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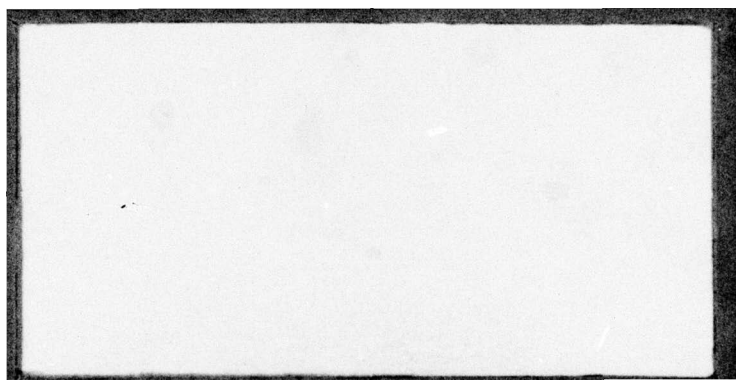
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## ORGANIZATIONAL VARIABLES IN AN AIR FORCE PROGRAM ENVIRONMENT

Carolyn J. Noyes, Captain, USAF  
Thomas E. Parker, Captain, USAF

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This research examined the proposed relationships among nine organizational variables (program phase, organizational size, tenure, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity) as perceived by program managers in Air Force System Program Offices (SPOs). The variables were measured with a collective questionnaire based on survey items tested and used by previous researchers. The sample consisted of managers within SPOs that were either commissioned officers or civilians in the grade of GS-7 or higher. The data was analyzed using a combination of descriptive and path analysis statistical techniques. Findings included (1) general support for previous research efforts, and (2) general support for a revised path analysis causal model. The study concludes that certain structural variables have a significant impact on behavioral outcomes. It is recommended that program managers and their superior military officials apply this information and establish organizational structures most conducive to integrating technical and behavioral factors in accomplishing acquisition program objectives.

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In Partial Fulfillment of the Requirements for the  
Degree of Master of Science in Logistics Management

By

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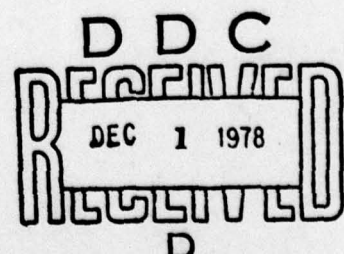
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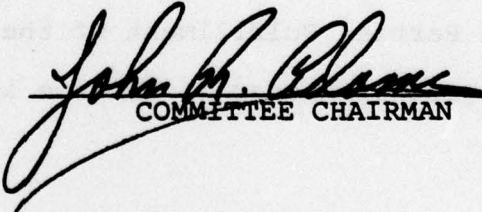
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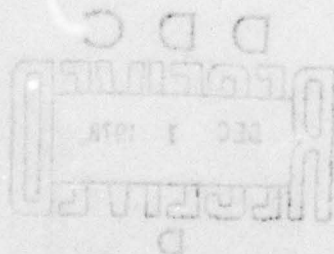
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has been accepted by the undersigned on behalf of the  
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## TABLE OF CONTENTS

	Page
ACKNOWLEDGEMENTS . . . . .	iii
LIST OF TABLES . . . . .	viii
LIST OF FIGURES . . . . .	x
 Chapter	
I. INTRODUCTION . . . . .	1
Statement of the Problem . . . . .	2
Background of the Problem . . . . .	2
Justification of Research Effort . . . . .	5
Research Objectives . . . . .	12
Research Questions . . . . .	12
Scope . . . . .	13
Organization of the Study . . . . .	14
II. LITERATURE REVIEW . . . . .	15
Introduction . . . . .	15
The Weapon System Acquisition Process . . . . .	15
Organizational Size . . . . .	19
Tenure . . . . .	22
Level of Bureaucracy . . . . .	24
Organizational Climate . . . . .	29
Role Conflict . . . . .	33
Role Ambiguity . . . . .	36

Chapter	Page
Role Stress . . . . .	38
Conflict Intensity . . . . .	39
Proposed Causal Relationships Among Organizational Variables . . . . .	42
III. RESEARCH DESIGN AND METHODOLOGY . . . . .	45
Introduction . . . . .	45
Data Producing Population . . . . .	45
Selection of Sample . . . . .	47
Data Collection Method . . . . .	47
Data Collection Instrument/Variables . . . . .	49
Part I--Tenure . . . . .	50
Part II--Organizational Nature of a Manager's Tasks . . . . .	50
Part III--Stress . . . . .	51
Part IV--Organizational Climate . . . . .	53
Part V--Conflict Intensity . . . . .	54
Organizational Size . . . . .	55
Interval Scale Data . . . . .	55
Instrument Reliability . . . . .	56
Instrument Validity . . . . .	58
Statistical Procedures . . . . .	59
Assumptions . . . . .	70
Limitations . . . . .	71
IV. DATA ANALYSIS AND INTERPRETATION . . . . .	72
Examination of Collected Data . . . . .	72



Chapter	Page
Questionnaire Response Profile . . . . .	73
Analysis by Question. . . . .	74
Analysis by Major Variable . . . . .	77
Analysis and Comparison of Major Variables . . . . .	78
Organizational Size . . . . .	78
Tenure . . . . .	81
Level of Bureaucracy . . . . .	85
Organizational Climate . . . . .	90
Role Conflict . . . . .	94
Role Ambiguity . . . . .	95
Role Stress . . . . .	98
Conflict Intensity . . . . .	101
Path Analysis . . . . .	105
Analysis Step I: Path Coefficients . . . . .	106
Analysis Step II: Effect Coefficients . . . . .	113
Analysis Step III: Decomposition of Covariation . . . . .	118
Analysis Step IV: Statistical Significance of the Path Coefficients . . . . .	118
Restructure of the Model . . . . .	125
Discussion . . . . .	135
V. REVIEW, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY . . . . .	145
Review . . . . .	145
Conclusions . . . . .	151

Chapter	Page
Recommendations for Future Research . . . .	157
The Variable Level of Bureaucracy . . . .	157
The Variable Tenure . . . . .	157
The Variable Productivity . . . . .	158
Alternative Causal Data Analytic Methods . . . . .	158
Subordinates and Co-located Personnel . .	159
Final Thoughts. . . . .	160
APPENDICES . . . . .	162
A. SURVEY INSTRUMENT AND RELATED DOCUMENTS . . .	163
B. SUMMARY OF PREVIOUS RESEARCH DATA . . . . .	180
C. DESCRIPTIVE STATISTICS . . . . .	182
D. SPSS COMPUTER PROGRAMS. . . . .	186
E. RAW DATA . . . . .	190
SELECTED BIBLIOGRAPHY . . . . .	200
A. REFERENCES CITED . . . . .	201
B. RELATED SOURCES . . . . .	207
BIOGRAPHICAL SKETCH OF THE AUTHORS . . . . .	209

## LIST OF TABLES

Table	Page
1. Definition of Organizational Variables . . . . .	7
2. Categorization of Program Life-Cycle Phases . . . .	20
3. Comparison of the Functional and the Project Viewpoints . . . . .	25
4. The Seven Sources of Conflict . . . . .	41
5. Sample-Producing Population Information . . . . .	48
6. Generalized Regression Equations for the Model in Figure 7 . . . . .	64
7. Response Profile Statistics . . . . .	75
8. Respondent Profile . . . . .	76
9. Organizational Size . . . . .	80
10. Level of Bureaucracy . . . . .	87
11. Organizational Climate . . . . .	91
12. Role Conflict . . . . .	96
13. Role Conflict--Instrument Validity . . . . .	97
14. Role Ambiguity. . . . .	99
15. Role Ambiguity--Instrument Validity . . . . .	100
16. Role Stress . . . . .	102
17. Conflict Intensity . . . . .	103
18. Calculated Regression Equations for the Model in Figure 7 . . . . .	107
19. A Decomposition Table . . . . .	108
20. F-Tests for Statistical Significance . . . . .	120



Table	Page
21. Revised Generalized Regression Equations for the Model in Figure 14 . . . . .	128
22. Revised Calculated Regression Equations for the Model in Figure 14 . . . . .	129
23. Revised Decomposition Table . . . . .	130
24. Revised F-Tests for Statistical Significance .	134
25. Presentation of Data: Number of Cases, Means, and Standard Deviations for All Scaled Questions . . . . .	183

## LIST OF FIGURES

Figure	Page
1. Organizational Variables Considered in the Program Environment . . . . .	6
2. Major Factors Affecting Productivity . . . . .	9
3. Phases of the Acquisition Process . . . . .	17
4. Organizational Continuum . . . . .	28
5. Model of the Determinants of Motivated Behavior in Organizations . . . . .	31
6. Proposed Causal Relationships Among Organizational Variables . . . . .	43
7. Proposed Causal Model with Path Analysis Variables Identified . . . . .	63
8. Military/Civilian Respondents by Tenure Year Group . . . . .	83
9. Number of Respondents (per Category) by Tenure Year-Group . . . . .	84
10. Response Rate for Level of Bureaucracy Questions . . . . .	88
11. Organizational Climate Response Profile by Category . . . . .	92
12. Comparison of Response Profiles-- Organizational Climate . . . . .	93
13. Proposed Causal Model with Path Analysis Residual Values Identified . . . . .	.112
14. Revised Proposed Causal Model . . . . .	.127



## CHAPTER I

### INTRODUCTION

The technological and organizational complexity involved in the design, development, and introduction of new products has increased significantly during the past fifteen years. One of the major consequences of this accelerating sophistication has been its impact upon the management systems required to convert new and often uncertain technology into operating systems (47:4). Extensive innovation is required to provide a management system capable of consolidating and controlling the wide range of specialized skills needed to develop modern Air Force weapon systems. The principal result has been the development of the project or program management concept (2:1).

The program management concept has been adopted by the Department of Defense and the Air Force to cope with the variety of managerial challenges inherent in the weapon system acquisition process (56:1). A System Program Office (SPO) is established to bring a particular weapon system or major end item into operational use whenever anticipated research and development costs exceed \$75 million or the expected cost of production exceeds \$300 million (56:2).

### Statement of the Problem

Many factors--such as the nature of the tasks being performed, the size and structure of the organization, the degree to which decision-making authority is shared between managers and subordinates, the types and intensity of conflicts encountered, and a manager's vulnerability to role stress--may affect the environment in a System Program Office. A number of studies have been conducted on the organizational structure of SPOs to investigate the effect of selected organizational variables during certain phases of the project life cycle (4; 12; 15; 16; 27; 29; 45; 48). These research efforts have provided some insight regarding the impact of individual variables upon SPOs. However, no attempt has been made to synthesize the effects of these variables to provide a systemic analysis of the program environment across the project life cycle phases.

### Background of the Problem

The management of major weapon system acquisitions within the Air Force is one of the most complex and demanding tasks in existence today (39:10). Management is complex because a weapon system consists not only of the weapon itself, but also of the equipment, spare parts, training, and the personnel required to develop a complete and effective weapon system. It is demanding because managers



must develop these complex weapon systems within limiting financial, manpower, and schedule parameters from the time the weapon system is first conceived until it is deployed to using organizations (59:272).

For the purpose of this research effort, the term *project management* indicates the management of specified projects under the direction of a designated manager with the authority to cut across traditional (mechanistic) organizational boundaries to fulfill his project's objectives. The term *program management* refers to management of longer-life, complex military program organizations such as the Air Force's (Weapon) System Program Offices or of very large, technically complex civilian programs. Either of the preceding types of programs may comprise several ongoing projects (12:1).

The program management system was adapted by the Department of Defense from the similar project management concept to provide a management system for the acquisition of major weapon systems, and is ". . . designed to provide sustained, intensified, and integrated management of complex ventures [8:85]." A Department of Defense Directive (57:5) has specified that the military service branches will select a single individual (the Project or Program Manager) who will be given commensurate authority to accomplish the objectives of a particular weapon system acquisition program. The Program Manager assembles a

team which constitutes the System Program Office (SPO), a limited-life organization with one major objective--to guide a weapon system through the various stages of its acquisition life cycle (57:1).

Air Force Systems Command Pamphlet 800-3 (54:1) states that a SPO directs a weapon system through five phases of a development program. These phases are conceptual, validation, full-scale development, production, and deployment. During the *conceptual* phase the technical, military, and economic bases are established, and the management approach is delineated. In the *demonstration and validation* phase, major program characteristics are validated and refined, and program risks are assessed, resolved, or minimized. The design, fabrication, and test of the weapon system are accomplished during the *full-scale engineering development* phase. The *production* phase produces and delivers the weapon system as an effective supportable system. Finally, in the *deployment* phase the weapon system reaches its operational ready state, and is transitioned to Air Force Logistics Command (AFLC) for support and to the appropriate using command(s) for operations (53:1-1 to 1-3). As a weapon system progresses through these various stages of development, any number of structural and behavioral variables are constantly changing and interacting. Collectively referred to as organizational variables, these factors dictate to an extent the managerial



strategies most appropriate for a given situation. Figure 1 identifies the specific organizational variables to be considered in this study, while Table 1 provides the basic definitions for these variables. More complete analyses of these variables are presented in the literature review, Chapter II.

#### Justification of Research Effort

In 1976, an *Aviation Week* article indicated that Air Force Systems Command was charged with managing acquisition programs valued at approximately \$7 billion divided among its four major divisions--the Armament Development and Test Center, the Space and Missile Systems Organization, the Electronic Systems Division, and the Aeronautical Systems Division. Aeronautical Systems Division (ASD) alone was involved in management of twenty-seven major programs valued at \$3.5 billion (13:75). General William J. Evans stressed the importance of AFSC's role when he stated, "How well this command carries out its responsibilities will determine whether the Air Force can meet its world-wide mission requirements in the years to come [7:16]."

During the past two years a trend has developed in weapon system acquisition to concentrate funds in fewer programs than in the past due to the higher cost and longer lead time required to develop an operational weapon

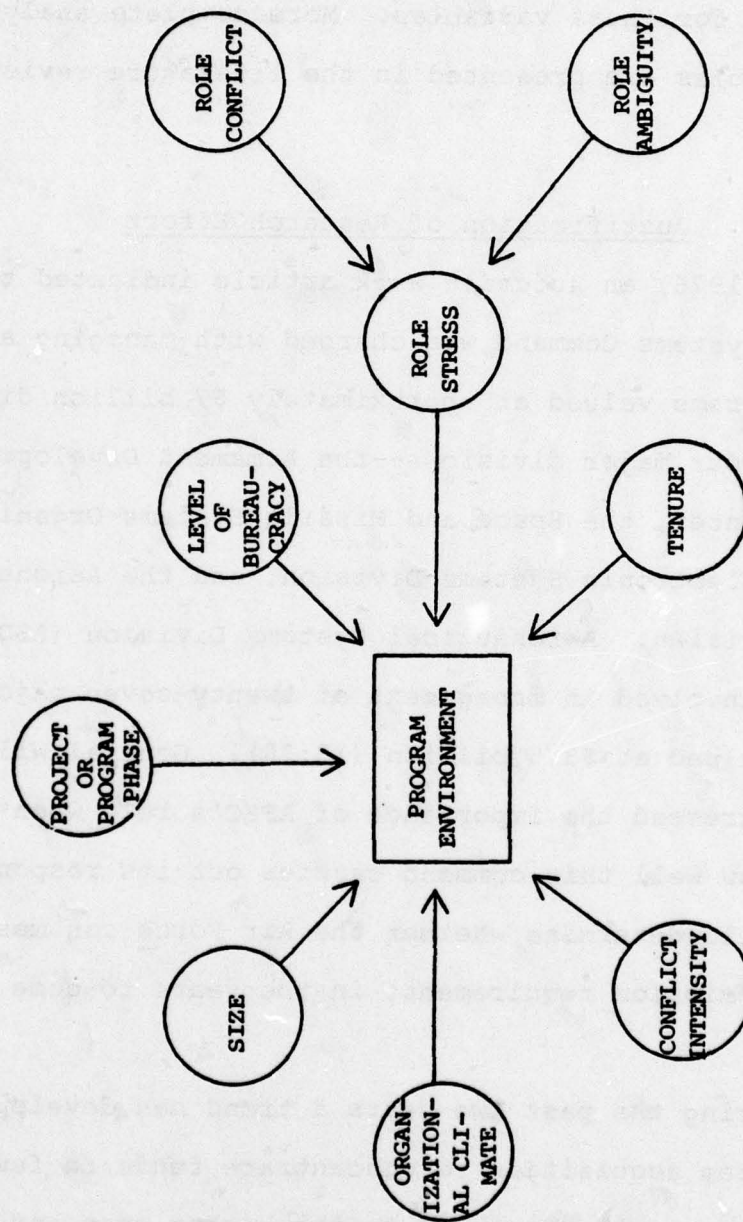


Fig. 1. Organizational Variables Considered in the Program Environment

TABLE 1  
DEFINITION OF ORGANIZATIONAL VARIABLES\*

Organizational Variable	Operational Definition
Organizational Size	Refers to the number of personnel directly assigned to the program organization on a full-time basis.
Tenure	The length of time a person has been a member of an organization (24:158).
Level of Bureaucracy	A set of measurable properties of the organizational structure as perceived by the people who work in the organization, ranging from a mechanistic (bureaucratic) to an organic (systems) structure (1:3).
Organizational Climate	A set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior (31:1).
Role Stress	The combined effects of role ambiguity (lack of information required for an organizational position) and role conflict (conflicting information on which to base behavior within an organizational position) (24:223).
Conflict Intensity	The mean frequency of occurrence of conflict sources which are considered to be operative throughout the life of a project or program. The emphasis of conflict intensity is upon structural sources of conflict.

\*A more detailed analysis of these variables is presented in the literature review, Chapter II.



system (37:52). The implication here is that the U.S. defense capability will be based upon fewer, extremely sophisticated, multiple-purpose weapon systems. For example, current plans call for the F-15 aircraft to serve an advanced air-superiority role for Tactical Air Command, an interceptor role for the Aerospace Defense Command, and a tactical reconnaissance role to replace the RF-4 reconnaissance system (52:16).

As a result of this trend in weapon system acquisition, considerable attention has been directed toward improving the productivity of SPO organizations. *Productivity* is defined as a

. . . measure of how well resources are brought together in organizations and utilized for accomplishing a set of results. Productivity is reaching the highest level of performance with the least expenditure of resources [32:6].

Defined in this manner, productivity combines the concepts of effectiveness (achievement of desired result) and efficiency (minimum resource consumption). Sutermeister has noted that increasing productivity depends upon the proper combination of technical factors (e.g., raw materials, technological developments, job layout) and human factors which contribute to improved job performance (49:3).

Figure 2 illustrates the relationship between technical factors and human factors as they relate to productivity.



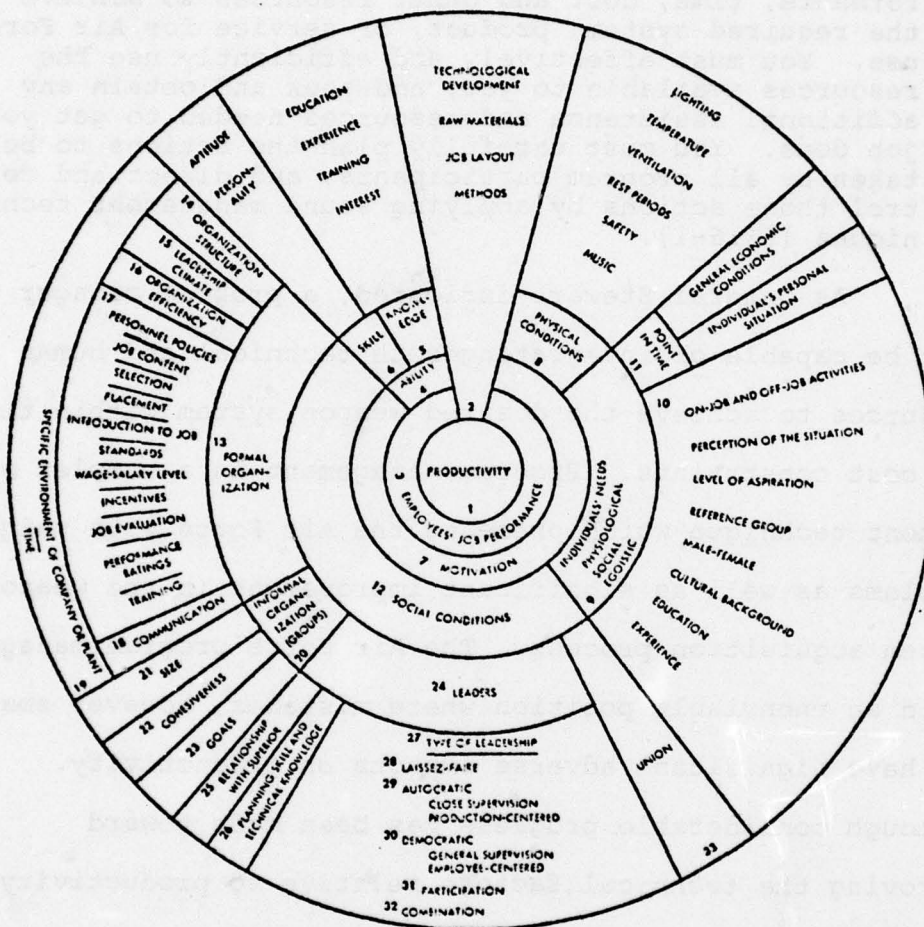


Fig. 2. Major Factors Affecting Productivity (49:Fwd)

The challenging tasks which a program manager faces were recently summarized by General James T. Stewart when addressing managers of AFSC programs:

Your job is one of balancing the factors of performance, time, cost and other resources to achieve the required system, product, or service for Air Force use. You must effectively and efficiently use the resources available to you, and seek and obtain any additional assistance and resources needed to get your job done. You must carefully plan the actions to be taken by all program participants, and direct and control those actions by applying sound management techniques [56:6-1].

As General Stewart indicated, a program manager must be capable of integrating both technical and human resources to achieve the desired weapon system within time and cost constraints. Program management is a complex management technique which presents the Air Force with unique problems as well as significant improvement in the weapon system acquisition process. The Air Force program manager is in an unenviable position where mistakes, however small, can have significant adverse impacts on productivity. Although considerable progress has been made toward improving the technical factors relative to productivity, attention is currently being focused on managerial aspects of the acquisition process. The primary reason for this emphasis on management was expressed by General Bernard A. Shriever:

Many times we have found the pacing factor in acquiring new weapon, support, and command and control systems is not technology--it is management. All too

often technology has been known, but it was not put to use because of shortcomings in our management ability [55:Fwd].

One reason why program managers have not been able to incorporate the latest technology into their particular programs may relate to the changing nature of the program environment. General Stewart stressed the need for AFSC program managers to recognize these changes:

Implicit in this is for you [program managers] to have a sound knowledge of your individual program requirements, the process through which the program must travel, and the recognition of the environment in which a program lives from beginning to end [56:6-1].

General Stewart's remarks are consistent with the contingency approach to management. As Kast and Rosenzweig explain:

Contingency views are ultimately directed toward suggesting organizational designs and managerial actions most appropriate for specific situations [25:505].

.....  
This trend towards the more explicit understanding of patterns of relationships among organizational variables is essential if theory is to facilitate improved management practice [25:507].

.....  
While a contingency approach does not make the task any easier, it does facilitate understanding of the complexity and helps the general manager cope with the problem realistically [25:515].

Thus, an awareness of the nature of the program environment at any given phase of its life cycle should help prepare managers for assignments to System Program Offices. A program manager who possesses a thorough understanding of how organizational variables change over the



life of the program should be in a better position to develop managerial strategies most conducive to integrating technical and human resources in accomplishing program goals (1:12).

### Research Objectives

The objectives of this research were:

1. To synthesize prior findings relative to major organizational variables into a more comprehensive perspective of program organizations as they progress through the project life cycle.
2. To create new information to supplement the prior findings by examining the causal relationships among the organizational variables.

### Research Questions

The research question used as a guide for the research effort is stated below:

How does the management environment of major weapon system acquisition organizations change as the programs progress through their life cycles?

Related questions are:

1. How does each specific program phase and its related activities affect other variables, such as organizational size, level of bureaucracy, and tenure?
2. How does level of bureaucracy affect organizational climate?

3. How does organizational climate affect role conflict, role ambiguity and through them, role stress?
4. What level of conflict intensity is generated by role stress across the program phases?
5. Can support be drawn for proposed causal relationships among the variables?

#### Scope

The program organizations studied consisted of System Program Offices (SPOs) within Air Force Systems Command's Aeronautical Systems Division at Wright-Patterson Air Force Base, Ohio. The research was confined to those SPOs which could be identified with a specific major weapon system or end item. SPO managers who are commissioned officers or hold a General Schedule (GS) rating of GS-7 or higher and were not specifically identified as holding administrative positions were considered eligible for study in this research.

The research effort was limited to a cross-sectional study which provided a "snapshot" of the SPO environment, obtained by examining a number of SPOs representing different points in the life cycle, at the same specific point in time. Although a longitudinal study would provide the capability to determine precisely when and how organizational variables change over the course of the project's life, time and financial constraints prohibited such a research approach.

### Organization of the Study

The thesis is composed of five chapters. Chapter I provides a conceptual background and framework for the study. Chapter II reviews the pertinent literature to describe the current state of knowledge about the variables and problems being explored. Chapter III discussed the research methodology, including a description of the population and sample from which data were gathered, the data collection techniques, and the analytical approaches which were used in the research effort. Chapter IV consists of a data analysis and an interpretation of the research findings. Chapter V presents the conclusions of the study and provides recommendations for further research in related fields of study.



## CHAPTER II

### LITERATURE REVIEW

#### Introduction

This chapter presents background information on each of nine areas investigated in this study, and includes research findings from both civilian industry and the SPO environment. The nine areas considered are the weapon system acquisition process, organizational size, personnel tenure, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity. The relationships between each of these areas and the other organizational variables to be investigated in this study are discussed where such relationships have been established in the literature. The chapter concludes with the presentation of a causal model illustrating the relationships among the variables implied in the literature. This model provides a framework for the research methodology, data analysis, and interpretation of the research findings developed later in the thesis.

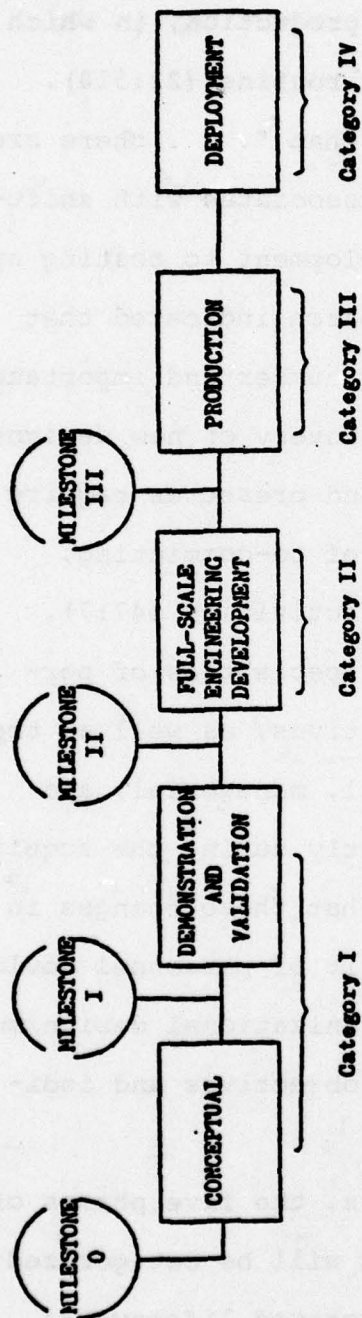
#### The Weapon System Acquisition Process

The United States' Department of Defense weapon system acquisition process is divided into five major phases, distinguished from each other by the unique

objectives and task characteristics of each phase. The acquisition process is initiated with the approval of a mission need and extends through either deployment of the weapon system or termination of the program. The first four phases are separated by required program continuation decisions (milestones) that are made by the Defense System Acquisition Review Council and ratified by the Secretary of Defense (57:3). These phases, their objectives and tasks, and the milestone decision points are illustrated in Figure 3 (53:37). Although the production and deployment phases normally overlap in Air Force programs, for the purpose of this research the deployment phase begins when the user accepts the first operational unit and ends when the program office specifically identified with a given weapon system is disbanded.

Holtz noted that the most significant characteristic of the acquisition process appears to be the type of work performed in each phase. In the conceptual, demonstration, and validation phases, the tasks are primarily analytical, nonrepetitive, and widely varied. During the full-scale engineering development phase, activities have reached a stage where sufficient information exists to permit resource allocation and scheduling of events for specific functions, although tasks are still not highly repetitive. By the time the weapon system is tested, evaluated, and approved for production, most of the





**Conceptual Phase:** Technical, military, and economic bases are established, and the management approach and acquisition strategy are delineated.

**Demonstration and Validation Phase:**

Major program characteristics are validated and refined, program risks assessed, resolved or minimized.

**Full-Scale Engineering Development Phase:**

Design, fabrication, and test are completed.

**Production Phase:**

The system is efficiently produced and delivered as an effective supportable system.

**Deployment Phase:**

The system reaches its operational ready state and is turned over to the using command and transitioned to AFLC.

Fig. 3. Phases of the Acquisition Process (53:37)

technical uncertainty has been resolved. During the production phase the weapon system is produced in quantities on a level that often resembles mass production, in which tasks are highly repetitive and often routine (22:318).

Sayles and Chandler reported that ". . . there are always the organizational upheavals associated with shifting from conception to design to development to testing and early operations [47:6]." Their research indicated that technical uncertainties, the changing number and importance of interest groups, the continual discovery of new designs and facts, and changing constraints and pressures require a management system which is capable of re-committing, reassessing, and redirecting program activities (47:7). They also found that the numbers and specialties of personnel required to meet program objectives, as well as the overall mix of professional, technical, managerial, and service personnel, changed significantly during the acquisition cycle (47:8). It would appear that these changes in tasks and the continual influx and exit of personnel would have considerable impact upon the organizational design most conducive to satisfying both program objectives and individual needs and desires.

For the purpose of this thesis, the five phases of the weapon system acquisition process will be categorized with respect to the four generally accepted life-cycle stages of a civilian project/program. Grouping the five



phases into the four stages is justified on the basis of the similarity in the nature of tasks and problems in each category, and is necessary to allow the comparison of results with those found in the civilian literature (see Table 2).

