONAL STABILITY TRAIT - Well balanced and relatively free from anxieties and nervous tensions.

FATIGUE TRAIT - Subjectiveness to feelings of weariness.

GROUP HOMOGENEITY OF ATTITUDE - Common purpose and goals.

JOB CURIOSITY TRAIT - Interest in discovering and learning all facets of a job.

MSET - Maintenance Standardization and Evaluation Team; MSET tasks are those subject to Command Team evaluation.

ORGANIZATION CLIMATE/IDENTITY - Atmosphere which creates a feeling of belonging as a valuable member of a working team.

ORGANIZATIONAL CLIMATE/REWARD - Atmosphere which creates a feeling of being rewarded for jobs well done.

ORGANIZATIONAL CLIMATE/RISK - Atmosphere which creates a feeling of riskiness or uncertainty about job and/or organization, including job safety hazards.

ORGANIZATIONAL CLIMATE/STANDARDS - Atmosphere which creates a feeling for the perceived importance of implicit and explicit goals and performance standards.

ORGANIZATIONAL CLIMATE/STRUCTURE - Atmosphere which creates a feeling of group constraints via rules, regulations, red tape.

ORGANIZATIONAL CLIMATE/WARMTH - Atmosphere which creates a feeling of general good fellowship.

ORGANIZATIONAL IDENTIFICATION - Feelings of association with and support from the organization.

PAY AND BENEFITS SATISFACTION - Feelings of technician about these extrinsic rewards.

PERSISTENCE TRAIT - Sees work through to completion.

PROFESSIONAL IDENTIFICATION - Good feelings about job speciality as important and necessitating special skills.

RANK - Position level in AF organizational structure.

RESPONSIBILITY TRAIT - Positive and perservering in using own judgements; determined; reliable.

SAINT - Systems Analysis of Integrated Networks of Tasks; a computerized simulation methodology.

SOCIAL STATUS - Feelings about the importance of occupation within society; a perceived level of society acceptance and status.

SRAM - Short Range Attack Missile

STATEMENT OF WORK

An important current objective of the United States Air Force is to improve the effectiveness of weapon system maintenance and maintainability. To meet this objective, the USAF is expending considerable resources in determining the content of maintenance tasks, in determining the impact of equipment design decisions upon these tasks, in streamlining technician selection and training procedures, and in providing well-documented technical information on AF air and ground equipment.

This research considers the design of an effectiveness planning and evaluation model for use by Air Force maintenance organizations at the wing and squadron levels. The model is intended for use in (1) planning maintenance activity requirements on selected end-item equipments, as part of life-cycle staffing and costing, and (2) evaluating the performance of a maintenance organization at a point of time and highlighting areas for improvement.

During the summer period 1978, initial phases of this research were conducted by the author while participating in a USAF/ASEE Summer Faculty Fellowship at the Air Force Human Resources Laboratory, Advanced Systems Division, Wright-Patterson AFB, Ohio. The summer work included an extensive literature review of previous studies and proposals concerning the selection, training and performance of Air Force maintenance personnel. Factors uncovered in the literature search were then developed into A Taxonomy of Air Force Maintenance Manpower Effectiveness as shown in Table 1. It may be noted that the taxonomy is divided into four major categories: (1) Equipment Reliability/Maintainability factors, (2) Maintenance Equipment and Technical Information factors, (3) Technician Experience, Skill and Knowledge factors, and (4) Technician Productivity and Morale factors. The subfactors listed in the Taxonomy have been shown to have an impact on either (1) the performance of maintenance technicians (primarily AF personnel) or (2) the morale and job satisfaction of maintenance technicians, in one or more research investigations. Reference is made to a report prepared for AFHRL/ASD at the end of the summer fellowship by the author (Young, 1978). References included in the Summer 1978 Design Report are also included in the Bibliography of this Final Scientific Report.

Three studies uncovered in the literature search were of particular interest to this author and suggested a possible framework for modeling the performance of an AF maintenance organization. The first research study was an attempt to ascertain what equipment design and operating variables affect AF maintenance performance, using survey and statistical techniques (Meister, Finley and Thompson, 1971). The study covered organizational and intermediate avionics maintenance of two autopilot subsystems in the B-52 and KC-135 aircraft. Observations were made involving SAC personnel at March AFB and Wright-Patterson AFB and covered performance measures of time to perform maintenance, whether technical orders (manuals) were used or not used, the number of unique diagnostic checks made (in trouble shooting), the number of repeated diagnostic checks made, the number of components removed or replaced, the technician's rating of task difficulty, the number of times assistance was required by the technician, the number of components actually worked on, the maintenance diagnostic strategy used, and the observer's ratings of the technician relative to understanding the problem and efficiency of work. A total of 14 subjects were included in the study. Table 2 summarizes results from the study for performance time production. The values stored surfaced as significant Beta coefficients (predictors of time to perform maintenance) in the multiple

Table 1

A Taxonomy of Air Force Maintenance Manpower Effectiveness

Equipment and Information Resources

Equipment Reliability/Maintainability Factors

Maintainability:

Weight/size of equipment system
Weight/size of subsystem and components
Access for test and check
Clearance for removal/replacement
Number and arrangement of internal components
Number, location, and arrangement of test points

Reliability:

Design operating parameters of equipment
Average flight or operating hours between servicing of equipment
Level of discrepancy reporting by aircrew (aircraft only)
Spares availability

Maintenance Equipment and Technical Information Factors

Handling:

Malfunction occurrence level in handling equipment
Weight/size of end item equipment
Location of equipment at flightline

Testing and Repair:

Design efficiency of test equipment
Level of information received from tests
Type and amount of test equipment information provided
Length of procedural sequence for test
Logic information for diagnosis
Ease of hand tool use
Adequacy and completeness of technical information on equipment

Table 1 (continued)

A Taxonomy of Air Force Maintenance Manpower Effectiveness

Human Resources

Technician Experience, Skill, and Knowledge Factors	Technician Productivity and Morale Factors
Experience:	**Organizational Climate and Group Morale:**
AFSC level (3, 5, 7, etc.)	Competency of supervision
Rank	Supervisory conditioning of tasks
Months in career field	Structure/Warmth/Standards/Identity/Risk
	Group satisfaction of individual motives
	Satisfaction with Interpersonal relationships
Skills (supervisor/observer ratings):	Team cohesiveness
For components worked on	
For test equipment used	**Personal Traits and Motivators:**
For use of test equipment in general	Job curiosity trait; Responsibility trait
For equipment repair	Persistence trait; Self-starter trait
	Emotional stability trait; Ascendency trait
Knowledge (supervisor/observer ratings):	Fatigue trait
Of maintenance procedures	Organizational identification
Of equipment handling procedures	Professional identification
Of use of equipment when operational	
Of equipment maintenance procedures in general	**Operational and Environmental Conditioners:**
	Pay and benefits, as perceived
	Assignment locality and climate
	Airmen/civilian relationships
	Participation in interest/service clubs
	Social status of occupation, as perceived
	Lighting/noise/workplace size/clothing

Table 2

Summary Statistics from Study of Maintenance Job Performance
on Two Autopilot Systems (Compiled from Meister, Finley, and Thompson, 1971)
Performance Time Predictors (Observation)

Ident.	Predictor Variable	Multiple Regression Coeff. Shop (inter) March, AFB (B3.30)	Multiple Regression Coeff. Flightline (B-15.5)WPAFB	Multiple Regression Coeff. Shop (B2.64)	Correlation Coefficients Correl. R's > .30 March AFB	Correlation Coefficients Correl. R's > .30 WPAFB
29	Clearance Remove/Replace				-.47	
37	Type Diag. Information	S		* - .070	-.65	-.33
47	Assessibility Int. Comp.			* - .623	-.34	-.40
51	Type Test Equip. Info.			* -1.584		-.37
53	Amount Test Equip. Info.				-.35	
55	Design of Test Equip.				-.48	
57	T.O./Checklist Info.	- .557* S	7.873 *		-.98	-.32
71	AFSC Level			* .892	.30	.47
73	Rank		4.158 *		.47	.38
75	Experience				-.50	
85	Supv. Rat.-Skill Working on Indiv. Components				-.52	-.47
87	Supv. Rat.-Test Equip. Item Used-Skill	S			.77	-.55
89	Supv. Rat. -Overall Test Equipment Usage	S		S	.77	-.69
91	Supv. Rat. -Equip. Repair Performance	Excluded from regression analyses.			.51	-.71
93	Supv. Rat. -Procedures				.52	-.72
95	Supv. Rat. -Handling Skills				.32	-.48
97	Supv. Rat. -Functions				.58	-.70
99	Supv. Rat. -Overall Capability				.61	-.68

* - Surfaced in Regression Analysis
S - Significant in Anova F Test at (P<.10) or better

Selected Predictive Regression Equations [Supervisor ratings excluded]

March AFB

Flightline None

Shop $y = 3.30 - 0.557\,(57) - 0.005(57)^2$

WPAFB

Flightline $y = 15.55 + 7.873\,(57) - 1.424(57)^2 + 4.158(73) - 0.649(73)^2$

Shop $y = 2.64 - 0.070(37) - 0.623(47) - 1.584(57) + 0.892(71)$

regression analyses. The Meister et al. study did not include motivational factors, nor was accuracy of performance used as a criterion measure.

The second important study was aimed at adapting a computerized network simulation model known as SAINT (Systems Analysis of Integrated Networks of Tasks) to the maintenance task performance network on SRAM missile handling tasks (Askren, Campbell, Seifert, Hall, Johnson and Sulzen, 1976). Two performance measures generated by SAINT were then compared with human resources specialists. Three handling tasks in organizational maintenance of the Short Range Attack Missile (SRAM) were included in the study and involved 120 maintenance technicians. Dependent variables in the multiple regression analyses included performance time estimates and performance accuracy (or hazards) estimates. Five independent variables were measured from survey questions or data covering (1) system proficiency (as measured by months in SRAM), (2) quality of written materials, (3) environment-temperature, (4) number of fatigue symptoms, and (5) work motivation. Table 3 shows some results from the study. A further analysis of the results was made by the author in Summer 1978 to show the percentile contribution of each of the five independent factors towards prediction of performance time on Task 29, with the following results: (1) written materials - 35.4%, (2) work motivation - 25.5%, (3) environment - 17.2%, (4) proficiency - 16.8%, and (5) fatigue symptoms - 5.5%.

The third and perhaps most important study was directed towards maintenance airman characteristics and motivational factors which contribute to the speed and accuracy of maintenance task performance (Sauer, Campbell, Potter and Askren, 1977). The survey-type study covered 140 missile mechanics and technicians performing organizational maintenance on 19 SRAM MSET tasks. These are tasks subject to maintenance standards evaluation. An additional 90 technicians working on the AIR-2A Genie System and/or Minuteman MKIII reentry vehicle were included in the opinion survey. Data was collected at five AF bases. The dependent variables to be predicted were (1) supervisor ranking of technician overall speed of task performance, (2) supervisor ranking of technician overall accuracy of task performance, (3) time to complete task as entered on MSET evaluation report (the latter data was too sketchy to be useful). Results of the study are summarized in Tables 4 and 5. In Summer 1978, the author further summarized the Sauer et al. results to provide the information shown in Table 6. The top portion of the table shows the weighted priority of the prediction variables relative to <u>time</u> to perform task.

Based on the Summer 1978 review, it was concluded by the author that the single most important "equipment/information" predictor of performance rate (or conversely time to perform) is the adequacy and completeness of the technical information provided to the technician and that the "human resources" predictors of most importance are (1) technician motivation, (2) organization climate and group morale, (3) months in career field, and (4) assignment locality. For accuracy of performance, the human resource predictors which appear to be most important are (1) technician motivation, (2) assignment locality, (3) months in career field, and (4) pay and benefits satisfaction. Other important findings from the literature review are summarized in Appendix A.

Objectives and Scope of Research

This research is aimed primarily at the human resources factors which affect job performance. However, technician supervisors are asked to provide a limited amount of information about equipment and technical information factors

Table 3

Comparison of Performance Time Curves
as Estimated by 13 Human Resources Raters and
as Generated by SAINT Computer Simulation
(Compiled from Askren, Campbell, Seifert, Hall,
Johnson, and Sulzen, 1976)

A. Performance Times vs Number of Fatigue Symptoms for SRAM Missile Handling Task 27 (Load Launcher to Aircraft)

Number of Fatigue Symptoms	Mean Subjective Time Estimates of 13 Raters (Minutes)	Computer Generated Times Using SAINT Simulation
0	54.6	59.9
5 Baseline	63.6	61.1
10	72.6	62.7
15	81.6	
20	90.6	65.7
25	99.6	
30	108.6	68.8

B. Performance Times vs Environment (Temperature) on Three Tasks on SRAM Missile

Temperature Conditions	Task 2 (Transport)[1]		Task 27 (Assemble)[2]		Task 29 (Checkout)[3]	
	Raters	Simulation	Raters	Simulation	Raters	Simulation
-40°F	22.6	15.7	114.0	70.7	483.6	271.3
0°	18.3	15.0	87.6	66.0	358.8	265.5
40°	14.8	14.3	66.0	62.0	275.6	261.4
60° Baseline	14.2	14.2	61.8	61.1	260.0	260.7
90°	15.1	14.4	68.4	62.2	291.2	261.9
120°	19.3	15.2	96.0	67.1	397.8	266.6

1. Task 2 - Transport Payload to IMF, 463x0 crew, Mean Time 140 Minutes

2. Task 27 - Load Launcher to Aircraft, 462x0 Crew, Mean Time 60 Minutes

3. Task 29 - Perform Aircraft System Checkout, 316x0 Crew, Mean Time 260 Minutes

Table 4

Statistical Results on Factors Affecting Maintenance Performance Speed Based on Data Collection Across 140 SRAM Technicians AFSC 462x0 and 463x0 (Compiled from Sauer, Campbell, Potter, and Askren, 1977)

	Significant High Performance Variable and Multiple Regr. Coefficients 462x0(B33.1879)	463x0(B70.8817)	Correlation Coefficients Correl. R's ≥ 0.25 462x0	463x0
Years of Service		.2168	.28	(.17)
Months in Career Field			.25	.29
No. of Individual Sports				.28
No. of Service Clubs	.2132		.25	
No. of Interest Clubs	.1702	.3109	.26	(-.01)
Trait Anxiety Level			-.36	-.32
Gordon Personal Profile				
Sociability trait				-.27
Emotional stability			.30	
Ascendency trait	.2218		.28	
Fatigue Symptoms-Trait	-.3193		-.41	
Fatigue Symptoms-State			-.29	-.26
Occupational Opinion				
AF policy/practices				.43
Assignment locality	.1933		.35	.43
Social status				.36
Organizational Climate				
Structure		.3272		(.09)
Risk	-.2241		(-.11)	
Warmth			.27	
Conflicts		-.3353		(.07)
Group Morale				
Satis. indiv. motives			.34	.29
Homogeneity of att.	.2456		.30	.27
Satis. interpersonal rel.				.34
Satis. with leader				.33
LBDQ				
Persuasiveness				.28
Consideration		-.4230		(.15)
Motivation				
Job curiosity trait	HP(.01)	HP(.01)	.37	.53
Persistence trait	HP(.01)	.6173 HP(.01)	.31	.61
Prof. identification	HP(.01)	HP(.01)	.29	.42
Team attitude		HP(.01)		.41
Org. identification		HP(.01)	.32	.38
Self-starter trait				.43

Table 5

Statistical Results on Factors Affecting Maintenance Performance Accuracy Based on Data Collected Across 140 SRAM Technicians (Compiled from Sauer, Campbell, Potter, and Askren, 1977)

Predictor	Significant High Performer Variables and Multiple Regr. Coefficients		Correlation Coefficients Correl. R's ≥ .25	
	462x0(B14.3824)	463x0(B13.5316)	462x0	463x0
Years of Service				.34
No. of Re-enlistments				.26
Months in Career Field				.32
No. of Interest Clubs		.1991	.32	
No. of Indiv. Sports		.1588		(.18)
Gordon Personal Profile:				
Responsibility trait			.29	
Fatigue Symptoms-Trait	** HP(.01)		-.40	
Fatigue Symptoms-State			-.26	
LBDQ:				
Representation				-.36
Tolerance of freedom			.26	
Occupational Opinion				
AF policy/practices	** HP(.01)		.27	
Assignment locality	** .3540-HP(.01)		.39	
Pay and benefits	-.2338		(.18)	
Promotion opportunity	** HP(.01)		.28	
Organization Climate				
Responsibility				-.29
Rewards	-.3263		(.06)	
Warmth			.29	
Group Morale				
Satis. indiv. motives	* .3817 HP(.001)		.41	
Homogeneity of attitude			.32	
Satis. with leader		-.3111		
Motivation				
Job curiosity trait	** .8249-HP(.01)	** HP(.01)	.46	.57
Persistence trait	** HP(.01)	** .7897 HP(.01)	.37	.71
Prof. identification	** HP(.01)	** HP(.01)	.32	.51
Team attitude	** HP(.01)	** HP(.01)		.50
Organ. identification	** HP(.01)	** HP(.01)	.37	.45
Self-starter trait	**-.4368 HP(.01)	** HP(.01)		.54

* Significant at ($p<.001$) for high performers

** Significant at ($p<.01$) for high performers

Table 6

Prioritized Predictive Factors for Time to Perform Five Selected MSET Tasks Based on Regression Equations (Data from Computer Runs Analyses by Sauer, Campbell, Potter, and Askren, 1977)

Priority	MSET Task 1101	MSET Task 1107	MSET Task 1322	MSET Task 1323	MSET Task 1325
1	Interp. Relations	Interp. Relations	Prof. Identification	Job Curiosity Trait	Org. Identification
2	Pay & Benefits Satis.	Org. Identification	Production Emphasis	Leadership/Structure	Mos. in Career Field
3	Org. Climate/Reward	Warmth of Org. Climate	Satis. Indiv. Motives	Months in SRAM	Org./Standards
4	Social Status	Org./Structure	Fatigue Trait	Org./Structure	Org./Responsibility
5	Int. Club Officer	Homo. of Gr. Attitude	Service Clubs	Org./Standards	Fatigue Trait
6	---	Months in SRAM	---	Fatigue State	Service Clubs
7	---	Service Clubs	---	---	---

Weighting Calculations-Task 1102-1325

Task	Factor	Coeff.	Mean Value	Weight	Task	Factor	Coeff.	Mean Value	Weight
1102	Interp. Relations	.5145	18.322	9.4267	1323	Job Curiosity Trait	.3206	63.545	20.3725
	Org./Identification	.1554	56.271	8.7445		Leadership/Structure	.3846	37.836	14.5517
	Org./Warmth	.6592	11.864	7.8207		Months in SRAM	.3791	19.309	7.3200
	Org./Structure	.4911	11.593	5.6933		Org./Structure	.3887	16.108	6.2612
	Homogeneity	.3861	12.305	4.7510		Org./Standards	.3111	15.182	4.7231
	Months in SRAM	.3389	13.542	4.5894		Fatigue State	.2404	2.727	.6556
	Service Clubs	.2681	.396	.1062					
1322	Prof.Identification	.4637	55.472	25.7224	1325	Org./Identification	.5747	46.182	26.5408
	Prod. Emphasis	.7409	16.528	12.2456		Mos. in Career Field	.4772	24.364	11.6265
	Satis. Ind. Motives	.3230	5.906	1.9076		Org./Standards	.4813	13.164	6.3358
	Fatigue Trait	.2203	2.717	.5986		Org./Responsibility	.2655	15.182	4.0308
	Service Clubs	.2681	.396	.1062		Fatigue Trait	.3721	2.600	.9675
						Service Clubs	.3308	.400	.1323

which may also be expected to impact on performance. In total, forty-eight predictor variables were eventually included in the performance model. The two dependent variables selected were technician performance rate and technician performance accuracy, as judged by a first line or immediate supervisor.

The specific objectives and scope of the research are

(1) to develop one or more survey instruments, using existing and pre-validated questions when possible, for gathering data from AF maintenance technicians and their supervisors that might be predictive of technician performance (herein defined as some combination of speed and accuracy of work),

(2) to develop a rating instrument by which first line (immediate) supervisors could compare technicians performance and establish performance ratings,

(3) to secure Air Force clearance for conduct of extensive surveys of maintenance personnel at Williams AFB and Luke AFB, Arizona, using the developed survey and rating instruments,

(4) to conduct the surveys at the two AF bases,

(5) to summarize the survey data, including supervisory ratings, from each of the two bases and prepare the data for statistical analyses,

(6) to subject the data from each base to extensive statistical treatment as a means of generating useful predictive models of maintenance squadron technician performance,

(7) to examine similarities and differences between the predictive models for differing AF maintenance squadrons, and

(8) to develop conclusions, make recommendations for future work, and write and publish the results of the study.

The long-run objectives of the research, of which this grant and research are a first step, is to standardize on a set of survey instruments and rating scales which (1) would permit an AF Wing or squadron to periodically examine its performance effectiveness and (2) would permit the U.S. Air Force to more accurately predict maintenance requirements on selected end-item equipments for life-cycle staffing and costing.

RESEARCH EFFORTS AND RESULTS

At the proposal stage of this research, a performance effectiveness model was postulated with the following dependent and independent variables:

(1) Average technician performance rate (or speed of work) across a squadron, a dependent variable to be predicted. For purposes of experimentation, supervisor ratings of technician performances would be used.

(2) Average technician performance accuracy (or quality of work) across a squadron, a dependent variable to be predicted. For purposes of experimentation, supervisor ratings of technician performances would be used.

(3) Average weight of subsystems or components handled by technicians within the squadron, a predictor variable averaged from supervisor estimates for each supervisory work group (normally a shift work group).

(4) Average difficulty of servicing assigned subsystems, across the squadron, based on accessiblity or clearance for such tasks. A predictor variable based on supervisor estimates for each work group.

(5) Average difficulty of removing and/or replacing subsystems (or components), across the squadron, based on the accessibility or clearance for such tasks. A predictor variable based on supervisor estimates for each work group.

(6) Average number of internal components in subsystems serviced, across the squadron, based on supervisor estimates for each work group.

(7) Operating hours between services for equipment subsystems, across the squadron, based on supervisor estimates for each work group.

(8) Adequacy of technical information available to technicians, across the squadron, based on supervisor estimates for each work group.

(9) Usability of the available test equipments, across the squadron, based on supervisor estimates for each work group.

(10) Average knowledge of technicians for performing servicing requirements, across the squadron, based on supervisor estimates for each work group.

(11) Average skills of technicians in performing servicing requirements, across the squadron, based on supervisor estimates for each work group.

(12) Average (mean) shift assignment, across the squadron, based on technician inputs.

(13) Mean year of enlistments into the Air Force, across the squadron, based on technician inputs.

(14) Mean skill level of technicians, across the squadron, based on technician inputs [3,5,7,9 levels].

(15) Mean year of assignment to current duty status, across the squadron, based on technician inputs.

(16) Mean year of assignment to current equipment type, across the squadron, based on technician inputs.

(17) Average number of months on current equipment assignment, based on technician inputs.

(18) Mean of sex distribution (where 0 = female and 1 = male), across the squadron, based on technician inputs.

(19) Average complexity level of aircraft or missile equipment (based on analysis and using an interval scale), across the squadron, based on technician inputs.

(20) Average military rank (or civilian grade), across the squadron, based on technician inputs [1 = military and 2 = civilian].

(21) Average number of sequential work days between days-off-periods (weekend or other), across the squadron, based on technician inputs.

(22) Average number of additional duties assigned to maintenance technicians, across the squadron, based on technician inputs.

(23) Average number of hours worked per work shift, across the squadron, based on technician inputs.

(24) Average hours per week spent on additonal assigned duties, across the squadron, based on technician inputs.

(25) Average number of clubs in which technicians particpate, across the squadron, based on technician inputs.

(26) Average number of persons supervised by technicians (including 0), across the squadron, based on technician inputs.

(27) Average number of months technicians have served as a supervisor, across the squadron, based on technician inputs.

(28) Average technician satisfaction with squadron and work group in meeting <u>individual motives</u> of technicians, across the squadron, based on responses to series of questions.

(29) Average technician <u>satisfaction with supervision</u> received, across the squadron, based on responses to a series of questions.

(30) Average technician expressions concerning the <u>homogeneity of attitude</u> within the squadron and work group, across the squadron, based on responses to a series of questions.

(31) Average technician satisfaction with <u>interpersonal relationships</u> among peers within the squadron and work group, across the squadron, based on responses to a series of questions.

(32) Average technician expressions concerning the <u>organizational structure</u> of the squadron and work group, across the squadron, based on responses to a series of questions.

(33) Average technician expressions concerning the <u>organization warmth</u> of the squadron and work group, across the squadron, based on responses to a series of questions.

(34) Average technician expressions concerning the <u>organizational rewards</u> of the squadron and work group, across the squadron, based on responses to a series of questions.

(35) Average technician expressions concerning organizational risks within the squadron and work group, across the squadron, based on responses to a series of questions.

(36) Average technician expressions concerning organizational conflicts within the squadron and work group, across the squadron, based on responses to a series of questions.

(37) Average technician expressions concerning organizational identity with the squadron and work group, across the squadron, based on responses to a series of questions.

(38) Average technician expressions concerning their current assignment locality (and AF Base), across the squadron based on responses to a series of questions (AF personnel only).

(39) Average technican expressions concerning their current pay and benefits, across the squadron, based on responses to a series of questions (AF personnel only).

(40) Average technician expressions concerning their current social status within the Air Force, based on responses to a series of questions (AF personnel only).

(41) Average fatigue trait of technicians, across the squadron, based on their responses to a series of possible identifiers.

(42) Average ascendency trait of technicians, across the squadron, based on their responses to a series of identifiers.

(43) Average responsibility trait of technicians, across the squadron, based on their responses to a series of identifiers.

(44) Average emotional stability trait of technicians, across the squadron, based on their responses to a series of identifiers.

(45) Average sociability trait of technicians, across the squadron, based on their responses to a series of identifiers.

(46) Average job curiosity trait of technicians across the squadron, based on supervisor evaluations of technicians within each work group.

(47) Average persistence trait of technicians, across the squadron, based on supervisor evaluations of technicians within each work group.

(48) Average professional identification trait of technicians, across the squadron, based on supervisor evaluations of technicians within each work group.

(49) Average organizational identification trait of technicians across the squadron, based on supervisor evaluations of technicians within each work group.

(50) Average self-starter trait of technicians, across the squadron, based on supervisor evaluations of technicians within each work group.

Thus the model included 48 predictor variables and two dependent variables: speed of technician performance and accuracy of technician performance. The reader may have recognized from the above list of factors that certain well known, existing and validated survey instruments provide information for some of the factors and led to their inclusion. The Glossary of Terms section at the beginning of this report further defines some of the above characteristics.

Development of the Survey Instruments

The predictor factors (or variables) included in the modeling effort resulted from one or more of three conditions:

(1) The factor was a significant predictor of maintenance technician performance rate or technician performance accuracy in some previous research study (military and nonmilitary systems).

(2) The factor was suggested in the literature, or by one or more of several Air Force maintenance officers interviewed, as relating in an important way to maintenance technician performance and should be worthy of study.

(3) A measurement instrument exists, or is easily developed, for gathering data on the factor.

All of the 48 predictor variables initially proposed were included in the survey instruments developed. It was decided to separate the data collection into three independent survey instruments, one of which would be completed by each selected maintenance technician and two of which would be completed by the first line, immediate shift supervisor of each technician. The three survey instruments developed are shown in Appendix B.

The selection of the performance measure or measures to be used in the study, as well as the methodology of measurements, required careful study. The writer was aided in this investigation by Captain Joel R. Hickman, USAF, who undertook a graduate student project on this topic in partial fulfillment of the requirements for a master's degree from Arizona State University in Industrial and Management Systems Engineering. The performance measure or measures would be the dependent variable(s) in the modeling effort. Certain portions of the following section are taken directly from or are summarized from the Hickman project report (Hickman, 1979).

Selection of the Performance Measures and Measurement System. Several evaluation schemes or rating schemes were investigated which purport to measure the performance of skilled workers. The purpose of the investigation was to select or develop a method for evaluating and measuring the performance of aircraft and missile maintenance technicians in the United States Air Force. Criteria developed for the performance measurement scheme may include:

(1) Be useful for describing performance to management.

(2) Be valid as a measurement of maintenance technician performance.

(3) Be applicable to different types of performance tasks such as repair, service, and preventive maintenance.

(4) Be applicable to military and civilian employees of the Air Force.

(5) Provide a performance measure throughout the many levels of weapon systems maintenance.

(6) Provide valid information for statistical analysis in the form of normal performance distributions with constant variance.

(7) Meet time and cost limitations for use of the evaluation methodology.

Techniques for performance measurement were evaluated in terms of (1) organization structure, (2) the quality of ratings, (3) the above list of performance criteria, (4) the appraisal methods, (5) rating scale errors, (6) scale format and (7) the raters.

One of the restrictions on the performance measure used is that it be applicable to different types of aircraft maintenance performed at different organizational levels. This is a difficult restriction to satisfy as the Air Force maintenance structure involves thousands of personnel performing a vast variety of functions. McDonnell (1979) reports that there are forty-five thousand Air Force members in the aircraft maintenance field alone.

Maintenance is concerned with aircraft and missiles and is performed by military or civilian technicians of both sexes. The three overall levels of maintenance organization are known as base or organizational, intermediate, and depot. Base level maintenance consists of inspecting, servicing, and replacing parts. Intermediate level maintenance is often indistinguishable from base level maintenance and consists of calibrating or replacing damaged or unserviceable parts, of modifying material, and of emergency manufacturing of unavailable parts. Depot level maintenance augments stocks of serviceable material with more extensive shop facilities and personnel of higher technical skill level (usually civilian employees).

Further generality of the rating technique is mandated by the varied tasks performed by a base level maintenance organization. A typical Air Force base with a mission involving aircraft might include field maintenance (FMSQ), organizational maintenance (OMSQ), avionics maintenance (AMSQ), and munitions maintenance (MMSQ) squadrons. Meister, Finley, and Thompson (1971), Foley (1974), and Wiley (1978) have considered automatic flight control maintenance performance in the AMSQ alone, while Sauer, Campbell, Potter and Askren (1977) dealt with Short Range Attack missile maintenance in the MMSQ alone. Enlarging the scope of a performance measurement tool to include avionics repair, fabrication, propulsion, and flightline launch and recovery personnel requires a generalized rating scale or scales applicable to many technician specialities or specific, noncomparable measures for each specialty. Separate measures, however, would make analysis of overall performance within any squadron impossible.

The nature of the maintenance organization strongly favors the use of general individual performance measures. Such measures would be applicable to the varied tasks and functions the different technicians are responsible for. Since most maintenance is performed by teams of five to ten technicians working under one supervisor, the supervisor could evaluate his personnel if a general, subjective performance measure is used. The structure, size, and complexity of the Air Force maintenance system thus requires the use of a new subjective, and general performance measurement system for this particular research effort.

Barrett (1966:12) feels that a performance measure is successful only if it meets three standards:

> It must be accepteable to the people who use it; it must cover what is important and only what is important; and a systematic examination of the results of ratings must show that they are reasonably free from important defects.

The performance data which will eventually be used to develop performance effectiveness models must be accepted by maintenance managers and evaluators as well as research personnel. The easiest way to gain acceptance might be to use existing measures such as Airman Performance Ratings (APRs) or merit ratings for civilian personnel. These measures, however, are used for administrative purposes of promotion and wage administration and not for developmental purposes. McGregor (1957) and Barrett (1966) warn against mixing incompatible purposes in one program, as management is placed in the incompatible role of judge and counselor.

If a new performance measure is developed it might be advisable to solicit the opinions of managers, using surveys or limited acceptance tests as to criterion acceptability.

An alternative to using existing measures or soliciting manager opinions as to acceptability would be to develop criterion-referenced test measures. A criterion-referenced test measures what an individual can do, or knows, compared to what he must be able to do, or must know, in order to complete a task successfully (Glaser and Nitko, 1971: Swezey and Pearlstein, 1975). Such Criterion-Referenced Job Task Performance Tests (JTPT) were experimentally developed by Foley (1974) for electronic maintenance tasks after much time and effort. Such objective tests might prove to be more acceptable then other subjective performance judgments such as supervisors' ratings.

However, acceptance is not enough; a measure that omits essentials or gives weight to trivia is defective. Barrett (1966) feels that a clear statement of the objectives of the ratings is the first step while Guion (1965) believes that the first step is a judgment of the importance of the concept being developed. Both authors agree that the second step is a clear statement of what the job requires and the kinds of job behavior that are essential to success. As Barrett points out, punctuality may be important in an automated office where each person's performance affects his neighbors, but it is unrelated to the success of a door-to-door salesman.

Subjective ratings or judgments are relied upon by management as criteria for validation studies. Guion (1965:96) reports that eighty-one percent of validation studies appearing in the Journal of Applied Psychology and Personnel Psychology between January, 1950, and July, 1955, relied upon ratings.

According to Barrett (1966:33) rating scales are concerned with three kinds of concepts: personality, performance, and product. Personality is the total of a person's characteristics. It includes emotional make-up, intelligence, and what is commonly called character. Performance has to do with how an individual goes about doing work. Included are working hard, following instructions, planning, and taking responsibility. Product is a person's output. The quantity and quality of work are product.

The most pertient of the three is product. Management is fundamentally interested in sales, production of finished goods, and other factors that are visible and inherently measurable. Product in some cases can be measured directly (objective measurement) and in other cases it is necessary to have a rater look at the product and evaluate its quality. Measures of product often suffer from deficiency, as only part of an individual's output can be measured in objective terms. They may also be contaminated since much of what is measured is beyond the individual's control; for example, product may be the output of many individuals, not one alone.

Existing ratings of individuals employed by the Air Force are of little value except for administrative purposes. Airmen Performance Reviews (APRs) are inflated according to Callander (1979) and of little value as a single performance measure.

If products are not available for evaluation, the rater may evaluate how the employee goes about his work instead of what he produces. Though not as objectively measured as products, these job performance characteristics are both ratable and important. Studies by Barrett (1966) indicate that supervisors and subordinates are quite sensitive to performance, agree on the relative importance of performance traits, and attach a great deal of weight to the performance style used on the job.

In this case it appears that subjective appraisals are most applicable. There are, however, many potential traits that could be used. Lawler (1967:371) indicates that it is easy to err on the side of providing too many traits upon which to make ratings. Dunnette (1963:252) points out that the use of a single criterion is unrealistic while Rush (1953:23) indicates that between three and five criterion factors surface in factor-analysis studies. The potential size of a study covering Air Force maintenance performance mandates the use of as few factors as possible--either two or three.

Lawler (1967:371) indicates that one rating that probably should be included is one on quality of job performance. When people are asked to make such general ratings on quality they act in a very predictable way, as efficient appraisers of critical incidentdata from their observations of an individual's performance in the past.

According to Locker and Teel (1977:246), conventional ratings constitute the most popular form of appraisal technique. Rating scales generally have several statements about employee characteristics or behavior. A continuous or discrete scale is established for each item. Figure 1 illustrates several scaling procedures from Cummings and Schwab (1973:90). Item A is scaled continuously: the evaluator places a check somewhere on the scale to represent his assessment of the appraisee. Item B has a numerical discrete scale although letters are sometimes used instead of numbers. Item C is also scaled discretely with adjectives. Discrete scales generally result in greater interrater agreement and hence are preferable to continuous scales, according to Cummings and Schwab (1973).

Considerable attention has been paid in experimental psychology to the problems of scaling to find out all that can be learned about man as a measuring

	Item	Scaling Format
A	Overall job performance	Low — High
B	Overall job performance	1 — 2 — 3 — 4 — 5
C	Overall job performance	Low — Below Aver. — Aver. — Above Aver. — High

Figure 1

Illustrations of Conventional Rating Scale Formats
for a Single Item (Cummings and Schwab, 1973)

instrument. Experience has shown that certain rules are favorable to effective graphic ratings. Guilford (1954:267) lists the following rules.

(1) Each trait should occupy a page by itself.

(2) The line should be at least five inches long, but not much longer.

(3) The line should have no breaks or divisions.

(4) The "good" or "high" ends of the lines should be in the same direction.

(5) For unsophisticated raters, the "good" end should be placed first.

(6) Descriptive phrases or cues should be concentrated as much as possible at points.

(7) Do not use end cues so extreme in meaning that they will never be applied.

(8) Set the end cues at a little distance from the ends of the line.

(9) In scoring, use a stencil that divides each line into sections to which numerical values are assigned.

It appears that the best scale format would follow the rules listed by Guilford. The rating standards, in this case, should be based on comparisons with other technicians within a particular maintenance squadron. Using two adjectives to anchor the ends of scales for quality and quantity of performance appraisal serves several purposes: (1) the term "average" is avoided, (2) generality of the scale is maintained to make it applicable to many maintenance activities, (3) the possiblity of obtaining a normal performance distribution is improved, and (4) multimodal distributions grouped around descriptive adjectives are avoided. The use of ten steps is familiar to the raters due to the similarity with Airman Performance Ratings and, since interpersonal performance is being rated, allows for finer distinctions between technicians.

Based on previous work the appraisal forms shown in Figures 2 and 3 were developed and included in the survey instruments. They should provide useful performance information for valid statistical analysis.

Generating the Three Survey Instruments. The three survey instruments shown in Appendix B may now be discussed more fully. The first instrument, entitled Supervisors Technical Information and Performance Rankings Form, has two parts. The first part covers technical information needed from the supervisor to support predictive factors numbered 3 through 11. Horizontal interval scales were selected foreach question with verbal descriptions at ends of the scales. Part 2 contains the performance ranking scales for speed and quality of work, in which technicians assigned to a shift supervisor are first ranked against each other and then rated individually on a 1-10 scale against a near perfect "10".

The second instrument, also designed for supervisor completion, allows the supervisor to evaluate motivation traits of each particular technician included in the study. The Supervisors Technician Motivation Evaluation is coupled externally to the Maintenance Technician Survey, as part of the data for each technician selected for the study. One form is completed by the shift supervisor for each of the technicians (which he supervises) that are selected

The first aspect of performance we are interested in is <u>speed</u>, or how quickly an individual accomplishes a job. To rank everybody whom you supervise, imagine that you must assign one individual to a job in which time is very important. The sooner the job is completed the better. List below, in order of choice (first choice, second choice, third choice, and so on), the persons you would assign to this job. After you have ranked everybody whom you supervise on your list, then rate each person on their performance on jobs where speed is important compared to everybody in the squadron with a similar job. Use the (10 point) scale to the right of each name for this, considering that the top-ranked technician in the squadron on speed of performance is given a 10 rating. Your own top-ranked subordinate may receive a rating of less than 10.

Performance Rank	Name of Technician	Slowest 0	1	2	3	4	5	6	7	8	9	Fastest 10
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

Figure 2 Rating Scale for Speed of Performance

The second aspect of performance we are interested in is the quality of the individual's work. We are interested in the accuracy and care an individual puts into a job as well as the reliability of the completed product or task. To rank everybody whom you supervise, imagine that you must assign one individual to a task in which quality, accuracy, and reliability are very important. There are no time pressures to complete the task. List below, in order of choice (first choice, second choice, third choice, and so on), the people you would assign to this job. After you have ranked everybody whom you supervise, rate each person on their performance on jobs where quality is important compared to everybody in the squadron with a similar job. Use the 10-point scale to the right of each name for this, considering that the top-ranked technician in the squadron on quality of performance is given a 10 rating. Your own top-ranked subordinate may receive a rating of less than 10.

Rank	Name of Technician	Lowest 0	1	2	3	4	5	6	7	8	9	Highest 10
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

Figure 3 Rating Scale for Accuracy of Performance

in the sample. The survey instrument uses vertical scales, each containing 5 tic marks, with a "high" description at the top of the scale and a "low" description at the bottom of the scale. The scales are a modification of those developed by Sauer et al. and used in a previous study (Sauer, Campbell, Potter and Askren, 1977). The motivation traits examined include (1) job curiosity, (2) persistence, (3) professional identification, (4) organizational identification, and (5) self-starter characteristics.

The third instrument is the Maintenance Technician Survey and is completed by each of the technicians selected for the sample. The body of the questionnaire consists of five areas, covering (1) group morale, (2) organization climate, (3) occupational attitude, (4) fatigue trait (feelings while working), and (5) personal traits. Each of these will be discussed in more detail.

Part I. Group Morale. The Bernard Goldman Group Morale Scale was adapted for this part of the survey with very little modification (Goldman, 1958). The scale consists of 20 questions covering the following four factors:

(1) Group support of individual motives--questions 1, 8, 13, and 18 [4 items].

(2) Group homegeneity of attitude--questions 2, 7, 11, 15 and 16 [5 items].

(3) Group interpersonal relationships--questions 3, 6, 9, 12, 14, 19, 20 [7 items].

(4) Satisfaction with supervision--questions 4, 5, 10 and 17 [4 items].

As discussed in the earlier design report (Young, 1978), pros and cons for the Goldman Group Morale Scale have been presented in the literature. Further, the GMS dates back to 1958. However, it is this author's opinion that the GMS is still a useful and valuable survey instrument and that the questions are well adapted to the survey of maintenance technicians with a few minor changes in wording. The GMS employs a four category answer directory: A - Strongly Agree, B - Agree, C - Disagree, D - Strongly Disagree.

Part II. Organization Climate. This section of the survey instrument was derived from the Organization Climate Inventory (Litman and Stringer, 1968). The published OCI consists of 50 items and covers 9 factors. In previous Air Force studies which used the OCI, only the factors of (1) organization structure, (2) organization rewards, (3) organization risk, (4) organization warmth, (5) organization conflict and (6) organization identity have proven significant as predictors of technician performance. It was therefore decided to include in the Maintenance Technician Survey only those questions which related to these 6 factors:

(1) Organization structure--questions 21-28 [8 items].

(2) Organization rewards--questions 29-34 [6 items].

(3) Organization risk--questions 35-39 [5 items].

(4) Organization warmth--questions 40-44 [5 items].

(5) Organization conflict--questions 45-48 [4 items].

(6) Organization identity--questions 49-52 [4 items].

The OCI is an often used and thoroughly validated survey instrument. It was adapted for use in the Maintenance Technician Survey by changing words relating to organization form. The same response categories are used as for Part I.

Part III. Occupational Attitude. A survey instrument known as the Occupational Attitude Inventory was developed for the U.S. Air Force (Tuttle, Gould and Hazel, 1975). The instrument is specific to Air Force personnel; therefore, civilian technicians (employed by the Air Force) who completed the Maintenance Technician Survey were instructed to bypass Part III. The original OAI consists of 348 items and covers 26 factors. The only factors which have shown significance in past research on Air Force maintenance technicians are (1) assignment locality, (2) pay and benefits, and (3) social status. Thus the questions covering these 3 factors were extracted from the OAI for direct use in the Maintenance Technician Survey:

(1) Assignment locality--questions 53-69 [17 items].

(2) Pay and benefits--questions 70-81 [12 items].

(3) Social status--questions 82-92 [11 items].[1]

There are four response categories which are (1) very satisfied, (2) satisfied, (3) unsatisfied, and (4) very unsatisfied.

Part IV. Feelings While Working (Fatigue Trait). This section of the Maintenance Technician Survey employs a series of response indicators to a fatigue trait (Yoshitake, 1971). The items include some word modifications for proper interpretation by Air Force technicians. The factor covered by the items included proved significant in the previously referenced study by Sauer, Campbell et al.

(1) Fatigue Symptoms (Trait)--Items (indicators) 93-124 [32 items].

Two answer categories are used: (1) does describe feelings or (2) does not describe feelings.

Part V. Personal Traits. For this part of the Maintenance Technician Survey, the Gordon Personal Profile was adapted (Gordon, 1963). The GPP consists of 18 set of 4 descriptive phrases, each set being identified as a tetrad. Four factors are covered:

(1) Ascendency--[18 items]

(2) Responsibility--[18 items]

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1. Definition of terms are given in the Glossary at the beginning of the report.

(3) Emotional stability--[18 items]

(4) Sociability--[18 items]

Each item covers all four factors. The writer chose to use only the first 13 items, in order to limit the overall questionnaire to 150 questions. The matrix of selection response categories is as follows:

Item	Question	Cat.	Ascendency	Responsiblity	Emotional Stability	Sociability
1	125 126	Most Least	Sel B	Sel C	Sel D	Sel A
2	127 128	Most Least	Sel D	Sel C	Sel B	Sel A
3	129 130	Most Least	Sel B	Sel D	Sel A	Sel C
4	131 132	Most Least	Sel C	Sel B	Sel D	Sel A
5	133 134	Most Least	Sel A	Sel D	Sel C	Sel B
6	135 136	Most Least	Sel D	Sel B	Sel C	Sel A
7	137 138	Most Least	Sel C	Sel A	Sel B	Sel D
8	139 140	Most Least	Sel A	Sel B	Sel D	Sel C
9	141 142	Most Least	Sel B	Sel C	Sel D	Sel A
10	143 144	Most Least	Sel A	Sel C	Sel B	Sel D
11	145 146	Most Least	Sel B	Sel D	Sel A	Sel C
12	147 148	Most Least	Sel B	Sel C	Sel D	Sel A
13	149 150	Most Least	Sel A	Sel C	Sel B	Sel D

Scoring on the Gordon Personal Profile is based on 2 points for a "most like" selection, 1 point for no selection, and 0 points for a "least like" selection. However, this writer chose to use a +1, 0, -1 scale to highlight the null position across the 13 items used. Thus an average score of "0" on one of the four factors would indicate a mean level of factor response wherein the "most like's" and "least like's" cancelled out (or the factor was not indicated as a "most like" or "least like" in the 13 items).

