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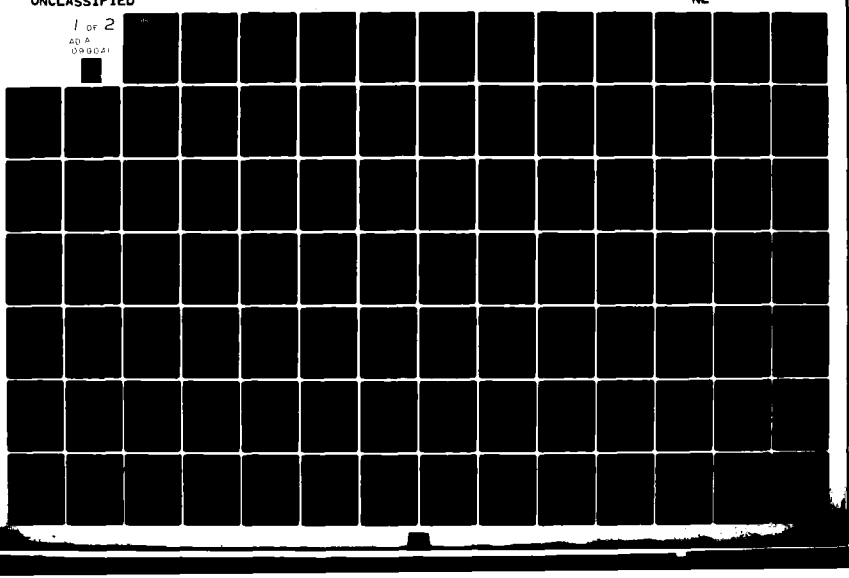

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AN ANALYSIS OF SUCCESS IN SYSTEMS PROGRAM MANAGEMENT.

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Prepared for

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

This study investigated the definition of, and causes for, success in United States Air Force system program management. The major activities were to (1) construct a classification of success criteria; (2) identify the most successful Air Force system programs in the period 1965-1980; and (3) suggest the important reasons for system program management success. Data was gathered through (1) a survey questionnaire sent to current and former senior Air Force and Office of the Secretary Defense personnel; search of oficial historical and congressional records; and (3) a review of

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published and unpublished literature. The study concluded that system program management success generally is defined more in terms of how well the deployed system performs than how close the program cost, schedule, and performance requirements were met. Likewise, the leading causes for success tend to be expressed by factors such as (1) user understanding of the system's military utility and (2) how well the system actually worked. The report suggests that a program manager, to be successful, must above all else be able to thoroughly articulate the system's end use; with this understanding, programmatic structure and decisions can be properly defined and defended through every level of the acquisition organization.

SUMMARY

A. Research and experience provide convincing evidence that no magic ingredient or precise mathematical formula has yet been nor will ever be found to guarantee that a program manager will succeed. This study has concentrated on the concept "to succeed," to include the attributes and important causes of success.

B. The study was conducted in two phases: first to develop a classification of success attributes, then to use the attributes to identify the most successful Air Force programs in the 1965-1980 time period and prepare a list of the most notable causes for their success. The desired payoff of the study is that a knowledge of what is and what causes success will directly assist Air Force program managers in developing acquisition strategies and directing their programs.

C. PHASE I

1. Phase I had as its objective: Defining Success Criteria. The fundamental question was "What is system program success?"

2. Two working hypotheses formed the basis for investigation of the Phase I objective:

a. Hypothesis I. System program success is defined in terms of (a) the program's record in meeting directed cost/schedule/performance (CSP) requirements, and (b) the program's system's ability to attain and maintain a military effectiveness.

b. Hypothesis II. The closer one is to the Program Office (in an organizational sense), the more likely it is that success will be defined in terms of meeting CSP requirements.

3. All research was directed toward the following overall objectives:

a. Developing a classification of success criteria.

b. Supporting/refuting the hypotheses.

c. Developing a list of major programs felt to have been successful.

d. Suggesting possible reasons for program success (as inputs to Phase II).