### Organizational Size

This section focuses upon organizational size as a determinant of both structural and behavioral variables. For the purpose of this study, organizational size refers to the number of personnel directly assigned to the program organization on a full-time basis.

Pugh and Hickson were among the first researchers to extensively study the relationship between size and other organizational variables. The Pugh-Hickson research was initially a follow-up to the Woodward studies which examined the effects of technology upon organizational structure. The primary difference between the two research efforts was that Woodward concentrated primarily on small firms, whereas Pugh and Hickson surveyed a higher percentage of large sized companies (42:241). Analysis of their data led Pugh and Hickson to conclude that:

Structural variables will be associated with . . . technology only where they are centered on the work flow. The smaller the organization the more its structure will be pervaded by such technological effects; the larger the organization the more these effects will be confined to variables . . . on activities linked with the work flow itself, and will not be detectable in variables of the more remote administrative and hierarchial structure [21:394-395].



TABLE 2  
CATEGORIZATION OF PROGRAM LIFE-CYCLE PHASES (3:20)

Categories for Study	"Civilian" Life-Cycle Stages		Activities Involved
	"Military" Life-Cycle Phases	Formation	
I	Conceptual/ Validation	Formation	<ol style="list-style-type: none"> <li>1. Identify need</li> <li>2. Establish feasibility</li> <li>3. Prepare proposal</li> <li>4. Program characteristics validated and refined</li> <li>5. Program personnel identified and scheduled</li> </ol>
II	Full-Scale Development	Buildup	<ol style="list-style-type: none"> <li>1. Design system</li> <li>2. Build and test prototype models</li> <li>3. Approval for final production</li> </ol>
III	Production	Main Program	<ol style="list-style-type: none"> <li>1. System production</li> <li>2. Logistical support activities implemented</li> <li>3. Performance verified during transition to the field</li> </ol>
IV	Deployment	Phasedown	<ol style="list-style-type: none"> <li>1. Other agencies assume responsibility for new product</li> <li>2. Program effort decreases and disbands</li> <li>3. Personnel reassigned</li> </ol>

The Pugh-Hickson findings thus imply that the effects of technology on organizational structure cannot be considered without accounting for the effects of organizational size. Pugh-Hickson also found a strong correlation between size and the structuring of activities, including standardization of functions, formalization of procedures, and specialization of roles. As a result of their findings, Pugh and Hickson hypothesized that

An increasing scale of operations increases the frequency of recurrent events and the repetition of decisions, which are then standardized and formalized. . . . Once the number of positions and people grow beyond control by personal interaction, the organization must be more explicitly structured [44:112].

Other researchers have supported the Pugh-Hickson findings that increased organizational complexity, in terms of horizontal (span of control) and vertical (levels in the organizational hierarchy) differentiation, and increased formalization of procedures is related to size (17:138). Porter and Lawler suggested that problems associated with communication and coordination may not be severe in small organizations. In large organizations, however, such problems may require that a manager supervise fewer personnel, and may also dictate a need for more levels in the organizational hierarchy (42:44-45). Porter, *et al.*, stated that:

Although the available evidence . . . is not clear-cut about the relationships of size to other organizational variables, it does appear to point to

some limited impact of size if (1) the range of sizes being considered is great enough and (2) the other variables in the relationship tend toward measures of bureaucratic-type operations. The direction of the relationship, where there is one, seems clear: larger size tends to be related to a more mechanistic, bureaucratic mode of operation [43:244-250].

Research on organizational size in Air Force SPO organizations has been limited to treatment of size as a purely demographic characteristic. However, each of several separate research efforts have observed that SPO organizations ". . . tend to be relatively small in the early and late phases of their life cycle, and much larger in their middle phases [1:11]." If the studies on organizational size conducted in civilian industrial firms are applicable to Air Force SPO organizations, one could expect size to be a significant determinant of the SPO's tendency to institute bureaucratic methods of communication and control into its organization structure.

#### Tenure

The turnover of personnel in an organization has been widely studied and reported in the open literature (14:122-123; 43:111,216-217). As personnel recruitment, training, and orientation become more expensive, organizations seek to retain personnel longer, and experience with a given job becomes more valuable to the organization. In other words, organizations attempt to avoid turnover and thus increase the conceptual opposite of this term, tenure.



*Tenure* has been defined as ". . . the length of time the person has been a member of the organization [24:158]."

One major problem associated with frequent turnover of personnel in a program environment relates to program continuity. Porter, *et al.*, in addressing the impact of turnover, stated that

. . . most organizations are purposely designed in such a way as to anticipate and take into account the fact that membership will be changing. . . . The organization thus attempts to preserve its own continuity by fostering the substitutability of its members . . . organizations are often able to achieve only partial or limited substitutability. Hence, the organization's continuity is made more dependent upon the continuity of membership of a particular individual . . . to the extent that particular members contribute unique and highly needed personal resources (ideas, experience, abilities, etc.) [43:97].

In the area of program management in particular, the personality of the manager may have a significant impact on the success of the work effort. Lempke and Mann (29) reported that the mode of operation of any given project is significantly shaped by the personality of the project/program manager:

Personal uniqueness is important to a project management organization because the project manager is relied upon to counter organizational shortcomings with his ability to move toward project goals through the development of informal relationships [29:28-29].

Thus, it may be important in program management to extend the tenure (reduce the turnover) of key program personnel. In particular, Kahn, *et al.*, reported that as tenure among supervisory personnel increases they tend to

more actively support formal organizational rules over personal, informal rules (24:76,158-160). Thus, it may be possible to associate tenure with various levels of bureaucracy.

#### Level of Bureaucracy

*Level of bureaucracy* refers to a set of measurable properties of the organizational structure, as perceived by the people who work in the organization, ranging from a mechanistic (bureaucratic) structure at one extreme to an organistic (systems) structure at the opposite extreme (1:3). Other terms have been used to describe these polar positions, such as closed versus open, stable versus adaptive, and functional versus project organizations (10:229-232; 25:507,509).

Cleland and King adopted the functional-project dichotomy to illustrate the range of alternative structural considerations available to project/program managers. Table 3 shows a comparison of the functional and project viewpoints relative to organizational structure. This table emphasizes the highly structured environment in which a functional manager operates: responsibility is specified, line-staff relations are established, and a scalar chain from superior to subordinate dictates operations. Conversely, a project manager must integrate activities across functional lines and is often faced with

TABLE 3

## COMPARISON OF THE FUNCTIONAL AND THE PROJECT VIEWPOINTS (9:231)

Phenomena	Project Viewpoint	Functional Viewpoint
Line-staff organiza- tional dichotomy	Vestiges of the hierarchical model remain, the line functions are placed in a support position. A web of authority and responsibility exists.	Line functions have direct responsibility for accomplishing the objectives; line commands, and staff advises.
Scalar principle	Elements of the vertical chain exist, but prime emphasis is placed on horizontal and diagonal work flow. Important business is conducted as the legitimacy of the task requires.	The chain of authority relationships is from superior to subordinate throughout the organization. Central, crucial, and important business is conducted up and down the vertical hierarchy.
Superior- subordinate relationship	Peer-to-peer, manager-to-technical expert, associate-to-associate etc., relationships are used to conduct much of the salient business.	This is the most important relationship; if kept healthy, success will follow. All important business is conducted through a pyramiding structure of superiors and subordinates.
Organizational objectives	Management of a project becomes a joint venture of many relatively independent organizations. Thus, the objective becomes multilateral.	Organizational objectives are sought by the parent unit (an assembly of suborganizations) working within its environment. The objective is unilateral.



TABLE 3--Continued

Phenomena	Project Viewpoint	Functional Viewpoint
Unity of direction	The project manager manages across functional and organizational lines to accomplish a common interorganizational objective.	The general manager acts as the one head for a group of activities having the same plan.
Parity of authority and responsibility	Considerable opportunity exists for the project manager's responsibility to exceed his authority. Support people are often responsible to other managers (functional) for pay, performance reports, promotions, etc.	Consistent with functional management; the integrity of the superior-subordinate relationship is maintained through functional authority and advisory staff services.
Time duration	The project (and hence the organization) is finite in duration.	Tends to perpetuate itself to provide continuing facilitative support.

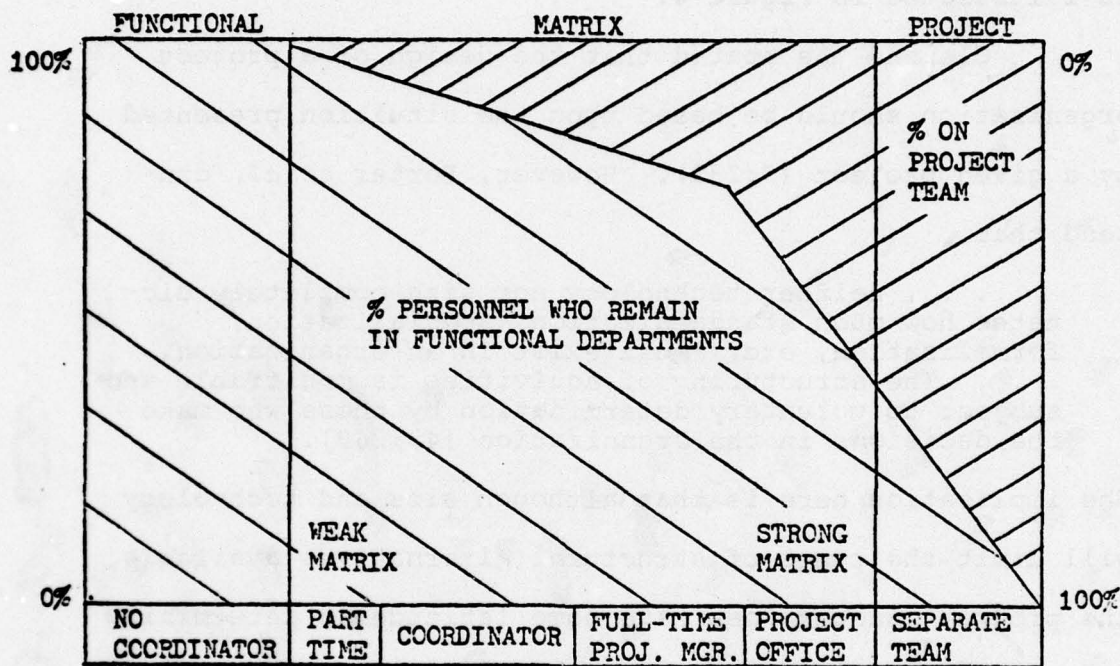
a situation in which his responsibilities to the project exceed his formal authority (10:231). The matrix organization form combines aspects of both functional and project organizational structures. The relationship between functional, matrix, and project organizational structure is illustrated in Figure 4.

Cleland has stated that the design of a project organization should be based upon the situation presented by a given project (9:232). However, Porter *et al.* contend that

. . . neither technology nor size completely dictates how much standardization, specialization, formalization, etc., must exist in an organization. . . . The structuring of activities is modifiable and subject to voluntary determination by those who make the decisions in the organization [43:260].

The implication here is that although size and technology will limit the range of structural alternatives available, the program manager does have some latitude in determining how he will tailor his organization to meet the demands of a particular program.

Although an extensive review of the literature was conducted, no widely recognized instrument that would measure the degree to which a manager's job is project or functionally oriented was located. In the conduct of their research into the Air Force SPO environment, Lempke and Mann developed an instrument which was structured around the relevant differences between functional and project



Note: The continuum is based on the percent of personnel who work in their own functional departments versus the percent of personnel who are full-time members of the project team. The bottom line shows that a weak matrix has a part-time coordinator, whereas a strong matrix has a project office established.

Fig. 4. Organizational Continuum (60:22)



organizations identified by Cleland and King (10:40). Lempke and Mann concluded that SPO organizations tend to be more mechanistic in the middle phases of the acquisition cycle than in the initial or late phases. The more organic type of organization was reported during the initial phases of the acquisition cycle (29:62-67). These differences in the level of bureaucracy may be attributable to changes in the size of the SPOs, in the tenure of personnel assigned to SPO organizations, and in the nature of tasks being performed as the program transitions from one phase of development to the next. Changes in the level of bureaucracy may, in turn, affect employees' perceptions of the organizational work environment (41:136).

#### Organizational Climate

A key factor in a SPO environment is organizational climate. Litwin and Stringer defined *organizational climate* as

. . . a set of measurable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior [31:1].

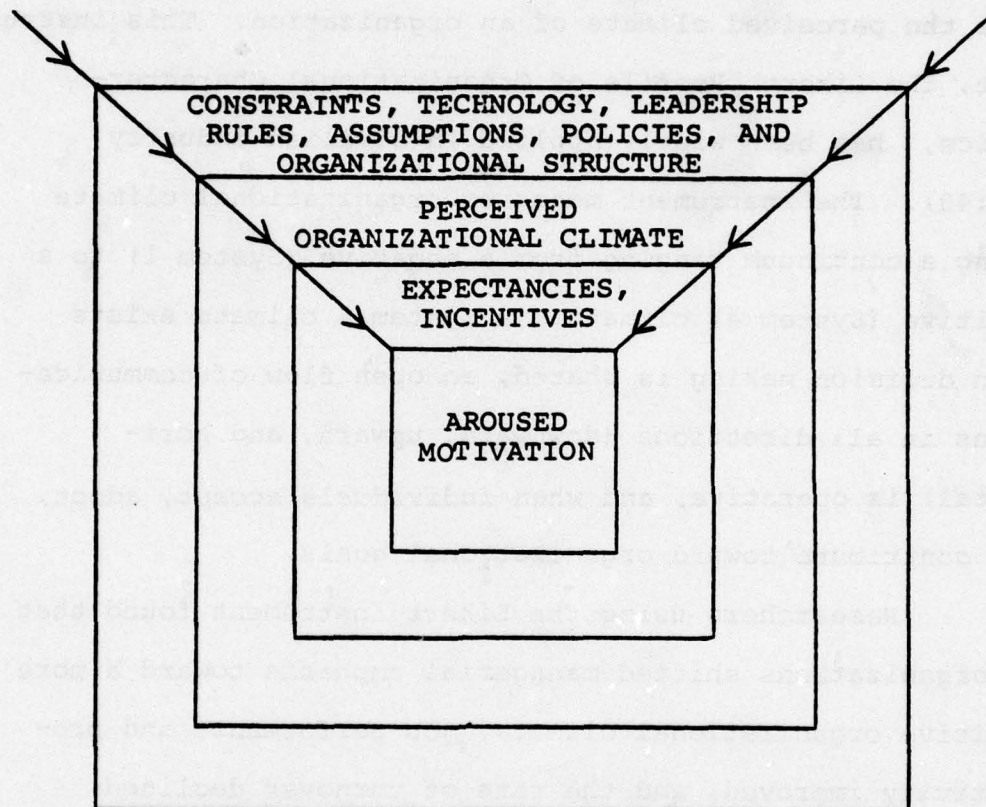
The concept of organizational climate stemmed from attempts to apply motivation theories to behavior in organizations. Litwin initiated the first explicit studies in the 1930s and concluded that climate was an essential link between the individual and his work environment (31:37). As a

result of this work, Litwin and Stringer developed a subjective model which outlines determinants of motivating behavior in organizations (31:43). This model is illustrated in Figure 5. The model indicates that organizational climate provides a conceptual link between organizational structure and procedures, and the needs, expectancies, and motivation of individuals in the organization (31:44). More recently, Lawrence and Lorsch identified several structural factors that significantly influence behavior. These structural factors are believed to be major determinants of the job expectations that exist within an organization. Some of the factors include the number of levels of hierarchy, span of control, and locus of formal authority (14:315-316).

Research related to organizational climate has resulted in supporting some relationships between structural characteristics (size, technology, hierarchy) and measures of the psychosocial atmosphere. Payne and Mansfield examined the relationships between various dimensions of organizational structure and organizational climate in 14 different work organizations which varied in size from 262 to 4,480 employees. The results indicated that individuals higher in the organizational hierarchy viewed their organization as providing greater work interest, being more friendly, less authoritarian, and more willing to innovate than did individuals in lower

**EXTERNAL  
ENVIRONMENT**

**EXTERNAL  
ENVIRONMENT**



**Fig. 5. Model of the Determinants of Motivated  
Behavior in Organizations (31:43)**



positions (33:515-526). Thus, between the work of Lawrence and Lorsch and Payne and Mansfield, the relationship between organizational climate and level of bureaucracy seems well established.

Rensis Likert (30) developed an instrument to measure the perceived climate of an organization. This instrument, the Likert "Profile of Organizational Characteristics," has been widely applied in civilian industry (30:40). The instrument measures organizational climate along a continuum ranging from a negative (System 1) to a positive (System 4) climate. A System 4 climate exists when decision making is shared, an open flow of communications in all directions (downward, upward, and horizontal) is operative, and when individuals accept, adopt, and contribute toward organizational goals.

Researchers using the Likert instrument found that as organizations shifted managerial emphasis toward a more positive organizational climate, job performance and productivity improved, and the rate of turnover declined (34:32-80).

Research on climate in Air Force SPO organizations has revealed a number of relationships with various structural variables. Research by Larson and Ruppert (27:56) indicated that perceptions of organizational climate in Air Force system program offices varied significantly between program phases. Haddox and Long (16) found that

perception of organizational climate by SPO managers varied with the SPO size, the managerial level in the hierarchy, and the system acquisition phase. It is apparent from the construction of variables that organizational climate is likely to affect the behavioral reactions of individuals within an Air Force SPO organization.

### Role Conflict

*Role conflict* has been defined as ". . . the simultaneous occurrence of two [or more] sets of pressures such that compliance with one would make more difficult compliance with the other [24:19]." The term "role" is used to designate cultural patterns associated with a given status position, and includes attitudes, values, and behavior ascribed to and expected of individuals in specific positions (25:286).

Kast and Rosenzweig (25:292-293) have identified several sources of pressure which create role conflict situations, all of which may be affected by the organizational climate. *Person-role conflict* results from requirements placed upon an individual to act in a manner contrary to that person's needs and values. *Interrole conflict* occurs when expectations for a role in an organization conflict with other roles an individual must play. For example, the requirement to work overtime may conflict with a person's family role. *Intersender conflict* results



from various expectations being placed upon an individual from many directions. For example, management may expect a line foreman to demand higher production levels at the same time subordinates expect the foreman to reduce the workload requirements. *Intrasender conflict* develops when an individual receives conflicting instructions or perceives contradictory expectations from one source. Such a conflict situation could arise when a manager is directed to improve efficiency but is not granted authority to change work procedures or reallocate funds.

Kahn, *et al.*, have developed a *boundary position* concept which states that persons in positions requiring them to interface with organizations outside their own tend to experience high levels of role conflict (24:101). Other authors (28:142-143; 36:34) have used the term *integrator* to identify managers in boundary positions.

Pondy stated that the matrix form of organization results in high levels of intersender conflict, primarily as a result of conflicting expectations imposed upon program participants by program and functional managers (40:253). Miles found that managers identified as integrators perceived higher levels of role conflict than did non-integrative managers in the same organization (36:35). Within the Air Force environment, Lempke and Mann discovered that as a SPO manager's tasks become more project oriented, his perceived level of role conflict increased (29:87).



Kahn, *et al.*, summarized the consequences of role conflict. They stated that:

The strain experienced by those in conflict situations leads to various coping responses--social and psychological withdrawal (reduction in communication and attributed influence) among them.

. . . . .  
. . . the presence of conflict in one's role tends to undermine his relations with his role senders, to produce weaker bonds of trust, respect, and attraction. . . . It is quite clear that role conflicts are costly for the person in emotional and interpersonal terms. They may also be costly to the organization, which depends on effective coordination and collaboration within and among its parts [24:71].

Walton and Dutton identified several underlying causes of conflict in program organizations that are directly related to an individual's perceived level of role conflict (58:73). Many program organizations must secure manpower resources from functional departments. Unless these personnel are assigned to the program on a long-term basis, they are normally evaluated by their functional department supervisors. As a result, an individual is caught in a position where he or she must cope with two supervisors--the functional and the program manager (50:34). It would also appear that role dissatisfaction (person-role conflict) would result, for example, when an individual who values stability is assigned to a dynamic program office. The level of role conflict experienced by an individual would also logically be affected by his perception of the organization's climate. Although these relationships between role conflict and sources of conflict in

program organizations appear to be strong, an extensive review of the literature indicated that no research had been conducted to investigate these variables jointly in a program environment.

### Role Ambiguity

Role clarity has been defined as

. . . certainty about duties, authority, allocation of time, and relationships with others; the clarity or existence of guides, directives, policies; and the ability to predict sanctions as outcomes of behavior [46:156].

*Role ambiguity*, on the other hand, is the conceptual opposite of role clarity. It exists when the information available to an individual is less than what is required for adequate performance of his organizational role (24:94).

Kahn, *et al.*, noted that ambiguity in a given position may result because information is either nonexistent or is inadequately communicated, and they cited three general sources of role ambiguity: organizational complexity, rapid organizational change, and current managerial philosophies (24:21,75). All of these are characteristics which may well be related to the organizational climate.

According to classical theory, each organizational position receives sufficient information for the incumbent to perform specific tasks. However, in a dynamic environment with a high incidence of technical, personnel, and organizational changes evident, the process of clearly



defining and delegating specific tasks becomes more difficult than would be encountered in a more stable environment. Thus it would appear that ambiguity should be higher in a dynamic technically oriented environment.

This is not to imply that ambiguity is a consequence of factors completely out of the control of management. Most organizations are in a position to influence information flow through both formal and informal channels of communication. One would expect that an organization with open communications channels would experience less role ambiguity than one which severely restricts information flow (24:77-78).

Another method used to reduce ambiguity in a job is repetition and functionalization of tasks over time. As mentioned previously, Kahn, *et al.*, discovered that as tenure among supervisors increased they tended to profess greater adherence to rules and procedures (24:158-160). Note that the type of communications systems established and measures of bureaucratic tendencies, such as greater adherence to rules and procedures, both tended to be determining factors of organizational climate.

In summary, role conflict and role ambiguity are two different conditions that exist within an organization. Although they are different, their effect may be very similar, and may also be modified by the climate existing in the organization. Recognizing these similarities, Kahn



devised a new term that allows examination of role conflict and role ambiguity collectively (24:35).

### Role Stress

Role stress is the term developed by Kahn, *et al.*, to address the combined effects of role conflict and role ambiguity. *Role stress* is defined as the sum of role conflict and role ambiguity, given the assumption that role conflict and role ambiguity are independent (24:223).

Kahn has noted that the ability to cope with only one of these factors of role stress will not necessarily reduce role stress if the other factor is strong (24:54).

An instrument designed by Rizzo, *et al.*, to measure perceived levels of role conflict and role ambiguity was administered by Miles to a research and development organization (46). The research revealed significant correlations between perceived levels of role stress and certain behavioral variables such as tension, anxiety, and job dissatisfaction. Miles found that managers identified as integrators perceived the highest levels of role conflict and role ambiguity in the organization (36:34-35).

Research on role stress in Air Force SPO organizations has revealed relationships between role stress and other organizational variables. Lempke and Mann (29), using the Rizzo instrument, discovered that as a program manager's tasks become more project oriented, his perceived

level of role stress increases. They also found that the longer a program manager remains in a job, the more he is able to functionalize tasks. Although they could not statistically support a relationship between tenure and stress, it would appear that increased functionalization of tasks over time would tend to reduce role ambiguity. At any rate, due to the definition of role stress, all affects of such relationships would have to be operative through the intervening variables of role conflict and role ambiguity.

#### Conflict Intensity

The final variable being investigated is *conflict intensity*, defined as the mean frequency of occurrence of conflict sources which are considered to be operative throughout the life of a project program. Care must be taken to avoid confusing this variable with the variable *role conflict*. Role conflict stresses behavioral perceptions, while conflict intensity emphasizes structural causes of conflict.

As is the case with role conflict, role ambiguity is identified by Walton and Dutton as a possible cause of organizational conflict. Many of the factors which tend to foster role ambiguity--obscure authority relationships, unorganized lines of communication, and poorly defined

tasks--appear to have a cumulative effect upon the program organization as a whole (58:467).

Thamhain and Wilemon (50) identified seven possible sources of conflict which a program manager may encounter. These sources of conflict are identified and defined in Table 4. In conducting this research, Thamhain and Wilemon developed an instrument designed to measure: (1) the average intensity of the seven potential conflict sources over the entire project life cycle, (2) intensity of each of these conflict sources in the four project life cycle stages, and (3) which conflict resolution modes were used most frequently by project managers. The instrument was administered to project/program managers in over one hundred technology-oriented firms, which included a number of aerospace, computer, and research and development organizations. The researchers concluded that conflict intensity is greatest during the project buildup phase and least during the final stage of the life cycle (51:38). They also discovered that conflicts over schedules, project priorities, and manpower resources are the primary sources of conflict over the total project life cycle (50:43).

Eschmann and Lee (12) replicated the Thamhain and Wilemon study to determine the relevance of these research findings to the Air Force SPO environment. Using basically the same instrument that was used in the civilian study, the research team largely duplicated the Thamhain and



TABLE 4

THE SEVEN SOURCES OF CONFLICT [50:32-33]

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Conflict over Project Priorities. The views of project participants often differ over the sequence of activities and tasks which should be undertaken to achieve successful project completion. Conflict over priorities may occur not only between the project team and other support groups but also within the project team.

Conflict over Administrative Procedures. A number of managerial and administrative-oriented conflicts may develop over how the project will be managed; i.e., the definition of the project manager's reporting relationships, definition of responsibilities, interface relationships, project scope, operational requirements, plan of execution, negotiated work agreements with other groups, and procedures for administrative support.

Conflict over Technical Opinions and Performance Tradeoffs. In technology-oriented projects, disagreements may arise over technical issues, performance specifications, technical tradeoffs, and the means to achieve performance.

Conflict over Manpower Resources. Conflicts may arise around the staffing of the project team with personnel from other functional and staff support areas or from the desire to use another department's personnel for project support even though the personnel remain under the authority of their functional or staff superiors.

Conflict over Cost. Frequently, conflict may develop over cost estimates from support areas regarding various project work breakdown packages. For example, the funds allocated by a project manager to a functional support group might be perceived as insufficient for the support requested.

Conflict over Schedules. Disagreements may develop around the timing, sequencing, and scheduling of project related tasks.

Personality Conflict. Disagreements may tend to center on interpersonal differences rather than on "technical" issues. Conflicts often are "ego centered."

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Wilemon findings and concluded that as the program progresses through its life cycle, the overall intensity of conflict decreases.

#### Proposed Causal Relationships Among Organizational Variables

In the preceding discussion of the weapon system acquisition process, tenure, organizational size, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity, a number of previously researched and expressed relationships were presented. These findings suggest that cause and effect relationships may exist among these variables. The pattern of these relationships expressed in the literature review is summarized in Figure 6. This model illustrates the close association among the structural variables (program phase, organizational size, tenure, and level of bureaucracy) on the one hand, and among the behavioral variables (role conflict, role ambiguity, role stress, and conflict intensity) on the other. As suggested in the literature, organizational climate provides the tying link between the structural and the behavioral variables in the model. Although not directly investigated, productivity was included in the model to illustrate its position relative to the organizational variables under investigation in this research effort. This model provided the basis for

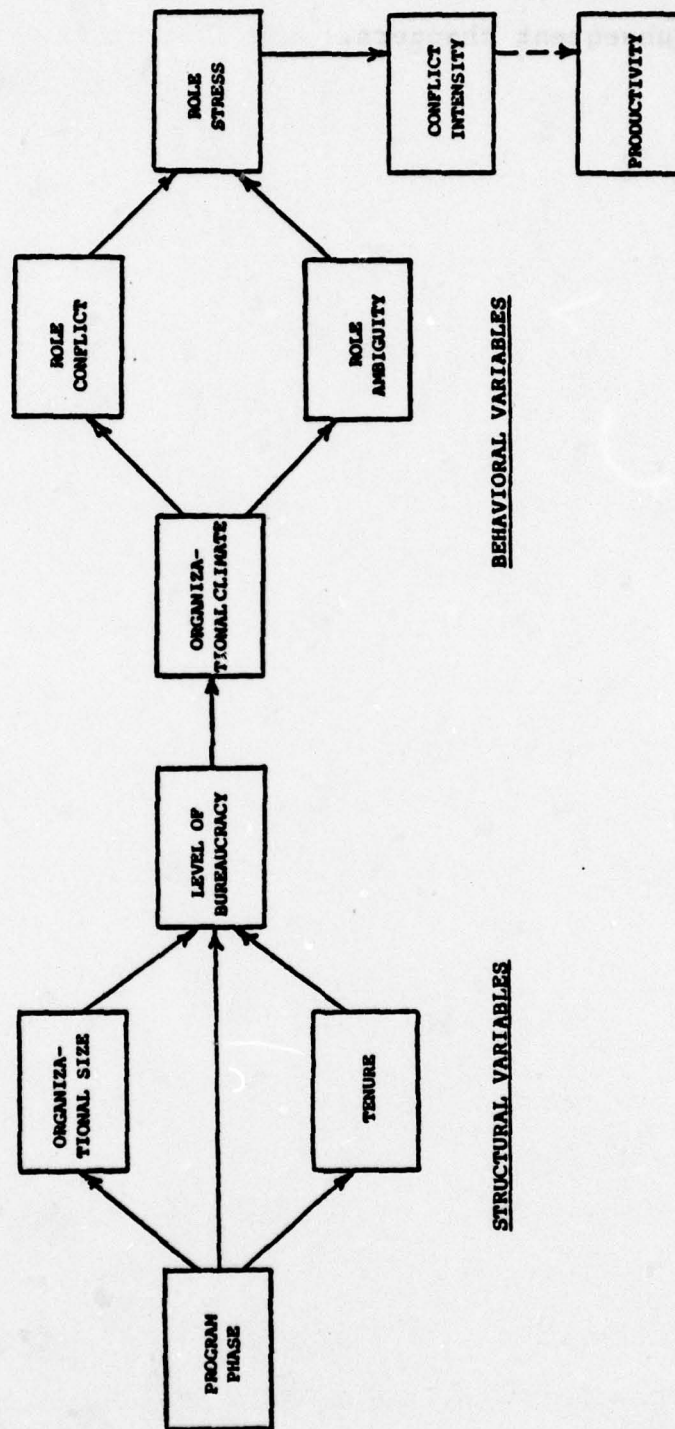


Fig. 6. Proposed Causal Relationships Among Organizational Variables



the research methodology and data analysis which is discussed in subsequent chapters.