Overall Maintenance Technician Survey. The final survey instrument, shown in Appendix B, consists of 150 questions, covering 137 items and 18 factors. In addition, the requested Biographic Information section provides input for additional factors included in the modeling effort.

The Biographic Information section of the Maintenance Technician Survey was designed to collect occupational information on the airmen completing the survey including sex, rank or grade, squadron assigned, AFSC's, skill level, equipment assigned, extracurricular activities, etc. (see Appendix B). For Privacy Act compliance, the name of the technician completing the questionnaire was not requested; however, a survey control number was assigned to each technician selected for the survey in advance.

The opening sheets on the Maintenance Technician Survey provide the source for and purpose of the study, note the USAF assigned Survey Control Number, provide the necessary Privacy of Information statement, and give instructions for completion of the survey.

Conduct of the Surveys

As will be detailed later in this report, surveys were administered by the writer and student associates at Williams Field AFB and Luke AFB, Arizona. Each AFB is approximately a one-hour trip by automobile from Arizona State University, Tempe, Arizona, where this modeling study was conducted. The Williams Field AFB Survey took place in October 1979 and the Luke AFB survey in November 1979, each survey covering approximately a 3-week period. Clearance for the study was solicited and received from AFMPC/MPCYS (Randolph AFB), prior to conduct of the surveys and survey control number 80-11 was assigned. Clearances for the study were also received from Headquarters Air Training Command (HQATC) and Headquarters Tactical Air Command (HQTAC), based on requests from the AFHRL, Advanced Systems Division, Wright-Patterson AFB, Ohio. Since it was elected to include civilian (civil service) USAF employees in the surveys, clearance was also obtained from the national and local union organizations.

Selection of the Sample Populations. In the early stages of this research, it was planned to pretest the developed survey instruments for construct validity and determination of sample size (based on response variability). However, the constrained time span (9 months) for the study and the time necessary to obtain USAF survey clearance finally ruled-out the pretests. Fortunately, an extensive portion of the survey instruments were incorporations (with minor modifications) of previously developed and tested instruments and items. Further, the independent factors included in the study had shown a significant relationship to maintenance technician performance in one or more previously published studies.

The final choice of sample size and selection procedures stemmed from (1) this researcher's view of an acceptable sample size based on previous research experience, (2) practical constraints associated with conduct of the surveys, and (3) the maintenance organizations studied. It was decided to include 180 maintenance technicians in the survey at each of the two Air Force bases.

Since the selected method of performance measurement involved first line supervisor rankings and ratings of technicians, it was also decided that five technicians should be rated by each supervisor.

Williams Field AFB has one AF Wing, the 82nd Training Wing, and involves primarily T37 and T38 aircraft. Maintenance is performed by two squadrons: the Organizational Maintenance Squadron (OMS) and the Field Maintenance Squadron (FMS). For the Williams study, it was elected to randomly draw 18 shift supervisors from each of the two squadrons. Supervisors with less than 4 reporting technicians were not included in the draw. If a supervisor selected in the draw had 4 or 5 reporting technicians, each of these reporting technicians was included in the survey. If a selected supervisor had more than 5 reporting technicians, random selection was made of 5 technicians to be included in the survey. The number of technicians assigned to the Williams FMS squadron in October was 500, with 480 assigned to the OMS squadron. Thus the selected sample design provided approximately the following percentages of the maintenance squadron personnel (82nd AF Wing):

Squadron	Size	Design Sample Size	Sample % of Population
FMS	500	90	18.0
OMS	480	90	18.6

Shift supervisors were drawn randomly across all three shifts and all shifts are represented in the sample. Technicians reporting to several of the selected supervisors were both military and civilian, and of both sexes.

Luke AFB has two AF Wings; the 405th Tactical Wing was selected for the survey study and involves primarily F15 aircraft. The maintenance organization is defined as a Production-Oriented Maintenance Organization (POMO) and includes three squadrons: Aircraft Generation (AGS), Component Repair (CRS) and Electrical Maintenance (EMS). Similar procedures to that used at Williams AFB were applied in selecting the survey sample from the Luke 405th Wing. Twelve shift supervisors were to be randomly drawn from the list of shift supervisors in each squadron, and for supervisors having more than 5 reporting technicians, a random draw was to be made of the 5 technicians to be included in the study. Because of researcher transportation difficulties, only the day and swing shifts were included in the Luke study and thus all mid-shift supervisors were excluded from the draw. Further, some shift supervisors were on temporary duty assignments and were not available. For these and other easons, the selection of shift supervisors for the sample was less random at Luke AFB than at Williams AFB. The selected sample design provided approximately the following percentages of the maintenance squadron personnel (405th AF Wing):

Squadron	Size	Design Sample Size	Sample % of Population
AGS	800	60	7.5
CRS	463	60	13.0
EMS	330	60	18.2

The writer feels that the selected, stratified sample design is appropriate for this type of research study in which comparative performance judgments must be made by supervisory personnel. The shift supervisors work most closely with the maintenance technicians and are best able to judge their performances. In most cases, the supervisory work groups included between 5 and 10 technicians. Some thought was given to also having the technicians selected for the study rated by the second-level supervisor (shop or unit supervisor). This procedure was ruled out, however, because of the question of how to weight the performance ratings at two levels of supervision. All random draws were made from a table of 4-place random digits.

Conduct of the Surveys

At each of the two AF bases, a classroom was available to conduct the surveys. The supervisor surveys were conducted first, over several days, followed later by the surveys of selected technicians. All surveys were conducted in the classroom, after brief oral instructions, and questionnaires were collected as participants completed their input and left the room. To minimize interference with work requirements of the maintenance squadrons, it was necessary to have multiple survey sessions at each base for both shift supervisors and the technicians. Maximum attendance at any session was approximately 20, with a minimum of 2.

The writer was assisted in the survey at Williams AFB by USAF Captain Joel R. Hickman, a graduate student on temporary AFIT assignment to Arizona State University, and USAF Captain Jerry Raney of the Williams AFB maintenance organization. At Luke AFB, the writer was assisted by Mr. Mark Bramlett, a graduate student on research assignment at Arizona State University, and USAF Captain Bob Tilton of the Luke AFB maintenance organization. All survey sessions were supervised by one or more of the above, including evening and early morning sessions for swing- and mid-shift personnel. Needless to say, this involved numerous round trips from ASU.

Supervisors attending the early round of survey sessions (for supervisors drawn in the samples) were given a list of 5 of their reporting technicians who were also drawn for inclusion in the study. For each name on these lists, a technician survey control number was also assigned. The supervisors were instructed to use only the technician survey control numbers in completing the Supervisors Technical Information and Performance Rankings Form and the Supervisors Technician Motivation Evaluation questionnaires. All responses were to be placed directly on the survey instruments (and would be hand scored). Supervisors were permitted to take the list of technicians with them at completion of the session so that they could assign the technicians to report to the classroom for completion of the Maintenance Technician Survey during the multi session times for technician surveys. Thus a supervisor only needed to part with one of his reporting technicians at a time, for a period of approximately one hour.

The supervisor survey and the technician survey each required one hour or less for completion. In the technician survey sessions, instructions were given to read the opening material and complete the Biographic Information page before preceding to the survey questions. Only one technician, of all surveyed at both AF bases, exercised his/her right to withdraw from the survey. A few other technicians failed to show, however, even after extra sessions were scheduled and held. In general response was excellent.

Technicians were instructed to respond to the 150 question survey by (1) entering their assigned survey control number (written in the survey booklet and also on a machine graded response form) in the block at the top of the form for machine scoring, and (2) enter their responses to the 150-question survey on the machine scoring form. A copy of the machine scoring form, IBM 1230 Document No. 511, is included in Appendix B. The form has response fields for exactly 150 questions. Technicians were instructed to leave the heading information blank. The completed form as developed by each technician was inserted in the survey booklet when submitted, and a check was made to verify the survey control number (identification number) with that written inside the survey brochure.

Processing of Data

A FORTRAN IV computer program was developed for processing the input data into printed output information and a set of punched cards with data prepared for input to the Biomedical Data Processing Software Package known as BMDP[1]. The program, designed to run data for one squadron at a time, is given in Appendix C with output for Williams AFB, FM Squadron. The program is available on punched cards and on a magnetic tape file, currently set up on the Univac 1142 Computing System at Arizona State University. The program is designed to include Mapping and requires 1143 words of program bank and 95, 944 words of data bank as presently constituted. Data dimensions are as follows:

(1) Number of supervisors per squadron--up to 20

(2) Number of technicians per squadron--up to 200

The FORTRAN program utilizes three types of input data, corresponding to the three survey instruments employed. These types of data are fully documented in the program and may be summarized as follows:

DATA1(I,J) - Inputs from the Supervisors Technical Information and Performance Rankings Form, Part I. The five technicians reporting to each supervisor are first identified by technician survey control numbers; then the technical information data of Part I is entered. Coding is by hand directly from the survey instrument. Eventually, this data is coupled to the survey data for each of the 5 reporting technicians. J is the supervisor counter (1-20) and I is the number of field positions needed per supervisor (40 available, 15 used).

DATA2(N,K) - Inputs from Part II of the Supervisors Technical Information and Performance Rankings Form (the speed and quality performance rankings for each technician), the Supervisors Technician Motivation Evaluation form, and the Biographic Information section of the Maintenance Technician Survey. Coding is by hand from the survey instruments. K is the technician counter (1-200) and N is the number of field positions needed per technician (56 available, 29 used prior to the later data coupling operations).

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1. BMDP (Biomedical Data Processing) is a software program for performing statistical evaluations on data, developed by the Department of Mathematics, School of Medicine, University of California at Los Angeles.

DATA3(I,J,K) - Input from the 150-question Maintenance Technician Survey, which is machine scored. Four input data cards are used for each technician's data. K is the technician counter (1-200), J allows for up to 5 cards per technician (4 are currently used), and I is the number of field positions per input card (72).

The technician survey control number, which appears on each of the three types of data input is used to couple all data to each particular technician. First, the data in the DATA1(I,J) file is added to the DATA2(N,K) file by technician. Then the DATA3(I,J,K) file is summarized by factor, question responses are averaged across each factor and the factor data is added to DATA2(N,K). After coupling, DATA2(N,K) contains all of the appropriate data for each technician in the squadron, for a total of 56 fields of information. It should be noted here that the 150 questions in the Maintenance Technician Survey result in only 18 predictor variables or factors.

Appendix C shows an example run of the FORTRAN program for one squadron, Williams AFB, FM squadron. It may be noted that echo checks are made of the input data, output data from DATA2(N,K) is printed following data collection, and a set of punched cards is output with most of the same data, prepared for use by the BMDP statistical package. The punched card output is on 2 cards, each 25I3 format. For input to BMDP, the technician number is unnecessary and the variables of squadron code, supervisor code, AFSC, status code and supervision code were considered not directly pertiment to performance. Thus the 50 variables used by the BMDP package are as shown in Figure 4, using appropriate letter names.

Output decks from the several FORTRAN data processing runs (one for squadron) were then input to the BMDP statistical package and in particular the 2R stepwise, linear multiple regression program. For each squadron, three runs were initialized: one in which the Performance Speed Rating (A) is the dependent variable and the Performance Quality Rating (B) is included as another independent variable, one in which the Performance Quality Rating (B) is the dependent variable and the Performance Speed Rating (A) is included as another independent variable, and one in which the dependent variable is a weighted transform of the two performance measures and neither appear as an independent variable. The latter is the most significant.

Hickman made a small survey of senior maintenance officers in which he included questions on the relative importance of speed vs. accuracy of performance relative to current Air Force mission (Hickman, 1979). The results favored accuracy, at least in peace time, over speed, though both were considered of importance. This writer elected to weight speed by 0.4 and accuracy by 0.6 in developing a transformed variable. Thus $ZZ = 0.4A + 0.6B$. These proportional weightings are elective. For a summary discussion on the BMDP2R program see the 1977 Series P Manual (University of California, 1977).

Appendix E provides an example output from the BMDP2R program, for the FM squadron at Williams AFB when the transformed variable $ZZ = 0.4A + 0.6B$ is used as dependent. The punched card output data from the FORTRAN program is read in format 25F3.0/25F3.0. One variable is added to allow for the ZZ transform. Having established ZZ, variables A and B are deleted by using only variables 3 through 51 in the analysis. Printing is established for the covariance matrix, the correlation matrix, the input data distributions, the step analysis of variances (ANOVA), the stepwise regression coefficients, the partial correlations, the predicted values and residuals, and the summary. Plots

Figure 4

BMDP2R Variable Identity

A	Speed Rating	AA	Clearance for Remove/Replace
B	Quality Rating	BB	No Internal Components
C	Job Curiosity	CC	Hours Between Equipment Servicing
D	Persistence	DD	Quality Technical Information
E	Professional Identification	EE	Quality Test Equipment
F	Organizationa Identification	FF	Technician Knowledge
G	Self Starter Tract	GG	Technician Skill
H	Work Shift	HH	Satisfaction Ind. Motives
I	Enlist Year	II	Homogeneity of Attitude
J	Skill Level	JJ	Sat. Interpersonal Relationships
K	Current Duty Assignment Year	KK	Satisfaction with Supervision
L	Current Equipment Assignment Year	LL	Structure
M	Months in Current Assignment	MM	Rewards
N	Sex	NN	Risk
O	Equipment Type	OO	Warmth
P	Rank	PP	Conflict
Q	Hours/Shift	QQ	Identity
R	Days Between Breaks	RR	Locality
S	No. Additional Duties	SS	Sat. Pay and Benefits
T	Hours Additional Duties	TT	Social Status
U	No. Clubs	UU	Fatigue Trait
V	No. Persons Supervised	VV	Ascendency
W	Months Supervision	WW	Responsibility
X	Weight Handled	XX	Emotional Stability
Y	Clearance for Service	YY	Sociability

requested include the normal probability plot of residuals and a detrended (trend removed) normal probability plot of residuals.

The BMDP2R computer program computes estimates of the parameters of a multiple linear regression equation in a stepwise manner. Variables are entered (forward stepping) or removed (backward stepping) one at a time according to any of four possible criteria. As may be noted in the BMDP2R sample output in Appendix E, control limits on the stepwise procedure are established by specifying F-levels to Enter and Remove and a Tolerance based on whether an entry or removal of a variable will produce an R^2 (accountability level) change, when compared to previously entered independent variables, exceeding the tolerance. The first numbers in ENTER and REMOVE establish entry limits and the second numbers in ENTER and REMOVE are used as remove limits. The particular numbers selected for use have been found to work well in providing good predictor variables with a very low level of multicollinearity; i.e., a high level of confidence can be placed on the variables selected for the prediction equation at the termination of the stepwise procedure.

At each step in the stepwise regression, an ANOVA is developed and the following parameters are printed: F ratio, R (multiple correlation coefficient), R^2 (which in percent form accounts for the variation in the dependent variable which can be accounted for by the independent variables included at the step), and the Standard Error of the Estimate. In general, R^2 values of 0.70 and better are considered very good in subjective research [70 percent accountability].

Results of the Study

Williams Air Force Base. For the Field Maintenance Squadron, data was collected from 18 supervisors and for 89 technicians. Sixty-three of the technicians worked day shift, 26 worked swing shift, none were mid-shift. Seven of the technician respondees were female, 18 of the technician respondees were civilians, 25 of the technician respondees supervised others in some capacity. Four of the technicians evaluated by their supervisors were "no shows" for the technician survey. The computer output from the FORTRAN data processing program is provided in Appendix E.

FMS Statistical Results. As described earlier, three statistical computer runs were made from the data for each squadron, using the BMDP2R stepwise linear multiple regression model. The selection of dependent variable was varied.

Table 7 shows the FMS data after processing for statistical distribution properties. It may be noted that the mean speed of performance rating by supervisors, across the squadron, is 6.5467 with a standard deviation of 2.1008. Likewise the mean quality of performance rating, across the squadron, is 7.3067 with a standard deviation of 2.0466. Letter names were applied to the variables as shown earlier in Figure 4. Coefficients of variation were high for M (months in current assignment), S (number of additional duties), T (hours on additional duties), LL (number of service clubs), V (number of persons supervised), W (months in supervision), VV (ascendency trait), WW (responsibility trait). Using the stopping criteria discussed earlier, the stepwise forward and backward regression included 26 steps when A (performance speed rating) was used as the dependent variable and resulted in the summary table shown in Table 8. The final model included 10 significant predictor variables, including the performance quality rating. The resulting prediction equation is

Table 7

Williams AFB, FM Squadron Data Showing Statistical Distribution Parameters

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VARIABLE NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	6.5467	2.1008	.3209	-.7979	3.3748	1.0000	10.0000	-2.6403	1.6438
2	B	7.3067	2.0466	.2801	-1.1017	3.0140	1.0000	10.0000	-3.0816	1.3160
3	C	3.0000	1.0000	.3333	-.5600	2.1067	1.0000	4.0000	-2.0000	1.0000
4	D	2.8533	1.0615	.3720	-.4467	1.9184	1.0000	4.0000	-1.7459	1.0802
5	E	3.0400	1.0324	.3396	-.6599	2.1469	1.0000	4.0000	-1.9759	.9298
6	F	2.8133	1.0093	.3588	-.3280	1.9433	1.0000	4.0000	-1.7966	1.1757
7	G	2.7600	1.0885	.3944	-.3291	1.7749	1.0000	4.0000	-1.6169	1.1392
8	H	1.2800	.4520	.3531	.9604	1.9084	1.0000	2.0000	-.6194	1.5928
9	I	67.0800	19.5239	.2911	-2.6797	9.3655	.0000	79.0000	-3.4358	.6105
10	J	4.5600	2.0549	.4506	-1.3340	3.8803	.0000	7.0000	-2.2191	1.1874
11	K	63.2800	26.9993	.4267	-1.8063	4.4720	.0000	79.0000	-2.3438	.5822
12	L	65.5733	25.0579	.3821	-2.0831	5.6650	.0000	79.0000	-2.6169	.5358
13	M	8.0267	17.3708	2.1946	2.7604	10.5631	.0000	99.0000	-.4557	4.6551
14	N	1.0133	.3853	.3802	.1306	6.6285	.0000	2.0000	-2.6299	2.5607
15	O	1.8800	.6142	.3267	-2.0032	7.6672	.0000	3.0000	-3.0607	1.8234
16	P	4.9467	2.7700	.5600	-.2805	1.5534	.0000	8.0000	-1.7858	1.1023
17	Q	7.6533	1.8995	.2482	-3.2982	14.4545	.0000	12.0000	-4.0292	2.2884
18	R	4.6267	1.3928	.3010	-2.8492	9.6589	.0000	7.0000	-3.3219	1.7040
19	S	.6133	.9138	1.4898	1.2409	3.3225	.0000	3.0000	-.6712	2.6119
20	T	1.4800	2.4404	1.6489	1.5568	4.2020	.0000	8.0000	-.6065	2.6717
21	U	.6133	1.0767	1.7555	1.8891	6.3485	.0000	5.0000	-.5696	4.0742
22	V	1.0800	2.0319	1.8814	2.2675	9.1939	.0000	11.0000	-.5315	4.8821
23	W	5.3067	14.8214	2.7930	4.2127	23.6193	.0000	99.0000	-.3580	6.3215
24	X	39.1333	31.6374	.8085	2.0800	7.6775	.0000	140.0000	-1.2369	3.1882
25	Y	1.8800	.9438	.5020	-.2401	2.5191	.0000	4.0000	-1.9919	2.2462
26	AA	2.4667	1.3083	.5304	.0003	2.4476	.0000	5.0000	-1.8854	1.9363
27	BB	18.3733	15.3454	.8352	.6886	2.4238	.0000	50.0000	-1.1973	2.0610
28	CC	125.0000	105.6140	.8449	.5128	1.6193	.0000	300.0000	-1.1836	1.6570
29	DD	3.6667	1.0946	.2985	-.7884	3.1721	.0000	5.0000	-3.3497	1.2181
30	EE	2.8533	1.9431	.6810	-.5377	1.6606	.0000	5.0000	-1.4685	1.1048
31	FF	3.5333	1.0045	.2843	-1.0372	4.6548	.0000	5.0000	-3.5175	1.4601
32	GG	3.4667	.9348	.2697	-1.3246	5.6646	.0000	5.0000	-3.7084	1.6403
33	HH	21.8533	9.3905	.4297	-1.5295	4.0788	.0000	32.0000	-2.3272	1.0805
34	II	23.9467	10.6224	.4436	-1.3304	3.6654	.0000	37.0000	-2.2544	1.2289
35	JJ	21.3733	8.7360	.4087	-1.8413	4.0505	.0000	28.0000	-2.4466	.7585
36	KK	24.1067	10.2147	.4237	-1.5541	4.3707	.0000	42.0000	-2.3600	1.7517
37	LL	20.9733	8.6769	.4138	-1.7531	4.6449	.0000	31.0000	-2.4166	1.1553
38	MM	21.9467	9.2603	.4219	-1.6253	4.3542	.0000	33.0000	-2.3700	1.1936
39	NN	22.4267	9.4543	.4216	-1.6134	4.4125	.0000	37.0000	-2.3721	1.5415
40	OO	23.1467	9.9454	.4297	-1.4835	4.1013	.0000	35.0000	-2.3274	1.1918
41	PP	22.5467	9.5015	.4214	-1.6035	4.4045	.0000	37.0000	-2.3730	1.5212
42	QQ	20.6133	8.6006	.4172	-1.6587	4.5954	.0000	35.0000	-2.3967	1.6728
43	RR	14.4133	11.5864	.8039	-.3153	1.3302	.0000	31.0000	-1.2440	1.4316
44	SS	18.0533	15.4803	.8211	-.2167	1.3537	.0000	43.0000	-1.2179	1.5598
45	TT	15.6667	12.9378	.8258	-.1558	1.4767	.0000	39.0000	-1.2109	1.8035
46	UU	15.3333	6.5189	.4251	-1.4709	4.5856	.0000	31.0000	-2.3522	2.4033
47	VV	-.7733	2.2456	-2.9037	-.1244	3.0317	-7.0000	5.0000	-2.7729	2.5710
48	WW	1.0667	2.1393	2.0056	-.1181	2.5310	-4.0000	6.0000	-2.3684	2.3061
49	XX	-1.6800	2.0279	-1.2071	-.5654	2.6225	-7.0000	2.0000	-2.6234	1.8147
50	YY	1.6800	[illegible]	1.1635	.3962	2.6040	[illegible]	8.0000	-1.6065	2.7589
51	ZZ	7.0027	1.9671	.2812	-1.0408	3.7681	1.0000	10.0000	-3.0485	1.5222

Table 8

BMDP2R Summary for Williams AFB, FM Squadron with Performance
<u>Speed</u> Rating A as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.8060	.6496	.6496	135.5289		1
2	19 S		.8283	.6860	.0365	8.3594		2
3	5 E		.8400	.7056	.0195	4.7063		3
4	11 K		.8486	.7201	.0145	3.6241		4
5	16 P		.8564	.7335	.0134	3.4724		5
6	14 N		.8607	.7408	.0074	1.9325		6
7	3 C		.8638	.7462	.0053	1.4041		7
8	24 X		.8679	.7532	.0071	1.6983		8
9	25 Y		.8729	.7620	.0088	2.3947		9
10	8 H		.8777	.7704	.0084	2.3975		10
11		11 K	.8776	.7703	-.0002		.0508	9
12	22 V		.8816	.7772	.0069	1.9738		10
13	45 TT		.8853	.7837	.0065	1.6661		11
14	23 W		.8889	.7902	.0065	1.5242		12
15	28 CC		.8922	.7959	.0058	1.7229		13
16	30 EE		.8960	.8029	.0070	2.1160		14
17	50 YY		.8989	.8080	.0051	1.5685		15
18	27 BB		.9021	.8138	.0058	1.8022		16
19	6 F		.9041	.8174	.0036	1.1259		17
20		5 E	.9027	.8150	-.0024		.7617	16
21		3 C	.9020	.8135	-.0014		.4445	15
22		45 TT	.8996	.8097	-.0038		1.2095	14
23		27 BB	.8967	.8041	-.0056		1.7736	13
24		50 YY	.8920	.7956	-.0085		2.6389	12
25		23 W	.8879	.7884	-.0072		2.1798	11
26		22 V	.8848	.7828	-.0056		1.6656	10

$$A = -0.669 + 0.608B + 0.358F + 1.107H - 1.151N + 0.148P + 0.382S + 0.025X$$
$$- 0.790Y + 0.003CC + 0.253EE \text{ [78\% prediction]}$$

The multiple R for the above equation is 0.8848 and 78 percent of the variation in A is accounted for.

Table 9 shows similar results when B (performance quality rating) is the dependent variable. The final model included only 5 significant variables after processing through 22 steps. The resulting prediction equation is

$$B = 0.768 + 0.566A + 0.780C - 0.010L + 0.279R - 0.109V \text{ [76\% prediction]}$$

The multiple R forthe above equation is 0.8722 and 76 percent of the variation in B is accounted for.

Table 10 shows similar results when the transformed dependent variable $ZZ = 0.4A + 0.6B$ is used and A and B are deleted. After 29 steps, only 3 predictor variables remain and the resulting equation is

$$ZZ = 1.599 + 1.300E + 0.219P + 0.009X \text{ [65\% prediction]}$$

The multiple R for the above equation is 0.8077 and 65 percent of the variation in ZZ is accounted for. Of course, if we accept a larger tolerance relative to the partial correlations, and more predictor variables, more of the variation in ZZ can be accounted for. For example, after 18 steps, there are 14 predictor variables which account for 78 percent of the variation in ZZ. At that point the equation is

$$ZZ = 1.856 + 0.936E + 0.336G - 0.418H + 0.139J - 0.012L + 0.187P + 0.214S$$
$$- 0.340U + 0.017X - 0.340AA + 0.377GG + 0.056II - 0.039PP$$
$$- 0.020SS \text{ [78\% prediction]}$$

It may be noted from the above that 11 more predictor variables (and the questionnaire data to support them) are needed to provide a 12 percent improvement in accountability. Further, multicollinearity may be present.

Although not included in this report, the prediction and residues tables in the computer reports show that when A is used as the dependent variable, only one time in 75 predictions evaluated did the number of standard deviations between actual and predicted exceed 3 and in only one other trial did it exceed 2. Thus the prediction capability is quite good. When B is used as the dependent variable, in 75 predictions the standard deviation between actual and predicted exceeded 3 once and exceeded 2 on three other trials. With ZZ as the dependent variable, in 75 trials the standard deviation between actual and predicted exceeded 3 once and 2 in four other trials.

Table 9

BMDP2R Summary for Williams AFB, FM Squadron with Performance Quality Rating B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOV.	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	1 A		.8060	.6496	.6496	135.3289		1
2	3 C		.8486	.7201	.0705	10.1272		2
3	16 P		.8582	.7365	.0164	4.4307		3
4	18 R		.8620	.7431	.0066	1.8002		4
5	12 L		.8697	.7564	.0133	3.7746		5
6	22 V		.8737	.7634	.0069	1.9802		6
7	10 J		.8766	.7684	.0051	1.4706		7
8	21 U		.8799	.7742	.0058	1.6876		8
9	8 H		.8826	.7789	.0047	1.3819		9
10	19 S		.8861	.7852	.0063	1.8700		10
11	23 W		.8902	.7924	.0072	2.1883		11
12	7 G		.8944	.8000	.0076	2.3534		12
13	13 M		.8964	.8035	.0035	1.1016		13
14		13 M	.8944	.8000	-.0035		1.1016	12
15		16 P	.8919	.7956	-.0044		1.3726	11
16		21 U	.8904	.7928	-.0028		.8572	10
17		7 G	.8871	.7870	-.0058		1.7947	9
18		23 W	.8824	.7786	-.0084		2.5485	8
19		8 H	.8784	.7715	-.0071		2.1121	7
20		19 S	.8749	.7655	-.0060		1.7696	6
21		10 J	.8722	.7607	-.0048		1.4007	5
22		22 V	.8664	.7507	-.0100		2.8726	4

Table 10

BMDP2R Summary for Williams AFB, FM Squadron with Transformed Variable ZZ = 0.4A + 0.6B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	5 E		.7351	.5404	.5404	85.8360		1
2	16 P		.7939	.6303	.0899	17.5007		2
3	8 H		.8090	.6545	.0243	4.9868		3
4	3 C		.8164	.6665	.0120	2.5207		4
5	21 U		.8229	.6772	.0107	2.2873		5
6	12 L		.8289	.6870	.0098	2.1200		6
7	24 X		.8340	.6955	.0085	1.8681		7
8	10 J		.8390	.7039	.0084	1.8807		8
9	44 SS		.8462	.7160	.0120	2.7565		9
10	29 DD		.8512	.7245	.0085	1.9779		10
11	7 G		.8562	.7330	.0085	2.0071		11
12	34 II		.8603	.7401	.0071	1.6978		12
13	41 PP		.8655	.7491	.0090	2.1886		13
14	26 AA		.8714	.7594	.0102	2.5522		14
15	32 GG		.8770	.7692	.0098	2.5140		15
16		29 DD	.8770	.7691	-.0001		.0187	14
17	19 S		.8818	.7775	.0084	2.2310		15
18		3 C	.8813	.7766	-.0009		.2413	14
19		8 H	.8778	.7706	-.0061		1.6279	13
20		44 SS	.8734	.7629	-.0077		2.0404	12
21		10 J	.8691	.7554	-.0075		1.9560	11
22		7 G	.8625	.7440	-.0114		2.9453	10
23		19 S	.8559	.7326	-.0113		2.8295	9
24		32 GG	.8484	.7197	-.0129		3.1462	8
25		21 U	.8411	.7074	-.0123		2.8906	7
26		12 L	.8318	.6920	-.0155		3.5429	6
27		34 II	.8225	.6765	-.0155		3.4133	5
28		41 PP	.8159	.6656	-.0109		2.3200	4
29		26 AA	.8077	.6523	-.0133		2.7850	3

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OMS Results. For the Organizational Maintenance Squadron at Williams AFB, data was collected from 18 supervisors and for 70 technicians. Thirty-two of the technicians worked day shift, 27 worked swing shift, and 11 worked mid-shift; 40 of the technician respondees were female. All were military. Twenty of the technician respondees supervised others in some capacity. Four of the technicians evaluated by their supervisors were "no-shows" for the technician survey. The computer output from the FORTRAN data processing program is provided in Appendix F.

OMS Statistical Results. Table 11 shows the BMDP2R data after processing for statistical distribution properties. It may be noted that the mean speed of performance rating, across the squadron, is 6.7714 with a standard deviation of 1.8971. This may be compared with parallel figures of 6.5467 and 2.1008 for the FMS. For quality of performance for OMS the values were 7.3143 (mean) and 1.8537 (standard deviation). Comparable figures for the FMS were 7.3067 and 2.0466. Coefficients of variation were high for some of the same variables as for FMS. When A was used as the dependent variable, the stepwise regression involved 30 steps and resulted in 8 significant predictor variables. The resulting prediction equation is

$$A = -1.846 + 0.547B + 0.388F + 0.256Q - 0.345R - 0.389LL + 0.784FF$$
$$+ 0.112LL - 0.089QQ \text{ [72\% prediction]}$$

The multiple R for the above equation is 0.8479 and 72 percent of the variation in A is accounted for. The summary is provided in Table 12.

Table 13 shows similar results when B is the dependent variable. The final model includes 15 predictor variables after 29 steps. The resulting equation is

$$B = 0.811 + 0.283A + 0.655D + 0.747F - 0.468G + 0.569J - 1.266N$$
$$+ 0.519O - 0.137P - 0.371R - 0.007X + 0.278EE + 0.422GG$$
$$- 0.081PP + 0.132UU + 0.152XX \text{ [81\% prediction]}$$

The multiple R for the above equation is 0.8983 and 81 percent of the variation in B is accounted for.

Table 14 shows results when the transformed dependent variable ZZ = 0.4A + 0.6B is utilized. Stopping after 27 steps the multiple regression model gives 11 predictor variables and results in the following equation:

$$ZZ = 1.142 + 0.364D + 0.727F + 0.815J - 1.680N - 0.405R - 0.282AA$$
$$+ 0.268EE + 0.723GG - 0.048II - 0.047PP + 0.133X \text{ [78\% prediction]}$$

The multiple R for the above equation is 0.8846 and 78 percent of the variation in ZZ is accounted for.

Computer program prediction tables show that when A is used as the dependent variable, no trials err by 3 or more standard deviations, three trials err by 2 standard deviations. With B as the dependent variable, the same results are obtained. With ZZ as the dependent variable, in only two cases do the prediction errors approach two standard deviations.

Williams AFB Overall Results. The goal of this research study is to provide a measurement instrument which will model performance effectiveness within an Air Force squadron. Performance is a combination of rate of work and accuracy of work. For the peacetime Air Force, the weightings of 40% on speed and 60% on quality seem reasonable. Therefore, the model which predicts ZZ (0.4A + 0.6B) seems most useful.

Similarities and differences may be observed for the ZZ prediction models for the FMS vs. OMS at a 78% level of accountability:

$$\begin{aligned}\text{FMS:}\quad ZZ = {} & 1.856 + 0.936E + 0.336G - 0.418H + 0.139J - 0.012L + 0.187P \\ & + 0.214S - 0.340U + 0.017X - 0.340AA + 0.377GG + 0.056II \\ & - 0.039PP - 0.020SS \text{ [78\% prediction]}\end{aligned}$$

$$\begin{aligned}\text{OMS:}\quad ZZ = {} & 1.142 + 0.364D + 0.727F + 0.815J - 1.680N - 0.405R - 0.282AA \\ & 0.268EE + 0.723GG + 0.048II - 0.047PP + 0.133XX \text{ [78\% prediction]}\end{aligned}$$

Variables J, AA, GG, II and PP are common between FMS and OMS. However, several factors which surfaced as significant for FMS are different from those which surfaced for OMS. Table 15 lists the factors which are involved for each squadron.

It is also of interest to note what factors for OMS would provide approximately a 65 percent prediction level (Multiple R^2), similar to the 3 factor FMS model. This reduced equation, obtained at step 5 for the OMS data, provides the prediction equation

$$ZZ = -0.187 + 0.907F + 0.864J - 0.466R + 0.215EE + 0.633GG \text{ [67\% prediction]}$$

For the equation, the multiple R is 0.8163 and 67 percent of the variation in ZZ is accounted for. However, the Beta coefficients may be weak.

The results in Table 15, based on R^2 comparisons at approximately 78 percent accountability, show the significant Beta coefficients for the prediction equations, the mean values of the variables from the data collection, predicted values for ZZ from the equations and the actual mean value of ZZ based on supervisor evaluations across each squadron.

Table 11

Williams AFB, OM Squadron Data Sharing Statistical Distribution Parameters

VARIABLE NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	6.7714	1.8971	.2802	-.8931	3.6124	1.0000	10.0000	-3.0422	1.7018
2	B	7.3143	1.8537	.2534	-.9145	3.1840	2.0000	10.0000	-2.8669	1.4489
3	C	3.0000	.9927	.3309	-.6133	2.2358	1.0000	4.0000	-2.0147	1.0073
4	D	3.1143	1.0150	.3259	-.8809	2.5828	1.0000	4.0000	-2.0830	.8726
5	E	2.8857	.9409	.3261	-.4965	2.3325	1.0000	4.0000	-2.0042	1.1843
6	F	3.0429	1.0417	.3423	-.7663	2.3364	1.0000	4.0000	-1.9611	.9188
7	G	2.7286	1.2029	.4409	-.5113	1.8343	.0000	4.0000	-2.2683	1.0570
8	H	1.7000	.7293	.4290	.5126	1.9855	1.0000	3.0000	-.9598	1.7825
9	I	74.2571	13.2432	.1783	-5.1035	28.3820	.0000	79.0000	-5.6072	.3581
10	J	4.8571	.6206	.1278	-1.6982	8.9092	3.0000	7.0000	-2.9927	3.4531
11	K	76.9429	2.8584	.0371	-6.4356	49.6749	55.0000	79.0000	-7.6766	.7197
12	L	77.1571	2.8673	.0372	-6.5515	50.9889	55.0000	79.0000	-7.7276	.6427
13	M	6.7429	9.8270	1.4574	1.7668	5.4644	.0000	43.0000	-.6862	3.6895
14	N	.9429	.2338	.2480	-3.7344	15.1192	.0000	1.0000	-4.0329	.2444
15	O	1.8286	.7014	.3836	.2405	2.0035	1.0000	3.0000	-1.1814	1.6702
16	P	3.5571	2.4175	.6796	.6560	1.7553	.0000	8.0000	-1.4714	1.8378
17	Q	7.9857	1.2098	.1515	-3.9912	28.4153	.0000	10.0000	-6.6010	1.6650
18	R	5.0571	.8493	.1679	-1.2253	25.3979	.0000	9.0000	-5.9544	4.6424
19	S	.6286	.9352	1.4878	1.3070	3.5469	.0000	3.0000	-.6722	2.5358
20	T	1.5429	2.6631	1.7261	1.6139	4.1775	.0000	8.0000	-.5793	2.4246
21	U	.4143	.8074	1.9490	1.7398	4.7848	.0000	3.0000	-.5131	3.2023
22	V	.8857	1.7156	1.9370	2.1098	7.1256	.0000	8.0000	-.5163	4.1468
23	W	2.1714	4.8573	2.2369	2.3765	7.5832	.0000	19.0000	-.4470	3.4646
24	X	93.4286	53.6193	.5739	.7092	2.4316	30.0000	200.0000	-1.1829	1.9876
25	Y	2.2429	.9393	.4188	.2353	2.0918	1.0000	4.0000	-1.3232	1.8708
26	AA	2.9286	1.0261	.3504	.1401	2.4979	1.0000	5.0000	-1.8796	2.0188
27	BB	14.2571	10.0602	.7056	1.6263	5.6027	.0000	45.0000	-1.4172	3.0559
28	CC	88.5714	111.9444	1.2639	1.0838	2.4213	3.0000	300.0000	-.7644	1.8887
29	DD	3.6429	1.0906	.2994	-1.1219	3.8927	1.0000	5.0000	-2.4233	1.2444
30	EE	1.1429	1.5906	1.3918	.7703	1.7555	.0000	4.0000	-.7185	1.7963
31	FF	3.5143	.7939	.2259	.0396	2.4905	2.0000	5.0000	-1.9075	1.8715
32	GG	3.8571	.8893	.2306	-.4551	2.4776	2.0000	5.0000	-2.0883	1.2851
33	HH	23.0571	6.5317	.2833	-2.3809	9.1186	.0000	32.0000	-3.5300	1.3691
34	II	26.9714	8.5405	.3169	-1.7341	6.2909	.0000	40.0000	-3.1558	1.5244
35	JJ	23.7000	6.7057	.2829	-2.4039	9.1185	.0000	32.0000	-3.5343	1.2377
36	KK	25.5857	7.1556	.2797	-2.4897	9.5515	.0000	35.0000	-3.5756	1.3157
37	LL	22.6857	6.1516	.2712	-2.7704	10.6935	.0000	30.0000	-3.6878	1.1890
38	MM	22.8000	6.7773	.2973	-2.1753	7.7981	.0000	33.0000	-3.3632	1.5046
39	NN	24.4857	7.1358	.2914	-2.1528	8.2572	.0000	35.0000	-3.4314	1.4734
40	OO	25.4143	7.2121	.2838	-2.3033	9.0729	.0000	37.0000	-3.5238	1.6064
41	PP	22.2000	6.7772	.3053	-1.7975	7.1671	.0000	35.0000	-3.2757	1.8887
42	QQ	22.5143	6.3582	.2824	-2.4075	9.2301	.0000	32.0000	-3.5410	1.4919
43	RR	21.9143	7.9432	.3625	-1.4458	5.4754	.0000	37.0000	-2.7589	1.8992
44	SS	26.3143	9.4571	.3594	-1.6054	5.4544	.0000	41.0000	-2.7825	1.5529
45	TT	22.6571	8.7442	.3859	-1.1250	4.4148	.0000	37.0000	-2.5911	1.6403
46	UU	16.6429	4.4723	.2687	-2.8989	11.0581	.0000	20.0000	-3.7214	.7507
47	VV	-.7714	2.2661	-2.9376	-.0882	2.6994	-7.0000	5.0000	-2.7485	2.5468
48	WW	1.1571	2.0756	1.7938	-.2930	2.6585	-4.0000	6.0000	-2.4846	2.3332
49	XX	-1.7857	2.0639	-1.1555	-.3814	2.7305	-7.0000	2.0000	-2.5270	1.8347
50	YY	1.7429	2.3510	1.3489	.2918	2.5829	-2.0000	8.0000	-1.5920	2.6615

Table 12

BMDP2R Summary for Williams AFB, OM Squadron with Performance <u>Speed</u> Rating A as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.7419	.5505	.5505	83.2658		1
2	31 FF		.7723	.5964	.0459	7.6278		2
3	6 F		.8025	.6440	.0475	8.8141		3
4	17 Q		.8137	.6621	.0181	3.4899		4
5	14 N		.8205	.6733	.0112	2.1870		5
6	21 U		.8272	.6843	.0110	2.2006		6
7	37 LL		.8331	.6941	.0098	1.9762		7
8	33 HH		.8480	.7191	.0251	5.4411		8
9	26 AA		.8569	.7342	.0151	3.4155		9
10	18 W		.8615	.7422	.0079	1.8152		10
11	42 WW		.8681	.7536	.0114	2.6865		11
12	24 X		.8736	.7631	.0095	2.2918		12
13	38 MM		.8775	.7700	.0069	1.6838		13
14	20 T		.8821	.7781	.0080	1.9892		14
15	15 O		.8846	.7826	.0045	1.1187		15
16	30 EE		.8887	.7897	.0072	1.8065		16
17	10 J		.8914	.7947	.0049	1.2534		17
18	32 GG		.8944	.8000	.0054	1.3694		18
19		32 GG	.8914	.7947	-.0054		1.3694	17
20		10 J	.8887	.7897	-.0049		1.2534	16
21		30 EE	.8846	.7826	-.0072		1.8065	15
22		15 O	.8821	.7781	-.0045		1.1187	14
23		20 T	.8775	.7700	-.0080		1.9892	13
24		38 MM	.8736	.7631	-.0069		1.6838	12
25		33 HH	.8692	.7556	-.0076		1.8175	11
26		17 W	.8615	.7422	-.0134		3.1805	10
27		24 X	.8528	.7273	-.0148		3.3943	9
28		26 AA	.8437	.7118	-.0156		3.4226	8
29		14 N	.8359	.6987	-.0131		2.7660	7
30	17 Q		.8479	.7189	.0202	4.3906		8

Table 13

BMDP2R Summary for Williams AFB, OM Squadron with Performance Quality Rating B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	1 A		.7419	.5505	.5505	83.2658		1
2	10 J		.7694	.5919	.0415	6.8061		2
3	5 E		.7934	.6296	.0376	6.7075		3
4	24 X		.8131	.6612	.0316	6.0657		4
5	21 U		.8340	.6955	.0343	7.2185		5
6	30 EE		.8438	.7121	.0165	3.6184		6
7	32 GG		.8546	.7304	.0184	4.2228		7
8	31 FF		.8644	.7472	.0167	4.0391		8
9	49 XX		.8704	.7575	.0104	2.5705		9
10	16 P		.8732	.7625	.0049	1.2220		10
11	7 G		.8760	.7674	.0050	1.2418		11
12	6 F		.8793	.7732	.0057	1.4362		12
13	4 D		.8827	.7792	.0060	1.5216		13
14	18 R		.8857	.7844	.0052	1.3365		14
15	15 O		.8896	.7914	.0070	1.8169		15
16	14 N		.8933	.7980	.0065	1.7180		16
17	23 W		.8965	.8037	.0057	1.5063		17
18	41 PP		.8994	.8088	.0052	1.3824		18
19	36 KK		.9080	.8244	.0156	4.4352		19
20	46 UU		.9103	.8287	.0043	1.2194		20
21	37 LL		.9134	.8343	.0057	1.6378		21
22	38 MM		.9156	.8383	.0040	1.1535		22
23		31 FF	.9154	.8380	-.0003		.0765	21
24		5 E	.9138	.8349	-.0031		.9145	20
25		21 U	.9120	.8318	-.0031		.9335	19
26		38 MM	.9094	.8270	-.0048		1.4153	18
27		37 LL	.9064	.8216	-.0054		1.6006	17
28		36 KK	.9037	.8168	-.0049		1.4151	16
29		23 W	.8983	.8069	-.0099		2.8581	15

Table 14

BMDP2R Summary for Williams AFB, OM Squadron with Transformed Variable ZZ = 0.4A + 0.6B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	6 F		.5428	.2947	.2947	28.4078		1
2	10 J		.6859	.4705	.1758	22.2481		2
3	32 GG		.7496	.5619	.0914	13.7678		3
4	18 R		.7937	.6300	.0681	11.9569		4
5	30 EE		.8163	.6663	.0364	6.9774		5
6	14 N		.8330	.6938	.0275	5.6556		6
7	4 D		.8491	.7210	.0272	6.0473		7
8	26 AA		.8642	.7468	.0257	6.2005		8
9	16 P		.8719	.7602	.0134	3.3485		9
10	23 W		.8788	.7723	.0122	3.1486		10
11	7 G		.8870	.7868	.0145	3.9565		11
12	17 Q		.8915	.7948	.0079	2.2061		12
13	49 XX		.8948	.8006	.0058	1.6258		13
14	31 FF		.8974	.8054	.0048	1.3634		14
15	34 II		.9000	.8100	.0046	1.3028		15
16	41 PP		.9078	.8240	.0140	4.2235		16
17	40 OO		.9103	.8287	.0047	1.4328		17
18	42 QQ		.9136	.8347	.0060	1.8469		18
19	47 VV		.9161	.8392	.0044	1.3791		19
20		17 Q	.9141	.8357	-.0035		1.0825	18
21		42 QQ	.9122	.8322	-.0035		1.0850	17
22		47 VV	.9081	.8246	-.0075		2.3369	16
23		31 FF	.9051	.8193	-.0054		1.6199	15
24		40 OO	.9019	.8135	-.0058		1.7270	14
25		16 P	.8967	.8041	-.0094		2.7608	13
26		23 W	.8906	.7932	-.0110		3.1345	12
27		7 G	.8846	.7825	-.0107		2.9464	11

Table 15

Comparison of Multiple Regression Equations for Williams AFB, Organizational Maintenance and Field Maintenance Squadrons (Compared at R^2 Level of Approximately 78%, Dependent Variable is ZZ)

Factor	FMS Beta Coeff.	FMS Mean	FMS Contr.	OMS Beta Coeff.	OMS Mean	OMS Contr.
1. D - Persistence				+0.364	3.114	1.134
*2. E - Prof. Identification	+0.936	3.040	2.845			
3. F - Organ. Identification				+0.727	3.043	2.212
4. G - Self Starter Trait	+0.336	2.760	0.927			
5. H - Work Shift (performance lower in swing and mid shifts)	-0.418	1.280	-0.535			
6. J - Skill Level	+0.139	4.560	0.634	+0.815	4.857	3.959
7. L - Current Equipment Assignment Year	-0.012	65.573	-0.787			
8. N - Sex (performance lower for male)				-1.680	0.943	-1.584
*9. P - Rank	+0.187	4.947	0.925			
10. R - Days Between Breaks (performance lower with longer work weeks)				-.405	5.057	-2.048
11. S - No. of Additional Duties	+0.214	0.613	0.131			
12. U - No. of Clubs	-0.340	0.613	-0.208			
*13. X - Weight Handled	+0.017	39.133	0.665			
14. AA - Clearance for Remove/Replace of Components	-0.340	2.467	-0.839	-0.282	2.929	-0.826
15. EE - Quality of Test Equip.				+0.268	1.143	0.306
16. GG - Technician Skill	+0.377	3.467	1.307	0.723	3.857	2.789
17. II - Homogeneity of Group Attitude	+0.056	23.947	1.341	+0.048	26.971	1.295
18. PP - Organizational Conflict	-0.039	22.547	-0.879	-0.047	22.200	-1.043
19. SS - Satisfaction with Pay and Benefits	-0.020	18.843	-0.377			
20. XX - Emotional Stability				+0.133	-1.786	-0.238
ZZ Intercept			1.856			1.142
Predicted Mean Performance Level ZZ for Squadron			7.006			7.098
Actual Mean Performance Level ZZ for Squadron (Based on Supervisor Evaluations)			7.003			7.097

*Present in FMS final 3 factor model.

