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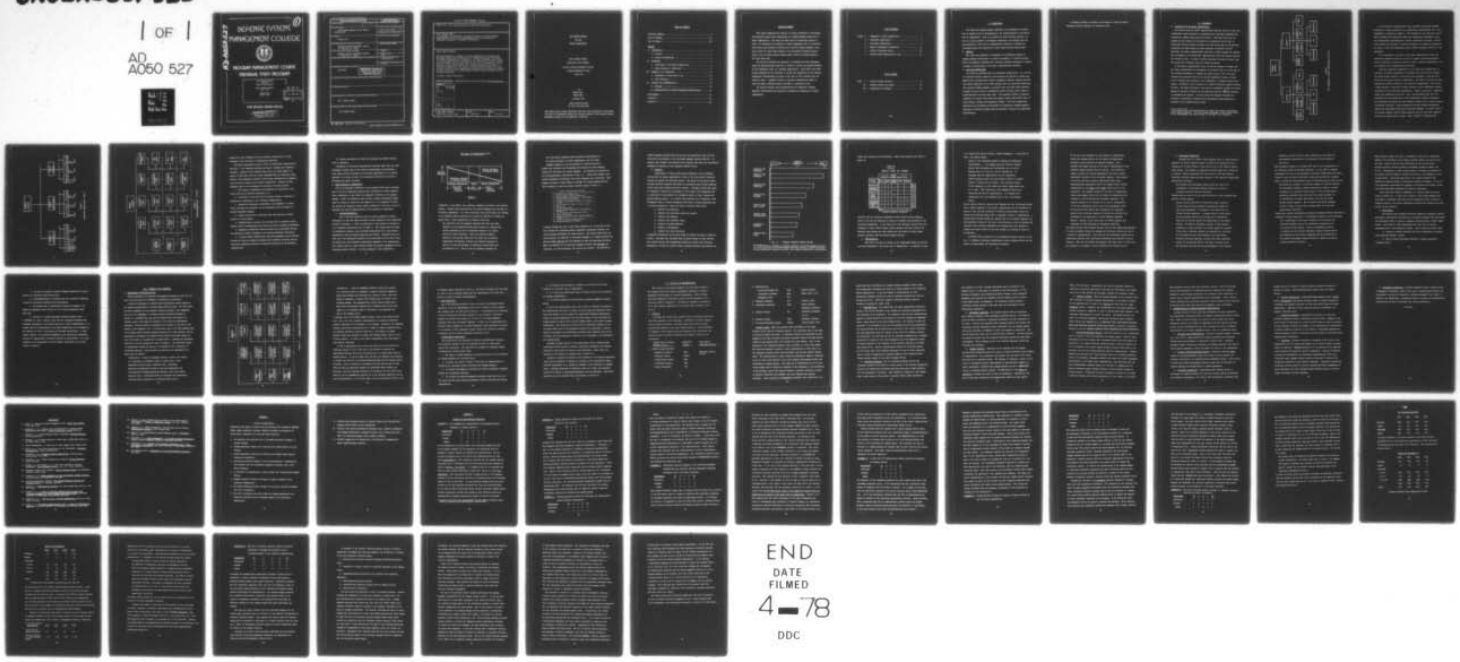

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

PROGRAM MANAGEMENT COURSE

INDIVIDUAL STUDY PROGRAM

THE PROGRAM MANAGER
AND THE
MATRIX ORGANIZATION

STUDY PROJECT REPORT
PMC 77-2

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DEFENSE SYSTEMS MANAGEMENT COLLEGE

STUDY TITLE: THE PROGRAM MANAGER AND THE MATRIX ORGANIZATION

STUDY PROJECT GOALS:

To investigate the structural constraints imposed on program managers functioning in a matrix-type organization and to develop improved management strategies to increase effectiveness.

STUDY REPORT ABSTRACT:

The report provides a summary of a study undertaken to investigate the principal problem areas encountered by a program manager when operating in a matrix organizational environment. The study correlates the findings of prior research efforts available in the literature and textbook theory with "real world" data obtained from the Air Force's Aeronautical Systems Division, Wright-Patterson AFB, Ohio, through structured interviews. Findings are reported in the areas of conflict identification, man power/resource "savings", intra-organizational communications, personnel appraisal techniques and methods of establishing effective functional/program office working arrangements.

KEY WORD: Matrix Organization

SUBJECT DESCRIPTORS: Organizational Structure (10:03:01) Matrix Management

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THE PROGRAM MANAGER

AND THE

MATRIX ORGANIZATION

STUDY PROJECT REPORT

Individual Study Program

Defense Systems Management College

Program Management Course

Class 77-2

By

Donald Losi

Major USAF

November 1977

Study Project Advisor

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EXECUTIVE SUMMARY

This report summarizes the results of a study undertaken to investigate the principal problem areas encountered by a program manager operating in a matrix organization. The study was based upon two fundamental sources of data: (1) literature and textbooks on matrix management; and (2) structured face-to-face and telephone interviews with selected program managers, functional heads and other staff members at the Aeronautical Systems Division (ASD) of the Air Force Systems Command (AFSC) located at Wright-Patterson Air Force Base, Ohio.

The data were analyzed and organized to highlight the major management areas and characteristics which are of concern to modern day program managers and the management staff of a matrixed organization. These areas were subsequently analyzed and are discussed to portray the perspective of the problem. Comparative determinations are made on the basis of the literature and the interview data. A separate finding is reported concerning the degree to which the matrix structure affords "savings" in resources at ASD.

The report concludes with recommendations for improving a program manager's effectiveness and describes a strategy for operating in a matrix organization.

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I. INTRODUCTION

The modern day program manager operating in the Department of Defense must be prepared with an understanding of the characteristics of the matrix form of organization. This is so because all three military services, as well as a large majority of Government contractors, are becoming more and more dependent on this form of organizational structure to support the increasing number and complexity of modern weapon systems acquisitions.

A. Purpose:

This study was conducted to investigate the constraints imposed on program managers functioning in a matrix environment, to identify specific areas for managerial awareness and to develop candidate techniques to improve a manager's effectiveness in the matrix organizational structure.

B. Scope and Methodology:

The study was conducted from two fundamental perspectives: (1) a review of literature sources relevant to the evolution and practice of matrix management which included prior studies, management articles, reports and textbook theory applicable to the study purpose; and, (2) structured interviews with selected program managers, functional heads and other staff personnel assigned to the Air Force's Aeronautical Systems Division (ASD) located at Wright-Patterson Air Force Base, Ohio. This approach enabled a subjective comparison of current "real-world" management concern with related areas of prior studies, analysis and management thought. From these comparisons, guidelines were developed and postulated for improving a program manager's awareness of potential problem areas and methods to improve his operational effectiveness.

A secondary finding is reported on the degree to which the matrix structure provides "savings" in resources at ASD.

II. BACKGROUND

A. Description of the Matrix Organization:

Over recent years the matrix organizational form has evolved to solve the increasingly complex problems of coordinating and scheduling organizational resources to support large project activities. This form, which was not imposed but was created and developed due to experience and the need to judiciously allocate limited resources, has been widely used by the National Aeronautics and Space Agency and major aerospace contractors (14:13)[1]. Basically, the matrix organizational structure is formed through the coupling and overlapping of two traditional organizational forms--the project form and the functional form. In order to better understand the matrix concept, both the project and functional forms are briefly discussed.

In the project organizational form, the project manager is charged with the total responsibility for developing a new product line or, in the case of the military environment, a complete new weapon system. One of the most effective and preferred forms of the project organization which is widely used in industry and Government is the "aggregate" or vertical project form. Figure 1 illustrates such a structure in a typical industrial product division (13:173). The major advantage of this type of arrangement is that the project manager is provided virtually all the necessary human and physical resources to accomplish the project. It also provides him adequate authority for planning, coordinating, controlling and concentrating these resources as required to meet changing project needs.

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[1]This notation will be used throughout the report for sources of quotation and/or major references. The first number corresponds to the source listed in the bibliography; the second number is the page in the reference.