## CHAPTER III

### RESEARCH DESIGN AND METHODOLOGY

#### Introduction

This research effort is part of a major ongoing study of behavioral factors within Systems Program Offices (SPOs) of the Aeronautical Systems Division (ASD) carried out under the aegis of several School of Systems and Logistics faculty members. Certain methodology conventions established in previous research studies are used so that this research study can contribute to the ongoing project. (Appendix B contains a table summarizing the other four research efforts in the project.)

#### Data Producing Population

The *universe* consists of all SPO officers or civilians in the grade of GS-7 or higher (29) involved in managing Air Force weapon systems acquisitions within the United States Air Force. According to the previously specified definition of SPO manager, administrative and functional support personnel are excluded from consideration in the study (29). Following the pattern established by previous studies, and in order to insure compatibility of this data with that of previous analyses, the *population of interest* consists of the program managers in SPOs

within the Aeronautical Systems Division (ASD) of the Air Force Systems Command (AFSC). This Division and its constituent SPOs are located at Wright-Patterson Air Force Base, Ohio. Only those SPOs that could be identified as being both dedicated to one specific weapon system or major end item and classified in a particular acquisition category (see Figure 3) were included in this population.

A stratified random *sample* of fifty SPO managers was chosen from each of the project life cycle phase categories. This sample size was selected to allow for non-responses and incomplete questionnaires, and yet permit statistical analysis based on the assumption of normality (62:146).

Assumptions used in this research effort concerning the validity of the results as applied to all other Air Force program managers are essentially the same as those considered by Lempke and Mann in their research study.

Because the population was limited to the SPO managers within ASD, the data-producing sample of ASD program managers can be considered representative. Common policies and regulations in AFSC govern the selection of program managers throughout the command. Additionally, the military members of the population share a variety of common experiences, including professional education, military training, and a multitude of military socializing influences. These common factors support a consideration



that the results of this study may be applied to the population (29:37).

#### Selection of Sample

The SPOs were stratified into four life cycle categories (see Table 5) using data obtained from the AFSC Management Evaluation Team. A complete listing of the program managers assigned to each of these SPOs was obtained from the Consolidated Base Personnel Office (CBPO), the Civilian Personnel Office, and the Program Control Office for Avionics Equipment. The listings were screened to insure each individual on the list met the definition of a SPO manager. Those meeting the definition were assigned a unique number for purposes of sample selection and control. A random number table was then used to select a sample of fifty SPO managers for each program life cycle phase.

#### Data Collection Method

A five-part questionnaire used to collect the data was personally distributed by the researchers to each selected SPO manager. The purpose of using this distribution method was essentially the same as stated by Lempke and Mann in their study:

1. To maximize response (reduce nonrespondent bias) by personally encouraging each subject to respond

**TABLE 5**  
**SAMPLE-PRODUCING POPULATION INFORMATION**

	Category I	Category II	Category III	Category IV
Acquisition Phases	Conceptual Demonstration Validation	Full-Scale Engineering	Production	Deployment
SPOs Identified	SPO Cadre	ATCA	F-16	F-15
	EF-111A	AMST		A-10
	Avionics I	B-1		TF-34
		Avionics II		F-100
				F-107

and by answering questions of an administrative nature concerning the questionnaire, and

2. To acquire a "feel" for the SPO environment from which the data would come (29:39).

Sample members were asked to complete the questionnaires within a specified amount of time and return them directly to the researchers via the inter-office administrative mail system of Wright-Patterson Air Force Base. Pre-addressed envelopes were provided to expedite the return-mailing process. Because of the need to identify the respondent to a specific SPO and hence to a phase in the acquisition life cycle, anonymity could not be afforded to either the respondents or the SPOs on the questionnaires. However, strict confidentiality was maintained at all times on all completed questionnaires, and there is no possibility of identifying specific respondents in the final research results. Respondents were given an option to request a summary of the study from the researchers.

#### Data Collection Instrument/Variables

Each section of the questionnaire addressed a particular variable. Therefore, each part of the questionnaire is discussed with the variable on which it was designed to collect data. This questionnaire is a combination of parts of three separate instruments used to



collect sample data for four of the preceding studies on which this research is based. Those segments from the previous instruments were incorporated to insure that the variables common to portions of the previous studies and to this research effort would be measured consistent with the preceding studies. Appendix A contains the complete questionnaire and related documents.

#### Part I--Tenure

Part I was a demographic data sheet used to obtain general information. In particular, three questions were structured to obtain time measures, to include time in a SPO (in months), time in the present SPO position (in months), and time associated with the Air Force (years and months). *Tenure* as used in this study refers to the length of time (number of months) a program manager has been a member of the organization (24:158) and is treated as interval data (16:25).

#### Part II--Organizational Nature of a Manager's Tasks

This section of the questionnaire, taken from the instrument used by Lempke and Mann, measured the variable titled level of bureaucracy (1). Unable to locate an instrument that would measure the degree to which a program manager's job is project or functionally oriented, Lempke and Mann structured this section around the relevant

differences between program and functional organizations as cited by Cleland (see Table 3) (10:231). The variable *level of bureaucracy*, as defined in the present research, is a set of measurable properties of the organizational structure ranging from a mechanistic (bureaucratic or functional) to an organistic (systems approach or program) structure (1:13). This variable was treated as a continuum ranging from a pure functional orientation to a pure program management orientation (29:41).

Nine questions were composed by Lempke and Mann to define the organizational nature of a manager's tasks. The questions solicited responses on a range of values weighted from one to seven. The scores for all the questions were totaled and averaged to afford an interval measure of the organizational nature (level of bureaucracy) of the respondent's tasks. The lower the respondent's score the more functionally oriented the nature of the individual's tasks, and the higher the score the more program management oriented the individual's tasks (29:41).

### Part III--Stress

Part III of the questionnaire was an instrument used by Lempke and Mann that was developed by Rizzo, *et al.* (46) to measure role stress and to determine, using the factor analysis technique, whether role conflict and role ambiguity could be definitively identified as intervening

variables summing up role stress (40). The researcher Miler used this instrument to collect supportive data for hypotheses postulating causal relationships between stress and certain adverse personal consequences within an organization, such as job-related tension and job dissatisfaction. The hypothesis that role conflict among managers attenuates as tenure in a position lengthens was also upheld by the same data (35:34-35).

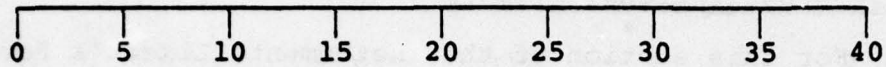
In the Lempke-Mann study, and in this research effort, *role stress* comprises the sum of role conflict and role ambiguity (24:223). The odd-numbered questions pertained to role conflict; the even-numbered questions referred to role ambiguity. The seven response options for each question varied from *disagree strongly* to *strongly agree*. The presentation of some questions required response reflection (inversion of the scoring scale) to sustain the convention that a low score indicated a lower level of stress and a high score signified a higher level of stress. The scores of all the questions for each subject were summed and averaged to provide an interval measure of stress. The possible range of scores for a given respondent was one to seven. An individual's numerical score corresponded to the amount of stress he perceived in performing tasks (29:42).



#### Part IV--Organizational Climate

For this section of the instrument, Likert's Form S (short form) was used in keeping with the previous studies which also surveyed organizational climate (16:23). Form S is a questionnaire consisting of 18 item composites compounded via factor analysis from Likert's 51-question "Profile of Organizational Characteristics" (30). These composites, when answered in total, measure individual perceptions of organizational climate (16:16; 27:29). *Organizational climate*, as defined by Litwin and Stringer, is a set of measureable properties of the work environment, perceived directly or indirectly by the people who live and work in this environment and assumed to influence their motivation and behavior (31:1).

Each of the 18 questions had four possible responses equally spaced along a five-inch scale. The respondent placed an X on the scale at the point which most accurately depicted his perception of the organizational characteristic in question, treating each question as continuous from the extreme at one end to that at the other (30:Appen.II,197). The scale used ranged from 0 (at the extreme left) to 40 (at the extreme right) and was divided into 40 equal parts. The researchers fabricated a template and divided it into four equal segments along the continuum. Each of the four segments was then subdivided into ten equal increments as shown:



The scale was treated as an equal interval measurement scale. The values ranking from 0 to 40 were summed and averaged to provide an interval measure of organizational climate. Helmstadter (20:365-370) referenced the Likert scale as an interval scale in a discussion on scale construction. Use of the interval scale permits application of most statistical tests, including path analysis and its applicable statistical test, the F test.

#### Part V--Conflict Intensity

Part V of the questionnaire contained only one question, which was taken from the instrument used in the Lee and Eschmann study (12). Lee and Eschmann adapted (with only minor alterations) the instrument developed by Thamhain and Wilemon (50) for their study of conflict in civilian program/project work environments. The question taken from the Lee and Eschmann study was Question 13, which was then adapted by the researchers into a question asking the respondents to rate on a standard four-point scale, ranging from *virtually none* to *a great deal*, the amount (intensity) of conflict they perceived in their organizations (at the time of the survey) in each of seven conflict categories. This adjustment to the instrument was made to simplify the response requirements, and was made possible

by the fact that the phase in which each SPO was operating was known ahead of time. Prior to distributing the survey, the researchers had determined in which acquisition phase category each respondent's SPO was functioning. The phase category data was combined with the corresponding program managers' responses to the seven conflict source categories, and mean intensity scores for each phase category were computed for each of the seven sources of conflict. The overall conflict intensity by phase was then calculated as the mean of means for the seven sources of conflict. *Conflict intensity* is defined as the mean frequency of occurrence of conflict sources which are considered to be operative throughout the life of a project or program.

#### Organizational Size

One other variable which was not measured in the questionnaire was *organizational size*, referring to the number of personnel directly assigned to the program organization on a full-time basis. The size of the different SPOs was obtained from ASD Manning Documents. Organizational size is measured on a ratio scale and is discrete data.

#### Interval Scale Data

Parts II, III, IV and V of the questionnaire solicit data that is interval in nature; that is, a common and constant unit of measurement is used which assigns a real number to objects in an ordered set and employs an arbitrary



zero point. The zero point, however, does not represent the total absence of the property under consideration. Cardinality in scaling is assumed on the basis that equally-appearing intervals are equal (18:70-76).

### Instrument Reliability

"Reliability is an indication of the extent to which a measure contains variable error [20:280]." Variable error is defined as random fluctuations in performance which result in a person obtaining a different score from one testing to the next (20:283). The reliabilities for each portion of the instrument were tested in previous studies which used the larger instruments from which each particular section was drawn. Section I of the instrument for this study, the demographic data, is factual material in nature and does not require reliability testing. Section II, Level of Bureaucracy, was developed in the Lempke and Mann thesis, and the test-retest reliability was determined using a pilot study-group of ten individuals with a six-week interval between successive administrations of the instrument. The test-retest reliability coefficient ( $r_{xx}$ , =.52) was determined to be within the boundary values reported by Helmstadter for tests with attitude scales (20:296). The relatively small number of questions would typically lead to a relatively low test-retest reliability coefficient. For the conditions under

which this portion of the instrument was constructed and administered, the reliability correlation of .52 is considered sufficient to lend confidence that much of the variable error in the responses lie external to the questions themselves (29:44-45).

Section III includes, as a single instrument, the measures of role conflict, role ambiguity and role stress. By definition, role stress equals the sum of role conflict and role ambiguity. Reliability of this instrument was based on the total measure, role stress. It can only be assumed that Rizzo, *et al.* (46), who developed this section of the instrument on role stress, and Miles (35:334-335), who made extensive use of the instrument, conducted the appropriate reliability tests. Lempke and Mann investigated the test-retest reliability and developed a reliability coefficient ( $r_{xx} = .80$ ) for the scale Role Stress. This is considered to be quite high within the boundary values established for tests of attitude scales (20:296).

Section IV is comprised of the Likert Form S questionnaire, which has been used extensively by a variety of researchers in the area of organizational behavior. While no information is available concerning Likert's testing of the instrument, Larson and Ruppert conducted a reliability test using an analysis of variance process and the Spearman-Brown test reliability statistic. Testing on three categories of data, the reliability indices were

reported as .72, .95, and .90, indicating that the instrument is highly reliable (27:47-49).

Section V measured conflict intensity and was developed from an instrument generated by Wilemon and Thamhain (50) and widely used by them on civilian data sources. Lee and Eschmann used the instrument on a military population, obtaining very similar results (12). Although no specific reliability indices have been reported, this is considered a standard instrument, well accepted in the field, and its reliability is assumed to be high.

#### Instrument Validity

Section I measured demographic rather than attitudinal data. It is therefore assumed that the respondents have answered the questions truthfully.

The validity for Section II was examined by Lempke and Mann through a series of tests. Face validity was demonstrated by a review of the literature; logical validity was demonstrated through the subjective evaluation of experts in the field; face validity was improved through use of a pilot study; and finally, an intercorrelation analysis on the questions was conducted, yielding high correlations among the questions themselves, and between these questions and an independent check question which was included in their survey. These tests lend support for the validity of Section II.



Sections III, IV and V are all generated from well-documented and established instruments in the field of attitudinal research. Their validity is generally accepted within the literature.

### Statistical Procedures

A path analysis technique was used to analyze the data collected via the combined survey instrument. Path analysis was originally introduced by Sewall Wright and has been popularized by H. M. Blalock, Jr., (5; 6) and by Otis D. Duncan (11) in the social sciences. The geneticist Sewall Wright (60; 61) used path coefficients as early as 1918, and he expounded upon the path analysis techniques in a series of articles dating from the early 1920s.

The main application of path analysis has been in population genetics, where the method has proved to be a powerful aid to "axiomatic deduction." The assumptions are those of Mendelian inheritance, combined with path schemes representing specified systems of mating. The method allows the geneticist to ascertain the "coefficient of inbreeding," a quantity on which various statistical properties of a Mendelian population depend. It also yields a theoretical calculation of the genetic correlations among relatives of stated degree of relationship [11:2].

Sewall Wright conducted pioneer studies in biometrics, relating to heredity and environment in the determination of intelligence (61), and in econometrics, concerning prices and production of corn and hogs (60). Sociologists and research workers may find this subject matter rather remote from sociological concerns, but these examples

and others from studies in animal biology have been instructive in the path analysis methodology (11:2). Since the late 1950s, Duncan (11) has contributed much to the adaptation of path analysis to social science uses. Blalock in particular has edited and published several articles and books discussing the technique (5; 6).

Path analysis is a method of decomposing and aiding the interpretation of linear relationships among a set of variables by assuming that (1) a (weak) causal order among these variables is known or can reasonably be assumed, and (2) the relationships among these variables are causally closed (38:383).<sup>1</sup>

Basically the assumption of weak causal ordering postulates that, given a pair of variables  $X_i$  and  $X_j$ , a weak order such that  $X_i$  is a cause of  $X_j$  is established if it is assumed or known that  $X_i$  may affect  $X_j$ , but  $X_j$  cannot affect  $X_i$ . (This directional assumption does not require  $X_i$  to be a cause of  $X_j$ .) (38:384-385)

---

<sup>1</sup>A detailed discussion of path analysis is beyond the scope of this study. It is assumed that the reader is thoroughly conversant with the theory of regression analysis, per se; this study will concentrate only on the application of regression analysis to proposed causal paths. A good introductory summary of the concepts of path analysis can be found in *Statistical Package for the Social Sciences*, 2d ed., Norman H. Nie, et al., McGraw-Hill Book Co., New York, 1975, and a more detailed analysis of the topic is presented in *Methodology in Social Research* eds. Hubert M. Blalock, Jr. and Ann B. Blalock, McGraw-Hill Book Co., New York, 1968, and in *Causal Inferences in Nonexperimental Research*, Hubert M. Blalock, Jr., Chapel Hill, NC: The University of North Carolina Press, 1964.



Causal closure assumes that, given a bivariate covariation between, say,  $X_1$  and  $X_2$ , and a known weak causal ordering, say  $X_1$  is a cause of  $X_2$ , the observed covariation between  $X_1$  and  $X_2$  may be due (1) solely to the causal dependence of  $X_2$  on  $X_1$ , (2) to their mutual dependence on some outside variable(s), or (3) to the combination of the preceding two (38:385).

The basic assumptions of linear regressions concerning the error components are also operative; that is, that the error terms are independently, identically and normally distributed, they have an expected value equal to zero, and a constant variance (homoscedasticity). Path analysis, however, is primarily a technique for working out the logical consequences of the first two cited assumptions.

The reader should be cautioned that the identification of a causal structure does not prove causal relationships, but it does provide a basis for drawing inferences.

. . . one can never demonstrate causality from correlational data, or in fact from any type of empirical information. Nevertheless it is possible to make causal *inferences* [italics Blalock] concerning the adequacy of causal models, at least in the sense that we can proceed by eliminating inadequate models that make predictions that are not consistent with the data [6:62].

"As a *pattern of interpretation* [italics Duncan] . . . path analysis is invaluable in making explicit the rationale for a set of regression calculations [11:7]."



Path analysis involves linear, additive, asymmetric relationships among a set of variables which are measurable on an interval scale. Some of these variables are interpreted as being linearly dependent on others. The remaining variables are then assumed to be given. Duncan stresses that

Each "dependent" variable must be regarded explicitly as *completely* [italics Duncan] determined by some combination of variables in the system. In problems where complete determination by measured variables does not hold, a residual variable uncorrelated with other determining variables must be introduced [11:3].

Path analysis uses both path (or causal) diagrams and systems of linear regression equations to represent a system of relationships among a set of variables, as in Figure 7. In path diagrams, assumptions about the causal order or direction of relationships are explicitly indicated by the direction of one-way arrows leading from each determining variable to each variable dependent on it. Paths between variables are labeled with path coefficients (similar to regression coefficients), such as  $P_{69}$  in Figure 7. According to Duncan, the order of the subscripts is significant: the first subscript identifies the dependent variable and the second indicates the variable whose direct effect on the dependent variable is measured by the path coefficient (11:4).

An examination of the simple recursive equations for the model presented in Table 6 shows that unbiased

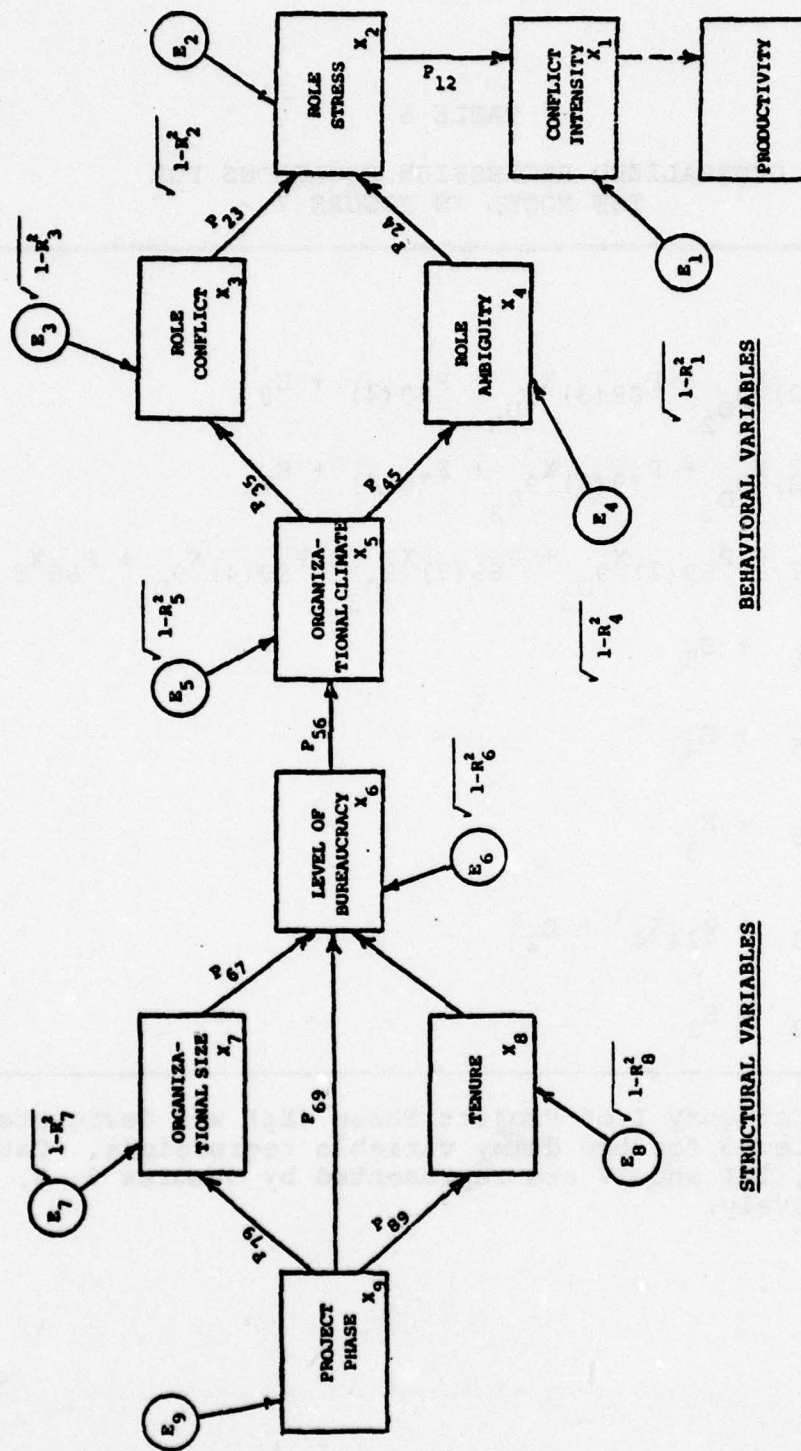


Fig. 7. Proposed Causal Model with Path Analysis Variables Identified

TABLE 6  
GENERALIZED REGRESSION EQUATIONS FOR  
THE MODEL IN FIGURE 7

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$$X_9 = E_9$$

$$*X_8 = P_{89(2)} X_{9D_2} + P_{89(3)} X_{9D_3} + P_{89(4)} + E_8$$

$$*X_7 = P_{79(2)} X_{9D_2} + P_{79(3)} X_{9D_3} + P_{79(4)} + E_7$$

$$*X_6 = P_{67} X_7 + P_{69(2)} X_{9D_2} + P_{69(3)} X_{9D_3} + P_{69(4)} X_{9D_4} + P_{68} X_8 + E_6$$

$$X_5 = P_{56} X_6 + E_5$$

$$X_4 = P_{45} X_5 + E_4$$

$$X_3 = P_{35} X_5 + E_3$$

$$X_2 = P_{23} X_3 + P_{24} X_4 + E_2$$

$$X_1 = P_{12} X_2 + E_1$$


---

\*Category I of Project Phase (X<sub>9</sub>) was designated as the base level for the dummy variable regressions. Categories II, III and IV are represented by Dummies 2, 3, and 4 respectively.



estimates of the path coefficients can be derived by assuming that the error terms in each equation are uncorrelated with those of other equations and with all of the independent variables that appear in their respective equations. Thus  $E_2$  is assumed to be uncorrelated with  $X_3$  and also the remaining error terms  $E_1$ . Further,  $E_1$  is unrelated to  $X_2$  and  $X_3$ , and so on (5:141). In a discussion of these assumptions in terms of the behavior of outside variables not explicitly contained in the model, Blalock says,

. . . if one assumes that outside variables have a direct effect on *only one* [italics Blalock] of the explicit variables, then the assumptions can be met. Notice that an implicit variable might have an *indirect* [italics Blalock] effect on some variable through one of the remaining  $X_i$  without violating the assumptions. But if an implicit factor *directly* [italics Blalock] affects two or more explicit variables, then it will ordinarily be correlated with one of the independent variables in its equation, and the assumptions will not be met. If this is the case, least squares estimates will be biased, and one's inferences will be incorrect. Such a variable should be *explicitly* [italics mine] included in the system. At some point one must stop and make the simplifying assumption that all remaining implicit factors operate (in a major way) on only one explicit variable [5:141-142].

In general, given  $n$  variables with the weak order  $X_n \leq \dots \leq X_2 \leq X_1$ , estimation of all the path coefficients will require  $(n-1)$  regression solutions, taking in succession each of the  $(n-1)$  lower-order variables as the dependent variable and using all of its higher-order variables as predictors (38:386).

It is also customary: to estimate path coefficients from latent variables (i.e., all residual causes)

associated with  $X_i$  by  $\sqrt{1-R^2}$ , the effect of  $E_i$ , where the multiple  $R$  is that part of the regression equation in which  $X_i$  is the dependent variable and all causally prior variables are used as predictors [38:387].

or independent variables.

The causal model in Figure 7 can be represented as a special case of general path analysis: one where there are no unmeasured variables (other than residual factors), the residuals are uncorrelated, and each of the dependent variables is directly related to all the variables preceding it in the causal sequence. In the model used by the researchers, path analysis equates to a series of conventional regression analyses, or a compact statement of the normal equations of regression theory for variables in a standard form. The path coefficients are merely the beta coefficients in a regression setup, and the usual system for regression setup may be utilized. By following the computing system which inverts the matrix of inter-correlations of the independent variables, the standard errors of  $\beta$  coefficients are automatically obtained (11:6). This method of path analysis measures variables as deviations from their respective means, thus obtaining standardized beta values for the variable (or path) coefficients, which in the bivariate case is mathematically equivalent to a zero-order correlation coefficient (23:329). Path coefficients in the multivariate case, however, are mathematically equivalent to multiple partial correlations (23:329). Both bivariate and multivariate regressions

appear in the regression equations (see Table 6) for the model in Figure 7.

Several interpretations of the path coefficient values are commonly made in path analysis. First, the completeness of each relevant subsystem may be assessed by examining the path coefficients from the latent (i.e., residual) variables (38:387). It should be noted that, in sociological models where there are likely to be large numbers of extraneous influences on each variable which is explicitly considered, the calculated residual influences may reveal that a high percentage of the variation in each variable remains unexplained by the explicit causal relations in the model. This will, of course, reflect on the value of the model.

Second, the effects of any prior causal variable on any succeeding variable may be identified. The effect coefficient ( $C_{ij}$ ) measures the accompanying changes in  $X_i$  given a unit change in  $X_j$  while controlling for extraneous (residual) causes (38:387).

Third, the total covariation between pairs of variables represented by  $r$  can be decomposed, in a tabular form which will be demonstrated later in the study, into causal and spurious components. Thus path analysis provides at least a partial test of the causal closure of bivariate relationships. As more variables are added to the model (in this study, nine variables are examined),



the proportion of relationships which are decomposed purely on the basis of causal assumptions decreases, and the proportion of relationships which can be examined for partial spurious correlations is also studied for intervening variable increases. The only relationship for which path analysis does not generate information beyond that contained in a bivariate correlation and the initial assumptions of the (general) model is the initiating relationship (38:388-389). The assumptions of regression analysis must hold. In the first variable, nominal or better levels of data can be used by incorporating a dummy variable technique into the regression equation. In path analysis, however, the dummy variable technique should only be used for the initiating variable of the causal model since it would unduly complicate the analysis of the result if it were incorporated later in the model. The initiating variable for the causal model in this study (Figure 5) is project phase, which is nominal in nature with four categories; therefore, the dummy variable technique for developing regression equations was used.

If path analysis is performed on sample data and it is desired that the findings be generalized to a population, sampling variability must be considered. Under a general model (in this study the researchers have used a specific [or "special"] application of the general model) where none of the causal variables explicitly included in the model

is completely determined by other such variables, the estimation of population path coefficients merely requires a series of ordinary least-squares (OLS) regressions, taking one variable at a time as the dependent variable and all the variables with higher causal order as the independent variables (38:392). As was noted earlier, if the model contains  $n$  explicit variables, then  $(n-1)$  regression equations must be solved. If there is an indication of a given path being null in the population, ordinary F tests for individual regression coefficients are commonly used to examine this possibility (38:393).<sup>2</sup>

This study was specifically designed to meet the assumptions of path analysis:

1. Necessary weak causal relationships among the variables were developed through extensive review of the literature, presented in Chapter II.
2. The causal relationships were grouped into a closed causal model, presented in Figure 7.
3. The basic assumptions of regression analysis hold.

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<sup>2</sup>If two or more regression coefficients are to be tested simultaneously with an overall level of significance of  $\alpha$ , each coefficient should be tested with an equivalent  $\alpha$  equal to  $\alpha$  divided by the number of coefficients being tested. A more detailed discussion is presented in *Applied Linear Statistical Models* by John Neter and William Wasserman, Homewood IL: Richard D. Irwin, Inc., 1974, pp. 147-148.

In this study the path analysis statistical procedure was used to test the model, determine the strength of the relationship derived from the literature and, if warranted by the data, modify the model to more accurately reflect the relationships reported by the respondees in the data.

#### Assumptions

This research was conducted under assumptions similar to those of the Lempke-Mann (29:55) and Eschmann-Lee (12:56-57) studies:

1. The data to be collected are based on perceptions. It is assumed that the data that was gathered and the information obtained from it are representative of the true relationships that exist.
2. The sample of SPO managers is representative of the population of SPO managers assigned to system program offices within the Aeronautical Systems Division.
3. Each respondent answered each question independently, and the responses are reflective of the individual's true feelings.
4. Definitions and assumptions from supportive research studies are valid and reasonable. For example, stratified categories within the weapon system acquisition process are logically and sufficiently defined to allow further research.



5. Uncontrolled variables that exist in SPOs at different categories of the weapon system acquisition process remain distinctive to those categories.

6. The full cooperation of the randomly selected program managers within ASD was obtained and resulted in the collection of unbiased data.

#### Limitations

1. The study is limited to the various program offices at ASD at Wright-Patterson Air Force Base, Ohio.

2. The results of this study may be formally generalized only to system program offices within the Aeronautical Systems Division, AFSC.

3. Validity of the results comparing the data collected in this study to that collected by the four previous studies (12; 16; 27; 29) is limited by the validity of results reported by those previous studies.

## CHAPTER IV

### DATA ANALYSIS AND INTERPRETATION

The analysis of the data collected for this study and its integration with the results of previous studies is a complex process presented in this chapter as a series of steps. The first requirement is to examine the new data collected to insure they are amenable to the use of parametric statistics. Then, if the results are to be considered valid and meaningful, the new data must be compared to the data collected by the prior research teams variable by variable, to assure that the variable measures are reasonably consistent. This constitutes a partial reliability test on the survey instrument itself. Once the data are qualified, the path analysis can be conducted on the new data and the results interpreted. Finally, the interpreted results of this study can be integrated with the results of the previous studies and conclusions drawn relative to the overall causal relationships among the variables studied.

