OPEN SYSTEMS CONCEPTS IN A FEDERAL PROCUREMENT ENVIRONMENT

A Dissertation

Presented to

the Faculty of the College of Business Administration

University of Houston

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

William Harrison Pope

Lt. Colonel, USAF

August, 1973

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ABSTRACT

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Committee Chairman: John V. Zuckerman.

Considerable research has been done over the past decade into the conditions under which large complex organizations function effectively, develop, and grow. This research has given rise to theoretical formulations which conceptualize organizations as open systems operating under conditions of uncertainty. Organizational success has been linked with organizational accommodation to the environment. These theories have been developed and applied mainly to profit-making organizations in the private sector of the economy.

The purpose of this study was to explore the relationships between industrial organization and governmental focal organizations jointly involved in major government-sponsored aerospace development projects and to develop hypotheses concerning these relationships. Extensive in-depth interviews and questionnaires explored the issues of goals, change effects, coordination, uncertainty,

organizational structural responses, interaction, and organizational performance in this environment.

Data analysis linked organizational structures to coordination difficulties, mitigation of change efforts, increased environmental and task uncertainty and perceived environmental performance.

A central finding which the study data suggested was that closely-linked organizations with task structures which did not match theoretical task structuring requirements tended to distort environmental signals, increase coordination difficulties, amplify rather than control uncertainty, and decrease perceived organizational performance and effectiveness.

Hypotheses, concerning these relationships, were suggested for further analysis and comparative testing in the environment of several governmental-sponsored development projects.

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INTRODUCTION

I. PURPOSE OF STUDY

There has been considerable research over the past decade into the conditions under which large, complex organizations function effectively, develop, and grow. This research has given rise to theoretical formulations which conceptualize organizations as open social system, operating under conditions of uncertainty in which organizational success is linked with organizational adaptation to the environment. The theories have been applied mainly to profit-making organizations in the private sector. This study is an attempt to extend the research to the federal government-private industry relationships in the field of aerospace technology. A large government agency and its industrial contractor were chosen. From the previous research, a series of dimensions were chosen for measurement, utilizing guided interviews and written questionnaires as instruments for data gathering. The results were utilized to develop hypotheses of organizational structure and functioning. A significant portion of the financial resources of the United States is spent

each year in the procurement of complex aerospace related products or projects for the Department of Defense (DOD) and The National Aeronautics and Space Administration (NASA).[1]

The high level of interaction between the governmental agency and the industrial contractor during most phases of the procurement effort can be made more productive. Increased understanding of the organizational - environmental relationships could suggest methods of improving environmental accomodation. This understanding would lead directly to increased effectiveness in the use of program resources and a lessening in the demand for severely limited governmental funds allocations. Open systems based analytical techniques may provide new insight into relationships which can increase the overall effectiveness and efficiency of these complex aerospace project procurements.

We investigated some of the organizational relationships between the government buyer and the industrial seller using open systems concept and techniques. From this exploratory research, hypothesis may emerge which will increase

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[1]A recent economic forecast which coupled several governmental and aerospace industry projections indicated that the current level of DOD and NASA spending on complex aerospace projects was in excess of $20 billions per year. This figure is forecast to rise to over $33 billions per year by 1990. The forecast was prepared by and furnished to this writer by the vendor "V" organization.

the understanding of the organizational relationships in this environment and ultimately lead to increased effectiveness of the organizations.

II. HISTORICAL NOTES

ORGANIZATIONAL PARADIGMS

It has been recognized that some organizations exist because tasks are more effeciently and effectively performed by the concerted efforts of two or more individuals than by a single individual working alone. Within each organization, the leadership group has actively sought to improve methods of resource application, effort coordination, task division, and goal direction to enhance the organization's effectiveness.

Many philosophers, administrative scientists, and organizational theorists have studied organizational structures. Each has investigated and described various aspects of the organizational pheonomina and in doing so, prescribed a frame work to improve resource application and to realize organizational goals.

> "For thousands of years, interested individuals have observed the practice of management (or administration)[2] and attempted to formulate

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[2]The (or administration) has been added by this writer to clarify Professor Rubenstein's remarks which were obviously aimed at both management and administrative practices.

> systematic descriptions of what they observed or prescriptions of how they thought this art should be practiced. Some of these observers were active participants in management or organizations -- public or private. Others were merely disinterested but curious observers of this very important social activity."

Claude S. George, Jr., (1968) for example, traces the continuum of major written contributions to the management of organizations back to the Sumerians in approximately 5000 B.C. Such a trace however, would be of little value to those interested in modern organizations except to note three significant trends.

First, each practicing manager or organizational 'theorist' has had as his central purpose the improvements of existing organizational practices of resource allocation, task division or assignment, and overall effort coordination. Second, each appears to have developed his rationale and analytical framework for description, prescription, or managerial actions from a very narrow foundation. He has strongly advocated the application of these narrow perceptual set bound 'findings' to the universal whole of all organizations. Third, until recently, no systematic approach to the study of organizational phenomena has existed.

ORGANIZATIONAL STRUCTURES

Organizational structuring or design is a particularly significant area of research on organizations. The issue is,

"What schema or methodological framework is appropriate for use as a model for the analysis or design of an organization's structure?"

It seems clear that organizational functioning, success, and goal achievement potential may be significantly improved by deliberately designing the 'basic structure'[3] in some specific manner or in accordance with some appropriate conceptual model rather than by attempting task accomplishment through unplanned congregation of resources and manpower. However, a great deal of controversy surrounds the question of which of several basic models (each with its own assumptions concerning the nature of man in his environment) should be used as the foundation for the design or analysis of the basic structure and operating mechanisms[4] of an organization.

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[3]The basic structure of an organization may be defined as those methods used to divide and assign organizational tasks among the various organizational elements and the methods used to coordinate the various efforts so the overall organizational objectives will be realized. For a more detailed description discussion of basic structures and operating mechanisms see Organization Structures and design by Dalton, Lawrence, and Greiner (1970).

[4]Operating mechanisms are factors which reinforce and implement the basic structure of the organization. They include such items as standardized rules, regulations, policies and procedures, internal control systems, reward and punishment systems, appraisal or evaluation systems, and information systems. Dalton, Lawrence and Greiner (1970) p. 1-2.

BASIC APPROACHES

No systematic scientific approach to the study of organizations, especially work organizations, had emerged until the past few decades. However, since the late 1890's or early 1900's[5], two distinct, yet opposed approaches to the question of "How to best organize a task endeavor" have been formulated. These approaches have served as basic models for both practicing organizational managers and interested organizational researchers. Curiously, both have strong research foundations and have enjoyed success when applied in "real world" organizational situations. Both claim universal applicability. These two approaches are the 'Classical School' and the 'Human Relations School'.

Classical Theory

The Classical School uses the "scientific management" and industrial engineering ideas of Frederick W. Taylor, Frank and Lillian Gilbreth, Henry L. Gantt, Harrison Emerson[6] and others (who were concerned with standardizing work

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[5]Most writers who discuss modern approaches to organization theory or management seem to agree that no systematic attempts at developing a theory occurred prior to this date.

[6]For a more complete enumeration of the classical writers and their concepts the reader may refer to any text on comparative theories of organizations or the original works of the authors themselves which are listed in the Bibliography.

methods or procedures for an 'economic man'[7] at the production level. These engineering ideas combined with the administrative organization ideas of Henry Fayol, Max Weber, James D. Mooney, and others who focussed on the structural aspects of the organization as a whole. The organization is viewed as a griant 'mechanistic'[8] entity governed by permanent and unchanging universal laws.

Human Relations Theory

The 'Human Relations School' uses the psychological, sociological, social psychological, and human engineering concepts of Elton Mayo, Fritz Roethlisberger, Curt Lewin, Chris Argyris, and others. This school assumes that organizations should aim at satisfying the needs and development goals of the individual. As open structures these organizations should insure participative interaction among task groups and individuals at all levels and insure that all employees are given the opportunity to participate in solving organizational problems. In essence, the human relations school advocates a structure in which the human element, the social situation at work, and the attitudes of the individual

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[7]The notion of "economic man" or the Economic man concept assumes that man is solely motivated by economic reward and thus his performance is directly related to economic incentives.

[8]Mechanistic is a term introduced by Tom Burns and G. M. Stalker to describe a stable, machine like system.

and task group workers are the sole keys to organizational success.

SYSTEMS APPROACH

In an effort to resolve some of the intellectual conflict created for both operating managers and organizational researchers by the apparent success of these two opposing approaches to designing the structures and operating mechanisms of an organization, a new approach toward organizational structures has evolved. This is the open systems or environmental interaction approach to the structural analysis of organizations.

The Open Systems approach or school advance the notion that there is no one best way to organize that is universally applicable to all organizational situations. Instead, open systems approaches recognize that the organization is in a state of constant interaction with external forces that combine to produce the firm's relevant environment. Different organizations have different environments, and these different environments place different demands upon the organization. The successful organization is structured to permit effective dealing with the demands of the relevant environment and the technology of the tasks.

A systems orientation to organizational analysis, (typified by the works of A. K. Rice, (1958-1963) T. Burns and

A. Stalker (1961), Joan Woodward (1964), and others of the Tavistock Institute, Paul Lawrence, Jay Lorsch and their associates (1967), and James D. Thompson (1967) emphasizes the importance of dynamic accommodation between the organization and the organization's relevant environment for organizational success.

A brief definition of systems, systems thinking, and a systems oriented approach to organizations is appropriate.

General Systems

A system, according to Von Bertalanffy (1950, 1968), is an organized assemblage of interrelated components. It is a holistic entity which includes the whole, the parts, and the patterned relationships as they interrelate to define the system.

Similarly, systems thinking is a holistic view of a defined or definable set of phenomena which considers the whole, the parts and those relationships which describe the interdependences between the whole and its parts.

A systems view or systems oriented approach to organizations, then, is one which considers simultaneously, the whole organization, the patterns which describe the interrelationships between the organization and the parts, and the organizational components or subsystems themselves.

This systems view of an organization may, in general, be based upon one of two basically divergent lines of reasoning, the Open Systems Paradigm and the Closed Systems Paradigm (Katz and Kahn, 1966).

Closed Systems:

Under the closed system model, the system is a closed, self-contained, generally self-sufficient and self-regulating entity. It might be visualized as following the second law of physics or thermodynamics. Closed systems tend to have rigid, nonpermeable boundaries which separate them from the environment, and preclude or severely limit environmental interaction. The system attains a static balance through internally generated measurements and corrections. All systems activities are aimed toward the primary goal of planned efficiency. Variances from planned sequences are regarded as errors. (Thompson, 1967).

In terms of the business organization, this model assumes that the organization has little or no meaningful contact with the environment and that the external environment has little or no impact upon the success or failure of the firm. The necessary inputs to the organization "magically" appear and the organizations outputs likewise "magically" disappear, without reference to the supplier consumer aspects of the firm's external environment.

The organization is thus a self contained "closed" system. Organizational problems are analyzed with reference to the organization's internal attributes. Any change in external environmental arrangements are accomodated within the existing structures or plans. Planned efficience, based upon functionally contributing activities, is the key criterion for organizational success.

Open Systems:

The open systems model assumes that the system is in a state of constant dynamic interaction with the relevant parts of its external environment. (Katz and Kahn, 1966). In essence, the "open" system is a sub-system of some larger super-system (environment) and forms an interrelated component of the larger systems. Open systems are transformation models which (1) receive inputs from the environment, (2) process or operate upon them internally and export the result to the same or another segment of the environment or super-system. (Johnson, Kast, and Rosensweig, 1967). Open systems have permeable boundaries which allow interaction between the system and the environment (Katz and Kahn, 1966).

Open systems tend to import more energy than they export. This energy advantage, known as "negative entrophy" provides the energy resources necessary for system growth, change, elaboration or interactive adjustment, and a dynamic equilibrium with the external environment. (Katz and Kahn, 1966).

Open systems also tend to be characterized by equifinality. In closed systems, there tends to be a direct cause and effect linkage between the initial conditions and the final or present state. Open systems tend to operate under different criteria; i.e., the same end or final result may be achieved through different circumstances and from different initial conditions. (Carzo and Yanouzas, 1969).

This property of equifinality of open systems introduces uncertainty into the system. Lacking the direct cause-effect linkage, open systems states (final or otherwise) are subject to conditions of multiple causality and uncertain direct causal factors or relationships. (Thompson 1967).

Even though the system is a part of the larger system and may cause changes in the overall system by changes within itself, the open system lacks the ability to control the relevant environmental forces of the supra-system.

Organizational Systems

An organization under the open systems paradigm can be viewed as a sub-system or component of the larger environmental or social supra-system. The organization is open to and in a constant state of dynamic interaction with the external environment. It resembles the classic transformation

model which effectively gained an energy "profit" or "negative entropy" during the transformation cycle. It used this energy surplus for growth, adaption to environmental demands and success oriented changes or elaborations.

Under open systems concepts, the organization would receive feed-back from the environment, and would not be perceived as limited to single causality but instead would be viewed as flexible enough to accept and process diverse environmental inputs in numerous ways.

Barnard (1938) advances many of these ideas when he suggested a systems approach to organizations. Specifically, he believes that "an organization is a system of cooperative human activities, the functions of which are (1) the creation, (2) the transformation, and (3) the exchange of utilities." (p. 240). He further suggests that organizational survival depended upon the creation of an excess of energy or a surplus of utilities; i.e. "negative entrophy" (pp. 244-45).

Walter Buckley (1967) summarized the systems approach as it applies to organizations. (To say that an organization is) "an open system means, not simply that it engages in interchanges with its environment, but that this interchanges with its environment is an essential factor underlying the system's viability, its

reproductive ability or continuity and its ability to change." Under these concepts, organizational phenomena take on meaning only when environmental variables are considered in relationship to internal organizational variables.

Open-Closed Organizational Systems:

A third approach, which appears to combine both open and closed concepts of general systems theory with organizational analysis is the open-closed paradigm. This model holds that organizations, as contrived social systems, are neither open nor closed. Instead, degree of openness or degree of closedness is a dimension applying to the organization and its structure and may vary within organizational hierarchical levels among organizations. (Kast and Rosenzweig, 1970).

Thompson (1967) following Parson's lead suggests that organizations are open systems, hence indeterminate and faced with uncertainties; at the same time organizations are subject to rationality and therefore need determinateness and certainty to preclude chaos. (p. 10). He further suggests that the organization, as an open-closed system, tends to vary within itself (along the open-closed dimension) with the specific purpose of removing uncertainty and adding determinateness or certainty to the technological core of the organization in order to facilitate environmental adaptation.

Contingency Model:

A variant of the general systems approach is the contingency model. This analytical framework seeks to simultaneously resolve the differences between the closed-systems paradigms of classical management and also some aspects of Human Relations Theory and to emphasize external organizational referents as key items to organizational success.

Contigency theory, or the Differentiation and Integration model as it is labeled by Lawrence and Lorsch in their book, Organization and Environment advances several key ideas; (1) the organization, as in the open system theory, is in a state of constant interaction with the environment; (2) organizational success depends upon the organization's ability to simultaneously divide itself so as to successfully deal with the principal segments of its total environment and re-integrate or coordinate these divided efforts into a unified whole; (3) any structural approach or theoretical paradigm is "correct" as long as that approach leads to the appropriate differentiation and integration levels required by the relevant environment of the firm (i.e. the Classical Approach is valid for one environment, the Human Relations Paradigm for another); (4) organizations which successfully differentiate their activities to deal with sub-environmental

demands must develop appropriate integrative mechanisms to resolve functional conflict, reduce the fragmenting effects of functional bias, and achieve total effort integration.

This contingency approach appears to incorporate most of the ideas of other analytical schema and is of value as an analytical reference point in any study which examines relationships between an organization and its environment. We shall draw heavily upon the contingency model during our analysis.

MARKETS

THE GENERAL CONSUMER MARKET

In most industrial settings the relevant market environment of the firm or organization is characterized by monoponistic competition which provides each buyer with some range of choices among substitutable products. Sellers, as a result of interpreting the wants, needs and demands of buyers provide the initiative and financial support required to design, develop, and market a product which hopefully will meet with buyer approval. Buyers and sellers deal on a genuine or quasi-genuine arms length basis and there is little direct buyer-seller interdependence. Supply and demand, competitive risks, consumer acceptance, venture capital, and astute management of some of the

factors which enhance comparative advantage appear to be major facets of the industrial environment or settings.

Sellers (organizational producers) in the consumer environment are, in general, regulated by good business practices and uniform commercial codes; they are thus able to select, without interference, both target market segments for the consumption of outputs and preferred suppliers for the desired energy inputs to the organization.

THE FEDERAL MARKET

One Buyer-One Seller

There is a somewhat different set of market oriented relationships in the environment of governmental procurement of systems. This environment may be characterized as a bilateral monopoly market in which THE ONE buyer and THE ONE seller are contractually linked. Each is largely dependent upon the other for success and thus the relationship assumes, simultaneously, many of the characteristics of a joint venture, a partnership, and a vertically integrated cooperation enterprise.

In this "world", the buyer establishes product requirements and specifications prior to the selection of a seller and potential sellers are invited to demonstrate their capabilities for fulfilling the buyer's requirements prior to contractual linkage of the buyer and the seller. After

seller selection, the buyer finances most, if not all, of the costs of product development and often provides the seller with equipment and facilities for use during product development and/or production.

The buyer is the only market for the seller's outputs and often contractually regulates the output flow from the seller. Likewise, the buyer exerts a great deal of influence over the energic inputs to the seller, specifying or approving in many cases the sources, quantities, and rates of flow of required resource inputs.

Further, as "senior partner" in this joint venture, the buyer often assumes an active role in the management of the seller's organization. Organizational structures, financial planning, executive selection (or retention), work flow programming, resource allocation, financial accounting, production techniques, product testing, and other purely internal operations may be operations of interest to the buyer and the buyer may suggest or demand changes in these operations.

In short, in this market environment, the buyer is "king". He represents the entire market place and tells the seller what he is to produce, when it is to be produced, how he is to produce it, generally, and what general methodolgy he feels is appropriate for managing the effort. Needless

to say, these transactions are quite different from those of the commercial, industrial, or consumer market environment.

Profits

No less different is the orientation toward profits. In the commercial/consumer market place, profits are often the tangible results of astute management or planning. Profits are the returns on risks taken in the market place, a reward for correct assessment of market demands, as well as efficient disposal of the organizational outputs. Further, profit furnishes, in part, some of the "negative entrophy" required for organizational survival, elaboration, and change, and is useful in measuring the comparative success of the organization in adapting to the demands of the relevant environment.

Operationally, the profit motive of organizations in the private economic sector would lead organizations towards endeavors which offered corporative advantages to the firm. These endeavors would promise consumer acceptance and a favorable positive return on invested resources, given the risk involved, and would order probabilistic risks and returns, given available resources and organizational capabilities.

Profit, in the Federal Procurement environment takes on a somewhat different connotation. While profit still represents some of the fruits of an astutely managed operation,

the elements of market risks, comparative return on alternate investments, and comparative advantages of varied or selective resource applications is missing.

Instead, profit is a subject of negotiation between the buyer and the seller, and may have little or no direct linkage with risks, comparative advantages, or alternate investments. In many cases, profits or rates of profits are fixed at the time of contract award by contractual agreement and by governmental regulation.

NOTE:

As per Armed Services Procurement Regulations (ASPR), and Federal Procurement Regulations (FPR) contracts fall into two broad general catagories, Fixed Price Types (FP) and Cost Types (CP). The general catagory of contract is selected based upon the level of certainty involved in the procurement.

FIXED PRICE TYPE

In the Fixed Price catagory designs are usually well defined and there is previous purchase history or well substantiated cost data. The Firm Fixed Price contract (FFP) is the preferred contractual arrangement (ASPR 3-24). Specific profit levels are negotiated as a part of the firm fixed price, but the seller is contractually obligated to deliver the product at the stated price regardless of profits. This contract is usually used for "off the shelf" purchases of clearly defined products, which require little or no modification to meet governmental specifications.

Fixed price contracts are usually modified significantly when the article to be procured is less well defined or requires modification. Clauses such as a price escalation clause to recognize uncertainties in labor or material cost may be inserted if required. The contract then becomes fixed price escalation (FPE).

Should target cost or efforts be somewhat ill-defined, an Incentive Fee Clause (FPI) may be inserted which grants the seller incentive fee or fees for accomplishing certain performance milestones. The incentive fee is usually variable and based upon a pre-performance negotiated formula.

Based upon the specific contingencies of the situation, other clauses are also available for contract modification. All, however, are the subject of buyer-seller pre-performance negotiation.

COST TYPE

The other general type of contract is the Cost Plus (CP). Cost contracts are generally used when a high degree of uncertainty concerning the product exists. Usually these contracts are used for research or development efforts when little hard date is available concerning the desired product. In the cost type of contract, the buyer reimburses the seller for the cost of the sellers effort and awards him a profit based upon numerous circumstances or contingencies. Again the previously mentioned clauses reflecting the unknowns, uncertainties, or expected contingencies may be (and usually are) negotiated into the buyer-seller contract prior to the beginning of actual work or product delivery. Cost Plus Fixed Fees (CPFF), Cost Plus Incentive Fee (CPIF) and Cost Plus Award Fees (CPAF) are typical examples. (Federal Procurement Regulations 1-13).

The point is, that the seller and buyer negotiations are based upon their perceptions of the certainty level of work effort and the rewards for the work effort, prior to the seller actually commencing work.

Most adjustments to the contract often depend largely upon the buyer's perception of need and political impact rather than upon product improvements.

This somewhat different approach to profit, or negative entrophy generation through effective and efficient operation of the transformation model, could not fail to have significant impact upon management thinking and organizational operations.

Success Measurement

A third major difference in the Federal Systems Procurement Environment is that of success measurement. Normally, in the environment of commercial enterprises, success is measured in terms of organizational growth, prosperity, or relative improvement of its position with respect to contemporary or competing organizations. Changes in profits, sales volumes, numbers of new products successfully developed and marketed, and industry ranking are specific measures often quoted as "success", or performance measuring devices. (Lawrence and Lorsch, 1967)

In the consumer/industrial environment, a somewhat more subjective measure of organizational performance and success is that of executive opinion. Numerous researchers and organizational analysis have asked organization executives simply "What are the high and low performing companies, units, programs, or organizations within this industry?", and have used these rankings as success measures. (See Morse, 1968, Mott 1972.)

Inevitably, however, the trend seems to be toward measuring success in terms of tangible increases in sales, market shares, economically successful new products, or other quantifyable means.

In the Federal procurement environment, success measurement appears to be in three distinct phases or parts: contract award, adherence to program rules, and retrospective evaluation. The first measure of success is the "winning" of a competitive struggle for a specific government contract. This is accomplished by submitting a minutely detailed proposed plan of action which convinces the buyer/proposal evaluator that the chosen seller is the most qualified of those competing for the task. Success is thus measured not by direct performance but by convincingly articulated performance potential.

The second, or interim measure, is quite subjective. It is based upon the buyers perception of (1) the seller's progress rate toward program completion, and (2) the degree that the seller has adhered to originally planned performance milestones. Little weight is apparently given to the factors of program uncertainty and/or buyer or seller incorporated program changes. (Interviews - Federal Procurement officials)

The final measure of success may be classed as retrospective judgement. When the program is concluded, value judgements, based upon various degrees of knowledge and varying familiarities with facts and specific circumstances surrounding the effort, are given by persons both

related to and completely disinterested in the program. Often, it appears that the buyer's agents most familiar with the program do not evaluate the seller's performance. Instead, final performance assessment may be more of a political issue, some weight is given to a comparison of the articles actual and planned technical performance and to the actual versus the proposed cost, schedule and technical performance of the seller. However, a majority of program success appears to be measured in terms of political expedience. This is a more complex issue that the acceptance or rejection by the market place of an organization's efforts.

Chapter 2

THE PROBLEM

I. OPEN SYSTEMS ANALYSIS

Open systems approaches to organizational theory, as it applies to large and complex organizations, have emphasized the importance of the interaction of the organization and its relevant environment in all stages of the transformation process and in all phases of organizational "life". According to theorists who advocate this open systems rationale for organizational analysis, the success or failure of the organization in achieving its goals is directly related to the relationship between the demands of the organization's relevant environment and the reaction of the organization to these demands. Typical examples of this reasoning include the Seiler adaptation of Homan's model (Seiler, 1967), the ideas advanced by Katz and Kahn (1966) in their organization interaction model, the organization postulates of James D. Thompson (1967) and the Contingency (D and I) Model developed by Paul Lawrence and Jay Lorsch (1967).

Open systems theorists have investigated organizations in a number of environmental settings in an effort to

clarify some of the relationships between the organization and its relevant environment. The results of these investigations have been numerous research based axioms, postulates, and hypothetical or theoretical relationships which tend to explain many of the relationships between the organization and its relevant environment.

In general, however, most of the relationships concerning the interaction of the organization and the relevant environment have been developed as a result of observations and research in the private or consumer sector of the economy. Some researchers have examined institutions in the public, or governmental sector, but these have been relatively few and appear adjunctive to the main body of theoretical research.

II. A NEGLECTED ENVIRONMENT

An important segment of the total business environment which has received little or no attention from open systems theorist is that organizational-environmental relationship formed by the government and industry during the systems acquisition process. For example, the National Aeronautics and Space Administration (NASA) and the Department of Defense (DOD) have initiated systems or systems related industrial procurements of over $25 billions each

year since 1960. By 1990, this figure is expected to grow to over $35 billion per year, in the Aerospace Industry alone! (VENDOR "V" economic forecast, 1973).

Viable analytical techniques which increase knowledge of these organizational relationships are beneficial in terms increased effectiveness in the utilization of all prime resource catagories.

The relevant relationships to the environment of the industrial vendor-governmental agency buyer may be significantly different from those investigated by the open systems oriented analysts and theorists who have concentrated in the consumer oriented or purely governmental segments of the total business spectrum. The readily apparent differences in the market, profit orientation, and the success criteria of these two different environments raises serious questions about the validity of transferability of analytical relationships from one environment to another.

III. CENTRAL PURPOSE

It is the central purpose of this research to examine some of the interorganizational relationships that exist between the government buyer industrial vendor of complex systems. Using open systems oriented concepts and findings of previous research, we have examined the relationship of

organizations and environmental forces in the environment of the system vendor and governmental agency.

IV. CENTRAL QUESTION

The central research question is: "What hypotheses, related to open system oriented, organizational analysis can be generated in or extended to the special environment of large and complex federally sponsored development projects?"

Three specific questions which must be answered in order to link some of the open systems concepts to the federal procurement environment are: (1) What segment of the somewhat broad overall environment would be selected and why; (2) Which open systems oriented concepts will tend to be appropriate for the environment; and (3) What investigative mechanisms are appropriate for linkage between the concepts and the research site?

V. THE RESEARCH SETTING

The range of selection possibilities within the federal procurement environment is almost limitless. Items which governmental agencies procure from industrial organizations range from common, household consumer items to complex, one-of-a-kind, space exploration systems. Direct interaction between the vendor and the governmental focal

agency tends to vary with the size and complexity of the procurement. Procurements of household items, nuts and bolts, or common "off-the-shelf" items demand and receive little buyer-seller interaction. The procurement is similar, if not identical, to any large purchase in the consumer/industrial market place. However, and as the size, complexity, and differences of items grow, so does the direct interaction between the buyer and the seller. (Interview - Federal Procurement official).

SELECTION OF THE STUDY LOCATION

Conversations with government procurement officials convinced us that an excellent setting for the exploratory research would be a major project in the aerospace industry. Here, most projects are large, costly, and complex and interraction between the vendor and governmental focal point is high.

We, therefore, selected the aerospace industry. Within the industry, we selected, again based upon the advice of federal procurement officials and vendor representatives, a representative program of major acquistions, both inside and outside the aerospace industry. Specifically, the size, complexity, technological uncertainty, and program length of the program we selected appeared to be similar to several in the aerospace industry, the land weapons development

industry and the ship building industry, and thus offered a wide transferrability potential.

The specific program which we studied had the following characteristics.

THE GOVERNMENTAL AGENCY

The governmental agency (known hereafter as Buyer "B") was a special program office set to act as a focal point of governmental interaction with the vendor organization. This buying organization (B) was internally divided into a central office at the buyers headquarters and a major satellite office at the vendor's plant.

Both the central and satellite offices were similarly organized into functional sub-units each of which monitored a major aspect of the program; e.g., product configuration, production, testing, financial management, and engineering. Each subunit was further divided into specialized catagories on an as required basis.

At the time of our study, the program was in the development stage of the acquisition cycle, and thus, both the central and satellite offices had a large contingent of engineering or engineering-oriented members. The engineering function was, the largest single segment of "B's" organization.

The organization chart is as illustrated by Figures 1, 1a, and 1b. An analysis of these organization charts provides the following data concerning the buyers organization.