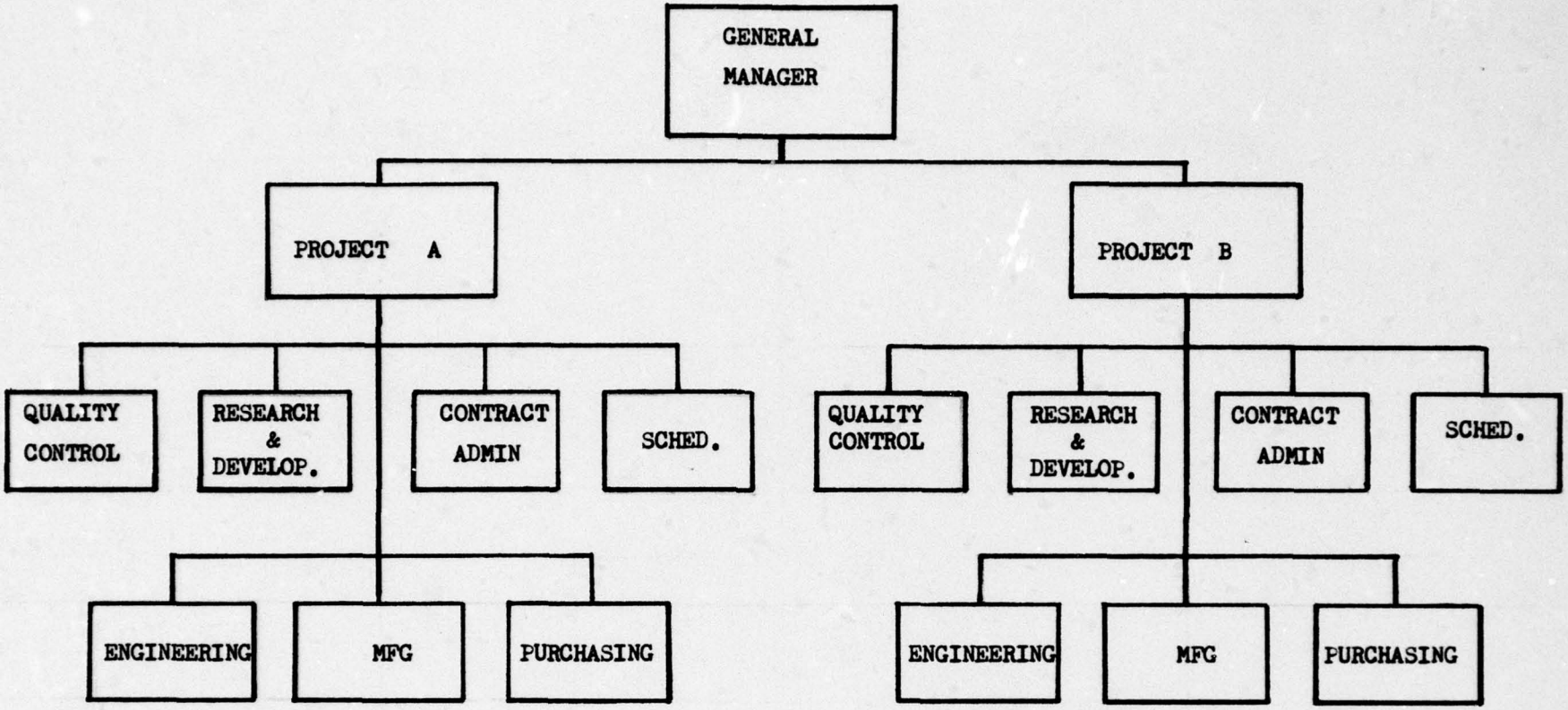

Figure 1

The "Aggregate" Project Organization (13:173)

In the functional organizational form, resources are grouped together according to a given specialty; e.g., engineering, manufacturing, etc. This arrangement is depicted in Figure 2. The advantage of the functional form is that it provides the specialized skills and capabilities necessary to deal with sophisticated technology and a number of products or projects. However, as the number and diversity of projects increases, the problem of completing all tasks on time with appropriate quality becomes extremely difficult if not impossible.

It is important to note that in both these organizational forms, the traditional management precepts of unity of command, superior/subordinate lines of authority, functional division of labor, vertical communication, etc. are preserved by the organizational structure.

While the functional organization is the oldest and simplest type of structure, the matrix organization is probably the newest and most complex. The matrix design attempts to incorporate the advantages of both the functional and the project forms of organization. The matrix is formed by superimposing the project structure on the functional organization. The project overlay provides a horizontal, lateral dimension to the traditional vertical orientation of the functional organization. Figure 3 represents a simplified matrix type organization (13:176). Here, the department heads have line authority over the specialists in their departments (vertical structure). The functional specialists are then assigned ("loaned out") to given projects (horizontal structure). These assignments are made through collaboration between the appropriate functional and project managers. In effect, each of the project managers "borrow" human resources from the functional organizations for an agreed period of time. These "borrowed" individuals then

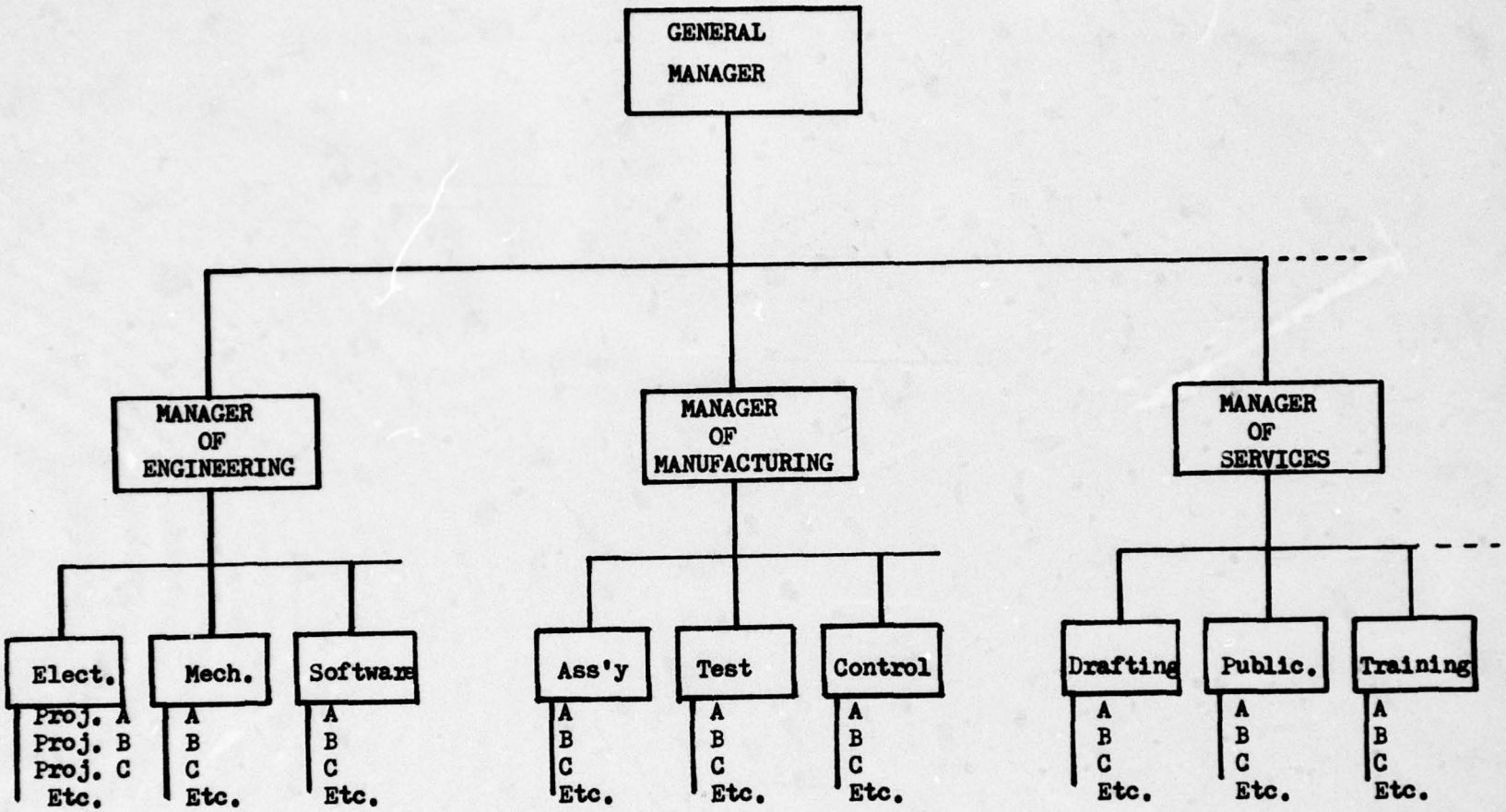

Figure 2

Functional Organization (20:7)

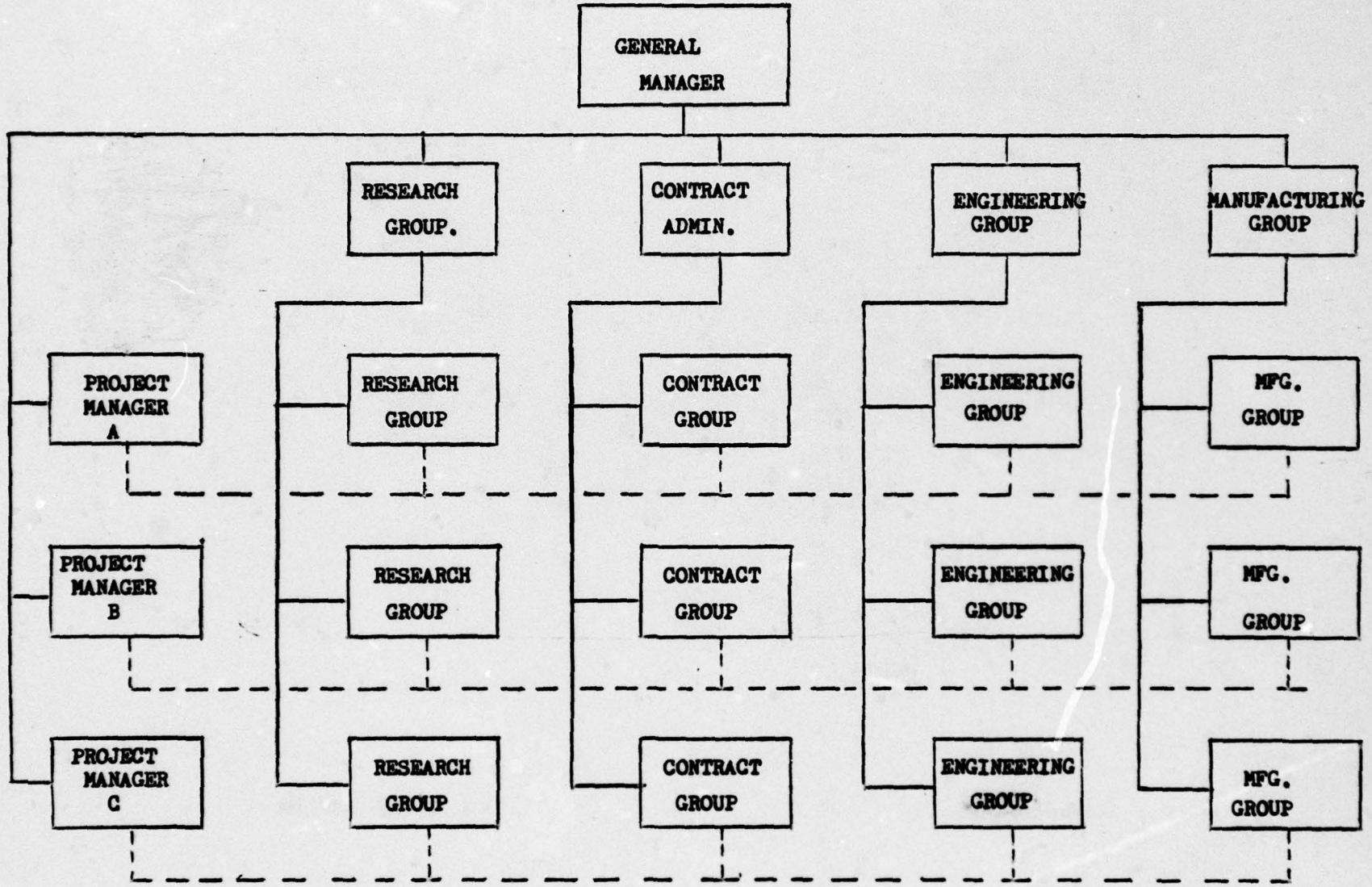

Figure 3

Matrix Organization (13:176)

provide the vital interface with the functional organizations to take advantage of the wide base of technological expertise.