4. Primary research was conducted through the use of a mailed survey questionnaire. The questionnaire was prepared, tested with five representative program management experts, approved by Air Force Military Personnel Center, then mailed to a population of 110 personnel who were or are currently occupying the following positions:

- o HQ USAF/RD/LE/XO
- o HQ AFSC/CC/CV
- o ASD/ESD/SAMSO/CC
- o OSD/USDR&E
- o /ASD (PA&E)
- o /ASD(C)
- o Contractor and Air Force program managers from ten programs from each product division over the 1965-1980 period.

5. Secondary research was performed through literature search of private sector, non-military authorities and of defense (military) related material at Washington, D.C. locations such as:

American University Library
Defense Systems Management College Library
Federal Acquisition Institute Library
George Washington University Library
HQ Air Force Systems Command Technical Information Center

6. The study resulted in these findings:

a. Little effort is made in management literature to define success in program management. Success is used to mean fulfilling the objectives of the organization.

b. In the private, non-military sector, program success usually is equated with product success. The basic method of evaluating a program is the size of the financial return from the resulting product. Hence, program managers are very knowledgeable of and sensitive to the expected product use.

c. Within the Air Force environment, program management is described by AFSCP 800-3 as a process of completing program objectives. Some authors suggest that these objectives are passed down to the program manager as his/her "mission."

d. In the success classification developed, the criteria under the element "System Worked Well When Needed" were listed with higher frequency and importance than "Accomplished Program Objectives."

e. Hypothesis I, "System program success is defined in terms of (a) the program's record in meeting directed cost/schedule/performance (CSP) requirements, and (b) the program's system's ability to attain and maintain a military effectiveness," was substantiated. The respondents believed that a system program is judged to be a success on the basis of how well the following criteria (in order of importance) have been met:

(1) The system was operationally capable.

(2) The program met its cost/schedule/performance requirements.

(3) The program maintained stability of program objectives.

(4) Deployment of the system was timely.

(5) There were sufficient numbers of the system to be militarily significant.

f. Hypothesis II, "The closer one is to the Program Office (in an organizational sense), the more likely it is that success will be defined in terms of meeting CSP requirements," was not substantiated. The two most important factors, irrespective of organizational perspective, appear to be (a) Deploying a capable system and (b) Producing a system for which the operational requirement has been clearly established.

g. The five major Air Force System programs felt to be the most successful during the period 1965-1980 were:

(1) F-15

(2) C-141

(3) F-16

(4) Minuteman II and III

(5) F-5E/F

D. PHASE II

1. Phase II of this research study had as its objective: Determining Successful Programs. After meeting this objective, the study phase considered the fundamental question "What are the reasons that certain programs are successful?"

2. The two working hypotheses which formed the basis for investigating the Phase II problem and fundamental question were:

a. Hypothesis III (NOTE: The first two hypotheses were used in Phase I): System program success is impeded because the Program Manager is disciplined to meet Cost/Schedule/Performance (CSP) requirements and to resist changes which may be necessary to ensure long term military effec-

tiveness of the system. This factor causes the acquisition management process to focus on the program objectives instead of the defense weapon system objectives.

b. Hypothesis IV: The most important determinant of system program success is the clarity and understanding of the intended military mission.

2. Research was conducted by the use of an investigative worksheet using historical and programmatic records at HQ USAF and HQ AFSC. Of the list of 40 major Air Force programs during the 1965-1980 period, 22 were evaluated, and 18 were not considered because of program age, scope, or security classification.