"B"
ORGANIZATION

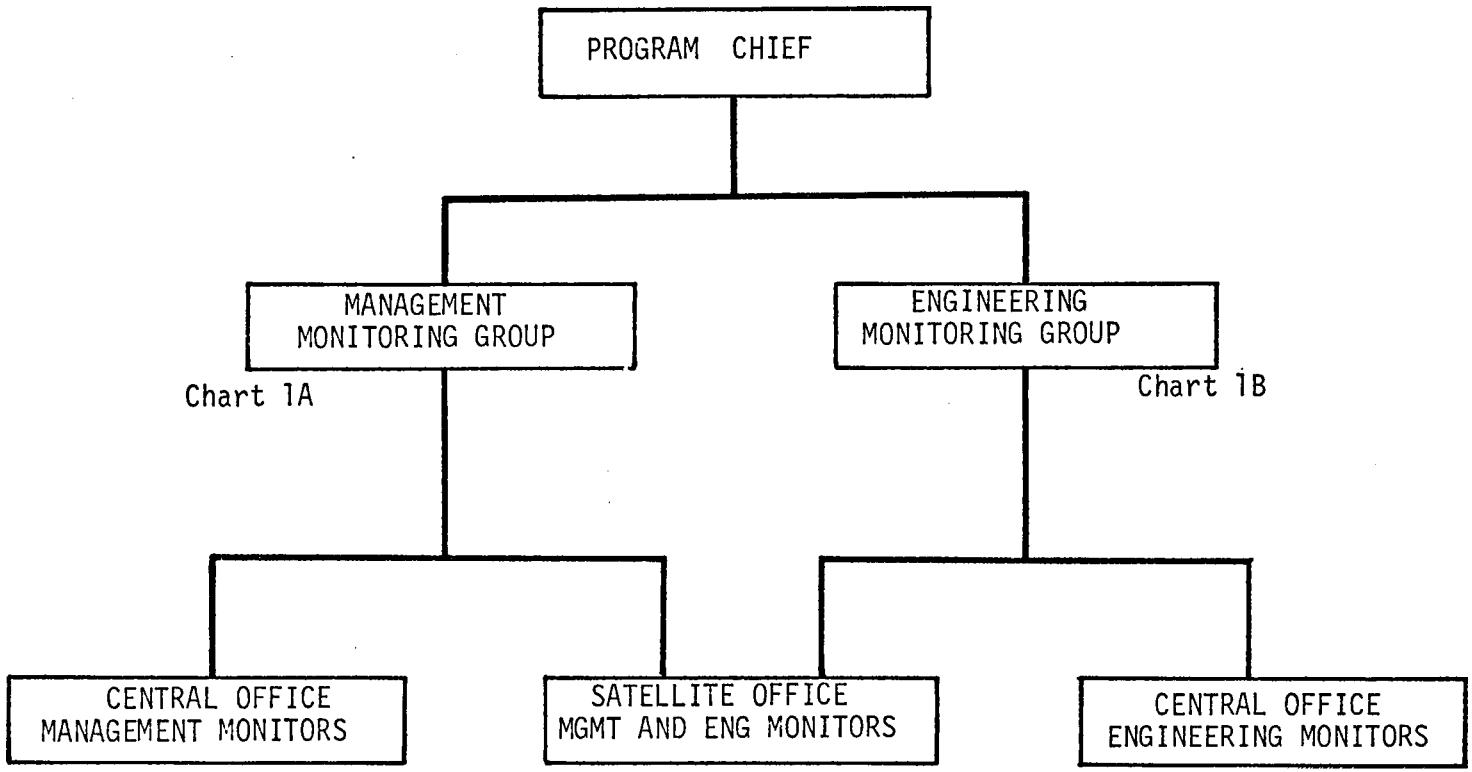
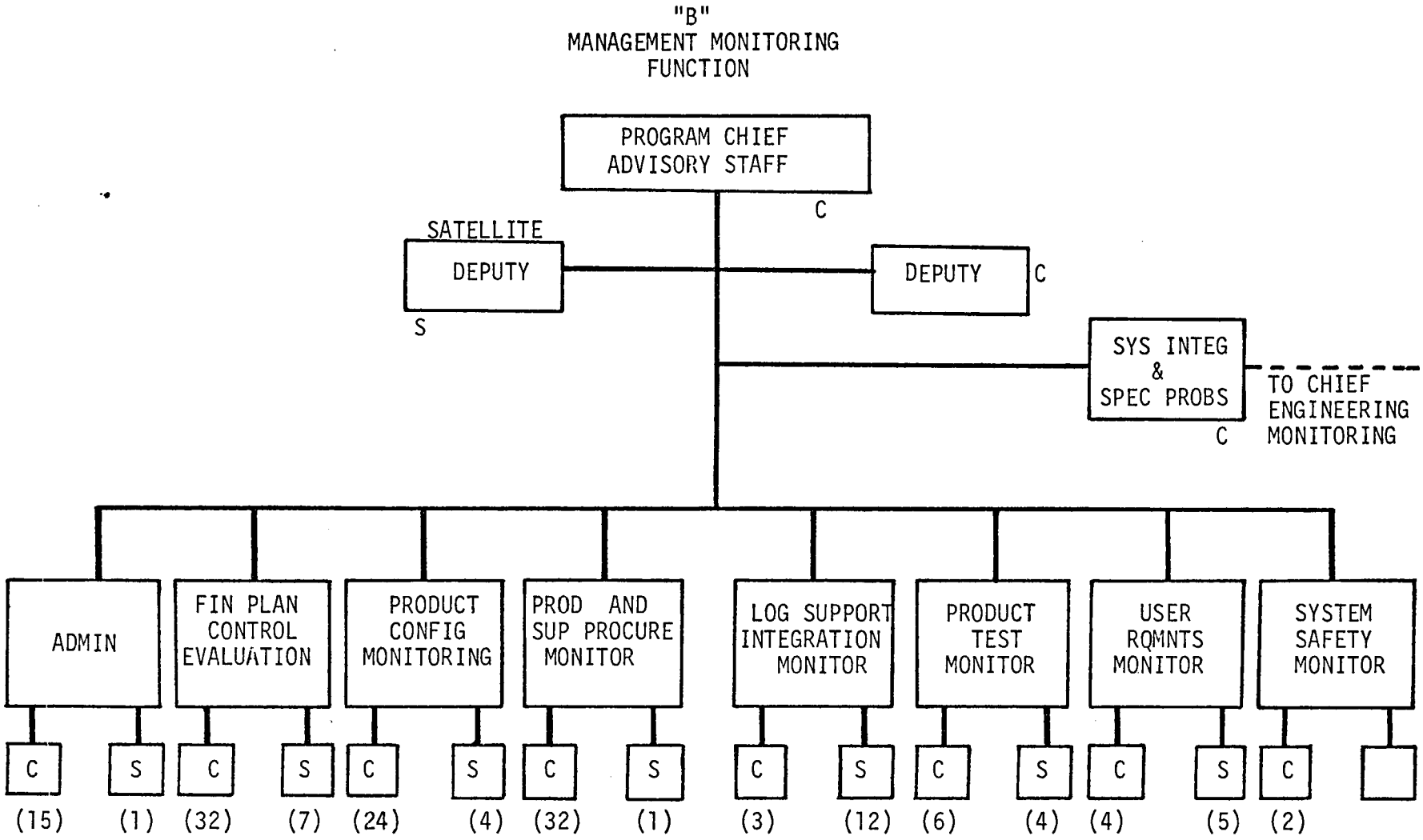


Figure 1



C INDICATES PERSONNEL AT CENTRAL OFFICE
S INDICATES PERSONNEL AT SATELLITE OFFICE (VENDOR FACILITY)
( ) INDICATES NUMBER OF PERSONNEL ASSIGNED TO TASK

Figure 1a

"B"
ENGINEERING MONITORING
FUNCTION

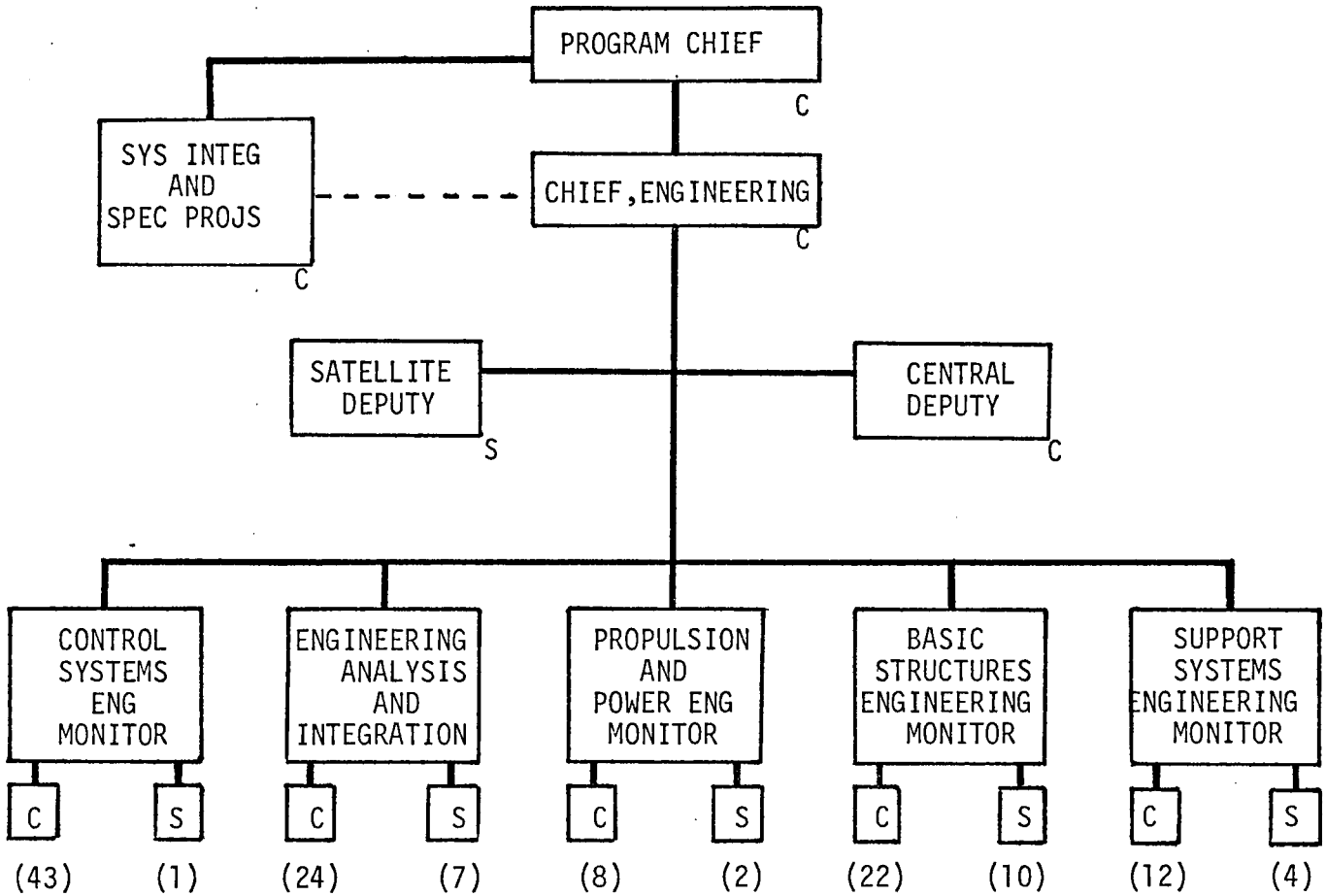


Figure 1b

(1) The "B" organization is organized along functional lines.

(2) All program functions or task disciplines have representatives in both central and satellite offices.

(3) The overall ratio of central office manning to satellite manning is approximately 4 to 1, but this varies with the functional discipline requirements.

(4) The entire organization has a strong engineering or engineering management bent which may be appropriate for the development stages of a large complex systems acquisition.

(5) The engineering monitoring function is the largest single function.

NOTE:

The organization chart should not mislead the reader. This chart shows only the static locations of the central and satellite offices. In reality, a great deal of personnel movement occurs. Members of the satellite office frequently pay coordination/guidance visits to the central office, and members of the central office make coordination/guidance and information exchange visits to their satellite counterparts (related functional task groups) and to vendor personnel.

THE CONTRACTOR'S ORGANIZATION

The vendor's organization, "V", is the Aerospace Products Division of a major United States corporation. This organization has a long and impressive history of developing aerospace hardware for a wide variety of applications. The

United States Government has traditionally been this division's major customer, but other business has included design and production work for other segments of the economy.

Sales, by the corporation as a whole, to various agencies of the United States Government, have exceeded 50% of total corporate sales (Ref. Corporate Documents of "H", the parent corporation of which "V" is a division) for the last five years, but an active effort is being made to reduce this percentage through product diversification and increase in other market sales.

"V" is a one product organization, contratually obligated to design, develop, and produce proto-types of a major aerospace system. No full production decision has been made, but generally speculation heavily favors a positive governmental decision to include this system in its aerospace inventory. (Interviews with "V" and "B" executives).

"V" is functionally organized as illustrated in the following chart (Figure 2).

Essentially, there are four major functional units, two support units and a samll program management liason group within the framework. These are:

ORGANIZATION V

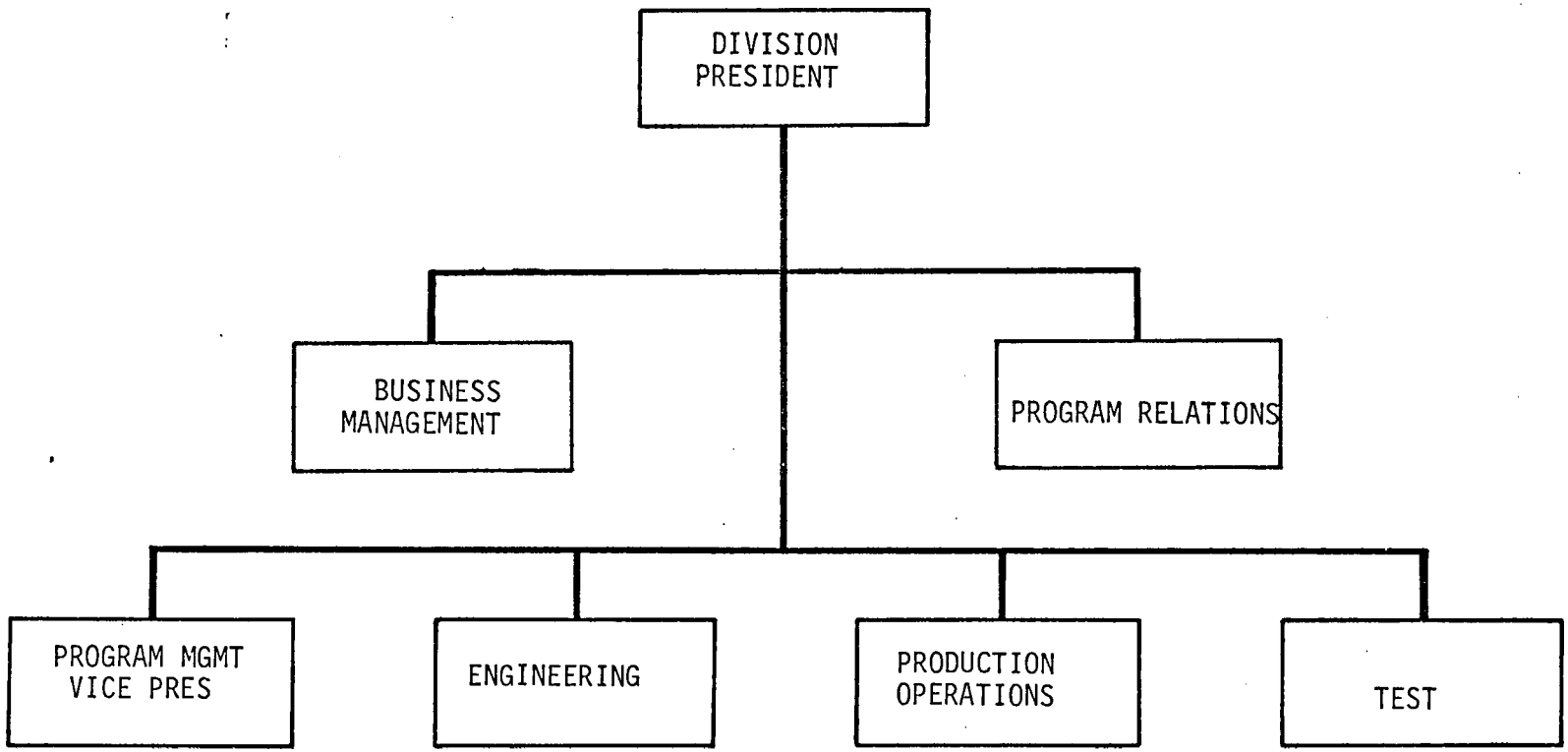


Figure 2

(1) The Business Contracts and Financial Management Function.

Business Management performs personnel administration, accounting, contracts management and monitoring, financial planning and analysis, management systems development, analysis, planning, and operations and data gathering and analysis. In essence, this function gathers, processes and analyzes management, financial, contractual, and performance information on an organizational wide basis.

(2) The Engineering Design and Development Function.

"Engineering" performs the actual designing of the aerospace system to include basis structure, control mechanisms, propulsion and power systems, and support systems. This function also includes a large staff of project engineers who coordinate the movement of the design task through the various engineering stages. Also included in this function is a large technical operations section which performs many of the same tasks for the engineering function that the business management function performs for the organization as a whole.

(3) The Production Operations Functions.

"Operations" is charged with the tasks of purchasing materials and major components for the system, manufacturing and assembly of the system, and developing and maintaining the industrial facilities and plant services required by the organization. Operations also has a large planning and control section which performs many of the same tasks for the production operations function that the business management function performs for the organization as a whole.

(4) The Product Testing Function.

The Test Function performs all of the predelivery testing of the system. It is responsible for

developing, planning integrating and performing systems tests which will demonstrate that the system meets contractually required performance parameters. Additionally, it must acquire testing facilities or sites at which to perform the required tests. Testing has a small planning and control section which performs many of the same functions for the Product Testing Function that the business management function performs for the organization as a whole. It is of note that the separate testing function was created only recently. It was formally a part of the Engineering Function.

(5) The External Publicity Directorate.

This unit is a small market relations staff organization.

Activities consist of customer relations and publicizing the merits of the organization and the aerospace system to external groups not directly connected with the system. It appears to have no direct connection with the actual task of developing or manufacturing the system.

(6) Industrial Safety.

This unit is a small organization responsible for monitoring and advising on matters of plant safety. It also has no direct connection with program development.

(7) The Program Management Function.

This is a very small organization consisting of a Vice-President and four associate program managers. This unit has the task of monitoring the entire program, mediating intra-functional differences and reporting overall program status to the division president. This organization was formally a part of the Engineering Function, but was changed to a separate entity several months prior to the start of our research.

THE CONTRACT

A review of the contractual instruments which binds "V" and "B" reveals:

(1) The task is the development of a major aerospace system.

(2) The contract is a cost plus incentive fee type (CPIF) of arrangement which carefully stipulates that the aerospace system is for development only.

(3) It further outlines specific technical, schedule and costs milestones and in doing so, specifically limits government financial obligation by fiscal year, by cost category, and in total dollar amount.

(4) It ties incentive fees to cost, schedule and technical performance milestones.

(5) It obligates the vendor to use a specifically approved method of data accumulating and of reporting systems development activities.

(6) It indirectly recognizes that the development is a "state of the art" effort.

(7) It implies that a decision for production after development largely depends upon the performance of "V" during the development effort.

(8) It implies that a strong and continuous mutual exchange or information and guidance will occur between the buyer "B" and the vendor "V" organizations.

VI. THE REFERENCE FRAME

The preliminary review of the literature and the environment points to a set of analytical guidelines:

(1) selected open and open-closed systems guide lines of general systems theory, with a concentration upon dynamic interaction between the organization and the organizations environment; (2) selected ideas concerning program, systems, and matrix management; and (3) relevant ideas advanced by the communications literature as it applies to inter-organizational transactions.

STRUCTURES

Stanley Udy (1958), in a study of production-oriented organizations, found that organizational structures were governed by the organizations technology.

R. H. Hall (1962) in a related study, investigated the relationship between departmental task technologies and formal departmental structures. He found that departments which dealt with routine activities required different organizational arrangements from those which engaged in non-routine or creative task activities.

THE TAVISTOCK APPROACH

Burns and Stalker (1961), in a study of some 20 industrial firms in the United Kingdom explored the relationships between internal management practices (organizational structures), rates of change in scientific techniques (environmental change), and economic performance. They found a relationship between the patterns of management

practices, environmental stability, and economic success.

Burns and Stalker identified the primary factors in environmental stability as rates of change in technical or market forces (Ibid. pp. 95-97). Two opposing types of management structures were termed appropriate responses to given rates of technical or market change. Under unstable or rapidly changing conditions, they found that an "organic" structure was appropriate for effective management or organizational success and that a "mechanistic" structure was more appropriate for stable or relatively unchanging conditions (Ibid. pp. 118-24).

Organic systems are characterized by (1) jobs not rigidly defined; (2) decision making based upon broad knowledge of the firm or project rather than positional influence; (3) loose, flexible organization structures, based upon program needs rather than hierarchical control; and (4) horizontal and vertical communications and interaction patterns.

This structure schema appears to have characteristics closely related to the "Human Relations" participative approach of Mayo, Roethlisberger, Dickson, Likert, Argyris, and others.

"Mechanistic" management systems, appropriate for the more stable environments, were characterized by (1) task

specialization; (2) role rigidity; (3) highly formalized structural hierarchies with decisions by supervisors; (4) vertical communications and managerial interactions; and (5) well defined and regulated work behavior (Ibid. p. 11).

This "mechanistic" schema tends to follow the general line of reasoning and structual procedures of the "classical or bureaucratic" schools of organization/management which advocate clearly defined jobs, rigid operating procedures, and inflexible hierarchical structures.

Burns and Stalker found that firms who had structures which were inappropriate for the demands or requirements of a new environment had difficulties in adjusting to the environment; a linkage between the demands of the environment and successful organizational performance could be postulated.

A. K. Rice in his work, "The Enterprise and Its Environment," (Tavistock, 1963) describes the organization in terms of a transformation model that "imports" resources from the environment, uses the imports in a "conversion process" and then "exports" products and services. (P. 17). Further, Rice emphasizes that the organization and its subparts have primary tasks which are dominate and which must be performed if the organization is to survive. (P. 12-13). In an earlier text, Productivity and Social Organization (Tavistock, 1958), Rice says:

> "The number and distribution of tasks vary between different systems and different departments or sections of any one systems. They may vary over time. Each system or sub-system has, however, at any given time, one task which may be defined as its primary task - the task which it is created to perform ....." (p. 32).

In elaborating his open systems/transformation ideas further, Rice (1963 p. 16) argues that the primary task of the organization or sub-group is defined by the nature of the firm's environment; this environment assigns priorities to many, if not all, of the transformation exercises that the firm conducts.

Similarly, he states "In making judgements about any organization, two questions have priority over all others. What is the primary task? How well is it performed? All other questions are subsidiary to these two." (1958 p.33)

Joan Woodward (1964), the English Sciologist, in a study of approximately 100 South Essex firms, groups firms into categories according to their production system. These categories were (1) unit or small batch operations, typified by engineering or research and development organizations, (2) large batch and mass production organizations such as assembly line operations, and (3) continuous process or production organizations such as petroleum or chemical concerns. Analysis of Woodward's data tended to link organizational structures, technology, and effectiveness of

organizational performance.

Specifically, Woodward found that those organizations with similar products systems tended to have similar structures. Within the similar structural groupings, those firms or organizations which had structural characteristics (span of control, hierarchy levels, ration of staff to production worker) near the median of the category tended to be more successful and effective. (pp. 50-80)

Another of Woodward's interesting findings suggests that within the three categories of organizations, a definite difference in the organizations' most critical function and the orientation toward that function existed. (pp. 122-53). For unit or small batch organizations which produced individual units to customer requirements, prototypes, or large special equipments, the most critical function was that of development; for large batch or mass production, the critical function was the actual production or fabrication unit and for the continuous process organizations, it was the sales function.

In the unit production organizations, Woodward found data to suggest requirements for a high degree of interfunctional interdependence, a close integration of functions and frequent and rapid interfunctional communications, at all levels of the hierarchy, (pp. 134-35). In the mass production

type of organizational technologies, she found that a more "classically oriented" structure seemed more appropriate for organizational operations. (pp. 130-33). Further, Woodward's data suggests that the further removed an organizations structure was from the median of structures in the industry, the less successful the firm tended to be.

In summary, the Woodward data suggests a direct linkage between technology (task or work of a firm or industry), and the organizational structures (the schema or methodology for organizing the work), and organizational success. The Tavistock research provides a most important research base: (1) Open systems concepts appear appropriate for organizational analysis; (2) relevant environmental elements tend to define tasks and success measures; (3) different organizational structures are appropriate for successful operations in different environments; and (4) specific structual approaches are appropriate for different levels of environmental stability or volatility.

OTHERS

Evan (1963) in a application of Merton's (1957) role-set concepts, advances the notion of the organizational set. He argues that a "focal organization" has both an input and output set or organizational/environmental forces

which tend to constrain or shape the focal organizations activities. Given that the organization is unable to fit with or control its "set," success would be questionable, if not impossible.

Terryberry (1968) in her treatise on the evolution of organizational environments suggested that the environment exerts selective pressure upon the organization to adapt or change to meet environmental demands or requirements and that it is the most adaptive organization which show successful economic progress.

CONTINGENCY THEORY

Lawrence and Lorsch (1967) and several of their associates, namely Garrison (1966), Walker (1967), Burns (1968) and Morse (1969) have synthesized and operationalized many of the open systems notions into a contingency model. Their approach adopts an open system orientation to organizations. They hold that organizations enjoy a state of dynamic interaction with relevant segments of the total environment.

Basically, the Contingency or Differentiation and Integration Model which they suggest is based upon the following interrelated research findings; (1) Organizations structures must be differentiated, elaborated or divided in such manner as to fit the demands of the

relevant segments of the total environment; (2) integration of efforts (coordinated task endeavors) must fit the required degree of differentiation and environmental demands for optimal effectiveness; (3) stable environments require different degrees of differentiation and integration than unstable environments; and (4) successful organizations have patterns of differentiation and integration that meet or fit environmental demands more closely than do unsuccessful organizations.

In essence, the Contingency Model / (D&I approach) views environmental uncertainty as the key variable in the organizational success formula and successful organizations are those who structure themselves to "fit" or deal effectively with the environmental forces of relevance while coordinating their functionalized efforts so as to achieve a unified task effort.

Some of the other interesting relationships which the contingency researchers also found include the following: (1) the greater the differentiation that an organization achieves among its sub-parts, the greater will be the difficulties in integrating the effort, and; (2) direct confrontation tends to be the most appropriate method of intra-organizational conflict resolution.

This approach, was viable for our research. We drew heavily upon the variables and instruments cited by the continguency researchers in the formulation of our analytic approach and data gathering instruments.

UNCERTAINTY

Another contribution which provided us with significant guidance was the work of James D. Thompson, (1967). For example, Thompson argues that an organizations chief goal is survival; (p. 6) that organizations cope with uncertainty by functionally dividing the organization into parts which deal with uncertainty and parts which operate under conditions at or near certainty, (articulating the parts as required by environmental demands), and; (3) that both technologies and environments are major sources of organization uncertainty. (p. 6).

The technology and environment of an organization determine the structural requirements of an organization and that in order to survive and flourish in the environment, structures must be such that they permit the organizational sub-parts to operate at acceptable levels of certainty so as to perform their primary tasks.

PROGRAM MANAGEMENT

Another set of research findings which we found applicable to our study were suggested by environmental demands upon the "V" organization. "B" insisted that "V" adopt a program or project oriented structure for his organizational segment that was involved in the project.

Since a functional organization does not usually provide sufficient program visibility or sufficient control over costs and schedules, most governmental agencies involved in expensive research and development projects usually demand a program oriented management structure to assist in providing this visibility. (Baumgartner (1963) provides an excellent case study of this in his discussion of the Atlas Missile Project in his text on Project Management.)

David Cleland (1964) states that program/project management is needed when a firm faces increased need for interfunctional coordination, when it has new products, or when it has a single costly product which could have an unusually strong impact upon the success or failure of the organization. (Pp. 82-83).

Stewart (1965) found similar reasoning for program management, but added, as did Kast and Rosensweig (1965),

the control or management of high rates of technological or environmental change.

Walker, (1967) in a study using the Lawrence and Lorsch contingency model found that program/product oriented management structure was more appropriate and led to better results when tasks were less predictable or innovative problem solving was required.

Similarly, Burns (1968) using the contingency approach in a study of program offices found that program structures were most effective in dealing with uncertain task situations.

Organizational documents of all major federal procurements agencies (DOD, NASA, The U. S. Army, Navy and Air Force) strongly recommend that major projects be controlled through project type organizations.

COMMUNICATIONS

Information flows also seemed to be an important part of our study. If organizations and enviornmental forces are to interact, information must be exchanged across the organizational environmental boundaries.

Leavitt, in research conducted with Bavelas, and others (1951) found that centralized communications patterns were more effective for routine tasks and

multi-channelled (circular) patterns were more effective for complex tasks. This suggests again that task structures should be constructed to accomodate environmental or technology requirements.

The literature may be summed by a single set of concepts. Successful organizations are structured so as to cope effectively with the signigicant facets of the relevant task environment.

Chapter 3

DESIGN OF THE STUDY

The paired organizations joined in this project effort gave us an opportunity to investigate directly, rather than through inference, some of the effects of interaction between a firm and its environment. As noted previously, in a brief discussion of relevant literature and previous research, the line of reasoning advanced by Thompson, the Tavistock Institute researchers, and the organization analysts using the Contingency model as a reference frame presented a great deal of face validity and applicability for this research endeavor.

The noticeable differences between the environmental arrangements of our research and those environments used in the development of the organizational postulates which we found reasonable lead us to be very cautious in our selecton of a research design and data gathering techniques. Many of these cautions were overcome or compensated for in that we were able to measure some of the environmental forces directly rather than measure them through inference. For example, Lawrence and Lorsch (1967) used perceptually implied measures of performance and success in their contingency model. We directly questioned significant environmental elements concerning these and other subjects.

I. DESIGN

The design was a two phased study. Phase I consisted of a review of:: (1) vendor "V" and buyer "B" program documents, procurement regulations, contractual instruments, organizational charts and published operating procedures; (2) informal interviews with 5 federal procurement officials and 5 vendor officials not connected with the research pair; and (3) a limited testing of our data gathering techniques for realism and clarity.

Data gathered from Phase I served several useful purposes.

PHASE I

The Phase I data provided valuable insight into the general characteristics and relevant environmental forces of the research environment. It provided general direction in terms of organizational relationships and possible interaction patterns; it gave us some insight into the selection of instruments and the modifications that these instruments might require.

Specifically, the Phase I data collection effort allowed us to investigate the face validity and inpart, the potential transferrability of some of the open systems wherein we perceived as applicable to data collection and variable measurement in the Federal environment.

Phase I interview feed back sessions were most helpful in connecting variables and interview questions. Similarly, the sample Questionnaire distributed to ten members of and aerospace organization was discussed with respondents to insure that the data being collected was, in fact, meaningful and appropriate for the study.

PHASE II

The main research effort was directed at the principal environmental force (the customer, organization "B") and the organization interacting with the environment (Vendor organization "V"). Data gathering techniques consisted of (1) interviews with key individuals within the government agency, "B", (2) administering a questionnaire on the relationships and perceptions between "B" and "V" as perceived by key individuals within "B", (3) interviews with a large number of managers representing each function or discipline with "V", and (4) administering a questionnaire to a large sample of key managers within the "V" organization to collect data on specific organizational relationships.

RULES OF DATA

The instruments used in Phase II are described in detail later in this chapter and are included in Appendix A-1 and A-4.

Each of the questions used in the written questionnaires were either direct copies or minor modifications of questions used by Contingency Theory oriented researchers to collect data on the same variables that we were investigating. For example, EQQ #4 and IQQ #4 are taken directly from an instrument used by Lawrence, Lorsch and others to measure the degree of actual integration (a measure of coordination). We used it for the same purpose.

RULES OF EVIDENCE

The rules of evidence or the methodology by which we formulated our hypotheses were these. First, for inclusion in the analysis, the relationship had to have previous importance in the literature. It had to have been connected directly with organizational performance or organizational success by the previous research. Second, the area had to show face validity or offer potential face validity in our vendor "V" buyer "B" organizational relationship. Third, it had to show some potential effect due to close interaction of two organizations such as "V" and "B". Fourth, it had to show some definite promise of being directly connected to improved success or organizational performance in the Federal procurement environment.

We looked for significant intersections of the data which passed the first test or the first general rule of evidence. Intersections of data of both "V" and "B" interview and questionnaire data, were then compared with the data patterns of previous research.

Given that the data had passed the first rule, a second rule was applied. That rule was a comparison of our findings and our implications with generalization potential. If the relationship approved to apply to the wider environment, we then reported an hypothesis for future testing. At all times the non-stated question, "How does that particular variable interaction affect the performance or preceived performance of the organizations? and How might a change in the operation of this variable affect Federal development procurements?" were asked.

An example of this procedure is: the area concerning required coordination in the organization. We researched the literature on coordination, specifically centering on the Lawrence & Lorsch coordination items called the "degree of integration". We found according to Lawrence & Lorsch, that integration was directly tied to performance. We then used their instrument and measured the degree of coordination or degree of integration present intra as well as inter organizationally. This data was combined with our interview

data which dealt with coordination among and between organizational units and external environmental elements. We then developed an hypotheses based upon the findings suggested by the relationships which we observed.

VALIDITY

The instrument used to gather data had strong-face validity. Questions were asked directly of the vendor organization "V" and it's dominant environmental force organization "B". Questions were asked to obtain specific data. For example: When data was required or specified concerning the dominant success criteria, both "V" and "B" were asked the question, "What are the success criteria of the program?" The data obtained from the interviews was similarly face valid and strongly supported the questionnaire data and therefore one must infer validity, i.e. the measuring instrument did in fact measure the variables that the researcher desired to measure.

Recognizing however that reliability is a limiting factor in instrument validity, we have further support for claiming validity when we examine reliability. It is true that no test re-test parallel forms or split half computations can be made. The instrument simply does not lend itself to this type of analysis. The method of questionnaire

construction, however, does give some reliability information. The specific questions were taken directly or adopted from, other contingency based studies. The same variables were measured and the same general types of results obtained from the environment as in the early studies. That is, question seeking data on degree of integration for instance in the original Lawrence & Lorsch study or in the Walker, or Burns studies furnish data on integration for that environment. The same instrumental question was used to gather data on integration in our research. High reliability therefore, although not in statistical terms, and the earlier indications of validity lead us to believe that our instrument is valid.

Recapping, we achieved validity first through face validity, by asking direct questions. Secondly, validity was again reinforced when the response data from the questionnaires very closely matched the response data from the oral interviews. One, in fact, supported and explained the nuances of the other. And last, but not least, validity was achieved through the use of a previously used instrument which measured the same variables in an environmental setting.

II. CATAGORIES OF DATA

A review of open systems concepts suggests that several types of subjective groupings of data would be appropriate for our effort. These categories include:

(1) The predominant environmental forces which are of concern to the firm as a whole and to each of the major task groupings of functions of the firm. (GENERAL ENVIRONMENT, RELEVANT ENVIRONMENT, AND RELEVANT SUB-ENVIRONMENTS)

(2) The perceived requirements for differentiation in the organization and among its subparts. (PERCEIVED REQUIRED DEGREE OF DIFFERENTIATION)

(3) The existing patterns of differentiation within the organization. (ACTUAL DEGREE OF DIFFERENTIATION WITHIN THE ORGANIZATION)

(4) The perceived requirements for task coordination or effort integration within the organization. (PERCEIVED INTEGRATION REQUIREMENTS)

(5) The existing levels of task coordination or effort integration within the organization and among its subparts. (ACTUAL LEVEL OF INTEGRATION)

(6) The perceived level of performance of the organization and its major subparts as judged by the organization's relevant environmental judges. (PERFORMANCE)

(7) The level of performance of the organization and its subparts as perceived by managerial decision makers within the organization. (PERFORMANCE)

III. POTENTIAL VARIABLES AND DATA SOURCES

In order to develop some meaningful hypothesis for future research, the following variables and potential data sources appeared relevant to the exploratory research.

VARIABLE	DATA SOURCES
1. The Organization's Environment	
General Characteristics	
Technical	Corporate documents
Economic	Customer documents
Product	Aerospace publications
Market	Interviews
Relevant Environmental Forces	
Strategic or dominant concerns	"V" & "B" documents
Customer demands	Corporate documents
Industry demands	"V" & "B" questionnaires
Corporate demands	Interorganizational contracts and agreements
Other firms	"V" & "B" interviews
Principal Sub-Environments	
Major task division groupings or functional arrangements	"V" & "B" organization chart
Sub-Environmental Diversity	
Relative task dominance	"V" & "B" questionnaires and interviews
Dominant functional contribution	
Feedback timespans	
Signal receptivity	
Relative environmental certainty	"V" questionnaires and interviews
Success criteria	
Task certainty	

VARIABLE	DATA SOURCES
Environmental/Task Interdependence	
Sub-unit autonomy	"V" questionnaire and interviews
Sub-unit task interdependence	
Work flow	
2. Structural Patterns of the Organization	
Patterns of Differentiation Among Functions	"V" organizational charts and interviews
Structural differences	Organizational Charts
Time orientation differences	"V" questionnaire and interviews
Task orientation differences	
Environmental concern differences	
Environmental stability differences	
Patterns of task integration	"V" documents
Coordination Methodology	"V" interviews
Work relationships	"V" questionnaire
3. Organizational Performance	
Overall diversion performance	"V" & "B" interviews and questionnaire
Functional sub-unit performance	

IV. DATA GATHERING DEVICES AND DATA SOUGHT BY EACH

ENVIRONMENTAL INTERVIEWS ("B" Organization)

Semi-structured interviews were planned for a small sample (10) of buyer personnel who are charged with the responsibility of technically and contractually monitoring the efforts of the "V" organization. Data gathered from these interviews include:

(1) Perceived organization performance (overall and sub-units)

(2) Organizational responsiveness to environmental demands (customer)

(3) Dominant concerns of the environment and the "V" organization

The interview questions, (Appendix A-1) were all of a direct nature and establish a focus for the environmental perceptions of the organization and some of the important points of environmental attention and force.