#### Examination of Collected Data

A listing of all eligible program managers assigned to System Program Offices (SPOs) within Aeronautical Systems Division (ASD) was obtained from the local Consolidated Base Personnel Office (military) and the ASD Civilian Personnel

Office. As discussed in Chapter III, eligible program managers consisted of all commissioned officers and civilians in pay grade GS-7 or higher assigned full-time to SPOs within ASD, excluding administrative and functional support personnel. The listing of program managers was stratified by the life-cycle category of the program to which they were assigned, and a random number table was applied to select a sample of up to fifty program managers in each life-cycle category under study.

#### Questionnaire Response Profile

One hundred eighty-nine questionnaires were personally distributed to managers in twelve SPOs within ASD. One hundred forty-five questionnaires were returned, representing a 77 percent response rate overall. All returned questionnaires were found to be usable for data analysis. However, a problem existed in terms of a disproportionate representation in Category IV relative to all other categories under study.

The portion of the sample identified with each life-cycle category can be considered a subsample. Before a comprehensive analysis of the variables under investigation was conducted, fourteen returned surveys were randomly eliminated from Category IV, leaving each life-cycle category with approximately equal-sized subsamples. This action was taken to permit comparable representation in each



life-cycle category under study and to reduce the possibility of bias across categories affecting the total sample statistics due to unequal subsample sizes. No significant difference in overall sample statistics was noted as a result of this random elimination and reduction in sample size. The response profile by life-cycle category is presented in Table 7.

As a first step in analyzing the data, characteristics of the respondents, both the total sample and by life-cycle category, were compared with data collected for past research efforts to insure comparable representation across studies. The distribution of respondents by rank and by their relative position in the organizational hierarchy was compared with the respondent profiles of the previous research teams. Both this sample and the previous samples were concluded on a random basis from the ASD SPOs. It was concluded that the sample in this study was essentially identical to past research efforts with respect to respondent profiles. Therefore, respondent profile bias should not be a factor in comparing the results of this study with results of previous studies. The respondent profile for this study is presented in Table 8.

#### Analysis by Question

Once the compatibility of respondents between the present research and previous studies was confirmed, the

TABLE 7  
RESPONSE PROFILE STATISTICS

Category	Sent	Received	% Response
Category I	46	34	74%
Category II	43	32	74%
Category III	50	32	64%
Category IV <sup>a</sup>	50	47	94%
TOTAL	189	145	77%

<sup>a</sup>NOTE: Before analysis, 14 responses were selected randomly and eliminated from Category IV to provide approximately comparable subsample sizes across categories. This left 33 responses (a 66% usable response rate) in Category IV, and 131 (69% usable response rate) from the overall study. This action was necessitated by the unusually high response rate initially experienced from the Category IV subsample.

TABLE 8

## RESPONDENT PROFILE

	Category I	Category II	Category III	Category IV	Composite
<u>Rank/Grade</u>					
Second Lieutenant	3	0	0	0	3
First Lieutenant	1	0	0	1	2
Captain	6	10	10	8	34
Major	10	8	7	11	36
Lieutenant Colonel	3	9	6	7	25
Colonel	1	0	0	0	1
GS-7	0	1	1	0	2
GS-11	1	0	2	0	3
GS-12	5	1	3	4	13
GS-13	4	1	3	2	10
GS-14	0	2	0	0	2
<u>Military/Civilian</u>					
No. Military	24	27	23	27	101
No. Civilian	10	5	9	6	30
<u>Organizational</u>					
<u>Level<sup>a</sup></u>					
1	1	1	0	0	2
2	6	4	2	2	14
3	18	18	13	16	65
4	7	9	12	11	39
5	2	0	5	4	11

<sup>a</sup>Organizational level was defined as the Program Director being the highest level, those reporting directly to him being the second level, and so on through five levels of the SPO organization.



frequency distribution for each scaled question in the survey was examined for central tendency, variance, and number of respondents. Central tendency was found for each question, indicating distributions appropriate for analysis using parametric statistics. Further, the number of cases per category was sufficient to warrant use of parametric statistics. Nothing was found that would prevent the data from being adequately described by the number of cases, the mean, and the standard deviation. These statistics for each scaled question are presented in Appendix C.

#### Analysis by Major Variable

Questions in Parts II through V of the survey instrument were aggregated to form measures for six of the nine major variables under study. Specifically, measures for the variables *level of bureaucracy*, *organizational climate*, *role conflict*, *role ambiguity*, *role stress*, and *conflict intensity* were derived from scaled questions, as discussed in Chapter III. Procedures similar to those used in examining the individual questions were used in the preliminary analysis of these major variables. Each variable exhibited central tendency, indicating that parametric statistics were appropriate for variable analysis. Further, as was the case with the individual questions, a sufficient number of respondents was evident in each life-cycle category to support the use of parametric statistics

(see Appendix C). However, the number of civilian respondents, when broken out by life-cycle category, did not provide sufficient subsample sizes to permit meaningful statistical significance tests to be conducted between military and civilian respondents by category in this study, or between civilian respondents in this and other studies. The numerical calculations of such tests are provided in this study only as informaton for possible future studies.

#### Analysis and Comparison of Major Variables

The data was analyzed and compared to the data collected by previous research teams, variable by variable. Each major variable was analyzed internally to identify relationships within the new data collected for this study, in preparation for comparing the present results with prior research findings. Then, comparisons between the present research and prior studies with respect to each major variable were made to determine the consistency between the data sets, and to determine in part the reliability of the survey instrument.

#### Organizational Size

The number of personnel directly assigned full-time to the system program organizations included in the study was obtained from ASD manning documents provided by each SPO. The average organizational size and the range

of sizes by life-cycle category are presented in Table 9. Analysis of the data on the variable *organizational size* revealed significant differences in mean size in most adjacent and all nonadjacent categories. In fact, the only pair of categories in which significant differences in mean size were not disclosed was between Categories I and II. The difference in mean organizational size was significant at above the .01 level between all other life-cycle categories under study.

A comparison of the current research data with the previous research findings is also presented in Table 3. Noticeable differences in size were evident in Categories II and IV between the present and prior research efforts.

Discussions with the current sample of program managers revealed that of the four SPOs studied in Category II, two had been placed on a "hold" status pending a major review for approval to continue weapon system development into Category III. This "hold" had been in effect for nearly a year. As a result, personnel authorizations for these SPOs had been significantly reduced, and many of the assigned personnel were being loaned to other program organizations. It would seem reasonable to assume that the mean organizational size would have been much greater for Category II if the acquisition process had not been interrupted in these SPOs. In Category IV, the F-15 and A-10 programs had progressed into the deployment phase



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TABLE 9  
ORGANIZATIONAL SIZE

Source	Mean (Range)			
	Cat I	Cat II	Cat III	Cat IV
Noyes-Parker	20 <sup>a</sup> (14-24)	32 <sup>b</sup> (10-79)	134 <sup>a,b</sup> (134)	85 <sup>a,b</sup> (3-108)
Adams-Barndt <sup>c</sup> (1:19)	15 (11-18)	114 (49-169)	102 (42-207)	38 (30-46)

<sup>a</sup>Difference of means significant at above .01 level (two-tailed t-test).

<sup>b</sup>Difference of means significant at above .01 level (two-tailed t-test).

<sup>c</sup>The Adams-Barndt article summarized the findings relative to organizational size in four previous research efforts (12; 16; 27; 29).

very recently, within approximately six months of data collection. Although reductions in personnel authorizations were beginning to take place at the time the research was conducted, their organizational sizes probably reflected a carry-over from Category III program requirements. Organizational size for SPOs in Categories I and III fell within the range of previous findings, and were probably quite representative of their respective categories.

In summary, while the general shape of the distribution seems reasonably appropriate, organizational size across categories in this study does not clearly follow in detail the pattern established in previous studies. The reasons for this, however, are explainable. There does appear to be noticeable size differences between categories, sufficiently so to allow the data to be used in the path analysis. The results of the path analysis, however, will have to be carefully interpreted with these size differences across categories clearly in mind.

### Tenure

Tenure data was based on the number of months a program manager had been assigned to a SPO, and was obtained directly from the respondent in Part I of the survey instrument. For the path analysis model, the full information content of the data was used. In order to compare this data with that collected in previous studies, however,



tenure data was transformed from ratio level to interval level by constructing equal-interval year groups. Classification in this manner permitted a direct comparison of the tenure data across research efforts.

Respondent tenure was concentrated in the zero-to-four year group at the expense of later year groups, as illustrated in Figure 8. Ninety-two percent of the sample had four years or less tenure in the SPOs under investigation. Only 6 percent of the military respondents had more than four years tenure, and no military respondent had more than six years tenure in a SPO. Seventeen percent of the civilian respondents had five years or more tenure, and 10 percent of the civilians reported having nine years or more tenure in their current program office. Respondents with four years or less tenure were approximately equally distributed among the four categories studied. However, 64 percent of the respondents with more than four years tenure came from Category IV. This data is displayed in Figure 9. This distribution of tenure data among the four life-cycle categories appears logical, and can be explained, by and large, with two generalizations. First, one would expect that long-tenured personnel would be concentrated in SPOs that had been in existence for a long time, and would logically have progressed to Category III or IV. Second, military assignment and rotation policies generally preclude military personnel from accruing more than four

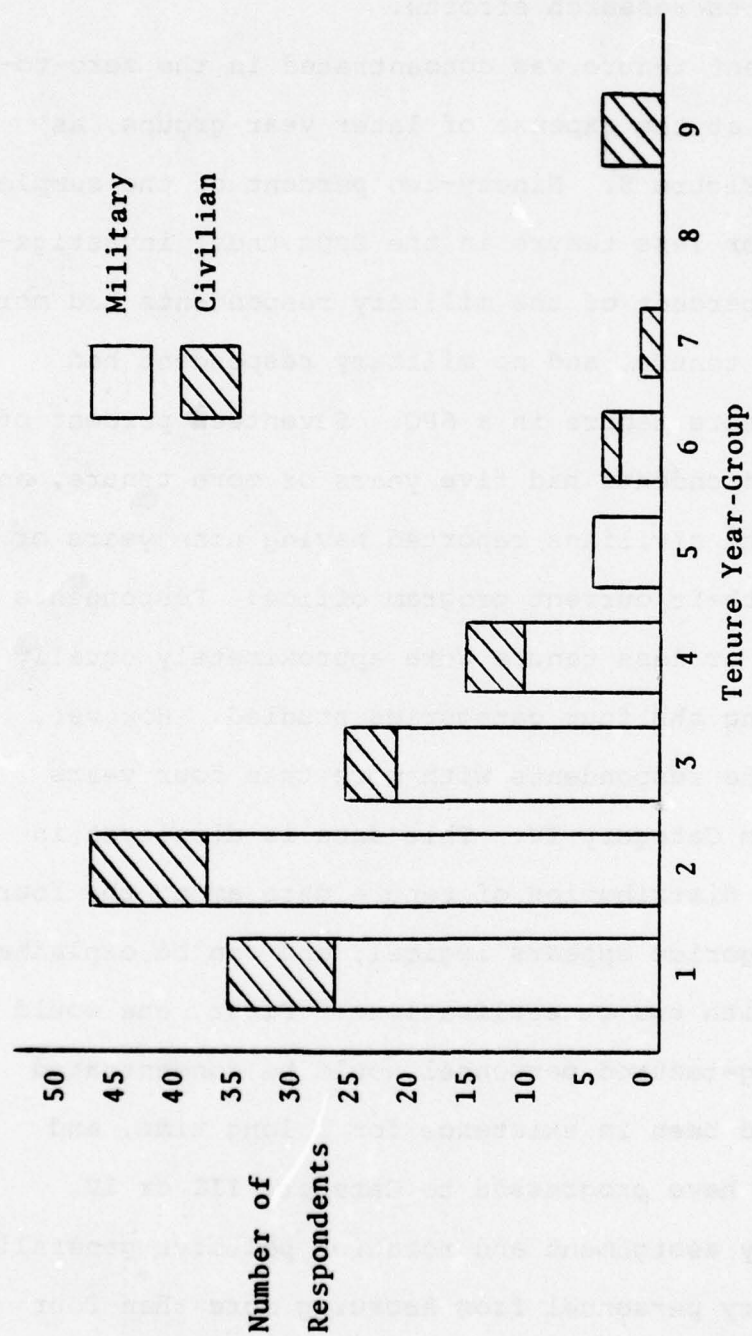
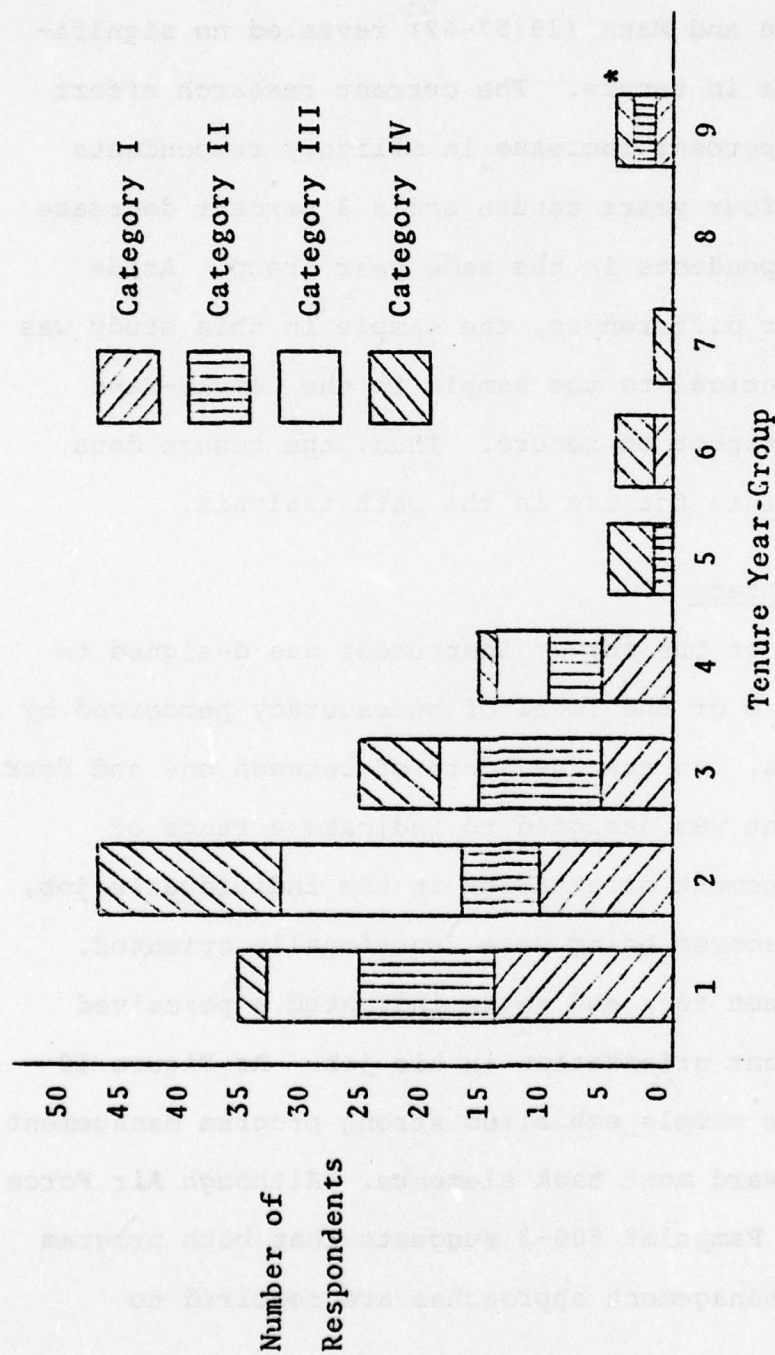


Fig. 8. Military/Civilian Respondents by Tenure Year Group



\*Note: It is expected that the two individuals who reported having more than nine years tenure in a Category I or II SP0 did so in error. However, the number of cases is small enough to have little effect on the results of the analysis.

Fig. 9. Number of Respondents (per Category) by Tenure Year-Group



years in any given assignment, including the system program office.

Comparison of the present data with research conducted by Lempke and Mann (29:57-62) revealed no significant differences in tenure. The current research effort identified a 6 percent increase in military respondents with more than four years tenure and a 3 percent decrease in civilian respondents in the same year group. Aside from these minor differences, the sample in this study was essentially identical to the sample in the Lempke-Mann research with respect to tenure. Thus, the tenure data appears appropriate for use in the path analysis.

#### Level of Bureaucracy

Part II of the survey instrument was designed to provide a measure of the level of bureaucracy perceived by program managers. An average score of between one and four from a respondent was designed to indicate a range of functional management orientation in the individual's job, with the lower scores being more functionally oriented. A response between four and seven indicated a perceived program management orientation in his job. As Figure 10 illustrates, the sample exhibited strong program management orientations toward most task elements. Although Air Force Systems Command Pamphlet 800-3 suggests that both program and functional management approaches are required to

accomplish any weapon system acquisition mission (54:20-1), the strength of the response to the questions in Part II of the questionnaire indicated that a majority of SPO managers perceived themselves to be in program management-oriented situations.

Results of classifying the data by life-cycle category and by military/civilian respondents are presented in Table 10. No significant differences in mean scores were evident between military and civilian respondents, although the mean scores of military program managers tend to be somewhat higher; that is, more program management oriented. Analysis of responses by category revealed that managers in Category II scored significantly higher than did Category I managers. The difference in response scores was significant at above the .05 level.

The relatively low score in Category I and the relatively high score in Category II were unexpected. Research conducted by Lempke and Mann (29:62-67) found that managers in Category I and a combined Category III and IV<sup>1</sup> scored significantly higher than did managers in Category II SPOs. Both research efforts exhibited a heavily skewed program management orientation and markedly similar response scores when analyzed across categories as shown in Figure 10.

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<sup>1</sup>The Lempke and Mann study classified SPOs in the production or deployment phases into one category (Category III).

TABLE 10  
LEVEL OF BUREAUCRACY

Mean  
(Standard Deviation)

Category	Military	Civilian	Composite Category
I	4.857 (.856) n = 24	4.767 (.872) n = 10	4.830 <sup>a</sup> (.849) n = 34
II	5.214 (.711) n = 27	5.289 (.617) n = 5	5.226 <sup>a</sup> (.689) n = 32
III	5.295 (.585) n = 23	4.667 (1.165) n = 9	5.118 (.822) n = 32
IV	5.086 (.654) n = 26	4.870 (.936) n = 6	5.045 (.703) n = 32
Composite Mil/Civ	5.113 (.717) n = 100	4.844 (.928) n = 30	5.051 (.775) n = 103

<sup>a</sup>Difference of means significant at above .05 level (two-tailed t-test).



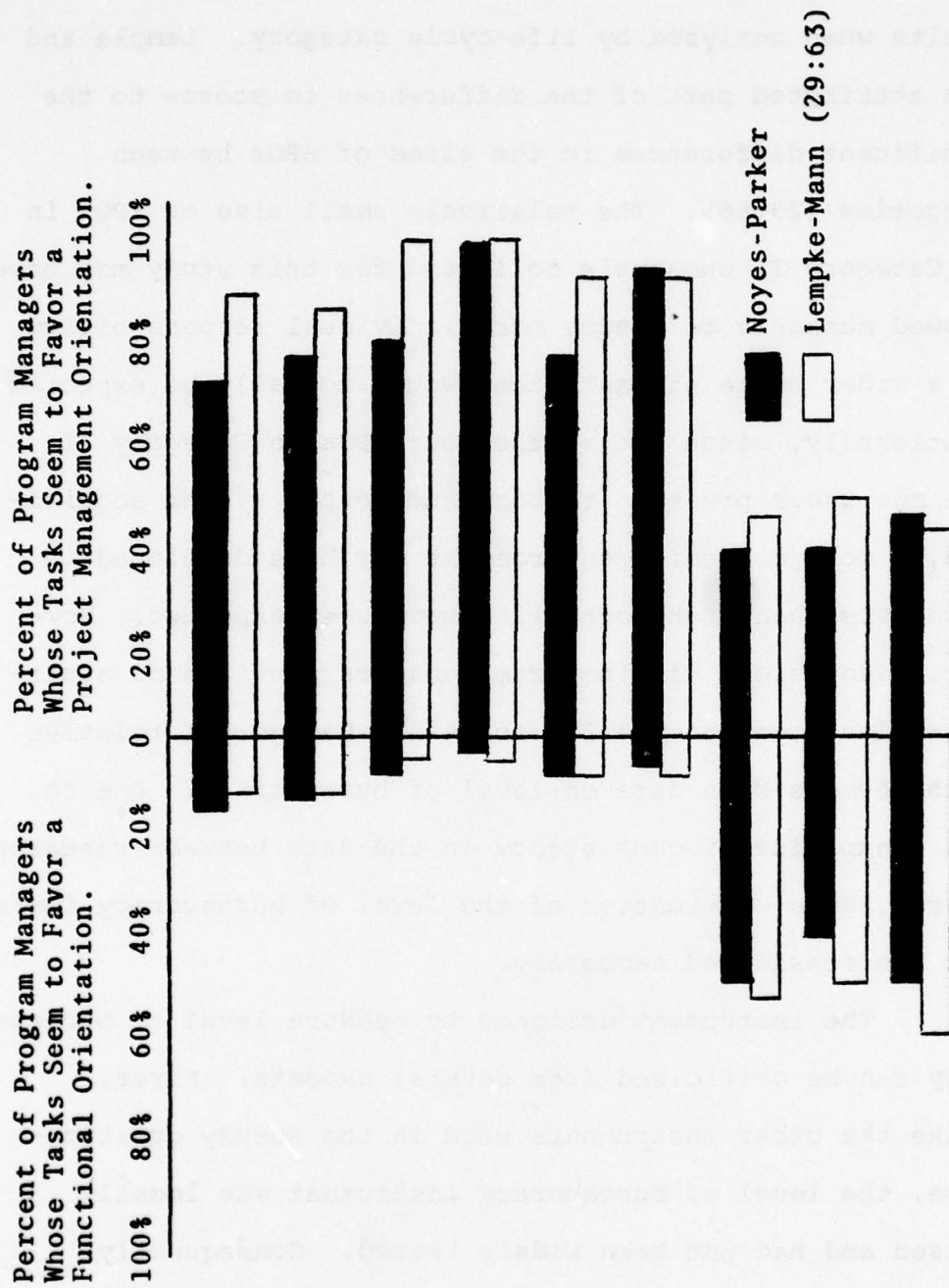


Fig. 10. Response Rate for Level of Bureaucracy Questions

The present research findings did not support past results when analyzed by life-cycle category. Lempke and Mann attributed part of the differences in scores to the significant differences in the sizes of SPOs between categories (29:66). The relatively small size of SPOs in the Category II subsample collected for this study may have allowed managers to assume more individual responsibility for a wider range of tasks than would normally be expected. Additionally, since two of the four SPOs in Category II were not under pressure to continue weapon system acquisition, a more congenial environment may have developed in these SPOs than might otherwise have been expected. However, discussions with program managers provided no apparent explanation for the low scores in Category I relative to the Lempke-Mann data on level of bureaucracy. Due to this unexplained inconsistency in the data between research efforts, a re-examination of the level of bureaucracy instrument was considered necessary.

The instrument designed to measure level of bureaucracy can be criticized from several aspects. First, unlike the other instruments used in the survey questionnaire, the level of bureaucracy instrument was locally devised and had not been widely tested. Consequently, only face and logical validity have been demonstrated. Second, the instrument has not been administered to personnel clearly identified as either "pure" functional

managers or "pure" program managers. As a result, a meaningful range of responses and a breakpoint have not been established to clearly differentiate between functional and program managers.

In summary, level of bureaucracy does not clearly follow the pattern established in previous studies when examined across categories. Further, the reasons for this deviation in the data are not fully explainable. Although the general shape of the distribution seems reasonably appropriate, the results of the path analysis will have to be carefully interpreted with these differences across categories in mind.

#### Organizational Climate

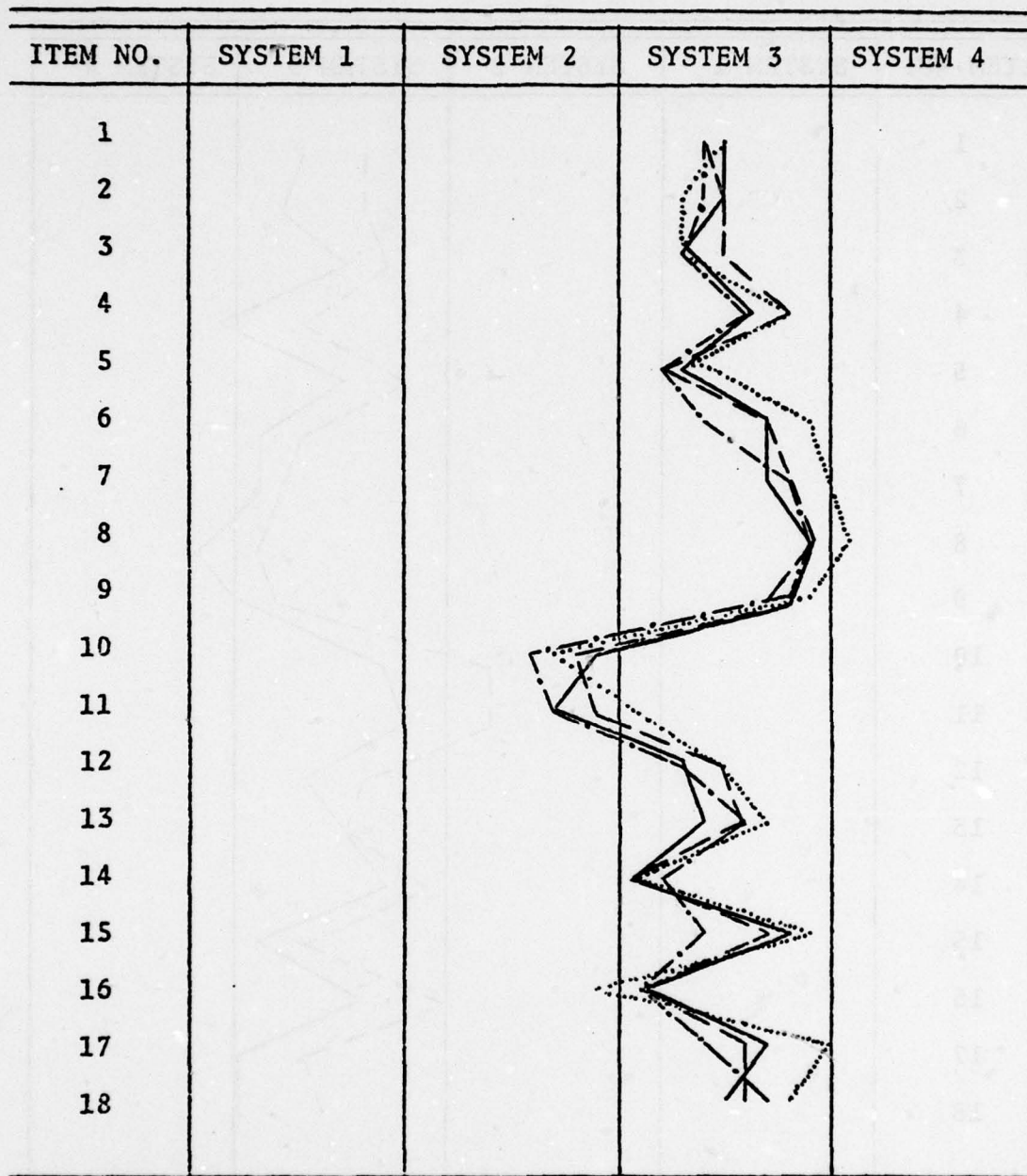
Analysis of responses to Part IV of the questionnaire revealed that program managers perceived their SPOs as exhibiting a mid-system 3 (consultative) organizational climate. As Table 11 shows, no statistically significant differences in mean response scores were disclosed when the sample was analyzed by life-cycle category or by military/civilian classifications. A question-by-question response profile by category is presented in Figure 11.