3. The study results led to the following:

a. All causes of success were classified under these five main input parameters:

(1) Attention to directed CSP requirements.
(2) Ability to maintain tight control.
(3) Adequacy of means to accomplish program objectives.
(4) Support for the system program.
(5) Existence of clear requirements.

b. Using the success criteria developed in Phase I, the most successful Air Force programs of those evaluated in the 1965-1980 period were determined to be:

Most Successful	Moderately Successful
C-141	Gunship
AGM-65 Maverick	F-15
F-5E/F	SRAM
F-16	A-7
E-3A	A-10
	KC-10

c. The Minuteman II/III program, felt by the survey questionnaire respondents to be one of the most successful programs, was not included in the top two success classes because of the Minuteman II program results. Rated on its own, the Minuteman III program would have been included in one of the top success classes.

d. Important causes for program success included:

(1) Availability of technology.
(2) Strict adherence to system performance/supportability.
(3) Funding was consistent.
(4) The system (program) was supported by HQ USAF.
(5) Continuity and authority of the program manager.
(6) The requirement was responsive to the threat.
(7) The contractor demonstrated excellence.
(8) Emphasis on change management.
(9) Ability of program office to maintain tight control.
(10) Attention to directed CSP requirements.

e. Hypothesis III, "System program success is impeded because the Program Manager is disciplined to meet CSP requirements and to resist changes which may be necessary to ensure long term military effectiveness of the system," was not substantiated. Collected data indicated that the desire for system effectiveness exceeded that for adherence to CSP requirements.

f. Hypothesis IV, "The most important determinant of system program success is the clarity and understanding of the intended mission," could not be substantiated. One input sub-parameter, "Availability of Technology," appeared to have the most importance.

g. The highest priority causes of system program success are availability of technology and strict adherence to system performarce. A review of the most successful programs revealed various methods to enhance these causes:

(1) Prototype to demonstrate technology.
(2) Extensive operator input in testing.
(3) Use of off-the-shelf components.
(4) Follow-on from a mature system.
(5) Modification of a mature system.

h. System program success tends to be measured in terms of how affirmative and strong the answers are to the following questions:

(1) Does the user understand what to do with the system to obtain military utility?
(2) Does the system work well?

E. Several issues were raised based on the results of this study:

1. What methods are used within the program office and by the acquisition management review process to estimate, measure, and control military utility?

2. What will be the effect of severely restricting entry of operationally experienced personnel into the acquisition management career field because of personnel shortages?

3. Are there correctable deficiencies within the Air Force requirements process which impede system program management success?

CONTENTS

SECTION I BACKGROUND

"Philosophers' stone. An imaginary substance sought for by alchemists in the belief that it would change base metals into gold and silver."

The objective of this research study was not to produce a "Philosophers' stone" which could be applied in just the right amounts by Air Force program managers to ensure success. Based on research and experience, it is safe to believe that no magic ingredient or precise mathematical formula has yet been or will ever be found to guarantee that the program manager will succeed. This study, instead, has concentrated on the concept "to succeed."

The objective of every manager is to succeed. This assumption, logical and supportable to the point of being self-evident, applies in every organizational endeavor. Air Force program managers face the question: How do I know if I did succeed? The answer--if their program was successful--becomes the basis and reason for analyzing success in systems program management.

Air Force program managers lack their private sector counterpart's all-powerful "Bottom Line." Success criteria in the private sector are generally expressed in terms of financial return. The private sector's product (or system) quickly demonstrates its ability to perform its mission, so a judgment of the program (which includes the product) is fairly straight-forward.

In Air Force system program management, defining success requires consideration of the duality of purpose faced by the program manager. First, the program--that is, the myriad of activities to complete an acquisition cycle--has a life and series of standards of its own. Second, the resulting system has success criteria totally divorced from those of the program. It is very apparent that much effort is expended to increase the manager's ability to accomplish the program activity tasks. Consider the amount of training in Defense Systems Management College and Air Force

Institute of Technology program management courses on financial and schedule control. Then, consider how little time is devoted to perfecting management techniques which help assure that the resulting system will provide the necessary military utility. How many program managers, for example, track and control planned system capability vs. threat with the same zeal as they do the program costs?