The questions are the result of a reversal of the general approach suggested by Lawrence, Lorsch, and other contingency researchers. The Contingency Modelers asked corporate officials for their perceptions or interpretations of environmental demands or requirements. We felt that a better approach would be to ask the environment directly, and to operate with their perceptions rather

than the use "V's" reactive interpretation of environmental forces or demands.

ENVIRONMENTAL QUESTIONNAIRE ("B" Organization)

A brief questionnaire was designed for administration to approximately 30 key decision makers in the "B" organization. (Appendix A-2). Data gathered as a result of responses to this instrument include:

(1)	Strategic task dominance	Question 1, 2
(2)	Environmental signal certainty	Question 1, 5 a,b
(3)	Environmental signal homogenity	Question 1 a,b
(4)	Perceived signal reception	Question 1 a,c and 2 b
(5)	Program success criterion mix	Question 1 a
(6)	Perceived differentiation requirements	Question 2, 5 b
(7)	Environmental stability, certainty and dynamics	Question 3, 5 a,b
(8)	Perceived degree of integrative success intra "V"	Question 4 Part I
(9)	Degree of integrative success (external)	Question 4 Part II
(10)	Overall division performance	Question 6 a
(11)	Functional unit task performance	Question 6 b

(12) Outstanding and marginal task structure — Question 6 c

This environmental questionnaire administered to the "B" organization was modeled primarily after several questions asked by contingency theorists. The questions were modified to fit the specific research setting.

Question I was suggested by Lawrence and Lorsch's work on environmental forces. Our Phase I interviews and documentary review suggested that performance was measured primarily in terms of time, money or technical achievement; thus we asked the question directly. Phase I interviews also suggested that significant perceptual differences might exist among "B" employees and between the "B" organization and the "V" organization. Thus, we asked 1a and 1c. Question 1b gave us an added data point as it indirectly asked for the buyer's perception of vendor ranking as a function of performance.

Question II of the environmental measure is a modification of the Lawrence and Lorsch question used to determine the relative importance of environmental parts. (Ibid, p. 252). We modified the question to obtain data concerning perceptions of; (1) critical nature of the task, (2) relative importance of functional units, and (3) the structural orientation of the respondents.

Question III was suggested by the work of Burns and Stalker. It measures directly the environmental assessment of the relative stability of each functional unit.

Question IV, Part 1, was suggested by Lawrence and Lorsch (ibid. p. 254). This question measures the quality or state of coordinated efforts among "V's" functions as perceived by the environment.

Part II of the same question is an extension of the Lawrence and Lorsch measure. This part measures the perceived degree of external coordination between the vendor and other important program elements.

Question V was suggested by a gap in our knowledge. We felt that some understanding of the inter-organizational communications patterns was mandatory if we were to analyze the environmental relationships.

Question VI was suggested by our inability to meaningfully measure organizational performance through market comparisons. We also felt that direct environmental questioning would be of greater value than market or statistical inferrences.

The results of this questionnaire, the interviews, and environmental document review, lead to an enumeration of some of the environmental forces which the vendor's organization must respond to, such as; (1) the environment's

success criterion, (2) the environments orientation toward organizational structures and task criticality, (3) the environment's perception of environmental stability, (4) perceived levels of program effort integration, and (5) perceived organizational performance levels.

VENDOR'S ORGANIZATIONAL INTERVIEWS

Structured interviews (see Appendix A-3 for format worksheet) were designed to gather data from the president, all functional vice presidents, approximately 25% of the functional directors and approximately 15% of the functional managers (level 4 only) of the "V" organization. Each interview was programmed for approximately one to one and one-half hours in length. Data sought included:

(1) Workforce expertise and orientation

(2) Operational task divisions

(3) Program work flow

(4) Functional autonomy

(5) Task integration requirements (perceived and actual)

(6) Perceived functional task difficulty differences

(7) Critical limiting resources

(8) Environmental stability

(9) Environmental change causality

(10) Operational decision structures

(11) Coordination methodology and devices

(12) Conflict resolution methodology

(13) Information flow patterns

(14) Task orientation

(15) Functional orientation

(16) Perceived overall division performance

(17) Perceived effectiveness in use of available resources

(18) Relative performance of functional units

(19) Perceived limiters of functional performance

(20) Perceived leadership effectiveness

(21) Perceived environmental demands

(22) Responses to environmental demands

Questions developed for the gathering of these interview data are the results of several interrelated forces. The literature of open-systems, contingency model concepts, and Thompson's organizational postulates, suggested that data concerning work flow, task differences, coordination, conflict resolution, structural control of uncertainty, and environmental influence would be analytically useful. Our limited access to company

managers through a written questionnaire motivated us to gather extensive interview data, although face valid. We were unsure of the applicability and discriminating power of our written questionnaire, but trusted our interview techniques for gathering data. Specific direct questions were devised by the writer which minimized our constraints, while guiding the interviews toward desired data areas.

VENDOR "V" INTERNAL QUESTIONNAIRE (IQQ)

An extensive questionnaire was designed to supplement, expand, and assist in quantifying some of the data gathered in the interviews and documentary research.

For the questionnaire, we used the basic approach and variables suggested by the Lawrence and Lorsch Differentiation and Integration Model. (Ibid, p. 248-268). However, this approach was modified severely (1) to fit into our specific intra-organizational investigation of reactions to inter-organizational transactions and (2) to conform to the desires and investigative limits set by organization "V".

The specific origin of each of the questions is tabulated.

Question I (IQQ 1): A replica of the question asked of the environment. This question measures goal orientation and perceived environmental success criterion. It is a minor modification of a question used by Lawrence and Lorsch.

Question II (IQQ 2): A modification of a question suggested by Lawrence and Lorsch (ibid, p. 252). Part a measures functional criticality, structural orientation, and perceived task dominance. Part b measures structural orientation of the respondent groupings.

Question III (IQQ 3): We devised this question to directly measure environmental uncertainty. Through an intra-functional comparison, we are able to assertain differences in certainty as a function of unplanned changes. This is a modification of a task certainty question used by several contingency researchers.

Question IV (IQQ 4): The measure of intra-organizational relationships was suggested by Lawrence and Lorsch (ibid, p. 259) as a measure of coordinated effort (integration) in each organization. We adopted this measure and expanded it to include relationships between the organization and its relevant environmental parts. (NOTE: The original matrix was reduced in size to a 2 x N matrix by the vendor "V" organization for

the stated reason that managers were not familiar with relationships other than their own).

We felt that this approach was valid for measuring the relative quality of coordinated efforts.

Question V (IQQ 5): This question was used to measure perceived resources criticality. It is useful when compared among functions and when used independently or in conjuction with the notions advanced by questions I and II.

Question VI (IQQ 6): Communications patterns and subjects are valuable tools in organizational analysis. While our research did not specifically touch upon this analytical approach, we felt strongly that subjects and frequencies of communications would give information concerning environmental concern, coordination, and relative influence.

Question VII (IQQ 7): VII a asks general information and seeks data concerning relative communications flows and subject matter. VII b, c, d, and e are concerned with environmental contacts and give insight into perceived environmental concerns.

Question VIII (IQQ 8): This question was suggested by a question asked by Lawrence and Lorsch, which measures the degree of required integration/task coordination (ibid, p. 250-251). We expanded it somewhat;

part a measured perceived autonomy or functional independence; part b measured the perceived degree of interdependence (required task coordination between the intra-company functions).

Question IX (IQQ 9): We wondered if our preliminary supposition concerning the relative importance of environmental forces was correct. We thus devised a question to test this. This question is in three parts; functional influence, hierarchical/peer influence, and external influence. Comparisons of the three categories gives valuable insight into the relative importance of environmental forces acting upon the organization.

Question X (IQQ 10): Question X was suggested by Lawrence and Lorsch (ibid, p. 261). We modified it for our environment and included intra-functional performance. From this question, we gathered data concerning perceived overall performance and relative functional performance.

V. SCORING THE ENVIRONMENTAL INSTRUMENTS - "B" ORGANIZATION

THE INTERVIEWS

No attempt was made to quantify or "score" the data gathered in the environmental interviews. Instead, the information was used to assist in interpreting the results

of the questionnaire, in framing the environmental demands, and in adding detail to the environmental analysis.

THE QUESTIONNAIRE

The environmental questionnaire was designed for simple question by question scoring. Each stands independently and measures a somewhat different environmental aspect. A coding schema was used, which allows the researcher to aggregate the data by employee category and by location. Responses may then be analyzed in the aggregate or by sub-groupings. The categories include:

(1) Total:
All respondents of the governmental focal organization, "B".

(2) Central office:
All respondents in the "B" central office.

(3) Central A:
Respondents in the central office with career patterns which tend to be broader and more varied than a strictly government procurement environment.

(4) Central B:
Respondents in the central office whose career patterns tend to be less broad than "A" and tend to be centered in the government procurement environment.

(5) Satellite:
All respondents in the "B" satellite office.

(6) Satellite A:
Satellite respondents similar to Central A.

(7) Satellite B:
Satellite respondents similar to Central B.

Data grouping was accomplished using the University of Wisconsin STAT JOB PROGRAM. The specific program was DSTAT #2, both with and without missing data options. DSTAT #2 provides means, variances, standard deviations, and correlation matrices. (Median and Modal values were calculated by hand, but added little to these data analyses.)

Results are presented in the form of mean scales in Appendix B.

VI. SCORING THE INTERNAL INSTRUMENTS - ("V" ORGANIZATION)

THE INTERVIEWS

Data grouping from these interviews were handled in a manner similar to the handling of the environmental interviews. Specific issues, not covered in the organizational questionnaire or the support analysis, are reported. The principal benefits of the interviews are to provide clarity concerning (1) orientation toward organizational structures, (2) operational approaches to task separation and coordination, (3) operational coordination mechanisms or integration devices, (4) perceived environmental influences and (5) perceived performance. Further, the interviews were used to assist in the interpretation of questionnaire results.

THE INTERNAL QUESTIONNAIRE

Scoring of the instrument used to gather data in Vendor "V's" organization follow a simplistic pattern.

First, each question will be scored on an individual basis using the following response categories, if appropriate.

(1) ALL - Total aggregate responses of Vendor "V" respondent

(2) EXEC - Total aggregate responses of Vice Presidents and Directors

(3) MGR - Total aggregate responses of level 4 managers

(4) BUS MGT - All responses from Business Function

(5) ENG - All responses from Engineering Function

(6) OPS - All responses from Production Operations Function

(7) TEST - All responses from Testing Function

(8) P/M - All responses from Program Managers

The data is grouped by aggregating the mean values of responses in each category. These values are then placed upon a response scale for interfunctional comparison and analysis. These data are analyzed in Appendix B.

Again, data grouping was accomplished for the Vendor "V" data using the DSTAT 2 portion of the University of

Wisconsin STAT - JOB Program, and the same procedures as discussed previously under environmental data analysis.

VII. HYPOTHESIS GENERATION

After individual analysis of the "B" environmental data and the "V" internal data, we compare the data sets and from this comparison suggest hypothesis for further testing in the Aerospace or Government Procurement environments.

Chapter 4

RESULTS AND CONCLUSIONS

I. INTRODUCTION

This chapter presents the results of the data gathering and uses these results to generate hypotheses about open systems concepts in the government related segment of the aerospace industry. A complete set of questions and data results are included in Appendices A and B. Selected segments of this appendix will be referenced as we draw our data together for Hypothesis Formulation.

II. METHODOLOGY

Our methodology for data analysis followed a four step sequence. First, we studied the literature on organizations and open systems theories concerning patterns of organizational interaction. Second, we developed a set of mental expectations concerning potential patterns or interaction sequences between the "V" and "B" organizations. Third, we analyzed the data to determine what patterns actually existed and fourth, we developed our hypotheses based upon the actual patterns which we found.

Our specific method of data grouping and pattern development first consisted of calculating the mean, median, and modal responses to each question in the aggregate, and by catagory of respondent.

Comparing these results with our interview data suggested the following relevant data groupings:

(1) Organizational structure

(2) Success goal orientation

(3) Uncertainty

(4) Communications patterns

(5) Integration/Task coordination

(6) Performance

ORGANIZATIONAL STRUCTURE

Our first important area is that of structure. The dynamic nature of the task and technological complexity of the project suggest that a total program-oriented, "organic" system of management seemed appropriate for "V's" task. Thompson suggests that the organizational parts should be reciprocally interdependent, have a high level of mutual penetration, and must achieve a high degree of inter-functional task coordination for program success. (Ibid., p. 54).

Lawrence, Lorsch, and other contingency theorists suggest that the "V" organization should be structurally

differentiated to meet both environmental and task requirements. (Ibid., 1967).

Similarly, Organization "B" should also have a total program orientation with high levels of inter-functional penetration and coordination among its parts and an "organic" management - decision system which deals with the environmental dynamics of the program.

The structural arrangements of the "B" and "V" organizations were derived from the organizational charts, interview responses and questionnaire responses. For "V" we specifically used responses to the task criticality questions:

(1) Internal questionnaire question (IQQ #2)

(2) Level of autonomy question (IQQ #8a)

(3) Interdependence question (IQQ #8b)

(4) Problem influence question (IQQ #12)

(5) Communications patterns question (IQQ #10)

(6) Functional integration question (IQQ #9)

"V" STRUCTURES

The results of these data suggest that the "V" organization is divided into strong functional task groups. Each functional task group perceives itself as highly autonomous dependent more upon itself than other task units

for task success and problem solution; tends to perceive its tasks as more critical to overall program success than other functional units perceive the same task; exhibits communications behavior which is internal task centered rather than program centered; perceives itself as achieving higher levels of intra-functional task coordination than inter-functional task coordination. Further, each function rates itself as a much higher performer than do other functions.

"V" interview data suggests that decision making structures are oriented toward the hierarchy in each function and that most decisions are made at or near the top levels of each functional unit.

The data suggest that the "V" organization is highly differentiated; that each function is defining itself and its task accomplishments based upon internally oriented specific task requirements rather than program or company wide - overall task requirements. The data further suggests that each function has a high sense of self-containment and relatively impermeable functional boundaries.

These structures are similar to those which Burns and Stalker labeled "Mechanistic" and suggested as appropriate for routine, stable, task environments. (Ibid., p. 118-24). Contingency theorist reached a similar conclusion

(Lawrence and Lorsch, 1967). Further, the structures of "V" appear to be similar to those which Thompson suggests as appropriate for projects or program efforts which require the simple pooled or non-interactive internal interdependence of discrete functional contributions.

"B" STRUCTURE

Organization "B" is somewhat less functionally oriented than "V". Analysis of the organizational chart, (Chapter 2), communications patterns (Environmental questionnaire question V (EQQ #V), strategic task dominance (EQQ #II), and interview data suggest that "B" has a mixed structure. Basically, the structure is a bureaucratic hierarchy, which is functionally organized in much the same manner as "V" and tends to match the "V" structures in terms of general functional differentiation. Communications patterns are partially function oriented and tend to reinforce the functional pattering.

Interview data on decision structures and program orientation as well as the questionnaire data on strategic task dominance, tend to mitigate this functional orientation significantly and indicate a difinite total program orientation.

The management monitoring segment of "B" has a definite total program orientation, relatively permeable interfunctional

boundaries and decision making at somewhat lower levels than were expected for the basic bureaucratic structure. Additionally, the functions appear to be more total program oriented than specific task oriented. These data, when compared to previous organizational research findings, suggest that a definite mismatch exists between organizational structures and task requirements.

"B's" structures are not totally oriented to the dynamic development task. Instead, they are matched partly to bureaucratic tradition, partly to political elements of the environment and significantly to Organization "V" structural patterning.

"V's" structures, on the other hand are discrete functions. They appear to be matched to specific elements of the task and to specific elements of Organization "B" rather than to the total program or the total environment.

These data, which indicate a discontinuity between the structural requirements for successful control of a dynamic development program and the structural arrangements of the principal program organizations involved in that program, suggest a set of rather broad hypotheses.

HYPOTHESES 1

In a government sponsored aerospace development program, organizational structures which do not match program requirements will tend to lead directly to:

(a) greater levels of task uncertainty than warranted by the technology of the program

(b) communications difficulties between organizational elements

(c) coordination difficulties between organizational elements

(d) limited program success

These data, and the mismatch of organizational structures suggest and are supportive of numerous other organizational postulates previously stated by other open systems researchers for other environments. For brevity, these will not be re-stated in terms of this specific environment, although it is obvious that many may directly apply.

SUCCESS GOAL ORIENTATION

The next important area of the data was program success orientation and strategic task dominance. Questions 1 and 2 of both the Environmental organization ("B") and the Target Organization ("V") questionnaires and the data concerning communications patterns (EQQ #5 and IQQ #6) and some of the interview data apply to goal orientation.

It is logical to assume that any organizational success formula must consider the goal or success criteria ordering of the relevant environment. Kast and Rosenzweig (1970) suggest that organizational goals, objective and success criteria form and the basis for planning and structuring of organizational efforts. Lawrence and Lorsch (1967) suggest that goal orientation is one of the key organizational variables in successful interaction patterns.

Interview data and review of "V" documents suggests that "V" received signals from three related environmental sources. These were general policy goal signals from political or governmental sources; specific environmental requirements guidance from contractual documents which link "V" to the governmental focal agency ("B") and the project; and supplementation, elaboration, or interpretation of environmental success criteria ordering signals by the members of the "B" organization.

Responses to the question concerning success measurement criteria suggest two distinct patterns. First, environmental organization "B" data indicates that program success measurement criteria are, in order of importance, cost performance, technical achievement, and schedule realization. This ordering is consistent with significant governmental documents and policy guidance furnished by senior governmental officials interested in this and other development programs.

Similarly, "V" questionnaire data and interview responses to the questions concerning program success criteria elicited responses which indicated that the "V" perceptions of program related goal criteria was closely related, if not identical, to those espoused by the environment (Organization "B"). The data further indicates that "V's" perception of "B's"

ranking of criteria is closely related to the actual rankings.

From these data a logical conclusion is that environmental success criteria signals which are transmitted by significant environmental elements are received and incorporated into planning and structuring frameworks by target organizations which depend upon that segment of the relevant environment for success.

A natural resulting hypothesis would indicate:

HYPOTHESIS 2

In a complex aerospace environment, success criteria signals transmitted by significant members of the relevant environment tend to be received, understood, and responded to without distortion by target organizations in the relevant environment.

HYPOTHESIS 3

Target organizations that receive ordered goal direction or success criteria signals from significant elements of the relevant environment tend to incorporate those signals as ordered organizational success criteria.

SIGNAL DISTORTION

The issue, however, is much more complex than this simple signal transmission - signal reception - goal guidance incorporation schema advanced by responses to Environmental Questionnaire Question (EQQ #1a) and Internal Questionnaire Questions (IQQ # 1a and #1b).

Organization "B" interviews and the responses to Environmental Question 1b indicate that members of the "B"

organization perceive "V" as performing as if the ordering of importance of program goal success criteria was technical excellence, schedule realization, and cost performance.

To resolve or explain this significant perceptual mismatch, i.e., both "B" and "V" reporting nearly identical program success goal criteria ordering, and "B" perceiving "V" as possessing a goal criterion ordering which is conceptually reversed, other data must be analyzed in conjunction with the success criterion results. Functional criticality (question EQQ #2 and IQQ #2) Communications patterns (EQQ #5 and IQQ #6) interactive responses and the previously discussed task-structures mismatch suggest portions of the answer.

Interviews, responses to EQQ #1c, the positioning of the mean responses to EQQ #1a and the responses to the strategic task dominance/program orientation question (EQQ #2) suggest that "B" is sending mixed and conflicting signals concerning program goal success criteria to "V".

"B" has "officially" signaled and cost control - technical achievement - schedule realization is the environmental ordering of program goal success criteria! "B" has reinforced this signal by suggesting that the Engineering Task is the most critical element of a design

program and the coordination/integration element is next in importance.

The data indicates, that "B", whose task it is to focus, synthesize, and interpret environmental signals, is not sending a uniform signal concerning the desired or required success criteria approach.

For example, "B" data results on task criticality or program orientation suggest that the central office, while recognizing engineering task predominance, expresses a desire for total program integration, as indicated by the positioning of the Program Management, Business Management, and Test Functions ahead of the Production Operations Function. This ordering of integration oriented task functions in their natural order of integration potential suggest a demand for a well coordinated and controlled total program approach. Conversely, Satellite responses to the same question indicate a more functionally isolated design-build-test orientation which is suggestive of a requirement for discrete functional contributions rather than an integrated total program approach.

Communication patterns (Appendix B) reported by "B" indicate strong functional and technical orientations rather than a cost dominated total program approach. Further, these patterns suggest orientation differences

between the central and satellite offices similar to those suggested by the task orientation responses.

Similarly, questionnaire responses suggest that "B" has signaled "V" that functional organizational structuring is both acceptable and unacceptable. "B" has conducted program business with "V" on a functional basis and has structured the "B" organizations along somewhat functional lines. "B" has demanded certain organizational elaborations by "V" which tend to increase technical performance and visibility, but "B" has not insisted upon a strong program oriented structure which might increase total program visibility and cost control. Simultaneously, "B" has penalized "V" for inadequate program performance and is openly critical of "V's" performance.

"B" interviewees and questionnaire respondents suggest that "B" perceives that he is sending mixed and confusing goal success criteria signals th "V". Patterns of guidance perception (Figure 5) suggest a wide divergence of opinions concerning the guidance being supplied by "B" to "V". These suggestions are supported by interview responses which indicated that some "B" managers firmly believe that technical achievement rather than cost control is the best program success measurement

criterion and translate these beliefs into guidance signals for "V".

These several data points tends to indicate that at least two distinct sets of confliction goal success criteria signals have eminated from the environment and Organization "B". These are the "official" success criteria signals which espouse a Design to Cost integrated program approach with cost control, technical achievement and schedule realization as the ordered factors; and an "unofficial" or environmental behavior deductable set of signals which suggests past environmental conditions of the Cost of Design or technology first - cost control last - schema.

The result is of course, a mixed and somewhat confusing set of environmental signals which suggest the following hypotheses:

HYPOTHESIS 4

In complex organizational environments, changes in environmental success criteria which are not uniformly enforced tend to result in mixed or confliction environmental success signals.

HYPOTHESIS 5

In a complex organizational environment such as the government segment of the Aerospace Industry, governmental focal agencies that lack high levels of internal coordination will tend to generate and transmit conflicting program success criteria to target organizations.

MIXED SIGNALS

Data from "V" suggests that "V" is receiving and reacting to both the "official" and "unofficial" success criteria signal sets and the uncertainty created by the divergence between the two sets.

"V" has publicly espoused the receipt and incorporation of the "official" set of success criteria into their planning and operating activities. This is clearly illustrated in interview responses and "V" response to the success criteria ordering question (IQQ #2).

Simultaneously, "V" has reacted to the "unofficial" signal set. This is evidenced by "V's" basic organizational structure and orientation toward functional or task criticality which are reminiscent of organizational designs and functional orientations which addressed a more fragmented task schema than those suggested as appropriate for complex development projects.

Similarly, "V" communications patterns tend to emphasize technology and functionally oriented subjects rather than cost or total program oriented subjects. These date suggest the following hypotheses:

HYPOTHESIS 6

In an environment which contains more than one definable set of environmental success criteria signals, complex aerospace organizations tend to develop organizational

response strategies which they perceive as appropriate for each set of signals.

HYPOTHESIS 7

In a complex organizational environment with mixed and conflicting signals concerning program success, complex organizations tend to equate subjective communications transactions by significant environmental elements to success criteria ordering.

UNCERTAINTY

The next segment of the data deals with some of the results of the mismatched organizational structures, the environmental uncertainty created by mixed and conflicting success criteria signals and organizational responses to this environment uncertainty.

Both "V" and "B" were questioned concerning the levels of technological and task certainty associated with the program. Responses to EQQ #3, IQQ #3 and 5 and to interview questions suggest that the program is well within the state of the technological art, but that major unplanned task changes occur on a very frequent basis.

Both "V" and "B" interviewees suggested that their perceptions of the environment was one of frequent unplanned or unprogrammed change.

It was obvious that these changes came from other than technology sources.

Thompson (1967) suggests that complex organizations seek to survive by the reduction of environmental uncertainty. He further suggests that the organization seeks to minimize environmental change effects or isolate their core technologies from the influence of environmental change through buffering, smoothing, or anticipation and adoptation of changes (Ibid., p. 24).

In the setting of a closely connected environmental-organizational pair, such as is typical of organizational relationships during governmental sponsored development programs, buffering and smoothing appear to be inapplicable isolation techniques due to the nature of the relationship between the vendor organization and its paired governmental agency. Change adaptation or anticipation would then become a primary mechanism for reducing uncertainty and isolating the technological from environmental disruptions.

Mixed or conflicting environmental signals would tend to make the task of change anticipation and adaptation considerably more difficult, increase uncertainty, and logically cause the organization to seek certainty by other means.

"V" interviewees, when asked about the "V" structures as they related to the task suggested:

(1) The "V" organization was well experienced in programs similar to the current effort.

(2) Structures similar to those now in existence were used on past successful projects.

(3) The "V" structure was the best way to organize a design task.

These data suggested the following hypotheses:

HYPOTHESIS 8

In a complex organizational environment such as a government sponsored development project:

(a) mixed and confliction environmental success criteria signals will tend to increase the level of program uncertainty.

(b) mixed and conflicting environmental success criteria signals will tend to elicit conflicting responses from target organizations.

(c) mixed and conflicting environmental success criteria signals will tend to reduce the impact of environmental change demands upon the target organization.

HYPOTHESIS 9

In an environment of mixed or conflicting program success criteria signals, complex aerospace organizations tend to buffer their core technologies from environmental uncertainties by a selective interpretation of environmental change signals which is based upon a minimization of organizational changes.

HYPOTHESIS 10

In an environment of mixed and conflicting program success criteria signals, complex aerospace organizations will attempt to reduce the uncertainty created by the mixed and conflicting signals by maintaining or implementing organizational structures reminiscent of past organizational successes.

INTEGRATION/TASK COORDINATION

We also measured the required and actual levels of integration or coordination of the task effort.

REQUIRED INTEGRATION

Data from organization "B" questionnaires and interviews and environmental documents suggests that the environment requires both functional excellence and a well integrated total program effort. Interview responses and the positioning of the high integration potential functions in their task related order of program integration potential by "B" questionnaire respondents demonstrate this point. (Appendix B, EQQ #2 responses)

Data from organization "V" suggests a lower level of perceived need for inter-functional task coordination. Results of the direct interdependence question and problem influence question show that each functional unit perceives a need for integrative efforts, but simultaneously believes that intra-functional activities are of greater importance than inter-functional task coordination.

These data suggest that the environment requires a higher level of inter-functional task coordination than organization "V" perceives as necessary for program success.

ACTUAL INTEGRATION

We measured the actual level of integration using the Lawrence and Lorsch schema (Ibid., p. 248-68). We asked identical questions of both the "V" and "B" organizations in the respective questionnaires, (EQQ #4, and IQQ #4) and raised this issue during interviews.

A summation of our data suggests that the environment perceives a low level of task coordination throughout organization "V". "B" interviewees stated the opinion that most task and decision making activities were accomplished in an atmoshpere of functional isolation and that there was a general feeling that only major crisis received coordinated attention. This is indicated also in the consistently low scores on the integration matrix.

Our results suggest that the inter-functional coordination integration efforts and effectiveness closely follow "V's" perceptions concerning task interdependence and problem influence. "V" interviewee responses indicated that coordination efforts were directly preportional to task interdependence. Similarly, our "V" questionniare data suggests the same patterns.

From these data, we suggest the following hypotheses:

HYPOTHESIS 11

In a complex aerospace organization, organized along functional lines, coordination efforts and effectiveness

will tend to vary directly with the level of perceived task interdependence and problem influence.

HYPOTHESIS 12

In a complex aerospace environment, when differentiation patterns generally conform to environmental expectations, environmental performance perceptions will be directly related to perceived inter-company coordination efforts.

HYPOTHESIS 13

In a complex aerospace organization, functional differentiation of major task elements will tend to result in coordination difficulties among principal task elements.

HYPOTHESIS 14

In a complex organization, the greater the functional isolation of the critical task elements, the greater will be internal coordination efforts.

HYPOTHESIS 15

In a complex aerospace environment, significant members of the relevant environment tend to be more acutely aware of internal coordination difficulties than do members of the target organization.

Recalling the data on the mismatch between task requirements and functional structures, and the increased levels of uncertainty due to mixed or confliction signals, the following hypothesis are suggested:

HYPOTHESIS 16

In a complex organizational environment, such as a government sponsored development program; mismatches between structural task requirements and organizational structures will tend to:

(a) Increase task coordination difficulties.

(b) Increase levels of unplanned task changes and task uncertainty.

(c) Amplify conflicting task signals.

EXTERNAL RELATIONS

Our data on external relationships showed a connection with patterns of coordination or levels of integration. (EQQ #4, and IQQ #4, 7, and 9).

Both "V" and "B" data suggest that coordination efforts, frequency of inter-organizational transaction and levels of external coordination effectiveness vary directly with the level of success influence that an organization perceives an external agency to possess. These relationships are clearly reflected in the "B" data results on external co-ordination and the data on external influence, contacts, and relationships gathered from "V".

The data suggests the following hypotheses.

HYPOTHESIS 17

In a complex aerospace environment, coordination efforts between the target organization and organizations in the relevant environment tend to be directly related to the perceived degree of influence which the environmental organization has over the target organization's success.

PERFORMANCE

The last measure was that of perceived performance. Performance was measured directly through oral interview

questions and through questionnaire responses the EQQ #6 and IQQ #10. Performance was measured indirectly at every point in the study.

Perceived performance, is, in reality, not a single factor. It is instead the results of a combining of all of the approaches that an organization takes toward the solution of a problem or the accomplishment of a task endeavor.

Earlier, in the literature review, open systems findings suggested a strong linkage between organizational performance, organizational structures, and uncertainty. Lawrence and Lorsch, for example, in their contingency approach (1967) demonstrated that high performing organizations were those which were structured in accordance with environmental demands.

ENVIRONMENTAL EVALUATION

The data from "B" interviews and responses to Question EQQ #6 indicate that the environment perceives "V" as a low or marginally performing organization. Respondents evaluated "V's" overall results as well as the results of the individual functions as significantly below optimum.

"B" interviewee responses indicated that performance rankings were not based upon task criticality, but instead, upon perceptions of the level of potential versus actual contribution to program success.

Respondents, in articulating the reasons for evaluating low (or high) performance suggested numerous specific task accomplishment results, coordination activities (or the lack there of), ability to plan for and adapt to changes or uncertainty, and responsiveness to environmental change suggestions as factors.

Similarly, the data provided by "B" responses to the question on percent of unplanned or unanticipated change suggests a similarity between levels of unplanned circumstances and performance.

These data suggest the following hypothesis.

HYPOTHESIS 18

In a complex task environment, target organizational performance, as perceived by the relevant environment will tend to be related to the target organizations:

(a) Potential and actual contributions to overall program success

(b) Ability to attend to and adapt to environmental changes or uncertainty.

(c) Responsiveness to environmental change suggestions

INTERNAL EVALUATION

The questionnaire data from "V" (Question IQQ #10) suggest that "V" perceives itself as a much higher performer than does the environment. "V" respondents indicate that their perceptions of overall division performance and individual functional unit performances were significantly

closer to optimal than those indicated by the environment. Again, however, there appeared to be little correlation between functional task criticality and performance perceptions.

Instead, the questionnaire data suggested that performance evaluations were related to direct interdependence, problem influence and functional relationships or degree of interfunctional integration.

These data were supported by "V" interview responses, which also verbalized the following formula for functional performance measurement.

(1) The individual respondent ranked his own function as highest in performance and used this performance level as a base line.

(2) Units which had no performance record (or detrimental histories) were ranked as high performers.

(3) Units which do not have effective communications with evaluatee's function were ranked as low performers.

(4) Units which were perceived as imposing resource constraints upon the evaluatee's unit were rated as low performers.

(5) Units upon which the evaluatee's unit was highly interdependent for task success were rated as low performers.

These data suggest the following hypothesis:

HYPOTHESIS 19

In a complex aerospace organization, perceived interfunctional performance is directly related to the level of task coordination which exists between functional units.

HYPOTHESIS 20

In a complex aerospace organization, perceived functional performance tends to be directly related to the degree of perceived constraints which one unit imposes upon another.

HYPOTHESIS 21

In a complex aerospace organization, units which lack performance records will be perceived as high performers.

HYPOTHESIS 22

In a complex aerospace organization, units which do not contribute directly to the product line will tend to be perceived as low performers.

HYPOTHESIS 23

In a complex aerospace organization, perceptions of units performance are directly related to the level of information transactions between the units.

OPEN SYSTEMS ORIENTED CONTINGENCY THEORY

Some of our questionnaire responses (Appendix B), when compared with previously advanced open systems or contingency concepts suggest that a contingency approach to organizational analysis are feasable in the federal procurement environment.

We concur. Many of the contingency model comcepts of open systems theory provide a usefull framework for analysis of inter-organizational activities in the governmental segment of the aerospace industry. However, we shall not restate these postulates for they are obvious to the reader.

Chapter 5

SYNOPSIS AND SUGGESTIONS

Open systems theorists suggest that successful organizations are structured to minimize uncertainty and cope with or adapt to environmental demands (Katz and Kahn, 1966).

Our data supports this contention. Additionally, the "V" and "B" data suggests that neither "V" nor "B" have organizational structures which are totally appropriate for dealing with the dynamic uncertainties of a development project.

"B's" less than total program oriented structures has produced mixed, uncoordinated, and conflicting signals concerning environmental demands and success criteria. These signals produce uncertainties for "V" and make "V's" task of environmental adaptation extremely difficult.