The graphical display in Figure 12 illustrates the relationship between the present data and the organizational climate data from the Larson and Ruppert study conducted in 1975 (27:50,55). It is apparent from this



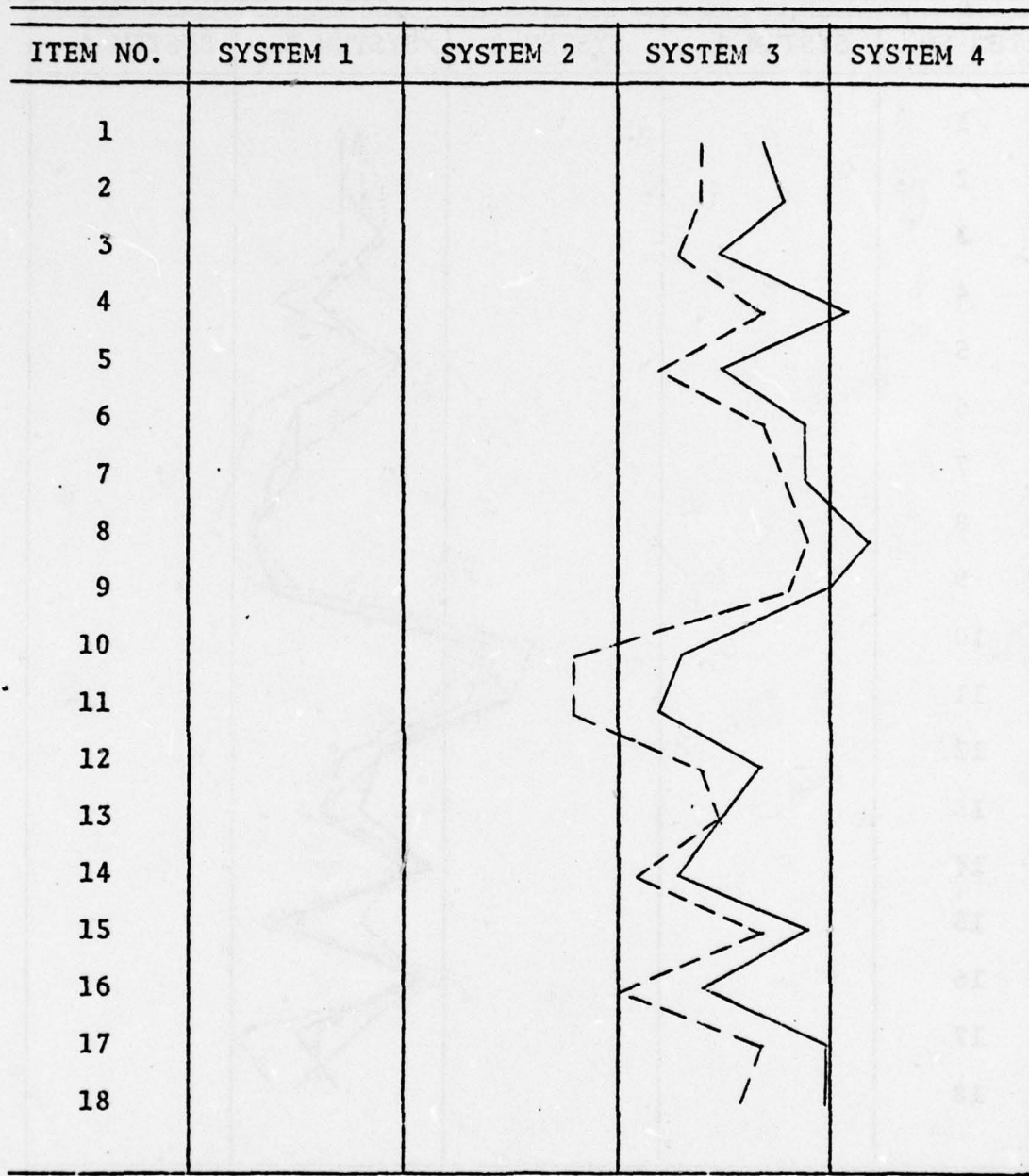
TABLE 11  
ORGANIZATIONAL CLIMATE  
Mean  
(Standard Deviation)

Category	Military	Civilian	Composite Category
I	2.43 (.57) n = 21	2.44 (.71) n = 10	2.43 (.61) n = 31
II	2.44 (.64) n = 24	2.42 (.44) n = 5	2.43 (.61) n = 29
III	2.40 (.50) n = 21	2.54 (.42) n = 7	2.43 (.48) n = 28
IV	2.57 (.59) n = 25	2.48 (.55) n = 5	2.56 (.58) n = 30
Composite Mil/Civ	2.46 (.58) n = 91	2.47 (.54) n = 27	2.47 (.57) n = 118



\_\_\_\_\_ Category I  
 - - - - - Category II  
 - . - . - Category III  
 . . . . . Category IV

Fig. 11. Organizational Climate Response Profile by Category



— Larson-Ruppert (27:50)

---- Noyes-Parker

Fig. 12. Comparison of Response Profiles--  
Organizational Climate



illustration that both research efforts exhibit a markedly similar response pattern. Organizational climate scores for the present sample of program managers were generally lower when compared to the Larson-Ruppert data. The greatest difference in perceived levels of organizational climate was observed in Category I, where the mean composite score dropped from 3.06 in the Larson-Ruppert study to 2.43 in the present study. This outcome may have resulted from the greater size of the SPOs, and hence the greater functional orientation perceived by program managers, for the subsample in Category I.

In summary, although the level of organizational climate was generally depressed relative to previous studies, the data clearly followed the pattern established in the Larson-Ruppert research when examined on a question-by-question basis. Thus, the organizational climate data appears appropriate for use in the path analysis.

#### Role Conflict

The odd-numbered questions contained in Part III of the questionnaire, when summed and averaged, provided a measure of perceived role conflict. When examined across life-cycle categories, role conflict remained relatively stable. No significant differences in mean response scores were revealed when the data was analyzed by category or by

military/civilian classifications. The data are shown in Table 12.

The data collected in this study relative to role conflict compared favorably to previous findings. Table 13 presents the mean and standard deviation for each conflict-oriented question identified in three separate research efforts. It was observed that of the fifteen conflict questions, thirteen of the mean scores in the present data fell within one standard deviation of the mean scores for the two previous studies. Comparison of the present data with the Lempke and Mann study (29:70) revealed no significant differences in mean levels of role conflict either within or across life-cycle categories. Since no significant patterns were evident between life-cycle categories in either study, it was concluded that the sample in this study was essentially identical to the sample in the Lempke-Mann research with respect to role conflict. Thus, the role conflict data appears appropriate for use in the path analysis.

#### Role Ambiguity

The variable role ambiguity consisted of the averaged responses to even-numbered questions contained in Part II of the survey instrument. Analysis of the data across life-cycle categories revealed that perceived levels of role ambiguity remained relatively constant.

TABLE 12  
ROLE CONFLICT

Mean  
(Standard Deviation)

Category	Military	Civilian	Category Composite
I	3.913 (.798) n = 23	4.173 (1.063) n = 10	3.992 (.877) n = 33
I	3.753 (.859) n = 27	4.533 (.457) n = 5	3.875 (.853) n = 32
III	3.939 (.914) n = 23	3.985 (.859) n = 9	3.952 (.886) n = 32
IV	4.089 (.681) n = 27	3.556 (.805) n = 6	3.992 (.722) n = 33
Composite Mil/Civ	3.923 (.811) n = 100	4.053 (.890) n = 30	3.953 (.828) n = 130



TABLE 13  
ROLE CONFLICT--INSTRUMENT VALIDITY (29:120)

Question No. (from Part 3)	Noyes/Parker Results Mean Std. Dev.	Lempke/Mann Results Mean Std. Dev.	Rizzo Results Mean Std. Dev.
1	4.32 2.00	3.80 1.82	3.85 1.81
3	3.06 1.75	2.34 1.26	4.00 1.88
5	4.47 1.57	4.19 1.61	4.19 1.80
7	3.42 1.75	4.29 1.76	4.46 1.72
9	3.63 1.68	3.62 1.64	3.60 1.93
11	4.29 1.76	4.17 1.63	4.50 2.04
13	4.07 1.63	3.91 1.49	3.66 1.98
15	2.66 1.46	5.58 1.25	5.90 1.14
17	4.56 1.67	3.94 1.66	3.01 1.63
19	5.24 1.58	5.44 1.51	4.70 2.06
21	4.15 1.71	4.09 1.66	3.88 2.04
23	4.87 1.61	4.90 1.61	4.35 1.89
25	3.97 1.60	3.80 1.63	4.24 1.82
27	3.81 1.83	3.49 1.71	3.66 1.88
29	2.88 1.43 (n=131)	5.27 1.36 (n=142)	4.52 1.58 (n=275)

Classification of the data by category and by military/civilian respondents failed to disclose significant differences in mean response scores, as shown in Table 14.

Comparison of the means and standard deviations for ambiguity-oriented questions in each of three separate research efforts is summarized in Table 15. Of the fifteen role ambiguity questions, only two of the mean scores in the present data did not fall within one standard deviation of the mean scores for both of the previous studies. Data relative to role ambiguity in this study were essentially identical to the Lempke-Mann data (29:70). No significant differences in mean ambiguity scores were revealed either within or across life-cycle categories. Additionally, neither study was able to support the presence of any significant patterns or relationships between life-cycle categories. Based upon the consistency in the role ambiguity data across studies, ambiguity data collected in this study appears appropriate for use in the path analysis.

#### Role Stress

The variable role stress consisted of the average responses to all questions contained in Part II of the survey instrument. Since role stress represents the combined effects of role conflict and role ambiguity, it was anticipated that the response profile for stress would

TABLE 14  
ROLE AMBIGUITY

Category	Military	Civilian	Category Composite
I	3.623 (1.027) n = 23	3.453 (1.117) n = 10	3.572 (1.040) n = 33
II	3.415 (.740) n = 27	3.800 (1.196) n = 5	3.475 (.815) n = 32
III	3.623 (.904) n = 23	3.259 (.876) n = 9	3.521 (.897) n = 32
IV	3.743 (.708) n = 27	3.111 (.887) n = 6	3.628 (.769) n = 33
Composite Mil/Civ	3.599 (.841) n = 100	3.384 (.992) n = 30	3.550 (.878) n = 130



TABLE 15

## ROLE AMBIGUITY--INSTRUMENT VALIDITY (29:120)

Question No. (from Part II)	Noyes/Parker Results		Lempke/Mann Results		Rizzo Results	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
2	3.28	1.72	4.73	1.65	4.00	1.80
4	4.02	1.87	3.87	1.96	3.95	1.70
6	3.77	1.65	3.85	1.63	4.12	1.80
8	3.18	1.27	3.27	1.41	2.87	1.61
10	2.87	1.37	5.00	1.38	4.16	1.48
12	2.57	1.29	5.31	1.46	5.05	1.60
14	4.53	1.64	4.66	1.60	4.33	1.92
16	4.31	1.90	4.08	1.99	4.05	1.88
18	2.68	1.30	3.03	1.43	3.96	1.68
20	3.54	1.56	4.57	1.58	4.20	1.67
22	2.67	1.31	2.85	1.58	3.01	1.88
24	3.80	1.71	4.29	1.66	3.66	1.76
26	4.22	1.52	3.80	1.62	3.92	1.58
28	4.35	1.56	4.15	1.69	3.76	1.77
30	3.31	1.59	2.98	1.47	3.32	1.69
	(n=131)		(n=142)		(n=275)	

manifest many of the profile characteristics of these two intervening variables. Analysis of the data across categories revealed that perceived levels of role stress remained relatively stable with no significant difference in mean stress scores evident. Additionally, no significant differences were noted in mean scores between military and civilian respondents, as shown in Table 16.

Comparison of the means and standard deviations for each of the thirty stress-related questions was conducted among the three studies cited in the discussions on role conflict and role ambiguity. Comparison of the data as depicted in Figures 13 and 15 revealed that only four of the questions in the present study had mean scores that fell outside one standard deviation from the mean scores reported in the other two research efforts. Thus, the current data pertaining to role stress were apparently consistent with prior stress data, and were appropriate to use in the path analysis.

#### Conflict Intensity

The sum of the mean scores for questions in Part V of the survey instrument was averaged to obtain an interval measure of conflict intensity. Analysis of the data by life-cycle category revealed that program managers in Category III perceived significantly greater levels of conflict intensity than did their counterparts in Category I, as shown in Table 17.

TABLE 16  
ROLE STRESS

Mean  
(Standard Deviation)

Category	Military	Civilian	Category Composite
I	3.742 (.784) n = 22	3.813 (1.067) n = 10	3.765 (.865) n = 32
II	3.584 (.675) n = 27	4.167 (.799) n = 5	3.675 (.715) n = 32
III	3.781 (.766) n = 23	3.622 (.787) n = 9	3.737 (.763) n = 32
IV	3.916 (.605) n = 27	3.333 (.833) n = 6	3.810 (.677) n = 33
Composite Mil/Civ	3.756 (.705) n = 99	3.719 (.896) n = 30	3.747 (.750) n = 129



TABLE 17  
CONFLICT INTENSITY  
Mean  
(Standard Deviation)

Category	Military	Civilian	Category Composite
I	2.100 (.422) n = 23	1.948 (.342) n = 9	2.057 <sup>a</sup> (.402) n = 32
II	2.156 (.425) n = 27	2.334 (.639) n = 5	2.184 (.456) n = 32
III	2.186 (.383) n = 22	2.365 (.339) n = 9	2.238 <sup>a</sup> (.374) n = 31
IV	2.098 (.467)	2.000 (.364)	2.082 (.448)
Composite Mil/Civ	2.134 (.422) n = 98	2.160 (.434) n = 28	2.140 (.423) n = 126

<sup>a</sup>Difference of means significant at above .10 level  
(two-tailed t-test)

Comparison of this data with the Lee and Eschmann study on conflict intensity revealed noticeable differences in mean scores across categories and in toto (12:78). Additionally, the pattern of responses in the Lee and Eschmann data was not replicated in the present data. As discussed in Chapter III, adjustments were made to the Lee and Eschmann question relative to conflict intensity to simplify response requirements in the present study. Whether the differences in the data between studies was a result of these adjustments or was in fact a reflection of actual changes in conflict intensity across studies could not be determined. However, since both studies used instruments adapted from a generally accepted and validated instrument, no apparent reason was found that would invalidate the data in either study. Thus, although generalizations relative to the data could not be made across studies, the data on conflict intensity generated in the current study was considered appropriate for use in the path analysis.

To this point, the new data has been examined and found to be amenable to the use of parametric statistics. Further, a variable-by-variable analysis of the data has been conducted to determine the consistency of the new data with respect to data collected by previous research teams. Analysis of the data now proceeds to the investigation of the proposed relationships among the organizational variables under consideration in this study.

### Path Analysis

In the exploration of causal relationships, researchers initially justify their proposed causal relationships by logical support drawn from previous knowledge published in the literature. To further justify the proposed causal relationships, researchers quantify the variables being considered to determine if what was theorized is statistically supportable. Since causal relationships are examined among sociological variables, many unknown or unexplained (exogenous) variables typically affect the relationships. High correlation coefficients ( $r$ 's) of .7 or .8 are seldom attained for such relationships. In *Foundations of Behavior Research*, Kerlinger maintains that  $r$ 's of .1, .2, or .3 are adequate, provided they are statistically significant, to allow inferences to be drawn which serve as a basis for further research (26:201).

Based upon previous research studies and upon causal relationships inferred from the literature, this study proposed a set of causal relationships among nine sociological variables. The researchers then proceeded to test the proposed causal relationships with the statistical technique of path analysis, looking for inferences which justify further research and support the results of previous research. As discussed earlier in this chapter, each of the major variables in this study exhibited decided



central tendency, and the sample size in each category is sufficiently large to invoke the central limit theorem. Further, an examination of the frequency distributions for the individual scaled questions provided no evidence to indicate that the data was inappropriate for use in a regression analysis. It was therefore concluded that regression was an appropriate statistical technique to use in examining this data, a necessary prerequisite for invoking the path-analytic technique.

#### Analysis Step I: Path Coefficients

The first part of the path analysis procedure was to assess the completeness of the relevant relationships by calculating the path coefficients from the residual variables associated with their respective  $X_i$ s. (See Tables 18 and 19.) (Analysis Sections A, B, C, etc. of Table 19 correspond to the different sections of the model; this device is used to facilitate ease of discussion.) Path coefficients are estimated by first deriving the residual (latent) variable's coefficient, the  $\sqrt{1-R^2}$  (6:47) (see Figure 13), where the multiple R is "that part of the regression equation in which  $X_i$  is the dependent variable and all causally prior variables are used as predictors [38:387]." The residual coefficient is then subtracted from 1.0 to obtain the path coefficient. Figure 13 shows the residual coefficients for all the  $E_i$ s in the model.

TABLE 18

CALCULATED REGRESSION EQUATIONS FOR THE MODEL IN FIGURE 7

	<u>R<sup>2</sup> Value</u>	<u>Multiple R</u>
$X_8 = -.01840X_{9D_2} - .0889X_{9D_3} + .2177X_{9D_4}$	.0700	.2646
$X_7 = .0996X_{9D_2} + 1.0021X_{9D_3} + .5714X_{9D_4}$	.8606	.9277
$X_6 = .1944X_7 + .2020X_{9D_2} - .0309X_{9D_3} + .0024X_{9D_4} + .0330X_8$	.0420	.2050
$X_5 = -.0480X_6$	.0023	.0480
$X_4 = -.5731X_5$	.3284	.5731
$X_3 = -.4448X_5$	.1978	.4448
$X_2 = .5414X_3 + .5743X_4$	1.0	1.0
$X_1 = .3940X_2$	.1218	.3490

TABLE 19

A DECOMPOSITION TABLE

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal		
			Direct (B)	Indirect (C)	Total (D) B + C
A	$x_8 x_9$ $D_2$	$r_{89}$ $D_2$ = (.0184)	$P_{89}(2)$ = (.0184)	None	$r_{89}(2)$ = (.0184)
	$x_8 x_9$ $D_3$	$r_{89}$ $D_3$ = (.0889)	$P_{89}(3)$ = (.0889)	None	$r_{89}(3)$ = (.0889)
	$x_8 x_9$ $D_4$	$r_{89}$ $D_4$ = (.2177)	$P_{89}(4)$ = (.2177)	None	$r_{89}(4)$ = (.2177)
	$x_7 x_9$ $D_2$	$r_{79}$ $D_2$ = (.0996)	$P_{79}(2)$ = (.0996)	None	$r_{79}(2)$ = (.0996)
					Noncausal (E) A - D
					None
					None
					None
					None



TABLE 19--Continued

Analysis Section	Bivariate Relationship	Causal			Noncausal (E) A - D
		Total Covariation (A)	Direct (B)	Indirect (C)	Total (D) B + C
A (cont)	$X_7 X_9 D_3$	$r_{79 D_3}$ = (.1.0021)	$P_{79(3)}$ = (.1.0021)	None	$r_{79(3)}$ = (.1.0021)
	$X_7 X_9 D_4$	$r_{79 D_4}$ = (.5714)	$P_{79(4)}$ = (.5714)	None	$r_{79(4)}$ = (.5714)
	$X_6 X_9 D_2$	$r_{69 D_2}$ = (.2220)	$P_{69(2)}$ = (.2020)	$P_{79(2)} (P_{67})$ + $P_{89(2)} (P_{68})$ = (.0255)	$r_{69(2)}$ = (.2220)
	$X_6 X_9 D_3$	$r_{69 D_3}$ = (.2286)	$P_{69(3)}$ = (.0309)	$P_{79(3)} (P_{67})$ + $P_{89(3)} (P_{68})$ = (.1977)	$r_{69(3)}$ = (.2286)

TABLE 19--Continued

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal			Noncausal (E) A - D
			Direct (B)	Indirect (C)	Total (D) B + C	
B (cont)	$X_6 X_9$ $X_{D_4}$	$r_{69}$ $r_{D_4}$	$P_{69(4)}$	$P_{79(4)} (P_{67})$	$r_{69(4)}$	None
		$= (.1207)$	$= (.0024)$	$+ P_{89(4)} (P_{68})$ $= (.1183)$	$= (.1207)$	
C	$X_6 X_8$	$r_{68}$	$P_{68}$	None	$P_{68}$	$r_{68} - P_{68}$ $= (.9644)$
		$= (.9977)$	$= (.0333)$		$= (.0333)$	
D	$X_6 X_7$	$r_{67}$	$P_{67}$	None	$P_{67}$	$r_{67} - P_{67}$ $= (.3733)$
		$= (.5677)$	$= (.1949)$		$= (.1944)$	
D	$X_5 X_6$	$r_{56}$	$P_{56}$	None	$P_{56}$	$r_{56} - P_{56}$ $= (.9788)$
		$= (.9968)$	$= (.0480)$		$= (.0480)$	
E	$X_4 X_5$	$r_{45}$	$P_{45}$	None	$P_{45}$	$r_{45} - P_{45}$ $= (.9988)$
		$= (1.5719)$	$= (.5731)$		$= (.5731)$	
	$X_3 X_5$	$r_{35}$	$P_{35}$	None	$P_{35}$	$r_{35} - P_{35}$ $= (.9988)$
		$= (1.4436)$	$= (.4448)$		$= (.4448)$	

TABLE 19--Continued

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal			Noncausal (E) A - D
			Direct (B)	Indirect (C)	Total (D) B + C	
E (cont)	$X_2 X_3$	$r_{23}$ = (1.4464)	$P_{23}$ = (.5514)	None	$P_{23}$ = (.5514)	$r_{23} - P_{23}$ = (.8950)
	$X_2 X_4$	$r_{24}$ = (1.3938)	$P_{24}$ = (.5743)	None	$P_{24}$ = (.5743)	$r_{24} - P_{24}$ = (.8195)
F	$X_1 X_2$	$r_{12}$ = (.3490)	$P_{12}$ = (.3490)	None	$P_{12}$ = (.3490)	$r_{12} - P_{12}$ = (0.0)



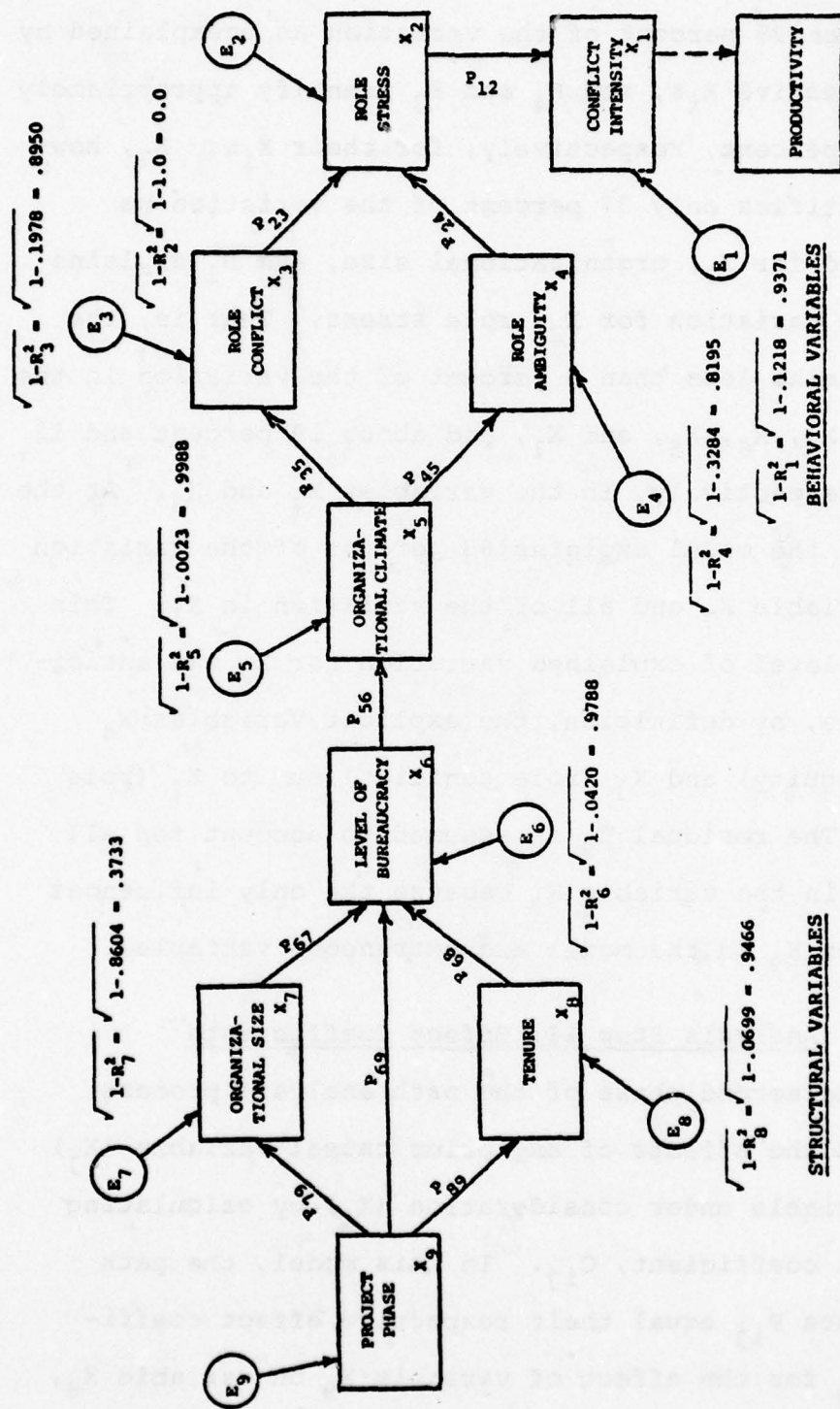


Fig. 13. Proposed Causal Model with Path Analysis Residual Values Identified

Note that the latent variables  $E_8$ ,  $E_6$ ,  $E_5$ , and  $E_1$  identify greater than 95 percent of the variation as unexplained by their respective  $X_i$ s, and  $E_4$  and  $E_3$  identify appropriately 81 and 88 percent, respectively, for their  $X_i$ s.  $E_7$ , however, identifies only 37 percent of the variation as unexplained for  $X_7$ , organizational size, and  $E_2$  explains 0.0 of the variation for  $X_2$ , role stress. That is, the model explains less than 5 percent of the variation in the variables  $X_8$ ,  $X_6$ ,  $X_5$ , and  $X_1$ , and about 19 percent and 12 percent, respectively, in the variables  $X_4$  and  $X_3$ . At the same time, the model explains 63 percent of the variation in the variable  $X_7$  and all of the variation in  $X_2$ . This very high level of explained variation for  $X_2$  was anticipated since, by definition, the explicit variables  $X_4$  (role ambiguity) and  $X_3$  (role conflict) sum to  $X_2$  (role stress). The residual  $E_9$  is assumed to account for all variation in the variable  $X_9$  because the only influences acting upon  $X_9$  in the model are extraneous variables.

#### Analysis Step II: Effect Coefficients

The second phase of the path analysis process identified the effects of any prior causal variable ( $X_j$ ) on the variable under consideration ( $X_i$ ) by calculating its effect coefficient,  $C_{ij}$ . In this model, the path coefficients  $P_{ij}$  equal their respective effect coefficients  $C_{ij}$  for the effect of variable  $X_9$  on variable  $X_8$ ,

and variable  $X_9$  on variable  $X_7$ . (See Analysis Section A of Table 19.)  $X_9$  is the model's initiating (nominal) variable project phase, which has been artificially divided into three dummy variables by the Method of Differences. The resulting effect coefficients in the cases of  $X_9$  on  $X_8$  and  $X_9$  on  $X_7$  would be  $C_{89}(2)$ ,  $C_{89}(3)$ ,  $C_{89}(4)$  and  $C_{79}(2)$ ,  $C_{79}(3)$ ,  $C_{79}(4)$  (see Table 19).

In the case of  $C_{69}$ , Analysis Section B in Table 19, the effect coefficient of variable  $X_9$  on variable  $X_6$ ,  $X_9$  can affect  $X_6$  along any one of three paths, which are causally independent by the design of the model. One of the paths,  $P_{69}$ , is a direct path from  $X_9$  to  $X_6$ ; the other two are indirect paths which involve the intervening variables  $X_8$  and  $X_7$ , respectively. Because all the structural variables in the model contribute to this relationship,  $C_{69}$  is a vital effect coefficient in the model.  $C_{69}$  can be calculated in the following manner:

$$\begin{aligned}
 C_{69} &= P_{69}(2) + P_{79}(2) (P_{67}) + P_{89}(2) P_{68} + P_{69}(3) + P_{79}(3) (P_{67}) \\
 &\quad + P_{89}(3) (P_{68}) + P_{69}(4) + P_{79}(4) (P_{67}) + P_{89}(4) (P_{68}) \\
 &= | .2020 | + | .0996 | * | .1944 | + | .0184 | \\
 &\quad * | .0333 | + | .0309 | + | 1.0021 | * | .1944 | \\
 &\quad + | .1889 | * | .0333 | + | .0024 | + | .5714 | \\
 &\quad * | .1944 | + | .2177 | * | .0333 | \\
 &= .5713
 \end{aligned}$$



The cumulative effect of the project phase ( $X_9$ ) on the level of bureaucracy ( $X_6$ ) is considered to be high, with  $X_6$  increasing by .5713 units for each unit increase in  $X_9$ . Thus, while the exogenous variables explain much of the variation *within* each major variable, the combined effect of the explained variation in  $X_9$ ,  $X_8$ , and  $X_7$  on  $X_6$  is quite large.

Continuing through the model with Analysis Section C, the path coefficients  $P_{68}$  and  $P_{67}$  equal their respective effect coefficients for the variable  $X_8$  on variable  $X_6$  ( $P_{68} = C_{68} = .0333$ ) and the variable  $X_7$  on  $X_6$  ( $P_{67} = C_{67} = .1944$ ). The effect of tenure ( $X_8$ ) on level of bureaucracy ( $X_6$ ) appears insignificant, since  $X_6$  increases by a mere .0333 units for each unit increase in  $X_8$ . The effect of size ( $X_7$ ) on level of bureaucracy ( $X_6$ ) is much more important, since  $X_6$  increased by .1944 units for each unit increase in  $X_7$ . These two relationships should not be evaluated by themselves, however, since they are only "partial paths," whose values lie in their contribution to the effect coefficient  $C_{67}$  discussed previously. The effect of tenure ( $X_8$ ) on level of bureaucracy ( $X_6$ ) can be identified as different from zero, since the standard error for this standardized  $\beta$  coefficient is .0070, a value much smaller than the beta (path) coefficient .0333. By the same rationale, the effect of organizational size ( $X_7$ ) on level of bureaucracy ( $X_6$ ) can also

be identified as different from zero, since its standard error is .0037, a value much smaller than its beta (path) coefficient .1944.

The next relationship in the model is the path linking the structural variables to the behavioral variables: the effect of variable  $X_6$  on variable  $X_5$ . Here again the path coefficient  $P_{56}$  equals the effect coefficient  $C_{56}$  because only one direct path is involved (see Analysis Section D, Table 19). The effect of level of bureaucracy ( $X_6$ ) on organizational climate ( $X_5$ ) cannot be identified as different from zero, for although the path coefficient  $P_{56} = C_{56} = .0480$ , the standard error for beta is .6765, a value much greater than the coefficient itself. Thus, the theoretical relationship represented by  $C_{56}$  is unsupported by the data. This result will be examined further in the discussion of the statistical significance of the path coefficients.

Analysis Section E of the Decomposition Table presents  $C_{25}$ , the effect coefficient of behavioral variable  $X_5$ , on behavioral variable  $X_2$ . Organizational climate ( $X_5$ ), can affect role stress ( $X_2$ ) along either of two paths which are causally independent. Both of the paths involve intervening variables,  $X_4$  and  $X_3$  respectively. The effect of  $X_5$  on  $X_2$  is of particular interest in this model, since the combination of role ambiguity ( $X_4$ ) and role conflict ( $X_3$ ) sum to role stress ( $X_2$ ) by definition, creating an

essentially complete set of relationships.  $C_{25}$  is computed as indicated below:

$$\begin{aligned} C_{25} &= P_{45}(P_{24}) + P_{35}(P_{23}) \\ &= | .5731 | * | .5743 | + | .4448 | * | .5514 | \\ &= .4743. \end{aligned}$$

The effect of organizational climate ( $X_5$ ) on role stress ( $X_2$ ) is considered to be high, with  $X_2$  increasing by .5743 units for each unit increase in  $X_5$ . All the "partial paths" contributing to the effect coefficient  $C_{25}$  exhibit strong path/effect coefficients:  $P_{45} = C_{45} = .5731$ ,  $P_{35} = C_{35} = .4448$ ,  $P_{23} = C_{23} = .5514$ , and  $P_{24} = C_{24} = .5743$ .