The matrix organization seems to flout the traditional organization's principles. The hierarchy principle and unity of command are flagrantly violated. Elements of the vertical chain exist, but prime emphasis is placed on horizontal work flow across organizational and functional lines. However, some management theorists counter these complications by emphasizing the positive aspects of the matrix organization. Cleland and King summarize some of the advantages of the matrix as follows (4:172):

1. The project is emphasized by designating one individual as the focal point for all matters pertaining to it.

2. Utilization of man power can be flexible because a reservoir of specialists is maintained in the functional organizations.

3. Specialized knowledge is available to all programs on an equal basis; knowledge and experience can be transferred from one project to another (corporate memory).

4. Project people have a functional home when they are no longer needed on a given project.

5. Responsiveness to project and customer needs is generally faster because lines of communication and decision points are centrally established.

6. Management consistency between projects can be maintained through the deliberate conflict operating in the project-functional environment.

7. A better balance between time, cost and performance can be obtained through the built-in checks and balances (the deliberate conflict) and the continuous negotiations carried on between the project and the functional organizations.

8. Reduces duplication of effort and resources and thereby reduces costs of operation.

Proponents of the matrix organizational structure argue that the above advantages overcome some of the inherent disadvantages of going matrix. Given these positive attributes of the matrix organization, it is equally important to be aware of some of the managerial difficulties involved in advocating the matrix structure.

B. Major Problems in "Matrixism":

One of the principle objectives of this research effort was to identify some of the more significant problem areas encountered in matrix organizations, especially as they affect the managerial functions of the program manager. Before investigating those specific problems experienced at ASD, which is covered in Section III and Appendix B, it is important to review the results and findings of prior studies conducted in this area in order to highlight the salient characteristics of the problems of "matrixism".

1. Authority/Ambiguity:

One of the more consistent areas of concern reported by various researchers is that the matrix structure fosters ambiguity in the traditional concept of authority. A useful illustration of this problem is provided by J. R. Galbraith re-presented here in Figure 4. This figure shows the range of alternatives between a pure functional organization and a pure product organization, with the matrix being half-way between. Galbraith points out that one of the significant features of the pure matrix form is that, first, the matrix has a dual authority relationship somewhere in the organization; and, second, there is a power balance between the project management and the functional sides (7:35-37). For those personnel in the organization

THE RANGE OF ALTERNATIVES (8:37)

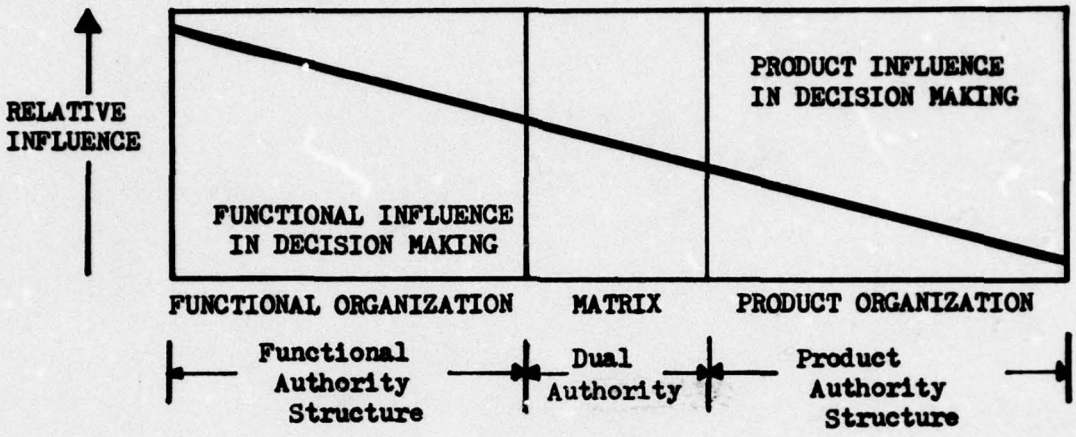

Figure 4

"somewhere" in the middle, this authority ambiguity can become a very serious problem. Normally these personnel are the project managers and the heads of functional departments. To further illustrate this problem area, the findings of two separate studies conducted by C. Reeser in 1969 and R. Goodman are quoted below. Reeser summarized his finding in this way:

> The interviews with the managers indicated that they were quite sensitive to the possibility that people loaned to a project from another organization could be disturbed because of, in effect, having two direct superiors. There were numerous comments relative to the general theme that the matrix form of project organization deliberately violates the venerable principle of unity of command and probably is upsetting to subordinates who are affected by it. Three of the six personnel managers who

were interviewed nominated plural authority relationships as the major detriment of project organization, and nine other managers assigned it the top priority as a problem (14:9-11).

Goodman was concerned with determining who actually had what authority between the functional and project managers. His research was conducted in six defense/aerospace corporations in the U. S. Within each company, both general management (functional) and project managers were interviewed. Each manager was asked to state whether he thought the project manager had the final authority to make the crucial decisions listed in Table I. *

Table I* Crucial Project Decisions

1. Initiate work in support areas.
2. Assign priority or work in support areas.
3. Relax performance requirements (i.e., omit tests).
4. Authorize total overtime budget.
5. Authorize subcontractors to exceed cost, schedule, or scope.
6. Contract change in schedule, or cost, or scope.
7. Make or buy.
8. Hire additional people.
9. Exceed personnel ceilings when a crash effort is indicated.
10. Cancel subcontract and bring work in-house.
11. Select subcontractors.
12. Authorize exceeding of company funds allocated to projects.
13. Determine content of original proposal.
14. Decide initial price of proposal.

A project manager was said to have final authority, if, in the case of conflict between the interested parties regarding a particular decision, the project manager determined the final decision. The results showed that for some decisions, the majority of functional managers in a company believed the project manager did not have the authority to make the particular decision, while the majority of the functional managers believed they did have the authority. On other decisions, the reverse was revealed. The majority of

project managers believed they did not have the authority to make the decisions while the majority of the functional managers believed they did. In general, both Goodman's and Reeser's data indicated that there was significant ambiguity in authority in all companies studied (14:11).

2. Conflict:

Another area of concern which arises frequently in the literature dealing with the matrix organization is that of the ever present "conflict" between the project and functional groups. The nature of the matrix organizational structure requires that tasks be coordinated among diverse organizational units which frequently fosters conflict. Although conflict may impede or temporarily restrict the attainment of one's goals, the consequences may be beneficial if they produce new information which, in turn, enhances the decision-making process. In a recent study conducted by R. Skowronek, seven fundamental areas of project management were cited as giving particular rise to conflict generation. These are listed in priority order below:

a. Conflict over schedules

b. Conflict over priorities within the project

c. Conflict over manpower

d. Conflict over technical issues

e. Conflict over administration

f. Conflict of personality

g. Conflict over costs (20:21-22)

A graphical illustration of the above areas of conflict is shown in Figure 5, (19:22). Skowronek also indicated that the major sources of this conflict were largely derived from disagreement between the project and functional departments, followed by conflict between assigned personnel team members and