Simultaneously, "V" has reacted to uncertainties with organizational structures which appear suggestive of past task technologies and efforts. "V's" functional structure has tended to limit total task coordination and increase task uncertainty.

These actions are fed back to "B" and the environment and program uncertainty is again magnified.

These sequences suggest that the functional structures of the "V" organization, when coupled with the semi-functionally structured "B" organization, create a positive feed back condition which tends to reduce coordination and increase uncertainty. This, of course, reduces the performance potential of both organizations and the probability of program success by any criteria developed.

The necessary conditions for this positive feed back loop appear to be (1) organizations in close interactive contact; (2) functional structures which reduce coordination; and, (3) changing environmental signals.

Other data which was not analyzed in this study suggest that when functional structures are replaced by program oriented or matrix structures with effective inter-task coordination mechanisms, the uncertainty generation problem is reduced.

I. FUTURE STUDIES

Our data indicates that most of the organizational postulates suggested by the contingency model variant of open systems theory are applicable to and may be restated for testing and extension to Governmental sponsored development projects or programs.

Several important modifications, however, may improve the results.

First, many of the environmental variables may be measured directly rather than through inference drawn from executive opinion. It is possible to isolate and examine principal segments of the seller's relevant environment, gather data directly from it, and thus define some of the principal environmental forces.

Second, the dynamic nature of the close interrelationships of vendors and governmental focal organizations and the subjective nature of performance evaluations requires both interview and questionnaire data gathering. To accurately portray the organizational relationships, extensive interviews of level 4 and 5 managerial decision makers as well as upper level executives in all major task groups is required for interpretation of questionnaire results.

It is therefore suggested that future testing of our hypotheses be conducted with these differences in mind.

II. FUTURE TESTING

Our results suggest that performance or program success is a joint, rather than individual organizational variable.

Both the Vendor and Buyer interaction patterns combine to determine performance and program success levels. It is therefore mandatory that both organizations be researched.

METHOD

First, we suggest the selection of four similar pairs of organizations.

Secondly, we suggest extensive interviews with both government and industry officials for the definition of critical issues.

Third, we suggest that the critical issues be translated into specific performance requirements or structural variables.

Fourth, we suggest that key decision makers in the top five levels of management in each organization be given identical questionnaires that deal with and measure approaches to the critical issues.

Fifth, we suggest that key decision makers at both the executive levels be interviewed and data gathered concerning the key program issues.

Sixth, we suggest that the data then be analyzed in terms of key program issues, structural appropriateness of organizational task structures, coordination patterns or devices, uncertainty control, and performance perception issues.

From these we are convinced that our hypothesis will gain support and improved resource conserving patterns of interaction will result.

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APPENDIX A-1

ENVIRONMENTAL INTERVIEW QUESTIONS

ENVIRONMENTAL WORKSHEET

(1). What factor or factors do you feel are most important to program success? Why?

(2). What appear to be the dominant concerns of the firm? (Cost, Schedule, Technical).

(3). How well has the organization performed (comparatively) to date?

(4). What are some of the strengths and weaknesses of the division?

(5). What are some of the high and low performing units in the company?

(6). When and why do you make program suggestions to the vendor?

(7). How responsive has the company (division) been to these program suggestions?

(8). How are decisions really made and coordinated in the company?

THE ENVIRONMENTAL QUESTIONNAIRE

ORGANIZATION "B"

APPENDIX A-2

Dear Sir:

Please allow me to introduce myself and the purpose of this brief data gathering questionnaire.

I am William H. Pope, a L/Col. currently assigned to AFIT. I am studying complex organizational theory as a part of the Ph. D. program at the University of Houston, Houston, Texas.

One facet of my studies consists of an in-depth analysis of a complex organization. The organization chosen for that analysis is a major aerospace company.

The purpose of this questionnaire is to gather some preliminary data which will help in framing the study of the organization. There can be do doubt that the individuals assigned to the BUYER "B" GROUP have an immense amount of knowledge about many aspects of the company as a whole and the performance of many of the task units which make up the division. Sharing some of this knowledge with me will greatly improve the quality and viability of the analysis.

I am fully aware of the fact that no single individual is familiar with all of the relationships which combine to form a complex organization. For this reason, you may feel that you do not possess enough valid information to answer some of the questions in the questionnaire. PLEASE DO NOT LET THIS DETER YOU. Answer each question to the best of your ability, based upon your knowledge, opinions, or beliefs.

Please let me assure you that there are no "right" or "wrong" answers. All data will be treated as confidential and no person associated with either organization will view the completed questionnaires. All data will be used solely for the purpose of giving guidance or direction to the organizational analysis.

Thank you for your cooperation.

William H. Pope

QUESTION I

Program success is often measured by different "yard-sticks". Some people or groups use TIME OR SCHEDULE PERFORMANCE as the foundation or critical basis for developing a formula for measuring program success. Others use COST PERFORMANCE as their primary element or critical constraint. Still others use TECHNICAL PERFORMANCE as the major factor in measuring program success.

WHAT IS YOUR PERSONAL OPINION CONCERNING THE BEST WAY TO MEASURE PROGRAM SUCCESS?

(a) Please rank Cost, Schedule, and Technical performance in their order of importance as program success measurement factors for the program. Place a 1 beside the factor which YOU FEEL is most important; a 2 by the next most important; and a 3 by the next most.

____ TIME OR SCHEDULE PERFORMANCE

____ COST PERFORMANCE

____ TECHNICAL PERFORMANCE

(b) If all of the employees of the major aerospace company were asked question (a) above, and their answers aggregated, how would these same factors of COST, SCHEDULE, and TECHNICAL PERFORMANCE be ranked? Please use the same 1-2-3 scale as above.

____ TIME OR SCHEDULE PERFORMANCE

____ COST PERFORMANCE

____ TECHNICAL PERFORMANCE

(c) If all members of the buyer organization were asked question (a) above, and their answers aggregated or averaged, how then would the factors be ranked? Please use the same 1-2-3 scale as in (a) above.

_____ TIME OR SCHEDULE PERFORMANCE

_____ TECHNICAL PERFORMANCE

_____ COST PERFORMANCE

QUESTION II

Below is a list of the major functional divisions of this company. While an adequate performance by every functional division is certainly necessary for the success of the program, a high level of competence or performance in one or two of these divisions may be more critical to the program success than others. Please rank the divisions listed below in terms of the importance of each in contributing to the company's ability to accomplish the program successfully.

Please place a 1 beside the division whose performance you feel is most critical for program success. Place a 2 beside the division you consider next most critical. Place a 3 beside the next most critical. Place a 4 beside the next most, etc. Place a 6 beside the division you consider least critical for program success. (You may also use a 7 if it is required.)

_____BUSINESS MANAGEMENT

_____PROGRAM MANAGEMENT

_____TEST

_____PROGRAM RELATIONS

_____OPERATIONS

_____OTHER (Please specify)_____

Please describe briefly your basis for the above rankings.

_____

_____

_____

_____

_____

_____

QUESTION III

At times, events combine to produce unanticipated or unplanned circumstances, which, if left unmanaged, could seriously affect effective task accomplishment.

(a) How often, in your opinion, do unanticipated or unprogrammed circumstances arise which result in major or significant changes in the task content or the task context of the functional divisions listed below? Please place the appropriate time code in the space provided by each unit.

1 indicates weekly
2 indicates monthly
3 indicates quarterly
4 indicates semi-annually
5 indicates annually
6 indicates less than one per year
7 indicates rarely, if ever
00 indicates completely unknown

_____ BUSINESS MANAGEMENT

_____ PROGRAM MANAGEMENT

_____ ENGINEERING

_____ OPERATIONS

_____ TEST

_____ PROGRAM RELATIONS

(b) In your opinion, what percentage (0-100%) of the major changes in task content or task context of the following functional divisions is the result of unanticipated or unprogrammed circumstances?

BUSINESS MANAGEMENT DIVISION _____ %

PROGRAM MANAGEMENT DIVISION _____ %

ENGINEERING _____ %

OPERATIONS DIVISION _____ %

TEST _____ %

PROGRAM RELATIONS _____ %

QUESTION IV, PART I

We are interested in the relationships which exist between the members of one functional division and those of another.

Listed below are some descriptive statements which may be thought of as describing the general nature of the task related relationships which exist between two separate task groups.

Please select the statement which, IN YOUR OPINION, describes the task related relationships which currently exists between the divisions listed below. Place the number which corresponds to that statement in the Grid Square for the two divisions.

Note: You may use the same number as often as it applies.

1 - EXTREMELY HARMONIOUS -- full unity of effort achieved at all times
2 - HARMONIOUS -- almost full unity of effort
3 - ABOVE AVERAGE -- somewhat better than average inter-divisional task relations
4 - AVERAGE -- sound enough to get by, but some problems associated with coordinating and achieving joint task efforts
5 - BELOW AVERAGE -- somewhat of a breakdown in the coordination of joint efforts
6 - DISHARMONIOUS -- numerous problems exist which make the achievement of joint endeavors extremely difficult
7 - BAD RELATIONSHIP -- serious problems exist which make the achievement of joint endeavors nearly impossible
8 - NO TASK RELATED RELATIONSHIPS REQUIRED

Example: If the task related relationship between Operations and Design Engineering qppears to be harmonious, than place the number 2 in the grid square formed by these two divisions.

	PROG MGMT	TEST	PROD OPNS	ENG	BUS MGMT
BUSINESS MANAGEMENT					
PROGRAM MANAGEMENT					
ENGINEERING					
PROD OPERATIONS					
TEST					

QUESTION IV, PART II

We are interested in the quality or nature of the relationships which exist between members of the division and certain outside organizations who have a direct interest in the program.

Listed below are some descriptive statements which may be thought of as describing the general nature or quality of the task related relationships which exist between two separate and distinct task groups.

Please select the statement which, IN YOUR OPINION, describes the task related relationships which currently exist between the functional divisions listed below and the "outside" organizations listed below.

Note: You may use the same number as often as it applies.

1 - EXTREMELY HARMONIOUS -- full unity of effort achieved at all times
2 - HARMONIOUS -- almost full unity of effort
3 - ABOVE AVERAGE -- somewhat better than average inter-divisional task relations
4 - AVERAGE -- sound enough to bet by, but some problems associated with coordinating and achieving joint task efforts
5 - BELOW AVERAGE -- somewhat of a breakdown in the coordination of joint efforts
6 - DISHARMONIOUS -- numerous problems exist which make the achievement of joint endeavors extremely difficult
7 - BAD RELATIONSHIP -- serious problems exist which make the achievement of joint endeavors nearly impossible
8 - NO TASK RELATED RELATIONSHIPS REQUIRED

Example: If the task related relationships between Operations and the Buyer Central Office appears HARMONIOUS, then place the number 2 in the grid square formed by these two groups.

	CUST CENT	SATT CENT	SUB CONT	ASSOC CONT	OTHER CORP DIVS
BUSINESS MANAGEMENT					
PROGRAM MANAGEMENT					
ENGINEERING					
PRODUCTION OPERATIONS					
TEST					
PROGRAM RELATIONS					

QUESTION V, PART I

We are interested in the frequency with which you communicate with vendor groups or individuals who are directly involved with the program or with related activities and the principal subjects of these discussions, memos, letters, or other types of information exchange.

(a) Using the scale provided below, please indicate the frequency with which you communicate or exchange TASK RELATED information with each of the groups or individuals listed below.

1 indicates daily
2 indicates greater than once each week
3 indicates weekly
4 indicates monthly
5 indicates quarterly
6 indicates semi-annually
7 indicates annually
8 indicates rarely - only on special occasions
9 indicates NEVER

_____ SENIOR CORPORATE OFFICIALS

_____ DIVISION EXECUTIVES

_____ FUNCTIONAL VICE-PRESIDENTS

_____ BUSINESS MANAGEMENT FUNCTIONAL MANAGERS

_____ PROJECT MANAGEMENT FUNCTIONAL MANAGERS

_____ ENGINEERING FUNCTIONAL MANAGERS

_____ OPERATIONS FUNCTIONAL MANAGERS

_____ TEST FUNCTIONAL MANAGERS

_____ PROGRAM RELATIONS MANAGERS

_____ ASSOCIATE CONTRACTORS

_____ SUB-CONTRACTORS

QUESTION V, PART II

What is the principal subject of these information exchanges? Is it cost, schedule, technical performance, or some other basic program related issue?

IF YOU EXCHANGE INFORMATION WITH ANY OF THE BELOW LISTED GROUPS OR INDIVIDUALS MORE THAN ONCE A YEAR, PLEASE INDICATE THE DISTRIBUTION OF THE PRINCIPAL TASK RELATED SUBJECTS WHICH YOU DISCUSS OR EXCHANGE INFORMATION ABOUT.

Please use a percentage (0-100%) to indicate the relative topic distribution. NOTE: Totals for each applicable group should equal 100%.

GROUP	SUBJECT MATTER OR TOPIC			
	COST	SCHED	TECH	OTHER
Senior Corporate Officials				
Division Executives				
Functional Vice Presidents				
Business Management Managers				
Project Management Managers				
Engineering Managers				
Production Operations Managers				
Test Managers				
Program Relations Managers				
Associate Contractors				
Sub Contractors				

QUESTION VI

In your observation of various functional or task units within the division, you may have formed some opinions concerning the effectiveness of these units and the division as a whole.

(a) Assuming that ideal or optimal performance is 100%, what percentage of ideal or optimal performance do you believe that the division as a whole is achieving?
_____ %.

(b) Again, assuming that 100% represents ideal or optimal performance, what percentage of ideal or optimal or ideal performance do you believe that each of the functional units is achieving?

BUSINESS MANAGEMENT _____ %

PROGRAM MANAGEMENT _____ %

PROGRAM RELATIONS _____ %

OPERATIONS _____ %

ENGINEERING _____ %

TEST _____ %

(c) In your observation of or interaction with the various functional, task or work groups of the division, you may have formed the opinion that certain of these units appear to exhibit a higher than average task performance while others appear to perform at a level somewhat below average.

It would be most helpful in this research if you would indicate by name those task groups (of functional units) which appear to be A HIGHER THAN or A LOWER THAN average performer. Please indicate (H) or (L) as appropriate.

UNITS IN BUSINESS MANAGEMENT	UNITS IN PROGRAM MANAGEMENT
_____	_____
_____	_____
_____	_____

QUESTION VI (continued)

UNITS IN PRODUCTION OPERATIONS

_____

_____

_____

UNITS IN ENGINEERING

_____

_____

_____

UNITS IN TEST

_____

_____

_____

UNITS IN PROGRAM RELATIONS

_____

_____

_____

OTHERS

_____

_____

_____

APPENDIX A-3

INTERNAL INTERVIEW FORMAT

NAME_____ POSITION_____

AGE_____ YRS IN AEROSPACE_____ AT CO._____

NO SPVSE____ EDUCATION BACKGROUND_____

JOB CHRONOLOGY_____

_____

_____

_____

WHAT IS THE MAJOR TASK OF YOUR FUNCTION/UNIT?

HOW DOES THIS TASK FIT INTO THE OVERALL PROGRAM WORK FLOW?

HOW DO THESE TASKS FIT OR CONNECT WITH OTHER TASK ELEMENTS?

WHAT ARE THE SPECIFIC OR DIRECT INPUTS TO THIS JOB?
FROM WHOM DO THEY COME?

WHAT ARE THE OUTPUTS? WHO GETS THEM?

DESCRIBE YOUR RELATIONSHIPS WITH_____(FREQUENCY, INFORMATION EXCHANGE, ETC.)

PROGRAM MANAGEMENT

BUSINESS MANAGEMENT

OPERATIONS

TEST AND EVALUATION

RESEARCH AND ENGINEERING

PROGRAM RELATIONS

WHICH GROUP HAS THE MOST DIFFICULT OR DEMANDING JOB?

WHY?

WHAT ARE SOME OF THE PRINCIPAL LIMITERS, CRITICAL RESOURCES OR STUMBLING BLOCKS RELATED TO THESE TASKS?

WHAT ARE THEY FOR YOUR JOB OR FUNCTIONAL UNIT?

HOW DOES YOUR JOB/FUNCTIONAL DISCIPLINE COMPARE TO OTHERS IN TERMS OF ROUTINENESS OR CHANGES IN THE CONTENT OR CONTEXT OF YOUR TASKS?

HOW OFTEN DOES A MAJOR CHANGE OCCUR IN THIS FUNCTIONAL UNIT?

CAN YOU TRACE THE CAUSE(S) OF MAJOR CHANGES? WHAT ARE THEY?

HOW AND FROM WHOM DO YOU OBTAIN INFORMATION CONCERNING A TASK CHANGE?

THINK ABOUT 2OR 3 OF THE MOST IMPORTANT CHANGES THAT HAVE OCCURRED IN THE PROGRAM DURING THE LAST 6-12 MONTHS THAT AFFECTED YOUR JOB OR FUNCTIONAL UNIT DIRECTLY. WHAT WERE THEY? HOW DID YOU OBTAIN INFORMATION CONCERNING THEM?

THINK NOW ABOUT THE MANNER IN WHICH THE TASKS OF OTHER UNITS BEAR UPON YOURS, i.e., INPUTS TO YOUR WORK OR THOSE WHO DEAL WITH OR USE YOUR OUTPUTS. HOW DO YOU GET INFORMATION ABOUT THEIR TASKS OR CHANGES IN THEM?

HOW DO YOU GO ABOUT COORDINATING THESE CHANGES?

DOES THIS PROCEDURE DIFFER FOR MINOR CHANGES?

CAN YOU TRACE THE CAUSE(S) OF MAJOR CHANGES? WHAT ARE THEY?

HOW AND FROM WHOM DO YOU OBTAIN INFORMATION CONCERNING A TASK CHANGE?

THINK ABOUT 2OR 3 OF THE MOST IMPORTANT CHANGES THAT HAVE OCCURRED IN THE PROGRAM DURING THE LAST 6-12 MONTHS THAT AFFECTED YOUR JOB OR FUNCTIONAL UNIT DIRECTLY. WHAT WERE THEY? HOW DID YOU OBTAIN INFORMATION CONCERNING THEM?

THINK NOW ABOUT THE MANNER IN WHICH THE TASKS OF OTHER UNITS BEAR UPON YOURS, i.e., INPUTS TO YOUR WORK OR THOSE WHO DEAL WITH OR USE YOUR OUTPUTS. HOW DO YOU GET INFORMATION ABOUT THEIR TASKS OR CHANGES IN THEM?

HOW DO YOU GO ABOUT COORDINATING THESE CHANGES?

DOES THIS PROCEDURE DIFFER FOR MINOR CHANGES?

WHAT IS THE GENERAL POLICY CONCERNING ROUTINE DECISIONS? (routine work adjustments, etc.)

WHAT IS THE GENERAL PROCEDURE FOLLOWED FOR MAKING NON-ROUTINE DECISIONS, DECISIONS CONCERNING MAJOR CHANGES, OR DECISIONS WHICH IMPACT ANOTHER MAJOR FUNCTION?

HOW ARE DECISIONS COORDINATED?

FROM YOUR PERSPECTIVE, WHAT WERE THE THREE MOST IMPORTANT DECISIONS WHICH HAVE BEEN MADE IN THE LAST SIX MONTHS THAT DIRECTLY AFFECTED YOUR TASK GROUP OR WORK? (Please discuss each briefly to include who, how made, where info came from.)

HOW ARE CONFLICTS CONCERNING TASK RELATED ISSUES RESOLVED?

WHAT ARE THE LAST TWO OR THREE REALLY CONTROVERSIAL ISSUES THAT DIRECTLY AFFECTED YOUR JOB? WHAT CAUSED EACH? HOW WERE THEY RESOLVED? (participants, information exchanges, decision making, formal procedures).

WHAT IS THE PRIMARY METHOD OF TASK COORDINATION WITHIN THE COMPANY? (across functions.)

WITH WHOM DO YOU INTERFACE FREQUENTLY? HOW OFTEN, WHAT DO YOU DISCUSS?

HOW ARE YOUR SUBORDINATES REWARDED?

HOW DO YOU RESOLVE THE CONFLICT BETWEEN ZEALOUS MANAGING OF A PROBLEM AND SURFACING PROBLEMS IN A TIMELY MANNER?

HOW DO YOU OBTAIN INFORMATION CONCERNING PROBLEMS?

HOW OFTEN DO YOU DEAL WITH SUB-CONTRACTORS? WHAT TYPE OF GUIDANCE IS NORMALLY GIVEN AND HOW IS IT COORDINATED?

WHAT HAS BEEN THE IMPACT OF CUSTOMER GUIDANCE UPON THE TASKS OF YOUR FUNCTION AND YOUR SPECIFIC UNIT?

VII

WHAT HAS BEEN THE IMPACT OF CUSTOMER GUIDANCE UPON THE TASKS OF YOUR FUNCTION AND YOUR SPECIFIC UNIT?

LET US NOW DISCUSS PERFORMANCE.

SUPPOSE THAT 100% REPRESENTS OPTIMUM PERFORMANCE OF AN AEROSPACE COMPANY INVOLVED IN A PROJECT LIKE THIS ONE. WE KNOW THAT ON THIS SCALE FROM 0-100 THAT NEITHER 0 NOR 100 IS LIKELY. MOST THEREFORE LIE BETWEEN THE TWO PERFORMANCE EXTREMES. USING ALL OF YOUR EXPERIENCE ON PAST PROGRAMS IN THIS OR OTHER FIRMS, PLEASE ASSIGN SOME GRADES TO THE PROGRAM TO DATE.

THE DIVISION AS A WHOLE

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

BUSINESS MANAGEMENT

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

PROGRAM MANAGEMENT

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

VIII

ENGINEERING

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

PRODUCTION OPERATIONS

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

TEST

PERFORMANCE_____

EFFECTIVENESS_____

EFFICIENCY_____

WHAT IS THE MOST EFFECTIVE OR PRODUCTIVE DIVISION OR UNIT: THE 100% PLUS UNITS?

IX

WHAT ARE THE LEAST EFFECTIVE OR PRODUCTIVE UNITS?

WHY?

THE ORGANIZATIONAL QUESTIONNAIRE

Vendor "V"

APPENDIX A-4

Vendor "V" Organizational Questionaire

PERSONAL DATA

MAJOR FUNCTION B (2) E (3) O (4) T (5) P (6)

MANAGEMENT LEVEL VP (2) DIRECTOR (3) MANAGER-LEVEL 4 (4) MANAGER-LEVEL 5 (5)

JOB DESCRIPTION (GENERAL TASKS YOU PERFORM) _____

_____

_____

AGE GROUP (CIRCLE ONE) (25-29) (1) (30-34) (2) (35-39) (3) (40-44) (4)

(45-49) (5) (50-54) (6) (55-over) (7)

EDUCATION (Please circle the appropriate level and indicate degree/year, if applicable)

(NONE) (1) (HS) (2) (COLLEGE 1 2 3 4) (3) (4) (5) (6) (Masters) (7) (PH.D) (8)

Degree _____ Year _____

Degree _____ Year _____

Degree _____ Year _____

How long have you been in aerospace or aerospace-related work? _____ years.

How long have you been with this company? _____ years.

How many individuals do you directly supervise? _____

IQQ I 1

Program success is often measured by different "yardsticks". Some people use TIME or SCHEDULE PERFORMANCE as the foundation or critical basis for developing a formula for measuring program success. Others use COST PERFORMANCE as their primary element or critical constraint. Still others use TECHNICAL PERFORMANCE as the major factor in measuring program success.

a. In your opinion, what is the best way to measure Program success?

Please rank cost, schedule, and technical performance in their order of importance as program success measurement factors for the program. Place a 1 beside the factor which you feel is the MOST IMPORTANT; and a 2 beside the NEXT MOST IMPORTANT; and a 3 beside the NEXT MOST IMPORTANT.

_____ TIME or SCHEDULE PERFORMANCE

_____ COST PERFORMANCE

_____ TECHNICAL PERFORMANCE

b. In your opinion, what order of importance would the customer (organization"B") attach to these same factors in measuring Program success. Please place a 1 beside the factor that your believe the customer feels is the MOST IMPORTANT FACTOR; a 2 beside the NEXT IMPORTANT; and a 3 beside the NEXT MOST IMPORTANT.

_____ TIME or SCHEDULE PERFORMANCE

_____ COST PERFORMANCE

_____ TECHNICAL PERFORMANCE

IQQ II 2

Below is a list of the major functional units of this company. While an adequate performance by every functional unit is certainly necessary for the success of the Program, a high level of competence or performance in one or two of these functions may be more critical to Program success than others. Please rank the functions listed below in terms of the importance of each in contributing to the Division's ability to accomplish the Program successfully.

Please place a 1 beside the division whose performance you feel is most critical for program success.

Place a 2 beside the division you consider next most critical.

a 3 beside the next most critical

a 4 beside the next most critical

and a 5 beside the division you consider least critical for program success.

(You may also use a 6 if it is required)

_____ BUSINESS MANAGEMENT (B)

_____ PROGRAM MANAGEMENT (P)

_____ ENGINEERING (E)

_____ TEST (T)

_____ OPERATIONS (O)

_____ OTHER (Please specify)_____

(b) Please describe briefly your basis for the above rankings.

_____

_____

_____

IQQ III

One of the most important facets of any complex organization or any complex task endeavor is the relationship between (a) routine stable tasks, (b) planned or evolutionary task changes, and (c) unanticipated or unprogrammed change generating circumstances which may affect job accomplishment.

a. Please circle the point on the scale, which, in your opinion most nearly represents or describes how routine and predictable the tasks of the following units appears to be:

YOUR MAJOR FUNCTION B E O T P

Very routine and predictable 1 2 3 4 5 6 7 Very unroutine and unpredictable

b. At times events combine to produce unanticipated or unplanned circumstances which, if left unmanaged, could seriously affect effective task accomplishment.

Please circle the point on the scale which you believe most nearly describes the FREQUENCY WITH WHICH UNPLANNED OR UNANTICIPATED CIRCUMSTANCES ARISE, that if left unmanaged, could seriously affect effective task performance abilities of:

YOUR MAJOR FUNCTION B E O T P

Rarely 1 2 3 4 5 6 7 Frequently

YOUR SPECIFIC TASK UNIT

Rarely 1 2 3 4 5 6 7 Frequently

c. How often, in your opinion, do these unanticipated or unprogrammed circumstances result in major changes in the task content or task context of your major function or specific task unit?

Please place the appropriate time code in the space provided for each unit.

1 indicates weekly
2 indicates monthly
3 indicates quarterly
4 indicates semi-annually
5 indicates annually
6 indicates less than one per year
7 indicates rarely, if ever
8 indicates completely unknown

IQQ III CONT.

_____Your Major Function (B E O T P)
_____Your Specific Task Unit

d. Not all circumstances are unforseen or unprogrammed. Indeed, managers are able to evaluate past and present events or situation and anticipate those circumstances which require task or resource change or adjustment. Thus, the circumstances which generate some changes are recognized and responses are planned in advance.

In your opinion, how often do these anticipated change generating circumstances cause major changes in the task content or task context of the functions listed below?

Please place the appropriate time code in the space provided by each unit.

1 indicates weekly
2 indicates monthly
3 indicates quarterly
4 indicates semi-annually
5 indicates annually
6 indicates less than one per year
7 indicates rarely, if ever
8 indicates completely unknown

_____Your Major Function (B E O T P)
_____Your Specific Task Unit

e. How often are you able to anticipate or plan for change generating events or circumstances, which, if left unmanaged, might seriously affect YOUR SPECIFIC TASK UNIT'S ability to effectively perform the units task?

_____PERCENT OF THE TIME

IQQ IV

a. We are interested in the relationships which exist between the members of one FUNCTIONAL UNIT and those of another.

Listed below are some descriptive statements which may be thought of as describing the general nature of the task related relationships which exist between two separate task groups.

Please select the statement which, IN YOUR OPINION, describes the task related relationships which currently exists between the FUNCTIONS listed below. Place the number which corresponds to that statement in the Grid Square for the two functional units.

NOTE: You may use the same number as often as it applies.

1 EXTREMELY HARMONIOUS -- Full unity of effort achieved at all times.
2 HARMONIOUS -- Almost full unit of effort.
3 ABOVE AVERAGE -- Somewhat better than average inter-divisional task relations.
4 AVERAGE -- Sound enough to get by, but some problems associated with coordinating and achieving joint task efforts.
5 BELOW AVERAGE -- Somewhat of a breakdown in the coordination of joint efforts.
6 DISHARMONIOUS -- Numerous problems exist which make the achievement of joint endeavors extremely difficult.
7 BAD RELATIONSHIP -- Serious problems exist which make the achievement of joint endeavors nearly impossible.
8 NO TASK RELATED RELATIONSHIPS REQUIRED.

EXAMPLE: If the task-related relationship between YOUR MAJOR FUNCTION AND PROGRAM MANAGEMENT appears to be HARMONIOUS, then place the number 2 in the grid square formed by the two units.

	TEST	PROD. OPNS.	DESIGN ENG.	PROG. MGT.	BUS. MGT.
YOUR MAJOR FUNCTION					
YOUR SPECIFIC TASK UNIT					

IQQ IV CONT.

b. We are also interested in the quality or nature of the relationships which exist between the Division and certain outside organizations who have a direct interest in the Program.

	"B" cent.	"B" sat.	Subcon. to you	Assoc. Contr.	Other Corp. Units	Group & Corporate Ofcs.
YOUR MAJOR FUNCTION						
YOUR SPECIFIC TASK UNIT						

See a. above for instructions

IQQ V

The constraints of limited TIME, TECHNOLOGICAL, and ECONOMIC resources are often viewed differently in different segments of an organization. Yet, in most cases, one of these is critical and has a greater constraining effect upon successful task accomplishment than do the others.

Please circle the point which you believe most nearly represents the degree to which each of the limited resources acts as a critical limiting constraint upon the task accomplishments of the following:

YOUR MAJOR FUNCTION B E O T P

TIME
Little or none 1 2 3 4 5 6 7 Extreme degree
TECHNOLOGY
Little or none 1 2 3 4 5 6 7 Extreme degree
ECONOMIC
Little or none 1 2 3 4 5 6 7 Extreme degree

YOUR SPECIFIC TASK UNIT

TIME
Little or none 1 2 3 4 5 6 7 Extreme degree
TECHNOLOGY
Little or none 1 2 3 4 5 6 7 Extreme degree
ECONOMIC
Little or none 1 2 3 4 5 6 7 Extreme degree

IQQ VI

We are interested in the frequency with which you discuss task activities or problems which are directly related to the success of YOUR SPECIFIC TASK UNIT with other individuals within the Division or with persons who are not members of the division but are directly involved with program related activities and the principal subjects of those discussions.

a. Using the scale below, please indicate the frequency with which YOU INITIATE task related conversations or task related information exchanges with each of the listed groups or individuals.

1. Daily
2. Greater than once each week
3. Weekly
4. Monthly
5. Quarterly
6. Semi-annually
7. Annually
8. Rarely, if ever, only on special occasions

*Principal Subjects:

	N/A	C	S	T	C/M
_____ Persons within my spec. task unit					
_____ My immediate superior(s)					
_____ Persons within this directorate					
_____ Persons within this func. unit					
_____ My Division Vice-President					
_____ Business Management People					
_____ Program Management People					
_____ Engineering People					
_____ Operations People					
_____ Test People					
_____ Group and Corporate People					

IQQ VI CONT.

	N/A	C	S	T	C/M
_____Subcontractors with whom I deal					
_____ Customer Satellite People located in the plant					
_____ Customer Central People not located in the plant.					
_____ Other Major Contractors					
_____ Others (please specify)					

* N/A - Not applicable
  C - Cost
  S - Schedule
  T - Technical
  C/M - Contractual Matters

IQQ VII

We are interested in the Contacts which you have with other members of the Program "Team" that are not employees of the Division. In general, these team members consist of subcontractors, other Corporate Divisions, associate contractors that supply the Customer with Program related goods and services, and various customer representatives.

a. How often do you contact (or contacted by) other non Division "Team" members CONCERNING PROGRAM MATTERS? Please use the scale below to indicate your answer.

1. Daily
2. Greater than once weekly
3. Weekly
4. Monthly
5. Quarterly
6. Semi-annually
7. Annually
8. Rarely, only on special occasions

_____SUBCONTRACTORS

_____MEMBERS OF OTHER DIVISIONS

_____ASSOCIATE CONTRACTORS

_____CUSTOMER REPRESENTATIVES

_____OTHERS (Please specify)_____

b. What is the principal subject which you discuss with each of these contacts?

1. Cost matters
2. Schedules
3. Technical matters
4. Contractual matters

NOT APPLICABLE

_____CUSTOMER REPRESENTATIVES

_____ASSOCIATE CONTRACTORS

IQQ VII CONT.

_____MEMBERS OF OTHER DIVISIONS

_____SUBCONTRACTORS

_____OTHERS (please specify)_____

c. Approximately, what percentage of your total work time is spent in these contacts:

_____PERCENT

d. If 100% represented the total time which you were in contact with other non-Division team members, how would this time be distributed among those with whom you have task related contacts?

_____% CUSTOMER REPRESENTATIVES

_____% MEMBERS OF OTHER CORPORATE DIVISIONS

_____% ASSOCIATE CONTRACTORS

_____% SUBCONTRACTORS

_____% OTHERS (please specify)_____

IQQ VIII

We are interested in the Task coordination that is required between some of the functional task units within the Division.

a. From the alternatives listed below, please select the statement which you believe most nearly describes the DEGREE OF AUTONOMY is herein defined as a units ability to define its job requirements and to make major changes in its activities on ITS OWN.

1 Not at all
2 Very little
3 To a small extent
4 To some extent
5 To a considerable extent
6 To a very great extent
7 To an extreme extent

EXAMPLE: If you believe that YOUR MAJOR FUNCTION/TASK UNIT is able to define its job requirements and to make major changes in its activities without any restrictions, then place a 7 in the space below:

_____YOUR MAJOR FUNCTION (B E O T P)

_____YOUR SPECIFIC TASK UNIT

b. We are also interested in the degree to which one function or unit's task performance or task successes are dependent upon the performance of another function or task unit within the unit.