The remaining relationship in the model, presented in Analysis Section F of Table 19, is the effect coefficient of variable  $X_2$  on variable  $X_1$ . Here again, since there is only one (direct) path between role stress ( $X_2$ ) and conflict intensity ( $X_1$ ), the path coefficient  $P_{12}$  equals the effect coefficient  $C_{12}$ . The value of  $C_{12}$  is .3490, meaning that  $X_1$  increases by .3490 units for each unit increase in  $X_2$ .

There is a tentative relationship (indicated by a dotted arrow) presented in the proposed causal model (see Figure 13) for which no data was collected in this study. The relationship of conflict intensity to productivity was



logically supported for this model by a search of the literature only.

### Analysis Step III: Decomposition of Covariation

The next path analysis step involved developing a decomposition table for the total covariation between pairs of variables, represented by simple  $r$ . As Table 19 indicates, the total causal effect (Column D) for some bivariate relationships, such as  $X_8X_9$  or  $X_3X_5$ , is expressed totally by the direct ( $P_{ij}$ ) causal effect. In other bivariate relationships, such as  $X_6X_9$ , the total causal effect is expressed by the sum of direct and indirect causal effects (Column B + Column C). In relationships which did not include the initiating variable  $X_9$ , spurious (non-causal) effects (Column E) caused by exogenous variables ( $E_i$ ) were detected, causing the total covariation (Column A) to be greater than that expressed by the total causal effect.

### Analysis Step IV: Statistical Significance of the Path Coefficients

The test of the model's generalizeability to a larger population was conducted by the use of ordinary F-tests for the individual coefficients (38:393). The calculated values  $F_s$  for the F-statistic were obtained

from the SPSS computer output and were compared with the F-critical values obtained from F-distribution tables for  $\alpha = .05$ . The results are presented in Table 20.

While an overall  $\alpha = .05$  was assumed to be sufficient for this model, the regression equations for  $X_8$ ,  $X_7$ ,  $X_6$ , and  $X_2$  (see Table 6) required use of the technique of testing the  $F_s$  of each individual source of variation in the equation against an F-critical derived from an equivalent alpha where equivalent alpha = alpha divided by number of independent variables in the equation (e.g.,  $F_{\text{equiv} - \alpha; 1,120} = F_{0.025; 1,120}$  for the  $X_2$  equation in Table 6). For the equations  $X_8$  and  $X_7$ , where there is only one information source artificially divided into three (dummy) variables by the Method of Differences, the  $F_s$  for each of the dummy variables was tested at an equivalent alpha = .0167 ( $F_{.0167; 1,120}$ ). This yielded an F-critical of 5.8915. (This F-critical was computed on a programmable calculator, since no table for alpha = .0167 was available.) As Table 20 indicates, each dummy variable failed to reject  $H_0$  when tested individually. In other words, each dummy variable of project phase ( $X_9$ ), was found to be statistically insignificant when tested alone--for every equation in which  $X_9$  appeared. However, when the three dummy variables were combined (e.g.,  $P_{89(2)} + P_{89(3)} + P_{89(4)}$ ) in order to obtain a true picture of the value of, say, path  $X_8X_9$ , and the total contribution was tested

TABLE 20

## F-TESTS FOR STATISTICAL SIGNIFICANCE

		Assume $\alpha=.05$ to be sufficient for this model.			
		$H_0: P_{ij} = 0$	$H_1: P_{ij} \neq 0$		
Path	Hyp. $H_0$	Std $\beta$	$F_s$	$F_c^*$	Fail to reject/reject
$X_8 X_9$	$P_{89}(2)=0$	-.0184	.032	5.8915	Fail to reject $H_0$
	$P_{89}(3)=0$	-.0889	.735	5.8915	Fail to reject $H_0$
	$P_{89}(4)=0$	.2177	<u>4.391</u>	5.8915	Fail to reject $H_0$
			5.158	2.68 <sup>a</sup>	Reject $H_0$
$X_7 X_9$	$P_{57}(2)=0$	.0996	6.165	5.8915	Reject $H_0$
	$P_{79}(3)=0$	1.0021	623.776	5.8915	Reject $H_0$
	$P_{79}(4)=0$	.5714	<u>201.868</u>	5.8915	Reject $H_0$
			831.809	2.68 <sup>a</sup>	Reject $H_0$

\*NOTE: Due to limitations in the available F-distribution tables, the F-critical values for 120 degrees of freedom in the denominator were used to conduct this test, even though the sample size was 131. The rate of change of the F-statistic value in this portion of the table is sufficiently small that little, if any, error was generated by this convention.

<sup>a</sup>F-critical for overall regression using  $F_{.05;3,120}$ .

<sup>b</sup>F-critical for combined variable using  $F_{.03;3,120}$ .



TABLE 20--Continued

$H_0: P_{ij} = 0$   
 $H_0: P_{ij} \neq 0$

Assume  $\alpha=.05$  to be sufficient  
 for this model.

Path	Hyp. $H_0$	Std. $\beta$	$F_s$	$F_c^*$	Fail to reject/reject
$X_6X_9$	$P_{69(2)}=0$	.2020	3.441	6.85	Fail to reject $H_0$
	$P_{69(3)}=0$	-.0309	.014	6.85	Fail to reject $H_0$
	$P_{69(4)}=0$	.0024	.000	6.85	Fail to reject $H_0$
				3.455	2.093 <sup>b</sup> Reject $H_0$
$X_6X_8$	$P_{68.9}=0$	.0333 <sup>c</sup>	.134	6.85	Fail to reject $H_0$
$X_6X_7$	$P_{67.9}=0$	.1949 <sup>d</sup>	.676	6.85	Fail to reject $H_0$
$X_5X_6$	$P_{56}=0$	-.0480 <sup>e</sup>	.266	3.92	Fail to reject $H_0$
$X_4X_5$	$P_{45}=0$	-0.5731	56.234	3.92	Reject $H_0$

<sup>c</sup>SPSS computer output gives the standard error of  $\beta$  for  $X_6X_8$  as .0037.

<sup>d</sup>SPSS computer output gives the standard error of  $\beta$  for  $X_6X_7$  as .0037.

<sup>e</sup>SPSS computer output gives the standard error of  $\beta$  for  $X_5X_6$  as .6765.

TABLE 20--Continued

$H_0: P_{ij} = 0$ $H_0: P_{ij} \neq 0$		Assume $\alpha=.05$ to be sufficient for this model.			
Path	Hyp. $H_0$	Std. $\beta$	$F_s$	$F_c^*$	Fail to reject/reject
$X_3X_5$	$P_{35}=0$	-0.4448	28.356	3.92	Reject $H_0$
$X_2X_3$	$P_{23}=0$	.5514	.107E18	5.15	Reject $H_0$
$X_2X_4$	$P_{24}=0$	.5743	.116E18	5.15	Reject $H_0$
$X_1X_2$	$P_{12}=0$	.3490	16.921	3.92	Reject $H_0$

with an F-test on the overall regression (using  $\alpha = .05$  to derive the F-critical,  $F_{.05;3,120}$ ), the combined variable project phase was found to be statistically significant for every equation in which  $X_9$  appeared. In other words, the total paths  $X_8X_9$  and  $X_7X_9$  are not null paths, and the data does confirm the validity of those portions of the model (see Table 20).

Equation  $X_6$  in Table 6 includes the three dummy variables plus two other independent variables,  $X_7$  and  $X_8$ . Here the  $F_s$  of each source of variation was tested against F-critical derived from an equivalent  $\alpha = .01$ . Again the three dummy variables were summed together. This time, however, the total contribution was tested with an F-test using  $\alpha = .03$  to derive the F-critical, 2.093 ( $F_{.03;3,120}$ ), and was found to be statistically significant. An equivalent  $\alpha$  of .03 was used because the total contribution of the combined dummy variable was  $3/5$  of the  $\alpha = .05$  for the overall regression. ( $F_{.03;3,120}$  was also computed on a programmable calculator since no table for  $\alpha = .03$  was available.) Note that, although  $P_{67}X_7$  and  $P_{68}X_8$  failed to reject  $H_0$  and are individually considered to be statistically insignificant, they do contribute to the explanatory power of the overall regression.

One other equation,  $X_2$ , required the use of the equivalent  $\alpha$  technique for testing the  $F_s$  of the two source of variation,  $P_{23}X_3$  and  $P_{24}X_4$ . Each independent



variable's  $F_s$  was tested against an F-critical derived from an equivalent  $\alpha = .025$ , taken from an F table for  $\alpha = .025$ . Both sources of variation in the  $X_2$  equation rejected  $H_0$  when tested and were found to be statistically significant.

The only equation which totally failed to reject  $H_0$  and was found to be statistically insignificant was the equation  $X_5$  (see Table 6), which has one independent variable  $X_6$ . Again, the variable level of bureaucracy ( $X_6$ ) appears to contribute nothing to the proposed causal model; it is a null path.

Equation  $X_6$  has two sources of variation which failed to reject  $H_0$ ,  $P_{68}X_8$  and  $P_{67}X_7$ . However, the overall regression is significant since the variable  $X_9$  is statistically significant and the other two variables,  $X_8$  and  $X_7$ , contribute to the regression and their coefficients  $P_{68}$  and  $P_{67}$  are found to be different from zero.

The remaining equations in the model are statistically significant. All equations except  $X_5$  rejected the null hypothesis. Relying on Kerlinger's premise that it is appropriate in behavioral research to "bother" with statistically significant correlation coefficients (or multiple R's) that are at least .10 or greater (26:201), the researchers examined the R (Multiple R on the SPSS computer output) for each of the regressions. The multiple R's are displayed in Table 18 under Calculated Regression

Equations. Note that, with the exclusion of equation  $X_5$ , the smallest R value is .2050 for equation  $X_6$ . These statistically significant R's can provide valuable leads to important relationships in subsequent research. An examination of the R's for the entire model shows the equations involving the behavioral variables (equations  $X_4$  through  $X_1$ ) have generally higher R's than do the equations involving the structural variables. These higher R's indicate that the relationships among the behavioral variables have stronger support than do the relationships among the structural variables, with the exception of organizational size ( $X_7$ ), whose R is .9277. One other exceptional R, 1.0 for equation  $X_2$ , should be noted. This value comes as no surprise since it is a correlation for the equation in which the combination of  $X_4$  and  $X_3$  sum to  $X_2$  by definition, thus creating a complete set of relationships.

#### Restructure of the Model

The variable level of bureaucracy ( $X_6$ ) was identified as contributing little value to the proposed causal model, and indeed the statistical test for the relationship  $X_5X_6$  proved this path to be null. Analysis by project phase categories of the responses to the instrument questions concerning level of bureaucracy revealed unexpected score patterns that differed significantly from those of previous research. These deviant patterns indicate some

difficulty in measuring the variable level of bureaucracy. The instrument which measured level of bureaucracy was developed by Lempke and Mann (29) and had been previously used only on their sample. It has not been subjected to a rigid, controlled validation to establish the end-points of the scale for this variable. Heise suggests that a relationship may be eliminated from a model if a statistical test reveals that the coefficient is either zero or small enough to indicate no effect (19:194). That is, the coefficient indicates that "the magnitude of the effect is so small in relation to other effects that it has no practical or theoretical interest [19:195]." Since the variable level of bureaucracy meets these tests for elimination, the researchers designed an alternative model which would better represent the data being analyzed. In the new model, the variable level of bureaucracy ( $X_6$ ) was dropped and the first three structural variables,  $X_9$ ,  $X_8$  and  $X_7$ , were directly linked to the first behavioral variable organizational climate ( $X_5$ ), as shown in Figure 14.

A modified set of generalized regression equations was developed (see Table 21) which deleted equation  $X_6$  and made the appropriate changes to equation  $X_5$ . New calculated regression equations,  $R^2$  values and R coefficients were obtained (see Table 22). The new effect coefficient  $C_{59}$  was calculated and the decomposition table for the new bivariate relationships was constructed (see Table 23).



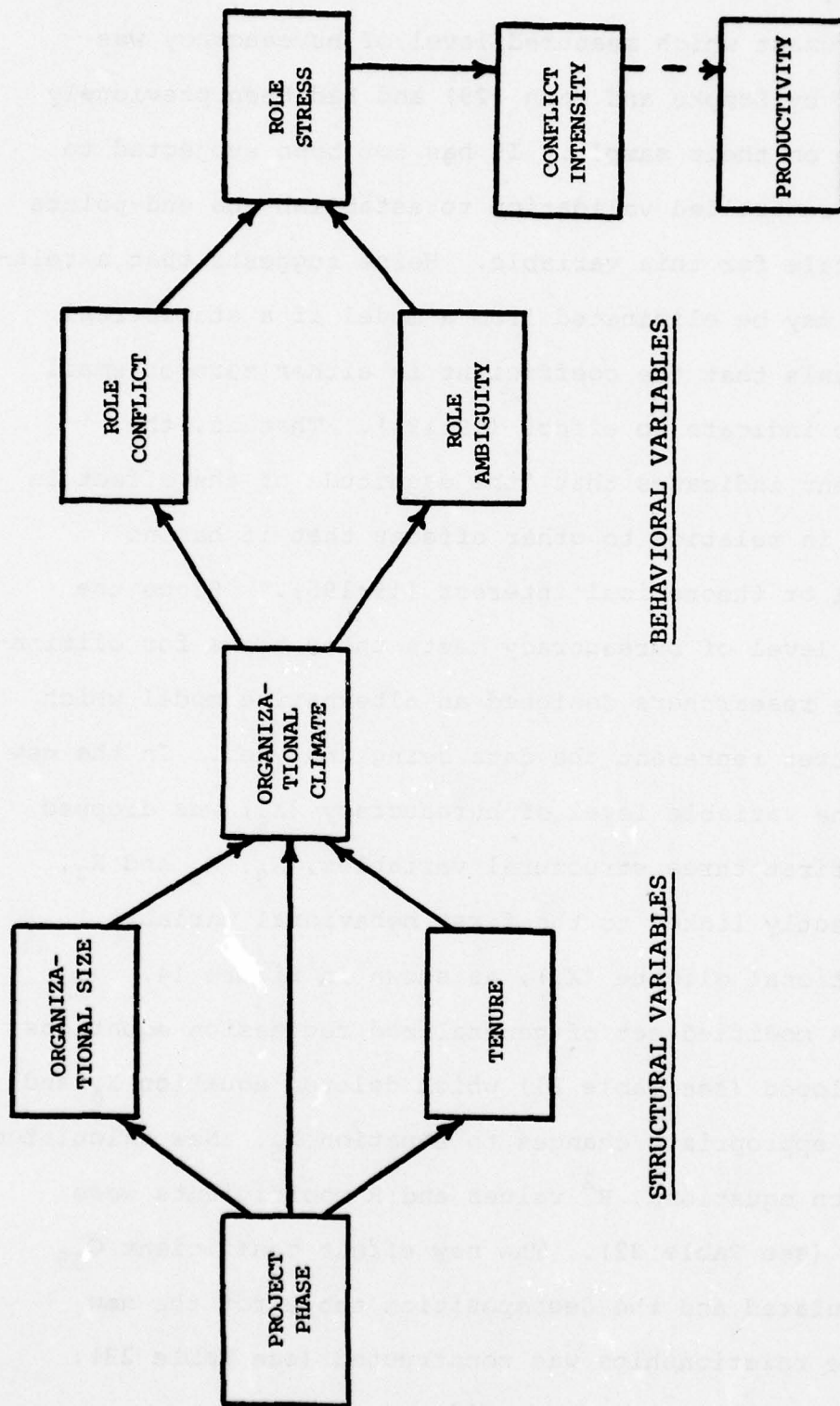


Fig. 14. Revised Proposed Causal Model

TABLE 21

REVISED GENERALIZED REGRESSION EQUATIONS  
FOR THE MODEL IN FIGURE 14

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$$X_9 = E_9$$

$$X_8 = P_{89(2)}X_{9D_2} + P_{89(3)}X_{9D_3} + P_{89(4)}X_{9D_4} + E_8$$

$$X_7 = P_{79(2)}X_{9D_2} + P_{79(3)}X_{9D_3} + P_{79(4)}X_{9D_4} + E_7$$

$$X_5 = P_{57}X_7 + P_{59(2)}X_{9D_2} + P_{59(3)}X_{9D_3} + P_{59(4)}X_{9D_4} + P_{58}X_8 + E_5$$

$$X_4 = P_{45}X_5 + E_4$$

$$X_3 = P_{35}X_5 + E_3$$

$$X_2 = P_{23}X_3 + P_{24}X_4 + E_2$$

$$X_1 = P_{12}X_2 + E_1$$


---

TABLE 22  
REVISED CALCULATED REGRESSION EQUATIONS  
FOR THE MODEL IN FIGURE 14

	<u>R<sup>2</sup> Value</u>	<u>Multiple R</u>
$X_8 = - .0184X_{9D_2} - .0889X_{9D_3} + .2177X_{9D_4}$	.0700	.2646
$X_7 = .0996X_{9D_2} + 1.0021X_{9D_3} + .5714X_{9D_4}$	.8606	.9277
$X_5 = .5694X_7 - .0647X_{9D_2} - .5813X_{9D_3} - .2002X_{9D_4} - .2029X_8$	.0970	.3114
$X_4 = -.5731X_5$	.3284	.5731
$X_3 = -.4448X_5$	.1978	.4448
$X_2 = .5414X_3 + .5743X_4$	1.0	1.0
$X_1 = .3490X_2$	.1218	.3490



TABLE 23

## REVISED DECOMPOSITION TABLE

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal			Noncausal (E) A ~ D
			Direct (B)	Indirect (C)	Total (D) B + C	
A	$X_8 X_9 D_2$					
	$X_8 X_9 D_3$					
	$X_8 X_9 D_4$					
	$X_7 X_9 D_2$					
	$X_7 X_9 D_3$					
	$X_7 X_9 D_4$					
BB	$X_5 X_9 D_2$	$r_{59(2)}$ = (.1251)	$P_{59(2)}$ = (.0647)	$P_{79(2)} (P_{57})$ + $P_{89(2)} (P_{58})$ = (.0605)	$r_{59(2)}$ = (.1251)	None

SAME AS TABLE 19

TABLE 23--Continued

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal			Noncausal (E) A - D
			Direct (B)	Indirect (C)	Total (D) B + C	
BB (cont)	$X_5 X_9$ $D_3$	$r_{59(3)}$ = (1.1699)	$P_{59(3)}$ = (.5813)	$P_{79(3)} (P_{57})$	$r_{59(3)}$	None
				+ $P_{89(3)} (P_{58})$ = (.5886)	= (1.1699)	
	$X_5 X_9$ $D_4$	$r_{59(4)}$ = (.5697)	$P_{59(4)}$ = (.2002)	$P_{79(4)} (P_{57})$	$r_{59(4)}$	None
				+ $P_{89(4)} (P_{58})$ = (.3695)	= (.5697)	
CC	$X_5 X_8$	$r_{58}$ = (1.1673)	$P_{58}$ = (.2029)	None	$P_{58}$	$r_{58} - P_{58}$ = (.9644)
					= (.2029)	
	$X_5 X_7$	$r_{57}$ = (.9427)	$P_{57}$ = (.5694)	None	$P_{57}$	$r_{57} - P_{57}$ = (.3733)
					= (.5694)	

TABLE 23--Continued

Analysis Section	Bivariate Relationship	Total Covariation (A)	Causal		
			Direct (B)	Indirect (C)	Total (D) B + C
					Noncausal (E) A - D
E	$X_5 X_6$				
	$X_4 X_5$				
	$X_3 X_5$				
	$X_2 X_3$				
	$X_2 X_4$				
F	$X_1 X_2$				

RELATIONSHIP DELETED

SAME AS IN TABLE 19



The path relationships stemming from  $C_{59}$  were tested for statistical significance using the same F-criticals that were used to test each F-statistic for the previous relationships comprising  $C_{69}$ , (see Table 24), since the structure for equation  $X_5$  was identical to the structure for the old equation  $X_6$ .

In the new decomposition table, Analysis Sections A, E, and F do not change. The altered analysis sections are labeled BB and CC. BB displays the bivariate relationships  $X_5X_{9_{D_2}}$ ,  $X_5X_{9_{D_3}}$ , and  $X_5X_{9_{D_4}}$  and the resulting direct, indirect, and total causal effects. Analysis Section CC presents the bivariate relationships  $X_5X_8$  and  $X_5X_7$  and the resulting direct and total causal effects. Section D has been eliminated altogether. A comparison of Total Covariation columns for the Analysis Sections B versus BB and C versus CC reveals that both BB and CC have higher values, overall, for total covariation than do Sections B and C of the first decomposition table. It is interesting to note that while some direct path coefficients for  $C_{59}$  were smaller than those for  $C_{69}$ , the indirect path coefficients for  $C_{59}$  were much larger than those for  $C_{69}$ , thus enabling the total covariation values for Sections BB and CC to be higher than those for Sections B and C (see Tables 20 and 24).

TABLE 24  
REVISED F-TESTS FOR STATISTICAL SIGNIFICANCE

$H_0: P_{ij} = 0$ $H_1: P_{ij} \neq 0$					Assume $\alpha = .05$ to be sufficient for this model.	
Path	Hyp. $H_0$	Std $\beta$	$F_s$	$F_c$	Fail to reject/reject	
$X_8 X_9$	SAME AS IN TABLE 20					
$X_7 X_9$						
$X_5 X_9$	$P_{59(2)} = 0$	-.0647	.337	6.85	Fail to reject $H_0$	
	$P_{59(3)} = 0$	-.5813	5.160	6.85	Fail to reject $H_0$	
	$P_{59(4)} = 0$	-.2002	1.283	6.85	Fail to reject $H_0$	
				6.780	2.093	Reject $H_0$
$X_5 X_8$	$P_{58.9} = 0$	-.2029	4.811	6.85	Fail to reject $H_0$	
$X_5 X_7$	$P_{57.9} = 0$	.5694	5.932	6.85	Fail to reject $H_0$	
$X_5 X_6$	RELATIONSHIP DELETED					
$X_4 X_5$						
$X_3 X_5$						
$X_2 X_3$						
$X_2 X_4$						
$X_1 X_2$						
	SAME AS IN TABLE 20					

The F-statistics for the dummy variables from the new equation  $X_5$ , when tested individually with F-criticals of  $F_{.01;1,120}$ , failed to reject  $H_0$  just as all the individual dummy variables in the other equations did. As in the old equation  $X_6$  (and like the combined dummy variables in the other equations), the  $F_s$  for the combined dummies in the new  $X_5$  equation rejected  $H_0$  when tested with the F-critical  $F_{.03;3,120}$ . Overall, the standard beta coefficients and F-statistics for the new equation  $X_5$  had higher values than did those for the old equation  $X_6$ , so it can be attested that removing the variable  $X_6$  did strengthen the model, even though the "partial paths"  $X_5X_8$  and  $X_5X_7$  did fail to reject  $H_0$  when tested with an F-critical of  $F_{.01;1,120}$ . Certainly the multiple R (.3114) for the new equation  $X_5$  is higher than the R (.2050) for the equation  $X_6$  (old). The higher R indicates that the causal relationship between project phase ( $X_9$ ) and organizational climate ( $X_5$ ) has more significance than the causal relationship between project phase ( $X_9$ ) and level of bureaucracy ( $X_6$ ).

#### Discussion

In the analysis and comparison of the new data relative to the past findings, the researchers observed that the data were mutually supportive across studies with respect to most of the major variables under



investigation. Tenure among respondents was virtually identical across studies. Consistency in respondent tenure would tend to indicate that program manager assignment policies have not changed appreciably from earlier practices. Nearly 65 percent of the military program managers sampled had two years or less tenure in their respective SPOs. Although difficult to assess, disruption within program organizations due to frequent assignment rotations may have an adverse impact on the productivity of SPOs in general. As previously discussed, the success of the work effort in a program organization often depends upon the program manager's personality and his ability to develop informal relationships to offset shortcomings in formal organizational structures and procedures. Insufficient tenure among military personnel may compel the SPOs to formalize and routinize the tasks performed by program managers. Although such action would enhance the substitutability of SPO managers, it might also limit the ability of Air Force SPOs to adapt to changing program requirements. Note that this adaptive ability is a key characteristic that makes a project or program type of organization useful.

Previous findings relative to organizational climate were generally supported in this research. The question-by-question response profile exhibited a consistent pattern across studies (see Figure 12). However,

two aspects of the findings warrant additional discussion. First, organizational climate scores for the present sample of program managers were generally lower than was evidenced in past research. Although not significant in a statistical sense, the present findings may reflect a gradual trend toward a System 1 or 2 type of organizational climate. As previously discussed, Systems 1 and 2 organizations are typically authoritarian and exhibit many qualities characteristic of functional or bureaucratic organizations. If in fact this is an actual trend, one might conclude that program managers may eventually find themselves operating in an environment which does not possess the flexibility needed to adapt to complex and changing program requirements.

A second aspect of the findings relates to the level of organizational climate perceived in different life-cycle categories. Unlike the findings reported by both Larson and Ruppert (27) and Haddox and Long (16), no significant differences in organizational climate were perceived by the present sample of program managers when examined between categories (see Figure 11). The relatively consistent level of organizational climate between life-cycle phases was unexpected and may itself be significant. Normally, program organizations should be tailored to meet the unique requirements of a given weapon system development effort. Further, one would expect that

certain changes in the SPO organization would occur as the weapon system progressed from one phase of development to the next, thus changing the tasks to be performed. However, these expectations to an extent depend on the freedom given the program manager to organize his program office. A military program manager may be encumbered by rules, procedures, and other limitations imposed upon him by the parent organization. Conceivably, the program manager's ability to select a unique organizational approach may be limited to the extent that organizational differences between SPOs are minimized. If this is the case, a program organization may be hampered in its ability to adapt to changing program requirements.

Analysis of the present data generally supported the Lempke-Mann findings relative to role conflict, role ambiguity, and role stress. As previously discussed, no significant differences in mean levels of stress, conflict, or ambiguity were observed in the analysis by life-cycle categories. However, one is reminded that these are summary variables comprised of many related but nonetheless unique elements. Miles has supported by research (35:337-338) that the variables role conflict, role ambiguity, and role stress may remain at relatively stable levels while the sources of these variables may change. Miles suggested that focus should be placed on the sources of role conflict, role stress, and role ambiguity. It is possible that a set



of circumstances similar to those reported in Miles' study were operative in the present sample.

Although support could be inferred for most of the variables investigated in previous studies, the researchers were limited in their ability to generalize the present findings to past research efforts for three of the variables under study. Specifically, support could not be drawn for organizational size, level of bureaucracy, and conflict intensity across program life-cycle phases.

The findings relative to organizational size did not support the previous research efforts. Noticeable differences in SPO sizes were evident in Categories II and IV in relation to past findings. However, one must keep in mind the fact that this study was cross-sectional in nature. As such, the data relative to size does not reflect the actual changes in size as a SPO proceeds from one phase of the life cycle to the next. Rather, the data reveals the differences in size by life-cycle category for a number of SPOs at a particular point in time. As explained earlier, extenuating circumstances involving major program changes or delays, apparently distorted normal or expected program requirements, and consequently the number of personnel normally required to support program objectives.

The present data did not support the previous findings relative to the level of bureaucracy. As discussed earlier in this chapter, the general pattern of sample

responses was consistent across studies when analyzed on a question-by-question basis. However, when the data was examined by life-cycle category, significant and inexplicable differences were noted between the present research and the Lempke-Mann study. Serious questions relative to the validity of the survey instrument were raised. Additionally, limited testing of the instrument placed a severe restriction on the researchers with respect to making meaningful interpretations of the data. Thus, any conclusions on the level of bureaucracy would be unwarranted and premature without further testing and evaluation of the instrument. As a result, the model being tested by path analysis was modified and retested after eliminating this variable.

The third variable in which the present data did not support that of past research was conflict intensity. As previously discussed, adjustments were made to the Lee and Eschmann instrument, thereby making it difficult to determine whether the generally higher levels of conflict intensity evident in this study identified actual perceptual changes in the sample, resulted from bias due to the altered instrument, or represented a combination of these factors. If in fact the difference reflects a change in the perceived level of conflict intensity among the sample of program managers, responsible personnel in the individual SPOs and Aeronautical Systems Division

should attempt to isolate and resolve the primary sources of conflict in the program organizations.

One of the objectives of this research effort was to synthesize prior findings relative to major organizational variables into a more comprehensive perspective of program organizations as they progress through the project life cycle. Seeking a vehicle for the synthesis effort, the researchers selected a causal model that depicted their proposed set of relationships for the previous studies' major variables, as inferred from the literature. The path-analytic technique chosen to test this causal model does support the relationships that were proposed from the previous studies. The path analysis regressions produced correlation coefficients (multiple R's) which were all .2 or better and were statistically significant, with one exception: the relationship of level of bureaucracy to organizational climate ( $X_5X_6$ ) (see Tables 18 and 20 and Figure 13). Excepting the  $X_5X_6$  relationship, the multiple R's are adequate to allow inferences to be drawn in support of both previous research results and future research efforts.

It is interesting to note that while the structural relationships had adequate multiple R's (except level of bureaucracy), the behavioral relationships had generally higher multiple R's than did the structural relationships (see Table 18). (Although equation  $X_7$  has a startling



multiple R of .9277, inferences regarding organizational size ( $X_7$ ) in relation to project phase ( $X_9$ ) should be approached cautiously, bearing in mind the cross-sectional nature of the data as previously discussed.)

Of particular interest were the strong inverse relationships between organizational climate and both role ambiguity (equation  $X_4$ , Table 18) and role conflict (equation  $X_3$ , Table 18). Equation  $X_4$  had a multiple R of .5731 while equation  $X_3$  had a multiple R of .4448. Since role ambiguity and role conflict sum to role stress by definition (Equation  $X_2$ ), it can be inferred that role stress also has a strong (inverse) relationship with organizational climate. Thus, the amounts of role ambiguity, role conflict and role stress decrease as improvement in organizational climate is perceived. Although these relationships appear to be logical, the literature did not directly address organizational climate in relation to role ambiguity and role stress. Therefore, such strong correlations (strong for sociological data) among these variables were not anticipated by the researchers.

The path relationship between role stress and conflict intensity is statistically significant. This indicates that role stress does contribute to conflict intensity. However, since for every unit increase in role stress ( $X_2$ ), conflict intensity ( $X_1$ ) increases only .3490 units, it is evident that there are other sources not

analyzed in this model which also contribute to conflict intensity, such as personality, manpower resources, and program priorities.