There is a need to identify what defines success in system program management so that policies and procedures which enhance success can be strengthened, and practices which inhibit success can be changed. Program managers, knowing how success has been defined (and aided) in the past, can then better develop and implement acquisition strategies which will help their program and themselves "to succeed."

SECTION II OBJECTIVES AND METHODOLOGY

A. PHASE I

1. Objectives

a. Statement of the Problem. Phase I of this research study had as its objective: Defining Success Criteria. The fundamental question was "What is system program success?"

Care must be taken to distinguish between cause and attribute. Phase I concerned attributes, or what is success. Phase II of this study considered the causes or whys of success.

The word "criteria" in the statement of the problem is used in the meaning (Webster's New World Dictionary, 1966) "A test by which a judgment of something can be formed." For Phase I, the challenge was to define and prioritize those tests to which system program activities and results can be subjected so that a worthwhile value judgment may be made.

b. Hypotheses. Two working hypotheses formed the basis for investigation of the Phase I problem:

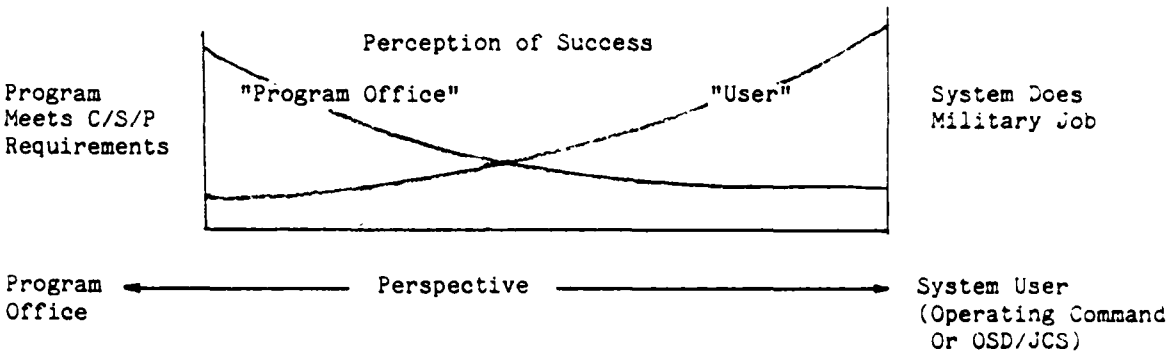
(1) Hypothesis I. System program success is defined in terms of (a) the program's record in meeting directed cost/schedule/performance (CSP) requirements, and (b) the program's system's ability to attain and maintain a military effectiveness.

(2) Hypothesis II. The closer one is to the Program Office (in an organizational sense), the more likely it is that success will be defined in terms of meeting CSP requirements.

The two hypotheses are discussed in the following two paragraphs:

(a) Hypothesis I established the framework for the extended classification of system program success attributes. This classification is discussed in Section III.

(b) Hypothesis II viewed the two broad elements of system program success from the perspective of all organizations involved with defense system acquisition and management. Conceptually, this hypothesis can be shown as:



This conception does not imply that the Program Manager does not care if the system does its military job, or that the user does not care if the program meets its CSP requirements. The conception portrays the philosophy of "I'll just worry about my own job and let somebody else look after the big picture."

c. Research Objectives. All research was directed toward the following overall objectives:

(1) Develop a classification of success criteria.

(2) Support/refute the hypotheses.

(3) Develop list of major programs felt to have been successful.

(4) Suggest possible reasons for program success (as inputs to Phase II of the study).

c. Methodology of Study Phase

a. Overview. Phase I of this study was accomplished as a series of tasks. Phase II (described in paragraph e of this section) was similarly organized. Activities and notable occurrences of each task follow.

b. Task Activities

(1) Task I-A: Prepare Detailed Plan of Approach. This plan, required by contractual SOW requirement I.-.'.', was prepared and presented to AFBRMC on 'b October '9cc. Task descriptions and a study schedule were provided. The plan also included the original "Contract Management Summary Report." This report has been updated and submitted monthly to show cost, schedule, and task accomplishment status.