Using the same (1-7) alternatives provided in a. above, please select the statement which you believe most nearly describes those relationships.

EXAMPLE: If you believe that YOUR task successes are directly influenced by the task performance of SUB-CONTRACTORS to a considerable degree then place a 5 in the space by SUBCONTRACTORS.
5 SUBCONTRACTORS.

The Task successes of YOUR SPECIFIC TASK UNIT are directly influenced by the task performance of (name of function) (how much).

IQQ VIII CONT.

_____ BUSINESS MANAGEMENT

_____ PROGRAM MANAGEMENT

_____ OPERATIONS

_____ ENGINEERING

_____ TEST

_____ SUBCONTRACTORS

IQQ IX

In general, how much say or influence do you feel that each of the following groups or individuals has on the major problems that YOUR SPECIFIC TASK UNIT faces. Please respond for YOUR SPECIFIC TASK UNIT ONLY.

NOTE: You may use the same number as often as necessary.

1 Little or no influence
2 Some influence
3 Quite a bit of influence
4 A great deal of influence
5 A very great deal of influence

_____ Business Management people

_____ Program Management people

_____ Research & Engineering people

_____ Operations people

_____ Test and Evaluation people

_____ Group and Corporate people

_____ My Division Vice President

_____ My immediate superiors

_____ My contemporaries within this division

_____ My co-workers or contemporaries within my specific task unit

_____ Customer representatives in the plant

_____ Customer representatives NOT in the plant

_____ Subcontractors with whom I deal

_____ OTHERS (please specify)_____

IQQ X

In your observation of various functional or task units within the Division, you may have formed some opinions concerning the performance of these units and the division as a whole.

a. Assuming that ideal or optimal performance is 100%, what percentage of ideal or optimal performance do you believe that the Division as a whole is achieving?

_____%.

b. Again, assuming that 100% represents ideal or optimal performance, what percentage of ideal or optimal or ideal performance do you believe that each of the Division's Major Functional Units is achieving?

BUSINESS MANAGEMENT _____%.

PROGRAM MANAGEMENT _____%.

OPERATIONS _____%.

TEST _____%.

YOUR SPECIFIC TASK UNIT_____%.

Thank you for your time and efforts in completing this questionnaire. Your's and efforts similar to yours will be of great value in developing a viable method of organizational analysis in a most complex organizational setting.

Please place it in the envelope provided and mail it directly to the Director of Research Administration.

Director of Research Administration
University of Houston
College of Business Administration
Office of Research Administration
Houston, Texas 77004

APPENDIX B-1

ENVIRONMENTAL DATA RESULTS

I. THE ENVIRONMENTAL DATA

A total of ten interviews were conducted with members of the Governmental Agency "B". In addition, 40 questionnaires were distributed to this organization. At least two questionnaires were distributed to each identifiable Task, Functional or Administrative grouping in order to insure that all segments of the agency had an opportunity to respond and thus minimize our sampling bias.

Thirty-six questionnaires were returned, of which 33 were usable, for a 71% response rate. A review of the questionnaire responses revealed that at least one person from each of the major Task Units had responded and that no two non-respondents came from the same Task group.

The data have been grouped in the following manner for convenience and clarity of environmental analyses:

1. Interview data will be presented first in a synthesized form.

2. The questionnaire data is reported on a question-by-question basis using mean scales constructed from the aggregate scores of each respondent group.

3. A brief interpretation of the responses is included at the end of each question.

4. The respondent groupings are:

   a. Total Aggregate - all responses catalogued (N = 33)

   b. Central Office Aggregate - all responses from Central Office (N = 18)

   c. Central "A" - Central respondents with one set of characteristics (N = 11)

   d. Central "B" - Central respondents with another set (N = 7)

   e. Satellite Aggregate - all responses from the Satellite Office located at Vendor "V's" facility (N = 17)

   f. Satellite "A" - Satellite respondents similar to c above (N = 10)

   g. Satellite "B" - Satellite respondents similar to d above (N = 7)

"B" ENVIRONMENTAL INTERVIEW DATA

A total of ten, one-hour semi-structured interviews were conducted with important decision makers in the Central and Satellite offices. (Format/worksheet is located in Appendix A-1). From these interviews, the following data concerning the program was collected.

1. The principal program concern for the buyer is cost tracking and control. Buyer interviewees identified cost as the most critical program parameter, indicating the less than satisfactory cost controls by the vendor could and probably would result in adverse political transactions concerning the program.

When questioned concerning the technical achievement and schedule parameters of the program, the interviewees admitted the importance of these factors, but reiterrated their notion that costs were of primary consideration in any cost schedule technical performance trade-offs.

The interviewees called our attention to a development concept known as "design to cost" rather than "cost of the design" which holds cost at a predetermined level and forces technical/design performance and schedules to be governed by the cost factor.

2. The dominant concern of the vendor organization is perceived as technical excellence through superior engineering design. Costs and schedules are of secondary importance and are "drawn" by design or engineering requirements. All program trades are perceived as originating from or containing an engineering excellence bias. The general feeling of the firm is perceived as design/engineering oriented to the detriment of all other functional activities.

When asked to further explain this point, a typical respondent's response was: "Those people don't know anything but engineering excellence ... they don't know when to stop designing and start building."

3. The organization was verbally perceived as a mediocre performer to date. Interviewees suggested that the firm had some strong individual performers at most levels in the Managerial structure, but had trouble "putting it all together" or integrating their capabilities and efforts.

4. Strengths were perceived as line talents in both design and production capabilities. Weaknesses included intra-company task coordination, program planning, and information exchanges. Specific comments included "The vendor has excellent capabilities, but tends to be slow in surfacing problems. Often, we (the buyer) know about problem developments before high level company officials do. The vendor

often does not realize the overall program consequences of his problems."

5. The buyer perceived the Production Operations Function and the Business Function as higher than average performers and the Design Engineering Function as a low performer in terms of balanced program performance.

6. The buyer perceived that most of the vendor's important organizational decisions were made by very high level managers in a setting of functional isolation. Interviewees suggested that most program decisions were made by Functional Vice-Presidents. They further suggested that the decisions did not appear well coordinated.

7. Interviewees reported that the buyer organization "B" made program suggestions and offered program guidance only when it was obvious that "V" needed managerial assistance or clarification of program requirements. They also suggested that the "V" organization was selective in both his interpretation and implementation of buyer suggestions. Further, interviewees suggested that major changes in the vendors organization or his task activities came only as the result of extreme buyer pressure at the highest levels of company or corporate management.

8. In discussing communications, buyer interviewees' responses suggested that most communications were functionally channelized. Subjects discussed tended to match the

primary task or functional technology of the communicating pair.

9. Some of the specific organizational structure changes which "B" directly demanded that "V" implement includes:

a. Creation of Program Management and Test Functions (structural elaboration)

b. Adjustments in the internal task structures of Engineering, Business, and Production Operations Function (Task differentiation)

c. Adjustments in work force size and individual placements (structural elaboration)

In summary, the buyer interviewees seemed to suggest that the vendor's organization was a functional organization centered around a strong engineering core. Planning and task coordination were perceived as less than required for a sound program. Decisions were made at the top of strong, functionally oriented, hierarchical structures without sufficient regard to overall program requirements. The vendor resisted or ignored all but the strongest and most persistent environmental demands for change, but many were implemented as a result of environmental ("B" Organization) demands. Vendor performance was marginal, due to a low level of division wide effort integration.

ENVIRONMENTAL QUESTIONNAIRE DATA

QUESTION I

Question I is an adaptation of a Lawrence and Lorsch Question which measured environmental demands. We modified it slightly to gather three goal perceptions. These are, by question part:

a. Individual perception of the program direction or environmental demands in terms of the three prime contractual goals suggested by Government documents, and preliminary interviews.

b. Part b of the question measures the environment's perception (Organization B's) of "V's" perception of these same environmental signals. (Relative importance based upon perceived performance.)

c. Part c tests the perceptions of the uniformity of the success signal being transmitted by the buyer's organization.

PROGRAM SUCCESS ORIENTATION
INDIVIDUAL CRITERION RANKING

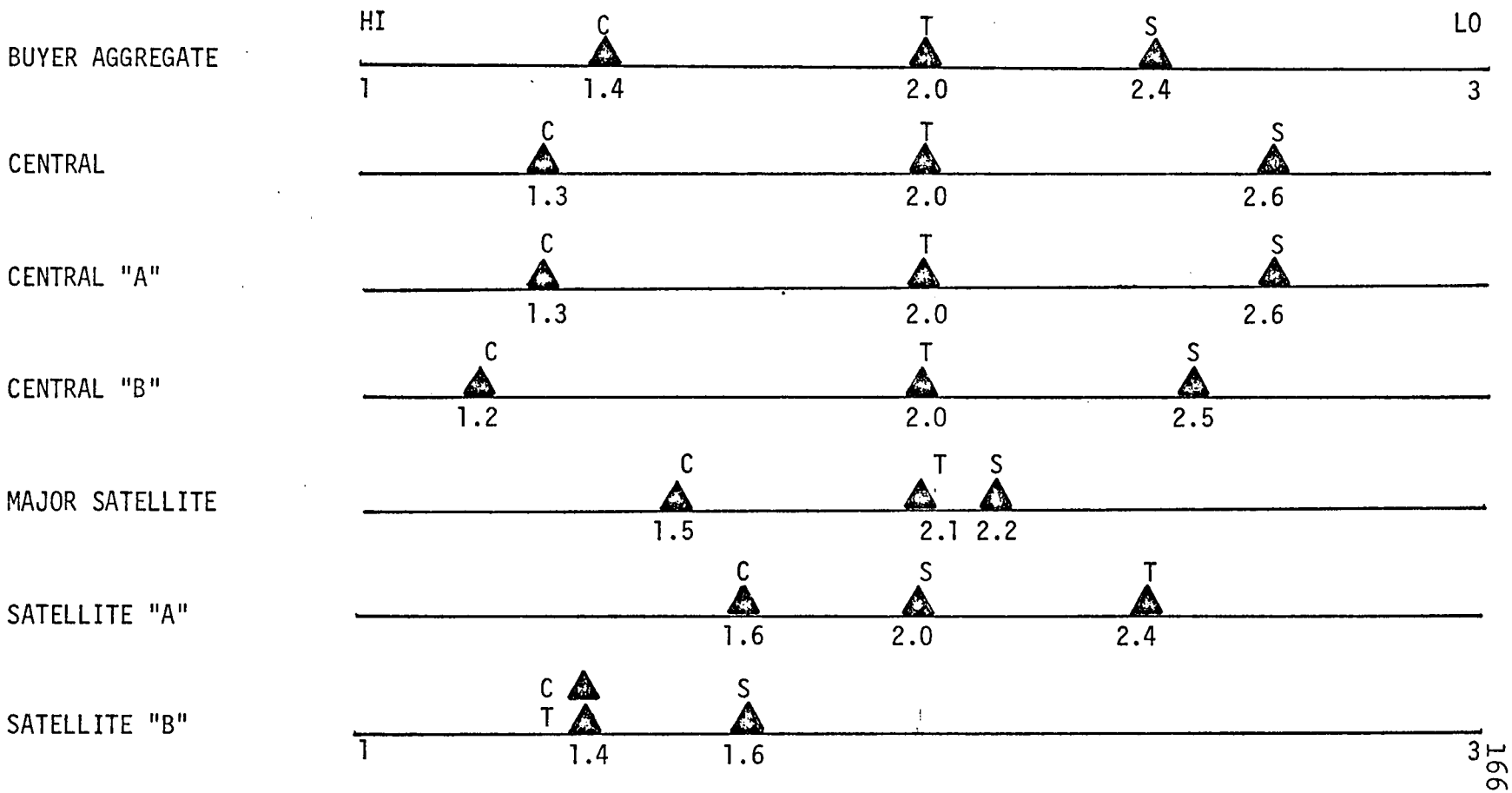

Figure 3

GOAL CRITERION PRIORITY

PERCEIVED VENDOR PERFORMANCE

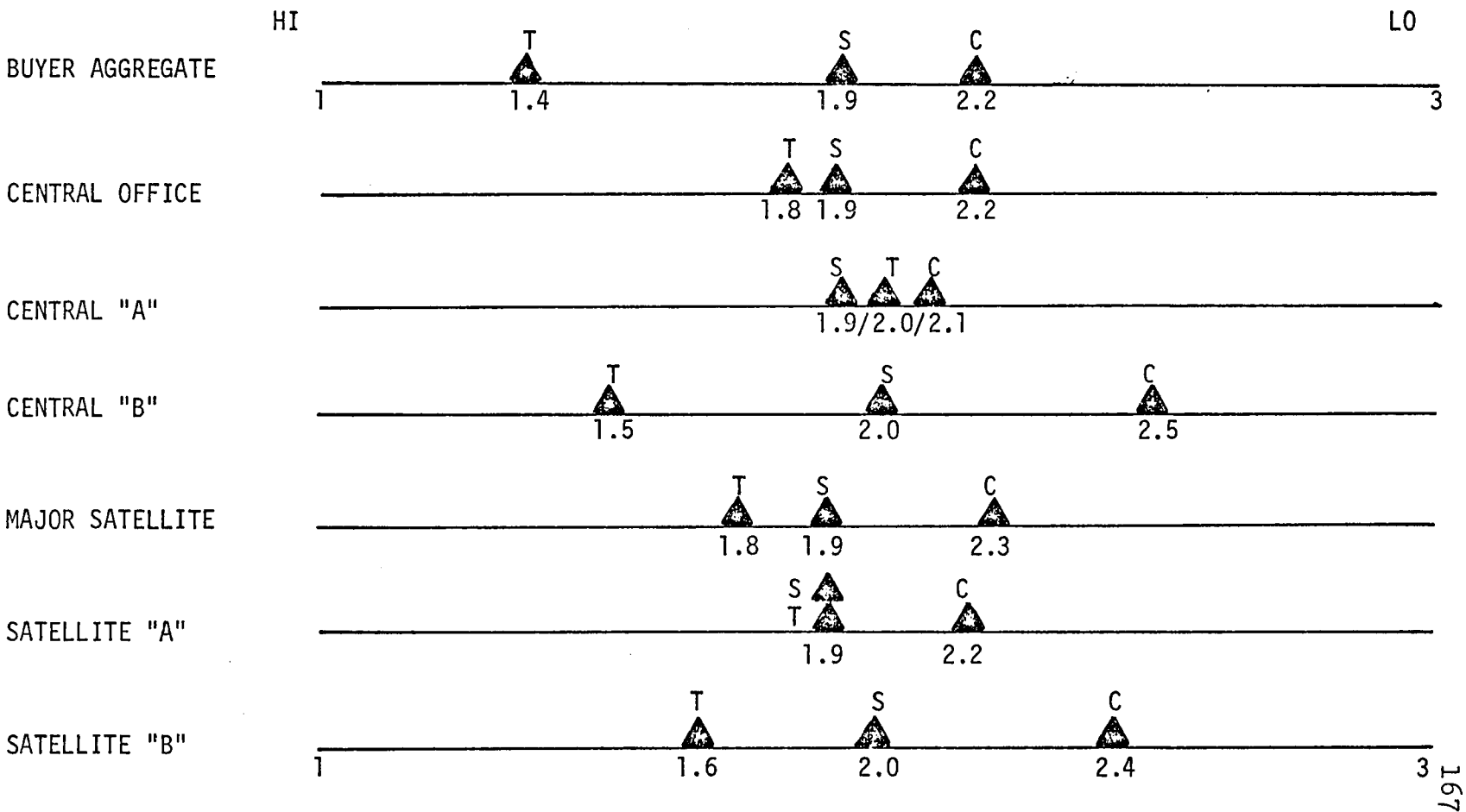

Figure 4

GOAL/SUCCESS CRITERION PRIORITY
COLLECTIVE GUIDANCE PERCEPTION

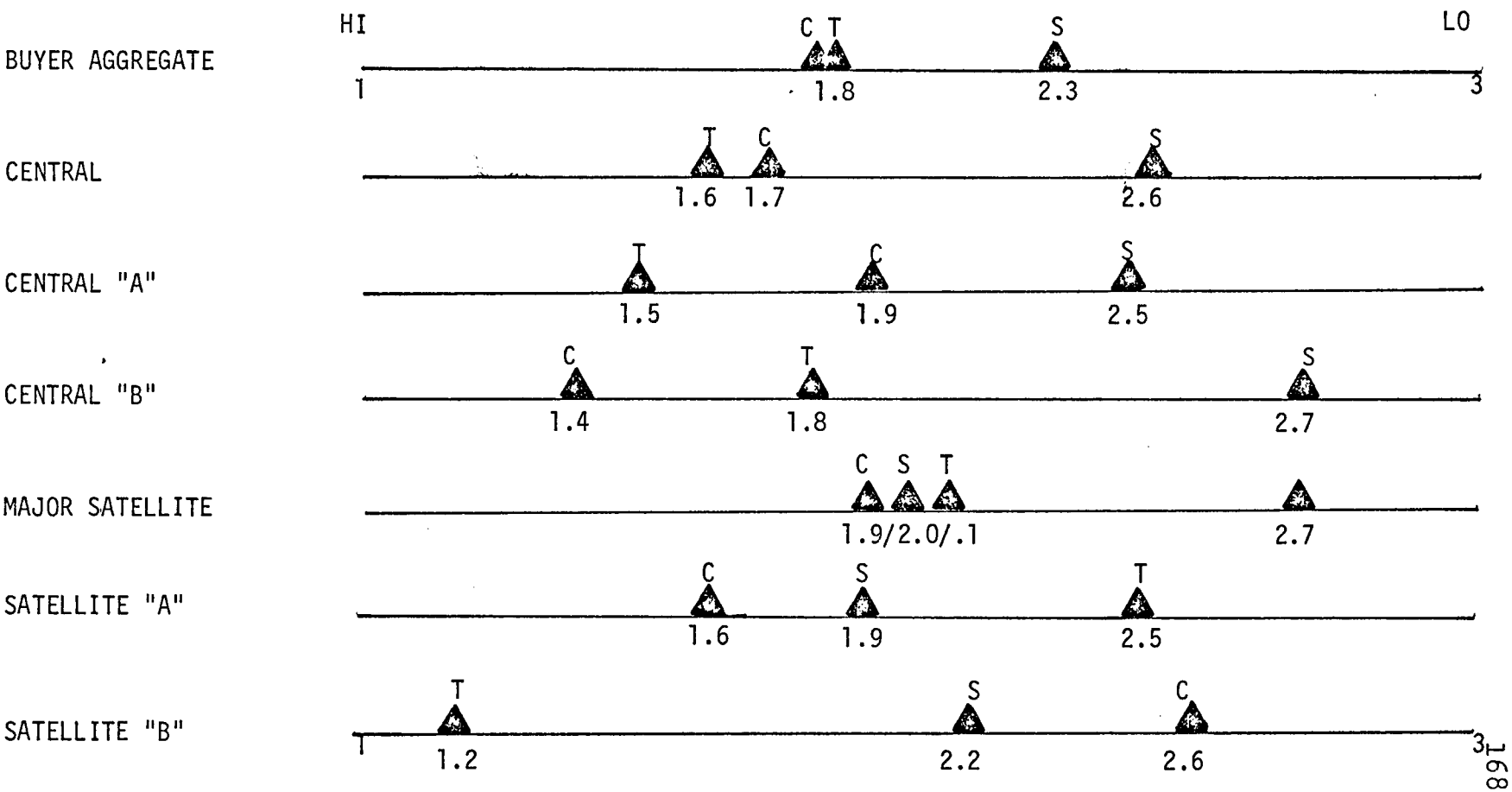

Figure 5

RESULTS

The results of aggregating this data is most interesting. The emergence of Cost, Performance, Technical Achievement, and Schedules Performance in the 1-2-3 order of success measurement criterion was predictable from the large volume of specific program literature which ranks them in that order. The somewhat regular patterns and consistency of answers to 1a was not. Part 1c is more difficult to explain. Central "A" and Satellite "B" tend to share perceptions, but these groups should be farthest apart in perceptions as a result of ages, experience, specific task and perceptual set orientations. In any case however, there is a clear indication that the buyer believes that the vendor is receiving conflicting signals concerning performance criterion.

Part 1b clearly indicates that the buyer perceives that the vendor is misinterpreting environmental signals concerning program success criterion. It seems fair to infer that this buyer perception is the result of observations of vendor activities, performance, utterances, and program documents.

This perception by the buyer may be stated thusly: "It appears that the Contractor is overly preoccupied with technological achievement and success through technical excellence. Schedules are important, but secondary to technical achievement. Costs appear least significant and can be expected to be."

In other words, the Vendor will deliver a very expensive, technically excellent product, a little late.

This being the case, we would expect the buyer to generate strong pressures to correct Vendor perceptions and performance.

In general these data indicate:

1. A strong and uniform perception that cost performance is the single most important program success measurement criterion.

2. The buyer perceives that his organization is providing the vendor "V" organization with diverse and conflicting signals concerning the relative importance of success measurement criteria.

3. The buyer perceives that the vendor has a uniform set of performance based program success criteria which differ significantly from those emphasized by the environment.

4. Patterns of responses to Parts 1a and 1b are extremely similar and suggest a uniformity of perceptions concerning both program criterion and vendor performance.

5. Patterns of responses to 1c indicate a relatively high degree of uncertainty concerning environmental guidance and may indicate that a lower than desirable level of intra-functional coordination exists within buyer "B's" organization.

6. In 1a no significant differences exist between the relative rankings of Aggregate, Central, Central A and Central B (P. 3-9) and Satellite total. Differences in the ordering by Satellite A and B are indicators of the specific task and program orientations of the satellite respondents who tended to be more specific task and less total program oriented than their Central counterparts.

QUESTION II

The "V" organization is functionally divided into three major lines, one major staff and two advisory functions. Some task overlap exists, of course, but, in the main each functional group has a clearly definable set of program oriented tasks, which are formally enumerated by division organization charts and operating procedure manuals.

Members of the "B" organization were asked to rank "V's" functional units in the order of their criticality to overall task success, and to briefly explain the rationale behind the rankings.

Respondent answers to this question provide data concerning:

1. That Task considered by the environment to be most critical for overall success.

2. The basis for assigning criticality.

3. The orientation of the environment toward Task structuring (functional, program/matrix, etc.)

4. The relative importance of each functional discipline.

TASK CRITICALITY
(PROGRAM ORIENTATION)

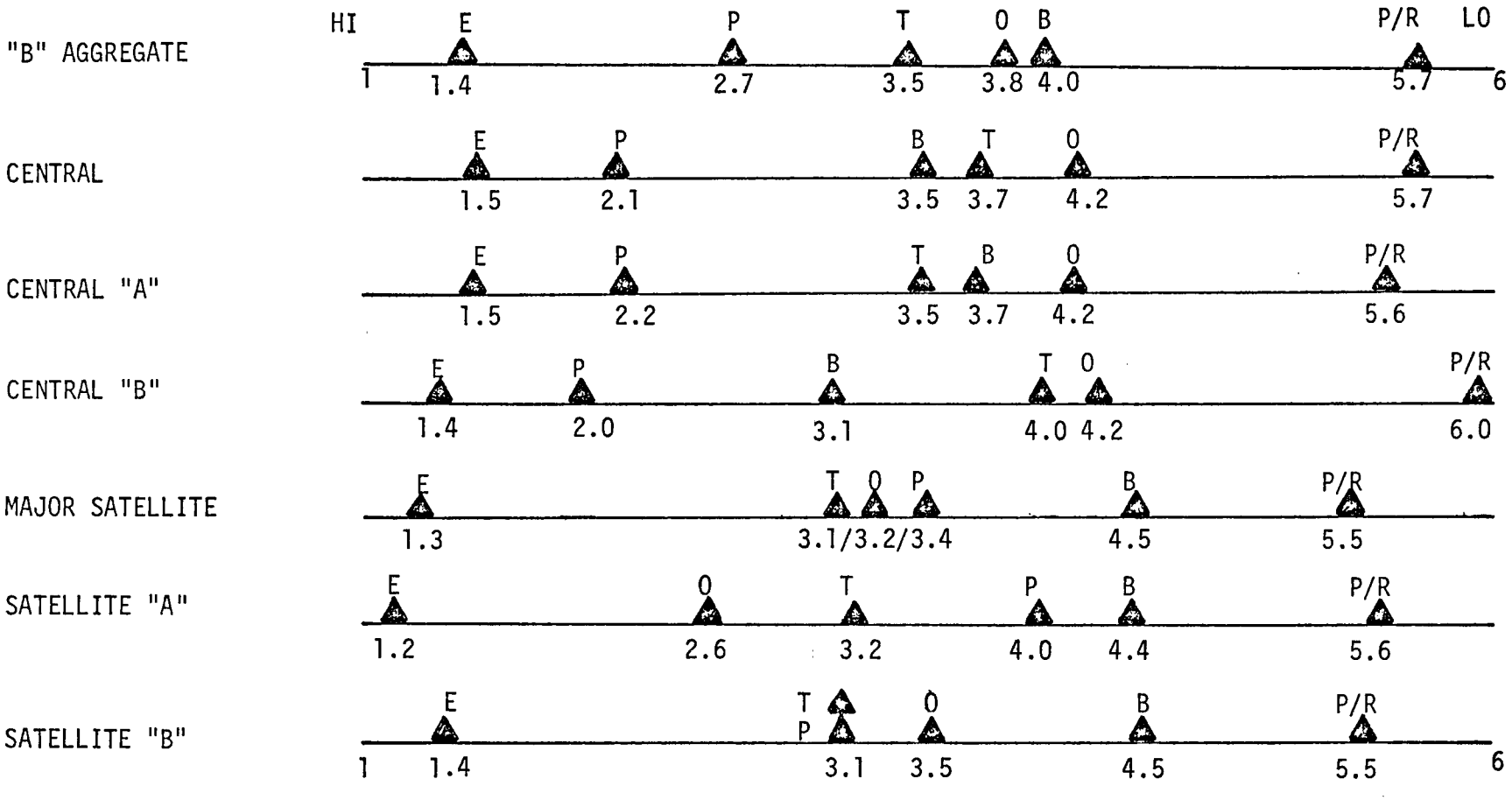

Figure 6

RESULTS

Results show that the environment strongly believes that the engineering Task is of prime importance to the success of the effort. Rationale (Part b) linked the engineering/development effort to all performance measurement criterion. Product design was viewed as the key to all successes.

While the general narratives followed a design - build test functional flow schema, significant attention was given to the necessity of overall program integration by individuals in each response category.

Among those respondents in the Central management office, the Engineering/design function was clearly Most Critical and the Public Relations/marketing/image solidification function Least Critical. The Program Management of Task integration function was also judged significantly more critical than the other functions. These respondents were also consistent in judging the production Operations Function (manufacturing, material gathering and control, quality assurance) as significantly less critical than other functions. Signals were mixed with regard to the business function and test function.

One logical interpretation of these Central Office responses, (based upon the narratives provided, the interviews,

and the data) is:

1. The program is a development effort, not a production effort and therefore the engineering "function" is the center of efforts.

2. Concentration upon functional division of the total Task without adequate attention to issues which affect the overall program (i.e., differentiation without adequate Task integration) could give rise to unbalanced or significantly biased, functionally oriented decisions as opposed to balanced program decisions.

The selection of the Program Management function as Number 2, but simultaneously of greater importance than other Task group units signals a desire for a "Total Program Approach" and a concern for the possibility of a functionally fragmented program performance. It is a call for program continuity and integrated trade-off decisions. Further, it may signal perceptions of past programs wherein the integrated (Program Management across functional approach) proved more successful in goal achievement efforts than did the functional approach.

3. The positioning of the Operations Function in a position of low criticality may be deceiving. Without material supply and control, manufacturing, and quality assurance activities no product would exist. There is

little doubt that less than adequate performance in this area could severly hamper or negate success in cost, schedule, and technical/product performance goals. This positioning of production OPERATIONS as 4.2 on the criticality scale and as next to least critical would tend to reflect.

a. The state of the art in Operations Tasks is such that the skills, activities, and task requirements of the program present few challenges to the operations function. It was noted during interview utterances and in the Question 2 narratives that the buyer tended to perceive the tasks of operations function as relatively certain and may hold the perception that "operations can build anything easily".

b. The position of the operations function in the total effort stream is such that the function has a lesser independent impact upon success.

c. Existing capabilities within the operations function, (i.e., skills, facilities, leadership, manpower, organizational structures) exceed Task requirement.

4. The evaluation of the criticality of the Business Management and Test Functions are less clear. As noted

previously, the Test Function is the final stage of the line process associated with the program. Tests must develop and conduct testing procedures and techniques which will "Prove" the extent towhich the product conforms with prescribed performance criterion and specifications. The positioning of the Test Function may be influenced by:

a. Until recently the Test Function was an integral subsidiary of the Engineering Function. As such, it may continue to be identified closely with that function and draw positional importance or task criticality based upon its former association.

b. The Test Function evolved as a separate entity partly as a result of strong suggestions by the buyers organization. The stated reasoning for this organizational elaboration from interview data was: "It seems appropriate that the engineering function be prevented from grading its own papers. Instead, a separate testing function should evaluate the effort".

   The fact that the buyer believed that a need existed for a separate testing unit may account, in part, for this positioning.

c. A third factor of some significance may lie in the intersection of the state of the art in testing.

technology, the unique testing requirements of the program, and the perceived high level of demand for positive proof of performance. The buyer may perceive that the testing effort is a two-edged sword which (1) adequately and credibly measures the capabilities and limitations of the development effort and (2) provides valuable data for decision making concerning future program activities. Further, the perceived unique requirements for "Proof" may be such that technical performance, though achieved, may be difficult to demonstrate. Of the three prime program goals; cost, schedule, and technical performance requirements, the technical parameters may be couched in a greater level of uncertainity, and though of great importance, much more difficult to measure and demonstrate than those of cost and schedule performance. Thus, the testing function would be perceived as significantly more critical by technical oriented respondents. Realistically, the analysis tends to suggest that a combination of all three factors is responsible for the positioning of the Test Function.

The positioning of the Business Management Function in the relative high position appears to reflect or reinforce

the concern for an integrated "total program approach" as opposed to the individual Functional Task separation. As stated previously, some of the Tasks of the Business Function include contractual obligation monitoring, financial tracking, financial analyses and visibility, and financial planning.

The financial visibility requirements may be linked directly to cost performance, schedules, levels of effort, and force levels and structures, on a program wide (aggregated) and a function by function basis.

In a program where costs performance is critical and limits of obligation a prime controlling factor, financial visibility may indeed be of significantly greater importance to decision making and program success.

The selection of Program Relations as least critical to overall program success tends to suggest that the marketing efforts associated with the program are of secondary importance to program success. The vendor has "sold" his proposal to the buyer and the contract has been negotiated. The environment may then logically view Program Relations as a public information organization which has no direct impact upon program goal achievement.

Satellite Analysis

The satellite office, although an integral part of the "B" organization, is located at the sellers plant.

A comparison of the environmental perceptions of the two offices (and the resulting environmental signals) shows some most interesting differences and suggests that the environmental force/or signals are somewhat diverse and mixed rather than uniform.

One plausible explanation for these differences is suggested by location differences. The Category A and B respondents are in direct daily contact with members of the Vendor's organization and may be integrating Task Criticality with Task Performance potential and observed Task Performance.

Perceptions of the Engineering/Design Function and the program relations functions as they pertain to overall program success criticality show no significant positional variance from the perceptions of the Central office. However, there are significant differences in positioning of the other functions, both in terms of the comparative responses of Category A and Category B respondents. Within the Satellite Office and between these responses and those of respondents in the Central Office (Note: The respondent populations of the satellite and the Central

Office are comparable in terms of Tasks and program duties; however, satellite respondents seem to be younger, have less total experience, and less total organization hierarchical position.) The response comparison tends to indicate that the respondents in the Satellite Office tend to adopt a functional view of program success criticality as opposed to the more "overall program" oriented view suggested by the Central Office responses.

Other suggested interpretations include:

1. Satellite "A" category respondents tend to perceive the criticality of the function in somewhat the same manner as discussed previously.

2. Satellite "A" category respondents recognize an integrated program orientation requirement, which may conflict with their functional orientation and thus influence the positioning of the program management function in a co-location with Test.

3. Satellite "A" respondents perceive the tasks of operations to be less challenging than the present assembled capabilities.

4. Satellite "B" category respondents may be expressing alarm at Engineering performance when they place Operations in a second position of critical importance. Herein, the interviewee advanced notion that "Operations must correct

Engineering errors prior to testing and delivery" is clearly stated.

5. The positioning of the Business Management Function at a very low level of criticality in terms of success may tend to signal that both Satellite A and B category respondents (1) perceive that the Business Management Function has little definitive impact upon the success of this development effort and (2) the satellite office perceives that functional line activities (R/E, O, T/E) hold the keys to success and that staff support activities are not allowed to contribute to program success.

Overall

Overall analysis of the responses tend to suggest:

1. Significantly different environmental orientations exist between the central and satellite office.

2. The Central Office tends to be concerned with problems of overall program success, tracking, and visibility while the satellite is more functionally oriented in its approach.

3. Both offices perceive design and engineering as most critical to success in all significant performance areas (cost, schedule, technical excellence).

4. Both offices perceive Program Relations as an element of low criticality to program success.

5. The Test Function is perceived as highly critical and thus may tend to reflect an inordinately high concern over the uncertainities involved in the adequate testing of the product.

QUESTION III

Question III measures the perceived environmental stability of the functional units of the "V" organization. It measures the externally visible level of the uncertainty or knowledge of cause and effect linkages between the function, its tasks, and the environment.