Statistical testing of all the causal paths involving the level of bureaucracy variable showed all those paths except the  $X_6X_9$  direct path to be statistically insignificant. Because (1) it was not possible to generalize from this study's level of bureaucracy data to the corresponding data in the Lempke-Mann study, (2) the level of bureaucracy portion of the instrument exhibited only logical and face validity and had not been widely tested and evaluated, and (3) the path analysis failed to provide significant inference for most of the relationships involving this variable, it was decided that level of bureaucracy should be dropped from the model. Proceeding with the theory that organizational climate could serve as a conceptual bridge between the structural variables and the human or behavioral aspects of a program organization, the researchers revised the causal model (see Figure 14). The revised model directly relates project phase, tenure, and organizational size to organizational climate. The path analysis of the revised regression equation  $X_5$  revealed larger path coefficients (direct and indirect causal paths) and total effect coefficients than did the former  $X_6$  equation (see Columns B, C, and D, Table 23). It was thus felt that the revised model was an improvement

over the original model, even though the F-tests on the  $X_5X_8$  and  $X_5X_7$  paths demonstrated statistical insignificance. If the F-statistics for these two relationships could have been tested at the overall alpha level of .05 rather than the equivalent alpha of .01, they would have been statistically significant.

This chapter has compared the current findings with those of previous studies and found that for most of the variables, the current data was consistent with that of the past. Thus, generalizations from the present research effort to the previous studies can be made for six of the nine variables under study. The path analysis of the causal model indicated that the proposed relationships between the past studies' major variables did exist and provided strong inferences on which to base future research.



## CHAPTER V

### REVIEW, CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY

Managing Air Force weapon system acquisition programs is an extremely complex and demanding undertaking. Any number of organizational variables are constantly changing and interacting across the life cycle of an acquisition program. Although many studies had investigated the effects of individual organizational variables on the productivity of Air Force SPOs, no attempt had been made to synthesize and examine the pattern of relationships among these variables. With this impetus, this study sought to (1) synthesize prior findings relative to nine major organizational variables into a more comprehensive perspective of program organizations as they progress through the project life cycle, and (2) through the synthesis process, create new information about the causal relationships involved to supplement the prior findings.

#### Review

The variables project phase, organizational size, tenure, level of bureaucracy, organizational climate, role conflict, role ambiguity, role stress, and conflict intensity formed the basis for the study. The sample was

selected from a population of military and civilian program managers assigned to SPOs within Aeronautical Systems Division (ASD). The sample was stratified into four life-cycle categories according to the phase of the weapon system acquisition process in which each SPO was functioning at the time of the survey. Data was gathered via a composite questionnaire assembled from portions of four previous studies' instruments. Only those portions of the previous questionnaires which measured the organizational variables of interest in this study were incorporated into the composite questionnaire, which is presented in Appendix A.

The vehicle used to synthesize the prior findings was a proposed causal model of the relationships among the nine variables selected for this study. The model's causal relationships were evaluated using a path-analytic technique to determine the validity and statistical significance of the proposed relationships.

The major research question which the causal model and the survey questionnaire were designed to answer is: *How does the management environment of major weapon system acquisition organizations change as the programs progress through their life cycles?* Related questions were formulated to facilitate "phased" answering of the major research question. The resulting conclusions follow.

1. *How does each specific program phase and its related activities affect other structural variables, such as organizational size, level of bureaucracy, and tenure?*

Analysis of the data revealed significant differences in organizational size in most adjacent and all non-adjacent program phases. Although program managers perceived significant differences in the level of bureaucracy between initial program phases and the full-scale development phase, questions relative to the validity of the instrument limited the ability of the researchers to make meaningful conclusions concerning this variable. Tenure was observed to remain relatively constant across program phases, reflecting current Air Force assignment rotation policies.

2. *How does level of bureaucracy affect organizational climate?*

The path analysis of the causal model revealed a null, statistically insignificant path for this particular relationship, suggesting that level of bureaucracy had little or no effect on organizational climate in these data. The researchers harbor doubt that this is actually a valid conclusion because of certain difficulties encountered with the measuring capability of the level of bureaucracy portion of the questionnaire. (A recommendation for validating this portion of the instrument appears in the next section of this chapter.) Further investigation



of this variable must be conducted before a definite conclusion can be reached.

3. *How does organizational climate affect role conflict, role ambiguity and through them, role stress?*

Analysis of the data by program phase revealed no significant differences in program managers' perceptions of organizational climate, role conflict, role ambiguity, or role stress. That these variables remained at relatively consistent levels across program phases was unexpected and may represent an important finding. Based upon a comprehensive review of the literature, it was presumed that role conflict, organizational climate, role stress, and role ambiguity would be closely related to technical aspects of the acquisition process. Since technical requirements are known to vary considerably from one phase of weapon system development to the next, it was anticipated that these changes would be reflected in the data when examined by phase. The fact that no significant differences in these variables were observed between life-cycle phases suggests that conflict, stress, ambiguity, and climate are functions of variables not directly related to the actual technical job.

The question then becomes one of isolating those factors which moderate the differences between life-cycle phases for these behavioral variables. For example, it was noted that the average tenure among respondents was

less than two years in a SPO assignment. In order to insure substitutability for its program managers due to frequent assignment rotations, it would appear logical to assume that many program responsibilities would be standardized or functionalized via formal policy guidance or regulations. Although such an approach would help maintain program continuity, functionalization might also limit the ability of individual SPOs to adapt to unique program requirements. That is, organizational climate, role conflict, role ambiguity and role stress may vary as a result of overriding Air Force variables, and thus be independent of changes within the SPOs themselves. The path analysis revealed strong inverse relationships between organizational climate and the other behavioral variables listed in the question. The relationship between organizational climate and role ambiguity demonstrated an effect coefficient and a statistically significant multiple R of .5731; the path between organizational climate and role conflict revealed an effect coefficient and a multiple R of .4448. A similar strong relationship is inferred between organizational climate and role stress, since by definition role stress sums up role ambiguity and role conflict. The actual effect is that as organizational climate is perceived to improve, levels of role conflict, role ambiguity and role stress decrease.

4. *What level of conflict intensity is generated by role stress across the program phases?*

No significant differences in the level of conflict intensity were observed across program phases. Path analysis revealed an effect coefficient and a statistically significant multiple R of .3490 between role stress and conflict intensity, indicating that as role stress increases by one unit, the frequency with which program managers encounter conflict situations increases by .3490 units. Thus, approximately 12 percent of conflict intensity is explained by role stress. While role stress is an important single contributor to conflict intensity, other sources of conflict not addressed in the model also contribute to conflict intensity.

5. *Can support be drawn for proposed causal relationships among the variables?*

Path analysis of the causal relationships validated all the *direct* causal relationships except that between level of bureaucracy and organizational climate with statistically significant multiple R's of .2 or greater. These multiple R's are large enough to allow inferences to be drawn to support future research; they also indicate quantitative support to supplement the logical support found in the literature for the proposed causal relationships. Certain relationships which



constituted only "partial paths" in the model, such as the relationships of tenure and organizational size to level of bureaucracy, or tenure and organizational size to organizational climate (in the revised model), failed their statistical significance tests and are considered null paths individually. These relationships do contribute significant indirect paths to the more complex relationships, however. The revised causal model supports all of its causal relationships.

### Conclusions

The reader is reminded that it is inappropriate to generalize from a single study. Although the present findings are generally supported by previous research, further study should be conducted and support for the causal relationships confirmed before action is taken relative to these findings. However, the results of this analysis may have significant implications for the future directions of military program management. Based upon the present findings it is evident that structural variables have a significant effect on behavioral outcomes. Although behavioral variables are difficult if not impossible to manage directly, program managers and their superior military officials do control many structural factors which are operative in program offices. The model developed in this study clearly indicates that if

certain structural conditions are known, then behavioral consequences can be predicted with some degree of certainty. Therefore, by controlling these structural variables, program managers may be able to indirectly influence many of the behavioral variables common to their program organizations. A brief re-examination of the causal model will help to illustrate this point.

Tenure policies in the military have long been a subject for debate. It has been suggested that the development of the military structure into a giant bureaucracy is due to the frequent rotation of personnel, which results in increased reliance on rules and regulations to allow for an interchangeability of personnel, and less reliance on personal and group initiative. Civilian industry has generally recognized that people can contribute more to an organization after they have been in a position long enough to understand its purpose and the details of its function. However, it has also been argued that increased tenure leads to increased functionalization of tasks and less dependence on other organizational personnel for task accomplishment.

The results of the data analysis tend to support the latter argument. The inverse relationships exhibited between program phase and organizational climate and between tenure and organizational climate indicate that over time a program manager tends to rely less upon a

participative or consultative management style and more upon an authoritative and independent approach to task accomplishment. Whether this tendency reflects a greater awareness of job requirements and less dependency on the expertise of others or a tendency for program managers to withdraw from the goals and activities of the program organization over time cannot be determined based on available data. In any event, the inverse relationships between climate and role conflict and between climate and role ambiguity suggest that a more authoritative, independent approach to task accomplishment leads to greater perceived levels of role conflict and role ambiguity and, consequently, role stress. Further, the direct relationship between role stress and conflict intensity suggests that as stress increases, a program manager perceives a greater incidence of conflict situations emanating from program activities and organizational participants.

This sequence of relationships has a certain logical appeal when one considers the dynamic nature of the program environment. Although task functionalization and independent action among the components of an organization may work well in a stable environment, such an approach is not congruent with the complex and ever-changing requirements of a weapon system acquisition effort. A program manager who tries to routinize his activities may run the risk of losing touch with current



program objectives as these objectives evolve. Further, functionalization in one area of a program office may hamper complete integration of total organizational activities, thereby increasing interdepartmental conflict and reducing the program's overall productivity.

The Air Force should strive to obtain the benefits of the inherent creativity that experienced program managers can apply to a job. The Air Force should also be concerned with the demonstrated tendency to functionalize activities over time on both an individual and organizational basis. Program organizations should establish a structure which fosters open communication and participative action in all directions. This structure should be designed such that a degree of dependency and interaction among all components of the program organization is an absolute requirement for program success throughout the acquisition process. Group decision making should be encouraged. These and similar actions should help insure that program managers not only understand the function and purpose of their own activities but also the relationship of those activities to other components and to program objectives over time.

Attention should also be focused on preventing functionalization of the program offices themselves. Just as individuals tend to functionalize tasks over time, organizations tend to routinize activities through the use

of rules, regulations, and operating instructions. As discussed previously, care should be taken to avoid limiting the responsiveness and adaptability of program organizations through over-regulation of these functions. By avoiding the restrictions and constraints of bureaucratic organizations, program offices can concentrate their full energies on achieving the desired end product at less cost and within time limitations.

Analysis of the data pertaining to organizational size revealed several inconsistencies between this and previous research on military program organizations. Additionally, the relationship between size and organizational climate exhibited in the causal model did not correspond to expected results. Previous researchers had concluded that large organizations were generally more bureaucratic and authoritative than were small organizations. Therefore, the researchers expected an inverse relationship would be revealed between size and climate in the present study. Instead, analysis of the data indicated a tendency for climate to improve as organizational size increased. A definitive explanation of this particular outcome cannot be made based on the quantitative data available. However, several factors may have influenced the relationship between size and climate. As such, these functions warrant further discussion and examination.

The first possibility is that unique circumstances were operative at the time the survey was conducted. Such an unusual situation may have distorted not only the normal size that would be expected in SPOs in various program phases but also the relationship between size and climate. In fact, this was the case, as discussed in Chapter IV. The unique distribution of SPO sizes experienced in this study, together with the reduced pressure for performance which existed in two of the larger SPOs which had been placed in a "hold" status, may have significantly biased the relationships with size reported in this study.

An alternate factor that may have contributed to the direct relationship exhibited between organizational size and organizational climate could have been the influence of co-located personnel on program managers' perceptions of organizational climate. The matrix form of organization has recently been expanded to include many functional specialties formerly under the direct control of individual SPO directors. It may be that the smaller SPOs have a greater proportion of co-located functional personnel than do the larger program offices. Given the natural conflict situation that exists between program and functional elements, and the additional regulations established to govern functional/project interfaces, a high percentage of co-located personnel may have had a strong influence on the attitude of program managers to



their respective SPOs. Unfortunately, although it is known that some co-located personnel contributed to the data for this study, there is no way to identify these individual cases or to determine the percentage of the response they represent.

### Recommendations for Future Research

#### The Variable Level of Bureaucracy

The researchers are unable to determine whether the variable level of bureaucracy was accurately measured. The data resulting from this study were not consistent with and could not be generalized to the previous findings on level of bureaucracy. Speculation on this problem suggests that an anchor point for establishing the range of scores obtained from the instrument is needed. Future research efforts should establish two matched groups--one clearly defined and identified as strictly functional managers and the other identified as purely project managers. That portion of the instrument which addresses level of bureaucracy should then be administered to both groups and the results compared in order to validate the instrument itself and determine the range of scores to be expected from the instrument.

#### The Variable Tenure

It is recognized that there are several possible measures of tenure. Future studies should examine

historical data to ascertain the amount of time each SPO has operated in each phase, up to and including its current phase of the weapon acquisition process. Respondents should be queried as to the amount of time each has spent (1) with the SPO, (2) in the present job, (3) in the current phase of the SPO, and (4) in the Air Force. The analysis could then compare the results of each measure of tenure to determine which aspect has the most significant impact on the remaining variables.

#### The Variable Productivity

Although productivity appears as a variable in the causal model, it was not included in the nine major variables. The instrument therefore did not collect data on the relationship of productivity to conflict intensity or its relationship to other variables in the model. Since the literature affords some support for such relationships, future researchers are encouraged to explore this area. A clearly established relationship between the variables studied here and productivity would greatly increase the value of these research findings to the Air Force.

#### Alternative Causal Data Analytic Methods

Path analysis is only one of several causal investigation techniques. A particular technique which would permit further exploration of both this study's data results

and the findings of prior thesis efforts is cross-lagged correlation. Cross-lagged correlation analyzes a collection of identical measures of the same variables at two points in time. Because this method does not require *a priori* specification of which variable is causal, it would be valuable in identifying which variables *should be* related to each other, as well as the strength of those relationships. Such an analysis would confirm or deny in detail the validity of the causal relationships studied here.

#### Subordinates and Co-located Personnel

Historically, research into program organizations within Aeronautical Systems Division has focused on the program manager to the exclusion of subordinate and co-located personnel. Future research might address these "non-program manager" personnel specifically to determine whether significant differences exist between them and program managers in terms of perceptions relative to the program environment. The existence of significant differences in perceptions could indicate areas where dysfunctional conflict among program managers and other personnel could be reduced, enabling the program organization to improve overall productivity.



### Final Thoughts

Integrating the technical requirements of weapon systems acquisition with the organizational aspects of program management is a difficult proposition at best. If the Air Force is to improve its approach to weapon system acquisition and achieve greater levels of productivity, it must first understand the complex interactions that occur among structural and behavioral factors throughout the life of a program. This is true because productivity is essentially driven by the behavioral aspects of the situation. To obtain the best technical results from its program managers, the Air Force must provide these people with the necessary time and training so that they may better understand their jobs. The Air Force should act to encourage innovative management practices among the various program offices. Most importantly, the Air Force must understand that no "canned" managerial strategy can satisfy the diverse requirements of any given weapon system acquisition effort. Uniqueness between program offices is not only desirable but often a mandatory aspect of successfully accomplishing program objectives. Such uniqueness should be encouraged. Finally, the Air Force should promote continued research into structural and behavioral aspects of military program management. The many technical/organizational interactions may be complex, but

research can provide insight that will make this interface more tenable.

APPENDICES



APPENDIX A  
SURVEY INSTRUMENT AND RELATED DOCUMENTS

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AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
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24 February 1978

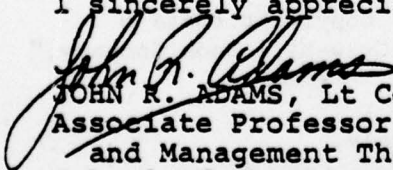
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Associate Professor of Organization  
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March 2, 1978

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Sincerely,

A handwritten signature in cursive script, appearing to read "Pat Colomban".

Pat Colomban (Mrs.)  
Permissions Supervisor  
Copyrights & Permissions Dept.

C:p



DEPARTMENT OF THE AIR FORCE  
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433



REPLY TO  
ATTN OF: LSGR (LSSR 31-78B)/Capt. C. Noyes/Capt. T. Parker/  
AUTOVON 78-55023  
SUBJECT: Program Management Questionnaire

TO:

1. The attached questionnaire was prepared by a research team at the Air Force Institute of Technology, Wright-Patterson AFB, Ohio. The purpose of the questionnaire is to acquire data concerning program managers' perceptions of key organizational variables which may affect the appropriateness of applying various management control techniques in different phases of the weapon system acquisition cycle.

2. You are requested to provide an answer for each question. Headquarters USAF Survey Control Number 78-97 has been assigned to this questionnaire. Your participation in this research is voluntary.

3. Your responses to the questions will be held confidential. Please remove this cover sheet before returning the completed questionnaire. Your cooperation in providing this data will be appreciated and will be very beneficial in examining the environment in which a program manager works. Please return the completed questionnaire in the attached envelope within one week after receipt.

*Henry W. Parlett*  
HENRY W. PARLETT, Colonel, USAF  
Associate Dean for Graduate Education  
School of Systems and Logistics

2 Atch  
1. Questionnaire  
2. Return Envelope

### PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

- (1) 5 U.S.C. 301, Department 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) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and/or DOD.

c. Routine Uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in written master's theses and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntary.

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.

## SURVEY OF PROGRAM MANAGEMENT

1. This survey of Program Management perceptions will provide data for use in an Air Force Institute of Technology student thesis project. The questionnaire is divided into five parts and will take approximately 20 minutes to complete.
  - (a) Part one consists of general duty information.
  - (b) Part two contains questions that ask you to describe your primary duties.
  - (c) Part three contains questions that ask you to indicate your feelings about your job.
  - (d) Part four contains questions that ask you to provide your opinion about certain characteristics of your organization.
  - (e) Part five contains one question that asks you to indicate, for seven different sources of conflict, the amount of conflict in your organization.
2. The questionnaire is not intended to assess organization or individual performance. All responses will be held in the strictest confidence. Individuals or SPO organizations will not be associated with any of the data.
3. There are no "trick" questions. Please answer each item as honestly and frankly as possible. There are no right or wrong answers. The important thing is that you answer each question the way you see things or the way you feel about them.
4. Your cooperation and assistance in completing this questionnaire will be appreciated.

This survey is to be used for research purposes only. It is not to be used without the permission of the School of Systems and Logistics and/or the authors.

USAF SCN 78-97 (Expires 30 August 78)



PART I

GENERAL DUTY INFORMATION

PLEASE PRINT

DUTY ORGANIZATION (SPO) \_\_\_\_\_

MILITARY RANK OR CIVILIAN GRADE \_\_\_\_\_

JOB TENURE:

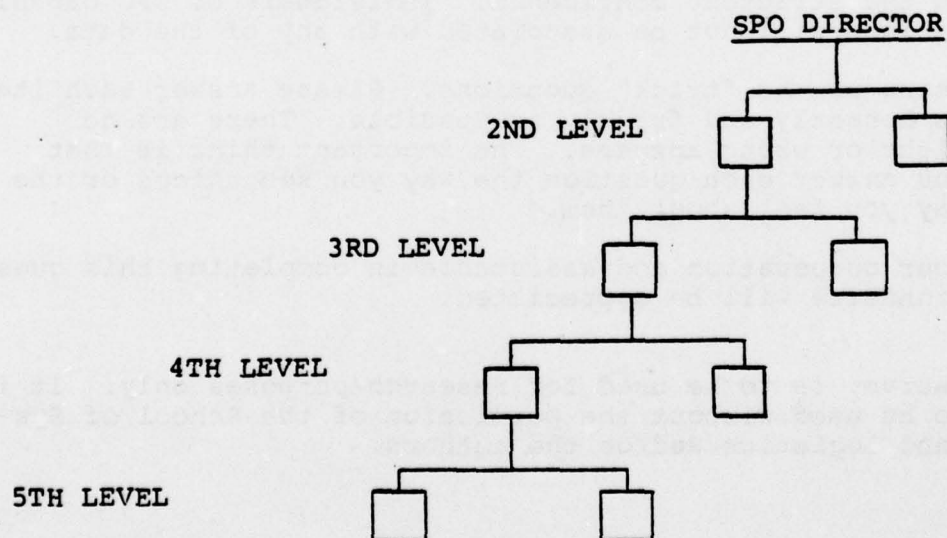
NUMBER OF MONTHS IN PRESENT POSITION: \_\_\_\_\_ MOS.

NUMBER OF MONTHS ASSIGNED TO PRESENT SPO: \_\_\_\_\_ MOS.

LENGTH OF TIME YOU HAVE WORKED WITH THE USAF:  
\_\_\_\_\_ YEARS AND \_\_\_\_\_ MOS.

WAS THERE A PERIOD OF JOB OVERLAP BETWEEN YOU AND  
THE LAST JOB INCUMBENT WHEN YOU ASSUMED YOUR PRESENT  
POSITION (YES/NO)? \_\_\_\_\_  
IF SO, HOW MUCH \_\_\_\_\_ MOS.

ORGANIZATIONAL LEVEL. PLEASE PLACE A CHECKMARK IN THE BOX  
IN THE FOLLOWING ORGANIZATIONAL CHART THAT BEST CORRESPONDS  
TO THE LEVEL OF YOUR DUTY ASSIGNMENT.



PART II

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO DESCRIBE  
HOW YOU CARRY OUT YOUR PRIMARY DUTIES.

Please put a checkmark in the box which is the most accurate description of your primary duties. The job descriptions presented represent the outermost boxes. The five intermediate boxes represent degrees of "inbetweenness" of the descriptions.

1. To what extent do you work outside of the chain-of-command of your organization to discharge your primary duties?

--	--	--	--	--	--	--

I can discharge all my primary duties by working strictly within the chain-of-command.

My primary duties require frequent use of horizontal and diagonal contacts that are outside of my specific chain-of-command.

2. To what extent do your primary duties require you to coordinate activities through a common supervisor who directly controls the activities of most groups contributing to the overall goal of your organization?

--	--	--	--	--	--	--

I only coordinate activities with my supervisor who has responsibility for a group of activities having the same overall goal.

My primary duties require me to personally coordinate activities across functional and organizational lines to accomplish an overall organizational goal.

3. To what extent do you determine how the objective of your job will be accomplished?

--	--	--	--	--	--	--

Specific procedures dictate exactly what I am supposed to do.

I am allowed to determine the best way to accomplish the objectives of my job.

4. To what extent do you accomplish your primary duties by dealing with people outside of your immediate working unit (branch, section, etc.)?

--	--	--	--	--	--	--

I work only with people within my working unit.

I work with people outside of my working unit frequently.

5. To what extent can you rely on previously developed methods of procedures to accomplish your primary duties?

--	--	--	--	--	--	--

My primary duties are generally repetitive, routine, and proceduralized.

I must search for new methods and ideas in order to accomplish each duty. They vary so much that they cannot be proceduralized.

6. To what extent do you deal with groups outside of the strict chain-of-command in order to accomplish your primary tasks?

--	--	--	--	--	--	--

I accomplish all my primary duties by working solely with my supervisor and my subordinates.

My working contacts vary in the accomplishment of my primary duties; therefore, I frequently work with groups that are outside the strict chain-of-command.

7. To what extent is your authority commensurate with your responsibilities?

--	--	--	--	--	--	--

I have complete authority to accomplish my primary duties for which I am held responsible; i.e., authority equals responsibility.

My authority for the accomplishment of my primary duties for which I am held responsible is incomplete; i.e., responsibilities exceed authority.



8. To what extent are you allowed to obtain and use resources (material, money, time) from outside of your chain-of-command to accomplish your primary duties?

--	--	--	--	--	--	--

I use only those resources provided through the formal chain-of-command.

I obtain and use resources from outside the chain-of-command in order to accomplish my primary duties.

9. To what extent do the primary duties that you are involved with support more than one organization's objectives?

--	--	--	--	--	--	--

My primary duties involve only the direct support of my SPO's objectives.

My primary duties involve a joint venture supported by many relatively independent organizations.

### PART III

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO INDICATE  
HOW YOU PERSONALLY FEEL ABOUT YOUR PRIMARY DUTIES.

Each of the statements below is something that a person might say about his or her job. Please indicate your own, personal feelings about your job by marking how much you agree or disagree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neutral	Agree	Agree	Agree
Strongly		Slightly		Slightly		Strongly

- \_\_\_ 1. I have enough time to complete my work.
- \_\_\_ 2. I feel certain about how much authority I have.
- \_\_\_ 3. I perform tasks that are too easy or boring.
- \_\_\_ 4. There are clear, planned goals and objectives for my job.
- \_\_\_ 5. I have to do things that should be done differently.
- \_\_\_ 6. There are a lack of policies and guidelines to help me.
- \_\_\_ 7. I am able to act the same regardless of the group I am with.
- \_\_\_ 8. I am corrected or rewarded when I really don't expect it.
- \_\_\_ 9. I work under incompatible policies and guidelines.
- \_\_\_ 10. I know when I have divided my time properly.
- \_\_\_ 11. I receive my assignment without the manpower to complete it.
- \_\_\_ 12. I know what my responsibilities are.
- \_\_\_ 13. I have to buck a rule or policy in order to carry out an assignment.

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neutral	Agree	Agree	Agree
Strongly		Slightly		Slightly		Strongly

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neutral	Agree	Agree	Agree
Strongly		Slightly		Slightly		Strongly

- \_\_\_14. I have to "feel my way" in performing my duties.
- \_\_\_15. I receive assignments that are within my training and capability.
- \_\_\_16. I feel certain how I will be evaluated for a raise or promotion.
- \_\_\_17. I have the right amount of work to do.
- \_\_\_18. I am unsure on how to divide my time.
- \_\_\_19. I work with two or more groups who operate quite differently.
- \_\_\_20. I know exactly what is expected of me.
- \_\_\_21. I receive incompatible requests from two or more people.
- \_\_\_22. I am uncertain as to how my job is linked.
- \_\_\_23. I do things that are apt to be accepted by one person and not accepted by other.
- \_\_\_24. I am told how well I am doing my job.
- \_\_\_25. I receive an assignment without adequate resources and material to execute it.
- \_\_\_26. Explanation is clear of what has to be done.
- \_\_\_27. I work on unnecessary things.
- \_\_\_28. I have to work under vague directives or orders.
- \_\_\_29. I perform work that suits my values.
- \_\_\_30. I do not know if my work will be adequate to my boss.

1	2	3	4	5	6	7
Disagree	Disagree	Disagree	Neutral	Agree	Agree	Agree
Strongly		Slightly		Slightly		Strongly



#### PART IV

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO PROVIDE YOUR  
OPINION ABOUT CHARACTERISTICS OF YOUR ORGANIZATION.<sup>a</sup>

On the line below each organizational variable (item), please place  
an X at the point which, in your experience, describes your organiza-  
tion at the present time. Treat each item as a continuous variable  
from the extreme at one end to that at the other.

1. How much confidence and trust is shown in subordinates?

Virtually none                      Some                      Substantial                      A great deal  
Amount

2. How free do they feel to talk to superiors about job?

Not very free                      Somewhat free                      Quite free                      Very free

3. How often are subordinate's ideas sought and used constructively?

Seldom                      Sometimes                      Often                      Very frequently

4. Is predominant use made of 1. fear, 2. threats, 3. punishment,  
4. rewards, 5. involvement?

1, 2, 3,  
occasionally 4                      4,  
some 3                      4  
some 3, and 5                      5, 4, based on  
group-set goals

5. Where is responsibility felt for achieving organization's goals?

Mostly at top                      Top and middle                      Fairly general                      At all levels

6. How much cooperative teamwork exists?

Very little                      Relatively little                      Moderate Amount                      Great deal

<sup>a</sup>From The Human Organization: Its Management and Values by  
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permission of McGraw-Hill Book Company.

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AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OHIO SCHO--ETC F/G 5/1  
ORGANIZATIONAL VARIABLES IN AN AIR FORCE PROGRAM ENVIRONMENT.(U)  
SEP 78 C J NOYES, T E PARKER

UNCLASSIFIED

AFIT-LSSR-31-78B

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2-79  
DDC

7. What is the usual direction of information flow?

Downward	Mostly downward	Down and up	Down, up and sideways
----------	-----------------	-------------	--------------------------

8. How is downward communication accepted?

With suspicion	Possibly with suspicion	With caution	With a receptive mind
----------------	----------------------------	--------------	--------------------------

9. How accurate is upward communication?

Usually inaccurate	Often Inaccurate	Often accurate	Almost always accurate
-----------------------	---------------------	-------------------	---------------------------

10. How well do superiors know problems faced by subordinates?

Not very well	Rather well	Quite well	Very well
---------------	-------------	------------	-----------

11. At what level are decisions made?

Mostly at top	Policy at top, some delegation	Broad policy at top, more delegation	Throughout but well integrated
---------------	-----------------------------------	--	-----------------------------------

12. Are subordinates involved in decisions related to their work?

Almost never	Occasionally consulted	Generally consulted	Fully involved
--------------	---------------------------	------------------------	----------------

13. What does decision-making process contribute to motivation?

Not very much	Relatively little	Some contribution	Substantial contribution
---------------	----------------------	----------------------	-----------------------------



14. How are organizational goals established?

Orders issued	Orders, some comments invited	After discussion by orders	By group action (except in crisis)
---------------	----------------------------------	----------------------------------	--

15. How much covert resistance to goals is present?

Strong resistance	Moderate resistance	Some resistance at times	Little or None
----------------------	------------------------	-----------------------------	-------------------

16. How concentrated are review and control functions?

Very highly at top	Quite highly at top	Moderate delegation to lower levels	Widely shared
-----------------------	------------------------	---	---------------

17. Is there an informal organization resisting the formal one?

Yes	Usually	Sometimes	No--same goals as formal
-----	---------	-----------	-----------------------------

18. What are cost, productivity, and other control data used for?

Policing, punishment	Reward and punishment	Reward, some self-guidance	Self-guidance problem-solving
-------------------------	--------------------------	-------------------------------	----------------------------------

## PART V

THIS PART OF THE QUESTIONNAIRE ASKS YOU TO INDICATE  
THE AMOUNT OF CONFLICT IN YOUR ORGANIZATION.