(2) Task I-AA: Brief Air Force Business Research Management Center (AFBRMC) Personnel. Major Frederick Y. Smith, AFBRMC, was briefed on October '5, '9cc. The Plan of Approach and proposed survey questionnaire were reviewed and submitted to AFBRMC.

(3) Task I-B: Determine Survey Population. The study team prepared (and received AFBRMC approval on '0 November '980) a survey population list composed of individuals who occupied the following positions from '965 to 1980:

- HQ USAF/RD
  - LE
  - XO
- HQ AFSC/CC/CV
- OSD USDR&E
  - ASD (PA&E)
  - ASD (I)
- ASD/CC
- ESD/CC
- SAMSO/CC
- Contractor and Air Force program managers from ten major programs from each product division over the 'bts-'8b period.

The population list is at Appendix 1.

HQ USAF/MPG, rather than provide the addresses of most active and retired generals (to ensure privacy), kindly agreed to address the survey questionnaires. Their assistance was appreciated.

Current addresses of the other survey participants were located and used.

(4) Task I-C: Prepare Survey Format. The survey questionnaire was structured to provide data to fulfill the research objectives. A dry run of the questionnaire was made with this representative sample of Air Force program management experts (all O-6/GS-15 grade):

Representing	Position
HQ AFSC	Assistant DCS
HQ USAF	Exec SAFAL (RD&L)
Product Division	Former SPD at ASD
SPD	Former SPD of ALCM
OSD	Associate Dean, DSMC

Comments from the dry run were incorporated into the questionnaire format.

Two minor problems were experienced with this task. First, there existed no definitive list of major programs from 1965-1980. Through the cooperation of HQ AFSC/SDD and HQ USAF/CVS, the list was compiled. Second, obtaining HQ AFMPC/YPS approval for the survey questionnaire took almost three weeks longer than the planned 16 days.

The approved Survey Questionnaire is at Appendix 2.

(5) Task I-D: Obtain the Survey Data. Questionnaires were mailed to 110 respondents between 26 November and 4 December 1980. Respondents returned the completed questionnaires in stamped, addressed enve-

lopes. A follow-up reminder letter was sent to non-answering respondents on 7 January 1981.

Also, secondary research was conducted in Washington-area institutions. Secondary research/literature search activities and results are described in Section IIIA/B of this report.

(6) Task I-E: Define Success Criteria. The task required that a classification of success criteria be developed, and a list of programs believed to be successful be prepared. Section III discusses two top level classifications suggested by secondary research, and the classification required by the study's SOW.

(7) Task I-F: Prepare Phase Report. The data and results of Phase I, plus a detailed plan for Phase II were provided by an Interim Technical Report dated and delivered 31 December 1980.

(8) Task I-FA: Brief Phase I Results. The Study Team Leader briefed AFBRMC personnel at Wright-Patterson AFB, OH, 15 January 1981, on results of Phase I.

3. Research Methods

a. Primary Research

(1) Survey Questionnaire

(2) Personnel Interviews (Respondents contacting Study Team Leader if desired).

b. Secondary Research

(1) Literature search, Non-defense private sector.

(2) Literature search, Defense sector, including unpublished research reports and case studies.

B. PHASE II

1. Objectives

a. Statement of the Problem

Phase II of this research study had as its objective: Determining Successful Programs. After meeting this objective, the study phase considered the fundamental question "What are the reasons that certain programs are successful?"