Respondent answers to this question give insight into:

1. Differences in environmentally perceived task certainty.
2. Planning effectiveness.
3. Levels of perceived linkages between change and change causality.

FREQUENCY OF MAJOR UNPLANNED CIRCUMSTANCES

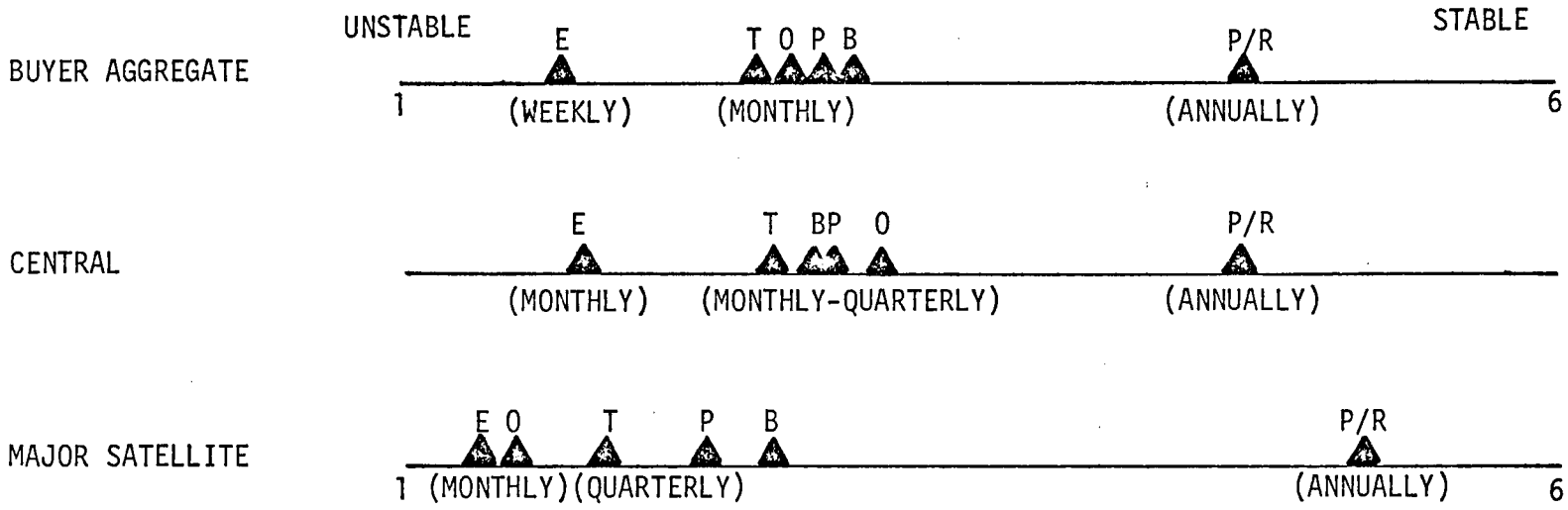

Figure 7

PERCENT UNPLANNED TASK CHANGES

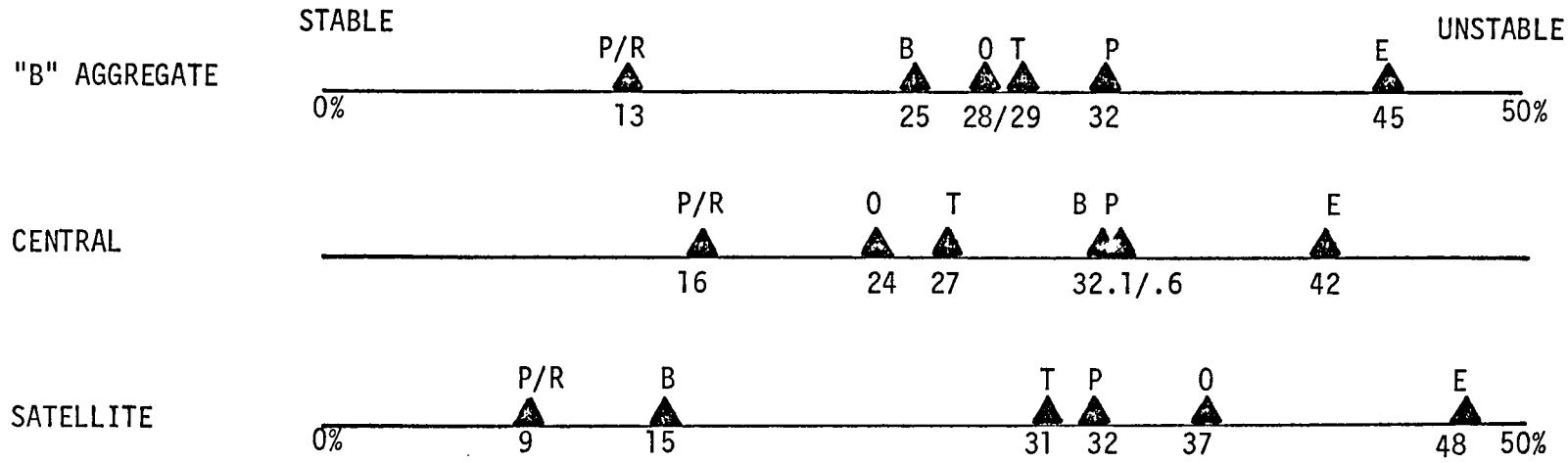

Figure 8

RESULTS

The data groupings suggest three distinct levels of uncertainty.

The Engineering Function operates in the most uncertain environment with changes occurring on a weekly basis.

Tests, Production Operations, Program Management and the Business Function are perceived as operating in a more stable environment with a higher level of anticipated task circumstances occurring infrequently.

Similarly, the results of the data on percentage of unplanned task changes groups the functions into the same three general groupings of Engineering clearly high, Program Relations clearly low, and the others dispersed near the center of the spectrum.

Again, however, the responses suggest a definite difference between the central and satellite perceptions of functional task stability. All agree that Engineering is least stable, but perceptions of Operations' stability fluctuates from second most to second least stable.

Similarly, the central and satellite responses to the question concerning the percentage of unplanned task changes suggest widely differing perceptions of the Operations and Business Management Functions.

These data suggest that the environment in total is relatively unstable with frequent task changes and a high level of unanticipated task change circumstances.

It further suggests that the ability of the "V" organization is somewhat lacking in its ability to link environmental circumstances to potential changes.

A Contingency Model interpretation of these data would suggest that a significant problem in interpreting the impact of environmental signals and in gathering or exchanging internal information exists in the "V" organization. This would indicate an inflexible task structure which did not fit the environmental demands. It also suggests that a highly flexible problem solving oriented task structure is required to cope with the uncertain environment, especially in the Engineering Function.

Question IV

Lawrence and Lorsch measured the degree of integration (inter-functional task coordination) through the use of a matrix scale. We decided to expand this notion somewhat and ask the environment about perceptions concerning effort integration. We reasoned that the relevant segments of the environment would have meaningful data or observation based perceptions as a result of frequent contacts with the organization and its sub-parts. We thus asked, "How do you perceive intra-organization effort coordination?" and simultaneously, "Which functions appear to be coordinated best?"

We then expanded the same notion further and asked about the buyer organizations perceptions of the functional relationships with selected segments of the external environment. We sought two sets of data from this measurement of the quality of external relations. These were:

1. Actual level of harmonious relations between the firm and the external agency.
2. Comparative levels of relationships between:
    a. External and internal relations
    b. Among external agencies
    c. Differences among functions in their external relations.

The two questions which we used were Part I and II of Question IV of Appendix A-2.

RESULT

These two measures will be reported in the aggregate or total form only.

TABLE I

INTERNAL COORDINATION (Question IV Part I)

(Integration)

	P/R	T	O	E	P/M
BUS	3.3	3.5	3.3	3.6	3.0
P/M	2.9	3.4	3.7	3.7	
ENG	3.5	3.3	3.9		
PROD. OPNS	3.3	3.5			
TEST	3.6				

TABLE II

EXTERNAL COORDINATION (Question IV Part II)

	CUST CENT	CUST SATT	SUP-LIER	ASSOC IATES	COMPANY
B	3.3	3.5	4.3	4.4	3.3
P	2.9	3.2	3.9	3.5	3.6
R	3.3	3.6	3.9	3.6	3.8
O	2.9	3.1	3.7	3.6	3.4
T	3.0	3.1	3.8	3.6	4.2
P/R	2.5	2.8	3.6	3.4	3.3

INTERPRETATION

Lawrence and Lorsch in their empirical research found that mean scores greater than 2.6 for a pair of units seemed to indicate that there were appreciable difficulties in achieving "intergration" (effort coordination).

Assuming momentarily that the 2.6 mean score is valid, our scores would seem to indicate that the buyer perceives that the vendors organization has little effective task coordination among or between the functions. Further, the external coordination scores would suggest that the inter-organizational coordination between the vendor and significant elements in the relevant environment was at a very low level.

We cannot accept this interpretation and the Lawrence and Lorsch 2.6 mean indicator without qualification. It is obvious that the firm is not totally ineffective in either it intra-functional effort coordination activities or its external program transactions. The buyer interviewees suggested that some difficulties did exist in the vendor's internal and external coordination efforts, but did not indicate or even suggest a complete lack of unity in all of the intra-functional coordination activities or any of the inter-organizational transactions.

Based upon these indications and logical observations that ineffective coordination on all sides would quickly lead to organizational chaos and program disintegration, we believe that a more logical interpretation of the data results would be a superlative comparison or ranking of relationships.

For example, the intra-functional matrix indicates that Program Relations is perceived as having achieved a higher level of effort coordination with the Program Managers, followed by a lesser level with the Business and Operations Function and is integrated least well with the Engineering and Test Functions.

Similarly, the Test Function is perceived as having achieved the highest levels of coordination with the Engineering Function and is least coordinated with Business, Production Operators and Program Relations.

Production Operations is perceived as achieving the lowest levels of coordination with the Engineering Function and the Program Managers. Engineering is similarly aligned, but adds the Business Function to the list of those with whom coordination is lowest.

Perceptions of the external or inter-organizational effort coordination levels show a somewhat surprising pattern. These data indicate that the buyer perceives that

all of the functional units in the company have achieved a higher level of task coordination with the buyer's organization than with external suppliers, other major industrial firms which build major system components, and other program related portions of the parent corporation.

A work flow analysis (design-build-test) of the program seems to indicate that the buyer perceives a low level of task coordination/effort integration among and between the "doing" functions. This would suggest that the buyer perceives a lack of effective coordination devices or activities.

Similarly, the buyer perceives a lower level of coordination between the vendor and those organizations which supply raw materials and parts than with the control or management force in the external environment.

Lastly, it is interesting to note that the buyer perceives that the vendor's functional units have achieved a higher level of effort coordination with the "B" central office than with the Satellite office. This suggests that some type of adversary relationship rather than a cooperating partnership may exist between the vendor's organization and the co-located satelite.

In general however, we may state that these data indicate that "B" perceives a definite lack of both internal and external task coordination by the "V" organization.

Communications Patterns

Communications patterns provided another dimension of the environmental interchange between "B" and "V". The patterns provide data concerning principal environmental and vendor organizational concerns. Three simplistic questions were asked:

1. With whom do you communicate?
2. How frequently do you communicate?
3. What is the synthesized subject of this communication?

These questions were translated into a format suggested by a Pelz, Andrews and Miller (1970) and appear as Question V, Part I and Part II of the Environmental Questionnaire.

Communications Pattern Analysis

The data suggests some very interesting yet logical patterns of information exchange between Organizations "V" and "B".

One pattern which is clearly visible is the shifting of subject matter and frequency of contacts between the "V" and "B" organizations as contacts occur with different segments of the managerial hierarchy. Conversations with Corporate officials are <u>schedule</u> and <u>cost</u> centered with some technical subjects discussed. This pattern shifts to one in which <u>costs</u> supplants <u>schedules</u> as the predominant subject at the vice-presidential and director level. The pattern

TABLE III

COMMUNICATIONS PATTERNS - TOTAL

GROUP	SUBJECT	AVERAGE CONTACT FREQUENCY
CORPORATE EXECUTIVE	SCHEDULE (C-T-O)	ANNUALLY
DIVISION EXECUTIVE	SCHEDULE (C-T-O)	QUARTERLY
VICE PRESIDENT	COST (S-T)	QUARTERLY
BUSINESS MANAGEMENT	COST (S-T)	QUARTERLY
PROGRAM MANAGEMENT	COST (S-T)	MONTHLY
ENGINEER	TECHNICAL (S-C)	MONTHLY
OPERATIONS	TECHNICAL (S-C)	QUARTERLY
TEST	TECHNICAL (S-C)	QUARTERLY
PROGRAM RELATIONS	SCHEDULE (O-T-C)	QUARTERLY
ASSOCIATE	TECHNICAL (S-C)	MONTHLY
SUB CONTRACTOR	TECHNICAL (S-C)	SEMIANNUALLY

C indicates Cost Matters
S indicates Schedule Matters
T indicates Technical Matters
O indicates Other Matters

TABLE IV

COMMUNICATIONS PATTERNS - CENTRAL

GROUP	SUBJECT	AVERAGE CONTACT FREQUENCY
CORPORATE EXECUTIVE	COST (S T O)	ANNUALLY
DIVISION EXECUTIVE	COST (S T O)	QUARTERLY
VICE PRESIDENTS	COST (S T)	QUARTERLY
BUSINESS MANAGEMENT	COST (S T)	QUARTERLY
PROGRAM MANAGEMENT	COST (S T)	MONTHLY
ENGINEER	TECHNICAL (C S)	MONTHLY
OPERATIONS	TECHNICAL (C S)	QUARTERLY
TEST	SCHEDULE (T C)	MONTHLY
PROGRAM RELATIONS	SCHEDULE (C T)	QUARTERLY
ASSOCIATE	TECHNICAL (C S)	WEEKLY
SUB CONTRACTOR	TECHNICAL (S C)	SEMIANNUALLY

TABLE V

COMMUNICATIONS PATTERNS - SATELLITE

GROUP	SUBJECT	AVERAGE CONTACT FREQUENCY
CORPORATE EXECUTIVE	SCHEDULE (C-O T)	SEMIANNUALLY
DIVISION EXECUTIVE	SCHEDULE (C T)	QUARTERLY
VICE PRESIDENT	COST (S T)	QUARTERLY
BUSINESS MANAGEMENT	COST (S T)	MONTHLY
PROGRAM MANAGEMENT	TECHNICAL (C S)	MONTHLY
ENGINEER	TECHNICAL (S C)	MONTHLY
OPERATIONS	TECHNICAL (S C)	MONTHLY
TEST	TECHNICAL (S C)	QUARTERLY
PROGRAM RELATIONS	SCHEDULE (T C)	QUARTERLY
ASSOCIATE	TECHNICAL (S C)	QUARTERLY
SUB CONTRACTOR	SCHEDULE (T C)	SEMIANNUALLY

again shifts from costs to technical subjects predominance at the fourth level of Management.

Similarly, the frequency of contact increases significantly as the levels of management decrease from one (division executive) to four (operating manager).

A second clear pattern of information transactions is centered in information exchanges between "B" and "V's" functional units. Subject matter tends to reflect the technology of the unit, i.e., cost matters are the predominant subject of discussion with the Business Function, and Technical matters are principal subjects of exchanges with the Engineering, Production Operations and Test Functions.

Some contrasts exist in the patterns. The central office tends to be more cost and less technically oriented in their contacts while the Satellite appears to discuss Technical and Schedule matters more frequently than costs.

Overall, communications patterns support general theoretical expectations. The only disconcerting note is that cost, the primary program success measurement criterion is the least frequently discussed subject among the line functions (below the vice presidential and director level).

Performance

A final measure of environmental perceptions was recorded by asking a question concerning performance.

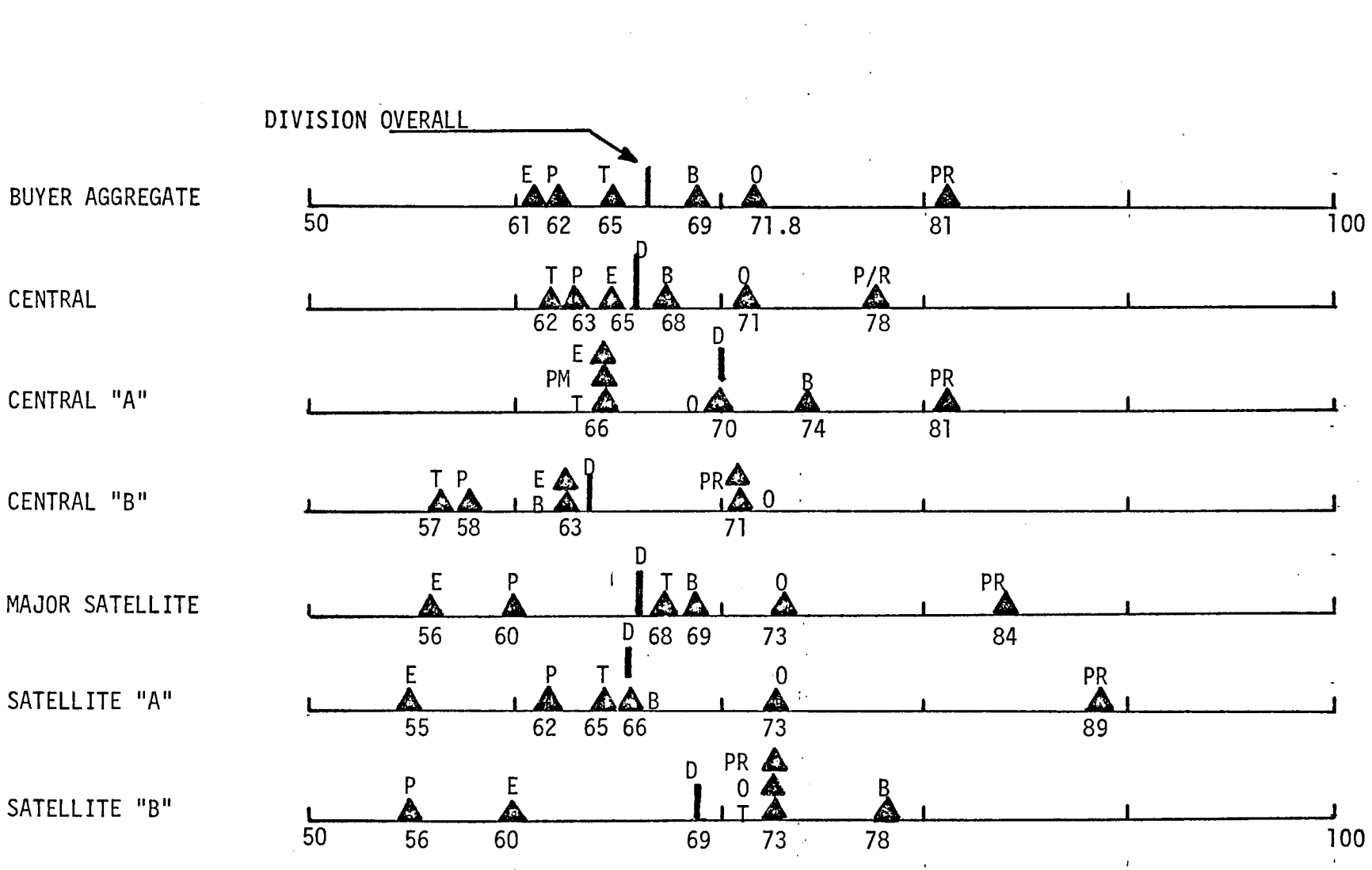
PERFORMANCE
(PERCENT OF OPTIMAL)
DIVISION OVERALL
BUYER AGGREGATE
E P T B O PR
50 61 62 65 69 71.8 81 100
CENTRAL
T P E D B O P/R
62 63 65 68 71 78
CENTRAL "A"
E PM T D O B PR
66 70 74 81
CENTRAL "B"
T P E B D PR O
57 58 63 71
MAJOR SATELLITE
E P D T B O PR
56 60 D 68 69 73 84
SATELLITE "A"
E P T D B O PR
55 62 65 66 73 89
SATELLITE "B"
P E D PR O T B
50 56 60 69 73 78 100

Figure 9

Performance is in fact the summation of all of the interaction or structural "fit" variables. For instance, if an organization was perfectly adapted to or "fit" the demands of the relevant environment, we might expect a performance level at or near optimium. The lesser the "fit", the lesser the performance "score".

We could find no satisfactory method of adequately assessing or quantifying performance other than a direct questioning approach. Therefore, we asked the environment to score the performance of the organization, both as a whole and functionally.

The following question was used as a substitute for the market evaluation/profit, sales, return on investment, etc., performance measurement criterion suggested by Lawrence and Lorsch and other open systems oriented researchers.

Due to the lack of data for meaningful comparison and due to the special nature of the buyer-seller relationship, we felt that a direct question would accurately portray the environments' perception of performance.

The data tends to suggest that the perceived performance of the Vendor's organization "V" is somewhat below that which is desirable and considerably below that which is considered optimal.

The central office data suggests that at this time functional performance levels are inversely proportional to perceived criticality of that function to program success. The Engineering Function is perceived as below "average" and the Program Management and Test Functions. Program Relations, with its low level of program success criticality, is perceived as the unequivocally high performer. Business management appears at or near average, and operations above average.

A clearly different set of perceptions exists at the satellite. The Engineering and Program Management performance perceptions remain very low, Operations and Program Relations relatively high, but differences exist in the perceptions of the Test and Business Management Functions. These fluctuate from below average to well above average in the evaluation by the "A" and "B" respondents.

OVERALL ENVIRONMENTAL ANALYSIS

At this point in the analysis of the data gathered from the environment, it seems appropriate to ask "What does this all mean? What are the environmental forces which signal direction to the organization in this study? What signals is THE VENDOR "V" receiving for interpretation?"

First, the data seems to suggest that the environment, though emanating from a single focal point, is producing diverse signals. The written publications, such as news releases, articles in industry related publications, and governement publications tend to suggest that the product is a significant advancement in the product line. Yet at the same time, these same publications indicate that the development of the product will be accomplished within cost and on a precise schedule.

Cost performance criterion success appear to have been emphasized most in all publications, including the contract between the Vendor "V" and Buyer "B" which contains the following stipulations:

1. An incentive clause that links the award of a substantial incentive fee to prescribed performance goals.

2. A buyer obligation limiting clause which defines limits and schedules of the buyers financial obligation.

3. A requirement for a specific cost and effort accounting and tracking system.

However, in day to day communications between "V" and "B", technical and schedule performance criterion appear frequently as most important subjects of information transactions. Simultaneously, "B" organizational members perceive that success criterion signals are not uniform throughout the organization.

Similarly, signals concerning preferred structural alignments are not uniform. "B" documents and some utterances call for a Program Oriented or Matrix structure. Yet, "B" appears willing to transact program business on a highly functionalized basis. Further, the "B" organization is organized along functional rather than program or matrix lines; and "B" personnel tend to interact with "V" personnel along task or functionally specific lines.

These mixed signals concerning success criterion and structural preferences could lead to higher levels of environmental uncertainty for "V".

Other specific data points include:

1. "B" perceives that the organizational structure of "V" is mismatched to Environmental/Program requirements. "B" perceives that "V" lacks program oriented information and task integration structures.

2. "B" perceives that the performance of critical task units is inversely proportional to their program success importance.

3. "B" perceives that "V" is performing well below expectations.

APPENDIX B-2

ORGANIZATION "V" DATA RESULTS

II. THE VENDOR DATA

After the review of the literature and preliminary analysis of the data gathered from the vendor's relevant environment, an examination was made of the vendor's organization.

The central purposes of this examination were to:

1. Determine the structural characteristics of the vendor's organization and its major functional units.

2. Determine some of the perceptions that the members of the vendor's organization had concerning their own organization.

3. Determine some of the perceptions held by members of the organization concerning the forces of the relevant environment.

4. Determine some of the effects of environmental interaction upon the vendor's organizations structure.

5. Determine some of the structural related reasons for performance perception differences among the organization's functional task units.

The data gathering consisted of structured interviews and a somewhat lengthy questionnaire (Appendix A-3). A total of 57 interviews, 1 to 1½ hours in length, were conducted

with the division president, all of the functional vice presidents, a large group of the functional directors (23 of 31) and a large percentage of the key decision makers among the level 4 managers within each function (28 of 107).

A total of 94 questionnaires were distributed to key organization members selected from each of the functions by the functional vice presidents. The functional vice presidents selected potential questionnaire respondents using the following criterion: (1) at least one key high level and two or more key lowerer level managers should be selected from each major directorate or large task unit within the function; (2) respondents (as perceived by the vice president) should have sufficient knowledge and experience in the organization to respond accurately to the questionnaire; and (3) the respondent was willing to voluntarily answer an extensive questionnaire; and (4) the anonymity of respondents would be positively insured.

Of the 94 questionnaires, 79 were returned (78 provided useful data) for a usable response rate of 78/94 = 84%. Specifically, among the functions, the Business Management function returned 21 of 23, for a 91.3% response rate; Program Management 3 of 4, for a 75% response rate; Production Operations Function 18 of 21 for a 85.7% response rate; Engineering Function 27 of 33 for a 81.8%

response rate; and the Test Function 9 of 13, for a 69.3% response rate.

These response rates, the methodology of selection, and the wide representation of management and task specialties suggests that the responses tend to represent the organization's decision structure.

In terms of the overlap between the questionnaire and the interviews, 40 of those receiving questionnaires were interviewed. This however, is not detrimental. Interviewees were selected by the researcher based upon: (1) key divisions executives (president and vice-presidents), (2) major functional task directors, (3) key managers from each function. The interviewees merely represent a smaller segment of the key managerial population of the organization. Taken together, a considerable population of the vendor's firm was covered, and 100% of the key decision makers were polled.

Specific findings have been aggregated by two methods, company wide and by specific task function. Mean and modal responses were examined and the mean selected for use as it appeared most representative of the data distributions.

Specific categories will include, where appropriate, the following groupings of data:

(1) All N=78

(2) Executives only (company wide VP and directors) (n=21)

(3) Managers only (company wide) (n=57)

(4) Business Management (only) (n=21)

(5) Program Management (only) (n=3)

(6) Test (only) (n=9)

(7) Production Operations (only) (n=18)

(8) Engineering (only) (n=27)

A synopsis of the interview data is presented first, followed by the data gathered from the internal questionnaire.

"V" INTERVIEW DATA

We conducted 57 structured interviews with managers in the top 4 levels of Management (Pres-1, VP-2, Directors-3, Managers-4). The interviews were scheduled for one hour each. Most, however, ran over this time and averaged approximately 1½ hours in length. Questions (Appendix A-3) served as a guide, but were amplified to suit the situation and the interviewee.

Interviewees were selected in such a manner as to insure balanced coverage of all Major Task groupings in "V" Organization charts, task descriptions, and advice from Organization "V" and "B" managers aided us greatly in the selection of Potential Interviewees and Alternates.

Extensive notes were taken during each interview and a 30 to 45 minute detailed synopsis of each interview was recorded by the researcher during the hour following each interview.

All interviewees had Functional Organization Charts on hand and could quickly elucidate their specific organizational address and task responsibilities. Few however, possessed inter-functional charts and thus had some difficulties in explaining specific inter-functional work flow or communications patterns of specific relevance to their task.

Results of the interviews are synthesized below. Additional interview findings are presented as they apply to the questionnaire data.

TASKS

Each interviewee was asked a series of questions concerning his specific tasks, task inputs, outputs and connectivity with intra-functional and interfunctional tasks groups.

All respondents demonstrated a high level of knowledge concerning specific task requirements and general task requirements of other task units in the overall work stream. However, in most cases, interviewees were vague in their education of specific input and output resources which were required for successful task accomplishment. The highest levels of this uncertainty were expressed by engineering interviewees, the lowest by business interviewees.

In most cases, interviewees demonstrated a high functional orientation, expressing their question responses in a manner calculated to convince the interviewer that theirs was a most important task in a most important division function.

In discussing tasks and the program in general, interviewees tended to concentrate upon the technical and schedule aspects of the work. Some acknowledgement

was given to the importance of costs, but this subject was rarely mentioned below the Vice-Presidential level in any function except business.

TASK CRITICALITY

Interviewees were questioned concerning tasks critical to program success and resource limitations. When corrected for functional bias, responses fell into two general categories. First, numerous respondents said that Engineering was the most difficult and demanding job and also most critical due to the developmental aspects of the program. These same respondents indicated that time and financial limitations were the factors which contributed most to the Engineering Task Difficulty.

The second group said that the Manufacturing section of the production operations function had the most difficult and critical task. Time was the factor which contributed most to these difficulties.

The same group then claimed that most, if not all, of the manufacturing difficulties could be traced to Engineering performance. They claimed that Engineering outputs were late, subject to change, and difficult to implement; all of which lead to lost time for manufacturing.

Interviewees in the line functions (Engineering, Production Operations, and Test) suggested that the

Business Function was least critical to Program Success. These interviewees tended to class the business function as a useless, unresponsive, but customer imposed necessary evil which added little save problems to the program.

CHANGE

Interviewees were questioned extensively concerning the frequency of changes, change causality, and information flow concerning changes in two areas; task or technology changes and organizational changes.

In terms of technological changes, frequency was perceived as high by all respondents. Specific change causality was vague and uncertain with most respondents attributing the high level of changes to increased knowledge of specific task requirements.

Information flow patterns concerning technical changes were also vague. Interviewees stated that notification concerning technical changes came from formal program change mechanisms and informal friends or long-time company associates. When asked about specific changes, respondents became vague (or elusive), were unable to recall only formal change procedures.

Organizational change patterns were somewhat clearer. Most respondents claimed that most, if not all, major structural changes were the result of customer (organization "B" demands,(e.g. the separation of the Test Function from

engineering, the change in status and positioning of the Associate Program Managers). The partial internal reorganizational changes were infrequent, but significant. A large number of interviewees not specifically connected with the organizational change exhibited a lack of knowledge concerning the stated merits or specific reasons for the organizational changes or alignments. All, however, claimed that customer influence was the major factor in any change.

Overall, changes, then, were attributed to increased task definition and customer (organization "B") influence. Specific change causality information flow appeared to be low.

DECISION STRUCTURES

We asked several questions concerning decision making, decision coordination and conflict resolution.

Routine decisions are made by each applicable manager, but each manager appears careful to inform his supervisor about all but the most mundane decision. Important decisions are reserved for the Director or Vice-Presidential level.

Most decisions appear to be coordinated on an informal basis, using telephonic or face to face verbal transactions.

Decision conflicts tend to be resolved using a combination of face to face confrontation and functional compromise.

A typical interviewee response was: "I make my own decisions. My boss has outlined my areas of decision latitude and he expects me to manage within it. I, of course, keep him informed on all decisions of consequence.

I am expected to go to the applicable manager (at any level) in other task functions to coordinate decisions and resolve problems.

Should conflicts or problems arise, I try to resolve them at this level. We (the managers involved) get together and work it out on a give and take basis. If that doesn't work, I'll escalate the problem to his (the other managers') boss and then to my boss. I try not to escalate problems: that's what I'm paid for, to solve problems."

The interview data clearly shows that all functional units have a strong, functionally oriented hierarchical decision structure. Level 4 Managers do participate in decisions, but under well-defined or controlled circumstances. Among the major task functions, it appears that no major differences exist in these basic decision structures. All have approximately the same basic procedures and decision

latitudes. All use informal coordination methods which are later formalized or documented.

Managers in operations tend to suggest problem escalation more readily than other functions, but appear more prone to compromise or "work around" problem areas.

INTER-FUNCTIONAL TASK COORDINATION

We asked several questions about specific interface or intra-organizaitonal coordination procedures. Respondents indicated two general types of coordination; friendship or collegial relations and ad-hoc committees and lesson groups.

Respondents indicated that most coordination was accomplished as a result of long service in the company, a broad span of contracts in other task groups, and a high level of aerospace development "know-how" based upon experience. They indicated that they informally coordinated or exchanged information with "counterparts" in other functions in a setting of friendly compromise.

Major changes were coordinated through the use of ad-hoc, inter-functional liason groups that re-worked or replanned the task and task sequences and published new work plans.

Topdown coordination was also mentioned frequently. Many interviewees suggested that most important decisions were made and coordinated at the Presidential and

Vice-Presidential level or in executive meetings and little inter-functional coordination was required. When asked to amplify these remarks, interviewees named several executive level weekly status meetings as their example.

PERFORMANCE

Each interviewee was asked to rate the overall organization and its major functional parts in terms of efficiency, effectiveness and overall performance; (as compared to optimal and other aerospace firms) on a scale from 0-100, with 100 equal an optimal performance.

Most respondents declined to separate the three notions of effectiveness, efficiency, and overall performance. However, they verbalized the perception that efficiency or the efficient use of program resources was somewhat lower than their stated "grade" for performance/effectiveness.

The division president suggested that all major functions were "above 70, but below 100" and declined to assign specific functional rankings.

Some respondents declined to rate some specific functions due to a lack of knowledge concerning the function's performance. This was especially true for the Test Function where 45 of the 57 interviewees

declined to evaluate performance; reasoning that test was a new function which showed good potential but had "no" track record.

Aggregate results of the ratings and number of respondents rating each are:

Company Overall Performance - 81% (N=53)

Production Operation Performance - 85% (N=12)

Business Performance - 77% (N=43)

Engineering Performance - 76% (N=48)

Program Management Performance - 74% (N=37)

These data will later be compared to the questionnaire data which asks a similar question.

An unexpected dividend that we received from the question concerning performance was a respondent articulation of the reasoning behind each ranking.

From these articulations, we found the following perceptions prevalent.

1. The Test Function has excellent potential, but no performance to date.

2. The Business Management Function is held in low esteem by members of the Engineering and Operations Functions. Business is perceived as unresponsive to functional needs and unnecessary for program success.