Luke Air Force Base. For the Component Repair Squadron, data was collected from 12 supervisors and for 58 technicians. Thirty of the technicians worked day shift and 28 worked swing shift, 8 of the technician respondees were female, 3 of the respondees were civilians, 17 of the technician respondees supervised others in some capacity. Five of the technicians evaluated by their supervisors were "no-shows" for the technician survey. The computer output from the FORTRAN data processing program is provided in Appendix G.

CRS Statistical Results. Table 16 shows the CRS data after processing by the BMDP package for statistical distributions properties. The mean speed of performance rating by supervisors, across the squadron, is 7.0508 with a standard deviation of 2.4735. The mean quality of performance rating is 7.8136 with a mean of 2.3229. High coefficients of variation are noted for LL (number of clubs), W (months of supervision) and WW (responsibility trait). Using the same stepwise stopping criteria as for the Williams AFB data, the stepwise regression included 13 steps when variable A (performance speed rating) was used as the dependent variable, resulting in the summary table shown in Table 17. The final most efficient model includes only 3 predictor variables and results in the following prediction equation:

$$A = -0.442 + 0.481B + 0.201V + 1.002GG \text{ [70\% accountability]}$$

Multiple R for the above equation is 0.8338 and 70 percent of the variation in A is accounted for.

A maximum R of .8691, with 76 percent explanation, is obtained with an 8 factor model after 8 steps.

$$A = -1.104 + 0.269B + 0.510F - 0.337U + 0.138V + 0.249AA - 0.004CC + 1.145GG - 0.131XX \text{ [76\% accountability]}$$

Table 18 shows similar results when B (quality performance rating) is used as the dependent variable. The efficient model includes 7 variables after 31 steps, resulting in the equation

$$B = 1.014 + 0.266A + 0.623C + 0.590D - 0.039K - 0.960N + 3.655\emptyset + 0.359DD \text{ [77\% accountability]}$$

The multiple R for the above equation is 0.8747 and 77 percent of the variation in B is accounted for.

Table 19 shows the results when the transformed variable ZZ = 0.4A + 0.6B is used as the dependent variable and A and B are deleted. The model stops iteration only after 42 steps and includes 18 variables as indicated in the summary. The prediction model is

Table 16

Luke AFB, 405th CR Squadron Data Showing Statistical Distribution Properties

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NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	7.0508	2.4735	.3508	-.7696	2.8515	.0000	10.0000	-2.8506	1.1923
2	B	7.8136	2.3229	.2973	-1.3274	4.5466	.0000	10.0000	-3.3638	.9413
3	C	3.2712	1.0477	.3203	-1.3408	3.8023	.0000	4.0000	-3.1224	.6957
4	D	3.2034	1.0793	.3369	-1.2096	3.1744	.0000	4.0000	-2.9681	.7381
5	E	3.2712	1.0142	.3100	-1.3278	3.9405	.0000	4.0000	-3.2253	.7186
6	F	3.2542	1.0102	.3104	-1.3008	3.9105	.0000	4.0000	-3.2215	.7383
7	G	2.9831	1.2105	.4058	-.8283	2.2340	.0000	4.0000	-2.4644	.8401
8	H	1.4237	.5633	.3957	-.2737	2.0467	.0000	2.0000	-2.5273	1.0229
9	I	67.7288	23.4975	.3469	-2.3937	7.0454	.0000	78.0000	-2.8824	.4371
10	J	4.4237	1.7141	.3875	-1.5485	4.9154	.0000	7.0000	-2.5808	1.5030
11	K	66.1864	26.7237	.4038	-1.9984	5.1307	.0000	79.0000	-2.4767	.4795
12	L	63.3220	30.5865	.4830	-1.5662	3.4672	.0000	79.0000	-2.0703	.5126
13	M	5.3559	9.1119	1.7013	1.8473	5.6243	.0000	37.0000	-.5878	3.4728
14	N	.7627	.4291	.5626	-1.2038	2.4405	.0000	1.0000	-1.7776	.5530
15	O	.8983	.3048	.3394	-2.5689	7.6795	.0000	1.0000	-2.9468	.3336
16	P	3.0169	2.0719	.6868	1.0068	3.3964	.0000	8.0000	-1.4561	2.4051
17	Q	7.1884	2.4668	.3433	-2.4600	7.3645	.0000	10.0000	-2.9132	1.1405
18	R	4.3898	1.6296	.3712	-2.2739	6.2639	.0000	5.0000	-2.6937	.3744
19	S	.3559	.6889	1.9355	1.9156	6.0600	.0000	3.0000	-.5167	3.8381
20	T	.8475	1.9371	2.2857	2.4504	8.2799	.0000	8.0000	-.4375	3.6925
21	U	.2881	.7204	2.5003	3.0630	13.7002	.0000	4.0000	-.4000	5.1524
22	V	1.1695	2.4223	2.0712	3.3901	18.4570	.0000	15.0000	-.4828	5.7098
23	W	4.8983	15.0890	3.0805	4.6380	27.1181	.0000	99.0000	-.3246	6.2364
24	X	80.9322	50.5817	.6250	.8486	3.3197	.0000	200.0000	-1.6000	2.3540
25	Y	2.0508	1.3573	.6618	-.3342	1.5351	.0000	4.0000	-1.5110	1.4361
26	AA	2.0000	1.2034	.6017	-.0583	1.7454	.0000	4.0000	-1.6619	1.6619
27	BB	26.5693	19.3607	.7290	.1541	1.2810	.0000	50.0000	-1.3718	1.2107
28	CC	74.3220	89.5268	1.2046	1.2795	3.3974	.0000	300.0000	-.8302	2.5208
29	DD	2.7797	1.9125	.6880	-.2427	1.4505	.0000	5.0000	-1.4534	1.1610
30	EE	3.0847	1.8127	.5876	-.3799	1.6202	.0000	5.0000	-1.7018	1.0566
31	FF	2.9322	1.1724	.3999	-.1868	2.4844	.0000	5.0000	-2.5009	1.7637
32	GG	3.4915	1.1503	.3295	-.3471	2.6873	.0000	5.0000	-3.0353	1.3114
33	HH	21.7288	8.8548	.4075	-1.5378	4.5444	.0000	35.0000	-2.4539	1.4988
34	II	26.5763	10.6677	.4014	-1.6668	4.7415	.0000	40.0000	-2.4913	1.2584
35	JJ	22.2373	8.6190	.3876	-1.8951	5.3763	.0000	31.0000	-2.5800	1.0167
36	KK	24.5424	9.4126	.3835	-1.9979	5.5543	.0000	32.0000	-2.6074	.7923
37	LL	21.3390	8.4560	.3963	-1.7662	4.9410	.0000	31.0000	-2.5235	1.1425
38	MM	22.7458	9.0812	.3992	-1.7353	4.8216	.0000	33.0000	-2.5047	1.1292
39	NN	22.0339	9.4010	.4267	-1.5907	4.2342	.0000	33.0000	-2.3438	1.1665
40	OO	22.9661	9.4449	.4113	-1.4765	4.4503	.0000	37.0000	-2.4316	1.4859
41	PP	21.0000	8.5238	.4059	-1.6322	4.5404	.0000	30.0000	-2.4637	1.0559
42	QQ	20.7458	8.8524	.4267	-1.4175	3.9647	.0000	32.0000	-2.3435	1.2713
43	RR	20.6102	9.9239	.4815	-1.3227	3.3243	.0000	31.0000	-2.0768	1.0470
44	SS	25.6610	12.6690	.4937	-1.1580	3.1080	.0000	43.0000	-2.0255	1.3686
45	TT	21.1017	11.1922	.5304	-.7510	2.6572	.0000	39.0000	-1.8854	1.5992
46	UU	15.7288	6.0139	.3823	-2.0339	5.6029	.0000	20.0000	-2.6154	.7102
47	VV	-1.0678	2.1243	-1.9894	.0022	3.0090	-6.0000	4.0000	-2.3218	2.3857
48	WW	.5593	1.8687	3.3410	-.4186	3.4075	-5.0000	5.0000	-2.9719	2.3763
49	XX	-1.0678	2.1645	-2.0271	.3465	3.1017	-6.0000	5.0000	-2.2787	2.8033
50	YY	1.7119	1.7816	1.0407	.3583	2.2520	-1.0000	6.0000	-1.5221	2.4069
51	[illegible]	[illegible]	2.0044	.2629	-.9750	3.6161	1.0000	10.0000	-3.3117	1.1785

Table 17

BMDP2R Summary for Luke AFB, 405th CR Squadron with Performance Speed Rating A as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.7309	.5342	.5342	65.3670		1
2	32 GG		.8116	.6567	.1245	20.4271		2
3	22 V		.8338	.6952	.0365	6.5952		3
4	6 F		.8412	.7076	.0124	2.2808		4
5	28 CC		.8490	.7207	.0131	2.4929		5
6	49 XX		.8559	.7326	.0119	2.3155		6
7	26 AA		.8637	.7460	.0134	2.6900		7
8	21 U		.8691	.7564	.0094	1.9180		8
9		21 U	.8637	.7460	-.0094		1.9180	7
10		26 AA	.8559	.7326	-.0134		2.6900	6
11		49 XX	.8490	.7207	-.0119		2.3155	5
12		28 CC	.8412	.7076	-.0131		2.4929	4
13		6 F	.8338	.6952	-.0124		2.2808	3

Table 18

BMDP2R Summary for Luke AFB, 405th CR Squadron with Performance Quality Rating B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	1 A		.7309	.5342	.5342	65.3670		1
2	5 E		.8104	.6567	.1225	19.9912		2
3	3 C		.8232	.6777	.0210	3.5789		3
4	29 DD		.8370	.7006	.0229	4.1332		4
5	20 T		.8446	.7134	.0128	2.3674		5
6	34 II		.8527	.7271	.0137	2.6075		6
7	11 K		.8736	.7632	.0361	7.7631		7
8	4 D		.8764	.7681	.0050	1.0715		8
9	15 O		.8806	.7754	.0073	1.5883		9
10	14 N		.8880	.7886	.0132	3.0027		10
11	40 OO		.8930	.7974	.0088	2.0426		11
12	23 W		.8974	.8054	.0079	1.8766		12
13	22 V		.9039	.8171	.0117	2.8834		13
14		20 T	.9039	.8171	-.0000		.0027	12
15	7 G		.9066	.8219	.0048	1.2083		13
16	28 CC		.9091	.8265	.0047	1.1829		14
17	25 Y		.9118	.8315	.0049	1.2578		15
18	12 L		.9150	.8372	.0058	1.4884		16
19	27 BB		.9184	.8434	.0062	1.6199		17
20	39 NN		.9230	.8520	.0086	2.3192		18
21		5 E	.9206	.8475	-.0045		1.2037	17
22		7 G	.9174	.8416	-.0059		1.5965	16
23		27 BB	.9141	.8357	-.0059		1.5764	15
24		39 NN	.9114	.8307	-.0050		1.3029	14
25		28 CC	.9082	.8249	-.0058		1.5008	13
26		25 Y	.9050	.8191	-.0058		1.4959	12
27		12 L	.9025	.8144	-.0046		1.1818	11
28		22 V	.8949	.8008	-.0136		3.4457	10
29		23 W	.8900	.7921	-.0088		2.1133	9
30		40 OO	.8821	.7781	-.0140		3.2902	8
31		34 II	.8747	.7650	-.0131		2.9431	7

Table 19

BMDP2R Summary for Luke AFB, 405th CR Squadron with Transformed Variable ZZ = 0.4A + 0.6B as the Dependent Variable

SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	4 D		.5791	.3354	.3354	28.2551		1
2	32 GG		.7470	.5580	.2226	27.6996		2
3	3 C		.7902	.6244	.0664	9.5485		3
4	28 CC		.8175	.6684	.0440	7.0282		4
5	26 AA		.8436	.7116	.0432	7.7958		5
6	12 L		.8543	.7298	.0182	3.4348		6
7	10 J		.8772	.7694	.0396	8.5894		7
8	11 K		.8986	.8074	.0380	9.6713		8
9	36 KK		.9069	.8225	.0151	4.0748		9
10	5 E		.9128	.8333	.0108	3.0386		10
11	48 WW		.9167	.8403	.0070	2.0275		11
12	17 Q		.9209	.8481	.0078	2.3062		12
13	16 P		.9248	.8553	.0072	2.2032		13
14		10 J	.9247	.8551	-.0002		.0598	12
15	18 R		.9286	.8623	.0072	2.3038		13
16	9 I		.9316	.8680	.0056	1.8301		14
17	42 QQ		.9348	.8739	.0059	1.9584		15
18		16 P	.9347	.8736	-.0002		.0755	14
19	21 U		.9381	.8800	.0064	2.2356		15
20	8 H		.9405	.8845	.0045	1.5908		16
21	30 FE		.9425	.8883	.0038	1.3498		17
22	13 M		.9456	.8941	.0059	2.1570		18
23	25 Y		.9472	.8971	.0030	1.0996		19
24	31 FF		.9491	.9008	.0037	1.3756		20
25		4 D	.9490	.9006	-.0001		.0553	19
26	20 T		.9514	.9051	.0045	1.7439		20
27	43 RR		.9546	.9112	.0061	2.4553		21
28		5 E	.9545	.9111	-.0001		.0380	20
29	34 II		.9570	.9158	.0048	2.0370		21
30	45 TT		.9606	.9227	.0068	3.0872		22
31		8 H	.9605	.9226	-.0000		.0171	21
32	22 V		.9642	.9297	.0071	3.5306		22
33	14 N		.9656	.9324	.0027	1.3602		23
34	44 SS		.9670	.9350	.0026	1.3297		24
35	40 OO		.9695	.9399	.0048	2.5711		25
36		36 KK	.9687	.9385	-.0014		.7484	24
37		14 N	.9678	.9366	-.0019		1.0220	23
38		42 QQ	.9665	.9341	-.0025		1.3350	22
39		45 TT	.9644	.9300	-.0041		2.1622	21
40		12 L	.9611	.9238	-.0062		3.1801	20
41		40 OO	.9593	.9203	-.0035		1.6824	19
42		44 SS	.9566	.9150	-.0053		2.5277	18

$$ZZ = 2.369 + 0.805C - 0.088I - 0.031K + 0.048M + 1.382Q - 0.631R$$

$$+ 0.209T - 0.387U - 0.136V - 1.015Y + 1.181AA - 0.011CC + 0.483EE$$

$$- 0.410FF + 0.754GG + 0.069II - 0.055RR + 0.278WW \text{ [92\% accountability]}$$

The multiple regression R for the above equation is 0.9566 and 92 percent of the variation in ZZ is accounted for.

Approximately 77 percent of the variation in ZZ can be accounted for by only 7 variables and the resulting prediction equation

$$ZZ = -0.481 + 0.748C + 0.303D + 0.298J - 0.017L + 0.446AA$$

$$- 0.005CC + 1.095GG \text{ [77\% accountability]}$$

At the 92% level of accountability for ZZ, 3 residuals varied by 2 standard deviations, none varied by as much as 3 standard deviations.

EMS Results. For the Electrical Maintenance Squadron, data was collected from 11 supervisors and for 51 technicians. 29 of the technicians worked day shift and 22 worked swing shift. Four of the technician respondees were female, all of the respondees were military, 18 of the technician respondees supervised others in some capacity. Three of the technicians evaluated by their supervisors were "no-shows" for the technician survey. The computer output from the FORTRAN data processing program is provided in Appendix H.

EMS Statistical Results. The mean speed of performance rating by supervisors, across the squadron, is 6.5769 with a standard deviation of 2.4443 as shown in Table 20. For the quality of performance ratings, the mean is 7.4038 with a standard deviation of 1.9328. When A (speed of performance) was used as the dependent variable, the BMDP program iterated through 43 steps and produced the following prediction equation with 17 variables:

$$A = -0.112 + 0.343B + 0.475D - 1.076H + 17.035\emptyset - 1.680Q$$

$$- 1.001S + 0.440T - 0.009X + 0.384AA + 0.958DD$$

$$- 0.310EE - 0.895FF + 1.101GG - 0.252JJ + 0.146NN$$

$$- 0.284WW - 0.316XX \text{ [90\% accountability]}$$

The multiple regression R for the above equation is 0.9476 and 90 percent of the variation in A is accounted for. Table 21 shows the summary results.

At an accountability level of approximately 77 percent, the resulting equation contains 10 predictor variables

Table 20

Luke AFB, 405th EM Squadron Data Showing Statistical Distribution Properties

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VARIABLE NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	6.5769	2.4443	.3716	-.4153	2.7044	.0000	10.0000	-2.6908	1.4005
2	B	7.4038	1.9328	.2611	-.9994	5.2659	.0000	10.0000	-3.8307	1.3432
3	C	2.5000	1.2127	.4851	-.7441	2.6877	.0000	4.0000	-2.0616	1.2369
4	D	2.6154	1.3307	.5088	-.7087	2.3006	.0000	4.0000	-1.9654	1.0405
5	E	2.6154	1.2549	.4798	-.8991	2.7414	.0000	4.0000	-2.0842	1.1034
6	F	2.7885	1.2885	.4621	-1.0138	2.9632	.0000	4.0000	-2.1641	.9403
7	G	2.5577	1.2744	.4983	-.6560	2.4563	.0000	4.0000	-2.0070	1.1318
8	H	1.4038	.5336	.3801	-.0020	1.7639	.0000	2.0000	-2.6311	1.1173
9	I	68.9038	22.7512	.3302	-2.6363	8.1021	.0000	79.0000	-3.0286	.4438
10	J	4.5385	1.4343	.3160	-2.3827	7.9629	.0000	7.0000	-3.1642	1.7162
11	K	67.9808	24.8482	.3655	-2.3182	6.4815	.0000	79.0000	-2.7358	.4435
12	L	66.7115	26.6247	.3991	-2.0618	5.3292	.0000	79.0000	-2.5056	.4615
13	M	6.1923	13.6469	2.2038	3.8358	20.8653	.0000	84.0000	-.4538	5.7015
14	N	.8462	.3643	.4306	-1.8637	4.5035	.0000	1.0000	-2.3225	.4223
15	O	.9231	.2691	.2915	-3.0843	10.6612	.0000	1.0000	-3.4306	.2859
16	P	2.8269	1.7570	.6215	.8971	3.8619	.0000	7.0000	-1.6089	2.3751
17	Q	7.4231	2.1814	.2939	-2.9825	10.3557	.0000	10.0000	-3.4028	1.1813
18	R	4.8077	1.8791	.3908	.9688	14.3129	.0000	14.0000	-2.5585	4.8919
19	S	.8846	1.0224	1.1557	.7654	2.2770	.0000	3.0000	-.8653	2.0691
20	T	2.0962	2.7458	1.3099	.8936	2.3362	.0000	8.0000	-.7634	2.1501
21	U	.2500	.5899	2.3598	2.7044	10.9966	.0000	3.0000	-.4238	4.6614
22	V	1.4615	2.8592	1.9563	2.4975	9.3131	.0000	13.0000	-.5112	4.0356
23	W	2.8462	5.0113	1.7607	1.6808	4.7348	.0000	18.0000	-.5679	3.0239
24	X	94.9038	65.2258	.6873	.2830	1.6912	.0000	200.0000	-1.4550	1.6113
25	Y	1.6923	1.3797	.8153	.3744	1.8540	.0000	4.0000	-1.2266	1.6726
26	AA	2.1923	1.6808	.7667	.3099	1.5496	.0000	5.0000	-1.3043	1.6705
27	BB	21.1923	15.5577	.7341	.5654	2.3762	.0000	50.0000	-1.3622	1.8517
28	CC	103.7500	98.8903	.9532	.8876	2.5896	.0000	300.0000	-1.0491	1.9845
29	DD	3.1538	1.6964	.5379	-.7797	2.1663	.0000	5.0000	-1.8591	1.0883
30	EE	2.1346	2.2231	1.0415	.2119	1.1844	.0000	5.0000	-.9602	1.2889
31	FF	3.2308	1.3521	.4185	-1.7209	4.4554	.0000	4.0000	-2.3895	.5689
32	GG	3.4808	.8515	.2446	-2.5575	10.8574	.0000	4.0000	-4.0876	.6098
33	HH	23.8846	8.0796	.3383	-1.8726	6.1490	.0000	32.0000	-2.9561	1.0044
34	II	27.4615	9.1875	.3346	-1.8817	6.4097	.0000	40.0000	-2.9890	1.3647
35	JJ	22.9615	7.1290	.3105	-2.4619	8.3618	.0000	30.0000	-3.2209	.9873
36	KK	24.3462	7.6821	.3155	-2.3151	7.9066	.0000	35.0000	-3.1692	1.3868
37	LL	22.6346	7.4255	.3281	-1.9572	6.9096	.0000	33.0000	-3.0482	1.3959
38	MM	23.6154	7.6213	.3227	-2.1197	7.3335	.0000	36.0000	-3.0986	1.6250
39	NN	23.5769	8.1273	.3447	-1.8255	5.8669	.0000	35.0000	-2.9010	1.4055
40	OO	24.0962	8.1632	.3388	-1.7127	6.1647	.0000	37.0000	-2.9518	1.5807
41	PP	22.8269	7.7756	.3406	-1.6539	6.1436	.0000	37.0000	-2.9357	1.8228
42	QQ	22.7115	7.3092	.3218	-2.0626	7.5318	.0000	35.0000	-3.1072	1.6812
43	RR	22.5962	7.4525	.3298	-1.9388	6.7342	.0000	33.0000	-3.0320	1.3960
44	SS	28.8269	9.2328	.3203	-2.1717	7.4757	.0000	39.0000	-3.1222	1.1018
45	TT	24.7692	8.6628	.3497	-1.4674	5.6096	.0000	40.0000	-2.8593	1.7582
46	UU	16.3846	5.0958	.3110	-2.4179	8.4121	.0000	25.0000	-3.2153	1.6907
47	VV	-1.0577	2.1730	-2.0545	-.0174	2.9754	-6.0000	4.0000	-2.2744	2.3275
48	WW	.5769	1.9438	3.3692	-.4438	3.2904	-5.0000	5.0000	-2.8691	2.2755
49	XX	-1.0192	2.2535	-2.2109	.3058	2.9416	-6.0000	5.0000	-2.2103	2.6711
50	YY	1.0538	1.7251	1.0431	.2613	2.0863	-1.0000	5.0000	-1.5384	1.9397
51	ZZ	7.0731	1.9534	.2750	-.7494	4.6373	.0000	10.0000	-3.6258	1.5004

Table 21

BMDP2R Summary for Luke AFB, 405th EM Squadron with Performance
<u>Speed</u> Rating A as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.6636	.4404	.4404	39.3440		1
2	49 XX		.7390	.5461	.1057	11.4147		2
3	4 D		.7853	.6166	.0705	8.8300		3
4	8 H		.8190	.6708	.0542	7.7341		4
5	5 E		.8335	.6947	.0239	3.5951		5
6	32 GG		.8468	.7170	.0224	3.5551		6
7	30 EE		.8550	.7310	.0140	2.2917		7
8	50 YY		.8636	.7459	.0149	2.5147		8
9	20 T		.8700	.7569	.0110	1.9003		9
10	19 S		.8809	.7759	.0190	3.4855		10
11	11 K		.8884	.7893	.0133	2.5283		11
12	33 MM		.9031	.8156	.0264	5.5785		12
13	39 NN		.9174	.8417	.0260	6.2507		13
14	29 DD		.9235	.8529	.0112	2.8141		14
15		5 E	.9234	.8526	-.0002		.0563	13
16	3 C		.9261	.8576	.0050	1.2951		14
17	18 R		.9289	.8629	.0053	1.3874		15
18	24 X		.9323	.8692	.0063	1.6910		16
19	14 N		.9357	.8756	.0063	1.7326		17
20	12 L		.9400	.8837	.0081	2.3019		18
21	44 SS		.9432	.8896	.0059	1.7232		19
22	35 JJ		.9467	.8963	.0067	2.0056		20
23	15 O		.9492	.9010	.0047	1.4234		21
24	17 Q		.9533	.9088	.0078	2.4660		22
25	43 RR		.9564	.9147	.0059	1.9485		23
26	31 FF		.9585	.9186	.0039	1.2978		24
27	21 U		.9602	.9220	.0034	1.1280		25
28		50 YY	.9601	.9218	-.0002		.0585	24
29	46 WW		.9628	.9270	.0052	1.8340		25
30		11 K	.9627	.9268	-.0002		.0746	24
31	26 AA		.9670	.9351	.0084	3.3508		25
32		3 C	.9670	.9351	-.0000		.0165	24
33	42 QQ		.9688	.9386	.0035	1.5039		25
34	37 LL		.9709	.9427	.0040	1.7539		26
35		33 MM	.9707	.9422	-.0005		.2006	25
36		14 N	.9700	.9409	-.0013		.5710	24
37		21 U	.9695	.9398	-.0011		.5048	23
38		18 R	.9673	.9356	-.0042		1.9491	22
39		37 LL	.9631	.9275	-.0081		3.6689	21
40		42 QQ	.9601	.9217	-.0058		2.3964	20
41		12 L	.9571	.9160	-.0057		2.2663	19
42		43 RR	.9522	.9067	-.0093		3.5396	18
43		44 SS	.9476	.8979	-.0088		3.0992	17

$$A = -0.563 + 0.751B + 0.750D - 0.360E - 1.128H - 0.521S$$

$$+ 0.266T - 0.192EE + 0.711GG - 0.379XX - 0.245YY \text{ [77\% accountability]}$$

Table 22 shows the results when B (performance quality) is used as the dependent variable. After37 iterations the resulting model contains 13 variables, with the prediction equation as

$$B = 0.646 + 0.188A + 0.651E + 2.376H + 0.409P + 0.115T - 0.121X$$

$$- 0.288Y - 0.012CC + 1.290DD + 0.213HH - 0.081II$$

$$- 0.177JJ - 0.269WW \text{ [85\% accountability]}$$

The equation provides a multiple R of 0.9225 and 85 percent of the variation in B is accounted for.

At an accountability level of approximately 77 percent, 11 variables are present in the prediction equation. Thus the inclusion of only two additional variables in this case increases the accountability from 77 to 85 percent.

Table 23 shows the results when the transformed variable ZZ = 0.4A + 0.6B is used as the dependent variable. After 26 steps in the multiple regression program, the prediction equation contains 10 variables.

$$ZZ = 1.173 + 0.939H + 2.682\emptyset + 0.383P - 0.338R - 0.825S + 0.332T$$

$$+ 1.101GG - 0.145II + 0.193UU + 0.324VV \text{ [70\% accountability]}$$

The multiple R for the above equation is 0.8363 and 70 percent of the variation in ZZ is accounted for.

To expand the accountability to approximately 77 percent requires the 14 variables shown below:

$$ZZ = 0.944 + 0.933H + 3.401\emptyset + 0.324P - 0.365R - 0.705S + 0.255T$$

$$- 0.624U + 0.106W + 0.299AA + 1.016GG - 0.176II + 0.070QQ$$

$$+ 0.114UU + 0.267VV \text{ [77\% accountability]}$$

Examination of the predicted values and residuals shows only one residual with a standard deviation of 2, none with 3.

<u>AGS Results</u>. For the <u>Aircraft Generation Squadron</u>, data was collected from 11 supervisors and for 41 technicians. Twenty-three of the technicians worked day shift and 18 worked swing shift. Five of the technician respondees were female. All of the technicians were military. Nine of the technician respondees supervised others in some capacity. Three of the technicians evaluated by their

Table 22

BMDP2R Summary for Luke AFB, 405th EM Squadron with Performance <u>Quality</u> Rating B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	1 A		.6636	.4404	.4404	39.3440		1
2	8 H		.7558	.5712	.1308	14.9496		2
3	48 WW		.7890	.6225	.0513	6.5225		3
4	3 C		.8111	.6579	.0354	4.8688		4
5	5 E		.8281	.6857	.0278	4.0617		5
6	16 P		.8382	.7026	.0169	2.5574		6
7	18 R		.8451	.7142	.0116	1.7892		7
8	33 HH		.8518	.7255	.0113	1.7665		8
9	44 SS		.8639	.7463	.0208	3.4475		9
10	34 II		.8692	.7556	.0093	1.5519		10
11	46 UU		.8761	.7676	.0120	2.0680		11
12	10 J		.8849	.7830	.0154	2.7705		12
13	28 CC		.8921	.7958	.0128	2.3783		13
14	29 DD		.9027	.8148	.0191	3.8089		14
15	24 X		.9147	.8367	.0219	4.8170		15
16	35 JJ		.9235	.8528	.0162	3.8424		16
17	25 Y		.9312	.8672	.0144	3.6831		17
18	23 W		.9383	.8804	.0132	3.6295		18
19	7 G		.9425	.8884	.0080	2.2988		19
20	21 U		.9474	.8977	.0093	2.8045		20
21	19 S		.9508	.9040	.0063	1.9687		21
22	31 FF		.9535	.9091	.0052	1.6532		22
23	15 O		.9559	.9137	.0046	1.4911		23
24	22 V		.9585	.9186	.0049	1.6277		24
25		44 SS	.9581	.9180	-.0006		.1951	23
26		18 R	.9576	.9170	-.0010		.3486	22
27		22 V	.9551	.9122	-.0049		1.7038	21
28		46 UU	.9525	.9073	-.0048		1.6464	20
29		3 C	.9492	.9010	-.0063		2.1205	19
30		31 FF	.9454	.8937	-.0073		2.3456	18
31		15 O	.9410	.8855	-.0083		2.5726	17
32		7 G	.9372	.8783	-.0072		2.1368	16
33		10 J	.9335	.8715	-.0068		1.9529	15
34		21 U	.9270	.8594	-.0121		3.3820	14
35		19 S	.9216	.8493	-.0100		2.6440	13
36		23 W	.9138	.8351	-.0143		3.6039	12
37	20 T		.9225	.8509	.0159	4.0484		13

Table 23

BMDP2R Summary for Luke AFB, 405th EM Squadron with Transformed Variable ZZ = 0.4A + 0.6B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	32 GG		.4766	.2271	.2271	14.6916		1
2	16 P		.5869	.3445	.1174	8.7718		2
3	47 VV		.6635	.4402	.0957	8.2100		3
4	20 T		.6867	.4716	.0313	2.7881		4
5	19 S		.7227	.5223	.0508	4.8870		5
6	26 AA		.7439	.5534	.0311	3.1314		6
7	34 II		.7670	.5883	.0349	3.7278		7
8	42 QQ		.8002	.6403	.0520	6.2140		8
9	11 K		.8096	.6555	.0153	1.8616		9
10	18 R		.8230	.6774	.0218	2.7753		10
11	15 O		.8349	.6970	.0197	2.5962		11
12	21 U		.8448	.7136	.0166	2.2589		12
13	23 W		.8570	.7344	.0208	2.9816		13
14	8 H		.8714	.7593	.0249	3.8204		14
15	37 LL		.8796	.7737	.0144	2.2879		15
16	46 UU		.8873	.7873	.0136	2.2445		16
17	35 JJ		.8953	.8016	.0143	2.4482		17
18		11 K	.8952	.8015	-.0001		.0256	16
19	39 NN		.8985	.8072	.0058	1.0156		17
20		39 NN	.8952	.8015	-.0058		1.0156	16
21		37 LL	.8884	.7892	-.0123		2.1621	15
22		35 JJ	.8768	.7688	-.0204		3.4789	14
23		42 QQ	.8700	.7569	-.0119		1.9052	13
24		21 U	.8584	.7368	-.0201		3.1385	12
25		26 AA	.8484	.7198	-.0171		2.5289	11
26		23 W	.8363	.6994	-.0204		2.9085	10

supervisors were "no-shows" for the maintenance technician survey. The computer output from the FORTRAN data processing program is in Appendix I.

AGS Statistical Results. Statistical distributions are shown in Table 24. Table 25 shows the results with A as the dependent variable. The program stopped after 48 steps with a model containing 40 of the 49 possible dependent variables. Only variables F, H, K, L, M, P, AA, BB and WW did not enter the prediction equation, the equation providing a perfect (R = 1.000) prediction of A.

With only 3 variables, the multiple R is 0.9003 and 81 percent of the variation in A is accounted for. This equation is

A = -0.899 + 0.765B + 2.690Ø - 0.105W [81% accountability]

By adding variables N, S, V, XX and YY, a 90 percent accountability for A is obtained.

A = -0.113 + 0.703B - 1.115N + 3.493Ø - 0.625S + 0.755V

- 0.188W - 0.113XX - 0.228YY [90% accountability]

With B as the dependent variable, the BMDP program iterates through 43 steps and produces a prediction equation containing 23 variables, while giving an R of 0.9970 and a 99.4% accountability for B (Table 26).

With only 4 variables, an accountability of approximately 80% is obtained.

B = 1.785 + 0.851A + 0.515E - 0.031L + 0.104W [80% accountability]

By adding variables ØØ, SS, V and J, an accountability of approximately 90 percent is obtained.

B = 1.065 + 0.795A + 0.708E + 0.496J - 0.069L - 0.390V

+ 0.151W + 0.168ØØ - 0.111SS [90% accountability]

In Table 27, results are shown when transformed variable ZZ = 0.4A + 0.6B is used as the dependent variable. After 30 stepwise iterations, the resulting prediction equation contains 12 predictor variables:

ZZ = -0.044 + 1.458C + 0.795D - 1.294E + 0.848J - 1.520N

- 0.535U - 0.546AA + 0.737DD + 0.440EE + 0.179ØØ

- 0.321RR + 0.105TT [90% accountability]

Table 24

Luke AFB, 405th AG Squadron Data Showing Statistical Distribution Properties

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VARIABLE NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	6.6905	2.4243	.3624	-.9090	3.4301	.0000	10.0000	-2.7597	1.3651
2	B	7.0952	2.4276	.3421	-1.1668	3.7130	.0000	10.0000	-2.9228	1.1966
3	C	3.0952	1.1436	.3695	-1.0405	2.8953	.0000	4.0000	-2.7066	.7912
4	D	3.1429	1.0948	.3483	-1.1464	3.3157	.0000	4.0000	-2.8707	.7829
5	E	2.9524	1.0809	.3661	-.8135	2.7753	.0000	4.0000	-2.7313	.9692
6	F	2.8333	1.0801	.3812	-.6970	2.5960	.0000	4.0000	-2.6232	1.0801
7	G	2.7143	1.2155	.4478	-.4920	1.8725	.0000	4.0000	-2.2331	1.0578
8	H	1.4048	.5437	.3870	-.0742	1.8452	.0000	2.0000	-2.5838	1.0948
9	I	68.4524	23.8063	.3478	-2.3458	6.7460	.0000	79.0000	-2.8754	.4431
10	J	4.3810	1.5294	.3491	-2.2357	6.4815	.0000	5.0000	-2.8644	.4048
11	K	66.5000	27.0648	.4068	-1.9620	4.9273	.0000	79.0000	-2.4580	.4620
12	L	69.7143	23.1551	.3321	-2.5650	7.8416	.0000	79.0000	-3.0107	.4010
13	M	4.1905	11.4492	2.7322	4.5732	26.0847	.0000	70.0000	-.3660	5.7479
14	N	.7857	.4153	.5286	-1.3432	2.8011	.0000	1.0000	-1.8919	.5160
15	O	.9048	.2971	.3284	-2.6599	8.2004	.0000	1.0000	-3.0453	.3206
16	P	2.7381	1.7399	.6354	1.0997	4.1635	.0000	7.0000	-1.5737	2.4495
17	Q	7.4286	2.5099	.3379	-2.3572	7.4151	.0000	10.0000	-2.9597	1.0245
18	R	4.3810	1.8735	.4276	-1.6540	4.4759	.0000	7.0000	-2.3384	1.3980
19	S	.3333	.6115	1.8346	1.5731	4.2748	.0000	2.0000	-.5451	2.7254
20	T	1.0476	2.1294	2.0326	1.8333	5.1070	.0000	8.0000	-.4920	3.2650
21	U	.2381	.7905	3.3200	3.6217	15.8303	.0000	4.0000	-.3012	4.7590
22	V	.5952	1.4152	2.3776	2.4821	8.3661	.0000	6.0000	-.4206	3.8190
23	W	2.5952	7.9144	3.0496	4.5680	25.8981	.0000	48.0000	-.3279	5.7370
24	X	95.9524	67.5462	.7040	.1887	1.4069	.0000	200.0000	-1.4205	1.5404
25	Y	2.9286	1.3140	.4487	-.9427	2.5495	.0000	4.0000	-2.2288	.8154
26	AA	2.5000	1.2543	.5017	-.4706	2.0167	.0000	4.0000	-1.9932	1.1959
27	BB	11.6667	9.4525	.8102	.5212	2.2638	.0000	30.0000	-1.2342	1.9395
28	CC	18.9286	31.7677	1.6783	2.2719	6.6973	.0000	120.0000	-.5958	3.1816
29	DD	3.4286	1.3640	.3978	-.7823	3.4488	.0000	5.0000	-2.5135	1.1520
30	EE	1.7857	1.5067	.8437	.0226	1.3309	.0000	4.0000	-1.1852	1.4697
31	FF	2.4048	1.1275	.4689	-.4165	2.4640	.0000	4.0000	-2.1329	1.4149
32	GG	2.5952	1.1906	.4588	-.6439	2.4746	.0000	4.0000	-2.1798	1.1799
33	HH	23.5000	7.6899	.3272	-1.8025	6.5882	.0000	35.0000	-3.0560	1.4955
34	II	26.6429	8.8808	.3333	-1.7087	6.1973	.0000	40.0000	-3.0000	1.5040
35	JJ	23.4286	6.9603	.2971	-2.6378	9.2326	.0000	30.0000	-3.3660	.9441
36	KK	25.6429	7.8735	.3070	-2.3220	8.1931	.0000	35.0000	-3.2569	1.1884
37	LL	21.9286	6.6969	.3054	-2.3177	8.4562	.0000	33.0000	-3.2744	1.6532
38	MM	24.4286	7.2789	.2980	-2.5863	9.1672	.0000	33.0000	-3.3561	1.1776
39	NN	23.5952	7.5322	.3192	-2.1577	7.1300	.0000	31.0000	-3.1326	.9831
40	OO	25.1667	8.1388	.3234	-1.9572	6.7336	.0000	35.0000	-3.0922	1.2082
41	PP	22.3095	7.4653	.3346	-1.9323	6.3115	.0000	32.0000	-2.9884	1.2981
42	QQ	22.3095	7.0278	.3150	-2.1103	7.4812	.0000	32.0000	-3.1745	1.3789
43	RR	24.0000	7.7868	.3244	-1.8339	6.7757	.0000	36.0000	-3.0821	1.5411
44	SS	28.0238	9.1797	.3276	-1.7997	6.5056	.0000	41.0000	-3.0528	1.4136
45	TT	24.9048	9.1540	.3676	-1.2322	4.6180	.0000	40.0000	-2.7206	1.6490
46	UU	15.8095	5.0182	.3174	-2.1976	7.1726	.0000	20.0000	-3.1504	.8351
47	VV	-.8810	2.0146	-2.2869	-.1587	3.2764	-6.0000	4.0000	-2.5410	2.4228
48	WW	.6190	1.8206	2.9410	-.0330	2.9081	-4.0000	5.0000	-2.5370	2.4063
49	XX	-1.2857	2.1559	-1.6768	.4332	3.2894	-6.0000	5.0000	-2.1866	2.9155
50	YY	1.5952	1.7539	1.0994	.3483	2.0324	-1.0000	5.0000	-1.4797	1.9413
51	ZZ	6.9333	2.2947	.3310	-1.0666	3.7792	.0000	10.0000	-3.0214	1.3364

Table 25

BMDP2R Summary for Luke AFB, 405th AG Squadron with Performance Speed Rating A as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.7801	.6086	.6086	62.1891		1
2	23 W		.8403	.7062	.0976	12.9545		2
3	15 O		.9003	.8105	.1043	20.9210		3
4	22 V		.9207	.8477	.0372	9.0381		4
5	14 N		.9280	.8612	.0135	3.5125		5
6	19 S		.9361	.8763	.0150	4.2541		6
7	50 YY		.9425	.8883	.0120	3.6428		7
8	49 XX		.9459	.8947	.0065	2.0264		8
9	3 C		.9497	.9020	.0072	2.3644		9
10	34 II		.9538	.9097	.0077	2.6569		10
11	35 JJ		.9586	.9189	.0092	3.3906		11
12	39 NN		.9649	.9311	.0122	5.1243		12
13	26 CC		.9679	.9369	.0059	2.6053		13
14	42 QQ		.9715	.9438	.0069	3.3180		14
15	4 D		.9747	.9500	.0062	3.2148		15
16	30 EE		.9789	.9582	.0082	4.8819		16
17	31 FF		.9809	.9623	.0041	2.5919		17
18	38 MM		.9822	.9647	.0024	1.5928		18
19	36 KK		.9833	.9668	.0021	1.3940		19
20	8 H		.9842	.9687	.0019	1.2929		20
21	43 RR		.9853	.9708	.0021	1.4290		21
22	44 SS		.9877	.9756	.0048	3.7711		22
23	41 PP		.9902	.9805	.0049	4.5301		23
24	25 Y		.9919	.9839	.0034	3.5816		24
25	24 X		.9940	.9880	.0041	5.4365		25
26		31 FF	.9940	.9880	-.0000		.0019	24
27		8 H	.9940	.9880	-.0000		.0484	23
28	40 OO		.9949	.9898	.0018	2.9617		24
29	18 R		.9954	.9907	.0010	1.6772		25
30	45 TT		.9958	.9916	.0009	1.5404		26
31	17 Q		.9964	.9929	.0013	2.5105		27
32	20 T		.9971	.9941	.0013	2.8259		28
33	32 GG		.9978	.9955	.0014	3.6619		29
34	47 VV		.9983	.9966	.0011	3.5248		30
35	46 UU		.9985	.9970	.0004	1.2885		31
36	5 E		.9990	.9980	.0010	4.5113		32
37	37 LL		.9994	.9988	.0008	5.4120		33
38	16 P		.9997	.9994	.0006	6.5350		34
39	7 G		.9998	.9995	.0001	1.7846		35
40	33 HH		.9999	.9997	.0002	3.1558		36
41	21 U		.9999	.9998	.0001	3.1043		37
42		42 QQ	.9999	.9998	-.0000		.0098	36
43	29 DD		1.0000	.9999	.0001	4.0412		37
44		16 P	1.0000	.9999	-.0000		.0423	36
45	10 J		1.0000	1.0000	.0001	19.9557		37
46	42 QQ		1.0000	1.0000	.0000	41.6789		38
47	31 FF		1.0000	1.0000	.0000	11.4476		39
48	9 I		1.0000	1.0000	.0000	************		40

Table 26

BMDP2R Summary for Luke AFB, 405th AG Squadron with Performance Quality Rating B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	1 A		.7801	.6086	.6086	62.1891		1
2	23 W		.8359	.6988	.0902	11.6825		2
3	12 L		.8712	.7590	.0602	9.4955		3
4	6 E		.8921	.7956	.0368	6.6687		4
5	40 OO		.9120	.8317	.0359	7.6799		5
6	44 SS		.9316	.8679	.0362	9.5870		6
7	22 V		.9418	.8870	.0191	5.7356		7
8	10 J		.9481	.8989	.0120	3.9113		8
9	49 XX		.9534	.9089	.0100	3.5053		9
10	26 CC		.9588	.9194	.0105	4.0190		10
11	30 EE		.9645	.9303	.0110	4.7233		11
12	4 D		.9688	.9386	.0083	3.9203		12
13	20 T		.9726	.9460	.0074	3.8359		13
14	36 MM		.9756	.9519	.0059	3.2885		14
15	42 QQ		.9810	.9624	.0105	7.2847		15
16	43 RR		.9832	.9666	.0042	3.1391		16
17	33 HH		.9863	.9727	.0061	5.3472		17
18	45 TT		.9893	.9788	.0061	6.6016		18
19	25 Y		.9919	.9838	.0050	6.8657		19
20	32 GG		.9930	.9860	.0022	3.3273		20
21	7 G		.9938	.9877	.0017	2.7224		21
22	11 K		.9944	.9889	.0012	1.9993		22
23	39 NN		.9949	.9898	.0009	1.5425		23
24	35 JJ		.9956	.9912	.0014	2.7490		24
25	21 U		.9960	.9921	.0009	1.7934		25
26	19 S		.9967	.9934	.0013	3.0240		26
27		4 D	.9967	.9934	-.0000		.0429	25
28	3 C		.9970	.9941	.0007	1.7372		26
29	27 BB		.9976	.9952	.0011	3.2120		27
30	46 UU		.9978	.9957	.0009	1.5000		28
31	37 LL		.9982	.9963	.0007	2.1760		29
32	50 YY		.9985	.9969	.0006	2.1760		30
33		30 EE	.9985	.9969	-.0000		.0511	29
34	36 KK		.9987	.9975	.0006	2.4375		30
35	41 PP		.9990	.9981	.0006	3.1249		31
36		42 QQ	.9990	.9981	-.0000		.0649	30
37		43 RR	.9989	.9978	-.0003		1.6630	29
38		11 K	.9988	.9976	-.0002		1.1370	28
39		41 PP	.9986	.9972	-.0004		2.1767	27
40		36 KK	.9982	.9964	-.0008		3.8388	26
41		50 YY	.9978	.9957	-.0007		3.0269	25
42		35 JJ	.9973	.9947	-.0010		3.6773	24
43		27 BB	.9970	.9940	-.0007		2.2339	23

Table 27

BMDP2R Summary for Luke AFB, 405th AG Squadron with Transformed Variable ZZ = 0.4A + 0.6B as the Dependent Variable

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	MULTIPLE RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	4 D		.6738	.4540	.4540	33.2550		1
2	40 OO		.7274	.5291	.0751	6.2195		2
3	43 RR		.7745	.5998	.0707	6.7153		3
4	8 H		.8009	.6415	.0417	4.3059		4
5	29 DD		.8390	.7040	.0625	7.5976		5
6	45 TT		.8513	.7247	.0208	2.6408		6
7	3 C		.8635	.7456	.0209	2.7936		7
8	10 J		.8789	.7725	.0269	3.9000		8
9	9 I		.8964	.8035	.0309	5.0392		9
10	30 EE		.9109	.8298	.0263	4.7952		10
11	21 U		.9215	.8492	.0194	3.8595		11
12	5 E		.9310	.8668	.0176	3.8279		12
13	26 AA		.9422	.8877	.0209	5.2067		13
14	14 N		.9522	.9066	.0190	5.4858		14
15	44 SS		.9562	.9143	.0077	2.3372		15
16	48 WW		.9596	.9208	.0064	2.0236		16
17	19 S		.9615	.9244	.0037	1.1611		17
18		8 H	.9615	.9244	-.0000		.0008	16
19	33 HH		.9632	.9277	.0033	1.1075		17
20	35 JJ		.9699	.9407	.0130	5.0263		18
21	38 MM		.9738	.9483	.0076	3.2539		19
22	7 G		.9755	.9516	.0032	1.3955		20
23		7 G	.9738	.9483	-.0032		1.3955	19
24		38 MM	.9699	.9407	-.0076		3.2539	18
25		19 S	.9664	.9340	-.0067		2.6097	17
26		35 JJ	.9609	.9234	-.0106		3.8362	16
27		33 HH	.9593	.9203	-.0031		1.0214	15
28		9 I	.9570	.9159	-.0044		1.4263	14
29		48 WW	.9544	.9110	-.0050		1.5918	13
30		44 SS	.9481	.8989	-.0120		3.7877	12

The above equation gives a multiple R = 0.9481 and 90 percent of the variation in ZZ is accounted for. For 77 percent accountability, the factors of E, N, U, AA, EE drop out but H is added.