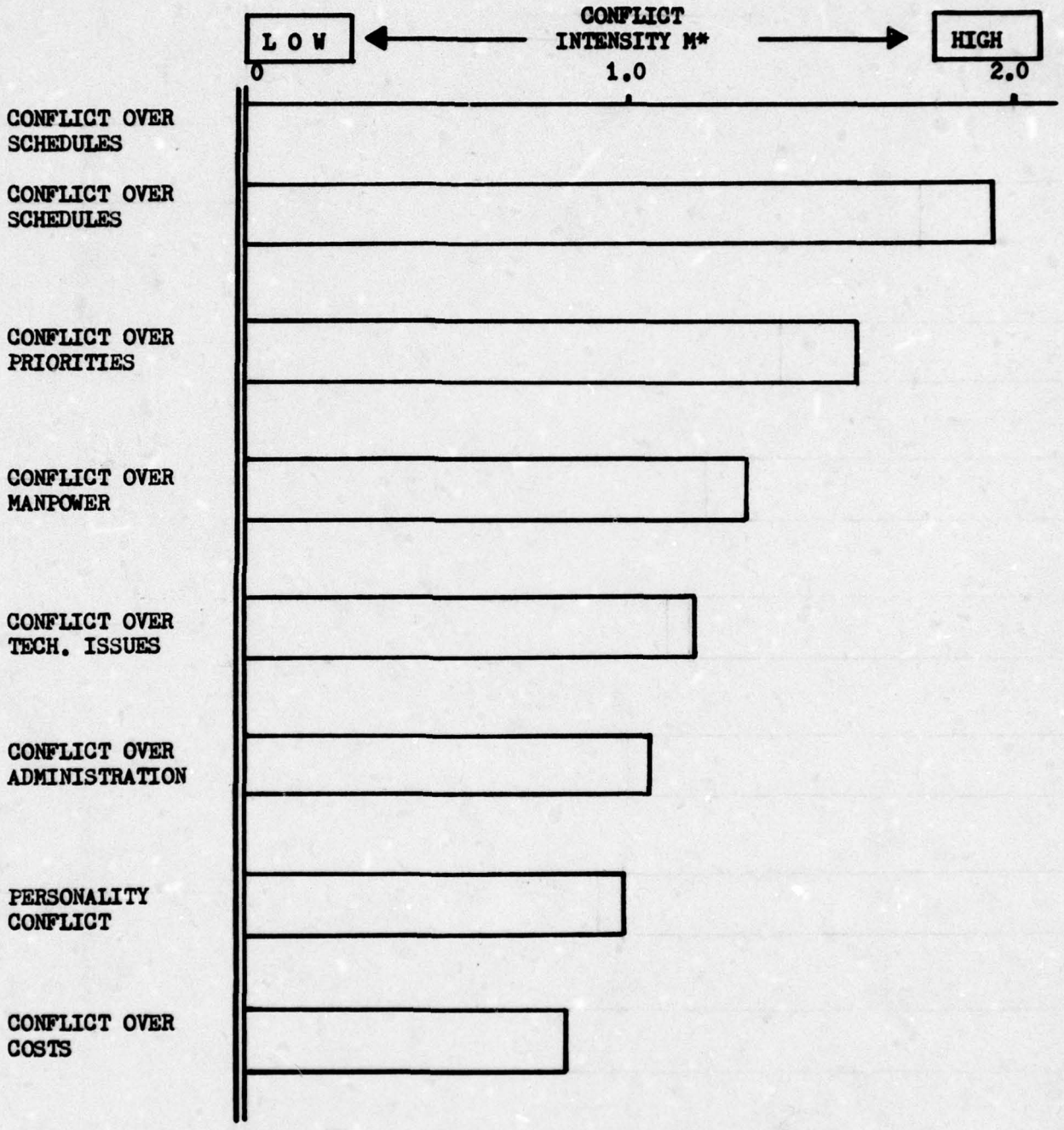

Fig. 5 CONFLICT INTENSITY PROFILE (20:22)

* M is the relative intensity of conflict perceived by project managers measured on a four point scale (0-3) and averaged over five sources: conflict with functional departments, assigned personnel, team members, superiors and subordinates.

lastly with superiors and subordinates. These latter profiles are shown in Table II*.

TABLE II*
(20:25)
CONFLICT CAUSE AND SOURCES

CONFLICT CAUSE	SOURCE — CONFLICT OCCURRED MOSTLY WITH... Funct. Depts.	Asgnd. Persnl.	Between Team Mbrs.	Superiors	Subordinates
Schedules	X	X			
Project Priorities	X	X	X		
Manpower	X	X			
Tech. Issues	X	X	X		
Adminis.	X	X		X	X
Personlity Conflict	X	X	X	X	X
Cost Objectvs	X	X		X	

High — Low: Relative Conflict Intensity

Low — High: Relative Conflict Intensity

Conflict with the functional departments occurs because project managers often do not have the authority to direct or determine the priorities of the functional departments. At the other end of the spectrum, conflict with subordinates is least intense because project managers have more control over immediate team members and these members are more likely to share common project objectives with the project manager (20:35).

3. Communications:

That this is an area of concern to any organization makes its effects even more pronounced in the matrix form of organization. As reported by DUNS

in an August 1970 article entitled, "Matrix Management: A Tough Game To Play", the authors report:

> Because of the unorthodox tangle of vertical and horizontal relationships. . . the company must have excellent communications both vertically and horizontally, and, as Yale's Shepard puts it, "A hell of a lot of cooperation". To encourage both the communication and the cooperation, prudent companies spell out every possible detail of a matrix project in advance and in writing. Says Sylvania's Duffy, "If the agreement is only verbal, the matrix organization just won't work." NCR's Rench adds, "The management team has to understand the need for communication. If a manager can't communicate--well, you generally have to get a new manager" (5:35).

Reeser reported from his research that "Managers who were interviewed stated that a common complaint in the project organizations was the frustration of trying to deal with the multitude of interface relationships between the project and functional groups with no systematic avenues of communication. A central theme running through the comments made by the project engineers was the frustration because of the lack of any guidelines on how to interact with engineers from functional departments who theoretically were supposed to support the project effort but who were alleged to be trying to direct it (17:464-465).

In another study conducted at the Aeronautical Systems Division in 1973 by W. S. Tsukamoto concerning communications between program offices and the Deputy for Engineering, the following was reported:

Of all the topics responded to, the problem of communication between the program offices and the Deputy for Engineering appeared to have attracted the greatest response. Most comments were highly critical of the lack of communication on the technical matters between these two groups. The alternative comment welcomed the shorter communication link that a matrix organization provides to the collocated engineer. This related to the fact that the collocated engineering force, being organizationally established within the program office, reduces communication to the inter versus intra offices level of communication. The comments critical of the lack of communication between the program offices and the Deputy for Engineering were submitted by both functional and collocated engineers. The comments appeared to be critical of the lack of communication at both the engineering level as well as the managerial level. The general feeling existed that information and experience gained by the collocated engineer is valuable and probably very meaningful in its application to other programs (corporate memory). However, it was noted that for various reasons, dissemination of this knowledge was restricted (21:40-48).

The author mentions that frequent disputes over the best engineering approach to a given situation between the program and functional offices gave rise to a closure of communications. Also cited was the frustration experienced by engineering personnel when engineering compromises were dictated to resolve disputes. This area was further investigated under this study in Section III and Appendix B to determine if these attitudes still existed at ASD.

4. Performance Appraisals:

Although this is a subset of the authority area, in large measure a manager's "de facto" authority degree of influence as perceived by subordinates is a direct function of the input he has to the latter's performance rating. This premise is supported by recent studies by C. Moyer and L. Melhart. Moyer investigated this area at ASD in 1974 and, based on interviews conducted among personnel assigned to the Deputy for Engineering, reported the following:

> The promotion and performance rating system was found to be advantageous to collocated military engineers, but not to collocated civilian engineers (16:xxvi).

Further study by Moyer as to the cause and effects of this situation were provided in this summary:

> Results indicate that 87% of collocated military engineers perceive they have good promotion opportunities relative to other work assignments, in contrast to only 33% of the collocated civilian engineers. A primary reason for this result is that military promotions are decided by an independent board and not the ENA (Deputy for Engineering) or SPO organizations. The OERs or performance ratings on which military promotions, in part are based, are usually signed by a general officer when a military engineer is collocated to a SPO which is not usually the case when assigned to the home office. Civilian collocated engineers, however, have their promotions decided by the ENA Home Office. The lack of contact by the ENA supervisor with the day-to-day performance of the civilian

engineers was cited often by those interviewed as the cause for poor promotion opportunities for collocated civilian engineers (16:51-53).

This evaluation occurred in September 1974 prior to the introduction of a new evaluation system for military engineers. In July 1976, L. Melhart investigated the role of the performance evaluation shortly after the introduction of this new Officer Evaluation System and reported the following based on interviews with personnel from ten different project offices at ASD:

> The ability of a project or functional manager to directly influence the performance ratings of project personnel had taken on an added importance as an influence factor because of the new OER system... respondents indicated that since there were limits (quotas) on the distribution of "good" OERs within a SPO, the new system favored project managers. This is because the project managers are more visible to those senior officers that sit on the OER rating boards (14:63-65).

Melhart also provided contradictory evidence concerning attitudes possessed by collocated civilian engineers as to performance appraisal in the following:

> It is interesting to note that in relation to both project and functional managers, all of the significant correlations for the civilians were positive. Also, no correlations positive or negative for the indirect performance rating influence method were exhibited by this group, suggesting that the sensitivity to the indirect performance rating influence is limited to military project personnel (14:70-71).

These findings coupled with those of Tsukamoto in 1973 show a significant change in the attitudes of the military personnel between the periods 1973 and 1976. Prior to 1976 and the introduction of the new OER system, military personnel favored by 87% the performance appraisal methods used at ASD. Subsequently, in 1976 a marked change in attitude was observed and the matrix structure became an inferred root cause of the inequities of the new OER system. During this same period, the civilian personnel also exhibited an apparent change in attitude as reported by Melhart. He did not find significant dissatisfaction expressed by civilians as did Moyer in 1974 concerning performance appraisal and promotion opportunity.

These areas were further investigated to a limited extent under this study in Section III. At this point, however, it has become apparent that collocation of personnel away from the home functional office is indeed an important aspect of the matrix organization affecting the attitudes and interactions of all personnel.

5. Other Areas:

The problem areas described previously (authority, ambiguity, conflict generation, communication effectiveness, performance appraisal and collocation) are significant areas of concern to managers operating within a matrix organization. Other areas of equal significance have been cited by various researchers and in the literature at large. Some of these are listed below.

a. Anxiety by project personnel over loss of employment as projects near completion (Reeser 17:462).

b. Lack of career development afforded to project specialists (Tsukamoto 21:31).

c. Low sense of loyalty of project assigned personnel due to perception of a transient state (Fiore 6:20).

d. Over-specialization of personnel who are collocated (inability to share in home/office experience and development).

e. The matrix form of organizations fosters an increase in the number of management levels (Reeser et al (17:466) and Middleton (HBR 15:27-28).

f. Results in a complex managerial structure (Moyer 16:14).