3. The Associate Program Managers are perceived as generally ineffective due to work load requirements. Their primary contribution is perceived as that of mediator of inter-functional task disputes or problems. They are not perceived as managers, coordinators, or integration devices.

4. Engineering is perceived as a marginally effective "prima-donna" that is extremely inefficient in the use of program resources and the central factor in low performance by other functions.

SUMMARY

In summary, the interview data suggests that "V" is a functionally organized division with strong inter-functional boundaries. Little structural differentiation exists between the functions with all being somewhat classically oriented structures.

Decisions are made at high levels or with specific approval of high level managers.

Conflicts are resolved by a face-to-face compromise or by rapid escalation to higher management levels for the same face-to-face style compromise.

Coordination appears informal and few operational coordinating devices other than the classical "information up decisions down" schema appears prevalent.

Organizational structures are perceived as satisfactory to the environment. If not, the environment is perceived as exerting demands to change them.

The "B" organization is perceived as the single most important environmental force for the "V" organization. It appears powerful, but somewhat inconsistent or arbitrary.

"V" QUESTIONNAIRE DATA

The following is a summary and analysis of the Questionnaire administered to the key decision makers of the "V" Organization. Response rates and Questionnaire origin were discussed previously in Chapter 3. It is of note that all questions used in this questionnaire are direct copies or slight modifications of questions used by Lawrence, Lorsch, or other contingency theorists; or suggested by the Communications Patterns Work, Pelz, Andrews,and others.

The concepts and measures which their questions suggest were transferred to the environment of this research.

GOAL ORIENTATION

IQQ I was suggested by one of the basic tenets of the open systems approach to organizations. Numerous researchers have shown that the organization is in a state of dynamic interaction with its relevant environment. Further, it has been shown that the ability to interpret and adapt or react correctly to environmental demands is a necessary ingredient in hte organization's succes achievement formula.

This question measures the organization's orientation toward (and relative importance of) the principal success measurement criterion suggested by environmental literature and utterances concerning the program. It further measures organization "V's" perceptions of these criteria in measuring success.

We operationalized an environmental measure suggested by contingency theorists, and used it to quantify goal orientation in a manner identical to that used in the Environmental Questionnaire.

EXPECTATIONS

Based upon our review of some of the pertinent program documents, and some of the articles appearing in leading trade journals, we expected to find that the

GOAL ORIENTATION

SUCCESS MEASURE CRITERION
(SELF)

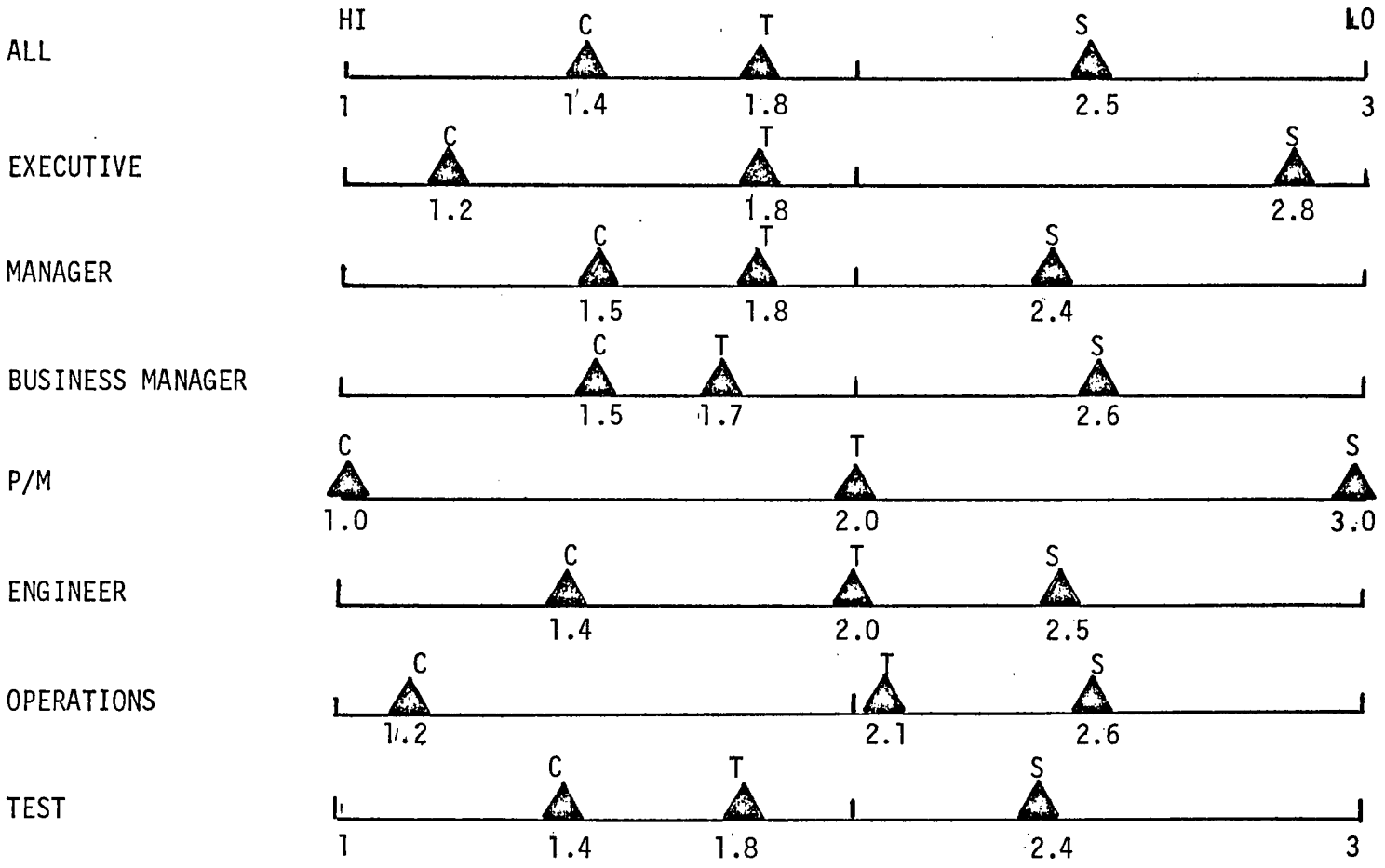

Figure 10

GOAL ORIENTATION
(PERCEIVED CUSTOMER CRITERION)

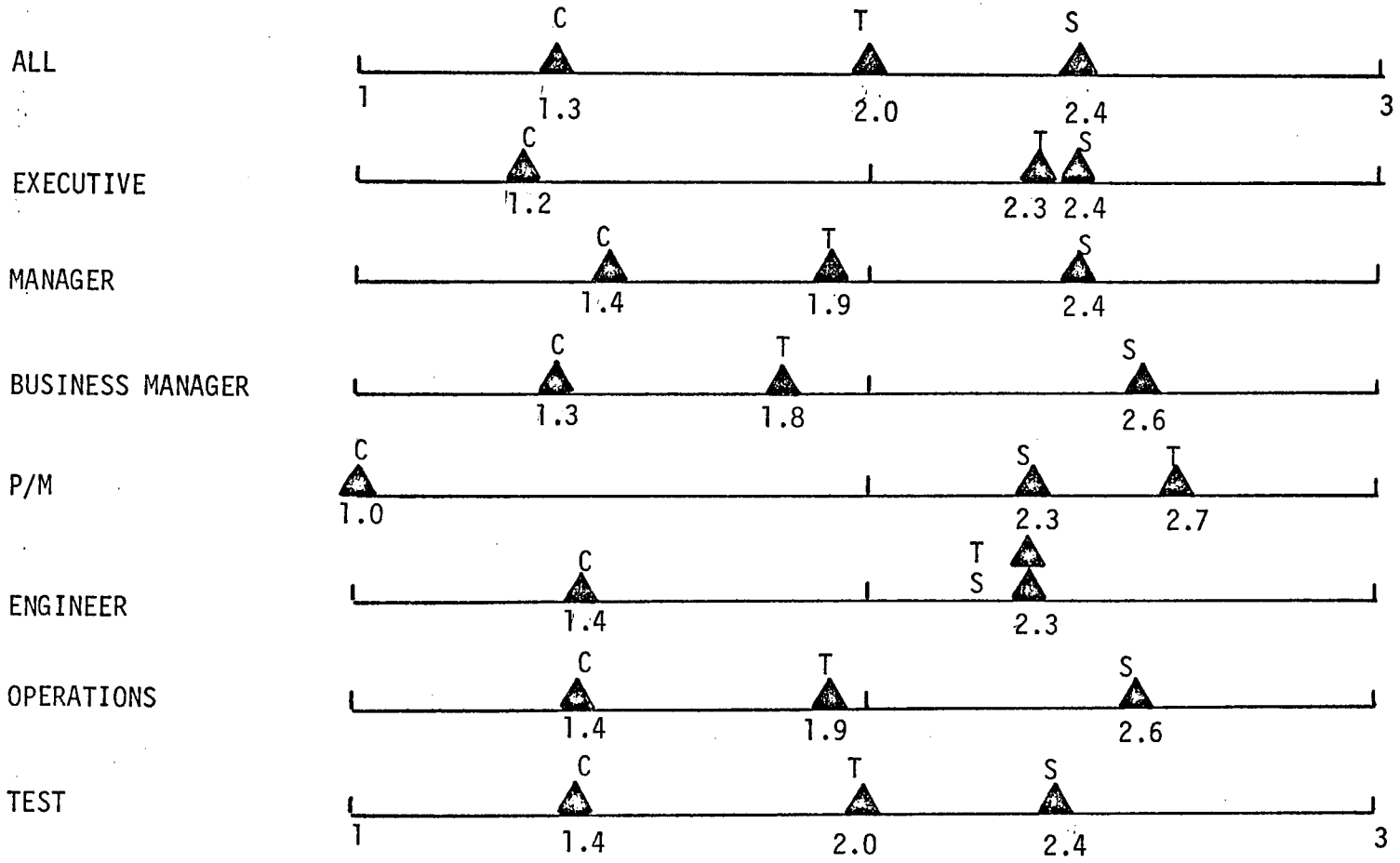

Figure 11

vendor "V's" organization would interpret the environmental criterion signals as (1) Cost, (2) Technical, and (3) Schedule Performance.

Our conversations with members of the buyer's organization, and a preliminary analysis of some of the buyer organization's perceptions of vendor "V's" activities, lead us to expect the vendor's organization to rank success criterion as (1) Technical, (2) Costs, and (3) Schedule Performance.

RESULTS

The results appear quite clear. The vendor "V" perceives that the ordering of program goals, by the environment, is (1) Cost, (2) Technical Achievement, and (3) Schedule Performance. Some scales positional differences occur which may be the result of perceived relative emphasis, but these are overshadowed by the regularities in ordering.

The two differences which are of significance are (1) the reversals of Technical Achievement and Schedule by the Operations Group, and (2) the reversal of Costs and Technical Achievement by the Test Function.

The rationale for the operations reversal is relatively simple. Operations managers are increasingly concerned with time and schedule performance due to actual, perceived or potential work flow delays, which occur or may occur "upstream" in the overall work flow.

Similarly, the test function tends to be concerned with technology because this area tends to control or channel much of the testing technique or effects.

We must emphasize, that, although the rankings provide a distinguishable pattern, the values attached to each of the criterion should not go unnoticed. The values are an indicator of opinion diversity within vendor "V's" organization. Not all respondents subscribed to the (1) Cost, (2) Technical, and (3) Structures, pattern. Instead, some respondents placed cost in a secondary position, and a few placed it third. The same is true for the positioning of the Technical and Schedule Performance criterion.

Figure 10 depicts the mean results of part b, of question 1. Again the patterns of Cost, Technology, Schedules appear predominant. However, several other interesting perceptions also surface.

First, all executives and all engineering respondents indicate that their perception of signals indicates that there is no significant difference between technical and schedule performance as a secondary measuring criterion.

Secondly, the Program Managers perceive Schedule performances as second to Cost performance as environmental criterion.

Both the scale positions and the differences in scale positions suggest that "V" managers are receiving mixed signals from the environment.

Interview data supports this suggestion of opinion/performance criterion diversity. During the structured interviews, interviewees, at most levels, and in all major functions suggested patterns other than that of CTS. Technical achievement and schedule realization, as well as cost performance were offered as most important success measurement criterion for the program.

FUNCTIONAL CRITICALITY/TASK ORIENTATION

IQQ II sought to ascertain the general orientation of organization "V".

The question, an adaptation of an approach used by Lawrence, Lorsch, and their associates in this contingency model development, measures the organizational perceptions of functional criticality, as it pertains to the organization's success in accomplishing the program.

Each of the organization's functional units has a relatively clear area of task responsibilities and constraints which pertain to the program. These are spelled out both contractually and in "V's" standard operating manuals, and appear to be well understood by managers.

The question which we used for this measurement was IQQ II in Appendix A-4.

FUNCTIONAL CRITICALITY
(ENVIRONMENTAL ORIENTATION)

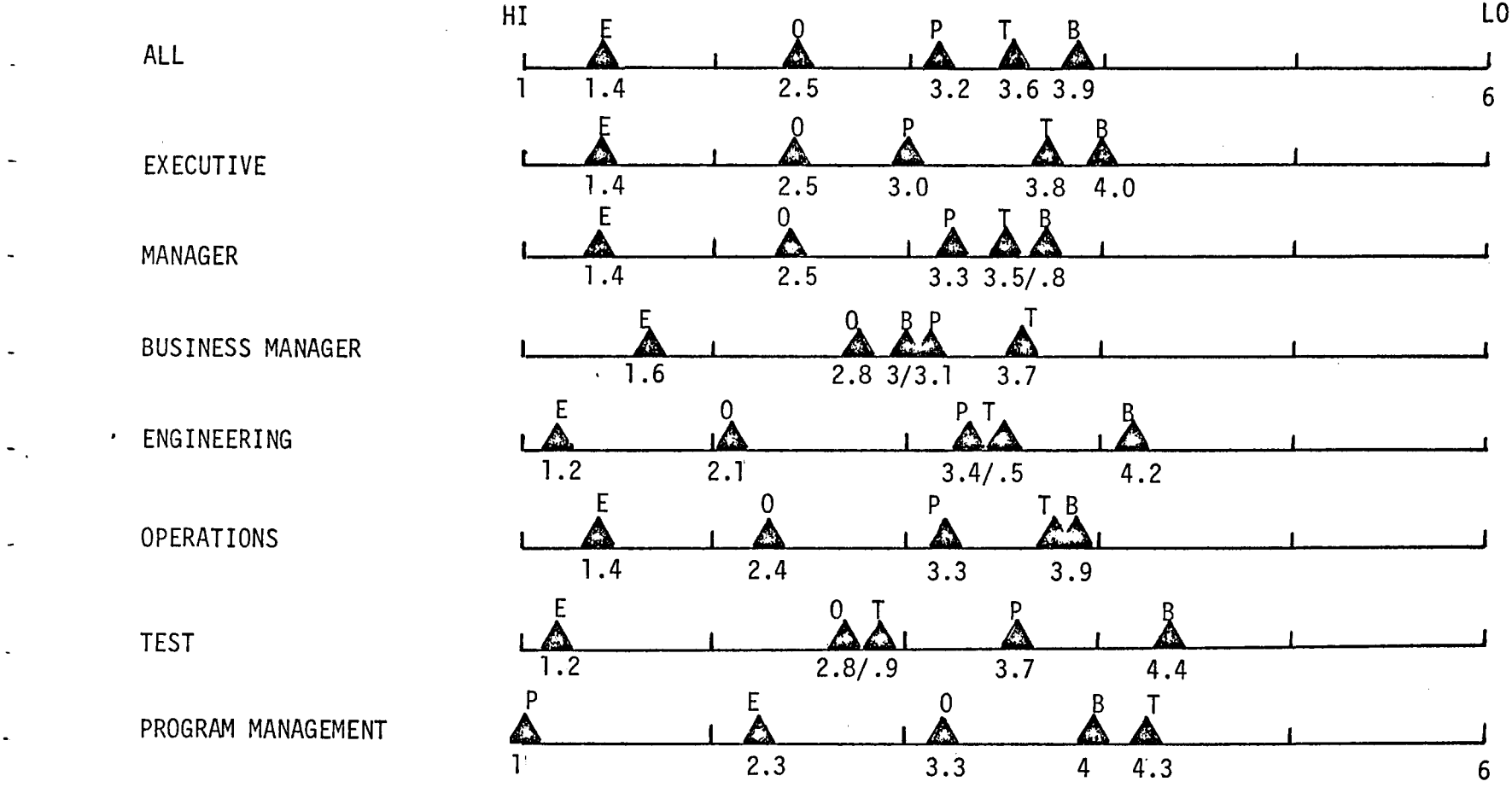

Figure 12

RESULTS

Results, when corrected for functional bias, tend to suggest a fairly uniform perception of the relative criticality of the task functions to program success.

Engineering is significantly more important than all others, with Operations a distant, but distinct, second. Business Management is clearly of least criticality.

This would tend to suggest, as expected, a functional organization, strongly oriented toward the principal line functions (engineering and operations), as opposed to the staff, control, support, or integration functions.

The positioning of Program Management as third suggests that an awareness exists for overall program integration, but this appears ancillary to the main success efforts.

Test, as fourth in importance, suggests an "after the fact" perception of the function. Test may be perceived as a staff agency which makes a contribution to the effort only after the product is designed and built, and thus having little goal achievement impact.

This possible interpretation is somewhat troublesome, in that it appears to contradict some customer/environmental emphasis. The Test Function was created as a

separate entity, partly due to customer suggestions that a separate testing entity would add considerable credibility to vendor testing.

The positioning of Business Management, in last position, appears indicative of the strong functional orientation of the vendor's organization. Some of the tasks of the Business Management Function are to provide management visibility data and support in financial and contractual areas. Interview data tends to suggest that Business Management is held in low esteem and perceived as an unnecessary service. A significant number of line managers (Engineering, Operations, Tests) indicated that the Business Management services were of little value, and that similar, more appropriate and timely services were provided by the business management services within their function.

This Perception may be due to the functional bias of the organization, the technical nature of the program, or the performance of the Business Function.

EXTERNAL CONTACTS

We also measured orientation in terms of external transactions. We reasoned that the degree of external contacts would furnish us with another measure of the relative importance of environmental elements and simultaneously provide data concerning the overall importance of the external environment.

We asked two direct questions:

1. What percent of your total work time is spent in program related contacts with outside agencies which have a direct interest in the program?

_____percent.

2. If 100% represented the total time spent in these contacts, how would it be distributed?

_____% Customer's Representatives

_____% Other Vendors to You

_____% Other Parts of the Corporation

_____% Other Major Suppliers to Program

_____% Others

TABLE VI

EXTERNAL CONTACTS

Group	Contact Percent	"B"	Direct Suppliers	Other Suppliers	Other Parts of the Corporation
Company (All)	16	48%	22%	9%	22%
EXECS	21	53	21	12	13
Managers	16	46	21	8	26
Bus. Mgt.	10	40	2	6	45
Prog. Mgt.	22	59	25	21	2
Engr.	21	47	26	12	14
Opns.	17	36	36	4	21
Test	15	76	16	6	2

EXTERNAL CONTACTS

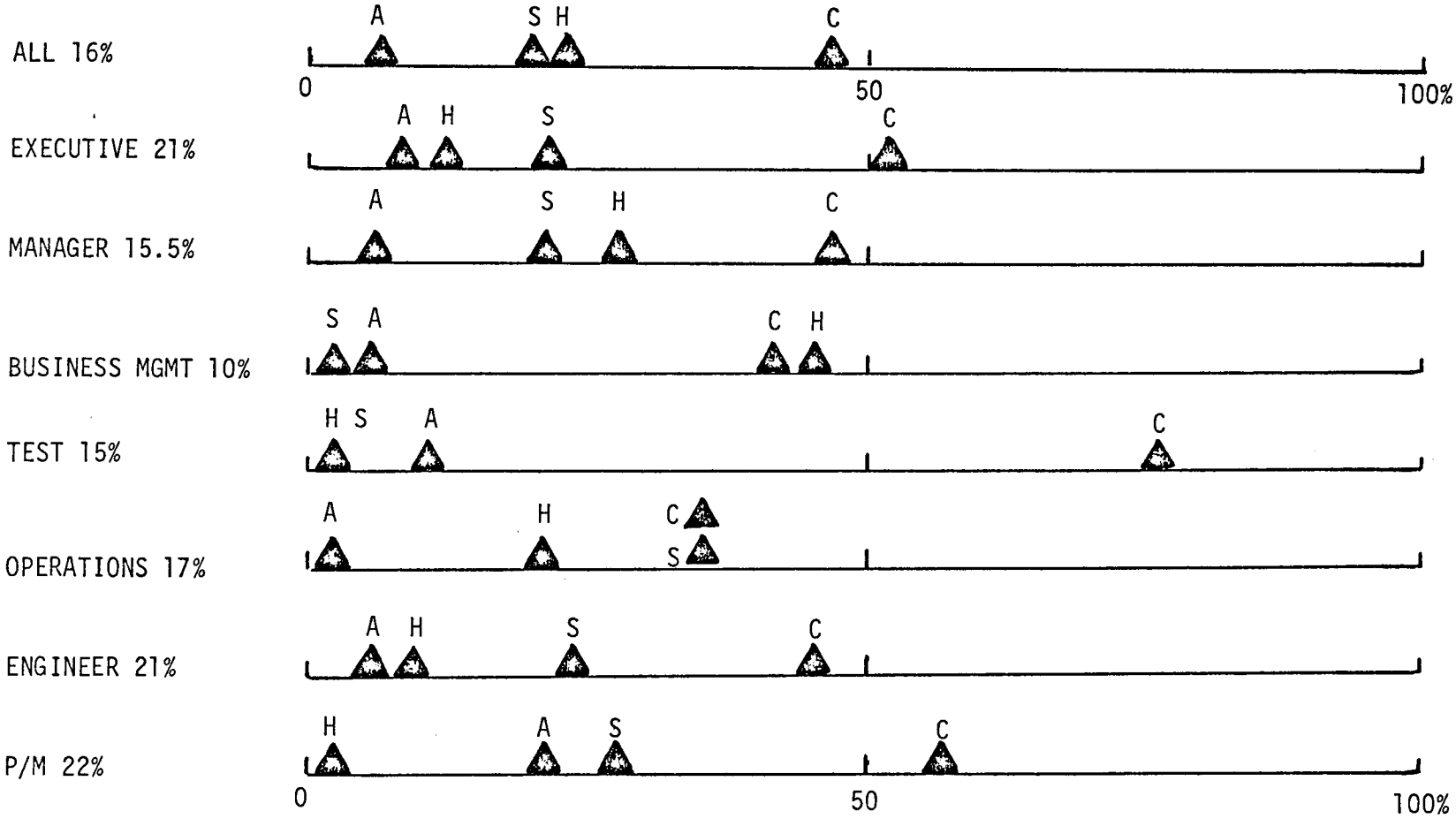

Figure 13

RESULTS

These data suggest that the external environment is, indeed, a significant factor in Division "V's" operations.

The relative positioning of contacts suggests that the Customer ("B") is of most significance and accounts for a majority of extra-organizational contacts.

The data also suggests a low level of contact with organizations supplying other major portions of the project.

Another point of interest is the fluctuation of Corporate contacts and supplier contacts. This suggests that the Business Function is oriented toward corporate financial contacts and that the operations function, finding manufacturing schedules supremely critical, is strongly oriented toward insuring that supply sources perform adequately.

COMMUNICATIONS PATTERNS

Another dimension which we measured was that of communications patterns. (IQQ Question VI and VII)

We asked each respondent to indicate the frequency and content of task related conversations with members of his function, other functional units and external contracts.

These patterns are depicted in the enclosed table in the following manner:

1. The subject most frequently discussed between each organizational pair is listed first.

2. Other subjects, if discussed with significant frequency (mean greater than or once each month) also appear in the order of their importance/frequency.

3. Internal communications patterns are indicated by the intersection of like functional names.

4. The company summary indicates a summation of the communications subjects.

To assist the reader in interpreting the chart, the following example is provided. Communications Patterns data from the Business Management Function indicates:

1. Internal communications deal with Costs first, followed by Schedules and Technical matters.

TABLE VII

PRINCIPAL COMMUNICATIONS SUBJECTS

TO \ FROM	BUS MGMT	PGRM MGMT	ENGR	OPS	TEST	COMPANY SUMMARY
BUS MGMT	C(ST)	S (CT)	C (ST)	S (CT)	S (TC)	C (ST)
PGRM	C	S (TC)	CS (T)	S (TC)	S (CT)	SCT
ENGR	C	T (SC)	T (SC)	S (TC)	T (SC)	TSC
OPS	C	S (TC)	S (TC)	S (TC)	T (SC)	STC
TEST	C	S (TC)	T (SC)	S (TC)	T (SC)	TSC
CORP	C	S (TC)	S (TC)	T (SC)	T (SC)	TSC
CUST CENT	C(CMS)	T (SC)	T (SC)	T (SC)	T (SC)	TSC
CUST SATELLITE	C(CMS)	T (SC)	T (SC)	T (SC)	S (TC)	TSC
SUPPLIERS	CM	T (SC)	T (SC)	S (TC)	S (TC)	TSC

C = COSTS S = SCHED T = TECH MATTERS CM = CONTRACTUAL MATTERS

2. The principal subject of Communications from Business Management to other functions in that of Costs.

3. Contractual matters and Schedules are also discussed with the Vendor and Cotnractual matters are the subject of frequent conversations with external suppliers.

4. A summary of all communications patterns indicates that Costs are the predominant subject of conversation with Busienss Management, but some Technical and Schedule matters are discussed.

Analysis of the Communications patterns suggests that a full range of task related subjects are discussed on an intra-functional basis, with each function emphasizing conversations along lines of predominate functional or task concerns.

External Communications, however, tend to be technical in nature, rather than balanced. This could lead the outside observer to conclude that technology was the prime concern of the organization.

ENVIRONMENTAL STABILITY

We measured perceived environmental stability, change anticipation, frequency of change, and percentage of unanticipated circumstances, using IQQ III.

This approach was suggested by a line of reasoning which begins in some of the oral questions used by Contingency Theorists. We extended the line slightly beyond their measure of Task Certainty and redesignated it Environmental Stability. The results show that the functions all perceive that a high degree of unanticipated circumstances arise that could affect task performance.

Results show (on a 1-7 scale with 1 = rarely, 7 = frequently):

1.	Program Management	5.83
2.	Operations	5.05
3.	Engineering	5.04
4.	Test	4.56
5.	Business	4.39

Asked to quantify this further in terms of time, a major task change which resulted (Part C):

1.	Program Management	2.0 (monthly)
2.	Operations	2.3 (monthly plus)
3.	Engineering	2.5 (6 weeks)
4.	Business	3.0 (quarterly)
5.	Test	3.5 (4½ months)

TASK CERTAINTY

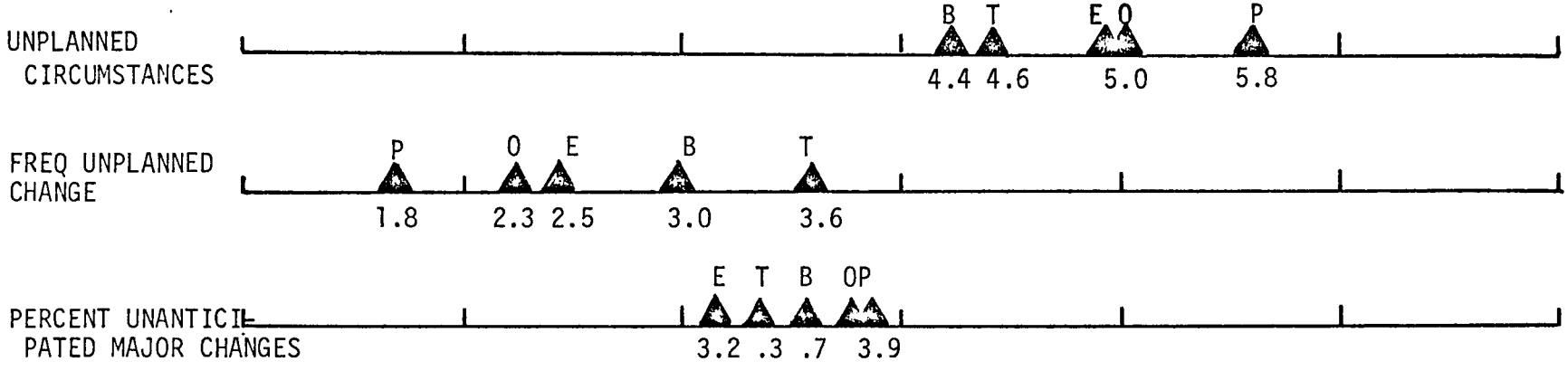

Figure 14

Adding this to Part D concerning the percentage of changes which were anticipated, we find:

Function	% Changes Unanticipated
Program Mgt.	39%
Operations	38.9%
Engineering	32.1%
Test	32.9%
Business	36.7%

Combining these perceptions, we find a very unstable task environment, which according to Burns and Stalker demands an "Organic/participative structure for task success". Previously discussed results suggest that such is not the case in "V". Instead, "V" appears to have a strong functionally organized structure which some, such as Burns and Stalker, suggest is not change oriented.

PROGRAM CONSTRAINTS

Our next measure was that of constraint criticality. We reasoned that the principal constraining resource would also be that resource which received the greatest management attention. Logically, it would also be of dominant concern to the unit or organization.

Our question (IQQ V) was a minor modification of an earlier question suggested by Lawrence and Lorsch.

RESOURCE CONSTRAINTS

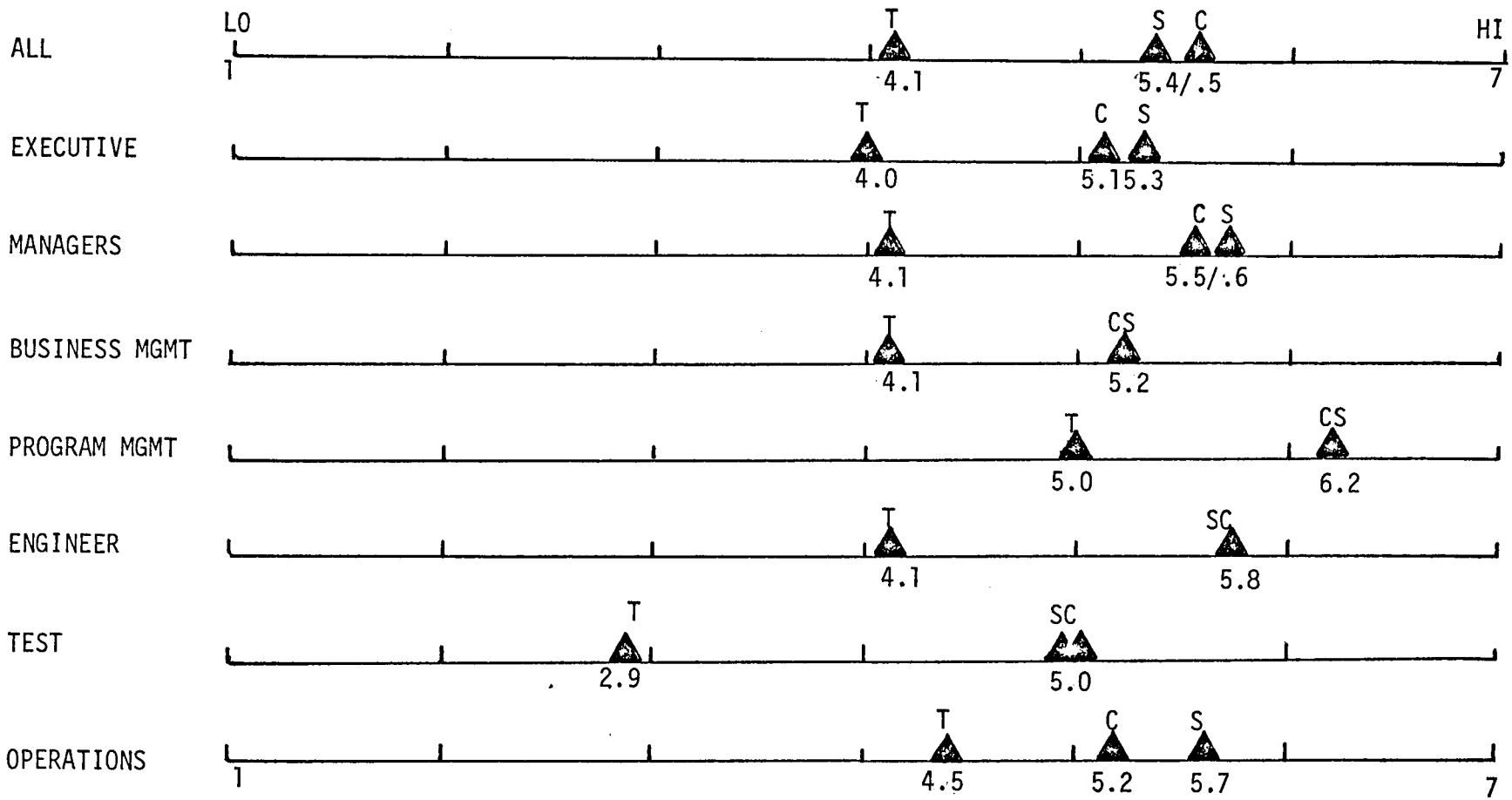

Figure 15

RESULTS

Perceptions concerning resource constraints followed a very regular pattern through all divisions of the data. Time is perceived as the most critical resource. Economics is perceived as next critical, and closely associated with the time constraint. Technology is third and significantly less than the economic and time constraints.