An examination of residuals showed no cases with 2 or more standard deviations.

Luke AFB Overall Results. Table 28 provides a summary comparison for the three maintenance squadrons supporting the 405th Tactical Wing at Luke AFB. Comparisons are made at an R^2 level of approximately 0.77 (77 percent or higher accountability). Similarities and differences between results for the three squadrons may be observed below, when the transformed variable ZZ is the dependent variable.

CRS: ZZ = -0.481 + 0.748C + 0.303D + 0.298J - 0.017L + 0.446AA

- 0.005CC + 1.095GG [77% accountability]

EMS: ZZ = 0.944 + 0.933H + 3.401Ø + 0.324P - 0.365R - 0.705S

+ 0.255T - 0.624U + 0.106W + 0.299AA + 1.016GG

- 0.179II + 0.070QQ + 0.114UU + 0.267VV [77% accountability]

AGS: ZZ = -1.055 + 0.671C + 0.604D + 1.202H + 0.313J + 0.297DD

+ 0.136ØØ - 0.252RR + 0.103TT [77% accountability]

A similar comparison may be made at an R^2 comparable level of approximately 0.90 (90 percent accountability). Again ZZ is the dependent variable.

CRS: ZZ = 2.369 + 0.805C - 0.088I - 0.031K + 0.048M + 1.382Q

- 0.631R + 0.209T - 0.387U - 0.136V - 1.015Y + 1.181AA

- 0.011CC + 0.483EE - 0.410FF + 0.754GG + 0.069II

- 0.055RR + 0.278WW [92% accuracy]

EMS: Not Possible [Maximum R^2 obtained = 80%]

AGS: ZZ = -0.044 + 1.456C + 0.795D - 1.294E + 0.848J - 1.520N

- 0.535U - 0.546AA + 0.737DD + 0.440EE + 0.179ØØ

- 0.321RR + 0.105TT [90% accountability]

Table 28

Comparison of Multiple Regression Equations for Luke AFB 405th TAC Wing, Component Repair, Electrical Maintenance, and Aircraft Generation Squadrons at Approximately 77% Accountability ($R^2 = 0.77$)

Factor	CRS			EMS			AGS		
	Beta Coeff.	Mean	Contr.	Beta Coeff.	Mean	Contr.	Beta Coeff.	Mean	Contr.
1. C - Job Curiosity	+0.748	3.328	2.489				+0.671	3.095	2.077
2. D - Persistence	+0.303	3.259	0.988				+0.604	3.143	1.898
3. H - Work Shift				+0.933	1.404	1.310	+1.202	1.405	1.689
4. J - Skill Level	+0.298	4.500	1.341				+0.313	4.381	1.371
5. L - Equipment Assign. Year	-0.017	64.414	-1.095						
6. O - Equipment Type				+3.401	0.923	3.139			
7. P - Rank				+0.324	2.287	0.916			
8. R - Days Between Breaks				-0.365	4.808	-1.755			
9. S - No. Add. Duties				-0.705	0.885	-0.624			
10. T - Hours Add. Duties				+0.255	2.096	0.535			
11. U - No. of Clubs				-0.624	0.250	-0.156			
12. W - Months in Supervision				+0.106	2.846	0.302			
13. AA - Clearance for Remove/Replace	+0.446	2.035	0.908	+0.299	2.192	0.655			
14. CC - Hours Between Equipment Service	-0.005	75.603	-0.378						
15. DD - Quality Tech. Information							+0.297	3.429	1.018
16. GG - Technician Skill	+1.095	3.552	3.889	+1.016	3.481	3.357			
17. II - Homogeneity of Group Att.				-0.179	27.462	-4.916			
18. OO - Organization Warmth							+0.136	25.167	3.423
19. QQ - Organization Identity				+0.070	22.712	1.590			
20. RR - Assignment Locality							-0.252	24.000	-6 048
21. TT - Social Status							+0.103	24.905	2.565
22. UU - Fatigue Trait				+0.114	16.385	1.868			
23. VV - Ascendency Trait				+0.267	-1.058	-0.283			
ZZ Intercept			-0.481			+0.944			-1.055
Predicted Mean Performance Level ZZ for Squadron			7.661			7.062			6.940
Actual Mean Performance Level ZZ for Squadron (Based on supervisor ratings)			7.638			7.073			6.933

From the above it may be observed that to increase R^2 from 0.77 to 0.90 requires 11 more variables for CRS and 4 more variables for AGS. For the data collected from EMS, the maximum multiple R^2 is approximately 80 percent. Comparison in Table 28 is therefore made at the 77% accountability level. No factors surfaced as significant for all 3 squadrons. Factors C, D, H, J, AA and GG surfaced as significant in two of the three squadrons.

Differences in squadron technician responses relative to supervisor performance ratings are clearly evident. Across the squadron, 23 of the 48 dependent variables surfaced as significant predictors of performance at the R^2 level of 0.77 (77 percent accountability).

In Table 29, results for CRS and AGS are compared at approximately the 90% level of accountability. We note that the eleven additional factors provide a somewhat better estimate of the mean ZZ performance score for CRS. The prediction error at the mean is 0.08 percent with the 18 variables included as compared to a prediction error at the mean of 0.30 percent with 7 variables included. For AGS, however, the addition of 4 variables worsens the prediction error of the mean. It may also be noted in Table 30 that the factors of M (months in current assignment), T (hours on additional duties, U (number of service clubs), V (number of persons supervised), and WW (responsibility trait) contribute little to the prediction of squadron performance ZZ.

Overall Results Across 82nd ATC Wing at Williams AFB and 405th TAC Wing at Luke AFB. A comparsion between the summary regression results in Table 15 (82nd ATC) and the results in Table 28 (405th TAC) shows the following (based on 77-78 percent accountability and ZZ as the dependent variable):

(1) Twenty independent variables (predictor factors) surfaced as significant for one or both of the two maintenance squadrons of the 82nd ATC; 23 independent variables surfaced as signficant for one or two of the three maintenance squadrons at the 405th TAC.

(2) Eleven of the same independent variables surfaced at the two different Wings, namely:

D. Persistence [3 squadrons - OMS, CRS, AGS]
H. Work Shift [3 squadrons - FMS, EMS, AGS]
J. Skill Level [4 squadrons - FMS, OMS, CRS, AGS]
L. Equipment Assignment Year [2 squadrons - FMS, CRS]
P. Rank [2 squadrons - FMS, EMS]
R. Days Between Breaks [2 squadrons - OMS, EMS]
S. Number of Additional Duties [2 squadrons = OMS, EMS]
U. Number of Clubs [2 squadrons - FMS, EMS]
AA. Clearance for Remove/Replace [4 squadrons - FMS, OMS, CRS, EMS]
GG. Technician Skill [4 squadrons - FMS, OMS, CRS, EMS]
II. Homogeneity of Group Attitude [3 squadrons - FMS, OMS, EMS]

(3) Nine factors surfaced for the 82nd ATC that did not surface for the 405th TAC, namely:

Table 29

Comparison of Multiple Regression Equations for Luke 405th TAC Wing for Component Repair and Aircraft Generation Squadrons at Approximately 90% Accountability (R^2 = 0.90 or higher)

Factor	CRS			AGS		
	Beta Coeff.	Mean	Contr.	Beta Coeff.	Mean	Contr.
1. C - Job Curiosity	+0.805	3.328	2.679	+1.458	3.095	4.513
2. D - Persistence				+0.795	3.143	2.499
3. E - Prof. Ident.				-1.294	2.952	-3.820
4. I - Enlist. Year	-0.088	68.897	-6.063			
5. J - Skill Level				+0.848	4.381	3.715
6. K - Duty Assign. Year	-0.031	67.328	-2.087			
7. M - Months Curr. Assign.	+0.048	5.448	0.262			
8. N - Sex				-1.520	0.786	-1.195
9. Q - Hours/Shift	+1.382	7.310	10.102			
10. R - Days Between Breaks	-0.631	4.466	-2.818			
11. T - Hrs. Add. Duties	+0.209	0.862	0.180			
12. U - No. of Clubs	-0.387	0.293	-0.113	-0535	0.238	-0.127
13. V - No. Persons Supervised	-0.136	1.190	-0.162			
14. Y - Clearance for Servicing	-1.015	2.086	-2.117			
15. AA - Clearance for Remove/Replace	+1.181	2.035	2.403	-0.546	2.500	-1.365
16. CC - Hours Between Equip. Servicing	-0.011	75.603	-0.832			
17. DD - Quality Tech. Infor.				+0.737	3.429	2.527
18. EE - Quality Test Equip.	+0.483	3.138	1.516	+0.440	1.786	0.786
19. FF - Technician Knowledge	-0.410	2.983	-1.223			
20. GG - Tech. Skill	+0.754	3.552	2.678			
21. II - Homogeneity of Group Attitude	+0.069	27.035	1.865			
22. OO - Organization Warmth				+0.179	25.167	4.505
23. RR - Assign. Locality	-0.055	20.996	-1.153	-0.321	24.000	-7.704
24. TT - Social Status				+0.105	24.905	2.615
25. WW - Responsibility	+0.278	0.569	0.158			
ZZ Crossing			2.369			-0.044
ZZ Prediction			7.644			6.905
ZZ Actual Per Supervisory Evaluations			7.638			6.933

*E. Professional Identification [positive][shows for AGS at $R^2 \simeq .90$]
F. Organizational Identification [positive]
G. Self Starter Trait [positive
*N. Sex [negative contribution for males][shows for AGS at $R^2 \simeq .90$]
X. Weight Handled [positive]
*EE. Quality of Test Equipment [positive][shows for CRS and AGS at $R^2 \simeq .90$]
PP. Organizational Conflict [negative contribution]
SS. Satisfaction with Pay and Benefits [negative contribution]
XX. Emotional Stability [negative contribution]

(4) Twelve factors surfaced for the 405th TAC that did not surface for the 82nd ATC, namely:

C. Job Curiosity [positive]
O. Equipment Type [positive]
T. Hours on Additional Duties [positive]
W. Months in Supervision [positive]
CC. Hours Between Equipment Services [negative contribution]
DD. Quality of technical information [positive]
OO. Organizational Warmth [positive]
QQ. Organizational Identification [positive]
RR. Assignment Locality [negative contribution]
TT. Social Status [positive]
UU. Fatigue Trait [positive--affecting performance negatively]
VV. Ascendency Trait [negative contribution]

(5) The total number of factors which surfaced as significant in one or both AF Wings is 32 of the 48 possible. The following factors included in the questionnaires did not surface in the regression equations [for 77-78% accountability].

I. Enlistment Year
K. Current Duty Assignment Year
M. Months in Current Asisgnment
*Q. Hours Per Shift
*V. Number of Persons Supervised by Technician
*Y. Clearance for Servicing Equipment
BB. Number of Internal Components
*FF. Technician Knowledge
HH. Group Satisfaction of Individual Motives
JJ. Satisfaction with Interpersonal Relations
KK. Satisfaction with Supervision
LL. Organization Structure
MM. Organization Rewards
NN. Organization Risks
*WW. Responsibility
YY. Sociability

Some of the above factors did surface as significant predictors when either A or B alone were used as the dependent variable, namely:

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*Factors show significance at Luke 405th at 90% accountability level.

Y, V, Q, FF, LL, NN and WW. Also, at the 92% accountability level for ZZ with data from the CRS, Q, V, Y, FF and WW surfaced.

(6) It is of interest to observe which factors surfaced when (1) performance <u>speed</u> (A) was used as the dependent variable and when (2) performance <u>quality</u> (B) was used as the dependent variable. Table 30 shows the comparison. Some of these variables did not show significance, however, when the transformed variable ZZ = 0.4A + 0.6B was used as the dependent variable.

(7) Correlation and covariance analyses were also made from the BMDP output data. In addition normal and detrended normal probability plots were obtained. For all of the survey data, the assumption of normality is by-and-large supported by the data plots, with very few outliers Plots are essentially linear on the normal probability graphs.

Multicollinearity across independent variables is indicated by large correlation coefficients in the correlation matrix. One of the advantages of the stepwise linear forward and backward multiple regression procedure is the dependent variables are withdrawn from the prediction equations that are correlated with one or more other variables which contribute a larger amount to the predicted quantity. Thus multicollinearity is minimized with proper choice of the stepwise parameters. Remaining correlations in the matrices were mostly between $\pm$ 0.2000, i.e., $-0.2000 < R < +0.2000$.

Table 30

Comparison of Significant Variables for Predicting Performance Speed (A) vs. Predicting Performance Quality (B). A and B are Excluded as Predictor Variables.

Predictor Variable	Dependent Variable is Performance Speed (A)	Dependent Variable is Performance Quality (B)
C - Job Curiosity	--	X(FMS, CRS)
D - Persistence	X(EMS)	X(OMS, CRS)
E - Prof. Ident.	X(EMS)	X(EMS, AGS)
F - Organization Ident.	X(FMS, OMS, CRS)	X(OMS)
G - Self Starter	--	X(OMS)
H - Work Shift	X(FMS, EMS)	X(EMS)
I - Enlis. Year	--	--
J - Skill Level	--	X(OMS, AGS)
K - Duty Assignment Year	--	--
L - Equip. Assignment Year	--	X(FMS, AGS)
N - Sex	X(FMS, AGS)	X(OMS, CRS)
O - Equipment Type	X(AGS)	X(OMS, CRS)
P - Rank	X(FMS)	X(OMS, EMS)
Q - Hours/Shift	X(OMS)	X(OMS)
R - Days Between Breaks	X(OMS)	X(OMS)
S - No. Add. Duties	X(FMS, EMS, AGS)	--
T - Hrs. Additional Duties	X(EMS)	X(EMS)
U - No. Clubs	X(OMS, CRS)	--
V - No. Persons Supervised	X(CRS, AGS)	X(FMS, AGS)
W - Months Supervision	X(AGS)	X(AGS)
X - Weight Handled	X(FMS)	X(OMS, EMS)
Y - Clearance for Service	X(FMS)	X(EMS)
AA - Clear. Remove/Replace	X(CRS)	--
CC - Hrs. Between Servicing	X(FMS, CRS)	--
DD - Quality Tech. Information	--	X(CRS, EMS)
EE - Quality Test Information	X(FMS, EMS)	X(OMS)
FF - Technician Knowledge	X(OMS)	--
GG - Technician Skill	X(CRS, EMS)	X(OMS)
HH - Sat. Indiv. Motives	--	X(EMS)
II - Homogeneity of Attitude	--	X(EMS)
JJ - Sat. Interper. Rel.	--	X(EMS)
LL - Organization Structure	X(OMS)	--
OO - Organization Warmth	--	X(AGS)
PP - Organization Conflict	--	X(OMS)
QQ - Oranization Identity	X(OMS)	--
SS - Assign./Locality	--	X(AGS)
UU - Fatigue Trait	--	X(OMS)
WW - Responsibility	--	X(EMS)
XX - Emot. Stability	X(CRS, EMS, AGS)	X(OMS)
YY - Sociability	X(EMS, AGS)	--

PLANNED PUBLICATIONS

A summary article on this research is being prepared for submission either to the TRANSACTIONS of the American Institute of Industrial Engineers or HUMAN FACTORS, the latter a publication of the Human Factors Society.

PROFESSIONAL PERSONNEL ASSOCIATED WITH RESEARCH

The principal researcher is Hewitt H. Young, P.E., Ph.D., a Professor of Engineering at Arizona State University. Professor Young currently teaches within the Department of Industrial and Management Systems Engineering and directs teaching and research activities in human engineering. He holds the BSME and MSIE degrees from Case Institute of Technology and the Ph.D. degree (Engineering) from Arizona State University. His most recent publication was in HUMAN FACTORS, 1979, 21(4), p. 399-407 in an article entitled, "The Impact of Environment on the Productivity Attitudes of Intellectually Challenged Office Workers." Professor Young was an ASEE/USAF Summer Faculty Fellow in 1978 assigned to the AF Human Resources Laboratory, Advanced Systems Division, Wright-Patterson AFB, Ohio. This current research is an outgrowth of research begun during the summer 1978 period.

The 1978 summer study was supervised by Mr. Robert C. Johnson, research psychologist for AFHRL/ASR. Mr. Johnson has continued his active interest in this research area by serving as program monitor for the current research project. He was particularly helpful in getting Air Force clearance for the study and the effort is much appreciated.

Two graduate students at Arizona State University were also involved in certain aspects of the research effort. Captain Joel R. Hickman, an AFIT graduate student, considered the problem of developing suitable supervisor performance rating scales for technicians as an engineering report effort. His work resulted in the scales for supervisory ratings of technician speed and quality of performance which were used in the research. Captain Hickman received his B.S. degree from the University of California at Los Angeles. He is a career Air Force officer who has now completed the MS degree with industrial engineering major from ASU. Parts of Mr. Hickman's master's engineering report are included in this report. A complete copy of his engineers report can be obtained at reproduction costs from the Department of Industrial and Management Systems Engineering, ASU. Captain Hickman was of invaluable help to the principal researcher because of his knowledge of Air Force organizations and procedures. He also helped with the data collection at Williams AFB. His current assignment is at K.I. Sawyer AFB, Michigan.

The second graduate student involved in the project is Mr. Mark J. Bramlett. Mr. Bramlett helped the author in the conduct of the survey at Luke AFB and with some of the analytic work. He holds B.S. and M.S. degrees from Oklahoma State University and is pursuing the Ph.D. degree at ASU. He also holds a position as graduate research assistant.

INTERACTIONS WITH AIR FORCE ORGANIZATIONS

The research involved extensive surveys of maintenance technicians and their immediate supervisors at Williams AFB and Luke AFB, Arizona. The survey instruments were developed during the early phases of the project and then reviewed for content with AFHRL/ASR. Mr. Johnson and his staff provided valuable inputs for survey instrument modification. The modified survey instruments were then submitted to AFMPC/DPMYPS (Randolph AFB) for approval by Dr. Gordon A. Eckstrand, Technical Director for ASR Laboratory.

Prior to operational activation of the project, letters were addressed to Headquarters, Tactical Air Command and Headquarters, Air Training Command through Lt. Colonel James A Cline, USAF, Chief, Advanced Systems Division. These letters requested the assistance and cooperation of the Commands relative to conduct of the surveys at Williams and Luke AFB's. A request was also directed to the Deputy Commander Maintenance at each of the two AFB's for local support of the project. As part of the survey review procedure at AFMPC/DPMYPS, Captain David Gambrell requested letters from Williams and Luke AFB's indicating agreement to participate in the surveys, having reviewed the survey instruments. Clearance was also requested from the two Chief Base Personnel officers, since both military airmen and civilian employees were to be included in the sample. At Williams AFB, meetings were held with Lt. Colonel Lanier (CBPO), Lt. Ford of the personnel office, Mr. Standquist (CCP) in charge of civilian personnel, and local Union representatives. At Luke AFB, meetings were held with Major Love (CBPO), and Mr. Cody (CCP). Cooperation was excellent in getting approvals, which were then forwarded to AFMPC/DPMYPS at Randolph. The researcher also directed a letter to Mr. Galloway of AF/MPKE, Pentagon, to expedite national clearance for the use of civilian employees in the survey, and he in turn provided an authorization letter to AFMPC/DPMYPS.

Approval for conducting the surveys was received from AFMPC/DPMYPS in early October, 1979, and arrangements were initiated to conduct the surveys through Colonel Thomas E. Walker, Deputy Commander Maintenance for the Williams AFB 82nd wing, and Colonel James W. Vorhees, Deputy Commander Maintenance for the Luke AFB 405th Wing. The study was conducted first at Williams AFB, with the invaluable help of Captain Jerry Raney of the DCM's staff. Captain Raney devoted a great deal of time to working with this writer and Captain Joel Hickman in the selection of the sample, providing a suitable classroom for the surveys, following up to see that proper notifications were given to personnel and soliciting attendance, and personally attending all of the survey sessions over a two-week period. The researchers also met with Colonel William J. Breckner, Jr., who is a recent incumbent as 82nd Wing Commander, to explain the purpose of the study and receive his authorization.

At the survey orientation session at Luke AFB, Captain David Bump represented HQTAC and Captain Bob Tilton was assigned by the DCM to work with the researchers on the project. Colonel Charles A. Horner, Wing Commander for the 405th, provided authorization for the study. As at Williams AFB, Captain Tilton took on the important tasks of helping with the sample selection, providing a classroom for the surveys, getting supervisors and technicians to the survey sessions, and personally attending some of the sessions.

The researcher wishes to thank all of those mentioned above, the maintenance squadron commanders and supervisors at both Air Force bases, and the many maintenance technicians who participated in the study for their courteous and valuable contributions to this research effort. Letters of appreciation were sent at an earlier date to Colonel Breckner and Colonel Horner.

CONCLUSIONS AND RECOMMENDATIONS

The proposed Air Force Maintenance Squadron Performance Prediction Model, which will be labeled AFMSPPM and consists of a variety of survey inputs, provides a very good estimate of a squadron's performance level based on results of this research study at Williams and Luke Air Force Bases. The multifactor model, based on survey inputs from a sampling of maintenance technicians and their immediate (shift) supervisors within a squadron, will predict a squadron performance level with a 78 to 92 percent accountability when compared to the average of supervisor performance ratings for the same sample of maintenance technicians. In addition, the survey responses of any one technician, when used as inputs in the AFMSPPM, will provide a good prediction (correlate well) with the supervisor's performance rating for that technician. In this latter case, the coefficient weightings used with the factor responses by a technician are determined across the squadron sample.

The squadron survey model consists of

(1) a representative sample of technicians responses to 150 survey questions, covering 138 items and 18 factors,

(2) selected biographical data on each of the sampled technicians

(3) immediate (shift) supervisor inputs on motivation traits for each of the sampled technicians, and

(4) immediate supervisor inputs on equipment and environmental factors which may influence each sampled technician's work.

In the research study performance ratings were made, for each of the technicians sampled, of <u>speed</u> and <u>quality</u> of work. These two performance ratings were first independently used as dependent measures in the multiple regression analyses and were then combined into a single performance measure such that speed of work was weighted by 0.4 and quality of work by 0.6. Based on limited inputs to the researcher, these weightings appear to be representative of maintenance commander (DCM) feelings in a peacetime situation. In time of war, speed of work would probably be weighted more heavily.

In the multiple regression analyses, differences in the factors which surfaced as significant for different squadrons may be observed. These differences may be attributed to

(1) particular aircraft equipment serviced by a squadron,

(2) organization, construct and activities of the particular maintenance squadron,

(3) conditions within the squadron at the time of the survey which may influence technician responses,

(4) personal attitudes and traits of the technicians involved, and

(5) extent to which an averaging of supervisor performance ratings of a sample of technicians within a squadron actually represent a squadron performance level.

For each particular maintenance squadron, the factors and weightings which surfaced in the multiple regression analyses, when combined in the prediction model, gave an excellent prediction of averaged supervisor performance ratings. Thus the survey model can be employed as a substitute for supervisor performance ratings and has the distinct advantages of (1) involving the technicians themselves, through a sampling process, in rating squadron performance and (2) highlighting those particular factors or conditions which are contributing either positively or negatively to the squadron performance level. Such input provides squadron and wing management with valuable information for improvement and control.

Most of the factors included in the developed AFMSPPM have shown significance as predictors of maintenance squadron performance in at least one of the five squadrons studied. Several of the factors were significant in two or three of the squadrons. At this juncture, therefore, no portion of the survey model should be eliminated. However, additional studies at other Air Force bases and for other squadrons may well suggest that the inclusion of survey questions in support of certain factors is not worthwhile. The general survey model could then be reduced and require less survey input and time.

Based on differences observed to date in applying the AFMSPPM, it would appear that only certain portions of the survey model might be used for particular types of squadrons and/or particular equipment types serviced. That is, all Field Maintenance squadron's in the Air Force may have sufficient similarities such that some factors in the AFMSPPM would often prove significant and other factors would seldom or never prove significant. Likewise, Air Force maintenance squadrons servicing a particular type of aircraft may have particular characteristics which would emphasize certain factors in the model and deemphasize others. Additional research is needed at other Air Force Bases and for a variety of maintenance squadrons to clarify whether either of the above is true.

In conclusion, this research has been a limited effort to (1) develop a comprehensive survey instrument for use with maintenance technicians and their immediate supervisors, combining factors (independent variables) which have shown significance in previous maintenance performance studies, such that the combined responses for a squadron would be predictive of a squadron performance level, and (2) by means of survey data input to a stepwise, linear multiple regression model to generate for a particular squadron a prediction model, which would indicate both squadron performance level and the factors which were contributing to such performance level at a point of time. The results across two Air Force Wings, at two AF bases and involving a total of 5 maintenance squadrons, are very encouraging. The study should be extended to other AF bases.

The AFMSPPM eventually offers the promise, probably in a somewhat reduced form, of

(1) permitting an AF maintenance squadron or Wing to periodically assess its overall performance level by direct input from the technicians and shift supervisors,

(2) permitting an AF maintenance squadron or Wing to assess the performance of each technician in a squadron against squadron performance, based solely on inputs from the technicians themselves and selected supervisory inputs on equipment, environment and technician motivation traits,

(3) establishing a performance predictive model for each squadron type and/or each equipment type,

(4) permitting a squadron to compare model inputs at two or more points of time and ascertaining those factors which are increasing or decreasing in their contributions towards effective squadron performance, and

(5) establishing a means for accurate life-cycle costing of maintenance technician activity for a particular type of end item equipment, placed at particular AF bases, and supported by given maintenance squadrons.

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APPENDICES

APPENDIX A

Summary of Important Findings from the Literature Review Conducted at Wright-Patterson AFB in Summer 1978.

Some

Findings of Past Research

1. Maintenance performance measures are significantly affected by hardware system desgin.

2. For jet engine depot maintenance (turbofans and turbojets), overhall costs are significantly affected by engine design and operating parameters and average flight hours between engine overhauls.

3. 22% of the variance in time to perform maintenance on autopilot avionics can be attributed to the design of test equipment.

4. PROMIS job selection provides a small increase in job interest and in airman felt utilization of talents and training where assignment is made to first choice at time of enlistment.

5. There is a strong interaction between measured individual differences (and attitudes) and maintenance task performance.

6. Technician skills, knowledge and overall capability are primarily a function of training. Formalized on-job training is more effective than classroom/theoretical training.

7. Measured abilities and values of technicians are useful in ascertaining what particular task charactersitics will appeal to certain persons.

8. ASVAB test grades and educational backgrounds of airmen are highly correlated with final school grades (training center).

9. Long-term recall of learned skills is a function of the type of task, learning parameters, retention interval parameters and recall parameters.

10. Persons differ widely in their reactions to location and work environment. Fears can be diminished with familiarity gained through training and experience.

11. Management decisions at the Wing level can significantly affect sypply costs.

12. Lack of spares is <u>not</u> a serious deterrant to maintenance performance effectiveness.

13. The Cost Center Performance Measurement System (CCPMS) has not been well received by the Commands, since the output measures are not considered particularly useful. Further, for similar output measure values across units, the actual performance costs vary widely.

14. Style and quality of supervision have highly significant affects on technician performance and job satisfaction.

15. Supervisory conditioning of maintenance tasks has an important impact on technician job satisfaction.

16. Important airman satisfiers, in addition to the quality of supervision, include:

    job security
    opportunity for technical training
    accomplishing work that gives a feeling of achievement

17. Job Guide improvements which incorporate more illustrations, logic and procedural charts, completeness of information, clarity and dual-level of presentation are well-received by maintenance personnel and can significantly affect both performance time and performance accuracy.

18. Human errors by maintenance personnel in the Air Force can be categorized as:

    40% - failure to follow procedures
    10% - incorrect diagnosis
    10% - misinterpretation of communication
    20% - inadequate support, tools, test equipment, environment
    20% - insufficient attention or caution

19. Environmental temperature and fatigue characteristics both affect performance capability.

20. Other conditions which may impact upon technician performance include:

    Organizational climate, including team cohesiveness, structure, warmth, etc.
    Personal traits of technician, including job curiosity, persistence, etc.
    Assignment location
    Impact of Pay and Benefits
    Social Status of Occupation

21. Maintenance airmen have a lower degree of job satisfaciton than for other AFSC's.

22. Reducing or eliminating present disincentives for maintenance personnel probably is more cost effective than to add new incentives.

23. Adequate feedback on performance is needed for both airmen and supervisors.

APPENDIX B

Survey Instruments Used in Study

MAINTENANCE TECHNICIAN SURVEY

The attached survey is part of a research effort being conducted by Arizona State University under contract with the Air Force Office of Scientific Research, and with the cooperation of the Air Force Human Resources Laboratory, Advanced Systems Division, WPAFB, Ohio. The purpose of the survey is to further identify factors which influence performance effectiveness in maintaining Air Force aircraft and missile systems.

Your participation in the Survey is voluntary but strongly desired. Your responses will be held confidential and in no way will impact upon your career nor upon the squadron to which you are assigned. Headquarters USAF Survey Control Number 80-11 has been assigned to this survey.

The value of this research effort is dependent upon the effort you make to provide open, honest responses to each question. Please turn the page and read the Privacy Act Statement and Instructions before proceeding. Thank you for your valued cooperation.

AD-A088 061 ARIZONA STATE UNIV TEMPE DEPT OF INDUSTRIAL AND MANA--ETC F/G 15/5
DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL F--ETC(U)
APR 80 H H YOUNG AFOSR-79-0111
UNCLASSIFIED ASU-ERC-R-80016 AFOSR-TR-80-0598 NL

2 OF 3

AD A088061

PRIVACY STATEMENT
Survey of Air Force Maintenance Technicians

a. Authority:

(1) 5 U.S.C. 301, Departmental Regulations; and/or
(2) 10 U.S.C. 8012, Secretary of the Air Force, Powers Duties, Delegation by Compensation; and/or
(3) DOD Instruction 1100.13, 17 Apr. 68, Surveys of Department of Defense Personnel, and/or
(4) AFR30-23, 23 Sep 76, Air Force Personnel Survey Program

b. Principal purposes: To collect information from Air Force and civilian squadron maintenance personnel concerning their perceptions of factors which influence their performance effectiveness. To initiate the development of an Air Force Maintenance Performance Effectiveness Model based on the survey results and other inputs.

c. Routine Uses: Data will be used for research purposes in initiating a predictive model of maintenance performance effectiveness.

d. Participation is voluntary. However, your cooperation is requested.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey. Please return the survey booklet to the Project Monitor if you wish to withdraw.

INSTRUCTIONS

Your responses to the survey questions are to be machine scored by OptScan technology. Accordingly, all answers are to be marked on the separate IBM answer sheet loosely inserted in this survey booklet. Remove the answer sheet from the booklet and use it to record your answers by blackening in the appropriate answer rectangle, marked A,B,C,D and E, for each question. Cleanly erase answers you want to change. DO NOT make stray pencil marks on the sheet. Check to be sure that only ONE answer rectangle is blackened for each question. Use only the No. 2 pencil provided or a comparable pencil with medium soft lead.

For control purposes, an identification number has been preassigned to each survey booklet and appears in a large block on the bottom of the next page. This five-digit identification number should be marked onto the first five rows of the coding section entitled IDENTIFICATION NUMBER at the top right of the answer sheet. Please make sure that the number is correctly reproduced for machine scoring. Ignore all other heading information.

Note that the answer sheet treats question numbers from left to right, with questions 1 to 4 on the top row. Be sure to use the correct answer block for each question, by question number.

Now turn the page and complete the Biographical Data before beginning to respond to the questions.

Later, after you have finished responding to the survey questions, reinsert the answer sheet in the survey booklet and turn both in together to the project monitor. Be sure that you have provided your Identification Number on the answer sheet. Thank you.

BIOGRAPHIC INFORMATION
(Please complete before responding to survey questions)

Date of enlistment or employment by USAF_______ / _______
Month Year

List your primary AFSC_____Duty AFSC_______Secondary AFSC_________.

List your skill level [1,3,5,7,9]__________

When were you assigned to your duty AFSC_______ / _______
Month Year

When were you first assigned to your current aircraft or missile system:

_______ / _______
Month Year

If you work with a team, how long have you been with your present team

____
Months

Who is your immediate supervisor?______________________________

Circle your sex: Male Female

Circle your USAF employment status: Military Civilian ART

What squadron do you belong to______________

What type and model aircraft or missile do you maintain_________

List your rank or civilian employment grade__________

How many hours do you currently work in a shift (circle one)

6 8 10 12 14 16

How many days do you work between breaks (circle one)

4 5 6 7 8 10 12 14 Other______

How many additional duties do you have (circle one) 0 1 2 3 Other________

How many hours a week do you currently devote to your additional duties

(circle one) 0 2 4 6 8 Other_________

How many service or interest clubs do you participate in? _________

Do you supervise the work of others? Yes______ NO______

If yes, how many others do you supervise?_________

If yes, how long have you been a supervisor?_______Months

** YOUR ASSIGNED SURVEY CONTROL NUMBER IS

PLEASE MARK THIS NUMBER ON THE ANSWER SHEET BY BLACKENING IN THE CORRECT NUMBERS, WORKING TOP TO BOTTOM.

MAINTENANCE TECHNICIAN SURVEY

Part I. Group Morale

This first portion of the questionnaire requests your frank feelings about your job, your immediate su pervisor and your fellow workers. There are no right or wrong answers. The best answer is your honest personal opinion.

You may agree or disagree with each of the following statements. If you strongly agree with a statement blacken rectangle A on the answer sheet (by question number). If you just agree with the statement mark rectangle B. If you mildly disagree with the statement mark rectangle C. If you strongly disagree with the statement mark rectangle D. Rectangle E is not used. Following question 1 is an example of the answer categories applicable to all questions in PART I.

1. I feel that what I am doing here gives me a chance to make friends.

   A. Strongly Agree B. Agree C. Disagree D. Strongly Disagree

2. I believe that all my associates in my work group hold beliefs that are unreasonable.
3. Most of my associates here would help me if I needed help.
4. My immediate supervisor is out for his own advancement; he doesn't care about me.
5. My supervisor can always be relied upon to do the right thing.
6. I just tolerate the people I associate with here.
7. All of my work group associates are a dull lot and don't think seriously about important issues.
8. I feel that there is plenty of chance to get ahead in what I am doing now.
9. I would never make friends with any of my associates here.
10. My supervisor is out to help me as much as he can.
11. I seldom pay attention to what other people say; I believe in making my own decisions.
12. I feel that I have made some lasting friends among my associates in my work group.

13. I believe that the work I do now keeps me in a rut.

14. I feel that I can ask advice of most of my work associates.

15. Most of my work associates are stubborn, no amount of argument will change them.

16. Just a few of my work group associates are open-minded; most of them have biased points of view.

17. My supervisor got ahead because of his connections, not because of his ability.

18. Sometimes I like what I am doing here, but most of the time I hate it.

19. Most of my work associates would risk their own security if it were necessary for the good of all.

20. I believe that most of my work associates would "stab me in the back" if it meant they could get ahead that way.

Part II. Organization Climate

This portion of the questionnaire requests your feelings about the local organization within which you work. As in Part I, you may agree or disagree with each of the following statements. If you strongly agree with the statement, mark rectangle A. If you just agree with the statement, mark rectangle B. If you disagree mark C, and mark D if you strongly disagree. Begin with answer block 21. Following question 21 is an example of the answer categories applicable to all questions in PART II.

21. The jobs in this squadron are clearly defined and logically structured.

    A. Strongly Agree   B. Agree   C. Disagree   D. Strongly Disagree

22. In this squadron it is sometimes unclear who has the formal authority to make a decision.

23. The policies and organization structure of the squadron have been clearly explained.

24. Red-tape is kept to a minimum in this squadron.

25. Excessive rules, administrative details, and red-tape make it difficult for new and original ideas to receive consideration.

26. Our productivity sometimes suffers from lack of organization and planning.

27. In some of the projects I've been on, I haven't been sure exactly who my boss was.

28. Our management isn't so concerned about formal organization and authority, but concentrates instead on getting the right people together to do the job.

29. We have a promotion system here that helps the best man to rise up to the top.

30 In this squadron the rewards and encouragements you get usually outweigh the threats and the criticism.

31. In this squadron people are rewarded in proportion to the excellence of their job performance.

32. There is a great deal of criticism in this squadron.

33. There is not enough reward and recognition given in this squadron for doing good work.

34. If you make a mistake in this squadron, you will be punished.

35. The philosophy of our management is that in the long run we get ahead faster by playing it slow, safe, and sure.

36. Our business has been built up by taking calculated risks at the right time.

37. Decision making in this squadron is too cautious for maximum effectiveness.

38. Our management is willing to take a chance on a good idea.

39. We have to take some pretty big risks occasionally to meet the sortie requirements of the wing.

40. A friendly atmosphere prevails among the people in this squadron.

41. This squadron is characterized by a relaxed, easy-going working climate.

42. It's very hard to get to know people in this squadron.

43. People in this squadron tend to be cool and aloof toward each other.

44. There is a lot of warmth in the relationships between management and workers in this squadron.

45. The best way to make a good impression around here is to steer clear of open arguments and disagreements.

46. The attitude of our management is that conflict between competing units and individuals can be very healthy.

47. We are encouraged to speak our minds, even if it means disagreeing with our superiors.

48. In management meetings, the goal is to arrive at a decision as smoothly and quickly as possible.

49. People are proud of belonging to this squadron.

50. I feel that I am a member of a well functioning team.

51. As far as I can see, there isn't very much personal loyalty to the squadron.

52. In this squadron people pretty much look out for their own interests.

Part III. Occupational Attitude

(To be completed only by Air Force Personnel. Civilian employees should skip to Part IV of the questionnaire).

This third portion of the questionnaire is intended to explore your feelings about your job with the Air Force relative to assignment locality, pay and benefits, and social status.

Different scales are to be used in Part III. If you are Very Satisfied with the statement given as it pertains to your position as an airman in the USAF, blacken A on the answer sheet. OR mark B for Satisfied, C for Unsatisfied, D for Very Unsatisfied. Give a true picture of your feelings and respond rapidly without going back to previous items marked. Begin with answer sheet block 53. Following question 53 is an example of the answer categories applicable to all questions in PART III.