A preamble to this effort is that with the increasing popularity and acclaimed suitability of the matrix structure to modern organizations, it is assumed that the disadvantages of the matrix organization are outweighed by the benefits in terms of efficiency and increased productivity. To what extent, however, is the matrix arrangement at ASD meeting the established precepts of organizational efficiency afforded by going matrix? It is this question, in the perspective of prior studies, that Section III of this report is oriented.

III. SUMMARY OF ASD INTERVIEWS

A. Application of Matrixing at ASD:

Before reporting on the specific investigations relating to ASD, the concept of the ASD matrix is described for reference and continuity.

At ASD the development of advanced major aeronautical weapon systems is the primary responsibility of System Program Offices (SPOs). The SPOs within ASD may be organized as line elements reporting directly to the Commander, ASD, as in the "aggregate" or vertical project structure discussed in Section II. Alternatively, they may be assigned under the purview of a "Deputy", such as the Deputy for Systems or the Deputy for Aeronautical Equipment. Here the Deputy is responsible for a number of SPOs and in turn reports to the Commander, ASD. In either case, each of the SPOs operates within an overall matrix structure whereby functional ASD staff elements, such as Engineering, Procurement and Program Control provide functional support to each of the SPOs on an apportioned or shared basis. A partial and simplified depiction of the ASD structure is shown in Figure 6. The functional support is accomplished through the process of "collocation" and "dedication" of functional personnel. These concepts are defined by ASD Regulation 30-2 (June 1977) as follows:

> "Collocation" - A type of assignment whereby a person, who because of a functional or supportive skill, is placed with a User Organization (SPO) to meet a specific need. Collocated personnel are physically located in the user organization and are responsible through appropriate channels to the user organizational chief. Collocation should be considered when essentially full-time work is required on a continuing basis (22:2).

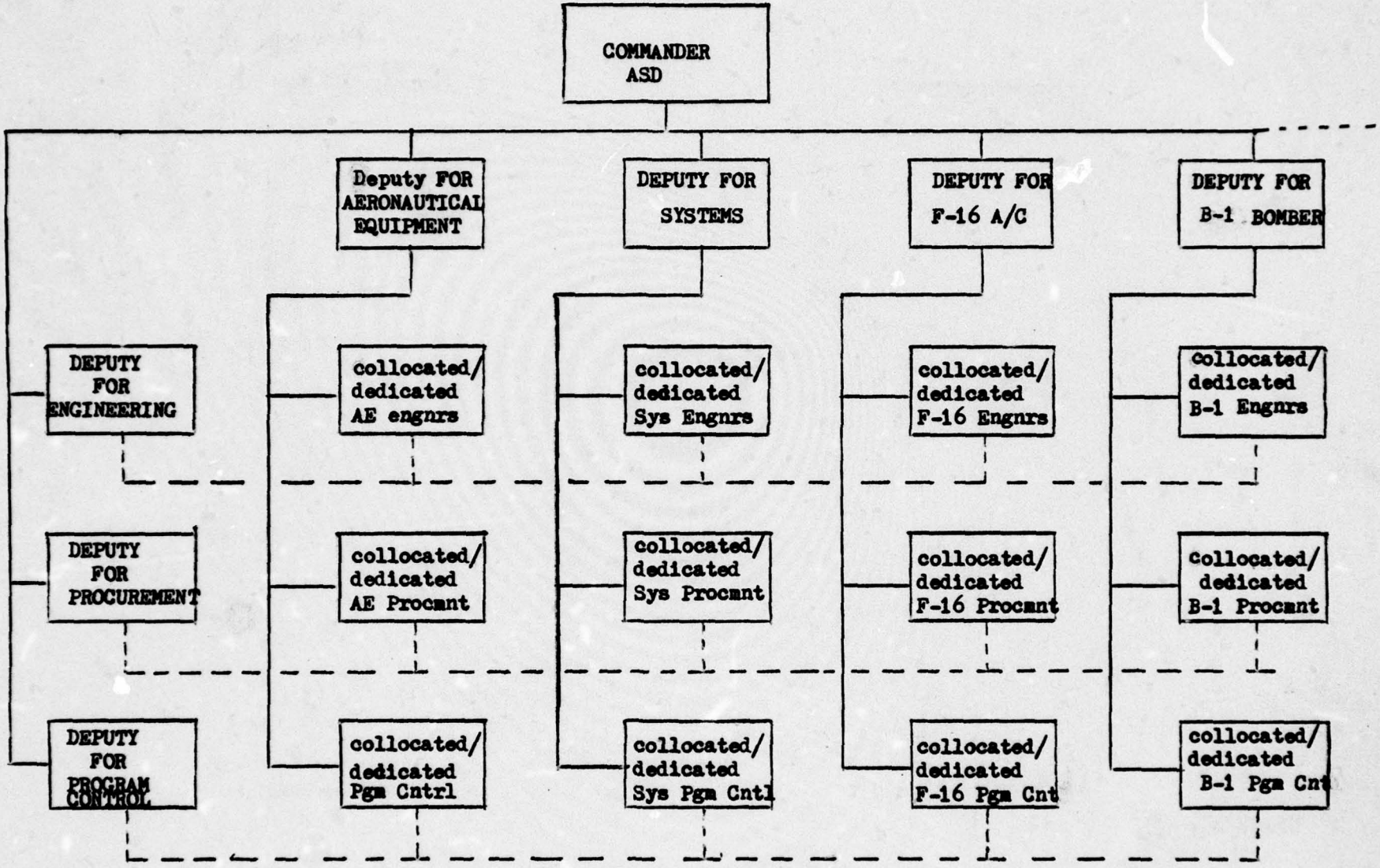

Figure 6. Partial Depiction of Matrix at ASD

"Dedication" - A type of assignment whereby a person who, because of a functional skill, is assigned to support a specific program by giving that program first priority for a period of time. This individual is available to support other efforts when not needed on the assigned program. The assignment may involve remote support from a home office (functional) location and is primarily used to meet work surges or in a situation where an individual is not required full-time on one program (22:2).

In general, most of the larger program offices, such as the Deputy for the F-15, A-10, F-16, etc., possess a preponderance of collocated functional personnel basically for the duration of the program. Similarly, the remaining Deputies, which have responsibility for a number of smaller program offices, are provided collocated resources which are in turn shared or further matrixed within this deputate to support the various program offices of the overall deputate. In effect, these latter organizations must work within a "dual matrix" framework.

It may be appropriate here to point out that ASD first initiated the matrixing concept at ASD in 1964 when it was decided to allocate the engineering resources from their functional home on a shared basis with the program offices. It was not until July 1976 that ASD expanded this matrixing to include the functions of Procurement/Manufacturing and the Program Control functions. This is mentioned to illustrate the fact that as late as 1973, 1974 and 1976, as previously reported by researchers Moyer, Melhart and Tsukamoto, that the corporate experience of ASD gained over the period since 1964 had not yet successfully resolved all of the problems resulting from the matrix implementation. On the other hand, ASD has successfully fielded a host

of improved weapons systems into the U. S. Air Force inventory since that time and thus it can be credibly argued that the organization is far from ineffective in terms of mission accomplishment.

B. Data Collection:

One of the principle purposes of this study was to investigate current operations at the ASD organization, gather data pertinent to these significant problem areas, and thus enable comparative determinations as to relevancy of the ASD operations with those reported in prior studies. Particular emphasis was desired with respect to the role of the Program Managers operating within the ASD matrix structure. To this end, a questionnaire was developed based primarily on the major managerial issues presented in Section II to ascertain if any correlation existed between the findings of previous researchers and the current management operations at ASD.

Questionnaire Description:

The questionnaire was structured to solicit non-attribution responses from personnel assigned to the ASD organization based on "real-world", present day experiences. The questions were designed to stimulate comment concerning the following major areas:

1. The degree to which ambiguity in authority exists at ASD as perceived by Program Managers and Functional Heads.

2. To assess the extent to which a "free flow" of communications is practiced and encouraged between functional and program managers.

3. To evaluate the degree of influence the current performance appraisal methods has on matrixed personnel.

4. To identify the salient management techniques being used at ASD as the basis for day-to-day working arrangements between functional and project organizations.

5. To determine the "savings" in resources experienced at ASD since inception of the matrix form of organization.

6. To identify the significant areas of conflict between the functional and program organizations.

7. To solicit suggestions for improving the matrix management implementation.

A copy of the questionnaire used in the survey is contained in Appendix A. The questionnaire was used in a series of face-to-face and telephonic interviews with members of ASD's Deputy for Aeronautical Equipment Organization, Deputy for Systems Organization and also with members of the functional and systems groups at Hqs Air Force Systems Command (AFSC), ASD's parent command organization. The study did not lend itself to statistical analysis due to the small sample size of the population surveyed (ten personnel). However, emphasis was gained from interviewing personnel keenly familiar with the ASD structure, and those serving in positions at the crossroads of the functional and program groups.

Although the major impetus to the questionnaire was in obtaining data concerning the above areas of interest, additional information was obtained relating to other areas of concern to the respondents. These topics are reported in the analysis of responses and in Section IV.

Appendix B presents the results of the interviews on a question-by-question basis, and are arranged to indicate the identity of the respondent's organizational affiliation--i.e., whether he belonged to the functional or program group. Although statistical correlations could not be made, the responses indicate the extent of agreement/disagreement with the statement. Open-ended questions were also included which are reported in Section IV.

IV. FINDINGS AND RECOMMENDATIONS

This section of the report summarizes the principal findings of the research effort and presents recommended techniques to improve managerial effectiveness in a matrix organization. These findings are based primarily on responses obtained from ASD personnel to the questions listed in Appendix A. The reader is referred to Appendix B for a more detailed commentary on the specific areas covered in this section.