These data suggest that the technical aspects of the program are perceived as being within the state of the technical art and that sufficient technical capabilities are present within all company functions to achieve the required or desired technical performance.

Time and economic considerations present a different picture. First, the data suggests that both these constraints enjoy a relatively high level of criticality. This further suggests that time and money management, i.e., overall task sequencing, contingency planning, financial analysis and financial planning are critical aspects of the overall company and bear heavily upon program success.

Another interesting data point is the apparent perception of interchangeability of economic and time resources. This would tend to suggest that workload (perceived as moderately high by most functional respondents) or level of effort was a key issue in program goal realization. Either more time

or more money would thus significantly reduce the possibilities of marginal program performance and increase the probability of program success.

This interpretation is consistent with interview data. The interviewees were asked, "Which organization (function) has the most difficult or demanding job?" and "If we were somehow able to 'magically' provide more of a single resource to that function, just once, which resource would they want most?".

Answers varied somewhat due to the different perceptions of the individual interviewees, but one answer emerged as the central response. That answer was MONEY/TIME. Typical answers were:

1. "Manufacturing has the most difficult job. It has to build that 'thing', and correct the engineering mistakes as it builds. Schedules have slipped, but delivery dates have not. Given one dip into that magic 'trough', manufacturing would select more time - time to do a better job."

2. 'Engineering has the most difficult job. They have to invest and design the 'thing'. Many of these tasks must follow a distinct sequence and cannot be run in parallel. Engineering would select time or money to buy time with."

3. "Costs are the name of the game. We must control costs or we shall fail. Given your magic box, the President of the company would select more money."

4. "All of the jobs are hard because of financial constraints. This has limited everyone, but especially (us). I am sure that more money would make everyone's job a lot easier."

These data are not, however, immediately consistent with the data concerning funcitonal criticality to program success. Few interviewees or questionnaire respondents selected Business Management (financial planning, analysis, and contractual matters) or Program Management (overall program management, task sequency change arbitration) as highly critical task success functions. This would tend to suggest that these functions are perceived as performing somewhat different roles than their charters suggest.

AUTONOMY AND INTERDEPENDENCE

The next dimension of the sellers organization to be measured was that of perceived autonomy, functional interdependence and degree of task integration or coordinated efforts. (IQQ IVa, VIII, and IX)

The general line of reasoning for this measure was inspired by the earlier mentioned contingency model of Lawrence, Lorsch, and their associates (ibid, P. 248). Herein, the researchers equated the quality of harmonious relationships between organizational functions to the state of integration or coordinated efforts within the organization.

We could not refute this argument. However, in the intra-company, inter-functional case, the question seemed to relate to much more than integration of efforts. It appeared related to task required interdependence and functional autonomy. Given that little or no task related interdependence exists, then the quality of the inter-functional relationship would have little bearing upon the overall task success. However, given a high level of task interdependence as well as a high level of perceived autonomy, as in the case in Vendor "v's" organization, then interrelationships have a direct impact upon the final outcome.

We felt that a modification of this approach would be more applicable to our study. We saw that autonomy, task interdependence, and problem/success influence as factors which influenced task coordination and effort integration.

We measured these dimensions in the questionnaire and to some extent, in the interviews. We expected to find some direct relationships between the level of perceived autonomy, level of perceived direct inter-functional interdependence, and problem success influence.

For example, we expected to find a functional unit which was low on perceived autonomy to be relatively high in perceived direct task interdependence and high in perceived influence of others over the problems of his unit.

A logical extension would then lead us to conclude that a high level of interdependence would inspire a high quality of functional interrelationships.

We first measured autonomy, direct interdependence and problem influence using IQQ Questions VIII and IX.

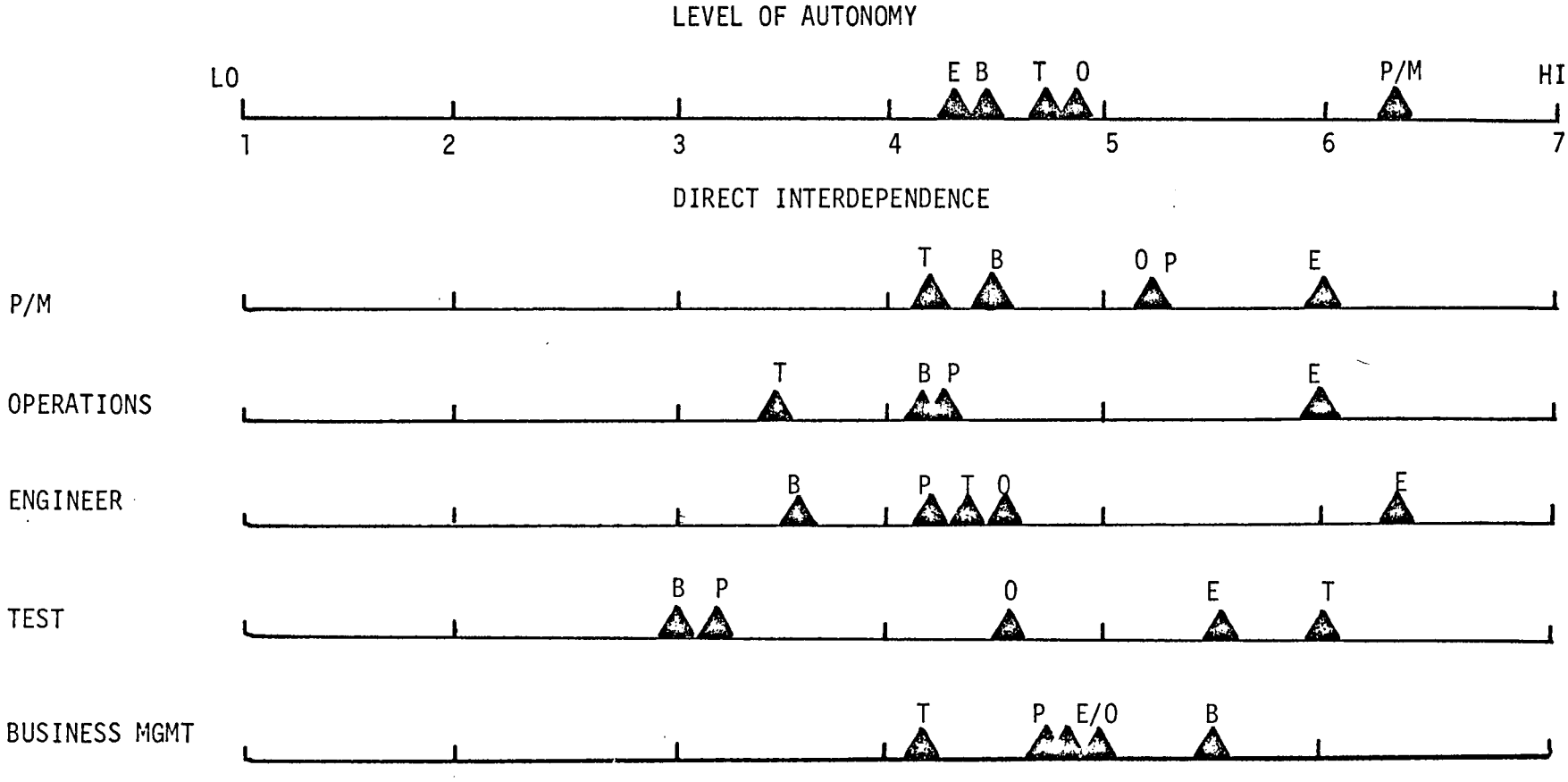
LEVEL OF AUTONOMY
LO
E B T O
P/M
HI
1
2
3
4
5
6
7
DIRECT INTERDEPENDENCE
P/M
T B O P E
OPERATIONS
T B P E
ENGINEER
B P T O E
TEST
B P O E T
BUSINESS MGMT
T P E/O B

Figure 16

PROBLEM INFLUENCE

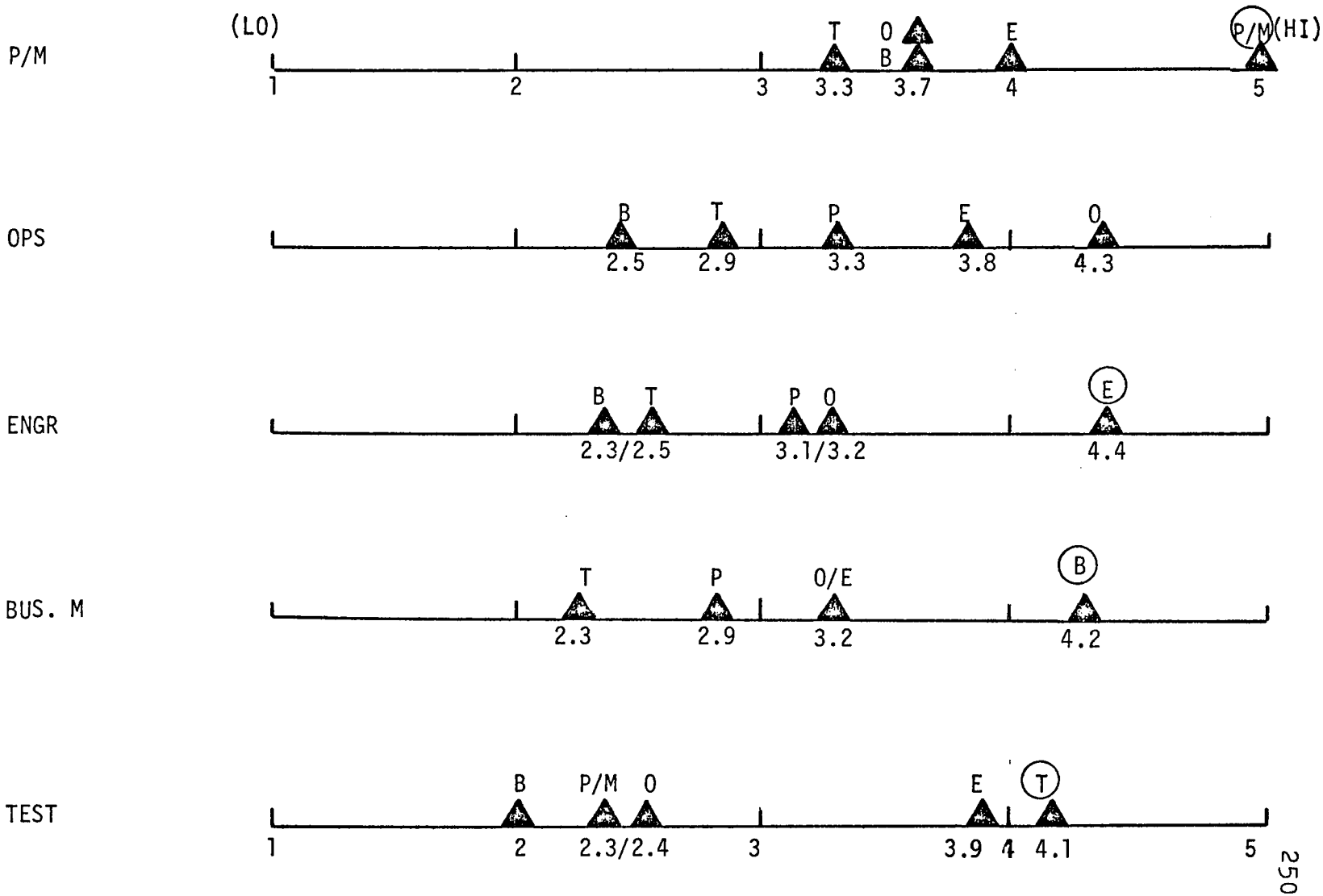

Figure 17

RESULTS

The results of the Level of Autonomy, Problem Influence and Direct Interdependence questions are most interesting.

There is a clear indication that perceived autonomy is high in each function. This is demonstrated by the high autonomy scores (average 4.7 on a 1-7 scale) and by the fact that each function perceives that the function itself has the highest influence in the solution of its own problems, and is more intra-dependent that interdependent for task success.

The obvious conclusion here is that there are strong functional boundaries between each function and that integration requirements will be difficult to achieve.

Simultaneously, however, the data suggests that the functions perceive that integration of efforts is required for success. In all cases, the level of direct interdependence is greater than 4 on the 1-7 scale. This suggests that the requirements for overall and interfunctional integration will be relatively high. This seems logical in terms of the developmental nature of the program.

A third data point which reinforces the data obtained from Question II suggests that interdependence is perceived as related to Functional task criticality.

TASK COORDINATION/INTEGRATION

A logical nexus was the measure of the actual level of integration within organization "V".

Lawrence and Lorsch, (ibid., P. 259) argue, that the degree or state of integration between two units could be measured through the use of a question measuring harmonious relationships.

We could not refute the logic of this argument. However, in the intra-company case, we saw logic in the argument that harmonious relations were also related to mutual interdependence and competition for resources. Given that a low level of interdependence and resource competition exists, then harmonious relations would have little bearing on integrated efforts or program success. Given that the reverse is true, then there would be significant impact.

We intended to develop a full matrix of perceived relationships, but were limited by Organization "V" desires and beliefs concerning inter-company knowledge levels. We thus used the modification of the Lawrence and Lorsch measure of Integration listed as Question IV, Part a, of the IQQ.

FUNCTIONAL INTERRELATIONSHIPS
(DEGREE OF INTEGRATED EFFORTS)

	P/M	R/E	O	T	B
P/M	2.00	3.83	2.66	2.50	2.00
R/E	2.82	2.26	3.00	2.72	3.70
O	2.50	2.67	2.34	3.10	3.40
T	2.30	2.53	2.58	2.00	2.67
B	2.86	3.13	3.02	3.12	2.70

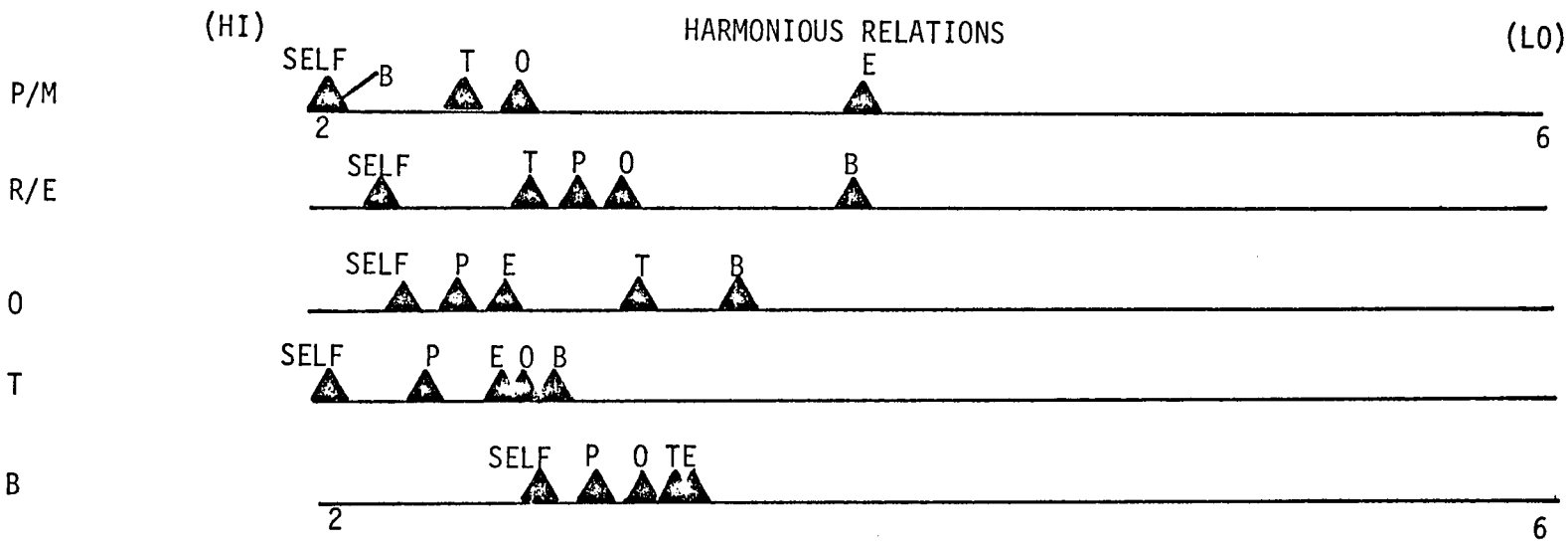

Figure 18

RESULTS

The data suggests several interesting points. First, if we adopt the criterion suggested by Lawrence and Lorsch which indicates that a harmonious relations level greater than 2.6 may be equated to insufficient task integration within the firm, (bid, P. 248), then we must conclude that there is general disharmony and a lack of integrated efforts within the division.

We must partially reject this interpretation. Interview data suggests that the state of integrated efforts is below that which seems required for program success, but we are able to categorically state that interfunctional relations are not in a state of collapse.

Interview data and a study of corporate documents was very helpful in determining the level or state of integration within the organization and among the functions.

Both the organizational procedures and task manuals and interviewee responses suggest that there is no company wide integration mechanisms. Instead, there are intra-functional integration efforts which lack program or organization wide frame of reference. For example, the Engineering function, perceiving the need for integrated results has both a program or Project Management sub-function and a Business Management sub-function. These organizations perform many of the same tasks

intra-functionally that similar functions are responsible for on a company wide basis.

Similarly, in Operations, there exists a Business Management related function and a Program Integration related function.

Neither of these organizations have strong relationships with the company wide functions of similar task responsibilities.

We thus must interpret this data as suggesting that integration efforts are below requirements for optimal program achievement; below the requirements elucidated in organizational documents; and below those required by the environment for program success.

Comparison of the mean scales suggests high levels of internal harmony within Program Management and the Test Function, a lesser level in the Engineering and Operations functions, and a significantly lower level in the Business Function. These findings were supported by interview data. Interviewees, both inside and outside of the functions, perceived three levels of internal relationship quality. Test and Program Managers were perceived as internally harmonious; Operations and Engineering as "average", and Business Management as internally inconsistent.

Another interesting data point surfaces when the responses concerning functional interdependence are compared to those on inter-relationships. These data suggest that harmonious relations (level of integration) vary inversely with perceived interdependence.

One exception, however persists; that is the law ranking of the Business Function. Interview data suggests that the Business Function is held in low esteem for both performance and functional reasons.

EXTERNAL INFLUENCE

Another question which we asked concerned the level of influence that various external groups had upon the performance of the organization.

Open systems concepts recognize that the organization and its sub-parts are in a state of constant dynamic interaction with elements of its relevant environment. The organization both influences and is influenced by these interactive transactions.

We selected two environmental forces which logically combine with the one which we investigated (Buyer "B") to form a major portion of "V's" relevant environment; suppliers inputs and receives outputs. We then asked two questions which were identical to those concerning interfunctional interdependence and integration. These questions were Part b of Question IV and items 6, 12, 13, and 14 of Question IX.

TABLE VIII

ENVIRONMENTAL INFLUENCE

	CENTRAL (C)	SATELLITE (S)	SUPPLIERS (X)	CORPORATE (H)
ALL	2.9	2.9	2.3	2.2
EXEC	3.3	3.2	2.3	2.2
MGRS.	2.8	2.8	2.3	2.2
P/M	3.7	3.3	3.0	3.3
BM	3.3	2.7	1.2	3.3
OPNS.	2.7	2.5	2.8	2.0
ENGR.	3.5	3.2	2.5	1.7
TEST	3.1	2.9	2.0	1.7

SCALE: 1 = little influence

5 = a very great deal of influence

EXTERNAL ENVIRONMENTAL INFLUENCE

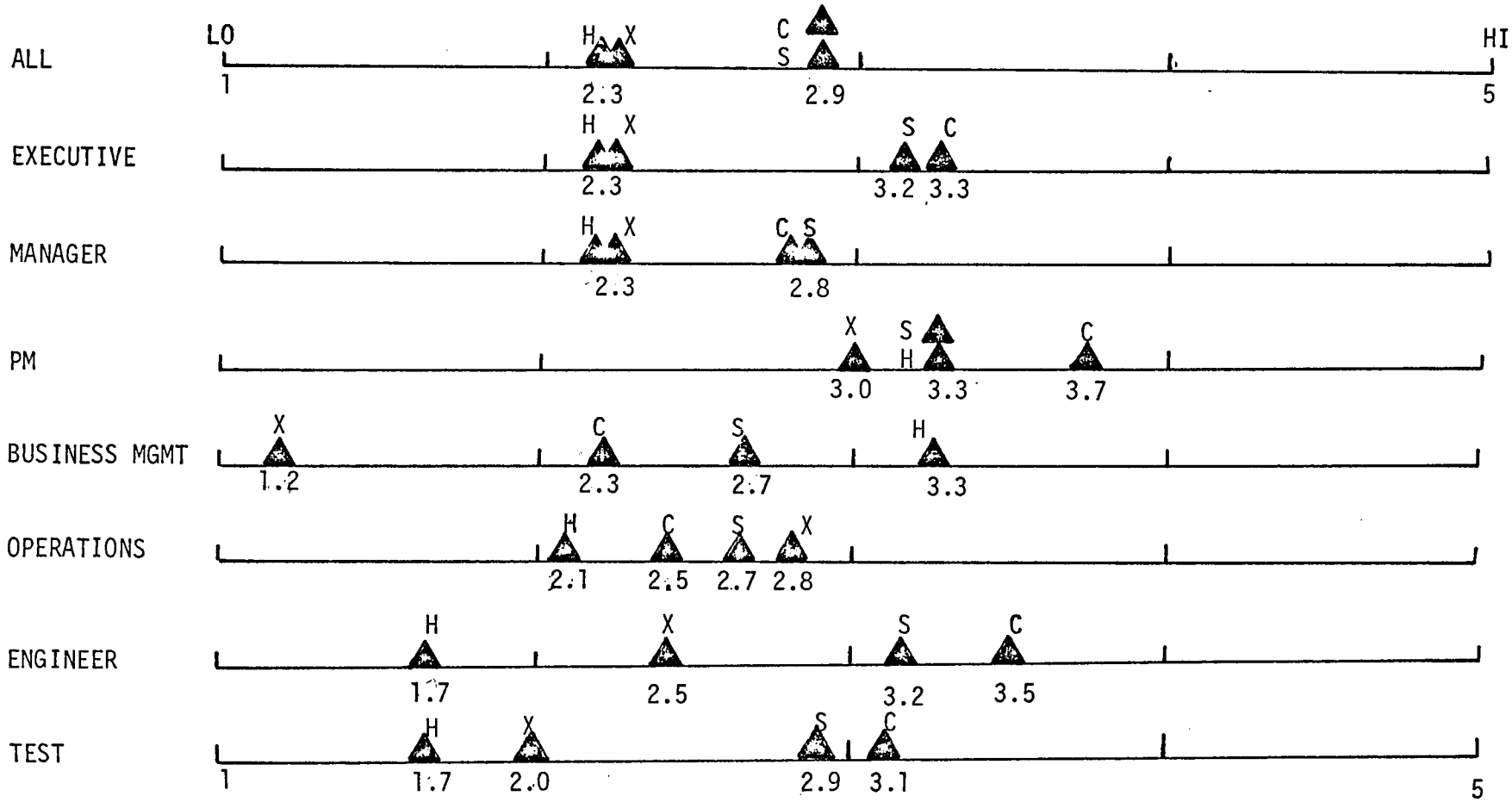

Figure 19

TABLE IX

EXTERNAL RELATIONSHIPS

	CUST CENTRAL	CUST SATELLITE	SUPPLIERS	CORPORATE
ALL	2.7	2.5	3.6	2.8
EXEC	2.7	2.7	3.1	2.8
MANAGERS	2.7	2.4	3.8	2.8
P/M	2.5	2.7	2.7	2.5
BUS. MGMT.	2.4	2.4	4.3	2.9
OPNS	2.4	2.1	3.5	2.5
ENGR	2.9	2.9	3.3	3.1
TEST	2.0	2.0	3.9	2.4

EXTERNAL RELATIONSHIPS

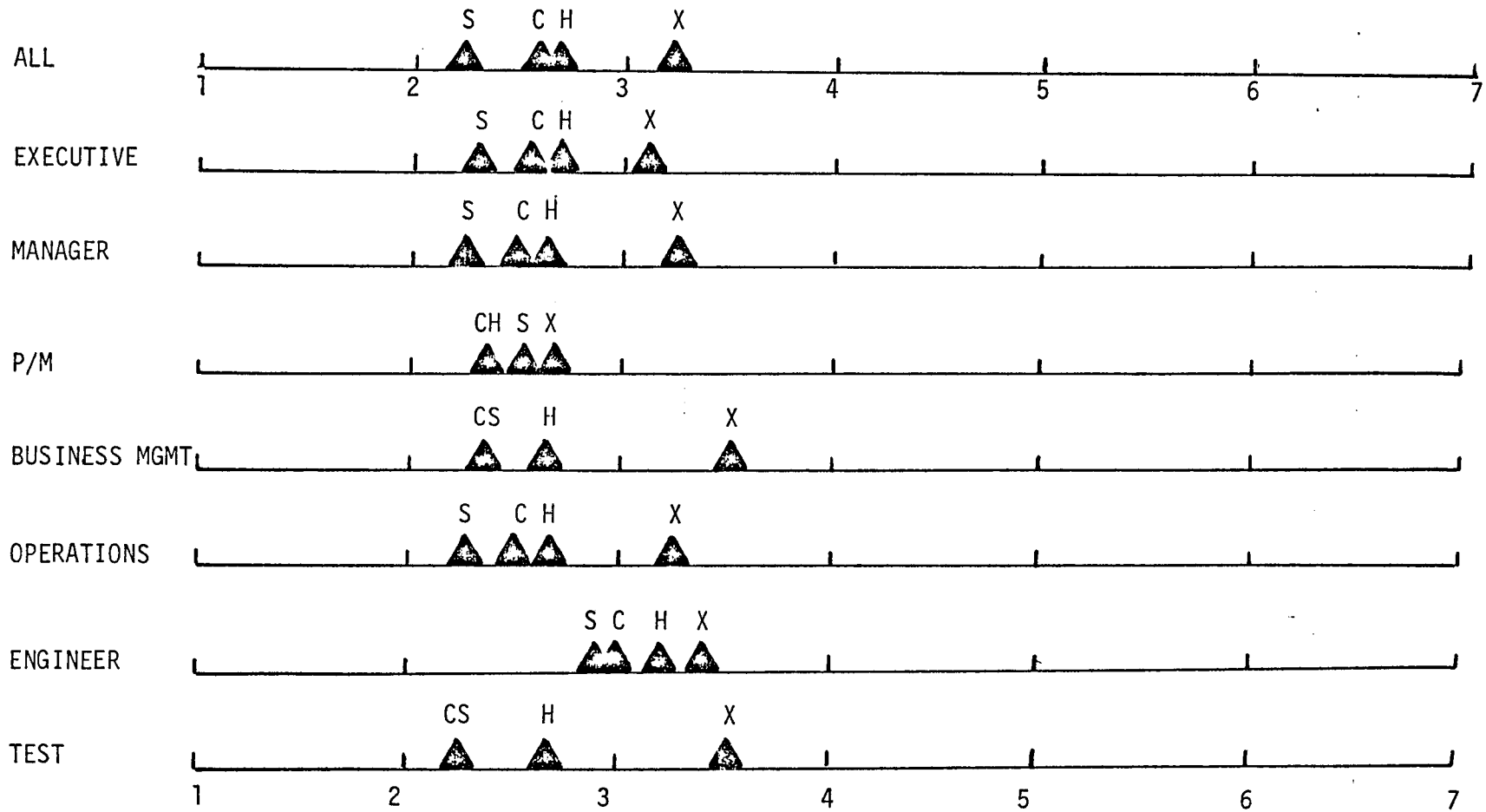

Figure 20

RESULTS

Our findings were as depicted upon the included charts and tables. Major suppliers were perceived as having a somewhat low level of task success influence. This may indicate a very high level of perceived technical competence by the company and/or the presence in the market place of numerous alternate sources of supply. Corporate and Group Headquarters were also ranked low (essentially in the same place with outside vendors and suppliers). This suggests that the company is oriented toward the customer as a chief source of environmental influence. This is, or course, a principal contention of this study.

It is interesting to note that among the line functions, corporate influence was consistently rated lowest of all.

The rating of corporate influence as highest by the Business Function is indicative of the financial frame of reference of that organizational unit. Similarly, the rating of suppliers as highest in influence by operations suggests again the perceived schedule criticality orientation of that function.

Degree of harmonious relations are also interesting. Most respondents indicated that there was a higher level

of harmony between themselves (individually and as a function) with the customer, than with other environmental groups. This is another indicator of the perception of high customer influence (especially in the cases of Operations and Business Management).

The pattern here is much clearer than that concerning Internal Coordination and Interdependence.

Corporate documents and operating manuals are relatively clear concerning external contacts and integration of external - internal efforts, and interviewees demonstrated a higher level of certainty concerning external contacts and external operations.

Imposing the Lawrence and Lorsch 2.6 criterion on the integration results would suggest that the functions tend to be satisfactorily integrated with the "B" segment of the environment in all but the Engineering Function. This same schema suggests a lower integration of efforts with corporate groups and suppliers. Interview data tended to support this interpretation somewhat.

Data suggest that integrations is directly related to perceived degree of external influence.

PERFORMANCE

A final demension which we measured was that of perceived Organizational Performance. We asked identical questions of both "V" and "B".

The question (IQQ XI) which we used was identical to one previously used by several Contingency Researchers to measure a like dimension.

The results of interview data are presented in conjunction with results from the questionnaire data for comparison.

Performance data also includes one aggregate measure which we collected indirectly. By summing the self evaluations within each unit, we were able to collect a second measure of functional performance.

TABLE X

PERFORMANCE TABLE

	DIVISION	ENG	OPNS	P/M	B/M	TEST	SELF
COMPANY	84%	82%	81%	82%	80%	84%	86%
EXECS.	83%	81%	80%	81%	78%	85%	85%
MGRS.	84%	83%	82%	82%	82%	83%	87%
BUS. MGT.	88%	85%	85%	86%	90%	88%	88%
PROG. MGT.	82%	78%	82%	88%	76%	87%	87%
TEST	84%	84%	81%	77%	77%	87%	87%
OPERATIONS	79%	72%	80%	80%	80%	81%	81%
ENGINEERING	83%	85%	79%	80%	76%	80%	87%
INTERVIEWS	81%	76%	82%	74%	77%	85%	

RESULTS

The following data points appear relevant.

1. In every case, save one, respondents evaluated their functional performance as highest within the organization. (Production Operations respondents scored the Test Function as the highest performer and themselves as next highest.

2. The testing function, was perceived as a relatively high performer by all respondent groups except the Engineering Group.

This evaluation agrees with that of interviewees who rated the Test Function as highest among Functional performers. However, the evaluation is simultaneously somewhat suspect in that 45 of the 57 interviewees declined to verbally evaluate the performance of the Test Function, stating that Test had recently evolved from the Engineering function and as yet, had no performance to evaluate.

3. Performance evaluations were mixed and followed few clearly dissernable pattern. Both the Business and Engineering functions (the low and high program criticality elements) were perceived as low performers.

Some similarity exists, however, between interdependence, problem influence, degree of integration and performance.

SYNTHESIS OF RESULTS

A non-comparative synthesis of the data from "V" suggests that the organization is at once a closed system and an open system.

Data on functional task criticality, autonomy, problem influence and interdependence suggest a strong functional orientation, replete with relatively impermeable or closed inter-functional boundaries, high recognition of functional hierarchial arrangments, and concentration.

An inward-looking, intra-functional problem definition and solution strategy. These data coincide with and support interview utterances which suggested that the functional divisions of "V" perceived themselves as clearly separated or seperable entities. Then systemic attributes suggest a relatively closed system. (Katz and Kahn, 1966) (Katz and Rosenzwig, 1970).

Simultaneously, and again supported by interviews, results suggests a recognition of the importance of the external environment. Data on Environmental influence, external information transaction suggests that "V" and the functional divisions of "V" enjoy a high level of environmental interaction, and recognize that the environment is the principal factor in the organization's success. When asked about external organizational forces, "V" interviewees,

in all functions, suggested that the customer "B" was primary and of predominant importance to the defining of organizational importance and success. Concurrently, many interviewees mentioned the lesser, but significant, importance of external suppliers, other corporations involved in certain elements of the program and parent corporate offices. These data suggest that the organization is relatively open and recognizes the importance of environmental interaction and accomodation to goal success achievement. (Katz and Kahn, 1966) (Kast and Rosenzweig, 1970).

In terms of success criterion, or "official" goal orientation, a clear pattern of uniform perception exists. Costs are clearly of paramount importance, with technical achievement and schedule accomplishment or lesser importance.

Similarly, the perceived environmental/customer goal orientation reflects these same patterns. This may reflect the often repeated and widely publicized "design-to-cost" concept. Currently in vogue among federally procurred development projects.

Significant deviations from patterned regularity occurred among the executives and Engineering Managers who equated technical and schedule performance.

These pattern changes may be attributed in part, to mixed environmental signals and interpretations of the design-to-cost concepts.

Task criticality follows a definite design - build - test functional philosophy, with some recognition of project wide integration requirements. Interviewees and the narative portion of Question 2, (part b) verbalized this philosophy: "Design is the primary element in any development program. Thus you build it, test it, and deliver it to the customer. You also need a little program management and bookkeeping to tie up the loose ends." (Interview and narative synthesis).

Communications patterns tend to suggest discussions centered around the technology of the conversation initiator; another indication of closed- self-defining functional entities, rather than open- program oriented structures.

Resource constraints, results follow a very regular pattern and suggest that the program is "state of the art" development with universally perceived rigid financial and schedule constraints.

Interestingly enough, the results also indicate that there is no significant difference in the level of Cost and Schedule constraints. This may indicate that respondents

equate these two constraints as direct trade items. Interviews tend to support this view.