Results of this study's Phase I have provided a classification of system program management success. This listing became the criteria to apply to major Air Force system programs so that a rank order of successful programs could be made. Having identified the most successful programs, the study effort attempted to establish causal relationships between management inputs and demonstrated program success.

b. Hypotheses

The two working hypotheses which formed the basis for investigating the Phase II problem and fundamental question were:

(1) Hypothesis III (NOTE: The first two hypotheses were used in Phase I): System program success is impeded because the Program Manager is disciplined to meet Cost/Schedule/Performance (CSP) requirements and to resist changes which may be necessary to ensure long term military effectiveness of the system. This factor causes the acquisition management process to focus on the program objectives instead of the defense weapon system objectives.

(2) Hypothesis IV: The most important determinant of system program success is the clarity and understanding of the intended military mission.

c. Discussion of Hypotheses

Hypotheses III and IV are related through the idea that without a concise, clear-cut knowledge of desired system use, the System Program Manager cannot understand nor endorse changes to the program baseline, so adopts a position of defending the status quo. This position finds meaning in the expression "It's their (the operator's) system, but it's my program." Hence, any proposed change becomes viewed as a threat to the program (and program manager).

The study phase used Hypotheses III and IV in the process of determining what programs were successful and why. If collected data could substantiate the two hypotheses, the conclusions should show:

(1) System Program Managers believe their programs CSP requirements are their personal standards of success.

(2) System Program Managers can and will enthusiastically effect necessary changes to programs only when the resulting improvement of the system to do its mission can easily be perceived.

(3) The simpler the system military mission can be explained, the more support the whole bureaucratic organization will give the program and program manager.

2. Methodology of Study Phase

a. Task Activities

(1) Task II-A: Prepare Program Population. Using data available at HQ USAF and HQ AFSC (the significant data sources for Phase II), a listing was prepared of all USAF major programs which have experienced a DSARC III (or equivalent) milestone from 1 July 1965 through 30 April 1980, and which resulted in definable, deployable weapon systems. See Section IV-B for a discussion of this task list.

(2) Task II-B: Prepare List of Input Parameters. A list of input parameters was determined by research of each population program and Phase I results. This list was reviewed by and coordinated with AFBRMC, effective 23 January 1981.

(3) Task II-C: Obtaining Input Parameter Data. Each population program was analyzed to obtain the input parameter data as specified in Task II-B.

(4) Task II-D: Ranking Programs Into Success Classes. Each program was analyzed using the Success Criteria determined in Phase I. The analysis resulted in categorizing each program into Success Classes.

(5) Task II-E: Compare Successful Program Rankings. The programs in the top two Success Classes of Task II-D were compared with the "list of programs felt to be successful" from Task I-E. Significant anomalies are discussed in Section IV-C.

(6) Task II-F: Analyze Input Parameters for Successful Programs. From the list of programs in the upper Success Classes (Task II-D) as generally validated by the Task I-E list, each group of input parameters was analyzed to determine those input types which appear to be the most correlatable with program success.

(7) Task II-G: List Input Factors Associated with Successful Programs. The input parameters/factors (both controllable and uncontrollable) which appear to correlate with program success were identified and are listed in Section IV-D.

(8) Task II-H: Prepare Phase Report. The data and results for Phases I and II, with hypotheses results described, has been prepared as a Final Report. The ADTECH Study Team Leader shall brief AFBRMC personnel at Wright-Patterson AFB, OH on results of this report. The briefing shall be modified as directed, then formally presented to representatives of AFRDC and AFSC.

3. Research Method

The basic method used for research during this study phase was research of official records. Historical and programmatic documentation at HQ USAF and HQ AFSC included the following types of official records:

a. Selected Acquisition Reports (SAR).
b. Official Histories.
c. System Program Monographs.
d. Program Assessment Review (PAR) briefings.
e. Published and unpublished literature.

(NOTE: This report contains no quantitative program data of any type.)

SECTION III ATTRIBUTES OF SUCCESS

Overview. This section responds to Section C.4.1 of the SOW, and expands the findings of Interim Technical Report F33615-80-C-5184-I to include all survey questionnaires received through 13 February 1981. The discussion order for this section is success in the non-military sector, success in the military (defense) sector, Hypotheses I and II (to include a classification of success criteria), and some overall observations concerning success criteria.