A. FINDINGS:

In general the current data obtained from ASD correlated quite well with that contained in the literature. Differences do exist, however, both in degree and content. The table shown below lists the major problem areas reported in the data obtained from ASD. This information is compared to data obtained from the literature and a subjective correlation factor is provided indicating those areas of high and low correlation.

CURRENT MATRIX PROBLEMS REPORTED AT ASD	CORRELATION FACTOR	PRIOR YEAR'S LITERATURE FINDINGS
1. Conflict Areas (priority)		
- manpower allocation	High	Skowronek, Reeser, et. al.
- personnel loyalty	Medium	
- tech/contract issues	High	
- functional response	High	
- social interaction	N/A	

2.	Communications:		
	- Functional/Program Off	High	Reeser, Melhart,
	- Personality Dependent	High	Moyer, DUNS, et al
	- Management Level	Low	
3.	Authority Ambiguity	Low	Cleland & King
4.	Performance Appraisal	High	Moyer, Melhart, Tsukamoto, Galbraith
5.	Program Priority	Low	Skowronek, Cianfrani, et al
6.	Resource Savings	High	Middleton, Cleland
7.	Collocation/Corporate Memory	Medium	Reeser, Moyer, Fiore

Conflict Areas: There was generally high correlation in all areas reported by ASD with the literature sources. The exceptions were in the areas of personnel loyalty and costs. As mentioned earlier, the perception by some managers at ASD that functional collocated personnel exhibit less than desired loyalty to the program office was reported with some emotion. This is also mentioned in the literature (Reeser, Moyer), however, to a much less degree. The functional manager's position is also understandable in this area; i.e., the corporate interests should take precedence over specific project requirements. The reconciliation of these differing perspectives remains a challenge at ASD in view of the effects it has on the working relationships between the functional and program groups. That there was no correlation at ASD to costs being a major area of conflict as reported in the literature is not surprising. In the industry, much of the support rendered to project activities is based on specific documented work packages, man hours required and material resources. These resources are chargeable to specific cost centers and it is

easily seen that differences over support rendered (charged) versus actual work accomplished (productivity) could be a serious problem in the industrial matrix organizations. At ASD this method of accounting has not been implemented primarily because the costs of personnel resources are borne at the Hqs USAF level. Additional comments concerning conflict areas are contained in Appendix B, Pages 52-53.

2. Communications: The finding that the major communication difficulty occurs in ASD at the interface of the program and functional organizations is well supported by the literature. One exception noted was that communications appears to improve between the two groups as one rises through the management layers, being poorest at the lower working levels. The reasons for this are perceived to be the impact of the new ASD regulation whereby the negotiations for support between the two groups have been fixed to the "senior collocate". Only when agreements cannot be reached at this level are problems escalated for resolution. The fact that the ASD top corporate management has encouraged resolution of conflict at the lowest management level has apparently helped to insure resolution of the majority of the interface problems at no higher than Deputy level. However, communications between the functional groups and the "super SPOs" still requires improvement as well as areas across-the-board in terms of improving the corporate memory of the functional homes through lessons learned in the various program offices.

3. Authority Ambiguity: The low correlation between ASD and the literature sources in this area is a direct result of the recently implemented policy at ASD whereby the functional heads have been given formal authority over the allocation of resources. This authority is balanced in the program area to some degree by the presence of general officer grade individuals

(see Appendix B, Pg 39). Secondly, differences must be elevated to the command section if they cannot be resolved at the Deputy Levels. In the military environment, this situation generally fosters a more cooperative atmosphere when problems are escalated from the working levels to successively higher layers of management. The literature sources support a continuing industry problem in this area where the environment is more individually competitive.

4. Performance Appraisal: The findings indicate that ASD personnel still perceive inequity in the performance appraisal process. The degree to which the matrix structure is singularly responsible for this perception is not clear. However, the perception that "program personnel are favored over functional personnel (especially those collocated)" has not changed significantly since reported by Tsukamoto in 1973 (See Appendix B, Pgs 40-42). The new OER system has served only to intensify this situation. Civilian personnel are equally concerned over the perceived favoritism rendered the home office counterparts. Recent changes at ASD in the civilian appriasal process may alleviate this situation.

5. Program Priority: Interviews at ASD reported that the program priority would definitely affect the degree of support rendered by the functional organizations. The respondents also reported that the rank of the Deputy head also was an important factor. The findings of Cianfrani, however, in his review of comparable projects being managed at Naval Material Command in a matrix environment, indicated that program priority was not a significant factor in obtaining adequate support. The differences in the degree of matrixing is probably the cause of this non-correlation. Matrixing in the Navy is much more centralized and program office staffs are much smaller

than in the Air Force. Consequently, the need for equitable sharing of resources is much more pronounced in the Navy and differences, even slight ones, can be noted quickly and the impact reported for corrective action.

6. Resource Savings: There was general agreement in the research study that "savings" in resources through implementation of the matrix structure can be expressed only in terms of the long run and then only as a "cost avoidance" factor. Generally, the implementation of the matrix resulted in initial increases in manpower in order to provide additional overhead to the functional organizations to service the matrix. The matrix also has the impact of increasing management layering and associated grade increases. These factors were reported by C. J. Middleton (15) in the Harvard Business Review and partially supported by ASD data. Appendix B contains a historical analysis of the ASD civilian manpower trends supporting the above conclusions.

7. Collocation/Corporate Memory: This area continues to be a significant issue of concern to both the functional and program groups. There is sharp disagreement over the priority that collocation should have with respect to maintenance of a strong functional corporate memory. Recent initiatives at ASD to centralize even further program control resources within each of the deputates, has met with strong resistance from the program groups. Program managers are concerned that "dual matrixing" such as is currently practiced within the Aeronautical Equipment Deputate will weaken the overall management effectiveness in the "basket-type" organizations. The functional side supports centralization pointing towards the "savings" in manpower and the inherent advantages gained through sharing of lessons learned through the corporate memory. Subordinate personnel perceptions continue to be divided in both the military and civilian population as to the equity of the perfor-

mance appraisal process under the collocation process. While the military resists being attached to a functional home and competing with "program management" peers through collocation, the civilians prefer "dedication" to improve their long-term organizational career development. These findings closely parallel those previously reported by prior research efforts conducted during the period 1973, 1974 and 1976 by Tsukamoto, Moyer and Melhart.

B. Recommendations to Improve Management Effectiveness:

Previous sections of this report have identified the major constraints and complexities confronting modern day managers operating the matrix environment. Based on these findings, the results of prior studies and proven management practices and finally on suggestions received from the personnel at ASD, several recommendations have been developed to improve a manager's effectiveness in the matrix management arena. These are postulated below:

1. Encourage Open Communications: Top-level corporate emphasis encouraging a free flow of communications will improve organizational efficiency through early identification of significant conflict areas. Regularly scheduled forums involving key functional and program personnel will serve to foster genuine management concern throughout all levels of the organization.

2. Periodic Functional/Program Reviews: Frequently scheduled joint reviews of functional/program issues will surface resource problems and interface difficulties for clarification and management action. Joint reviews by lower level functional/program personnel should also be encouraged to improve planning and implementation of support agreements.

3. Documented Agreements: Program/functional managers should be encouraged to formally document and "spell-out" mutual support requirements and interface arrangements. Time-phased task descriptions, catalogued work

packages should be coupled to detailed manpower resources necessary to support the effort. Collocation/dedication issues should be clearly defined.

4. Resource Forecasting: Functional/Program managers should jointly develop standardized forecasting techniques based on accurate management information and program activities for near term (90-180 days) and annual requirements. Updating of these forecasts should be accomplished on a regular, structured basis.

5. Conflict Resolution: Confrontation has proved to be the most effective management method in reconciling conflict areas. Managers at all levels should be encouraged to identify conflict areas as early as possible, develop candidate solutions and engage in open negotiation and communication to achieve efficient resolution of the conflict. Withdrawal, smoothing and forcing techniques should be considered secondary methods to achieving inter-organizational cooperation.

6. Education: Increased education of personnel at all levels of the organization as to the nature and dynamics of the specific matrix structure should be practiced. Maximum orientation of new personnel to the organizational policies and procedures should be emphasized. Tailored information briefings and documentation at subordinate organizational levels (e.g., functional homes, program offices) should be developed to reinforce the concept and procedures of the specific department. Training of specialized functional personnel should be provided through home office programming of these individuals into both corporate-unique training courses, as well as formal job-related education programs.

7. Management Consultants: Corporate management should consider hiring of management consultants, expert in the area of organizational behavior and development to provide an independent, periodic assessment of the state of health of the organization. Recommended actions to improve the organizational effectiveness can then be evaluated from several perspectives.

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APPENDIX A

Interview Questionnaire

Respondents were asked to choose from the following five categories (STRONGLY AGREE, AGREE, UNDECIDED, DISAGREE, STRONGLY DISAGREE) for questions 1-8 listed below; questions 9-11 were open-ended questions.

1. The authority and responsibility of (Program/Functional) Managers is clearly defined.
2. Working agreements between the Functional and Program Offices are well defined.
3. Working agreements between the Functional and Program Groups require frequent re-negotiation.
4. Subordinate personnel assigned to the Functional/Program organizations are satisfied with the performance appraisal techniques used in the matrix structure.
5. A "free-flow" of communications exists between the Functional and Program Offices.
6. Program "Priority" dictates the degree of support rendered by the Functional Organization.
7. The matrix structure affords "savings" in man power, material resources and costs of operation.
8. The need to collocate personnel within the Program Organization outweighs the potential loss of corporate memory to the functional organization.

9. Identify some principal sources of conflict between the functional and program offices which you have experienced.

10. Identify some specific management techniques (e.g., letters of agreement, work package descriptions, scheduled reviews, etc.,) being used as the basis for functional/program office working relations.