53. The geographical area to which you are assigned.

    A. Very Satisfied B. Satisfied C. Unsatisfied D. Very Unsatisfied

54. The attitudes of civilians around your base toward the Air Force.

55. The educational opportunities provided by the surrounding community.

56. The BX and Commissary facilities at your base.

57. The cost of living in the area to which you are assigned.

58. The similarity between your assignment and your assignment preference.

59. The facilities provided by the base.

60. The distance to your home of record.

61. The on-base housing.

62. The size of your base.

63. The size of the surrounding community.

64. The additional duties associated with your job.

65. The cultural opportunities provided by the surrounding community.

66. The recreational opportunities provided by the surrounding community.

67. On-base and off-base transportation facilities.

68. The quality of base quarters, barracks, or civilian housing in which you live.

69. The quality of food and availability of eating facilities at your base or location.

70. The amount of money you can make in the Air Force.

71. Your pay compared to what you could make on the outside.

72. The protection provided by the Air Force Life Insurance program.

73. Your fringe benefits compared to fringe benefits offered by a civilian job.

74. The advantages provided by the commissary and BX.

75. The opportunity for you or your family to travel at military rates.

76. The standard of living which your income provides.

77. The quality of medical care provided by the Air Force.

78. The retirement income you would receive from an Air Force career.

79. The benefits provided by the Air Force.

80. The cost of TDY versus the payment received.

81. The extent to which your military pay covers your living expenses.

82. The respect that results from your rank and job.

83. The opportunity to meet and work with important people.

84. Your social position in the Air Force as a result of your job.

85. The status you have in the civilian community because of your job.

86. The prestige that goes with your position.

87. The status given a military man by the civilian community.

88. The pride your family has in your work.

89. Your prestige in the military community resulting from the type of work you do.

90. The prestige your family receives as a result of your job.

91. The feelings you get from wearing the Air Force uniform.

92. The status your job gives compared to the status you would expect as a civilian.

Part IV. Feelings While Working

The statements listed below describe how a person may feel while working. Reac each statement carefully and decide whether it is applicable to how you generally feel when you are at work. If it Does describe your feelings, blacken A in the answer block. If it Does Not describe your feelings, mark rectangle B. Rectangles C, D, E are not used in Part IV. Begin with answer sheet block 93. Following question 93 is an example of the answer categories applicable to all questions in PART IV.

93. Can't seem to think.

    A. Does describe B. Does not describe

94. Lack patience.

95. Feel a little hoarse.

96. Have a headache.

97. Feel unsteady on my feet.

98. Body feels generally tired.

99. Can't think clearly; have "cobwebs".
100. Lack self-confidence.
101. Feel thirsty.
102. Want to lie down.
103. Don't want to talk anymore.
104. Seems hard to sit or stand up straight.
105. Find it hard to breathe.
106. Feel drowsy.
107. Feel sick to my stomach; nauseous.
108. Feel stiff and cramped in the shoulders.
109. Eyelids twitch.
110. Seem to have no interest in things.
111. Feel like yawning.
112. Feel anxious about things.
113. Feel dizzy.
114. Eyes feel strained.
115. Seem to forget things.
116. Legs feel tired.
117. Hard to holc my head up; feels heavy.
118. Arms and legs feel "shaky.
119. Feel aches and pains in my back.
120. Feel clumsy and rigid when moving around.
121. Unable to concentrate for very long.
122. Feel nervous.
123. Feel bored.
124. Keep watching my watch or a clock.

Part V. Personal Traits

In this final part of the survey are a number of descriptions of personal characteristics of people. The descriptions are grouped into sets of four. Following each set of four descriptions are two questions: (1) Which is MOST LIKE YOU, and (2) which is LEAST LIKE YOU. Mark the answer sheet in rectangle A if the A description applies, mark B if the B description applies, mark C if the C description applies and mark D if the D description applies. Begin with answer sheet block 125.

A A good mixer socially
B Lacking in self-confidence
C Thorough in any work undertaken
D Tends to be somewhat emotional

125. In above statements, the one most like you is (mark A,B,C or D on answer sheet,

126. In above statements, the one least like you is(mark A,B,C or D on answer sheet,

----

A Not interested in being with other people
B Free from anxieties or tensions
C Quite an unreliable person
D Takes the lead in group discussion

127. In above statements, the one most like you is

128. In above statements, the one least like you is

A Acts somewhat jumpy and nervous
B A strong influence on others
C Does not like social gatherings
D A very persistent and steady worker

129. In above statements, the one most like you is

130. In above statements, the one least like you is

A Finds it easy to make new acquaintances
B Cannot stick to the same task for long
C Easily managed by other people
D Maintains self-control even when frustrated

131. In above statements, the one most like you is

132. In above statements, the one least like you is

A Able to make important decisions without help
B Does not mix easily with new people
C Inclined to be tense or high-strung
D Sees a job through despite difficulties

133. In above statements, the one most like you is

134. In above statements, the one least like you is

A Not too interested in mixing socially with people
B Doesn't take responsibilities seriously
C Steady and composed at all times
D Takes the lead in group activities

135. In above statements, the one most like you is

136. In above statements, the one least like you is

A A person who can be relied upon
B Easily upset when things go wrong
C Not too sure of own opinions
D Prefers to be around other people

137. In above statements, the one most like you is

138. In above statements, the one least like you is

A Finds it easy to influence other people
B Gets the job done in the face of any obstacle
C Limits social relations to a select few
D Tends to be a rather nervous person

139. In above statements, the one most like you is

140. In above statements, the one least like you is

A Doesn't make friends very readily
B Takes an active part in group affairs
C Keeps at routine duties until completed
D Not too well-balanced emotionally

141. In above statements, the one most like you is

142. In above statements, the one least like you is

A Assured in relationships with others
B Feelings are rather easily hurt
C Follows well-developed work habits
D Would rather keep to a small group of friends

143. In above statements, the one most like you is

144. In above statements, the one least like you is

A Becomes irritated somewhat readily
B Capable of handling any situation
C Does not like to converse with strangers
D Thorough in any work performed

145. In above statements, the one most like you is

146. In above statements, the one least like you is

A Prefers not to argue with other people
B Unable to keep to a fixed schedule
C A calm and unexcitable person
D Inclined to be highly sociable

147. In above statements, the one most like you is

148. In above statements, the one least like you is

A Free from worry or care
B Lacks a sense of responsibility
C Not interested in mixing with the opposite sex
D Skillful in handling other people

149. In above statements, the one most like you is

150. In above statements, the one least like you is

END OF SURVEY. PLEASE RETURN BOOKLET AND ANSWER SHEET.

MAINTENANCE TECHNICIAN SURVEY

SUPERVISORS TECHNICIAN MOTIVATION EVALUATION

All first and second level supervisors of participants in the Maintenance Technician Survey are requested to complete a Supervisors Technician Evaluation Form for each technician on the enclosed listing (persons either directly under your supervision or under the supervision of those whom you supervise). The enclosed number of forms provided in the packet should match the number of technicians on your list.

The Maintenance Technician Survey is being conducted as part of a research effort being conducted by Arizona State University under contract with the Air Force Office of Scientific Research, and with the cooperation of the Air Force Human Resources Laboratory, Advanced Systems Division, WPAFB, Ohio. Headquarters USAF Survey Control Number__________ has been assigned to this survey. Participation of the airman and civilians selected is voluntary and each subject will be provided with a Privacy Statement and have an opportunity to decline participation.

The purpose of the Maintenance Technician Survey, to be conducted at only Williams and Luke Air Force Bases at this time, is to collect information from Air Force and civilian squadron maintenance personnel concerning their perceptions of factors which influence their performance effectiveness. A second objective is to initiate the development of an Air Force Maintenance Performance Effectiveness Model based on the survey results and other inputs. The research data is intended for general Air Force use and is not intended as a means of performance measurement at either Base.

Your thoughtful cooperation in completing the Supervisors Technician Evaluation Form for each of the technicians on the enclosed list is requested. Then please complete the separate Supervisors Technical Information and Performance Rankings Form covering all of the equipment and personnel under your supervision. If you are a shop chief, please rank the airman and civilians who report to the supervisors which you direct.

The enclosed list of personnel who were selected for the Maintenance Technician Survey either directly report to you or report to a supervisor who in turn reports to you. Next to the names on the list are assigned Survey Control Numbers. Only the Survey Control Number is to be placed on the Supervisors Technician Evaluation Form (one number per form) in keeping with the Privacy Act of 1976.

However, the separate Supervisors Technical Information and Performance Rankings form, one required for your entire area of supervision, is to treat all of the equipments and personnel under your supervision. Names of all of the personnel reporting to you, or to the supervisors under you, may be used in the part 2 performance rankings. Note that the rankings are not to be limited to only those technicians on the selected list of subjects who completed the maintenance technician survey.

Thank you for your cooperation in this research effort.

SUPERVISORS TECHNICIAN EVALUATION FORM

for Maintenance Technician Survey

September 1979

Maintenance Squadron ______________________________

Your Name ____________________ Your Supervisory Position ____________

Survey Control Number of Maintenance Technician to be Evaluated [ ]

Instructions: You are requested to evaluate the above referenced technician on five important traits which are motivation indicators. For each item, two written statements of motivation behavior are provided at the extreme ends of a vertical line scale. For each item, you are to place an X somewhere along the line, at the point which in your opinion best represents this technician's typical behavior. The type of motivation which each item is designed to measure is written along the vertical rating scale. Note that your responses are for research purposes only and will not become part of the technicians personnel record. Place an X on each of the five trait scales.

1. Job Curiosity Trait of Technician.

When working, this individual would be most likely to:

seek out information about other parts of the aircraft and try to find out how his/her tasks fit into the whole system, even if such information was not essential to his/her task performance.

Scale 1

Job Curiosity

work only on his/her task and would not care how his/her work relates to the whole system.

2. <u>Persistence Trait of Technician</u>

While working on a long task, the technician's work group ran out of a crucial lubricant and no additional supplies were available in the shop. This individual would be likely to:

willingly go to another shop to get the lubricant necessary to complete the job, whether asked to or not.

Scale 2

Persistence

use this as an excuse to stop work on the task and leave the problem for someone else, or complain if asked to get the lubricant.

3. <u>Professional Identification Trait of Technician</u>

This individual would be likely to:

show pride in his/her AFSC, training, and job, and consider his/her daily work worthwhile to the Air Force.

Scale 3

Professional Identification

consider his/her AFSC "worthless" and possibly degrading. Also, he/she would consider his/her job unnecessary busy work which did not use his/her talents.

4. <u>Organizational Identification Trait of Technician</u>

This individual would be likely to:

take pride in his/her participation in the squadron and/or work group, and cooperate harmoniously with supervisor and/or associates.

Scale 4

Organizational Identification

continually complain about the squadron and/or work group and display alienation towards supervisor and/or associates.

5. <u>Self-Starter Trait of Technician</u>

An urgent work order has unexpectantly come down to the shop. If this individual had a "routine" dental appointment, he/she would be likely to:

ask the supervisor for a few minutes to call and cancel or delay the appointment so he/she could become involved in the <u>urgent</u> work.

Scale 5

Self Starter

complain to the supervisor that he/she could not possible re-schedule the appointment and ask to get out of the work.

SUPERVISORS TECHNICAL INFORMATION AND PERFORMANCE RANKINGS FORM

for Maintenance Technician Survey

September 1979

[One form to be completed covering your area(s) of supervision.]

Maintenance Squadron____________________________________

Your Name____________________________________

Your Job Classification or Title____________________________________

Part I. Technical Information

Instructions: Both first and second level supervisors are requested to describe the technical systems, test and repair equipments, and technical information with which their technicians work. Please provide your best estimate on each of the following 9 items by marking an X along the horizontal scale at an appropriate position.

1. What is the average estimated weight in pounds of the subsystems (assemblies) which are serviced by the group(s) you supervise?

   0 pounds 40 80 120 140 200 or more

2. How difficult is it, on the average, for your technicians to service assigned subsystems, based on the accessibility or clearance for servicing?

   simple (adequate clearance) most difficult (very tight clearance)

   0 1 2 3 4 5

3. How difficult is it, on the average, for your technicians to remove and/or replace subsystems (or components), based on the accessibility or clearance for such tasks?

   simple (adequate clearance) most difficult (very tight clearance)

   0 1 2 3 4 5

4. What is the average number of internal components your group(s) deals with in servicing subsystems?

   0 parts 10 20 30 40 50 or more

5. Estimate the average hours between servicing actions for the subsystems serviced by your group(s).

0 25 50 100 150 200 250 300

6. Rate the adequacy of the technical <u>information</u> available to your group(s) for servicing subsystems.

poor excellent
0 1 2 3 4 5

7. Rate the usability of the test equipment available to your group(s) for the subsystems serviced (leave this blank if your group(s) does not use test equipment).

low high
0 1 2 3 4 5

8. Estimate the average knowledge of the technicians you supervise for the subsystems serviced.

low high
0 1 2 3 4 5

9. Estimate the average skills of the technicians you supervise for the subsystems serviced.

low high
0 1 2 3 4 5

Part 2. Performance Rankings

<u>Instructions</u>: Two separate rankings are desired for all of the technicians whom you supervise. Since you have worked directly with the technicians as a first-level supervisor, or have observed the technicians in action as a second-level supervisor, you are well qualified to rank the speed (work productivity) and the quality (work accuracy) of each technician under your direct supervision [or direct observation]. The first performance ranking is for Speed, the second for Quality. In each case, after the technicians have been rank ordered by Speed or by Quality of performance, you are requested to scale the expected level of performance from 1 to 10, with 10 being used for the top-ranked technician in each category.

1. SPEED OF PERFORMANCE RANKINGS

The first aspect of performance we are interested in is <u>speed</u>, or how quickly an individual accomplishes a job. To rank everybody whom *you* supervise, *imagine that you must assign one individual to a job in which* time is very important. The sooner the job is completed the better. List below, in order of choice (first choice, second choice, third choice, and so on), the persons you would assign to this job. <u>After</u> you have ranked everybody whom you supervise on your list, then rate each person on their performance on jobs where speed is important compared to everybody in the <u>squadron</u> with a similar job. Use the (10 point) scale to the right of each name for this, considering that the top-ranked technician in the <u>squadron</u> on speed of performance is given a 10 rating. Your own top-ranked subordinate may receive a rating of less than 10.

Performance Rank	Name of Technician	Slowest 0	1	2	3	4	5	6	7	8	9	10 Fastest
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

2. QUALITY OF PERFORMANCE RANKINGS

The second aspect of performance we are interested in is the <u>quality</u> of the individual's work. We are interested in the accuracy and care an individual puts into a job as well as the reliability of the completed product or task. To rank everybody whom you supervise, imagine that you must assign one individual to a task in which quality, accuracy, and reliability are very important. There are no time pressures to complete the task. List below, in order of choice (first choice, second choice, third choice, and so on), the people you would assign to this job. <u>After</u> you have ranked everybody whom you supervise, rate each person on their performance on jobs where <u>quality</u> is important compared to everybody in the <u>squadron</u> with a similar job. Use the 10-point scale to the right of each name for this, considering that the top-ranked technician in the squadron on quality of performance is given a 10 rating. Your own top-ranked subordinate may receive a rating of less than 10.

Rank	Name of Technician	Lowest 0	1	2	3	4	5	6	7	8	9	Highest 10
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												

APPENDIX C

FORTRAN IV Computer Program for Processing Survey Data (including a complete example output). Program prepares data input on cards for BMDPZR Statistical Package.

Data for Williams AFB, Field Maintenance Squadron

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WSTRIC PUNCH...CP2

GROUP TOURNIER N YOUNGER I PROJECT          FIRT/Williams FMS

WEINSTEIN.FTP
FIN 741U1=12/26/79-19:001.0)
      C      THIS PROGRAM IS FOR COMBINING AND ANALYZING THE SURVEY DATA SECURE . D AS
      C      PART OF AIR FORCE CONTACT 79-0111 BETWEEN THE AFOSR AND ARIZONA ST . ATE
      C      UNIVERSITY. THE DATA COME FROM THREE SURVEY INSTRUMENTS IDENTIFIED .  AS
      C          1. MAINTENANCE TECHNICIAN SURVEY (RESPONSES TO 150 ITEMS)
      C          2.  SUPERVISORS TECHNICIAN MOTIVATION EVALUATION
      C          3. SUPERVISORS TECHNICIAN EVALUATION AND PERFORMANCE RATING SU . RVEY
      C      THE DATA FROM THE 1ST SURVEY INSTRUMENT IS MACHINE SCORED AND OUTP . UT IN
      C      THE FOLLOWING FORMATS:
      C         CARD 1 FOR EACH TECHNICIAN INPUT
      C           COLS 1-5  COMPETION ORDERED CONTROL NO. ASSIGNED              .        I5
      C           COLS 6-10 SURVEY CONTROL NUMBER ASSIGNED.BY SUPERVISORY GROU . P      I5
      C           COLS 11-30  GROUP MORALE FACTORS                              .      20I1
      C                          INDIVIDUAL MOTIVES - COLS 11,18,23,28
      C                     HOMOGENEITY OF ATTITUDE - COLS 12,17,21,25,26
      C                 INTERPERSONAL RELATIONSHIPS - COLS 13,16,19,22,24,29,3 . 0
      C                SATISFACTION WITY SUPERVSION - COLS 14,15,20,27
      C           COLS 31-62 ORGANIZATION CLIMATE FACTORS                       .      32I1
      C                                   STRUCTURE - COLS 31-38
      C                                     REWARDS - COLS 39-44
      C                                        RISK - COLS 45-49
      C                                      WARMTH - COLS 50-54
      C                                    CONFLICT - COLS 55-58
      C                                    IDENTITY - COLS 59-62
      C
      C           COLS 63-80 OCCUPATIONAL ATTITUDE FACTORS (PARTIAL)            .      18I1
      C                                    LOCALITY - COLS 63-79
      C                           PAY AND BENEFITS - COL 80 (CONT CARD 2)
      C         CARD 2 FOR EACH TECHNICIAN INPUT
      C           COLS 6-10 SURVEY CONTROL NUMBER ASSIGNED.BY SUPERVISORY GROU . P      I6
      C           COLS 11-32 OCCUPATIONAL ATTITUDE FACTORS (COMPLETED)          .      22I1
      C                           PAY AND BENEFITS - COLS 11-21
      C                              SOCIAL STATUS - COLS 22-32
      C           COLS 33-64 FATIGUE TRAIT FACTORS (FEELINGS WHILE WORKING)     .      32I1
      C           COLS 65-80 PERSONAL TRAITS FACTORS (PARTIAL)                  .      16I1
      C              ASCENDENCY RESPONSIBILITY EMOT.STABILITY SOCIABILITY   - C . OLUMNS
      C                SEL B        SEL C          SEL D          SEL A        . 65-66
      C                SEL D        SEL C          SEL B          SEL A        . 67-68
      C                SEL B        SEL D          SEL A          SEL C        . 69-70
      C                SEL C        SEL B          SEL D          SEL A        . 71-72
      C                SEL A        SEL D          SEL C          SEL B        . 73-74
      C                SEL D        SEL B          SEL C          SEL A        . 75-76
      C                SEL C        SEL A          SEL B          SEL D        . 77-78
      C                SEL A        SEL B          SEL D          SEL E        . 79-80
      C         CARD 3 FOR EACH TECHNICIAN INPUT
      C           COLS 6-10 SURVEY CONTROL NUMBER ASSIGNED.BY SUPERVISORY GROU . P
      C           COLS 11-20 PERSONAL TRAITS FACTORS (COMPLETION)
      C              ASCENDENCY RESPONSIBILITY EMOT.STABILITY SOCIABILITY   - C . OLUMNS
      C                SEL B        SEL C          SEL D          SEL A        . 11-12
      C                SEL A        SEL C          SEL B          SEL D        . 13-14
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```
C                    SEC B         SEC D            SEC A          SEC C         . 15-16
C                    SEC B         SEC C            SEC D          SEC A         . 17-18
C                    SEC A         SEC C            SEC B          SEC D         . 19-20
C
C       THE SECOND INPUT DATA FORM IS MANUALLY PREPARED FROM THE SUPERVISO . RS EQUIP
C       MENT EVALUATION INPUTS AND GROUP KNOWLEDGE/SKILL RATINGS
C           ONE CARD FOR EACH SUPERVISOR
C             COLS 1-3   SUPERVISORS ASSIGNED NUMBER                            .       I3
C             COLS 4-8   SURVEY CONTROL NUMBER FOR REPORTING TECHNICIAN  ( . 1)  I5
C             COLS 9-13  SURVEY CONTROL NUMBER FOR REPORTING TECHNICIAN  ( . 2)  I5
C             COLS 14-18 SURVEY CONTROL NUMBER FOR REPORTING TECHNICIAN  ( . 3)  I5
C             COLS 19-23 SURVEY CONTROL NUMBER FOR REPORTING TECHNICIAN  ( . 4)  I5
C             COLS 24-28 SURVEY CONTROL NUMBER FOR REPORTING TECHNICIAN  ( . 5)  I5
C             COLS 29-31 AVE. WEIGHT HANDLED BY TECHNICIANS                     .       I3
C             COLS 32-33 CLEARANCE RATING FOR SERVICING EQUIPMENT               .       I2
C             COLS 34-35 CLEARANCE RATING FOR REMOVE AND REPLACE                .       I2
C             COLS 36-37 AVE. NO. OF INTERNAL COMPONENTS                        .       I2
C             COLS 38-40 AVE. HOURS BETWEEN SERVICES ON EQUIPMENT               .       I3
C             COLS 41-42 QUALITY RATING ON TECHNICAL INFORMATION                .       I2
C             COLS 43-44 QUALITY RATING ON TEST EQUIPMENT                       .       I2
C             COLS 45-46 AVE. RATING OF TECHNICIAN KNOWLEDGE IN GROUP           .       I2
C             COLS 47-48 AVE. RATING OF TECHNICIAN SKILLS IN GROUP              .       I2
C
C       THE THIRD FORM OF INPUT DATA COMES FROM THE BIOGRAPHICAL SKETCH CO . MPLETED
C       BY EACH TECHNICIAN  .  THE SUPERVISORS MOTIVATION EVALUATION ON EA . CH
C       TECHNICIAN, AND THE SUPERVISORS RATINGS OF SPEED AND ACCURACY PERF . ORMANCE
C       FOR EACH TECHNICIAN
C             COLS  1- 6  SURVEY CONTROL NUMBER FOR TECHNICIAN(RT.JUSTIFIED . )   I6
C             COLS  7- 8  SPEED RATING FOR TECHNICIAN                           .       I2
C             COLS  9-10  QUALITY RATING FOR TECHNICIAN                         .       I2
C             COLS 11-15  MOTIVATION RATINGS FOR TECHNICIAN
C                         JOB CURIOSITY  - COL. 11                              .       I1
C                         PERSISTENCE    - COL. 12                              .       I1
C                    PROF.IDENTIFICATION - COL. 13                              .       I1
C                    ORG .IDENTIFICATION - COL. 14                              .       I1
C                    SELF STARTER TRAIT  - COL. 15                              .       I1
C             COL.     16  (BLANK)
C             COL      17  SQUADRON CODE (1-OMS OR AGS),(2-FMS OR CRS),(3-E . MS)  I1
C             COLS 18-19   SUPERVISOR CODE NUMBER                               .       I2
C             COL      20  SHIFT CODE (1-DAY) ,(2-SWING) ,(3-MID)               .       I1
C             COLS 21-24   MONTH AND YEAR OF ENLISTMENT OR EMPLOYMENT AF        .       I4
C             COLS 25-29   PRIMARY AFSC OR JOB CODE                             .       I5
C             COL      30  SKILL LEVEL (3,5,7,9)                                .       I1
C             COLS 31-34   MONTH AND YEAR ASSIGNED DUTY AFSC                    .       I4
C             COLS 35-38   MONTH AND YEAR ASSIGNED TO CURRENT EQUIPMENT         .       I4
C             COLS 39-40   MONTHS IN CURRENT WORK GROUP OR TEAM                 .       I2
C             COLS     41  SEX CODE (0-FEMALE),(1-MALE)                         .       I1
C             COLS     42  STATUS CODE (1-MIL),(2-CIV),(3-ART)                  .       I1
C             COLS 43-44   EQUIPMENT CODE (WILLIAMS AFB:1-T37,2-T38,3-F4/5) .   I2
C                                      (LUKE AFB: ALL F15)
C             COLS 45-46   RANK/GRADE CODE (1-AMN,2-A1C,3-E3,4-E5,5-E7,6-E9 .   I2
C                                         7-SRA,8-GS10 OR WG8)
C             COLS 47-48   AVE. HOURS PER WORK SHIFT                            .       I2
C             COLS 49-50   AVE. WORK DAYS BETWEEN BREAKS                        .       I2
C             COL      51  NUMBER OF ADDITIONAL ASSIGNED DUTIES                 .       I1
C             COL      52  HOURS SPENT ON ADD. DUTIES ASSIGNED                  .       I1
C             COL      53  NUMBER OF SERVICE CLUBS                              .       I1
C             COL      54  SUPERVISE OTHERS? (1-YES),(0-NO)                     .       I1
```

```
C             COLS 55-56  NUMBER SUPERVISED                            .       12
C             COLS 57-58  NUMBER OF MONTHS AS A SUPERVISOR             .       12
C       THE PROGRAM IS WRITTEN IN ASC2 FORTRAN FOR INITIAL USE ON UNIVAC 1 . 190
C       COMPUTER SYSTEM. ALL DATA READ IN FROM INPUT FORM 1 (MACH. READ DA . TA) IS
C       STORED IN DATA3(I,J,K), WHERE I=COLS.OF DATA,J=NO. OF 72 COLUMN SE . TS,K=
C       NUMBER OF TECHNICIANS IN SAMPLE. ALL DATA READ IN FROM INPUT FORM  . 2 (
C       SUPVS. EQUIPMENT RATINGS) IS STORED IN DATA1(I,J), WHERE I= COLUMN . S OF
C       DATA,J=NUMBER OF SUPERVISORS IN SAMPLE. ALL DATA READ IN FROM INPU . T FORM
C       3 (TECHNICAN RATINGS AND BIOGRAPHIC DATA) IS STORED IN DATA2(N,K), .  WHERE
C       N=COLUMNS OF DATA,K=NUMBER OF TECHNICIANS IN SAMPLE.
C
C       N1 IS A COUNTER FOR SUPERVISORS
C       N2 IS A COUNTER FOR TECHNICIANS
C       NOSUP IS THE NUMBER OF SUPERVISORS IN SAMPLE
C       NOTEC IS THE NUMBER OF TECHNICIAN BIOGRAPHIES
C       NOSUR IS THE NUMBER OF TECHNICIAN SURVEYS
C       THE PROGRAM WILL HANDLE UP TO 99 SUPERVISORS AND 999 TECHNICIANS I . N SET
C
        INTEGER DATA1(20,40),DATA2(56,200),DATA3(72,5,200),SUMM(4)
        DIMENSION DATA(56,200)
        DO 10 J=1,40
        READ(5,12) (DATA1(I,J),I=1,15)
     12 FORMAT(I3,5I5,I3,3I2,I3,4I2)
        IF (DATA1(1,J).EQ.0) GO TO 14
     10 CONTINUE
     14 NOSUP=J-1
        WRITE(6,15)
     15 FORMAT('1',10X,'ECHO CHECK DATA1'//)
        WRITE(6,16)((DATA1(I,J),I=1,15),J=1,NOSUP)
     16 FORMAT (                                        10X,I3,5I5,I3,3I2,I3,4I2)
        DO 18 K=1,200
        READ(5,20)(DATA2(N,K),N=1,29)
     20 FORMAT(1X,I5,2I2,6I1,1X,I1,I2,I1,2X,I2,I5,I1,2X,I2,2X,I2,I2,2I1,
       1I12,4I1,2I2)
        IF(DATA2(1,K).EQ.0) GO TO 22
     18 CONTINUE
     22 NOTEC=K-1
        WRITE(6,23)
     23 FORMAT('1',10X,'ECHO CHECK DATA2'//)
        WRITE(6,20)((DATA2(N,K),N=1,29),K=1,NOTEC)
        DO 26 K=1,200
        DO 26 J=1,4
        READ(5,28) (DATA3(I,J,K),I=1,72)
     28 FORMAT(I5,I5,70I1)
        IF(DATA3(1,1,K).EQ.0) GO TO 25
     26 CONTINUE
     25 NOSUR=K-1
        WRITE(6,33) NOSUP,NOTEC,NOSUR
     33 FORMAT(//2X,'NOSUP=',I5,'  NOTEC=',I5,'  NOSUR=',I5//)
        WRITE(6,31)
     31 FORMAT('1',10X,'ECHO CHECK DATA3'//)
        DO 11 K=1,NOSUR
        DO 11 J=1,4
     11 WRITE(6,29) (DATA3(I,J,K),I=1,72)
     29 FORMAT(3X,2I6,70I1)
        DO 34 M=1,NOTEC
        DO 34 L=1,NOSUP
        DO 34 K=2,6
```

```
  3        IF(DATA1(1,N).NE.DATA1(1,L)) GO TO 34
  3        DO 35 N=30,36
  4        NN=N-23
  4        DATA2(N,K)=DATA1(NN,L)
  4     35 CONTINUE
  3     34 CONTINUE
           DO 36 K=1,NOREC
  1        DO 36 M=1,NOSUB
  2        IF(DATA2(1,K).NE.DATA3(1,1,M)) GO TO 36
  2        SUM=DATA3(3,1,M)+DATA3(10,1,M)+DATA3(15,1,M)+DATA3(20,1,M)
  2        DATA2(39,K)=SUM/4.*10.
  2        SUM=DATA3(4,1,M)+DATA3(9,1,M)+DATA3(13,1,M)+DATA3(17,1,M)+DATA3(18
  2       +,1,M)
  2        DATA2(40,K)=SUM/5.*10.
  2        SUM=DATA3(5,1,M)+DATA3(8,1,M)+DATA3(11,1,M)+DATA3(14,1,M)+DATA3(16
  2       +,1,M)+DATA3(21,1,M)+DATA3(22,1,M)
  2        DATA2(41,K)=SUM/7.*10.
  2        SUM=DATA3(6,1,M)+DATA3(7,1,M)+DATA3(12,1,M)+DATA3(19,1,M)
  2        DATA2(42,K)=SUM/4.*10.
  2        NUM=0
  2        N=1
  2     56 GO TO (38,40,42,44,46,48,50),N
  2     38 LL=23
  2        MM=30
  2        KK=43
  2        GO TO 52
  2     40 LL=31
  2        MM=36
  2        KK=44
  2        GO TO 52
  2     42 LL=37
  2        MM=41
  2        KK=45
  2        GO TO 52
  2     44 LL=42
  2        MM=46
  2        KK=46
  2        GO TO 52
  2     46 LL=47
  2        MM=50
  2        KK=47
  2        GO TO 52
  2     48 LL=51
  2        MM=54
  2        KK=48
  2        GO TO 52
  2     50 LL=56
  2        MM=71
  2        KK=49
  2     52 DO 54 L=LL,MM
  3     54 NUM=NUM+DATA3(L,1,M)
  2        DIV=MM-LL+1
  2        DATA2(KK,K)=FLOAT(NUM)/DIV*10.
  2        NUM=0
  2        N=N+1
  2        IF(N.LE. 7) GO TO 56
  2        NUM=DATA3(72,1,M)
  2        N=1
```

```
2        56 GO TO (58,60,62),K
2        58 LL=1
2           MM=13
2           KK=50
2           GO TO 64
2        60 LL=14
2           MM=24
2           KK=51
2           GO TO 64
2        62 LL=25
2           MM=56
2           KK=52
2        64 DO 66 L=LL,MM
3        66 NUM=NUM+DATA3(L,2,M)
2           DIV=MM-LL+1
2           DATA2(KK,K)=FLOAT(NUM)/DIV*10.
2           NUM=0
2           N=N+1
2           IF(N.LE.3) GO TO 68
2           DO 71 KKK=1,4
3        71 SUMM(KKK)=0
2           LL=57
2           DO 70 L=LL,72
3           N=DATA3(L,2,K)
3           J=L-56
3           GO TO (93,94,95,96,97,98,99,100,101,102,103,104,105,106,107,108),J
3        93 GO TO (114,111,112,113),N
3        94 GO TO (118,115,116,117),N
3        95 GO TO (114,113,112,111),N
3        96 GO TO (118,117,116,115),N
3        97 GO TO (113,111,114,112),N
3        98 GO TO (117,115,118,116),N
3        99 GO TO (114,112,111,113),N
3       100 GO TO (118,116,115,117),N
3       101 GO TO (111,114,113,112),N
3       102 GO TO (115,118,117,116),N
3       103 GO TO (114,112,113,111),N
3       104 GO TO (118,116,117,115),N
3       105 GO TO (112,113,111,114),N
3       106 GO TO (116,117,115,118),N
3       107 GO TO (111,112,114,113),N
3       108 GO TO (115,116,118,117),N
3       111 SUMM(1)=SUMM(1)+1
3           GO TO 70
3       112 SUMM(2)=SUMM(2)+1
3           GO TO 70
3       113 SUMM(3)=SUMM(3)+1
3           GO TO 70
3       114 SUMM(4)=SUMM(4)+1
3           GO TO 70
3       115 SUMM(1)=SUMM(1)-1
3           GO TO 70
3       116 SUMM(2)=SUMM(2)-1
3           GO TO 70
3       117 SUMM(3)=SUMM(3)-1
3           GO TO 70
3       118 SUMM(4)=SUMM(4)-1
3        70 CONTINUE
```

```
2         DO 72 I=3,12
3         N=DATA1(I,3,K)
3         JAL=2
3         GO TO (120,121,122,123,124,125,126,127,128,129),J
3     120 GO TO (132,133,134,131),N
3     121 GO TO (136,137,138,135),N
3     122 GO TO (131,133,132,134),N
3     123 GO TO (135,137,136,138),N
3     124 GO TO (132,134,131,133),N
3     125 GO TO (136,138,135,137),N
3     126 GO TO (132,133,134,131),N
3     127 GO TO (136,137,138,135),N
3     128 GO TO (131,133,132,134),N
3     129 GO TO (135,137,136,138),N
3     131 SUMM(1)=SUMM(1)+1
3         GO TO 72
3     132 SUMM(2)=SUMM(2)+1
3         GO TO 72
3     133 SUMM(3)=SUMM(3)+1
3         GO TO 72
3     134 SUMM(4)=SUMM(4)+1
3         GO TO 72
3     135 SUMM(1)=SUMM(1)-1
3         GO TO 72
3     136 SUMM(2)=SUMM(2)-1
3         GO TO 72
3     137 SUMM(3)=SUMM(3)-1
3         GO TO 72
3     138 SUMM(4)=SUMM(4)-1
3      72 CONTINUE
2         DO 74 NN=1,4
3         KK=NN+52
3      74 DATA2(KK,K)=SUMM(NN)
2      34 CONTINUE
          WRITE(6,75)
       75 FORMAT('1',5X,'STRUCTURED INPUT DATA FOR INPUT TO BMDP MULTIPLE RE
         *GRESSION MODEL'///2X,'TECH SPD ACC JOB PER PRO ORG SLF SQD SUP SFT
         * ENLI AFSC SKL DUTY EQPM MO SEX SQA EQP RNK HRS DAY ADD HRS NO  NO
         *  MON'/2X,'NUMB RAT RAT CUR SIS IDT IDT STR CDE CDE CDE DATE
         *LEV DATE DATE TM CDE CDE CDE CDE SFT BTB DUT DUT CLB SUP SUP'/2X,'
         * 1  2  3  4  5  6  7  8  9  10  11  12  13   14  15  16
         *  17  18  19  20  21  22  23  24  25  26  28  29  '///)
          DO 90 K=1,NOTEC
1      90 WRITE(6,76) (DATA2(KK,K),KK=1,26),DATA2(28,K),DATA2(29,K)
       76 FORMAT(1X,I5,1X,I2,9(2X,I2),1X,I4,I6,2X,I1,1X,I4,1X,I4,1X,I2
         *,2X,I1,3X,I1,3X,I2,3(2X,I2),2X,I1,3(3X,I1),3X,I2//)
          WRITE(6,77)
       77 FORMAT('1',5X,'STRUCTURED INPUT DATA FOR INPUT TO BMDP MULTIPLE RE
         *GRESSION MODEL'///2X,'    MGT SER REM INT HRS TEC TST TEC TEC IND
         *MON INT SAT STR NEW HIS WAR CON IDN LOC PAY SUC FAT ASC RES EMO SO
         *C '/2X,'    MDL CLR CLR CPS SRV INF LGT KNO SKL MOT ATT REL SUP UC
         *T AND K   MTH FLT TTY AL  BFT STS TRT END PON SAY IAL '/3X,'    30
         *  31  32  33  34  35  36  37  38  39  40  41  42  43  44  45  46
         *47  48  49  50  51  52  53  54  55  56 '///)
          DO 91 K=1,NOTEC
1      91 WRITE(6,78) (DATA2(KK,K),KK=30,56)
       78 FORMAT(5X,27I4,//)
          DO 80 K=1,NOTEC
```

```
  1      390.          PUNCH 82, (DATA2(J,K),J=2,11),(DATA2(J,K),J=11,12),(DATA2(J,K),J=19
  1      391.         1,19),(DATA2(J,K),J=20,26),(DATA2(J,K),J=28,31)
  1      392.          PUNCH 82,(DATA2(J,K),J=32,56)
  1      393.       82 FORMAT(25I3)
  1      394.       80 CONTINUE
         395.          STOP
         396.          END

END FTN 1136 IBANK 95999 DBANK


@MAP,SEI
MAP 29R1E1 RL72-8 12/20/79 14:01:08
ACCM STATUS OF OUTPUT ELEMENT=UNKNOWN

ADDRESS LIMITS     001000 003244      1189 IBANK WORDS DECIMAL
                   040000 336072     97339 DBANK WORDS DECIMAL
STARTING ADDRESS   001065


             SEGMENT SMAIN$        001000 003244     040000 336072

F2MIN$                                          $(2)     040000 040000          19 DEC 74    14:35:16
F2ACTIV$                 $(1)    001000 001014  $(2)     040001 040003          07 APR-77    08:07:01
                         $(3)    001015 001031
                         $(5)    001032 001032
F2IAMA                                          $(2)     040004 040315          26 JUN 75    13:29:39
F2FCA                                           $(0)     040316 040322          03 JAN 75    07:43:40
FURCUN$/FUNFIN                                  $(2)     040323 040330          23 JUL 75    12:16:44
F2CLOSE                  $(1)    001033 001064  $(0)     040331 040333          13 OCT 77    13:07:03
CERUS/SYS71-3-COM                                                               26 AUG-77    14:42:16
PRUSCOM(COMMONBLOCK)                                     040334 040334
NUERUS(COMMONBLOCK)                                      040335 040340
F2CON                                           $(2)     040341 042060          13 OCT 77    13:07:25
                                                $(0341)  NUERUS
                                                $(0361)  PRUSCOM
F2FNT                                           $(0341)  042061 042122          18 JAN 74    14:56:11
F2SCT                                           $(2)     042123 042374          31 MAR 77    15:45:28
F2INIT                                          $(0)     042375 042375          13 OCT-77    13:08:56
                                                $(2)     042376 042460
F2CDCD$                                         $(2)     042461 042526          19 DEC 74    14:35:02
ERUS/SYS72-8                                                                    19 NOV 75    13:43:33
F2EXIT                                          $(2)     042527 042562          13 OCT 77    13:07:50
F2IDENT                                                                         09 AUG-77    11:57:39
AFP                      $(1)    001065 003244  $(0)     042563 334547          28 DEC 79    14:01:08
                                                $(4)     334550 335365
                                                $(6)     335366 335366
                                                $(010)   335367 336066
                                                $(012)   336066 336072

SYS$*RLIB$. LEVEL 77-8
END MAP. ERRORS : NONE

@ASG
```

ECHO CHECK DATA1

```
 1  1010  1020  1030  1040  1050  60  2  225290  4  4  3  4
 2  2070  2080  2090  2100  2110  70  2  225  60  2  2  1  1
 3  3140  3150  3160  3170  3180  30  3  4  9  70  2  4  4  4
 4  4190  4200  4210  4220  4230  10  3  3  1100  5  5  5  4
 5  5260  5270  5280  5290     0  30  1  225  10  3  4  3  3
 6  6300  6310  6320  6330  6340  20  0  0  0300  4  0  4  3
 7  7360  7370  7380  7390  7400  20  1  550  25  5  0  4  5
 8  8420  8430  8440  8450  8460  20  1  1  0290  4  0  4  4
 9  9480  9490  9500  9510  9520  60  2  318200  2  4  3  3
1010530105401055010560105 70  35  2  2  0    3  5  5  4  4
1111580115901160011610116 20  20  1  310  30  4  4  3  3
1212640126501267012680126901 40  3  330  15  4  0  3  3
1313710137201373013740137 50  30  2  245170  4  3  4  4
1414760147701478014790148 10  40  3  420100  3  5  5  4
1515820158301584015850158 60  20  2  1  2150  4  3  3  3
1616860168701688016890161 07  60  4  446300  5  5  4  4
1717910179201793017940179 50  40  2  418250  4  3  4  4
1818950189601897018980181 03  40  2  2  5  20  0  4  4  4
```

ECHO CHECK DATA2

1010	9	933422	2	11	76426525	76	76 011	2	7	8	50001	3	6
1020	9	999993	2	11	75426525	79	79 311	2	7	6	52221	2	46
1030	6	833331	2	11	77426525	77	77 421	3	2	8	50002	0	0
1040	6	999999	2	11	76426526	78	78 021	3	2	6	50002	0	0
1050	8	999993	2	11	77426525	78	78 011	3	3	8	52201	2	4
2070	1	211111	2	21	77426525	77	77 011	2	2	8	50012	0	0
2080	10	099999	2	21	44432605	46	63 012	2	8	8	51402	0	0
2090	9	999999	2	21	76426525	76	76 011	2	7	8	50001	5	18
2100	1	632222	2	21	76426525	78	79 811	2	2	8	50001	2	2
2120	6	633339	2	12	76426505	78	781311	2	2	0	01402	0	0
3140	8	1099933	2	11	66426527	68	69 011	2	4	12	52201	2	6
3150	3	321212	2	31	0 00	0	0 000	0	0	0	00000	0	0
3160	6	993923	2	31	71426707	71	76 011	2	4	8	50012	0	0
3170	5	721121	2	31	76426526	77	77 011	2	7	8	50402	0	0
3180	2	921111	2	31	77426525	77	79 011	2	7	8	50000	0	0
4190	3	311121	2	42	77 05	78	771811	1	2	8	50022	0	0
4200	5	739939	2	42	67426727	72	691611	2	4	8	51621	5	40
4210	5	623333	2	42	67426727	73	79 611	2	0	8	60001	3	6
4220	5	899933	2	42	79426525	75	75 011	3	7	8	50002	0	0
4230	6	833393	2	42	71426727	71	796111	2	4	8	50001	0	48
5260	8	943999	2	51	79427505	79	79 011	2	0	8	50001	5	8
5270	7	832321	2	51	56 05	56	67 012	2	8	8	50002	0	0
5280	7	899929	2	51	0 00	0	0 000	0	0	0	00000	0	0
5290	7	833322	2	51	77427505	78	78 011	2	3	8	51411	2	12
6300	8	999923	2	61	65 05	0	773012	2	8	6	60002	0	0
6310	6	833313	2	61	56 06	62	629912	2	8	8	51821	1	0
6320	6	621111	2	61	0 00	0	0 000	0	0	0	00000	0	0
6330	6	721211	2	61	77427015	78	78 011	2	3	8	50012	0	0
6340	1	132221	2	61	77427515	77	782311	2	2	8	50002	0	0
7360	8	699999	2	72	71427707	73	78 011	2	4	8	52661	4	24
7370	2	211121	2	72	77 05	0	781821	2	2	8	50002	0	0
7380	6	721339	2	72	64 00	0	66 012	2	6	6	60002	6	0
7390	10	999999	2	72	72 00	0	0 012	2	8	8	61002	0	0
7400	8	999999	2	72	74 05	74	74 012	2	8	8	50042	0	0
8420	6	832233	2	81	77427595	77	781811	2	2	8	52802	0	0
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YOUNGMAN H YOUNGER J PROJECT DATE 122079 PAGE 11

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YOUNMAN N YOUNGER F PROJECT DATE 122079 PAGE 19

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STRUCTURED INPUT DATA FOR INPUT TO DHDP MULTIPLE REGRESSION MODEL

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STRUCTURED INPUT DATA FOR INPUT TO BROP MULTIPLE REGRESSION MODEL

WOT HOL 30	SEN CLN 31	MEM CLR 32	INT CPS 33	MAS SAV 34	TEC INF 35	TST EQT 36	TEC KNO 37	TEC SKL 38	IND HOT 39	HUM ATT 40	INT REL 41	SAT SUP 42	STR UCT 43	REW ARD 44	RIS K 45	WAR MTH 46	CON FLT 47	IDN ITY 48	LOC AL 49	PAY OFT 50	SOC STS 51	FAT INT 52	ASC END 53	RES PUN 54	CHU SHY 55	SOC IAL 56
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90	2	2	6	20	0	4	4	4	27	35	27	27	23	26	23	25	25	25	26	35	27	16	-1	-2	-3	6
90	2	2	6	20	0	4	4	4	25	27	27	25	23	25	27	23	20	26	0	0	0	19	-2	1	0	1
90	2	2	6	20	0	4	4	4	20	27	25	30	22	30	27	21	22	22	24	-34	-31	18	-1	0	2	-3
90	2	2	6	20	0	4	4	4	25	33	25	27	26	21	27	23	26	25	27	-30	-29	18	-3	4	-8	[illegible]
90	2	2	5	20	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX D

Brief Summary on BMDP Statistical Programs

Sample page from BMDP 77,Series P Manual
Health Sciences Computing Facility
Department of Biomathematics
School of Medicine
Univ. of California at Los Angeles

P2R

13.2 Stepwise Regression

P2R computes estimates of the parameters of a multiple linear regression equation in a stepwise manner. That is, the variables are entered (forward stepping) or removed (backward stepping) from the equation one at a time according to any of four possible criteria. The order of entry or removal can be specified entirely or in part. The regression equation can be estimated with or without an intercept.

- RESULTS

The Werner blood chemistry data (Table 5.1) are used to illustrate the results produced by P2R. In Example 13.7 we request that a stepwise regression be performed with CHOLSTRL as the dependent variable. Only the *REGRess* paragraph is specific to P2R. The remaining Control Language instructions are described in Chapter 5.

Example 13.7

```
/PROBLEM      TITLE IS 'WERNER BLOOD CHEMISTRY DATA'.
/INPUT        VARIABLES ARE 9.
              FORMAT IS '(A4,5F4.0,3F4.1)'.
/VARIABLE     NAMES ARE ID,AGE,HEIGHT,WEIGHT,BRTHPILL,
                    CHOLSTRL,ALBUMIN,CALCIUM,URICACID.
              MAXIMUM IS (6)400.
              MINIMUM IS (6)150.
              BLANKS ARE MISSING.
              LABEL IS ID.