Please read the definitions of the seven potential conflict sources. Then, on the line beside each category of conflict (item), place an X at the point which, in your experience, describes the degree of conflict in your organization at the present time. Treat each item as a continuous variable from the extreme at one end to that at the other.

Conflict over:	1 Virtually none	2 Some	3 Substantial amount	4 A great deal
A. Program Priorities	1	2	3	4
B. Administrative Procedures	1	2	3	4
C. Technical Issues	1	2	3	4
D. Manpower Resources	1	2	3	4
E. Cost Objectives	1	2	3	4
F. Schedules	1	2	3	4
G. Personality	1	2	3	4

### Definitions for Question

#### 7 POTENTIAL CONFLICT SOURCES

CONFLICT OVER PROGRAM PRIORITIES. The views of program participants often differ over the sequence of activities and tasks which should be undertaken to achieve successful program completion. Conflict over priorities may occur not only between the SPO and other support groups, but also within the SPO itself.

CONFLICT OVER ADMINISTRATIVE PROCEDURES. A number of managerial and administrative-oriented conflicts may develop over how the program will be managed; i.e., the definition of the program manager's reporting relationships, operational requirement, scope, definition of responsibilities, interface relationships, negotiated work agreements with other groups, and procedures for administrative support.

CONFLICT OVER TECHNICAL OPINIONS AND PERFORMANCE TRADEOFFS. Disagreements may arise over technical issues, performance specifications, technical tradeoffs, and the means to achieve technical performance.

CONFLICT OVER MANPOWER RESOURCES. Conflicts may arise around the staffing of the program with personnel from other functional and staff support areas or from the desire to use another department's personnel for program support even though the personnel remain under the authority of their functional superiors.

CONFLICT OVER COST. Conflict may develop over cost estimates from support areas regarding various program work breakdown packages.

CONFLICT OVER SCHEDULES. Disagreements may develop around the timing, sequencing, and scheduling of project related tasks.

PERSONALITY CONFLICT. Disagreements may tend to center on interpersonal differences rather than on "technical issues." Conflicts are often "ego-centered."



APPENDIX B  
SUMMARY OF PREVIOUS RESEARCH DATA (1)

Source	Sample	Data Collection	Pertinent Findings
Lempke and Mann (1976)	142 program managers (95% response) randomly drawn from 13 program offices representing 3 phases of project life cycle.	Questionnaire, personally distributed, yielded data on organizational nature of tasks, phase of life cycle, and size of organization.	Organizations are most project oriented in early phase of project life, least project oriented in middle phase of project life. Organizations are smallest in early phase, largest in middle phase.
Barndt, Larson and Ruppert (1977) and Haddox and Long (1976)	185 program managers (80% response) randomly drawn from 13 program offices representing 3 phases of project life cycle.	Questionnaire, mailed to subject, yielded data on organizational climate, satisfaction, organizational size, and phase of life cycle.	1. Significant differences in organizational climate among phases. 2. Significant differences in organizational climate among program offices of different sizes. Organizational climate is correlated with satisfaction.
Eschmann and Lee (1977)	136 program managers (58% response) randomly drawn from 20 program offices representing 4 phases of project life cycle.	Questionnaire, personally distributed, yielded data on sources of conflict, intensity of conflict, method of conflict resolution, and phase of life cycle.	Conflict intensity changed across program life cycle, Air Force program managers perceived less intensity of conflict than civilian project managers, and Air Force and civilian project managers agreed on conflict resolution modes across life cycle phase.

NOTE: 1. Findings of the Barndt, Larson and Ruppert study.  
2. Findings of the Haddox and Long Study.

APPENDIX C  
DESCRIPTIVE STATISTICS



TABLE 25

PRESENTATION OF DATA:  
NUMBER OF CASES, MEANS, AND STANDARD DEVIATIONS  
FOR ALL SCALED QUESTIONS

QUESTION NUMBER	NUMBER OF CASES	MEAN	STANDARD DEVIATION
PART II			
1	131	5.145	1.701
2	131	5.359	1.554
3	131	5.580	1.375
4	131	6.366	1.009
5	130	5.377	1.282
6	131	5.908	1.106
7	131	3.885	1.796
8	131	3.878	1.796
9	131	3.924	2.118
PART III			
1	131	4.321	1.997
2	131	3.275	1.719
3	131	3.061	1.753
4	131	4.015	1.865
5	131	4.473	1.571
6	131	3.771	1.653
7	131	3.420	1.754
8	131	3.176	1.274
9	131	3.634	1.679
10	131	2.870	1.372
11	130	4.292	1.763
12	131	2.565	1.290
13	131	4.069	1.628
14	131	4.527	1.638
15	131	2.664	1.455
16	131	4.313	1.898
17	131	4.557	1.669
18	131	2.679	1.297
19	131	5.244	1.579

TABLE 25--continued

QUESTION NUMBER	NUMBER OF CASES	MEAN	STANDARD DEVIATION
PART III (cont'd)			
20	131	3.542	1.560
21	131	4.153	1.707
22	130	2.669	1.308
23	131	4.870	1.614
24	131	3.802	1.712
25	131	3.969	1.603
26	131	4.221	1.521
27	131	3.809	1.828
28	131	4.351	1.564
29	131	2.878	1.431
30	131	3.305	1.588
PART IV			
1	130	2.428	.795
2	130	2.422	.916
3	131	2.329	.878
4	127	2.691	.993
5	131	2.248	1.050
6	131	2.666	.786
7	129	2.813	.921
8	128	2.948	.658
9	130	2.820	.504
10	129	1.757	.892
11	130	1.812	1.023
12	130	2.419	.738
13	129	2.543	.864
14	130	2.125	.898
15	130	2.697	.777
16	130	2.030	.914
17	129	2.692	.780
18	126	2.629	.859

TABLE 25--continued

QUESTION NUMBER	NUMBER OF CASES	MEAN	STANDARD DEVIATION
PART V			
1	130	2.316	.818
2	129	2.209	.808
3	130	2.034	.794
4	129	2.566	.884
5	129	1.896	.734
6	130	2.019	.795
<u>MAJOR VARIABLES</u>			
ORGANIZATIONAL SIZE	131	67.105	48.929
TENURE	131	25.687	19.132
LEVEL OF BUREAU- ACY	130	5.051	0.775
ORGANIZATIONAL CLIMATE	118	2.465	0.567
ROLE CONFLICT	130	3.953	0.828
ROLE AMBIGUITY	130	3.550	0.878
ROLE STRESS	129	3.747	0.750
CONFLICT INTENSITY	126	2.140	0.423



APPENDIX D  
SPSS COMPUTER PROGRAMS

```

100##S,R(SL) :,8,16;;;,16
110$:IDENT:WP1149,AFIT/LSG PARKER NOYES 78B
120$:SELECT:SPSS/SPSSNMSG
130RUN NAME:PATH ANALYSIS REGRESSION PROGRAM
140VARIABLE LIST;SPO, RANK, MOSPOS, MOSSPO, MOSUSAF,
150;OLAP, LEVEL, C1, A1, C2, A2, C3, A3, C4, A4,
160;C5, A5, C6, A6, C7, A7, C8, A8, C9, A9, C10, A10,
170;C11, A11, C12, A12, C13, A13, C14, A14, C15,
180;A15, CON1 TO CON7, B1 TO B9, CLI1 TO CLI18
190INPUT FORMAT;FIXED(1X,4F2.0,F3.0,F2.0,F1.0,1X,
200;30F1.0,1X,7F2.0/1X,9F1.0,1X,18F2.0)
210INPUT MEDIUM;CARD
220N OF CASES;131
230MISSING VALUES;C1 TO C15,A1 TO A15,B1 TO B9(0)/
240;CON1 TO CON7,CLI1 TO CLI18(00)
250RECODE;SPO(11,12,13 = 0)(21,22,23,24 = 1)(31 = 2)
260;(41,42,43,44,45 = 3)/C1, A1, A2, C4, A5, A6, C8,
270;A8, C9, A10, A12, A13, C15(1 = 7)(2 = 6)(3 = 5)
280;(4 = 4)(5 = 3)(6 = 2)(7 = 1)
290COMPUTE;BUREAU = (B1 + B2 + B3 + B4 + B5 +
300;B6 + B7 + B8 + B9)/9
310ASSIGN MISSING;BUREAU (0)
320COMPUTE;CONFL = (C1 + C2 + C3 + C4 + C5 + C6 +
330;C7 + C8 + C9 + C10 + C11 + C12 + C13 + C14 + C15)/15
340ASSIGN MISSING;CONFL (0)
350COMPUTE;AMBIG = (A1 + A2 + A3 + A4 + A5 + A6 +
360;A7 + A8 + A9 + A10 + A11 + A12 + A13 + A14 + A15)/15
370ASSIGN MISSING;AMBIG (0)
380COMPUTE;CLIMATE = (CLI1 + CLI2 + CLI3 + CLI4 + CLI5 +
390;CLI6 + CLI7 + CLI8 + CLI9 + CLI10 + CLI11 + CLI12 +
400;CLI13 + CLI14 + CLI15 + CLI16 + CLI17 + CLI18)/18
410ASSIGN MISSING;CLIMATE (0)
420COMPUTE;INTENSTY = (CON1 + CON2 + CON3 + CON4 +
430;CON5 + CON6 + CON7)/7
440ASSIGN MISSING;INTENSTY (0)
450COMPUTE;STRESS = (CONFL + AMBIG)/2
460ASSIGN MISSING;STRESS (0)
470REGRESSION;VARIABLES = STRESS,CONFL,AMBIG/
480;REGRESSION = STRESS WITH CONFL,AMBIG(2) RESID = 0
490STATISTICS;ALL
500READ INPUT DATA
510$:SELECTA:78B78/THESIS
520FINISH
530$:ENDJOB

```

```

100##S,R(SL) :,8,16;;;,16
110$:IDENT:WP1149,AFIT/LSG PARKER NOYES 78B
120$:SELECT:SPSS/SPSSNMSG
130RUN NAME:PATH ANALYSIS REGRESSION FOR VARIABLE "SIZE"
140VARIABLE LIST;SPO, RANK, MOSPOS, MOSSPO, MOSUSAF,
150;OLAP, LEVEL, C1, A1, C2, A2, C3, A3, C4, A4,
160;C5, A5, C6, A6, C7, A7, C8, A8, C9, A9, C10, A10,
170;C11, A11, C12, A12, C13, A13, C14, A14, C15, A15,
180;CON1 TO CON7, B1 TO B9, CLI1 TO CLI18
190INPUT FORMAT;FIXED(1X,4F2.0,F3.0,F2.0,F1.0,1X,
200;30F1.0,1X,7F2.0/1X,9F1.0,1X,18F2.0)
210INPUT MEDIUM;CARD
220N OF CASES;131
230MISSING VALUES;B1 TO B9(0)/CLI1 TO CLI18(00)
240IF;(SPO EQ 11) SIZE=17
250IF;(SPO EQ 12) SIZE=24
260IF;(SPO EQ 13) SIZE=14
270IF;(SPO EQ 21) SIZE=79
280IF;(SPO EQ 22) SIZE=15
290IF;(SPO EQ 23) SIZE=10
300IF;(SPO EQ 24) SIZE=44
310IF;(SPO EQ 31) SIZE=134
320IF;(SPO EQ 41) SIZE=108
330IF;(SPO EQ 42) SIZE=66
340IF;(SPO EQ 43) SIZE=4
350IF;(SPO EQ 44) SIZE=16
360IF;(SPO EQ 45) SIZE=3
370RECODE;SPO(11,12,13 = 0)(21,22,23,24 = 1)(31 = 2)
380;(41,42,43,44,45 = 3)
390IF;(SPO EQ 1) CATII=1
400IF;(SPO EQ 2) CATIII=1
410IF;(SPO EQ 3) CATIV=1
420COMPUTE;BUREAU = (B1 + B2 + B3 + B4 + B5 +
430;B6 + B7 + B8 + B9)/9
440ASSIGN MISSING;BUREAU (0)
450COMPUTE;CLIMATE = (CLI1 + CLI2 + CLI3 + CLI4 +
460;CLI5 + CLI6 + CLI7 + CLI8 + CLI9 + CLI10 + CLI11 +
470;CLI12 + CLI13 + CLI14 + CLI15 + CLI16 + CLI17 +
480;CLI18)/18
490ASSIGN MISSING;CLIMATE (0)
500REGRESSION;VARIABLES = CLIMATE,CATII,CATIII,CATIV,SIZE,
510;MOSSPO/
520;REGRESSION = CLIMATE WITH CATII,CATIII,CATIV,SIZE,
530;MOSSPO(2) RESID = 0
540STATISTICS;ALL
550READ INPUT DATA
560$:SELECTA:78B78/THESIS
570FINISH
580ENDJOB

```



```

100##S,R(SL) :,8,16;;,16
110$:IDENT:WP1149,AFIT/LSG PARKER NOYES 78B
120$:SELECT:SPSS/SPSSNMSG
130RUN NAME:T-TEST ON MAJOR VARIABLES BY CATEGORY (SAMPLE)
140VARIABLE LIST;SPO, RANK, MOSPOS, MOSSPO, MOSUSAF,
150;OLAP, LEVEL, C1, A1, C2, A2, C3, A3, C4, A4,
160;C5, A5, C6, A6, C7, A7, C8, A8, C9, A9, C10, A10,
170;C11, A11, C12, A12, C13, A13, C14, A14, C15, A15,
180;CON1 TO CON7, B1 TO B9, CLI1 TO CLI18
190INPUT FORMAT;FIXED(1X,4F2.0,F3.0,F2.0,F1.0,1X,
200;30F1.0,1X,7F2.0/1X,9F1.0,1X,18F2.0)
210INPUT MEDIUM;CARD
220N OF CASES;131
230MISSING VALUES;C1 TO C15,A1 TO A15,B1 TO B9(0)/
240;CON1 TO CON7,CLI1 TO CLI18(00)
250RECODE;SPO(11,12,13 = 0)(21,22,23,24 = 1)(31 = 2)
260;(41,42,43,44,45 = 3)/C1, A1, A2, C4, A5, A6, C8,
270;A8, C9, A10, A12, A13, C15(1 = 7)(2 = 6)(3 = 5)
280;(4 = 4)(5 = 3)(6 = 2)(7 = 1)
290COMPUTE;BUREAU = (B1 + B2 + B3 + B4 + B5 +
300;B6 + B7 + B8 + B9)/9
310ASSIGN MISSING;BUREAU (0)
320COMPUTE;CONFL = (C1 + C2 + C3 + C4 + C5 + C6 +
330;C7 + C8 + C9 + C10 + C11 + C12 + C13 + C14 + C15)/15
340ASSIGN MISSING;CONFL (0)
350COMPUTE;AMBIG = (A1 + A2 + A3 + A4 + A5 + A6 +
360;A7 + A8 + A9 + A10 + A11 + A12 + A13 + A14 + A15)/15
370ASSIGN MISSING;AMBIG (0)
380COMPUTE;CLIMATE = (CLI1 + CLI2 + CLI3 + CLI4 + CLI5 +
390;CLI6 + CLI7 + CLI8 + CLI9 + CLI10 + CLI11 + CLI12 +
400;CLI13 + CLI14 + CLI15 + CLI16 + CLI17 + CLI18)/18
410ASSIGN MISSING;CLIMATE (0)
420COMPUTE;INTENSTY = (CON1 + CON2 + CON3 + CON4 +
430;CON5 + CON6 + CON7)/7
440ASSIGN MISSING;INTENSTY (0)
450COMPUTE;STRESS = (CONFL + AMBIG)/2
460ASSIGN MISSING;STRESS (0)
470T-TEST;GROUPS = SPO(2,3)/VARIABLES=MOSSPO,BUREAU,
480;CLIMATE,CONFL,AMBIG,STRESS,INTENSTY
490READ INPUT DATA
500$:SELECTA:78B78/THESIS
510FINISH
520ENDJOB

```

APPENDIX E

RAW DATA

# QUESTIONNAIRE RAW DATA

The raw data responses from each questionnaire were coded in a sequence of numbers to represent the respective questionnaire items. Each set of responses is contained on two lines of data. The questionnaires were grouped by life-cycle categories. The following example illustrates the key used for coding the data:

```

A  B C D E F G H I                                     J
100 11121505204003 676712441717126661571147371161 20201020303010

K  L                                     M
101 676676157 373736353636253825382536372438383637
  
```

ITEM	VARIABLE NAME/LABEL	REMARKS
A.	Input Line Number	Even Number = Line #1
B.	Duty Organization(SPO)	11 = SPO Cadre (XRZ) 12 = EF-111A (SD25) 13 = Avionics I (AE) 21 = ATCA (YT) 22 = AMST (SD29) 23 = B-1 (YY) 24 = Avionics II (AE) 31 = F-16 (YP) 41 = F-15 (YF) 42 = A-10 (YX) 43 = TF-34 (YZ34) 44 = F-100 (YZ100) 45 = F-107 (YZ107)
C.	Military Rank or Civilian Grade	01 = 2Lt, 02 = 1Lt, 03 = Capt, 04 = Maj, 05 = Lt Col, 06 = Col, 07 = GS-7, 09 = GS-9, 11 = GS-11, 12 = GS-12, 13 = GS-13, 14 = GS-14, 15 = GS-15



ITEM	VARIABLE NAME/LABEL	REMARKS
D.	Number of Months in Present Position	
E.	Number of Months Assigned to Present SPO	
F.	Number of Months in USAF	
G.	Number of Months in Job Overlap	ØØ = No Overlap
H.	Level in Organization	
I.	Perceived Role Stress Question Responses (Questionnaire Part III)	
J.	Perceived Conflict In- tensity Responses (Questionnaire Part V)	
K.	Input Line Number	Odd Number = Line #2
L.	Level of Bureaucracy Responses (Questionnaire Part II)	
M.	Perceived Organizational Climate (Questionnaire Part IV)	

# RAW DATA: CATEGORY I

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 101 676676157 373736353636253825382536372438383637  
 102 12041034192004 523157525343464555724442426746 39372821001915  
 103 437255622 130612181211191929180612121422201220  
 104 12041212147012 562534646456225262663232435545 20202030201010  
 105 646666442 301130301735363127220421212030243520  
 106 12051836242052 541344246474446234646264656643 40102010302010  
 107 267767457 290921300325253625070715300831052631  
 108 12011714019013 674454745656665742245327265434 20201010302010  
 109 475435321 373725363625252536251525251538252536  
 110 11041212175003 662622622426456652262247262262 10202020101020  
 111 556655121 26383035363533343332735363333343934  
 112 12041212147003 616166226402476124626461624646 20162738272325  
 113 533535721 181819170822192919100913141924183116  
 114 11042525216004 222264644263566226524463637555 30103020202030  
 115 656646425 152515363725252525160425252525152615  
 116 11022020123003 635143454641472424434454446435 23152212121919  
 117 245632211 192024000621222020110921201220293232  
 118 11060808288011 625362355533546313533355335552 40103010202010  
 119 466546765 252525253525373725152425372525252637  
 120 12130410263063 362523522656236632635257263352 20003229201519  
 121 666656324 282128302932323030303131313029293030  
 122 12127272351005 717622162622226111522261262222 11111111211112  
 123 222727272 142401363615373737023524143538153636  
 124 12050303258002 362662622636226662262226262262 20102020202010  
 125 216766221 363635003636373636250335362437153536  
 126 12040724195023 362235625675454412454254645462 30303040303020  
 127 466767566 152515151525162538251515021538152615  
 128 12031111107003 772622222626267662661116222262 10101020202010  
 129 667666236 352525253535353525353525252535252535  
 130 12123802089003 662352343656236342232255434244 27202014203010  
 131 554625512 302520300931203322251525211531253126  
 132 12044141157003 172152611267751722675177661272 30203020403020  
 133 677766272 293837350332293020230234291525222515  
 134 12011914019004 655454335625566442746545335564 30302415153320  
 135 654735652 192415311519152930110925111929142025  
 136 12032230120003 671352623656236752666176331572 19102119191131  
 137 556756256 263836243735353536282534352727282733  
 138 12050823204022 171717141717777771771077171171 10202020202015  
 139 427777277 333433401540403125153220402540403319  
 140 12034242045064 556352635546456232535344526562 30302030302030  
 141 566635422 252515361525362525151525251525252525  
 142 12044848180013 262256244675655122743264535666 18183433212121  
 143 664677646 150015050525252525051515152525152515  
 144 12034848228032 233264635466456324536364534545 30302040202020  
 145 555756641 152515031615151525031514141615152515

146 12030103071013 232665323436355263545256232566 10403010301030  
 147 772447365 282423052608163132201620210933123505  
 148 12030606180003 165656145556555413762277325561 25122030303010  
 149 666766555 303130363615373131210220313632322536  
 150 13131836201004 156173357277657317627272737676 19221029101010  
 151 667766466 132904070620041222080606340919060206  
 152 13040624189003 261765325627536322656262162572 30202010102010  
 153 577777557 3135333333343333253325252025333032  
 154 13042424275005 622564214626566662662463227666 20302020202020  
 155 444453773 160718072930291929080719050718181819  
 156 13131414169004 342452334455443233353335336353 22211518181818  
 157 265652223 282818273330343131262632281822213331  
 158 13010202002004 332664624656256633455366344562 17171323191910  
 159 345655436 323231312731312829292728292832252825  
 160 13130724239002 233536436665566533635355432533 19261524182428  
 161 566666626 171520322124172824121218172029033315  
 162 13129999448003 365654645656557532563255455352 18271925181832  
 163 554766233 202822312129223232193032303121213332  
 164 13128409326003 526161217376667135727571717736 40351029102612  
 165 562756766 310808011931332931080111051006061305  
 166 13114444048003 635665455653564653545356545462 35252020101520  
 167 565644522 373736373132241931252530332822193033

# RAW DATA: CATEGORY II

200 22143030240002 223264223222663226626662545636 20201020201020  
 201 475676342 151520251521192519160821262016151519  
 202 23050825210004 353444334535556334644564435533 20102030202040  
 203 456757321 151515251525252525151525252515252525  
 204 23050709237003 266553626666216222666122661362 36201440201440  
 205 567767261 172526301525152920200319250926252637  
 206 23031223143012 261553545676556132634365636563 20102020203010  
 207 776766241 252223313332333125222630322024202632  
 208 21033030138004 362215712516156335652225252562 15203915122825  
 209 666777252 343332311526323535253534323030312933  
 210 22041010162003 642533643626554662364265252563 20251020102511  
 211 564666331 253736370237153625251536363035153625  
 212 22051111191003 766323242626467542664176545556 10252020202020



213 777757311 252536251532373030151425252525142625  
 214 23051426234023 532563261636635142735255242262 19291939191919  
 215 553766334 131212251125252435021436250325152525  
 216 22032020172003 662622622626636562252225252263 18181122231625  
 217 226752441 272028272632373131192528322927212828  
 218 22131317204003 234264354355664234634264534654 20203020203020  
 219 665636546 23302325293231292513151622227302520  
 220 22071010242001 561652227667657631667162642664 40202040401030  
 221 775777377 293837303023262620252525372526312537  
 222 23030606199003 261527645366465555764164621775 20201040302010  
 223 767777667 383838383337393932323737383734363534  
 224 2303222217124 351655352626627352777267635372 20303020203040  
 225 637766745 152020141502142515030303020302020114  
 226 22050642204242 656524642427666222662262245453 10101010101010  
 227 777777145 363625362736363736212525303036252500  
 228 22041818192003 654633542426454344665253245566 20302030202020  
 229 466754532 2525373726383837251525252525253800  
 230 21052323168004 665644742626216622654454243452 10202020102010  
 231 767776262 373736362537313031252525253038263635  
 232 21040707168013 453555536445455654252365565344 20202020101020  
 233 667756242 251526333529343427182032271035192625  
 234 21043030191004 261363763326367226736263233576 31123821313131  
 235 666766357 172219191921342818061121282121292219  
 236 21030404096004 633535643523356252332632232555 17303619191920  
 237 516665313 252525353025383328192823282732203331  
 238 21051216204043 662642626536636562666266263652 19213320171720  
 239 666676366 332828313433293032222931302937323532  
 240 23032020120004 131272613546552713756745637552 30201040303010  
 241 763777717 272816230325382625080518310619061725  
 242 23051058252012 263565643646366622562225353562 28181833221824  
 243 567755273 132018281930213028110822191928073129  
 244 23044040192003 661222622466256633252262562563 40104040303010  
 245 177667317 373836363638373737383636373138393636  
 246 23033232117004 263356326666663662566266533662 20202530202015  
 247 777757663 152615262020223026260823262525202931  
 248 23149909101004 665672443346556452643255434342 31313131313131  
 249 635766653 272721262021202521101918192028191728  
 250 24050210261013 142664446666567412767464642674 25202540303516  
 251 626767667 150915002526362534092025002525273325  
 252 24042325174033 662652642726227571562166262273 10201020202020  
 253 267766247 151525251525263825251625253625242525  
 254 24129999327003 264532343646426722662645534553 18121822151916  
 255 655646623 222928332921333230222536362529113333  
 256 24042325185013 633532432657426362632226562262 20202020102010  
 257 777747667 302626292627312730261315151632072720  
 258 24040808193003 222164326664664125726562616726 20202016252525  
 259 545755617 151515090315161515072525020315152502

260 24031111120023 132562652755661525535343327362 37322922151522  
 261 655754634 282218283333111928192322221130290329  
 262 24034040126013 212451243326556151226266626165 30201425251430  
 263 371766711 182125131525142232180218151525072510

RAW DATA: CATEGORY III

300 31052323213003 362575726646546422664226435511 20202740121212  
 301 777777465 363636371625263926151525253534052531  
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 303 676775467 252930323321362122112631253506110724  
 304 31071010270002 642255425676663361756374723662 30261840182626  
 305 676767567 303028302623303030202525242822222128  
 306 31041940181013 262653645566626623543253456553 26211435211329  
 307 567766632 222523221526282828162524282729313433  
 308 31042222142005 117177117777777111717177711771 40401040404020  
 309 767756716 253815150330022026051727282110180127  
 310 31041818231013 261652222645566242646466324343 29131919292919  
 311 757777251 293132312625383838262530252530223030  
 312 31031010120004 362645442446426442665254462262 11211123111212  
 313 365646332 222827313234293028212928303118323028  
 314 31031313097004 624144644466566244434242444552 20251932201500  
 315 667766561 272826372018173933100324372419031633  
 316 31031414210005 253345524556454434535553452564 19191928192819  
 317 664766352 282226072222282725141823231220202920  
 318 31041616178003 672622632657216562662156252272 28171140212416  
 319 656766115 323223333233373735282325281529253415  
 320 31032915120004 635356414645456233635551535545 10202020102010  
 321 546766455 150515351515151525050515151535152525  
 322 31050909225003 336354444675353633533323646525 20203040202020  
 323 554666565 262525342626373635252526371637283533  
 324 31121818446004 222634342654616632662226331262 20301020103040  
 325 327756726 001525152526252538151525371515252515  
 326 31121414169003 253542241545555531442225363252 20202525101228  
 327 155645422 293525372526253125253130281530153331  
 328 31110202071014 652642621616256542162235264554 20202020202030  
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 331 763746411 131220061319360030070623211130170001

332 31032222129004 766655644745663222643365454463 25331918181929  
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 334 31043636222004 121176714662664124626272624657 30402030202030  
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 336 31032309123005 435355244356566335746566434525 20203030103020  
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 338 31041010145004 665136622623466452235552523656 20201020102020  
 339 655666553 250315031615262625000315153725252536  
 340 31040808156005 362336614536566135222462327626 30301020102020  
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 342 31031313136003 361622722656226262565126262561 20202040202020  
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 344 31051822204003 232265642646226232635252445342 20202030302020  
 345 566656345 253236282822282831251924242825261626  
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 348 31131717226003 232354655366722125635266651313 31342731192217  
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 357 227776643 273518331929191927183328181918292829  
 358 31032424216004 653332654443466554544464443355 40202020302020  
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 360 31030634123005 252662624666322622664226555562 20202030202020  
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# RAW DATA: CATEGORY IV

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 409 356645535 150315001515152025032515151739163700



410 42045466184003 324344355663456132635253635444 28133034151819  
 411 655446643 200815292930382934031625311735283521  
 412 42045151243004 665167662345566635226662536626 22293213141838  
 413 664706321 070605081821020627060605210610111220  
 414 41033434124024 264245625466545424646465424665 27383200353528  
 415 665646443 182107233528252923222518281123213128  
 416 42050122241072 322333511656546552625255535254 21211931151617  
 417 665656623 181925230231323227250626361435033125  
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 419 777777267 363625363336373728262834343334242630  
 420 42133648311004 662622622626226662666266262262 19102910191919  
 421 625555355 3334233533340000000000000000000000  
 422 42043060186013 362353433556326532655255556342 20251720102030  
 423 575746522 251625251525260025151525201515152600  
 426 42031836096004 131126624334274413425452442666 20301020101020  
 427 777757777 372014250332043125042025361630183020  
 428 42032828132004 65535262272553626263352255364 15271810122715  
 429 636766462 304037191929252637162625381728153438  
 430 42123535145005 562562642656256632662235253362 20101030102010  
 431 177757314 252501372525383838251637253639013737  
 432 42127676084005 652252635636253662662253355363 20221626111429  
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 434 42020622034004 556245622645266432432326355442 10151121181618  
 435 746536335 243228363730312928142827252330063032  
 436 41030831097013 352266254645236233756274431552 28262222202729  
 437 757567213 202726343037373628292728302834213233  
 440 41050921204003 161226625576232513736462511762 12201030101020  
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 445 776767252 383136362738373637241536262525152736  
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 449 666666255 202025212128383132111521212525212631  
 450 41033333216005 764342543625456261752272265355 30202020102020  
 451 777767266 252525361437372525152425253615242525  
 452 41031719130054 271752643637227362272226262262 20101020101020  
 453 777767161 383837373836383837373737363537383737  
 456 41052328247003 375753625276653332645354532542 10302040302020  
 457 634544333 373736363638363625253636372537252637  
 458 41040636006005 726256744446261311262262267513 15271530141420  
 459 154757266 150615230620383225202025333325192625  
 460 41051224216013 161262326666656422762464622564 30304030203020  
 461 477777541 242324341525403431231529231831182933  
 468 41040303180004 162523442276252312252225552265 20203030101010  
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