11. Identify suggestions for improving the effectiveness of managing the matrix organizational structure.

APPENDIX B

Analysis of Questionnaire Responses

STATEMENT 1: The authority and responsibility of (Program/Functional managers) is clearly defined. *

Respondents	SA	A	U	D	SD
Functional	1	7	0	1	0
Program	1	9	1	0	0
TOTALS	2	16	1	1	0

It was surprising to note that 89% of the functional managers and 91% of the program managers did not experience any significant sense of ambiguity in their concepts of authority and responsibility. The one exception disagreed only to the extent that responsibilities are sometimes misinterpreted. This respondent indicated that the program offices frequently fail to understand that the functional groups are chartered to provide "services - not bodies". In comparing this set of responses with those of prior studies referenced in Section II, there is a clear non-correlation. This conclusion is based in large measure on the responses obtained from the interviewees and also on discussions held with functional members of the Hq AFSC staff. It was frequently reported that the recent revision of the ASD regulation governing the roles and responsibilities of the various groups (functional groups allocate resources; program groups maintain operational control) has provided a more effective policy and organizational framework governing the purview of each of the groups.

* Responses here (20) were consolidated from two separate original statements on authority and responsibility, respectively.

STATEMENT 2: Working agreements between the Functional and Program offices are well defined.

Respondents	SA	A	U	D	SD
Functional	0	3	0	1	0
Programs	0	4	0	2	0
TOTALS	0	7	0	3	0

Actually this statement was used as a lead-in to Statement 3 which deals with the frequency that these agreements required renegotiation. Statements 2 and 3 in turn relate indirectly to Statement 5 concerning communications within the matrix and also with Statement 9, identifying areas of conflict. However, before discussing these inter-relationships, the results shown above indicate that the majority of personnel in both groups agreed that working agreements (whether formal or informal) were well understood. Those who disagreed emphasized their experience with the Program Control organization. Based on this finding as well as several others yet to be discussed, it is felt that the Program Control group, being the newest to be matrixed at ASD has a way to go in establishing satisfactory rapport with those program offices interviewed. The functional manager disagreement emerged from the engineering group. The statement here was that only 40% of the working arrangements were clearly defined and the remainder required continuous coordination between the functional and program groups.

STATEMENT 3: Working agreements between the functional and program groups require frequent renegotiation.

Respondents	SA	A	U	D	SD
Functional	1	2	0	1	0
Programs	0	5	0	1	0

TOTALS	1	7	0	2	0

Here, an apparent contradiction emerges with respect to Statement 2. If working agreements are clearly defined, why is there a need for frequent renegotiation of these agreements? The responses tend to support the contention that the matrix structure requires constant updating, clarifying, tailoring/modification and interpretation of previously established working agreements. To put it succinctly, the matrix is dynamic. A need often cited was that of continually "re-inforcing" the sense of the working agreements. Program/functional differences as to the level of support required were frequently renegotiated especially in the engineering area. These results indicate that effective and open communications is vital to maintaining a healthy climate in the matrix organization. The "deliberate conflict" generated by the matrix can only be successfully managed if communication channels are available and effectively used.

STATEMENT 4: Subordinate personnel assigned to the (Functional/Program) organizations are satisfied with the performance appraisal techniques used in the matrix structure.

Respondents	SA	A	U	D	SD
Functional	0	2	1	1	0
Programs	0	2	1	1	2
TOTALS	0	4	2	2	2

This question elicited a great deal of response from the sample group surveyed. As the data shows, there is a range of responses which precludes acceptance of a general consensus, even within a single group context. In reviewing ASD policy it is important to point out that there exists a different rating chain for the collocated civilian and military personnel within the matrix.

Civilians are rated initially by program office managers with the final review being made by the "home office" functional head. The military personnel are rated completely through the program chain except for the final review authority which is at the Command Section (a common baseline for either functional or program military personnel throughout ASD). Thus, it can be appreciated that collocated civilians are closer to the "two boss" syndrome than are most of the military personnel. One finding of this survey was that a great majority of the civilian personnel would prefer the "dedicated" functional assignments over "collocated" ones primarily because of the nature in the way the appraisal process is structured. This result correlated strongly to prior studies conducted at ASD by Moyer and Melhart over three and four years ago. That this situation is not peculiar to military organizations is also well supported by Cleland and King and other management theorists in industrial and aerospace organizations utilizing the matrix form. In the case of the military personnel it was found that a strong negative perceptual set still exists as to the equity of ratings rendered the collocated functional personnel versus the "program management" associated personnel. This finding was also reported in 1976 in Melhart's study taken at ASD. However, it was tempered by the fact that, as long as there were no stringent quotas on the number of good versus bad OERs, 87% of the military personnel were satisfied with the appraisal process then in effect. It now appears that the new OER system itself is the primary root cause of the dissatisfaction as opposed to the matrix form of organization. However, it is also apparent that the unique arrangement of the matrix framework lends itself to promulgating this perception of inequity because, (1) respondents consistently reported difficulty in convincing subordinates that functional, collocated personnel were getting a "fair shake" in the rating process; and,

(2) the civilian preference for "home office" assignments still exists even after many years of matrixing at the ASD organization. It is postulated that these results are generally conceded in the face of the current organizational structure, rating processes and interpersonal climate at ASD.

Another finding which was reported from a senior ranking officer within the ASD structure indicated there was a significant degree of misunderstanding of the nature of the ASD appraisal process. This individual was in a very good position to evaluate this conclusion, as he had responsibilities over several of the functional and program groups. His conclusion was also reinforced by a program manager who reported that he wasn't sure how the process "really operated". Here again, improved communications would serve to strengthen the matrix operations.

STATEMENT 5: A "free-flow" of communications exists between the Functional and Program offices.

Respondents	SA	A	U	D	SD
Functional	0	1	0	3	0
Programs	1	2	0	3	0
TOTALS	1	3	0	6	0

The responses to this statement generated even more comments than that of the performance appraisal issue. It was interesting that the respondents either agreed or disagreed, with none lying in between. It is perhaps in this area that the individual operating in the matrix structure plays a most significant role. One of the respondents indicated that the flow of communications was largely a function of the individual personalities involved. Others indicated that a reasonably good flow of communications existed between the middle managers (senior collocates/functional homes) but admitted to a shortcoming at the lower working levels where misunderstandings were frequent.

Newness of employees was mentioned several times as contributing to the reduced communication effectiveness. This correlates to Statement 3 where updating and reinforcement of working agreements was required to insure mutual understanding between the different groups. The larger "super SPOS" were reported to be un-communicative by the functional managers. They felt this situation existed because of the large numbers of collocated personnel assigned to these long-term programs. Being nearly totally self-sufficient, these programs did not require continuous feedback and consultation with the functional homes. Unfortunately, some functional managers felt that this negated one of the advantages the matrix was designed to provide, that of disseminating lessons learned to the general ASD community through the home offices. One respondent reported the existence of "intermittent gaps" in the communications lines, stating that communications would be good at one point or phase of a program and would be non-existent as a new phase was entered. The Aeronautical Equipment organization strongly felt that communications was weak in the interaction with the Program Control functional group. Here there existed the "dual Matrix" problem which perhaps accentuated the importance of the communications channels. The reason for poorer communications in this instance was that the Program Control resources were spread too thin over the Deputate and that frequently personnel were simply unavailable when needed by the program groups. This finding was further confirmed under the separate investigation of the allocation of resources at ASD (Statement 7).

STATEMENT 6: Program priority dictates the degree of support rendered by the functional organizations.

Respondents	SA	A	U	D	SD
Functional	0	1	1	2	0
Programs	2	2	0	2	0
TOTALS	2	3	1	4	0

This issue was raised with the sample groups to determine if there was any significant correlation to an investigation conducted by J. Cianfrani in 1976 with the Naval Material Command's matrix project offices. In Cianfrani's analysis of ten major project offices in both the Sea Systems Command and the Air Systems Command, he concluded that most project managers believed that "the project charter and system priority will not influence functional personnel" (2:21). Cianfrani recommended that the program manager allocate much of his energy and that of the project staff to formalizing in writing specific tasks the functional organizations would perform complete with task descriptions, due dates, levels of support and collocation periods. He believed the effectiveness of the program manager in obtaining satisfactory agreements with these functional heads was independent of the project priority and directly a function of the project manager's persuasive expertise, referent powers and personal abilities (2:23).

Although the findings at ASD generally supported Cianfrani's findings, there were some significant differences. The exceptions to the consensus were noted by higher management individuals where the respondents indicated that large, nationally prominent programs such as the F-16 aircraft, B-1 Bomber, etc. would without question maintain whatever level of support was required to insure successful completion of the program. At the middle and lower ASD management levels the opposite consensus was reported. These personnel, while agreeing that formalized priority had somewhat little weight, believed

that the phase of the program (e. g. conceptual, validation, production) dictated to a large degree the extent of support rendered by the functional groups. They also believed that "surge" resources would readily be made available during source selection activities, critical design reviews, etc. when the smaller programs required increased levels of support. There was not uniform agreement on this point, however, as the personnel from the Aeronautical Equipment Deputate stated quite clearly that the level of support afforded the majority of the smaller programs within this organization was less than desired and was reduced as a result of matrixing at ASD. Another significant finding was that the rank of the head of the "user" organization greatly affected the degree of support rendered by the functional groups. Most of the "super SPOS" and other deputies at ASD are headed by General Officer level personnel, while the functional groups are headed by Colonels. It was generally conceded that the prestige and referent power associated with the organizations having General Officer heads resulted in higher levels of support from the functional organizations than other "user" activities. There was also the expected report that the "squeaky wheel gets the grease!". This comment was provided by a functional manager and reinforced comments reported by several program managers who emphasized the continual competitive environment that exists among the groups in the allocation of the limited resources.