/REGRESS      DEPENDENT IS CHOLSTRL.

/END
```

The Control Language must be preceded by System Cards to initiate the analysis by P2R. At HSCF, the System Cards are

```
//jobname  JOB  nooo,yourname
//  EXEC  BIMED,PROG=BMDP2R
//SYSIN  DD  *
```

The Control Language is immediately followed by the data (Table 5.1). The analysis is terminated by another System Card. At HSCF, this System Card is

```
//
```

The results of the regression analysis are presented in Output 13.7. The circled numbers below correspond to those in the output.

1. Complete cases only are used in the computations; i.e., cases that have no missing values or values out of range. Therefore only 180 of the original 188 cases are used. All variables are checked for invalid values

APPENDIX E

Example Output of BMDP2R Statisical
Program (Multiple Linear Stepwise Regression).
Shows Output for Williams Air Force Base,
Field Maintenance Squadron Data.

```
YOUNHH.BMDP2R                                                                              DATE 011780        PAGE    3

BMDP2R - STEPWISE REGRESSION                                                PROGRAM REVISED JULY 7, 1976
HEALTH SCIENCES COMPUTING FACILITY                                          MANUAL DATE  --  1975
UNIVERSITY OF CALIFORNIA, LOS ANGELES
```

Williams FMS
Depend = A (Performance Speed)

```
PROGRAM CONTROL INFORMATION

        PROBL    TITLE='STEPWISE LINEAR REGRESSION AF MAINTENANCE SURVEY DATA'./
        INPUT    VARIABLE=50.
              FORMAT='(25F3.0/25F3.0)'./
        VARIABL    NAME=A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U,V,W,X,Y,AA,BB,CC,DD,EE,
                       FF,GG,HH,II,JJ,KK,LL,MM,NN,OO,PP,QQ,RR,SS,TT,UU,VV,WW,XX,YY./
        PRINT    COVA,CORR,DATA,ANOVA,STEP,PARTIAL,COEFF,SUMMARY./
        PLOT     PROBIT,RESD./
        REGRESS      DEPEND=A.
                     TOL=.001.
                     ENTER= 1.0,4.0.
                     REMOVE=.1,3.9./
        END/

PROBLEM TITLE . . . . . . .STEPWISE LINEAR REGRESSION AF MAINTENANCE SURVEY DATA

NUMBER OF VARIABLES TO READ IN. . . . . . . . . .        50
NUMBER OF VARIABLES ADDED BY TRANSFORMATIONS. . .         0
TOTAL NUMBER OF VARIABLES . . . . . . . . . . . .        50
NUMBER OF CASES TO READ IN. . . . . . . . . . . .   1000000
CASE LABELING VARIABLES . . . . . . . . . . . . .
LIMITS AND MISSING VALUE CHECKED BEFORE TRANSFORMATIONS
BLANKS ARE. . . . . . . . . . . . . . . . . . . .     ZEROS
INPUT UNIT NUMBER . . . . . . . . . . . . . . . .         5
REWIND INPUT UNIT PRIOR TO READING. . DATA. . . .        NO

INPUT FORMAT
    (25F3.0/25F3.0)

VARIABLES TO BE USED
        1  A          2  B          3  C          4  D          5  E
        6  F          7  G          8  H          9  I         10  J
       11  K         12  L         13  M         14  N         15  O
       16  P         17  Q         18  R         19  S         20  T
       21  U         22  V         23  W         24  X         25  Y
       26  AA        27  BB        28  CC        29  DD        30  EE
       31  FF        32  GG        33  HH        34  II        35  JJ
       36  KK        37  LL        38  MM        39  NN        40  OO
       41  PP        42  QQ        43  RR        44  SS        45  TT
       46  UU        47  VV        48  WW        49  XX        50  YY

REGRESSION INTERCEPT. . . . . . . . . . . . . . .NON ZERO
WEIGHT VARIABLE . . . . . . . . . . . . . . . . .
PRINT COVARIANCE MATRIX . . . . . . . . . . . . .      YES
PRINT CORRELATION MATRIX. . . . . . . . . . . . .      YES
PRINT ANOVA AT EACH STEP. . . . . . . . . . . . .      YES
PRINT STEP OUTPUT . . . . . . . . . . . . . . . .      YES
PRINT REGRESSION COEFFICIENT SUMMARY TABLE. . . .      YES
```

```
PRINT PARTIAL CORRELATION SUMMARY TABLE . . . . .     YES
PRINT F-RATIO SUMMARY TABLE . . . . . . . . . . .     NO
PRINT SUMMARY TABLE . . . . . . . . . . . . . . .     YES
PRINT RESIDUALS AND DATA. . . . . . . . . . . . .     YES

NUMBER OF CASES READ. . . . . . . . . . . . . . .     75
```

2

NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION	COEFFICIENT OF VARIATION	SKEWNESS	KURTOSIS	SMALLEST VALUE	LARGEST VALUE	SMALLEST STD SCORE	LARGEST STD SCORE
1	A	6.5467	2.1000	.3209	-.7979	3.3740	1.0000	10.0000	-2.6403	1.6438
2	B	7.3067	2.0466	.2801	-1.1017	3.8140	1.0000	10.0000	-3.0816	1.3160
3	C	3.0000	1.0000	.3333	-.5600	2.1067	1.0000	4.0000	-2.0000	1.0000
4	D	2.8533	1.0615	.3720	-.4467	1.9184	1.0000	4.0000	-1.7959	1.0802
5	E	3.0400	1.0324	.3396	-.4599	2.1467	1.0000	4.0000	-1.9759	.9298
6	F	2.8133	1.0093	.3588	-.3280	1.9433	1.0000	4.0000	-1.7964	1.1757
7	G	2.7600	1.0886	.3944	-.3291	1.7749	1.0000	4.0000	-1.6167	1.1392
8	H	1.2800	.4520	.3531	.9604	1.9084	1.0000	2.0000	-.6194	1.5928
9	I	67.0000	19.5239	.2911	-2.6797	9.3466	.0000	79.0000	-3.4358	.6105
10	J	4.5600	2.0549	.4506	-1.3340	3.8803	.0000	7.0000	-2.2191	1.1874
11	K	63.2800	26.9993	.4267	-1.8063	4.4720	.0000	79.0000	-2.3438	.5822
12	L	65.5733	25.0579	.3821	-2.0831	5.6650	.0000	79.0000	-2.6169	.5358
13	M	8.8267	19.3708	2.1946	2.7604	10.5831	.0000	99.0000	-.4557	4.6551
14	N	1.0133	.3853	.3802	.1306	6.4286	.0000	2.0000	-2.6299	2.5607
15	O	1.8800	.6142	.3267	-2.0032	7.4672	.0000	3.0000	-3.0607	1.8234
16	P	4.9467	2.7700	.5600	-.2806	1.6634	.0000	8.0000	-1.7858	1.1023
17	Q	7.6533	1.8995	.2482	-3.2982	19.4545	.0000	12.0000	-4.0292	2.2884
18	R	4.6267	1.3928	.3010	-2.8492	9.8689	.0000	7.0000	-3.3219	1.7040
19	S	.6133	.9138	1.4898	1.2409	3.3225	.0000	3.0000	-.6712	2.6119
20	T	1.4800	2.4404	1.6489	1.5568	4.2020	.0000	8.0000	-.6065	2.6717
21	U	.6133	1.0767	1.7555	1.8891	6.3488	.0000	6.0000	-.5696	4.0792
22	V	1.0800	2.0319	1.8814	2.2676	9.1939	.0000	11.0000	-.5315	4.8821
23	W	5.3067	14.8214	2.7930	4.2127	23.6193	.0000	99.0000	-.3580	6.3216
24	X	39.1333	31.6374	.8085	2.0800	7.0778	.0000	140.0000	-1.2369	3.1882
25	Y	1.8800	.9438	.5020	-.2401	2.3191	.0000	4.0000	-1.9919	2.2462
26	AA	2.4667	1.3083	.5304	.0003	2.4476	.0000	5.0000	-1.8854	1.9363
27	BB	18.3733	15.3454	.8352	.6886	2.4230	.0000	50.0000	-1.1973	2.0610
28	CC	125.0000	105.6140	.8449	.5128	1.8193	.0000	300.0000	-1.1836	1.6570
29	DD	3.6667	1.0934	.2982	-.7883	3.1721	.0000	5.0000	-3.3537	1.2191
30	EE	2.8533	1.9431	.6810	-.6377	1.6604	.0000	5.0000	-1.4684	1.1048
31	FF	3.5333	1.0045	.2843	-1.0372	3.9640	.0000	5.0000	-3.5176	1.4601
32	GG	3.4667	.9348	.2697	-1.3246	5.6644	.0000	5.0000	-3.7084	1.6403
33	HH	21.8533	9.3906	.4297	-1.5295	4.0788	.0000	32.0000	-2.3272	1.0805
34	II	23.9467	10.6224	.4436	-1.3309	3.6659	.0000	37.0000	-2.2544	1.2289
35	JJ	21.3733	8.7360	.4087	-1.8413	4.8505	.0000	28.0000	-2.4466	.7585
36	KK	24.1067	10.2147	.4237	-1.5591	4.3707	.0000	42.0000	-2.3600	1.7517
37	LL	20.9733	8.6789	.4138	-1.7531	4.6449	.0000	31.0000	-2.4146	1.1553
38	MM	21.9467	9.2603	.4219	-1.6253	4.3643	.0000	33.0000	-2.3700	1.1936
39	NN	22.4267	9.4533	.4216	-1.6134	4.4125	.0000	37.0000	-2.3721	1.5415
40	OO	23.1467	9.9454	.4297	-1.4835	4.1013	.0000	35.0000	-2.3274	1.1918
41	PP	22.5467	9.6015	.4214	-1.6035	4.4095	.0000	37.0000	-2.3730	1.6212
42	QQ	20.6133	8.6006	.4172	-1.6587	4.5954	.0000	35.0000	-2.3967	1.6728
43	RR	14.4133	11.6864	.8039	-.3163	1.3302	.0000	31.0000	-1.2440	1.4316
44	SS	18.8533	15.4803	.8211	-.2167	1.3537	.0000	43.0000	-1.2179	1.5590
45	TT	15.6667	12.9378	.8258	-.1558	1.4767	.0000	39.0000	-1.2109	1.8036
46	UU	15.3333	6.5189	.4251	-1.4709	4.5856	.0000	31.0000	-2.3522	2.4033
47	VV	-.7733	2.2456	-2.9037	-.1244	3.0317	-7.0000	5.0000	-2.7729	2.5710
48	WW	1.0667	2.1393	2.0056	-.1181	2.5310	-4.0000	6.0000	-2.3684	2.3061
49	XX	-1.6800	2.0279	-1.2071	-.6094	2.8225	-7.0000	2.0000	-2.6234	1.8147
50	YY	1.6800	2.2900	1.3636	.3962	2.6040	-2.0000	8.0000	-1.6068	2.7589

```
REGRESSION TITLE. . . . . . . . . . . . . . . .STEPWISE LINEAR REGRESSION AF MAINTENANCE SURVEY DATA
STEPPING ALGORITHM. . . . . . . . . . . . . . .STANDARD
MAXIMUM NUMBER OF STEPS . . . . . . . . . . .     100
DEPENDENT VARIABLE. . . . . . . . . . . . . .       1 A
MINIMUM ACCEPTABLE F TO ENTER . . . . . . . .   1.000,   4.000
MAXIMUM ACCEPTABLE F TO REMOVE. . . . . . . .    .100,   3.900
MINIMUM ACCEPTABLE TOLERANCE. . . . . . . . .  .00100
```

STEP NO. 0