STATEMENT 7: The matrix structure affords "savings" in manpower, material resources and costs of operation.

Respondents	SA	A	U	D	SD
Functional	0	1	1	2	0
Programs	0	0	2	4	0
TOTALS	0	1	3	6	0

The majority of the personnel responding indicated that they either didn't know at their level within the structure, could not observe the savings, or did not accept the premise based on shortages currently being experienced. The one individual agreeing with the premise qualified it by stating that the savings were not in terms of hard numbers of man hours saved, but more of a gain in "efficiency" of use of the available resources. Higher level managers indicated that it was too early to tell if the full matrixing at ASD would provide significant manpower savings. This correlates closely with a report from the corporate ASD staff presented in November 1976 to Hq AFSC concerning the implementation of the matrix (11:10). The briefer here stated:

> The primary goals of matrixing are improved flexibility and improved overall productivity. The latter takes time to develop. The immediate impact of matrixing may actually be demand for increased man power to satisfy the new central overhead responsibilities of the functional organizations (11:15).

In order to better assess the material advantages to matrixing, additional data was gathered from Hq AFSC sources pertaining to the manpower trends over the last several years at ASD. This data is summarized below (Source: AFSC Historical Office):

ASD PERSONNEL RESOURCES

	1974	1975	1976	1977
OFFICERS	1222	1302	1416	1489
AIRMEN	434	792	1101	921
CIVILIANS	4380	4643	4692	4760
TOTALS	6036	6737	7209	7170

A further breakdown of the above resources is provided from data available for two of the functional organizations at ASD, the Deputy for Engineering and the Deputy for Procurement. This information is provided below:

DEPUTY FOR ENGINEERING *

	1974	1975	1976	1977
OFFICERS	291	298	299	289
AIRMEN	24	24	24	22
CIVILIANS				
(11-15)	1019	1021	1023	1024
(7-10)	102	114	98	57
(6 & blw)	274	246	221	231
	1395	1381	1342	1312
TOTALS	1710	1703	1665	1623

* Matrix structure first implemented in 1964

DEPUTY FOR PROCUREMENT

	1974	1975	1976*	1977
OFFICERS	20	36	77	159
AIRMEN	1	9	9	10
CIVILIANS				
(11-15)	89	154	334	435
(7-10)	11	20	38	70
(6&blw)	61	120	195	270
	161	294	568	776
TOTALS	182	339	654	945

*Initiation of Procurement matrixing function (Jul 76)

The data presented in the various tables indicates several trends. First, ASD as a corporate structure has begun to level out the total man power strength over the last two years. Projections for 1978 (not shown) indicate that a slight reduction (7,066) from the 1977 level will be implemented. The civilian population in particular has remained basically static for the past two years and the Deputy for Engineering man power levels has stabilized recently at the constant level of approximately 1600 personnel.

However, one particular trend which is noted is that of increased levels of manager strength in the GS 11-15 grades relative to lower grades in the Deputy for Engineering. This "creep" in management layering is tabulated in the chart below:

DEP FOR ENGR	1974	1975	1976	1977
% GS 11-15 to lower civ grades	73	74	76	78
Ratio of GS 11-15 to lower civilian grades	2.71	2.83	3.20	3.55

Although data is not available for the total ASD structure it is postualted that this "grade creep" experienced in the Deputy for Engineering is a result of the matrixing. This observation correlates well with studies performed by C. J. Middleton of the Harvard Business Review who reports:

> A predictable result of using the project (matrix) approach is the addition of organization structure and management position. Thus: One aerospace company compared its organization and management structure as it existed before it began forming the matrix structure with the structure that existed afterward. The number of departments had increased from 65 to 106, while total employment remained practically the same. The number of employees for every supervisor had dropped from 13.4 to 12.8 It also found it had 11 more vice presidents and directors, 35 more managers and 56 more second level supervisors. (15:27-28)

The author further points out that the sum effect of the matrixing was the creation of 60 more management positions.

Another trend noted in the Deputy for Procurement was that there was an initial increase in personnel requirements upon implementation of the matrix (1976), especially in the upper to lower civilian management. The ratio average for 1974-1975 between GS-11/15 to lower grades was 1.16. After matrixing, this ratio increased to an average of 1.35 for 1976-1977. However, the stabilization of the Engineering organization indicates that matrixism, over a period of time will reach an equilibrium once the inter-organizational requirements settle out.

Statement 8: The need to collocate personnel within the project organization outweighs the potential loss of "corporate memory" to the functional organizations.

Respondents	SA	A	U	D	SD
Functional	0	1	0	3	0
Program	2	4	0	0	0
Totals	2	5	0	3	0

In general the program office respondents indicated a strong need for collocation in order to maintain operational control and develop an effective working rapport with support personnel. Respondents indicated that the "dedicated" personnel, when they were not physically a part of the day-to-day working operation, was an ineffective arrangement which reduced productivity and communications. The program manager personnel also indicated that without collocation, the personnel would not be subject to performance appraisal by the program office and hence the effective influence of the program manager with these individuals was reduced.

The data also shows, however, that the functional managers did not believe that collocation was to be favored "at the expense"of maintaining an effective corporate memory. They expressed the opinion that the corporate memory must be sustained if the matrix is to remain effective over the long haul. These two diametrical positions remain one of the fundamental areas of conflict in the matrix structure.

Questions 9, 10 and 11 were open-ended concerning the areas dealing with conflict, day-to-day management techniques, and suggestions for improving the matrix management process at ASD.

In response to the question concerning typical sources of conflict experienced by program and functional managers, the following is a listing of the more frequently mentioned areas:

1. Conflict over man power resources (includes dedicated/collocation issue.

2. Perception of reduced loyalty of functional personnel to the program office.

3. Program/functional differences over technical and contractual approaches.

4. Unsatisfactory personnel quality.

5. Unsatisfactory functional response time to program offices.

6. Reduced social interaction.

The above areas are presented in order of perceived priority. However, although the competition over man power resources is ranked first, the most emotional issue discussed was that of the loyalty issue. Program managers expressed deep concern that they could not confide 100% in subordinate functional personnel assigned to the program, especially in the areas of program costs/budget. The situation described was that if a given program were underrunning its fiscal year dollar allocation and would prefer to spend the money on previously deferred program unique areas, there existed the possibility that the functional support personnel would advise the home office of this situation and the head of the functional group may recommend re-programming of this money elsewhere within the overall ASD structure. Respondents have indicated that this may have actually occurred and has had adverse impact on the particular program office's interaction with the functional support group.

Conversely, the functional manager in this case reported that this situation was handled properly from the corporate viewpoint in that excess dollars on any program within ASD should not be re-prioritize within a given program necessarily but should certainly be reviewed in terms of the total ASD requirements.

Items 3 and 5 coincide closely with reported results by Skowronek and others as shown in figure 5 and Table II (technical and schedule issues). These areas of conflict can become quite serious --- in one case the program office actually made it a matter of informal policy that functional home office coordination would be sought only if absolutely necessary. This practice was reached to avoid and minimize controversy and delays based on previous experience this office had with the functional department.

The issue over personnel quality stemmed principally from program managers' experiences with the program control function. It was reported that because of considerable shortages in the overall functional staff, the resultant average quality of the individuals assigned to support their specific program was less than desired. This in turn caused an increase in the workload of the program manager and his assistant in maintaining surveillance and tighter control than normal, in the areas of cost and schedule, program review perquisites, etc. The functional managers indicated current problems in meeting the manpower support requirements necessary to service the various ASD programs, but that initiatives were in process to correct this imbalance. It was also revealed that a formalized training program was being developed to increase the expertise of assigned functional personnel in the their specialty areas. Most of the present problems appeared to be based on the turbulence created during the initiation of the matrix

in the Program Control department. The corporate ASD management was aware of the situation and steps were in process to reallocate resources among the various ASD deputates. Members of one deputate advised that they were being pressured to "centralize" their Program Control resources currently distributed throughout the deputate on a collocated basis in order to free up personnel resources for reallocation to other ASD deputies. This rearrangement would more closely parallel that of the Aeronautical Equipment deputate which had a "dual matrix" arrangement in the Program Control area. The former group was not in favor of this reallocation as they perceived an overall reduction in program effectiveness. This reaction was supported by comments from the Aeronautical Equipment group who was experiencing the original difficulty with the program control support as a result of inadequate resource allocation.

The responses to question 10 concerning specific management techniques currently being utilized at ASD within the matrix were broad and general. Overall, most program managers utilized informal verbal agreements with their respective functional managers as the basis for daily working arrangements. The ASD regulation was mentioned frequently as the formal document spelling out the functional and program manager roles. In particular, the "senior collocate" was held responsible for negotiating support requirements for the particular program with the functional office. If he could not work out a satisfactory agreement, the issue would be escalated to whatever level was necessary to resolve the conflict. Escalation of these differences rarely exceeded the Deputy level. The use of specific task descriptions, work packages, letters of agreement, etc. were the exception among the various offices interviewed. The functional manager, however, reported an increasing level of activity to develop a short term forecasting capability

(90-180 days) to delineate future support requirements. To this end they were developing PERT techniques and other management information systems within the functional staff to detail out the workload requirements for each program over time so as to be able to better plan and organize their resources to meet the various program requirements. In one instance a computerized approach was being developed to reduce the overhead burden on the functional staff once this method was debugged and implemented. All organizations reported that the monthly program reviews given by the program managers and the monthly functional reviews presented by the functional heads proved to be a very effective tool in maintaining visibility as to the level of support and its adequacy over the various programs. This technique also provided the ASD corporate staff the necessary information to render top level decisions on resource allocation when this action was needed.

The final question (#11) solicited suggestions from the ASD personnel on ways to improve the matrix management at ASD. These responses have been incorporated in the discussions presented in Section IV of this report.