```
MULTIPLE R             .0000
MULTIPLE R-SQUARE      .0000
STD. ERROR OF EST.    2.1888
```

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	.00000000	0	.0000000	.000
RESIDUAL	326.58667	74	4.413333	

VARIABLES IN EQUATION

VARIABLE	COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT	6.697)				

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
B	2	.80597	1.00000	135.329	1
C	3	.61753	1.00000	44.997	1
D	4	.61817	1.00000	45.149	1
E	5	.69382	1.00000	67.740	1
F	6	.54588	1.00000	30.989	1
G	7	.53091	1.00000	28.662	1
H	8	-.02106	1.00000	.032	1
I	9	.00946	1.00000	.007	1
J	10	.06899	1.00000	.349	1
K	11	-.02513	1.00000	.046	1
L	12	-.02683	1.00000	.053	1
M	13	.02926	1.00000	.063	1
N	14	-.09260	1.00000	.631	1
O	15	.17719	1.00000	2.366	1
P	16	.43469	1.00000	17.008	1
Q	17	.15650	1.00000	1.833	1
R	18	.09841	1.00000	.719	1
S	19	.34391	1.00000	9.792	1
T	20	.15372	1.00000	1.767	1
U	21	.00510	1.00000	.002	1
V	22	.29620	1.00000	7.044	1
W	23	.17726	1.00000	2.360	1
X	24	.06517	1.00000	.311	1
Y	25	-.02781	1.00000	.056	1
AA	26	-.03507	1.00000	.090	1
BB	27	.25432	1.00000	5.048	1
CC	28	.11262	1.00000	.938	1
DD	29	.12145	1.00000	1.093	1
EE	30	.02322	1.00000	.039	1
FF	31	.00085	1.00000	.000	1
GG	32	.12299	1.00000	1.120	1

HH	33	.18428	1.00000	2.566	1
II	34	.19879	1.00000	3.002	1
JJ	35	.15082	1.00000	1.889	1
KK	36	.17357	1.00000	2.248	1
LL	37	.14608	1.00000	1.592	1
MM	38	.18977	1.00000	2.727	1
NN	39	.17248	1.00000	2.238	1
OO	40	.08666	1.00000	.552	1
PP	41	.08367	1.00000	.515	1
QQ	42	.15022	1.00000	1.685	1
RR	43	-.29255	1.00000	6.833	1
SS	44	-.23228	1.00000	4.163	1
TT	45	-.23134	1.00000	4.128	1
UU	46	.17696	1.00000	2.360	1
VV	47	-.29876	1.00000	7.189	1
WW	48	-.02325	1.00000	.039	1
XX	49	.05989	1.00000	.263	1
YY	50	.09300	1.00000	.637	1

STEP NO. 1
VARIABLE ENTERED 2 B

MULTIPLE R .8054
MULTIPLE R-SQUARE .6486
STD. ERROR OF EST. 1.2521

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	212.14821	1	212.1482	135.329
RESIDUAL	114.93036	73	1.567499	

VARIABLES IN EQUATION

VARIABLE	COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT	.502)				
B 2	.827	.071	.806	135.329	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	.11480	.80083	.962	1
D	4	.22992	.59950	4.018	1
E	5	.20048	.60936	7.156	1
F	6	.22447	.71017	3.820	1
G	7	.20536	.71814	3.170	1
H	8	.09292	.99118	.627	1
I	9	-.07821	.99523	.453	1
J	10	-.08171	.97898	.484	1
K	11	-.11130	.99745	.909	1
L	12	.04041	.99399	.269	1
M	13	.04672	.99999	.161	1
N	14	-.17262	.99986	2.211	1
O	15	.05493	.96759	.218	1
P	16	.14999	.80293	1.546	1
Q	17	-.02964	.95369	.063	1
R	18	-.08426	.96453	.515	1
S	19	.32263	.96223	8.359	1
T	20	.20841	.99857	3.249	1
U	21	.04292	.99937	.133	1
V	22	.23966	.96178	4.387	1

	VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
.	W	23	.04368	.94460	.138	1
.	X	24	.04907	.99799	.174	1
.	Y	25	-.12107	.99706	1.071	1
.	AA	26	-.06795	.99996	.334	1
.	BB	27	.17128	.96310	2.176	1
.	CC	28	.09607	.99619	.671	1
.	DD	29	-.03079	.97010	.068	1
.	EE	30	-.07847	.99257	.446	1
.	FF	31	-.11292	.99299	.930	1
.	GG	32	-.03588	.96815	.093	1
.	HH	33	-.00021	.94746	.000	1
.	II	34	.03856	.95206	.107	1
.	JJ	35	.03270	.96993	.077	1
.	KK	36	.04352	.96419	.137	1
.	LL	37	-.00779	.96508	.009	1
.	MM	38	-.04952	.96007	.177	1
.	NN	39	.00412	.95646	.001	1
.	OO	40	-.04535	.98026	.148	1
.	PP	41	-.05262	.97982	.200	1
.	QQ	42	.01262	.96858	.011	1
.	RR	43	-.12305	.92376	1.107	1
.	SS	44	-.10697	.95531	.833	1
.	TT	45	-.12553	.94132	1.153	1
.	UU	46	.05249	.96700	.199	1
.	VV	47	-.08346	.90296	.607	1
.	WW	48	-.08753	.99875	.556	1
.	XX	49	-.00525	.99504	.002	1
.	YY	50	.01449	.98902	.015	1

STEP NO. 2
VARIABLE ENTERED 19 S

MULTIPLE R .8283
MULTIPLE R-SQUARE .6860
STD. ERROR OF EST. 1.1933

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	224.05279	2	112.0264	78.666
RESIDUAL	102.53384	72	1.424081	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.511)				
B	2	.788	.069	.748	130.207	1
S	19	.447	.155	.195	8.359	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	.07328	.99058	.383	1
D	4	.16123	.55573	1.898	1
E	5	.24933	.48037	4.706	1
F	6	.14957	.65693	1.625	1
G	7	.19808	.71687	2.899	1
H	8	.13693	.97888	1.357	1
I	9	-.13352	.97426	1.289	1
J	10	-.16149	.93579	1.901	1
K	11	-.19476	.95214	2.799	1
L	12	.02119	.97831	.032	1

. M	13	.07416	.99433	.393	1
. N	14	-.18673	.99970	2.565	1
. O	15	.00653	.94637	.003	1
. P	16	.17785	.79880	2.319	1
. Q	17	-.08370	.93186	.501	1
. R	18	-.10346	.96982	.768	1
. T	20	-.00331	.87211	.001	1
. U	21	.02085	.99918	.031	1
. V	22	.15030	.86951	1.641	1
. W	23	-.09491	.81450	.645	1
. X	24	.06816	.99768	.241	1
. Y	25	-.11084	.99982	.883	1
. AA	26	-.06561	.99963	.307	1
. BB	27	.12869	.93898	1.196	1
. CC	28	.05835	.97888	.243	1
. DD	29	.02093	.94650	.031	1
. EE	30	-.08435	.99256	.509	1
. FF	31	-.08565	.98307	.525	1
. GG	32	-.03423	.96804	.083	1
. HH	33	-.01750	.99810	.022	1
. II	34	.06223	.94832	.276	1
. JJ	35	.03460	.96993	.085	1
. KK	36	.05552	.96591	.220	1
. LL	37	-.00817	.96808	.005	1
. MM	38	.02458	.95367	.043	1
. NN	39	.01706	.95913	.021	1
. OO	40	-.06095	.97883	.265	1
. PP	41	-.06491	.97916	.296	1
. QQ	42	.01773	.96892	.022	1
. RR	43	-.19351	.89969	2.762	1
. SS	44	-.16021	.93809	1.870	1
. TT	45	-.19234	.93992	2.727	1
. UU	46	.03699	.96915	.097	1
. VV	47	-.14519	.87908	1.520	1
. WW	48	-.06607	.99267	.311	1
. XX	49	-.02606	.98683	.048	1
. YY	60	.08088	.95399	.967	1

STEP NO. 3
VARIABLE ENTERED 6 E

MULTIPLE R .8400
MULTIPLE R-SQUARE .7056
STD. ERROR OF EST. 1.1638

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	230.42680	3	76.80893	56.712
RESIDUAL	96.15977	71	1.354363	

VARIABLES IN EQUATION						.	VARIABLES NOT IN EQUATION				
VARIABLE	COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL	.	VARIABLE	PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
(Y-INTERCEPT	.327)					.					
B 2	.449	.093	.632	48.636	1	.	C 3	-.14396	.28319	1.981	1

4	6	.410	.187	.202	4.706	1	. D	4	-.04222	.23954	.125	1
5	19	.374	.155	.163	5.057	1	. F	6	-.01226	.39071	.011	1
							. G	7	.06916	.47952	.336	1
							. H	8	.06793	.89238	.324	1
							. I	9	-.15611	.96956	1.799	1
							. J	10	-.18491	.93137	2.478	1
							. K	11	-.22187	.99635	3.629	1
							. L	12	-.03232	.94990	.035	1
							. M	13	.07634	.99433	.410	1
							. N	14	-.20120	.99866	2.963	1
							. O	15	-.06326	.87986	.281	1
							. P	16	.21928	.78887	3.369	1
							. Q	17	-.10176	.92863	.732	1
							. R	18	-.08142	.95511	.467	1
							. T	20	.02379	.54580	.037	1
							. U	21	.00478	.98897	.002	1
							. V	22	.08470	.78834	.506	1
							. W	23	-.12697	.80703	1.138	1
							. X	24	.11939	.94970	1.012	1
							. Y	25	-.12053	.99397	1.032	1
							. AA	26	-.10377	.98110	.762	1
							. BB	27	.11700	.93532	.972	1
							. CC	28	.06088	.97887	.260	1
							. DD	29	.03169	.94507	.070	1
							. EE	30	-.15257	.93663	1.668	1
							. FF	31	-.11883	.97008	1.003	1
							. GG	32	-.06530	.96232	.216	1
							. HH	33	.01407	.94987	.019	1
							. II	34	.04197	.94111	.129	1
							. JJ	35	.01463	.96339	.015	1
							. KK	36	.04146	.96171	.120	1
							. LL	37	-.02093	.96282	.031	1
							. MM	38	-.00686	.93877	.003	1
							. NN	39	-.00582	.94629	.002	1
							. OO	40	-.07636	.97621	.411	1
							. PP	41	-.08423	.97963	.500	1
							. QQ	42	-.00091	.96302	.000	1
							. RR	43	-.18996	.89339	2.621	1
							. SS	44	-.17295	.93740	2.145	1
							. TT	45	-.18367	.93113	2.449	1
							. UU	46	.02069	.95969	.030	1
							. VV	47	-.09233	.83115	.602	1
							. WW	48	-.12510	.94889	1.113	1
							. XX	49	-.01396	.96189	.014	1
							. YY	50	.06175	.94703	.268	1

STEP NO. 4
VARIABLE ENTERED 11 K

MULTIPLE R .8486
MULTIPLE R-SQUARE .7201
STD. ERROR OF EST. 1.1428

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	235.16018	4	58.79005	45.012

RESIDUAL 91.926385 70 1.306091

VARIABLES IN EQUATION			STD. ERROR	STD REG		
VARIABLE		COEFFICIENT	OF COEFF	COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.870)				
B	2	.491	.092	.624	49.035	1
E	5	.438	.184	.216	5.626	1
K	11	-.010	.005	-.124	3.624	1
S	19	.431	.156	.180	7.759	1

VARIABLES NOT IN EQUATION					
VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.14083	.26296	1.396	1
D	4	-.00159	.23198	.000	1
F	6	.04122	.36979	.117	1
G	7	.06863	.97947	.327	1
H	8	.05298	.88747	.194	1
I	9	-.03697	.65939	.094	1
J	10	-.08513	.68719	.509	1
L	12	.11012	.69764	.847	1
M	13	.09892	.78647	.682	1
N	14	-.12157	.82030	1.036	1
O	15	.06129	.64582	.260	1
P	16	.21889	.70856	3.472	1
Q	17	.02001	.66979	.028	1
R	18	.01323	.78683	.012	1
T	20	.04639	.64060	.149	1
U	21	.05459	.94510	.204	1
V	22	.12319	.76982	1.063	1
W	23	-.12641	.80679	1.110	1
X	24	.11430	.94847	.913	1
Y	25	-.08132	.98711	.457	1
AA	26	-.13709	.92460	1.322	1
BB	27	.07662	.89899	.407	1
CC	28	.09555	.95933	.634	1
DD	29	.01101	.93669	.008	1
EE	30	-.09336	.85973	.607	1
FF	31	-.12110	.97007	1.027	1
GG	32	-.07431	.95670	.383	1
HH	33	.04878	.92902	.165	1
II	34	.10397	.88091	.754	1
JJ	35	.07104	.90913	.350	1
KK	36	.09231	.91938	.593	1
LL	37	.03483	.90603	.084	1
MM	38	.04641	.88900	.150	1
NN	39	.03911	.91032	.106	1
OO	40	-.02570	.92260	.046	1
PP	41	-.02436	.88896	.041	1
QQ	42	.04624	.92427	.144	1
RR	43	-.10249	.70827	.732	1
SS	44	-.08892	.76761	.549	1
TT	45	-.10632	.70255	.789	1
UU	46	.06283	.92900	.273	1
VV	47	-.09792	.83098	.668	1
WW	48	-.09763	.93057	.664	1
XX	49	-.01489	.94622	.016	1
YY	50	.08071	.94148	.462	1

STEP NO. 5
VARIABLE ENTERED 16 P

MULTIPLE R .8564
MULTIPLE R-SQUARE .7335
STD. ERROR OF EST. 1.1232

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	239.54076	5	47.90815	37.976
RESIDUAL	87.045806	69	1.261533	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.804)				
B	2	.443	.078	.552	33.182	1
E	5	.497	.184	.234	6.604	1
K	11	-.010	.005	-.123	3.726	1
P	16	.099	.053	.130	3.472	1
S	19	.443	.152	.193	8.482	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.11845	.29933	.271	1
D	4	-.03223	.82632	.071	1
F	6	.06890	.36777	.237	1
G	7	.07833	.47887	.920	1
H	8	.03105	.87783	.066	1
I	9	-.08289	.62992	.970	1
J	10	-.09104	.68695	.569	1
L	12	.08698	.68792	.518	1
M	13	.06530	.95968	.291	1
N	14	-.16624	.79839	1.933	1
O	15	.01032	.61013	.007	1
Q	17	-.08077	.59836	.997	1
R	18	-.07042	.68821	.339	1
T	20	-.01706	.85019	.020	1
U	21	-.02002	.83997	.027	1
V	22	.15390	.75934	1.691	1
W	23	-.13269	.80458	1.218	1
X	24	-.13720	.94122	1.306	1
Y	25	-.08177	.95706	.958	1
AA	26	-.15559	.96042	1.687	1
BB	27	.07139	.89802	.348	1
CC	28	.09809	.95933	.640	1
DD	29	-.01596	.92298	.017	1
EE	30	-.08025	.85057	.941	1
FF	31	-.14403	.94282	1.941	1
GG	32	-.10098	.94854	.701	1
HH	33	-.04440	.77329	.134	1
II	34	.03230	.77933	.071	1
JJ	35	-.01619	.77017	.018	1
KK	36	.01793	.80080	.022	1
LL	37	-.04606	.79419	.145	1
MM	38	-.05216	.72956	.185	1
NN	39	-.03959	.80239	.107	1
OO	40	-.11422	.80434	.899	1
PP	41	-.11139	.78742	.859	1
QQ	42	-.04539	.78049	.140	1
RR	43	-.06349	.68261	.275	1
SS	44	-.09388	.73289	.131	1
TT	45	-.07425	.76278	.377	1
UU	46	-.03372	.76260	.077	1
VV	47	-.11007	.82946	.839	1
WW	48	-.09091	.92882	.560	1
XX	49	.02136	.92147	.031	1
YY	50	.04146	.90898	.118	1

STEP NO. 6
VARIABLE ENTERED 14 N

MULTIPLE R .8887
MULTIPLE R-SQUARE .7900
STD. ERROR OF EST. 1.1187

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAM SQUARE	F RATIO
REGRESSION	241.94619	6	40.32437	32.397
RESIDUAL	84.980376	68	1.249711	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		1.127)				
B	2	.657	.098	.543	32.395	
E	5	.481	.183	.237	6.920	
K	11	-.006	.005	-.081	1.345	
N	14	-.526	.377	-.096	1.933	
P	16	.112	.059	.148	3.366	
S	19	.427	.162	.186	7.428	

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.14327	.24528	1.409	
D	4	.05260	.22328	.184	
F	6	.10513	.34986	.749	
G	7	.08612	.47813	.501	
H	8	.06072	.85298	.248	
I	9	-.00576	.49146	.002	
J	10	-.04489	.42789	.138	
L	12	-.12321	.66210	1.033	
M	13	.06265	.95925	.269	
O	15	.06639	.55081	.296	
Q	17	-.00021	.41947	.000	
R	18	-.00564	.58199	.002	
T	20	.02774	.54809	.052	
U	21	-.00698	.83971	.003	
V	22	.14005	.75228	1.340	
W	23	-.14129	.80531	1.365	
X	24	.14302	.94076	1.399	
Y	25	-.08330	.98705	.468	
AA	26	-.13342	.93767	1.219	
BB	27	.11369	.85161	.877	
CC	28	.11076	.96517	.832	
DD	29	.00275	.91132	.001	
EE	30	-.07941	.85096	.426	
FF	31	-.13981	.96146	1.354	
GG	32	-.06880	.90461	.319	
HH	33	-.00443	.72817	.001	
II	34	.07936	.72656	.425	
JJ	35	.03275	.70828	.072	
KK	36	.07476	.72941	.377	
LL	37	.01340	.69607	.012	
MM	38	-.00399	.66763	.001	
NN	39	.01867	.70842	.023	
OO	40	-.06732	.72849	.306	
PP	41	-.05931	.69703	.237	
QQ	42	.01066	.69415	.008	
RR	43	-.02791	.64943	.052	
SS	44	-.00598	.69426	.002	
TT	45	-.03973	.72700	.106	

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
UU	46	.00439	.73290	.001	
VV	47	-.09494	.82087	.610	
WW	48	-.10326	.92462	.722	
XX	49	.01609	.92099	.017	
YY	50	.05246	.90670	.185	

STEP NO. 7
VARIABLE ENTERED 3 C

MULTIPLE R .8638
MULTIPLE R-SQUARE .7462
STD. ERROR OF EST. 1.1124

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	243.68356	7	34.81194	28.134
RESIDUAL	82.903013	67	1.237358	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		1.212)				
B	2	.574	.103	.579	33.621	
C	3	-.309	.261	-.147	1.409	
E	5	.689	.253	.339	7.417	
K	11	-.006	.005	-.076	1.126	
N	14	-.583	.379	-.107	2.358	
P	16	.106	.054	.140	3.896	
S	19	.421	.151	.163	7.727	

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.11055	.19614	.817	
F	6	.12323	.34053	1.018	
G	7	.09422	.47499	.591	
H	8	.03707	.82708	.091	
I	9	-.01952	.48751	.025	
J	10	-.03656	.62563	.088	
L	12	-.11501	.65909	.885	
M	13	.07776	.96018	.401	
O	15	.06487	.55068	.279	
Q	17	-.00149	.41949	.000	
R	18	-.02205	.57469	.032	
T	20	.02731	.54802	.049	
U	21	-.00719	.83971	.003	
V	22	.14326	.75217	1.383	
W	23	-.13969	.80494	1.313	
X	24	.16721	.92108	1.898	
Y	25	-.08571	.95495	.488	
AA	26	-.13854	.93706	1.291	
BB	27	.12141	.84904	.991	
CC	28	.10319	.96169	.710	
DD	29	-.00822	.90607	.004	
EE	30	-.09973	.83633	.663	
FF	31	-.14217	.96142	1.362	
GG	32	-.07301	.90399	.354	
HH	33	-.00195	.72798	.000	
II	34	.05919	.71029	.233	
JJ	35	.02013	.70245	.027	
KK	36	.05907	.71950	.231	
LL	37	-.01020	.67756	.007	
MM	38	-.01717	.66216	.019	
NN	39	-.01116	.70641	.008	
OO	40	-.08223	.72186	.449	
PP	41	-.06583	.69690	.287	

QQ	42	.00074	.69082	.000
RR	43	-.09672	.63922	.149
SS	44	-.01683	.69043	.019
TT	45	-.04813	.72483	.153
UU	46	-.00392	.72050	.001
VV	47	-.10342	.81877	.719
WW	48	-.09170	.91716	.560
XX	49	.03939	.89781	.103
YY	50	.04230	.90064	.118

STEP NO. 8
VARIABLE ENTERED 29 X

MULTIPLE R .8679
MULTIPLE R-SQUARE .7532
STD. ERROR OF EST. 1.1050

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	246.00132	8	30.75017	25.185
RESIDUAL	80.585261	66	1.220989	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE LEVEL
(Y-INTERCEPT		.971)			
B	2	.572	.103	.558	30.825
C	3	-.362	.262	-.172	1.903
E	5	.783	.260	.385	9.035
K	11	-.005	.005	-.069	.982
N	14	-.604	.377	-.111	2.569
P	16	.111	.053	.157	4.354
S	19	.412	.150	.179	7.510
X	29	.006	.004	.088	1.898

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER LEVEL
D	4	.11109	.19614	.811
F	6	.19008	.33801	1.301
G	7	.12227	.46634	.986
H	8	.09229	.75945	.568
I	9	-.02269	.48737	.033
J	10	-.01050	.61001	.007
L	12	-.09968	.43207	.652
M	13	.09766	.93919	.626
O	15	.09029	.54000	.539
Q	17	.01954	.91310	.025
R	18	-.01461	.57399	.014
T	20	.04688	.84122	.143
U	21	-.00127	.83366	.000
V	22	.13638	.74946	1.219
W	23	-.13118	.80148	1.138
Y	25	-.18850	.74642	2.396
AA	26	-.17613	.90291	2.081
BB	27	.06287	.72372	.258
CC	28	.13110	.73087	1.137
DD	29	.01558	.88831	.016
EE	30	-.07472	.81446	.365
FF	31	-.09344	.85756	.575
GG	32	-.03138	.84386	.064
HH	33	-.00242	.72794	.000
II	34	.06260	.71012	.256
JJ	35	-.00376	.68823	.001
KK	36	.05649	.71921	.208
LL	37	-.01477	.67710	.014
MM	38	-.01640	.66213	.017

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. NN	39	-.00082	.70279	.000	1
. OO	40	-.11354	.70143	.849	1
. PP	41	-.08979	.68393	.528	1
. QQ	42	-.01023	.68799	.007	1
. RR	43	-.09640	.59323	.610	1
. SS	44	-.08048	.60836	.429	1
. TT	45	-.12086	.62382	.964	1
. UU	46	-.01333	.71831	.012	1
. VV	47	-.09323	.81474	.570	1
. WW	48	-.07401	.90506	.358	1
. XX	49	.03299	.89636	.071	1
. YY	50	.02236	.88720	.032	1

STEP NO. 9
VARIABLE ENTERED 26 Y

MULTIPLE R .8729
MULTIPLE R-SQUARE .7620
STD. ERROR OF EST. 1.0935

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	248.86476	9	27.65164	23.126
RESIDUAL	77.721810	65	1.195720	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		1.174)				
B	2	.566	.102	.552	30.782	1
C	3	-.397	.260	-.189	2.327	1
E	5	.845	.261	.414	10.471	1
K	11	-.003	.006	-.046	.393	1
N	14	-.619	.373	-.114	2.748	1
P	16	.114	.053	.190	4.656	1
S	19	.383	.150	.167	6.520	1
X	24	.009	.005	.140	3.824	1
Y	26	-.241	.156	-.108	2.395	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
. D	4	.13858	.19297	1.263	1
. F	6	.18385	.32503	2.239	1
. G	7	.13426	.42427	1.211	1
. H	8	.18810	.63010	2.347	1
. I	9	-.03967	.48380	.101	1
. J	10	.02324	.59136	.035	1
. L	12	.08979	.64958	.520	1
. M	13	.09321	.93818	.561	1
. O	15	.06912	.53202	.307	1
. Q	17	.02592	.41269	.043	1
. R	18	-.02037	.57302	.027	1
. T	20	.02859	.53575	.052	1
. U	21	.00201	.83341	.000	1
. V	22	.14596	.74017	1.393	1
. W	23	-.10244	.77918	.684	1
. AA	26	-.08816	.62861	.501	1
. BB	27	.05986	.72338	.230	1
. CC	28	.09477	.88862	.580	1
. DD	29	.01831	.88817	.021	1
. EE	30	.06740	.45969	.292	1
. FF	31	-.00225	.65448	.000	1
. GG	32	.04464	.72109	.128	1
. HH	33	-.01006	.72681	.006	1
. II	34	.07036	.70831	.318	1
. JJ	36	-.02589	.67931	.043	1
. KK	36	.04237	.71464	.115	1

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
LL	37	-.03747	.66806	.090	1
MM	38	-.03820	.65400	.094	1
NN	39	-.02838	.68861	.052	1
OO	40	-.13108	.69711	1.119	1
PP	41	-.11568	.67377	.868	1
QQ	42	-.03873	.67339	.096	1
RR	43	-.11892	.58673	.918	1
SS	44	-.10460	.60039	.709	1
TT	45	-.13786	.62031	1.240	1
UU	46	-.02386	.71627	.036	1
VV	47	-.08153	.81049	.428	1
WW	48	-.05729	.89479	.211	1
XX	49	-.01079	.84908	.007	1
YY	50	.09476	.87585	.128	1

STEP NO. 10
VARIABLE ENTERED 8 H

MULTIPLE R .8777
MULTIPLE R-SQUARE .7704
STD. ERROR OF EST. 1.0823

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	251.61969	10	25.16197	21.479
RESIDUAL	74.971083	64	1.171436	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.466)				
B	2	.695	.103	.579	33.518	1
C	3	-.369	.259	-.169	1.849	1
E	5	.798	.265	.368	7.992	1
H	8	.637	.351	.116	2.397	1
K	11	-.001	.006	-.016	.051	1
N	14	-.730	.377	-.134	3.740	1
P	16	.112	.052	.198	4.649	1
S	19	.408	.149	.178	7.466	1
X	24	.013	.005	.195	6.032	1
Y	25	-.346	.169	-.166	4.206	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.10424	.18474	.492	1
F	6	.13583	.29549	1.186	1
G	7	.08957	.42963	.510	1
I	9	-.08679	.95920	.967	1
J	10	.00102	.58308	.000	1
L	12	.06371	.63827	.287	1
M	13	.07893	.93777	.423	1
O	15	.05098	.52641	.169	1
Q	17	-.00456	.90195	.001	1
R	18	-.00021	.56499	.000	1
T	20	.02395	.63537	.036	1
U	21	-.01333	.82807	.011	1
V	22	.17896	.73179	2.089	1
W	23	-.10223	.77905	.665	1
AA	26	-.11587	.61779	.867	1
BB	27	.05080	.72132	.163	1
CC	28	.14293	.84422	1.319	1
DD	29	-.01808	.86615	.021	1
EE	30	.16487	.37767	1.760	1
FF	31	-.00933	.65340	.005	1
GG	32	.05045	.72040	.161	1
HH	33	-.04048	.70926	.103	1
II	34	.04833	.49853	.148	1
JJ	35	-.04029	.67554	.104	1

KK	36	.04361	.71464	.120	1
LL	37	-.03890	.66805	.095	1
MM	38	-.04073	.65394	.105	1
NN	39	-.03605	.68791	.077	1
OO	40	-.13239	.69708	1.123	1
PP	41	-.12521	.67298	1.003	1
QQ	42	-.03843	.67338	.093	1
RR	43	-.11126	.58519	.790	1
SS	44	-.07956	.59951	.431	1
TT	45	-.13616	.62001	1.190	1
UU	46	-.04325	.70940	.118	1
VV	47	-.08001	.81099	.406	1
WW	48	-.04799	.89914	.145	1
XX	49	.00103	.84573	.000	1
YY	50	.04653	.87606	.131	1

STEP NO. 11
VARIABLE REMOVED 11 K

MULTIPLE R .8776
MULTIPLE R-SQUARE .7703
STD. ERROR OF EST. 1.0799

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	251.56620	9	27.95058	24.219
RESIDUAL	75.031376	64	1.164329	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.911)				
B	2	.596	.102	.581	34.303	1
C	3	-.359	.257	-.171	1.956	1
E	5	.748	.263	.367	8.056	1
H	8	.557	.337	.120	2.738	1
N	14	-.789	.333	-.141	5.348	1
P	16	.113	.052	.149	4.727	1
S	19	.402	.146	.176	7.425	1
X	24	.013	.005	.199	6.817	1
Y	25	-.358	.160	-.161	5.013	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.10019	.18760	.648	1
F	6	.13096	.30093	1.117	1
G	7	.08899	.92981	.510	1
I	9	-.08847	.60779	.505	1
J	10	-.00948	.67563	.006	1
K	11	-.02816	.67970	.051	1
L	12	.04369	.80932	.122	1
M	13	.09650	.94310	.602	1
O	15	.03389	.64667	.073	1
Q	17	-.01648	.94826	.017	1
R	18	-.00766	.60917	.004	1
T	20	.02155	.53899	.030	1
U	21	-.01813	.85526	.021	1
V	22	.17381	.74393	1.994	1
W	23	-.10178	.77921	.670	1
AA	26	-.10216	.67808	.675	1
BB	27	.05617	.74862	.203	1
CC	28	.13989	.85082	1.276	1
DD	29	-.01557	.86243	.016	1
EE	30	.16279	.37907	1.742	1
FF	31	-.00519	.66788	.002	1
GG	32	.05615	.77697	.202	1
HH	33	-.04289	.71535	.118	1

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
II	34	.04275	.71983	.117	1
JJ	35	-.04499	.69708	.130	1
KK	36	.04056	.72188	.105	1
LL	37	-.04230	.68023	.115	1
MM	38	-.04434	.66774	.126	1
NN	39	-.03751	.69395	.090	1
OO	40	-.13480	.70996	1.186	1
PP	41	-.12818	.69526	1.049	1
QQ	42	-.04103	.68017	.108	1
RR	43	-.11352	.68584	.836	1
SS	44	-.10295	.69047	.686	1
TT	45	-.13770	.69779	1.237	1
UU	46	-.04643	.72077	.138	1
VV	47	-.07779	.81971	.387	1
WW	48	-.05055	.90333	.169	1
XX	49	-.00319	.85073	.001	1
YY	50	.04464	.87665	.128	1

STEP NO. 12
VARIABLE ENTERED 22 V

MULTIPLE R .8816
MULTIPLE R-SQUARE .7772
STD. ERROR OF EST. 1.0663

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	253.82200	10	25.38220	22.326
RESIDUAL	72.764569	64	1.136946	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.389)				
B	2	.209	.101	.593	36.094	1
C	3	-.359	.255	-.171	1.980	1
E	5	.669	.268	.321	6.147	1
H	8	.674	.340	.139	3.405	1
N	14	-.766	.330	-.190	5.375	1
P	16	.120	.052	.168	5.383	1
S	19	.349	.149	.163	5.484	1
V	22	.100	.071	.097	1.994	1
X	24	.014	.005	.207	7.423	1
Y	25	-.390	.160	-.176	5.924	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.09078	.18686	.523	1
F	6	-.11289	.19670	.813	1
G	7	.07743	.42742	.388	1
I	9	-.10962	.60069	.766	1
J	10	-.03675	.66017	.085	1
K	11	-.06141	.64856	.148	1
L	12	.02496	.79949	.039	1
M	13	.08719	.93946	.483	1
O	15	.03276	.64652	.068	1
Q	17	-.03671	.59202	.085	1
R	18	-.04585	.58239	.133	1
T	20	.02788	.53837	.049	1
U	21	-.02792	.85279	.049	1
W	23	-.15505	.72565	1.552	1
AA	26	-.12059	.67227	.930	1
BB	27	.05970	.76727	.156	1
CC	28	.15609	.84678	1.572	1
DD	29	-.02149	.86155	.029	1
EE	30	-.13975	.37005	1.255	1
FF	31	.01148	.66179	.008	1
GG	32	.07342	.77061	.341	1

HH	33	-.06008	.70928	.228	1
II	34	.03467	.71805	.076	1
JJ	35	-.06274	.69079	.249	1
KK	36	.01746	.70867	.019	1
LL	37	-.05448	.67739	.188	1
MM	38	-.06618	.65855	.277	1
NN	39	-.04833	.69165	.147	1
OO	40	-.15126	.70660	1.478	1
PP	41	-.15006	.68719	1.461	1
QQ	42	-.05109	.67826	.165	1
RR	43	-.15206	.66047	1.491	1
SS	44	-.14376	.66197	1.330	1
TT	45	-.17049	.67963	1.886	1
UU	46	-.05771	.71829	.211	1
VV	47	-.05629	.80065	.200	1
WW	48	-.07269	.89063	.338	1
XX	49	-.02832	.82430	.051	1
YY	50	.08019	.89523	.408	1

STEP NO. 13
VARIABLE ENTERED 45 TT

MULTIPLE R .9853
MULTIPLE R-SQUARE .9857
STD. ERROR OF EST. 1.0590

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	255.93713	11	23.26701	20.748
RESIDUAL	70.649941	63	1.121420	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.603)				
B	2	.592	.101	.582	34.924	1
C	3	-.392	.254	-.186	2.377	1
E	5	.679	.266	.331	6.406	1
H	8	.609	.339	.131	3.235	1
N	14	-.589	.353	-.107	2.730	1
P	16	.107	.052	.141	4.186	1
S	19	.373	.149	.162	6.262	1
V	22	.116	.071	.112	2.639	1
X	24	.016	.005	.234	9.000	1
Y	25	-.386	.159	-.173	5.846	1
TT	45	-.014	.012	-.078	1.886	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.08278	.18420	.920	1
F	6	.08860	.28959	.493	1
G	7	.05461	.41866	.186	1
I	9	-.02976	.45439	.055	1
J	10	.02488	.57919	.038	1
K	11	.00316	.60013	.001	1
L	12	.04649	.70909	.271	1
M	13	.04696	.08196	.137	1
O	15	.09416	.57910	.555	1
Q	17	.02102	.43045	.027	1
R	18	-.00350	.54619	.001	1
T	20	.00498	.52058	.003	1
U	21	-.06792	.81178	.287	1
W	23	-.17350	.71906	1.929	1
AA	26	-.13840	.47148	1.039	1
BB	27	.03987	.76437	.099	1
CC	28	.15687	.84560	1.632	1
DD	29	-.03488	.85670	.074	1
EE	30	.13316	.36537	.955	1
FF	31	-.01199	.64949	.009	1

GG	32	.05669	.76386	.219	1
HH	33	.01662	.57279	.017	1
II	34	.14562	.52608	1.343	1
JJ	35	.04645	.45397	.134	1
KK	36	.14359	.47354	1.305	1
LL	37	.04677	.47547	.136	1
MM	38	.03951	.44081	.097	1
NN	39	.04289	.51986	.114	1
OO	40	-.04991	.38987	.155	1
PP	41	-.06694	.47240	.279	1
QQ	42	.05100	.47567	.162	1
RR	43	.01552	.09438	.015	1
SS	44	.09445	.03673	.558	1
UU	46	.02488	.56245	.038	1
VV	47	-.06767	.79772	.285	1
WW	48	-.04052	.85617	.102	1
XX	49	-.07525	.77091	.353	1
YY	50	.10042	.83561	.632	1

STEP NO. 14
VARIABLE ENTERED 23 W

MULTIPLE R .8889
MULTIPLE R-SQUARE .7902
STD. ERROR OF EST. 1.0513

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	258.06379	12	21.50532	19.458
RESIDUAL	68.522705	62	1.105284	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.535)				
B	2	.401	.100	.586	35.892	1
C	3	-.379	.252	-.180	2.256	1
E	5	.661	.264	.325	6.243	1
H	8	.625	.336	.134	3.447	1
N	14	-.585	.351	-.107	2.771	1
P	16	.109	.082	.144	4.398	1
S	19	.496	.167	.174	8.065	1
V	22	.143	.073	.139	3.813	1
W	23	-.013	.010	-.096	1.924	1
X	24	.015	.005	.224	8.348	1
Y	25	-.364	.159	-.160	4.986	1
TT	45	-.017	.012	-.106	2.255	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.09566	.18553	.562	1
F	6	.10626	.20756	.683	1
G	7	.01800	.39931	.020	1
I	9	-.02979	.45439	.054	1
J	10	-.01484	.54976	.013	1
K	11	-.00081	.69082	.000	1
L	12	.09672	.70782	.564	1
M	13	.05156	.08109	.163	1
O	15	.09056	.57861	.504	1
Q	17	.01003	.43649	.006	1
R	18	.00673	.54463	.002	1
T	20	.03172	.51677	.061	1
U	21	-.08498	.80536	.444	1
AA	26	-.14695	.62596	1.346	1
BB	27	.06290	.76263	.242	1
CC	28	.16574	.84414	1.723	1
DD	29	-.00663	.83349	.003	1
EE	30	-.11605	.36438	.833	1
FF	31	-.00209	.64736	.000	1
GG	32	.06923	.76163	.294	1

HH	33	.00113	.56822	.000
II	34	.12226	.51367	.926
JJ	35	.04131	.45346	.104
KK	36	.13849	.47271	1.193
LL	37	.03838	.47418	.090
MM	38	.03609	.44057	.080
NN	39	.02829	.51592	.049
OO	40	-.05591	.38456	.191
PP	41	-.06750	.47240	.279
QQ	42	.03796	.47269	.088
RR	43	.00820	.09421	.004
SS	44	.09809	.03672	.593
UU	46	.06273	.53878	.241
VV	47	-.14203	.69340	1.256
WW	48	-.03091	.85795	.086
XX	49	-.04830	.74731	.131
YY	50	.12637	.82212	.974

STEP NO. 15
VARIABLE ENTERED 28 CC

MULTIPLE R .8922
MULTIPLE R-SQUARE .7960
STD. ERROR OF EST. 1.0452

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	259.94601	13	19.99585	18.303
RESIDUAL	66.690556	61	1.092468	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		.204)				
B	2	.699	.100	.503	35.903	1
C	3	-.352	.252	-.168	1.965	1
E	5	.628	.224	.308	8.496	1
H	8	.799	.347	.160	4.606	1
N	14	-.656	.353	-.120	3.451	1
P	16	.111	.062	.147	4.637	1
S	19	.420	.154	.187	7.597	1
V	22	.151	.073	.146	4.265	1
W	23	-.014	.010	-.099	2.098	1
X	24	-.016	.006	-.230	9.430	1
Y	25	-.339	.159	-.152	4.546	1
CC	28	.002	.001	.083	1.723	1
TT	46	-.017	.011	-.106	2.239	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.07944	.18342	.381	1
F	6	.11587	.28679	.817	1
G	7	.06811	.37865	.283	1
I	9	-.04884	.44898	.143	1
J	10	-.05580	.51983	.187	1
K	11	-.01950	.69280	.023	1
L	12	.04721	.63956	.134	1
M	13	.00194	.80171	.000	1
O	15	.05841	.55397	.205	1
Q	17	.02138	.43471	.027	1
R	18	.00556	.54465	.002	1
T	20	.04134	.51526	.103	1
U	21	-.07477	.80189	.337	1
AA	26	-.07920	.51829	.379	1
BB	27	.09654	.72023	.553	1
DD	29	-.01490	.83172	.013	1
EE	30	.18457	.32357	2.116	1
FF	31	-.03924	.61732	.093	1
GG	32	.05402	.75434	.176	1
HH	33	.03275	.54883	.049	1
II	34	.14149	.50856	1.225	1

JJ	35	.05197	.46186	.163	1
KK	36	.17524	.48592	1.901	1
LL	37	.06177	.46582	.230	1
MM	38	.05671	.43451	.194	1
NN	39	.04931	.50841	.146	1
OO	40	-.03705	.37916	.082	1
PP	41	-.05677	.47006	.194	1
QQ	42	.07227	.45810	.318	1
RR	43	.00122	.09404	.000	1
SS	44	.06279	.03481	.237	1
UU	46	.09763	.81910	.576	1
VV	47	-.10679	.65392	.692	1
WW	48	-.06758	.81545	.276	1
XX	49	-.05194	.74466	.162	1
YY	50	.13224	.82137	1.068	1

STEP NO. 16
VARIABLE ENTERED 30 EE

MULTIPLE R .8960
MULTIPLE R-SQUARE .8029
STD. ERROR OF EST. 1.0358

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	262.21611	14	18.72972	17.458
RESIDUAL	64.370460	60	1.072841	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.313)				
B	2	.603	.099	.587	37.115	1
C	3	-.293	.253	-.190	1.345	1
E	5	.627	.271	.259	3.782	1
H	8	1.033	.397	.222	6.776	1
N	14	-.789	.362	-.196	4.759	1
P	16	.126	.052	.165	5.796	1
S	19	.444	.155	.193	8.158	1
V	22	.134	.074	.130	3.327	1
W	23	-.013	.010	-.098	1.966	1
X	24	.023	.007	.340	10.779	1
Y	25	-.607	.242	-.273	6.270	1
CC	28	.002	.001	.115	3.010	1
EE	30	.158	.109	.147	2.116	1
TT	46	-.016	.011	-.092	1.722	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.06639	.10230	.241	1
F	6	.13528	.20999	1.100	1
G	7	.08701	.37073	.450	1
I	9	-.03091	.44941	.056	1
J	10	-.04987	.51912	.147	1
K	11	-.04398	.64300	.114	1
L	12	.07379	.62814	.323	1
M	13	.01220	.79934	.009	1
O	15	.03937	.54761	.092	1
Q	17	.02883	.93410	.049	1
R	18	.00976	.54461	.001	1
T	20	.05756	.51163	.196	1
U	21	-.10379	.78549	.642	1
AA	26	-.04340	.49497	.111	1
BB	27	.15328	.67571	1.419	1
DD	29	-.00739	.83028	.003	1
FF	31	-.01289	.60436	.010	1
GG	32	.09793	.71899	.571	1
HH	33	.01412	.84304	.012	1
II	34	.11913	.49887	.849	1
JJ	35	.03038	.44524	.054	1
KK	36	.16011	.44418	1.360	1
LL	37	.04506	.46154	.120	1

MM	38	.02475	.92081	.036	1
NN	39	.04388	.50784	.119	1
OO	40	-.04649	.37836	.128	1
PP	41	-.06507	.96936	.251	1
QQ	42	.05205	.94899	.160	1
RR	43	-.01221	.09356	.009	1
SS	44	.06487	.03481	.249	1
UU	46	.10387	.81879	.649	1
VV	47	-.13701	.63997	1.129	1
WW	48	-.08010	.81255	.381	1
XX	49	-.09751	.74605	.133	1
YY	50	.14092	.80688	1.568	1

STEP NO. 17
VARIABLE ENTERED 50 YY

MULTIPLE R .8989
MULTIPLE R-SQUARE .8080
STD. ERROR OF EST. 1.0309

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	263.88301	15	17.59220	16.553
RESIDUAL	62.703558	59	1.062772	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.345)				
B	2	.407	.099	.592	37.978	1
C	3	-.262	.253	-.124	1.070	1
E	5	.456	.276	.224	2.741	1
H	8	1.026	.377	.234	7.474	1
N	14	-.817	.361	-.160	5.131	1
P	16	.116	.062	.183	4.894	1
S	19	.483	.158	.210	9.372	1
V	22	.164	.076	.149	4.228	1
W	23	-.016	.010	-.105	2.411	1
X	24	.023	.007	.350	11.490	1
Y	25	-.663	.246	-.298	7.295	1
CC	28	.002	.001	.121	3.350	1
EE	30	.177	.109	.163	2.608	1
TT	45	-.016	.011	-.101	2.070	1
YY	50	.073	.060	.080	1.568	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.07146	.18217	.299	1
F	6	.16680	.27642	1.701	1
G	7	.12442	.36499	.912	1
I	9	-.03585	.94907	.075	1
J	10	-.06373	.81682	.237	1
K	11	-.05233	.58170	.169	1
L	12	.04182	.67406	.223	1
M	13	.01771	.79848	.018	1
O	15	.05059	.64519	.149	1
Q	17	.00912	.42746	.005	1
R	18	-.00070	.54399	.000	1
T	20	.03856	.50410	.086	1
U	21	-.10288	.78529	.620	1
AA	26	-.00537	.96888	.002	1
BB	27	.17340	.64809	1.802	1
DD	29	.01342	.81682	.010	1
FF	31	.00607	.59611	.002	1
GG	32	.13902	.68334	1.143	1
HH	33	-.01729	.52306	.017	1
II	34	.08266	.46790	.399	1
JJ	35	-.00484	.42413	.001	1
KK	36	.12507	.43010	.922	1
LL	37	.01626	.44626	.016	1
MM	38	.00298	.41504	.001	1
NN	39	.00062	.47108	.000	1
OO	40	-.05518	.37742	.177	1

PP	41	-.08987	.46999	.472	1
QQ	42	.03156	.44117	.068	1
RR	43	-.03124	.09233	.057	1
SS	44	.02409	.03348	.034	1
UU	46	.06272	.47936	.229	1
VV	47	-.13635	.63997	1.132	1
WW	48	-.00240	.42238	.000	1
XX	49	.06081	.48199	.215	1

STEP NO. 18
VARIABLE ENTERED 27 BB

MULTIPLE R .9021
MULTIPLE R-SQUARE .8138
STD. ERROR OF EST. 1.0240

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	266.77365	16	16.61079	15.842
RESIDUAL	60.813920	58	1.048516	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.463)				
B	2	.408	.098	.592	38.626	1
C	3	-.225	.253	-.107	.793	1
E	5	.376	.280	.184	1.787	1
H	8	1.136	.396	.249	8.200	1
N	14	-.933	.369	-.171	6.410	1
P	16	.117	.052	.154	5.017	1
S	19	.467	.157	.203	8.808	1
V	22	.152	.074	.147	4.142	1
W	23	-.017	.010	-.118	3.014	1
X	24	.022	.007	.332	10.303	1
Y	25	-.703	.246	-.316	8.201	1
BB	27	.013	.009	.093	1.802	1
CC	28	.003	.001	.146	8.566	1
EE	30	.219	.113	.203	3.752	1
TT	45	-.016	.011	-.094	1.788	1
YY	50	.081	.058	.089	1.960	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.09164	.18020	.482	1
F	6	.13918	.26957	1.126	1
G	7	.13637	.38389	1.080	1
I	9	-.03960	.44393	.090	1
J	10	-.00567	.46710	.002	1
K	11	-.01721	.55709	.017	1
L	12	-.06305	.62905	.227	1
M	13	-.04329	.78259	.107	1
O	15	.04424	.64429	.112	1
Q	17	.03351	.41957	.064	1
R	18	-.00442	.54375	.001	1
T	20	-.08567	.47295	.421	1
U	21	-.06930	.75128	.276	1
AA	26	-.12986	.31499	.978	1
DD	29	-.00587	.80686	.002	1
FF	31	-.00712	.59274	.003	1
GG	32	.07849	.57870	.353	1
HH	33	-.03915	.51542	.087	1
II	34	.04136	.43887	.098	1
JJ	35	-.02735	.41739	.043	1
KK	36	.10628	.42370	.651	1
LL	37	-.02848	.41836	.046	1
MM	38	-.01502	.40876	.013	1
NN	39	-.02047	.46442	.024	1
OO	40	-.08143	.37007	.381	1
PP	41	-.10141	.45861	.592	1
QQ	42	-.00703	.41969	.003	1
RR	43	-.03520	.09230	.071	1
SS	44	.04460	.03209	.114	1
UU	46	.03837	.46914	.084	1

VV	47	-.12662	.63577	.929	1
WW	48	-.02696	.61120	.040	1
XX	49	.06107	.98193	.213	1

STEP NO. 19
VARIABLE ENTERED 4 F

MULTIPLE R .9031
MULTIPLE R-SQUARE .8174
STD. ERROR OF EST. 1.0229

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	266.95065	17	15.70298	15.009
RESIDUAL	69.635923	67	1.046244	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.380)				
B	2	.600	.098	.504	37.915	1
C	3	-.269	.256	-.128	1.108	1
E	5	.361	.300	.120	.792	1
F	6	.293	.229	.117	1.124	1
H	8	1.053	.403	.226	6.813	1
N	14	-1.071	.391	-.196	7.526	1
P	16	.125	.053	.168	5.671	1
S	19	.441	.159	.192	7.691	1
V	22	.146	.075	.140	3.790	1
W	23	-.018	.010	-.124	3.297	1
X	24	.023	.007	.344	10.933	1
Y	25	-.737	.247	-.331	8.879	1
BB	27	.011	.010	.028	1.224	1
CC	28	.003	.001	.148	4.746	1
EE	30	.224	.113	.209	3.980	1
TT	46	-.019	.011	-.084	1.916	1
YY	50	.091	.059	.099	2.401	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.06878	.17461	.266	1
G	7	.09089	.30219	.466	1
I	9	-.08131	.41105	.373	1
J	10	.00028	.45630	.000	1
K	11	-.05703	.81729	.183	1
L	12	.03601	.59857	.073	1
M	13	.06362	.76782	.228	1
O	15	.02391	.83211	.032	1
Q	17	.01073	.40808	.006	1
R	18	-.01929	.53783	.021	1
T	20	.11030	.96096	.690	1
U	21	-.05693	.74464	.182	1
AA	26	-.11989	.31282	.817	1
DD	29	-.02152	.79710	.026	1
FF	31	.01893	.57276	.020	1
GG	32	.09853	.54871	.599	1
HH	33	-.03553	.51500	.071	1
II	34	.03608	.93814	.073	1
JJ	35	-.02953	.91732	.049	1
KK	36	.12152	.91972	.839	1
LL	37	-.02975	.91834	.050	1
MM	38	.00056	.90369	.000	1
NN	39	-.00793	.96059	.004	1
OO	40	-.07673	.36949	.332	1
PP	41	-.10269	.95851	.596	1
QQ	42	-.00699	.41969	.003	1
RR	43	.08923	.08310	.400	1
SS	44	.02114	.03109	.025	1
UU	46	.04448	.96837	.111	1
VV	47	-.10146	.60960	.582	1
WW	48	-.04131	.60981	.096	1
XX	49	.06303	.90006	.160	1

F-LEVELS(1.000, .100) OR TOLERANCE INSUFFICIENT FOR FURTHER STEPPING

STEP NO. 20
VARIABLE REMOVED 5 E

MULTIPLE R .9027
MULTIPLE R-SQUARE .8150
STD. ERROR OF EST. 1.0208

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	266.15377	16	16.63461	15.965
RESIDUAL	60.932809	58	1.041946	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.534)				
B	2	.622	.094	.406	43.442	1
C	3	-.137	.204	-.046	.444	1
F	6	.314	.214	.151	2.164	1
H	8	1.156	.385	.248	8.990	1
N	14	-1.138	.382	-.209	8.867	1
P	16	.128	.052	.147	5.981	1
S	19	.453	.158	.197	8.239	1
V	22	.155	.074	.150	4.447	1
W	23	-.018	.010	-.130	3.407	1
X	24	.023	.007	.352	11.451	1
Y	25	-.793	.238	-.356	11.089	1
BB	27	.012	.010	.086	1.514	1
CC	28	.003	.001	.162	5.999	1
EE	30	.257	.107	.238	5.765	1
TT	46	-.013	.011	-.078	1.298	1
YY	50	.106	.057	.114	3.508	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
D	4	.10483	.20019	.633	1
E	5	.11483	.14765	.762	1
G	7	.11834	.32682	.810	1
I	9	-.08952	.91359	.461	1
J	10	-.01108	.96081	.007	1
K	11	-.07186	.52716	.296	1
L	12	.03831	.59886	.084	1
M	13	.06303	.76783	.227	1
O	15	.02943	.53343	.049	1
Q	17	.00055	.91125	.000	1
R	18	-.02967	.54249	.050	1
T	20	.11516	.96211	.766	1
U	21	-.04820	.79837	.133	1
AA	26	-.10437	.31795	.628	1
DD	29	-.02941	.80127	.050	1
FF	31	.02307	.57356	.030	1
GG	32	.10256	.56969	.606	1
HH	33	-.04664	.52026	.124	1
II	34	.03271	.43897	.061	1
JJ	35	-.02348	.41839	.031	1
KK	36	.12849	.92181	.957	1
LL	37	-.02319	.91963	.031	1
MM	38	.01417	.40990	.011	1
NN	39	.00141	.96379	.000	1
OO	40	-.06061	.37587	.210	1
PP	41	-.09578	.46978	.528	1
QQ	42	-.00014	.92116	.000	1
RR	43	-.09462	.08390	.514	1
SS	44	.03662	.03169	.077	1
UU	45	.04974	.96948	.141	1
VV	47	-.10631	.61107	.652	1
WW	48	-.03839	.60613	.084	1
XX	49	.04202	.98907	.101	1

STEP NO. 21
VARIABLE REMOVED 3 C

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MULTIPLE R .9020
MULTIPLE R-SQUARE .8135
STD. ERROR OF EST. 1.0169

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	265.67065	15	17.71271	17.161
RESIDUAL	60.895917	59	1.032134	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.635)				
B	2	.594	.083	.579	50.530	1
F	6	.243	.186	.117	1.742	1
H	8	1.181	.381	.264	9.596	1
N	14	-1.096	.375	-.201	8.533	1
P	16	.130	.062	.172	4.346	1
S	19	.457	.157	.199	8.466	1
V	22	.150	.073	.196	4.298	1
W	23	-.018	.010	-.129	3.672	1
X	24	.023	.007	.399	11.645	1
Y	25	-.784	.237	-.382	10.974	1
BB	27	.012	.010	.090	1.448	1
CC	28	.003	.001	.143	4.122	1
EE	30	.257	.107	.237	5.795	1
TT	45	-.012	.011	-.077	1.209	1
YY	50	.101	.056	.110	3.338	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.00721	.33253	.449	1
D	4	-.03614	.29951	.072	1
E	5	.04063	.22748	.096	1
G	7	.10109	.33683	.599	1
I	9	-.08016	.41768	.376	1
J	10	-.02522	.47360	.037	1
K	11	-.07174	.52716	.300	1
L	12	.03900	.59892	.088	1
M	13	.05004	.78301	.144	1
O	15	.01731	.54328	.017	1
Q	17	.00000	.91126	.000	1
R	18	-.01418	.55889	.012	1
T	20	.11298	.46229	.760	1
U	21	-.05451	.75272	.173	1
AA	26	-.10563	.31757	.654	1
DD	29	-.01663	.81825	.016	1
FF	31	.00968	.58668	.005	1
GG	32	.09699	.57235	.539	1
HH	33	-.05381	.57913	.168	1
II	34	.03590	.43915	.075	1
JJ	36	-.02612	.41880	.040	1
KK	36	.12578	.42207	.932	1
LL	37	-.01711	.42155	.017	1
MM	38	.00402	.41486	.001	1
NN	39	-.00709	.46839	.003	1
OO	40	-.06376	.37645	.237	1
PP	41	-.10083	.46149	.596	1
QQ	42	-.00429	.42212	.001	1
RR	43	-.06692	.09107	.263	1
SS	44	-.03642	.03169	.077	1
UU	46	.04462	.47094	.116	1
VV	47	-.10167	.61244	.606	1
WW	48	-.05272	.62370	.142	1
XX	49	-.04433	.48444	.114	1

STEP NO. 22
VARIABLE REMOVED 45 TT

MULTIPLE R .8999
MULTIPLE R-SQUARE .8099
STD. ERROR OF EST. 1.0177

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	[illegible]	14	10.80874	10.237
RESIDUAL	83.144341	80	1.038737	

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(CONSTANT)		-.816				
[illegible]	2	.409	.083	.584	51.493	1
[illegible]	6	.372	.183	.131	2.207	1
[illegible]	8	1.210	.381	.240	10.076	1
[illegible]	9	-1.243	.393	-.232	13.522	1
[illegible]	16	.143	.061	.188	2.877	1
[illegible]	19	.926	.155	.185	3.570	1
[illegible]	22	.131	.071	.127	3.428	1
[illegible]	23	-.017	.010	-.122	3.316	1
[illegible]	25	.022	.007	.337	10.878	1
[illegible]	25	-.811	.236	-.364	11.830	1
[illegible]	27	.013	.010	.093	1.774	1
CC	28	.003	.001	.166	4.383	1
EE	30	.270	.106	.250	6.470	1
YY	50	.098	.056	.109	2.891	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.08134	.33293	.393	1
D	4	.03603	.29964	.077	1
E	5	.03256	.22814	.063	1
G	7	.11559	.34127	.799	1
I	9	-.14078	.86455	1.193	1
J	10	-.06732	.87307	.367	1
K	11	-.11562	.88898	.800	1
L	12	-.01418	.68514	.012	1
M	13	.08799	.85263	.440	1
O	15	-.03609	.62437	.073	1
Q	17	-.04448	.45620	.117	1
R	18	-.04960	.59748	.145	1
T	20	.13636	.47902	1.118	1
U	21	-.01911	.79681	.022	1
AA	26	-.10238	.31769	.625	1
DD	29	-.01207	.81903	.009	1
FF	31	.03185	.40148	.060	1
GG	32	.10689	.57669	.682	1
HH	33	-.10894	.64246	.707	1
II	34	-.04698	.62240	.130	1
JJ	35	-.10602	.64747	.658	1
KK	36	.01726	.64566	.018	1
LL	37	-.09464	.62311	.532	1
MM	38	-.07907	.62598	.371	1
NN	39	-.07535	.21513	.337	1
OO	40	-.14225	.21128	1.218	1
PP	41	-.16151	.66471	1.580	1
QQ	42	-.08398	.62297	.419	1
RR	43	-.15586	.44739	1.469	1
SS	44	-.13000	.42737	1.014	1
TT	45	-.14173	.44750	1.209	1
UU	46	-.03021	.61628	.059	1
VV	47	-.08247	.42180	.402	1
WW	48	-.09316	.28858	.676	1
XX	49	.07496	.51087	.333	1

STEP NO. 23
VARIABLE REMOVED 27 BB

MULTIPLE R .8947
MULTIPLE R-SQUARE .8091
STD. ERROR OF EST. 1.0241

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	262.60538	13	20.20041	19.289

RESIDUAL 63.981222 61 1.048872

VARIABLES IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.736)				
B	2	.698	.084	.583	50.735	1
F	4	.337	.177	.162	3.611	1
H	8	1.147	.302	.251	9.325	1
N	14	-1.198	.342	-.220	12.266	1
P	16	.146	.051	.192	8.129	1
S	19	.437	.156	.190	7.899	1
V	22	.132	.071	.128	3.427	1
W	23	-.016	.010	-.112	2.781	1
X	24	.024	.007	.358	12.427	1
Y	25	-.791	.237	-.356	11.152	1
CC	28	.003	.001	.196	6.125	1
EE	30	.237	.104	.219	5.196	1
YY	50	.091	.056	.100	2.639	1

VARIABLES NOT IN EQUATION

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.09270	.33484	.521	1
D	4	.01405	.30345	.015	1
E	5	.04159	.22884	.104	1
G	7	.09493	.34531	.546	1
I	9	-.14767	.56820	1.330	1
J	10	-.11986	.59091	.874	1
K	11	-.15580	.64670	1.493	1
L	12	-.02247	.66607	.030	1
M	13	.06786	.82240	.278	1
O	15	-.03590	.62440	.077	1
Q	17	-.07399	.47188	.330	1
R	18	-.05029	.59752	.152	1
T	20	-.09689	.49999	.568	1
U	21	-.04765	.82102	.137	1
AA	26	.01732	.48303	.018	1
BB	27	.16949	.65718	1.779	1
DD	29	.00343	.82674	.001	1
FF	31	.04975	.60898	.149	1
GG	32	.16581	.69960	1.696	1
HH	33	-.09362	.64651	.530	1
II	34	-.01446	.64403	.013	1
JJ	35	-.08970	.65159	.487	1
KK	36	.03346	.65186	.067	1
LL	37	-.05841	.64737	.207	1
MM	38	-.06359	.63033	.244	1
NN	39	-.05650	.62166	.192	1
OO	40	-.12393	.69722	.934	1
PP	41	-.16453	.66620	1.468	1
QQ	42	-.05389	.64014	.175	1
RR	43	-.16157	.64889	1.608	1
SS	44	-.13903	.63012	1.183	1
TT	45	-.14600	.64843	1.307	1
UU	46	-.00968	.62985	.006	1
VV	47	-.08772	.62271	.465	1
WW	48	-.07708	.69361	.359	1
XX	49	.07232	.61091	.315	1

STEP NO. 24
VARIABLE REMOVED 50 YY

MULTIPLE R .8920
MULTIPLE R-SQUARE .7955
STD. ERROR OF EST. 1.0376

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	259.63751	12	21.63313	20.113
RESIDUAL	66.749067	62	1.076598	

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VARIABLES IN EQUATION VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.732	)			
B	2	.612	.085	.596	52.201	1
F	6	.320	.179	.164	3.174	1
H	8	1.156	.387	.249	8.918	1
N	14	-1.136	.344	-.208	10.861	1
P	16	.155	.052	.205	9.061	1
S	19	.403	.156	.175	6.669	1
V	22	.117	.072	.113	2.451	1
W	23	-.014	.010	-.100	2.180	1
X	24	.023	.007	.349	11.648	1
Y	25	-.732	.237	-.329	9.522	1
CC	28	.003	.001	.141	4.701	1
EE	30	.222	.105	.205	8.476	1

VARIABLES NOT IN EQUATION VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.07089	.33795	.308	1
D	4	.04217	.30871	.109	1
E	5	.09394	.24670	.543	1
G	7	.07714	.34733	.345	1
I	9	-.12530	.57302	.973	1
J	10	-.10265	.59308	.650	1
K	11	-.13627	.65062	1.154	1
L	12	.00892	.70281	.006	1
M	13	.05036	.86708	.155	1
O	15	-.03019	.62477	.084	1
Q	17	-.04132	.48256	.109	1
R	18	-.04177	.59832	.107	1
T	20	.11124	.50339	.769	1
U	21	-.05452	.82226	.182	1
AA	26	-.02324	.60229	.033	1
BB	27	.15533	.65808	1.508	1
DD	29	-.02529	.84231	.039	1
FF	31	.02037	.62041	.026	1
GG	32	.11426	.73897	.807	1
HH	33	-.04836	.67937	.143	1
II	34	.04243	.69481	.110	1
JJ	35	-.03301	.62480	.067	1
KK	36	.07617	.66251	.347	1
LL	37	-.00994	.68212	.006	1
MM	38	-.02236	.45902	.031	1
NN	39	.00876	.68905	.005	1
OO	40	-.09366	.70936	.540	1
PP	41	-.10940	.69064	.739	1
QQ	42	-.01282	.66997	.010	1
RR	43	-.12731	.66089	1.037	1
SS	44	-.08991	.64848	.615	1
TT	45	-.12266	.66950	.932	1
UU	46	.05349	.68976	.175	1
VV	47	-.10045	.62611	.629	1
WW	48	-.15389	.84195	1.900	1
XX	49	-.06894	.81883	.291	1
YY	50	.20363	.85197	2.639	1

STEP NO. 26
VARIABLE REMOVED 23 W

MULTIPLE R .8879
MULTIPLE R-SQUARE .7884
STD. ERROR OF EST. 1.0473

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	257.49078	11	23.40825	21.343
RESIDUAL	69.095819	63	1.096969	

VARIABLES IN EQUATION . VARIABLES NOT IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.666)				
B	2	.411	.085	.596	51.179	1
F	6	.298	.180	.143	2.724	1
H	8	1.160	.391	.250	8.819	1
N	14	-1.106	.347	-.203	10.165	1
P	16	.151	.052	.200	8.389	1
S	19	.336	.151	.196	4.974	1
V	22	.090	.079	.087	1.466	1
X	24	.024	.007	.344	12.416	1
Y	25	-.771	.238	-.347	10.825	1
CC	28	.003	.001	.139	4.456	1
EE	30	.228	.106	.211	4.653	1

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.06490	.33802	.279	1
D	4	.03915	.30876	.098	1
E	5	.10346	.29743	.471	1
G	7	.12132	.37275	.926	1
I	9	-.11109	.57538	.775	1
J	10	-.05378	.63008	.180	1
K	11	-.12274	.68293	.948	1
L	12	.01306	.70319	.011	1
M	13	.04137	.84981	.107	1
O	15	-.01494	.82074	.014	1
Q	17	-.02338	.90679	.034	1
R	18	-.04619	.89078	.133	1
T	20	.07479	.51990	.348	1
U	21	-.04362	.82963	.118	1
W	23	-.18429	.72017	2.180	1
AA	26	-.00459	.90721	.001	1
BB	27	.13132	.66707	1.088	1
DD	29	-.05381	.86918	.180	1
FF	31	-.00769	.62338	.004	1
GG	32	-.10294	.73078	.669	1
HH	33	-.02797	.68184	.049	1
II	34	.07303	.71842	.332	1
JJ	36	-.01813	.70106	.020	1
KK	36	.08711	.68615	.479	1
LL	37	.00676	.68743	.003	1
MM	38	-.01086	.66639	.007	1
NN	39	.02940	.69791	.084	1
OO	40	-.07705	.91390	.370	1
PP	41	-.09894	.69210	.613	1
QQ	42	.00792	.67275	.004	1
RR	43	-.10796	.66761	.731	1
SS	44	-.08193	.48332	.419	1
TT	45	-.10448	.65926	.684	1
UU	46	.02520	.70963	.039	1
VV	47	-.03088	.70671	.059	1
WW	48	-.15543	.84184	1.535	1
XX	49	.10082	.84811	.637	1
YY	50	.17835	.86269	2.037	1

STEP NO. 26
VARIABLE REMOVED 22 V

MULTIPLE R .8848
MULTIPLE R-SQUARE .7828
STD. ERROR OF EST. 1.0627

ANALYSIS OF VARIANCE

	SUM OF SQUARES	DF	MEAN SQUARE	F RATIO
REGRESSION	266.66404	10	26.66640	23.071
RESIDUAL	70.922630	64	1.108165	

VARIABLES IN EQUATION . VARIABLES NOT IN EQUATION

VARIABLE		COEFFICIENT	STD. ERROR OF COEFF	STD REG COEFF	F TO REMOVE	LEVEL
(Y-INTERCEPT		-.669)				
B	2	.408	.086	.592	50.164	1
F	6	.358	.175	.172	9.158	1
H	8	1.107	.390	.238	8.039	1
N	14	-1.161	.347	-.211	10.998	1
P	16	.148	.052	.196	8.044	1
S	19	.382	.147	.146	6.720	1
X	24	.026	.007	.372	12.006	1
Y	25	-.790	.239	-.355	10.977	1
CC	28	.003	.001	.139	9.437	1
EE	30	.253	.109	.234	5.001	1

VARIABLE		PARTIAL CORR.	TOLERANCE	F TO ENTER	LEVEL
C	3	-.05260	.34033	.175	1
D	4	.05673	.31285	.203	1
E	5	.12498	.26330	1.000	1
G	7	.13007	.37438	1.089	1
I	9	-.09085	.80279	.524	1
J	10	-.01918	.86756	.023	1
K	11	-.10475	.66933	.699	1
L	12	.03829	.72142	.092	1
M	13	.05769	.87936	.210	1
O	15	-.01083	.62912	.007	1
Q	17	-.00534	.49266	.002	1
R	18	-.01547	.61951	.015	1
T	20	.07366	.81990	.344	1
U	21	-.03548	.82695	.079	1
V	22	.16049	.73100	1.666	1
W	23	-.13642	.76737	1.195	1
AA	26	.00998	.51130	.006	1
BB	27	.13658	.66837	1.198	1
DD	29	-.06412	.86482	.165	1
FF	31	.00126	.67935	.000	1
GG	32	.09236	.93314	.542	1
HH	33	-.01186	.68836	.009	1
II	34	.08094	.72067	.415	1
JJ	35	.00168	.71199	.000	1
KK	36	.11062	.70428	.780	1
LL	37	.01939	.69199	.024	1
MM	38	.01399	.67216	.012	1
NN	39	.04607	.70098	.134	1
OO	40	-.05660	.72396	.202	1
PP	41	-.07408	.70613	.347	1
QQ	42	-.01891	.67599	.023	1
RR	43	-.07084	.69978	.318	1
SS	44	-.03705	.69925	.087	1
TT	45	-.06724	.68947	.286	1
UU	46	.04022	.71129	.102	1
VV	47	-.05601	.72565	.198	1
WW	48	-.13437	.85270	1.158	1
XX	49	-.08047	.85939	.411	1
YY	50	.15764	.82302	1.403	1

F-LEVELS(4.000, 3.900) OR TOLERANCE INSUFFICIENT FOR FURTHER STEPPING

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SUMMARY TABLE

STEP NO.	VARIABLE ENTERED	VARIABLE REMOVED	MULTIPLE R	RSQ	INCREASE IN RSQ	F-TO-ENTER	F-TO-REMOVE	NUMBER OF INDEPENDENT VARIABLES INCLUDED
1	2 B		.8059	.6494	.6494	135.3289		1
2	19 S		.8283	.6860	.0366	8.3679		2
3	5 E		.8400	.7056	.0196	4.7063		3
4	11 K		.8486	.7201	.0145	3.6231		4
5	16 P		.8565	.7336	.0135	3.4724		5
6	14 N		.8607	.7408	.0074	1.9326		6
7	3 C		.8638	.7462	.0053	1.4031		7
8	24 X		.8679	.7532	.0071	1.8943		8
9	25 Y		.8729	.7620	.0088	2.3237		9
10	8 H		.8777	.7704	.0084	2.3476		10
11		11 K	.8776	.7703	-.0002		.0508	9
12	22 V		.8816	.7772	.0069	1.2228		10
13	46 TT		.8853	.7837	.0065	1.6661		11
14	23 W		.8889	.7902	.0065	1.9242		12
15	28 CC		.8922	.7959	.0058	1.7229		13
16	30 EE		.8960	.8029	.0070	2.1140		14
17	50 YY		.8989	.8080	.0051	1.5685		15
18	27 BB		.9021	.8138	.0058	1.0027		16
19	6 F		.9041	.8174	.0036	1.1289		17
20		5 E	.9027	.8150	-.0024		.7417	16
21		3 C	.9020	.8135	-.0015		.4446	15
22		46 TT	.8998	.8097	-.0038		1.2096	14
23		27 BB	.8967	.8041	-.0056		1.7736	13
24		50 YY	.8920	.7956	-.0085		2.6369	12
25		23 W	.8879	.7884	-.0072		2.1798	11
26		22 V	.8848	.7828	-.0056		1.6656	10

APPENDIX F

FORTRAN IV Program Output for Williams AFB, Organizational Maintenance Squardon

STRUCTURED INPUT DATA FOR [illegible]

1	SPD RAT 2	ACC RAT 3	JOB CON 4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	28	29
19010	8	6	3	1	2	9	1	1	15	1	76	93151	5	75	76	0	1	1	1	2	6	5	0	0	0	0	0
19020	6	9	3	3	3	9	[illegible]	1	15	1	77	93151	5	77	77	29	1	1	1	2	6	5	0	0	3	6	12
19030	8	10	4	3	4	9	1	1	19	1	77	93516	5	77	77	20	6	1	1	2	6	5	0	0	0	1	2
19040	7	8	2	1	2	1	1	1	19	1	77	15101	5	77	79	3	1	1	1	2	8	5	2	4	0	0	0
19050	8	6	4	4	2	9	1	1	19	1	77	93151	5	77	77	0	1	1	1	3	8	7	0	0	0	0	0
20090	6	8	4	4	4	9	1	1	26	2	77	93151	5	77	77	0	1	1	1	7	8	5	4	4	0	0	0
20100	6	7	2	3	2	3	2	1	26	2	78	93151	5	78	76	13	1	1	1	2	8	5	0	0	0	0	0
20110	6	8	4	4	4	9	9	1	21	2	77	93151	5	77	77	0	1	1	1	2	8	5	1	4	2	0	0
20120	7	9	4	4	3	9	9	1	21	2	76	93151	5	76	76	0	1	1	1	3	6	5	2	4	3	2	18
21150	9	9	4	4	3	9	2	1	21	3	76	93151	5	77	77	3	1	1	1	3	6	5	1	6	2	0	0
21160	8	8	4	4	4	9	4	1	21	3	76	93151	5	77	77	2	1	1	1	2	6	5	0	0	0	0	0
21170	8	6	3	3	3	9	1	1	21	3	76	93151	5	76	76	2	1	1	1	3	6	5	1	2	0	0	0
22190	6	6	4	3	1	1	1	1	22	1	77	93100	5	77	77	15	1	1	1	0	6	5	0	0	0	0	0
22220	9	9	4	4	3	3	4	1	22	1	76	93151	5	79	76	12	1	1	1	2	6	5	0	0	0	0	0
22230	2	4	3	3	1	1	1	1	22	1	0	93151	5	77	77	3	1	1	1	2	0	9	0	0	0	5	3
23250	6	6	2	4	3	3	4	1	[illegible]	2	76	93151	5	77	77	0	1	1	1	7	6	5	1	0	0	0	0
23260	8	8	4	4	4	9	1	1	21	2	77	93151	5	77	77	0	1	1	1	2	6	5	0	0	0	8	1

23270	7	7	4	4	4	4	4	1	21	2	77	43151	5	78	77	0	1	1	1	2	6	5	0	0	0	0	0
23290	4	4	2	2	2	2	1	1	23	2	79	43131	3	79	79	0	1	1	1	1	6	5	0	0	0	0	0
24310	9	9	3	4	3	4	4	1	24	3	76	43151	5	77	77	33	1	1	2	7	8	5	2	2	0	2	3
24320	7	9	2	3	3	3	3	1	24	3	78	43151	5	78	78	6	1	1	2	2	6	5	0	0	2	0	0
24330	7	7	2	2	2	2	3	1	24	3	76	43151	5	77	77	1	1	1	2	2	6	5	0	0	0	0	0
24331	9	9	4	4	3	2	4	1	24	3	76	43151	5	76	76	34	1	1	2	7	5	0	0	0	1	3	3
25350	7	5	3	1	2	3	7	1	25	1	76	43151	5	77	77	26	1	1	2	7	6	5	1	4	0	0	0
25370	9	9	4	4	4	4	4	1	25	1	76	43151	5	76	77	1	1	1	2	7	8	5	1	2	0	0	0
25380	5	3	1	2	2	1	1	1	25	1	76	43151	5	77	77	30	1	1	2	7	8	6	0	0	1	0	0
26410	7	6	2	3	3	3	1	1	26	2	76	43151	5	77	79	5	1	1	2	7	8	5	0	0	0	5	1
26420	7	7	1	1	1	1	1	1	26	2	78	43151	5	78	76	0	1	1	2	2	6	5	1	2	0	0	0
26440	6	6	1	1	1	1	1	1	26	2	78	43151	5	78	78	10	1	1	2	2	8	5	2	8	0	0	0
26450	5	8	1	1	2	2	1	1	26	2	78	0	5	78	78	14	1	1	2	2	6	5	1	0	0	0	0
26460	5	7	1	2	2	2	1	1	26	2	78	43151	5	79	79	7	1	1	2	1	8	5	0	0	1	0	0
27470	6	6	2	3	3	3	1	1	27	1	77	43151	5	77	79	0	1	1	2	3	8	5	1	2	0	0	0
27480	4	3	3	4	3	3	3	1	27	1	79	43131	3	79	79	3	1	1	2	3	8	5	0	0	0	0	0
27490	7	9	4	4	3	4	3	1	27	1	79	43151	5	75	77	0	1	1	2	3	8	5	0	0	1	5	10
27500	3	2	1	2	2	2	1	1	27	1	76	43131	3	79	79	6	1	1	2	1	8	7	0	0	0	0	0
27520	10	7	4	4	4	4	4	1	27	1	76	43151	5	76	76	0	0	1	2	7	6	5	1	0	0	0	0

26590	9	6	4	4	3	4	1	1	28	1	78	43151	5	78	75	16	1	1	2	2	8	5	0	0	1	1	4
26550	6	9	2	4	2	2	1	1	28	1	78	6	5	77	76	13	1	1	2	2	6	5	1	2	2	0	0
26560	7	8	4	4	4	4	4	1	28	3	78	43151	5	78	79	9	1	1	2	1	6	5	1	2	1	0	0
26570	9	9	4	4	4	4	4	1	28	3	76	43151	5	76	76	43	1	1	2	3	8	5	3	2	0	4	19
29410	2	3	1	1	1	1	1	1	29	1	77	43151	5	77	77	1	1	1	1	2	8	5	0	0	0	0	0
29420	8	7	4	4	4	4	4	1	29	1	78	43151	5	78	78	20	1	1	1	2	8	5	0	0	0	0	0
29430	5	5	2	2	1	1	6	1	29	1	78	43131	3	79	79	7	0	1	1	1	8	5	0	0	2	0	0
30490	1	4	2	1	2	2	1	1	30	2	77	43151	5	77	77	2	1	1	1	2	8	5	0	0	0	0	0
30450	6	7	4	3	3	3	1	1	30	2	77	43151	5	77	77	3	1	1	3	2	10	5	1	4	0	2	3
30460	5	6	3	3	3	4	3	1	30	2	79	43131	3	79	79	2	1	1	1	1	8	5	0	0	0	0	0
31470	10	10	4	4	4	4	4	1	31	1	0	43151	5	77	77	1	1	1	2	3	8	6	3	8	0	3	18
31680	9	10	3	4	3	4	3	1	31	1	76	43151	5	77	77	7	1	1	2	7	8	5	0	0	0	0	0
31690	7	9	2	1	2	3	2	1	31	1	77	43151	5	78	78	1	1	1	2	2	8	5	0	0	1	0	0
31700	8	9	4	4	4	4	4	1	31	1	76	43151	5	77	79	1	1	1	2	7	10	5	0	0	0	0	0
32710	8	9	3	3	4	3	4	1	32	2	77	43151	5	77	79	0	1	1	2	2	8	5	0	0	0	0	0
32720	7	8	3	1	3	1	1	1	32	2	77	43151	5	77	79	2	1	1	2	3	8	5	0	0	0	0	0
32730	9	9	4	3	3	3	3	1	32	2	77	43151	5	77	77	2	1	1	2	3	8	5	0	0	0	0	0
32740	7	8	2	2	1	1	1	1	32	2	76	43151	5	76	76	4	1	1	2	7	8	5	0	0	0	0	0
33750	7	8	4	4	4	4	3	1	31	2	77	43151	5	78	77	0	0	1	2	7	10	5	3	2	0	3	8

33770	7	8	3	4	4	4	3	1	33	2	77	43151	5	76	77	3	1	1	2	0	10	5	2	2	0	0	0
33790	3	6	3	1	3	1	1	1	33	2	77	43151	5	77	77	12	1	1	1	2	6	5	0	0	0	0	0
34010	7	8	3	4	4	3	3	1	34	1	76	43151	5	76	76	0	1	1	3	4	8	5	0	0	0	0	0
34020	6	6	3	4	3	3	3	1	34	1	74	43151	5	74	77	0	1	1	3	7	10	5	3	8	0	0	0
34030	7	9	3	4	3	3	3	1	34	1	77	43151	5	77	77	7	1	1	3	2	8	5	0	0	3	0	0
34050	7	7	4	4	3	3	4	1	34	1	78	43151	5	78	78	0	1	1	2	3	8	5	1	8	2	2	3
34060	8	9	4	4	3	4	4	1	34	1	77	43151	5	77	77	3	1	1	2	2	8	5	2	4	2	3	5
35090	8	8	3	3	4	3	4	1	35	1	75	43151	5	75	75	3	1	1	3	7	6	5	3	8	1	2	18
35900	6	6	3	3	3	3	3	1	35	1	76	43151	5	77	77	20	1	1	3	3	6	5	0	0	0	0	0
35910	7	9	4	4	4	4	4	1	35	1	51	43151	5	55	55	0	1	1	3	8	8	5	0	0	0	1	0
35920	6	8	3	3	4	4	4	1	35	1	76	43151	5	76	76	0	1	1	3	7	8	5	0	0	0	0	0
36950	4	6	3	2	3	3	2	1	36	2	75	44350	3	79	79	0	1	1	2	7	8	5	0	0	0	0	0
36960	8	8	3	3	3	4	4	1	36	2	76	43151	5	77	77	2	1	1	3	7	8	5	0	0	0	0	0
36970	8	9	4	3	3	3	3	1	36	2	73	43171	7	78	78	1	1	1	3	8	8	5	1	8	2	2	9
36100	6	6	3	3	3	2	3	1	36	2	75	43151	5	75	75	0	1	1	3	7	10	5	0	0	0	2	12

30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
100	1	5	6	3	3	[illegible]	1	[illegible]	25	23	25	27	[illegible]	21	[illegible]	25	25	25	20	27	[illegible]	19	-1	0	-1	4
100	1	5	6	3	3	[illegible]	4	4	27	31	[illegible]	27	[illegible]	11	21	15	32	25	25	32	[illegible]	19	-7	3	2	7
100	1	5	8	3	3	[illegible]	1	[illegible]	22	30	25	25	21	26	21	25	22	25	20	29	21	17	4	3	0	-1
100	1	5	8	3	3	0	4	[illegible]	25	33	27	27	25	23	27	21	22	25	22	25	23	14	-3	3	-2	2
100	1	5	8	3	3	0	4	4	27	25	30	27	25	20	25	25	32	22	27	18	30	15	-4	4	2	-2
40	3	4	8	10	1	[illegible]	3	4	20	35	25	32	28	19	35	30	27	22	18	32	22	17	2	1	-2	1
40	3	4	8	10	1	0	3	4	22	25	27	25	27	25	25	23	28	22	18	30	24	14	-3	-1	-2	6
40	3	4	8	10	1	[illegible]	3	4	30	37	24	30	26	23	21	23	25	27	18	25	20	19	-4	-1	-1	6
40	3	4	8	10	1	0	3	4	25	25	20	30	25	25	27	23	22	25	24	33	29	15	-2	6	-2	-2
70	3	3	7	15	1	[illegible]	4	4	27	35	22	25	26	23	25	23	25	25	18	19	17	29	2	-2	-2	2
70	3	3	7	15	1	0	4	4	25	40	25	26	22	20	23	27	27	25	24	34	13	20	0	-1	-1	4
70	3	3	7	15	1	[illegible]	4	4	20	31	25	25	23	21	31	31	27	17	21	29	19	14	1	2	-4	1
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120	4	4	15	25	5	4	5	5	25	31	25	27	23	23	21	27	20	25	20	23	20	19	-4	-4	0	0
140	4	4	15	25	5	4	5	5	25	20	22	20	21	25	23	27	20	27	20	27	23	19	1	-2	-5	8
120	4	4	15	25	5	4	5	6	26	25	25	27	21	23	27	27	35	27	34	30	21	18	0	1	1	-2
200	4	3	10	15	3	0	4	3	22	27	24	25	20	25	23	25	20	25	23	29	25	18	2	-1	-2	1
200	4	3	10	15	3	0	4	3	26	31	27	30	23	23	25	31	27	22	22	26	19	18	-5	2	-1	4
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200	3	3	15	25	4	0	3	3	20	27	27	27	25	26	27	21	25	20	20	19	22	16	-1	3	-4	2

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60	2	2	5	280	3	3	2	2	27	10	18	32	16	21	23	27	22	25	30	30	30	17	1	2	-5	2	
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90	3	3	30	300	4	3	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	X
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60	2	2	12	40	4	3	3	4	25	30	29	27	23	21	25	23	22	25	25	26	20	20	-1	5	-2	-2	
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AD-A088 061 ARIZONA STATE UNIV TEMPE DEPT OF INDUSTRIAL AND MANA--ETC F/G 15/5
DEVELOPMENT OF AN EFFECTIVENESS PLANNING AND EVALUATION MODEL F--ETC(U)
APR 80 H H YOUNG AFOSR-79-0111
UNCLASSIFIED ASU-ERC-R-80016 AFOSR-TR-80-0598 NL

3 OF 3
AD
A088061

END
DATE
FILMED
9-80
DTIC

120	2	4	10	300	5	0	2	2	25	27	26	27	26	20	27	27	27	25	27	39	30	16	0	-2	1	1
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APPENDIX G

FORTRAN IV Program Output for Luke AFB, Component Repair Squadron

Luke CRS

TECH NUMB 1	SPD NAT 2	ACC NAT 3	JOB CUR 4	PER SIS 5	PHO IDT 6	ORG IDT 7	SLF STR 8	SUD CDE 9	SUP CDE 10	SFT CDE 11	ENLI DATE 12	AFSC 13	SKL LEV 14	DUTY DATE 15	EUPM DATE 16	NO TN 17	SEX CUE 18	SQA CDE 19	EUP CDE 20	WNK CDE 21	HRS SFT 22	DAY WTB 23	ADD DUT 24	HRS DUT 25	NO CLA 26	NO SUP 28	NON SUP 29
12101	9	9	4	4	4	4	4	2	91	1	69	42652	7	70	78	1	1	1	1	5	8	5	0	0	0	6	1
12102	10	10	4	4	4	4	4	2	91	1	78	42652	5	78	78	0	1	1	1	2	8	5	0	0	0	0	0
12103	10	10	4	4	4	4	4	2	91	1	76	42652	5	76	76	0	1	1	1	3	8	5	0	0	0	3	22
12104	10	10	4	4	4	4	4	2	91	1	75	42652	5	76	78	0	1	1	1	3	8	5	1	8	2	4	13
12106	9	10	4	4	3	4	4	2	91	1	78	46252	5	78	79	10	1	1	1	2	8	5	0	0	0	0	0
12111	10	10	4	4	4	4	4	2	92	1	74	42652	5	74	78	0	1	1	1	3	8	4	0	8	0	3	24
12112	8	9	3	3	3	4	3	2	92	1	76	42652	5	76	78	0	1	1	1	7	8	5	0	0	0	0	8
12113	7	9	3	3	4	4	4	2	92	1	76	42652	5	76	77	4	0	1	1	3	8	5	1	0	1	0	0
12114	7	9	3	3	3	3	3	2	92	1	78	42652	5	79	0	0	0	1	1	2	8	5	0	0	0	0	8
12115	10	10	4	4	4	4	4	2	92	1	78	42652	5	78	0	12	1	1	1	2	8	6	2	6	0	2	4
12121	4	6	3	2	2	2	1	2	93	1	78	42750	5	79	79	0	1	1	1	3	8	5	0	0	0	0	0
12122	4	6	3	3	3	3	3	2	93	1	77	42750	5	77	77	0	1	1	1	2	8	5	1	2	0	0	0
12123	2	5	4	3	4	3	1	2	93	1	78	42700	5	79	79	0	0	1	1	2	8	5	0	0	2	0	0
12124	1	1	1	1	1	1	1	2	93	1	78	42730	3	79	79	0	1	1	1	2	8	5	0	0	0	8	0
12125	9	9	4	4	4	4	3	2	93	1	54	42770	7	64	0	0	1	2	1	8	8	5	0	0	0	4	24
12131	6	9	4	4	4	3	4	2	94	1	65	32675	7	76	76	37	1	1	1	8	8	5	2	2	0	8	99
12132	9	8	4	4	4	4	4	2	94	1	77	32655	5	77	78	18	1	1	1	3	8	5	2	4	0	2	1

12133	4	7	3	3	3	3	4	2	44	1	77	32665	5	78	77	22	1	1	1	2	8	5	0	0	4	0	0
12134	5	7	4	3	4	4	3	2	44	1	76	32605	5	76	77	4	1	1	1	3	8	5	1	4	0	4	10
12136	4	6	3	3	3	3	3	2	44	1	77	32661	5	78	77	3	1	1	1	2	8	5	0	0	0	0	0
12141	8	10	4	4	4	4	4	2	45	1	76	32664	5	76	77	32	0	1	1	7	8	5	0	0	0	0	0
12142	7	8	4	4	4	4	4	2	46	1	78	32604	3	79	79	0	1	1	1	3	8	5	0	0	0	0	0
12139	8	9	4	4	4	4	4	2	45	1	76	32601	5	77	77	0	1	1	1	3	10	5	0	0	1	3	8
12144	4	6	2	1	1	2	1	2	45	1	78	32604	3	78	78	0	1	1	1	3	8	5	1	2	0	0	0
12145	7	8	4	3	4	4	4	2	45	1	78	42632	5	78	78	0	1	1	1	2	8	5	0	0	0	0	8
12151	9	10	4	4	4	4	4	2	46	1	76	42652	5	77	79	11	0	1	1	7	8	5	0	0	0	0	0
12152	9	10	4	4	4	4	4	2	46	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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12154	9	10	4	4	4	4	4	2	46	1	78	42652	5	78	79	0	1	1	1	2	8	5	0	0	2	0	0
12156	8	9	3	4	3	3	3	2	46	1	78	42652	5	79	79	10	1	1	1	2	6	0	1	0	1	2	0
12201	5	6	1	1	3	1	2	2	47	2	77	42652	5	78	78	0	1	1	1	2	8	5	0	0	0	3	12
12202	6	7	2	3	3	3	3	2	47	2	78	4	5	78	78	0	1	1	1	2	8	5	0	0	0	0	0
12203	9	10	4	4	4	4	4	2	47	2	76	4	5	76	76	6	1	1	1	7	8	5	0	0	0	3	6
12204	8	7	3	3	3	3	3	2	47	2	78	42652	5	78	0	13	1	1	1	2	8	5	0	0	0	0	0
12205	8	8	3	4	4	4	4	2	47	2	76	42352	5	77	77	0	1	1	1	3	8	5	1	2	0	4	3
12221	9	7	3	2	2	2	1	2	48	2	73	42652	5	74	77	0	1	1	1	3	8	5	0	0	0	3	60

14222	10	10	4	4	3	3	2	2	48	2	77	42662	5	77	77	30	1	1	1	2	8	5	0	0	0	0	0
14223	9	9	4	4	2	3	4	2	48	2	78	0	5	0	78	12	1	1	1	2	8	5	0	0	1	0	0
14224	8	7	1	4	2	3	1	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14226	8	6	1	2	1	2	1	2	48	2	78	42652	5	78	79	3	0	1	1	2	8	5	1	2	0	0	0
12231	8	9	4	4	4	3	2	2	49	2	78	42652	5	79	79	0	1	1	1	2	8	5	0	0	0	0	0
12232	9	9	4	4	4	4	3	2	49	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12233	6	7	3	1	2	2	1	2	49	2	78	42652	5	78	78	0	0	1	1	2	8	5	0	0	0	0	0
14234	6	7	2	2	2	1	1	2	49	2	77	42652	5	78	78	0	1	1	1	2	8	5	0	0	0	0	0
14235	8	10	4	4	4	4	3	2	49	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14241	3	8	4	4	4	4	4	2	50	2	79	32150	5	79	79	11	1	1	1	3	8	5	0	0	0	0	0
12242	4	10	4	3	4	4	3	2	50	2	77	32450	5	78	0	9	1	1	1	3	8	5	0	0	0	0	0
12244	5	3	2	1	1	1	1	2	50	2	75	32450	5	76	76	0	1	1	1	3	8	5	1	2	0	0	0
12245	5	4	4	3	4	4	3	2	50	2	76	23400	5	77	77	29	1	1	1	7	8	5	0	0	0	0	0
14251	6	9	4	4	3	3	3	2	51	2	78	32664	3	79	78	7	0	1	1	2	8	5	0	0	0	0	0
12252	5	7	4	4	3	3	2	2	51	2	78	32659	3	79	79	0	1	1	1	2	8	5	0	0	0	0	0
12253	7	9	1	1	3	3	1	2	51	2	78	32659	5	0	78	0	1	1	1	3	8	5	0	0	0	0	0
12254	4	3	2	4	4	4	4	2	51	2	78	32604	3	79	79	0	1	1	1	2	8	5	0	0	0	0	0
12255	10	5	4	3	4	4	4	2	51	2	76	32654	5	77	77	0	1	1	1	3	8	5	1	2	0	4	12
30001	10	7	3	3	3	4	4	2	52	2	73	34156	5	77	77	25	1	1	1	5	8	5	2	8	1	5	0

30082	10	10	9	2	9	2	3	2	62	2	52	39159	6	53	76	3	1	2	1	0	0	5	0	0	0	0	0
30089	0	9	9	9	9	9	9	2	62	2	75	39159	5	75	79	9	1	2	1	0	0	5	0	0	1	0	0
30086	6	9	3	9	9	9	9	2	62	2	69	39176	7	79	79	0	1	1	1	5	0	5	3	6	1	0	0

STRUCTURED INPUT DATA FOR INPUT TO BMUP MULTIPLE REGRESSION MODEL

HGT HOL 30	SEN CLR 31	REN CLR 32	INT CPS 33	HHS SHV 34	TEC INF 35	TST EQT 36	TEL KNO 37	TEC SKL 38	IND ADT 39	MON ATT 40	INT REL 41	SAT SUP 42	STR UCT 43	REW ARD 44	RIS K 45	BAR HTH 46	CON FLT 47	IDN TTY 48	LOC AL 49	PAY BFT 50	SOC STS 51	FAT TRT 52	ASC END 53	RES PON 54	END SBY 55	SOC IAL 56
130	0	1	50	5	5	3	5	5	25	33	29	25	22	26	21	25	22	22	24	25	20	18	0	0	-1	1
130	0	1	50	5	5	3	5	5	30	33	27	30	25	28	26	25	27	25	27	31	29	20	-2	2	0	0
130	0	1	50	5	5	3	5	5	25	33	29	27	25	30	27	27	25	27	21	28	26	19	1	-1	0	0
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60	0	0	0	0	0	0	3	2	27	31	27	27	23	28	23	23	27	27	31	33	21	20	0	1	-3	2
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60	0	0	0	0	0	0	3	2	25	27	22	30	22	26	30	30	30	25	0	0	0	20	-1	0	-4	5
10	3	3	17	60	2	1	1	2	25	33	31	27	26	25	31	30	27	27	30	33	29	18	-2	1	-4	5
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10	3	3	17	50	2	1	1	2	42	31	25	22	26	26	30	25	22	17	31	31	27	15	-1	1	1	-1
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10	3	3	17	50	2	1	1	2	25	31	25	27	28	28	25	21	25	22	28	34	26	17	0	1	-4	3
80	3	2	50	0	1	2	2	3	22	30	30	27	21	23	25	25	27	22	30	30	39	16	-2	3	0	-1
80	3	2	50	0	1	2	2	3	30	37	26	27	28	25	21	20	25	17	24	27	20	19	0	-1	1	0
10	3	3	17	50	2	1	1	2	22	31	22	32	27	26	27	27	22	32	20	29	29	17	1	-1	-2	2
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200	3	3	50	30	4	5	4	4	25	30	24	25	23	13	0	27	12	5	24	31	11	17	0	-1	-1	2
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85	4	4	10	50	5	5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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60	1	1	96	100	1	1	2	6	17	30	31	27	25	26	27	35	30	27	24	39	36	16	-1	3	-3	1

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120	3	3	10	25	4	4	4	4	22	30	22	22	22	26	33	33	30	26	30	40	29	18	0	2	-6	4
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120	3	3	10	25	4	4	4	4	27	27	26	30	26	28	27	25	25	25	22	37	31	20	1	-2	0	1
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60	1	1	50	300	3	3	2	3	22	26	27	22	26	28	26	26	26	26	30	42	32	19	-6	3	0	2
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90	3	3	16	200	0	6	3	3	22	35	24	30	26	21	27	27	22	26	24	30	24	19	-1	-1	-3	6
90	3	3	15	200	0	5	3	3	27	40	25	25	30	26	27	27	22	22	21	29	20	19	-4	-2	3	-1
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65	3	2	30	190	4	4	4	5	26	27	21	26	23	23	27	27	26	20	23	31	26	19	-1	1	-4	4

06	3	2	30	190	9	9	9	6	27	33	26	27	26	28	26	23	17	17	0	0	0	19	-1	-2	-3	6
05	3	2	30	190	9	9	9	5	30	33	27	27	20	31	21	15	20	17	0	0	0	18	-9	2	0	2
05	3	2	30	190	9	9	9	6	22	31	26	27	25	26	27	21	25	20	20	28	17	19	-2	2	-1	1

WFIN

APPENDIX H

FORTRAN IV Program Output for Luke AFB, Electrical Maintenance Squadron

STRUCTURED INPUT DATA FOR INPUT TO BMDP MULTIPLE REGRESSION MODEL

TECH NUMB 1	SPR RAT 2	ACC RAT 3	JOB CUR 4	PER SIS 5	PRV IDT 6	ORG IDT 7	SLF STR 8	SUP CDE 9	SUP CDE 10	SFT CDE 11	ENLI DATE 12	AFSC 13	SKL LEV 14	DUTY DATE 15	EUPH DATE 16	NO TM 17	SLA CDE 18	SQA CDE 19	EQP CDE 20	WNK CDE 21	HRS SFT 22	DAY BTB 23	ADD DUT 24	HRS DUT 25	NO CLB 26	NO SUP 28	MON SUP 29
1010	10	10	4	4	4	4	3	2	21	1	76	43151	6	77	77	0	1	1	1	7	8	5	1	4	1	3	11
1011	6	6	3	4	4	4	3	2	21	1	75	43101	3	79	79	0	1	1	1	3	8	6	0	0	0	1	6
1012	7	7	3	4	3	3	2	2	21	1	74	43284	6	78	75	0	1	1	1	5	8	5	3	4	1	0	0
1013	4	4	2	2	3	3	2	2	21	1	77	43111	5	77	77	0	1	1	1	2	8	6	0	0	0	0	0
10001	6	8	3	4	3	4	4	2	22	1	77	462	5	78	78	0	0	1	1	2	8	5	0	0	0	0	0
10002	7	6	2	1	2	3	2	2	22	1	73	46250	6	73	75	0	1	1	1	3	8	6	1	2	1	4	14
10003	7	8	4	4	3	4	4	2	22	1	77	46250	5	77	78	0	1	1	1	2	8	5	0	0	0	0	0
10004	6	7	2	3	3	3	2	2	22	1	77	46250	6	77	78	0	1	1	1	3	8	5	0	0	0	0	0
10005	4	5	3	3	3	3	4	2	22	1	79	46230	3	0	79	0	1	1	1	1	8	6	0	0	0	0	0
11001	8	7	3	2	3	3	4	2	33	1	75	42366	6	75	0	0	0	0	1	3	8	5	0	0	0	1	4
11002	7	6	2	2	2	2	2	2	23	1	76	42356	5	77	0	0	0	1	1	7	8	5	0	0	0	0	0
11003	9	9	3	4	4	4	4	2	23	1	76	42366	5	76	76	0	1	1	1	7	8	8	0	0	0	0	0
11004	5	6	3	3	3	3	2	2	23	1	74	42305	6	76	79	11	1	1	1	3	8	5	2	6	0	7	11
11005	6	6	4	3	3	4	2	2	23	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13001	7	7	3	3	4	4	2	2	24	1	72	43101	8	72	72	16	1	1	1	5	8	5	3	6	0	4	6
13002	7	7	3	3	3	4	3	2	24	1	72	43161	5	72	72	6	1	1	1	3	8	5	3	6	0	3	6
13003	8	8	3	3	3	4	4	2	24	1	74	43151	5	76	77	0	1	1	1	3	8	5	2	8	0	7	6

13004	5	5	2	2	2	2	3	2	24	1	77	43151	6	78	79	0	1	1	1	3	8	5	0	0	1	2	6
13005	6	7	3	3	3	4	3	2	24	1	77	42652	5	77	79	0	1	1	1	2	8	5	1	0	0	0	0
14001	9	8	3	4	3	3	4	2	25	1	75	43150	6	76	75	0	1	1	1	4	8	6	2	8	1	4	14
14002	6	5	1	2	1	1	1	2	25	1	77	43150	5	78	78	19	1	1	1	2	8	5	0	0	0	3	2
14003	9	9	2	3	3	2	2	2	25	1	78	43150	6	78	78	30	1	1	1	2	8	6	1	2	0	0	0
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14006	5	7	3	2	2	2	3	2	25	1	77	43100	6	77	77	1	1	1	1	2	10	6	2	4	1	3	18
15001	4	6	4	4	3	3	3	2	26	2	77	462	5	78	78	0	1	1	1	3	8	5	0	0	0	0	0
15002	5	6	3	4	2	3	3	2	26	2	75	46250	6	76	76	0	1	1	1	3	8	5	0	0	0	0	0
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16001	8	9	3	3	1	3	4	3	27	2	75	42305	5	76	0	4	1	1	1	3	8	5	0	0	0	0	0
16003	5	7	3	1	3	2	3	3	27	2	78	42355	5	79	79	10	1	1	1	2	8	5	3	0	1	0	0
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19002	4	10	2	2	3	2	2	3	28	2	77	42352	5	77	77	0	1	1	1	7	8	5	2	2	0	0	0
19003	10	6	4	4	3	3	3	3	28	2	78	32637	3	78	79	0	1	1	1	2	8	5	1	8	0	0	0
19004	8	7	3	4	3	4	4	3	28	2	73	42352	5	73	74	0	1	1	1	4	8	6	3	6	2	5	2

19005	2	4	2	2	2	2	2	2	26	2	78	42352	6	78	78	10	1	1	1	2	8	14	1	2	0	0	0
21001	9	10	0	0	0	0	0	2	29	1	74	43101	6	75	75	84	1	1	1	3	8	5	0	0	0	3	18
21002	10	10	0	0	0	0	0	2	29	1	75	73101	5	77	75	11	1	1	1	3	8	5	0	0	0	2	12
21003	10	9	0	0	0	0	0	2	29	1	77	43151	5	77	77	1	1	1	1	3	8	5	0	0	0	0	0
21004	8	8	0	0	0	0	0	2	29	1	78	0	6	79	79	7	1	1	1	1	8	5	0	0	0	0	0
21006	7	7	0	0	0	0	0	2	29	1	78	431	5	78	79	1	1	1	1	2	8	6	2	3	0	0	0
60001	10	10	4	4	4	4	4	2	30	2	0	42353	5	74	73	0	1	1	1	0	8	5	2	4	0	4	0
60002	4	7	3	3	3	4	3	2	30	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60003	10	10	4	4	4	4	4	2	30	2	76	42363	6	0	77	8	1	1	1	3	8	5	1	6	0	0	0
60004	7	8	3	3	3	3	2	2	30	2	78	60560	5	79	79	11	1	1	1	3	8	5	0	0	0	0	0
60006	6	7	2	1	1	3	1	2	30	2	77	42353	6	77	77	20	1	1	1	3	8	5	1	0	3	0	0
10001	7	9	1	3	4	3	3	2	31	2	75	43151	5	79	76	3	1	1	1	3	8	5	1	4	0	1	6
10002	3	9	2	1	3	3	2	2	31	2	75	431	5	76	77	16	1	1	1	3	8	5	2	4	0	0	0
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STRUCTURED INPUT DATA FOR INPUT TO BMUP MULTIPLE REGRESSION MODEL

WGT HOL 30	SER CLR 31	MEM CLR 32	INT CPS 33	HHS SKV 34	TEC INF 35	TST EQT 36	TEC KNO 37	TEC SKL 38	IND MOT 39	MOM ATT 40	INT REL 41	SAT SUP 42	STR UCT 43	REW ARD 44	RIS K 45	HAR MTN 46	CON FLT 47	IDN TTY 48	LOC AL 49	PAY OFF 50	SOC STS 51	FAT TRT 52	ASC END 53	RES PON 54	EMO SUY 55	SOC IAL 56
135	3	4	22	130	4	4	3	3	25	27	25	25	22	28	25	30	22	25	22	30	27	20	0	0	-1	1
135	3	4	22	130	4	4	3	1	30	35	25	25	25	24	23	23	22	20	21	30	25	18	-2	2	0	0
135	3	4	22	130	4	4	3	3	27	27	25	25	24	23	27	30	20	25	29	30	20	18	1	-1	0	0
135	3	4	22	130	4	4	3	3	27	30	30	20	25	21	21	27	22	22	27	33	24	15	-2	2	-3	3
100	1	1	15	75	4	6	4	4	22	27	25	25	20	21	25	30	22	22	24	27	22	17	1	-1	1	-1
100	1	1	15	75	4	5	4	4	30	40	27	25	23	23	27	21	26	25	18	32	23	19	0	1	-3	2
100	1	1	15	75	4	5	4	4	25	31	24	22	23	25	21	25	22	25	22	26	21	16	-4	-3	5	2
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100	1	1	15	75	4	5	4	4	25	31	27	27	28	23	23	21	25	25	27	28	23	18	-2	3	-1	0
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20	0	0	0	0	0	0	0	1	25	25	24	25	28	25	25	27	22	25	30	30	30	15	-2	1	-2	3
20	0	0	0	0	0	0	0	3	30	31	27	27	21	30	30	22	27	35	21	32	38	17	0	1	-3	2
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20	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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40	1	1	30	100	1	0	4	4	32	25	22	30	28	30	30	33	25	25	28	30	34	19	-5	1	-1	5

90	1	1	30	100	1	0	4	4	32	35	21	25	27	26	25	23	25	30	29	35	30	17	-1	1	1	-1
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120	2	3	30	5	3	2	3	3	22	35	27	27	28	28	30	25	25	25	26	26	23	18	0	1	-4	3
120	2	3	30	5	3	2	3	3	30	33	25	30	38	26	30	30	22	25	22	38	23	19	-2	3	0	-1
120	2	3	30	5	3	2	3	3	25		22	27	29	26	26	27	25	25	26	36	30	19	0	-1	1	0
120	2	3	30	5	3	2	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
120	2	3	30	5	3	2	3	3	30	37	28	22	32	30	31	23	20	20	18	30	17	19	4	-4	-4	4
200	1	1	0	270	5	5	4	4	25	33	22	30	18	23	20	23	32	22	22	29	29	15	-6	3	-1	4
200	1	1	0	270	5	5	4	4	25	33	28	27	22	25	26	21	26	22	27	33	22	19	0	-1	-1	2
200	1	1	0	270	5	5	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	1	1	0	270	5	5	4	4	27	30	25	25	22	25	27	30	22	20	25	30	26	17	0	0	-1	1
200	1	1	0	270	5	5	4	4	27	35	29	32	26	26	11	20	17	27	19	32	29	17	-2	3	-2	1
90	4	4	50	0	2	0	3	4	32	33	25	27	29	20	27	23	22	28	20	28	22	19	-2	3	0	-1
90	4	4	50	0	2	0	3	4	17	33	25	27	20	23	27	25	25	27	27	35	30	19	0	-2	0	2
90	4	4	50	0	2	0	3	4	27	30	25	30	28	28	25	25	27	25	23	31	27	16	3	0	-3	0
70	4	4	20	300	4	4	4	3	30	40	22	27	26	23	23	21	22	25	20	26	20	19	-1	8	-3	1
70	4	4	20	300	4	4	4	3	25	27	25	27	23	25	27	21	27	22	29	27	27	19	-2	0	1	1
70	4	4	20	300	4	4	4	3	22	30	21	27	25	23	21	21	20	20	25	32	22	18	-2	3	-2	1
70	4	4	20	300	4	4	4	3	22	25	25	22	22	26	33	31	20	25	26	31	29	17	-1	3	-3	1

70	9	9	20	300	9	4	9	3	22	31	27	27	23	26	27	25	25	20	29	28	29	17	-2	2	0	0
25	2	1	15	85	5	0	9	9	25	27	27	25	23	28	23	23	30	25	21	26	29	19	1	-1	-3	3
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25	2	1	15	85	5	0	9	9	30	31	28	27	26	23	23	20	22	27	29	26	29	25	0	2	-6	9
25	2	1	15	85	5	0	9	9	12	17	20	20	30	16	11	20	32	25	32	35	26	16	1	0	-9	3
140	0	5	50	80	9	0	9	9	22	25	27	25	25	23	30	23	22	27	28	39	20	18	1	-2	0	1
140	0	5	50	80	9	0	9	9	25	27	29	30	21	20	25	27	25	22	21	25	28	19	-5	0	9	3
140	0	5	50	80	9	0	9	9	22	27	28	30	27	25	30	30	30	22	26	28	39	19	-2	2	-1	1
140	0	5	50	80	9	0	9	9	25	30	29	22	23	25	27	36	27	25	23	30	22	17	-5	3	0	2
140	0	5	50	80	9	0	9	9	27	23	27	27	22	28	25	31	37	25	28	38	26	17	-9	2	0	2
200	3	2	8	100	9	5	9	9	32	35	30	35	33	36	35	37	32	35	29	30	33	18	-3	1	-1	3
200	3	2	8	100	9	5	9	9	32	30	25	30	28	25	30	31	25	25	28	39	33	18	-3	2	-1	2
200	3	2	8	100	9	5	9	9	22	30	21	27	31	31	30	27	20	25	29	32	24	16	-1	-1	-3	6
0	0	0	0	0	0	0	0	0	30	27	25	25	25	26	27	33	25	30	33	39	38	17	-9	-2	3	-1

WFIN

APPENDIX I

FORTRAN IV Program Output for Luke AFB,
Aircraft Generation Squadron

TOJWHM,H H YOUNG,A F PROJECT *Lowe AGS* DATE 013080

STRUCTURED INPUT DATA FOR INPUT TO BMDP MULTIPLE REGRESSION MODEL

TECH NUMB 1	SPD RAT 2	ACC RAT 3	JOB CUR 4	PER SIS 5	PRO IDT 6	ORG IDT 7	SLF STR 8	S2D CDE 9	SUP CDE 10	SFT CDE 11	ENLI DATE 12	AFSC 13	SKL LEV 14	DUTY DATE 15	EUPM DATE 16	NO TR 17	SLX CDE 18	SOA CDE 19	EQP CDE 20	RNK CDE 21	HRS SFT 22	DAY BTB 23	ADD DUT 24	HRS DUT 25	NO CLB 26	NO SUP 28	MON SUP 29
10011	1	7	2	1	2	1	1	1	1	1	72	43101	5	72	72	0	1	1	1	2	10	5	1	4	3	5	40
10012	6	5	3	3	3	3	3	1	1	1	75	43101	5	75	79	0	1	1	1	2	8	0	0	0	0	0	0
10013	9	7	4	4	4	4	4	1	1	1	78	43101	5	78	79	0	1	1	1	2	8	5	0	0	0	0	0
10014	4	2	3	3	3	2	1	1	1	1	79	0	3	79	79	0	1	1	1	3	8	5	0	0	0	0	0
10015	9	9	4	4	4	4	4	1	1	1	76	43101	5	76	76	0	0	1	1	7	8	5	2	0	0	1	3
10021	8	9	4	4	3	3	4	1	2	1	75	32606	5	76	76	0	1	1	1	5	8	5	1	2	0	0	0
10023	3	7	4	3	3	3	3	1	2	1	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
10025	6	3	3	3	3	4	3	1	2	1	78	32656	5	78	79	0	1	1	1	2	8	5	0	0	0	0	0
10034	9	9	4	3	3	3	4	1	3	1	77	462	5	77	77	4	1	1	1	3	8	0	0	0	0	0	0
10035	9	9	4	4	4	4	4	1	3	1	77	46250	5	77	77	0	1	1	1	2	8	5	0	0	0	2	0
10042	6	6	4	3	3	3	3	1	4	1	78	32637	3	79	79	0	1	1	1	2	8	5	0	0	0	0	0
10043	1	1	1	1	1	1	1	1	4	1	78	4	5	78	78	3	1	1	1	2	8	5	0	0	0	0	0
10044	7	8	4	4	4	3	4	1	4	1	78	32637	5	79	79	0	1	1	1	2	8	5	0	0	0	1	2
10051	7	9	4	4	4	4	3	1	5	1	78	42652	5	78	79	12	1	1	1	2	8	5	1	6	0	2	9
10052	6	9	2	3	2	3	1	1	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10053	8	9	3	3	4	4	4	1	5	1	78	43111	5	79	78	0	1	1	1	2	8	5	0	0	0	0	0
10054	9	9	4	4	4	3	4	1	5	1	76	32657	5	77	76	0	1	1	1	3	8	5	2	6	4	6	10

10855	7	9	2	3	3	3	3	1	5	1	78	43151	5	79	79	0	1	1	1	3	8	5	2	4	0	0	0
10861	7	8	4	4	4	4	3	1	6	1	75	43151	5	75	75	0	1	1	1	5	10	5	0	0	0	0	0
10862	5	5	1	1	1	1	1	1	6	1	76	42355	5	77	77	1	1	1	1	7	8	5	0	0	1	0	0
10863	6	7	4	4	4	4	4	1	6	1	76	43151	5	76	76	0	1	1	1	7	8	5	1	2	0	0	0
10864	5	5	1	2	2	1	1	1	6	1	78	43151	5	78	78	1	1	1	1	2	8	5	0	0	0	0	0
10865	6	6	4	4	4	4	4	1	6	1	78	43151	5	78	78	12	1	1	1	2	8	5	0	0	0	0	0
11021	5	5	1	2	1	2	1	1	8	2	76	43151	5	76	76	0	1	1	1	3	8	5	1	6	0	0	0
11022	7	7	2	4	3	4	1	1	8	2	78	32657	5	78	78	14	0	1	1	2	8	5	0	0	0	0	0
11035	9	10	4	4	4	4	3	1	9	2	74	43151	5	0	78	18	1	1	1	3	8	5	0	0	0	0	0
11041	10	10	4	4	4	3	4	1	10	2	75	32607	5	77	76	0	1	1	1	3	8	5	0	0	0	3	0
11042	9	9	4	4	4	3	2	1	10	2	77	32657	5	78	78	0	1	1	1	2	8	4	1	2	0	0	0
11043	7	7	4	4	4	4	4	1	10	2	78	32657	5	78	78	13	1	1	1	3	10	6	1	0	1	0	0
11044	7	7	4	4	4	3	3	1	10	2	78	32607	3	79	79	0	1	1	1	2	8	5	0	0	0	0	0
11045	5	5	4	4	3	3	2	1	10	2	78	32657	5	79	79	4	1	1	1	3	8	5	0	0	0	0	0
11051	10	9	3	4	2	2	3	1	11	2	76	43151	5	76	76	0	1	1	1	7	10	5	0	0	0	4	9
11052	9	9	3	3	3	3	3	1	11	2	78	43131	5	78	78	0	1	1	1	3	8	5	0	0	0	0	0
11053	9	9	3	4	3	3	3	1	11	2	77	43131	5	77	77	0	0	1	1	3	8	5	0	0	0	0	0
11054	9	7	3	2	2	2	2	1	11	2	78	43101	5	78	78	0	0	1	1	2	8	7	0	0	0	0	0
11055	9	9	3	2	2	2	2	1	11	2	78	43131	5	78	78	0	1	1	1	3	8	5	0	0	0	0	0

11061	9	9	3	3	2	2	2	1	12	2	27	64318	5	7	57	78	0	1	1	3	0	5	1	4	1	0	0
11062	6	9	3	4	4	4	4	1	12	2	78	43151	5	79	79	0	1	1	1	2	0	7	0	0	0	0	0
11063	5	4	1	1	1	1	1	1	12	2	78	431	5	78	78	0	1	1	1	2	0	5	0	0	0	0	0
11064	5	7	4	3	3	3	4	1	12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11065	7	8	4	4	3	2	3	1	12	2	78	43151	5	78	79	0	1	1	1	2	0	5	0	0	0	1	12

STRUCTURED INPUT DATA FOR INPUT TO BMDP MULTIPLE REGRESSION MODEL

WGT HOL 30	SER CLR 31	REM CLA 32	INT CPS 33	MRS SRV 34	TEC INF 35	IST EQT 36	TEC KNO 37	TLC SKL 38	IND MOT 39	MOM ATT 40	INT REL 41	SAT SUP 42	STR UCT 43	REW ANC 44	MIS K 45	WAR MTH 46	CON FLT 47	ION TTY 48	LOC AL 49	PAY BFT 50	SOC STS 51	FAT TRT 52	ASC END 53	RES PON 54	EMO SBY 55	SOC TAL 56
100	4	4	15	20	5	0	3	3	27	35	24	27	22	26	30	31	22	22	24	37	33	12	0	0	-1	1
100	4	4	15	20	5	0	3	3	22	33	27	30	20	26	27	23	25	30	30	32	30	16	-2	2	0	0
100	4	4	15	20	5	0	3	3	22	31	25	25	23	26	25	23	22	25	24	30	22	15	1	-1	0	0
100	4	4	15	20	5	0	3	3	25	25	25	27	18	25	25	27	27	20	20	31	25	18	-2	2	-3	3
100	4	4	15	20	5	0	3	3	27	25	27	25	21	25	25	27	25	22	24	35	30	18	1	-1	1	-1
30	2	1	5	10	2	0	2	2	25	27	20	30	23	21	27	31	25	22	25	34	24	20	0	1	-3	2
30	2	1	5	10	2	0	2	2	30	30	27	25	26	24	30	27	25	27	22	28	22	19	-4	-3	5	2
30	2	1	5	10	2	0	2	2	25	33	24	30	23	26	31	23	25	25	26	32	26	19	-4	0	3	1
100	3	2	3	120	5	0	4	4	17	25	28	35	20	25	30	31	25	22	31	39	37	10	-2	3	-1	0
100	3	2	3	120	5	0	4	4	22	40	22	25	21	26	27	21	27	20	23	28	27	19	2	0	-2	0
30	3	2	0	90	3	1	3	4	35	25	27	35	26	25	27	20	27	22	22	22	17	18	-2	1	-2	3
30	3	2	0	90	3	1	3	4	20	27	28	25	23	25	27	23	25	32	34	36	40	12	0	1	-3	2
30	3	2	0	90	3	1	3	4	27	33	25	27	25	26	25	25	25	25	22	26	20	19	-4	-1	2	3
25	4	3	30	5	5	4	3	3	25	30	24	25	25	25	27	33	25	25	29	30	26	18	2	-1	-3	2
25	4	3	30	5	5	4	3	3	27	35	21	30	25	25	25	23	32	30	19	30	34	18	-1	0	-4	0
25	4	3	30	5	5	4	3	3	17	30	24	27	23	26	23	31	27	22	29	32	30	13	-2	1	-4	5
25	4	3	30	5	5	4	3	3	27	30	27	30	26	26	25	31	25	25	24	30	26	18	-5	1	-1	5

25	4	3	30	5	5	4	3	3	25	25	25	27	22	28	30	30	20	20	27	24	30	15	-1	1	1	-1
200	4	4	20	10	3	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
200	4	4	20	10	3	3	1	1	32	35	27	32	22	25	25	30	32	25	25	31	27	17	0	1	-4	3
200	4	4	20	10	3	3	1	1	22	27	24	27	26	26	23	27	25	25	27	29	27	19	-2	3	0	-1
200	4	4	20	10	3	3	1	1	28	23	20	20	23	26	23	33	25	25	32	36	37	18	0	-1	1	0
200	4	4	20	10	5	3	1	1	25	27	27	22	22	30	15	25	25	17	23	27	23	19	1	-1	-2	2
20	0	0	0	0	0	0	0	0	35	30	27	27	21	39	25	31	20	27	27	30	36	18	4	-4	-4	4
20	0	0	0	0	0	0	0	0	25	30	25	30	23	29	27	23	25	25	21	26	23	12	-6	3	-1	4
125	4	2	5	5	4	2	3	3	27	27	27	32	22	20	25	25	25	25	20	22	21	19	0	-1	-1	2
40	1	1	0	5	3	3	4	4	22	27	24	25	23	29	27	25	20	25	22	30	28	19	-2	0	-2	4
40	1	1	0	5	3	3	4	4	27	35	21	27	21	28	25	21	20	25	20	27	20	19	0	0	-1	1
40	1	1	0	5	3	3	4	4	22	27	25	30	25	26	25	27	20	25	27	35	26	18	-2	3	-2	1
40	1	1	0	5	3	3	4	4	27	27	22	27	23	21	23	25	20	22	25	28	23	18	-2	3	0	-1
40	1	1	0	5	3	3	4	4	30	27	24	25	23	28	13	17	7	17	30	21	9	17	0	-2	0	2
160	4	3	0	5	3	3	2	2	27	31	25	27	23	28	23	25	20	25	24	26	27	17	3	0	-3	0
160	4	3	0	5	3	3	2	2	25	25	28	30	28	26	30	30	25	20	22	26	22	19	-1	5	-3	1
160	4	3	0	5	3	3	2	2	30	40	30	30	33	31	27	33	25	30	23	27	19	19	-2	0	1	1
160	4	3	0	5	3	3	2	2	22	25	25	22	22	29	23	30	25	22	33	38	40	17	-2	3	-2	1
160	4	3	0	5	3	3	2	2	28	27	22	27	26	30	23	31	27	27	27	27	31	16	-1	3	-3	1

140	3	3	15	5	4	1	2	3	20	17	28	30	21	24	27	27	20	22	30	32	30	15	-2	2	0	0
140	3	3	15	5	4	1	2	3	22	17	28	25	21	24	20	35	27	25	26	29	26	15	1	-1	-3	3
140	3	3	15	5	4	1	2	3	22	25	25	25	21	30	25	27	20	25	25	25	27	17	-1	2	-4	3
140	3	3	15	5	4	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
140	3	3	15	5	4	1	2	3	30	31	22	32	26	30	31	30	30	22	36	41	35	19	0	2	-6	4

3FIN

END

DATE
FILMED
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