A. Success in the Private, Non-Military Sector.

1. Research purpose: Through secondary research, determine the views of private sector, non-military authors on successful or effective program management. Sub-objectives included:

a. Estimate the importance of program management in the total management environment.

b. Seek case study examples as contrasts between unsuccessful and successful programs.

c. Through the literature, compare the emphasis placed on the project itself vs. the resulting product.

This secondary research was conducted through a review of books and periodicals at the following locations:

American University Library
Andrews AFB Base Library
Defense Systems Management College Library
Federal Acquisition Institute Library
George Washington University Library
Headquarters Air Force Systems Command Technical Information Center

Industrial College of the Armed Forces Library
Report Abstracts from DLSIE, DDC, DTIC, and Air University

All information facilities were searched using these key words:

Management, Program
Management, Project
Program Management
Project Management
Success
Systems Management
Weapon System Management

2. Research findings: Views of success in the private, non-military sector.

a. Importance of Program Management. Program management, in a non-military environment, is not the ordinary mode of management (functional management is). Also, the term "program" is sometimes used interchangeably with "project," and at other times used to mean a long-term undertaking made up of more than one project. The output of a program is, for the most part, a product. Hence, the three terms, program-project-product, may be referring to the same process. For definitional purposes, there is some justification to show that program management encompasses the project activities which result in a product. The remainder of this report will use the definition for the private, non-military sector that a program consists of projects which yield a product.

The non-military program manager, while concerned in the short run about project progress, is expected to stay with the program until the product either performs or fails to perform its mission. Hence, the non-military program manager devotes considerable attention to understanding the product's expected performance. Because of this knowledge of the product's goal, the non-military program manager is expected to define the standards of performance which will, in the end, determine if the product (hence the program) was a success.

Program management remains an exception within the non-military environment because of three primary reasons: First, it is not normally needed. Companies grow up using their predominant product as the main focus of organizational development. Program management, with its *ad hoc* connotation, is therefore not needed. Second, it is inefficient. Program management decreases the functional manager's ability to optimally use the existing personnel resources. Third, few personnel are trained or experienced to become effective program managers. The generalist is a rarity as rewards within a company encourage functional specialization. Additionally, program management training, as such, receives little support.

b. Case Study Examples.

(1) Ford Motor Company: Edsel vs. Mustang. The study team predicted that this classic management comparison would be an ideal example of project vs. product success. The team felt that data could be found to discuss the two programs in terms of project estimated vs. actual cost/schedule/performance (CSP) as indications of success. Accessable literature did not substantiate this avenue of investigation, however. All comparison involved the products--why Edsel as a commercial venture failed and Mustang succeeded. In this case example, the products' missions were identical: (sell many units) to provide to the company a substantial financial return. The project CSP requirements did not even rate a footnote in history.

(2) Motion pictures: Twentieth Century-Fox "Star Wars" vs United Artists' "Heaven's Gate." The most financially successful motion picture in history, "Star Wars," was over-budget when compared with original estimates; by definition an unsuccessful project. "Heaven's Gate," whose production cost escalated from its original budget of $11.6 million to over $40 million, was likewise an unsuccessful project and (having been withdrawn from distribution) was neither an artistic nor financial success. "Star Wars" was a spectacularly successful program; "Heaven's Gate" a spectactular failure.

Motion picture preparation exhibits many features of program management: single product, finite duration to produce, and unique preparation requirements (sets, locations, and personnel). Successful film production as program success is rarely reported on the basis of meeting cost or schedule estimates. The measures of success are financial return, artistic acclaim, or reception of awards by the film itself. The ideal, most successful motion picture would, in theory, maximize all three measures ("Gone With the Wind" comes to mind), yet still meet CSP goals. If CSP goals are missed and product success is gained, the program is a success. Hence, program success equals product success.

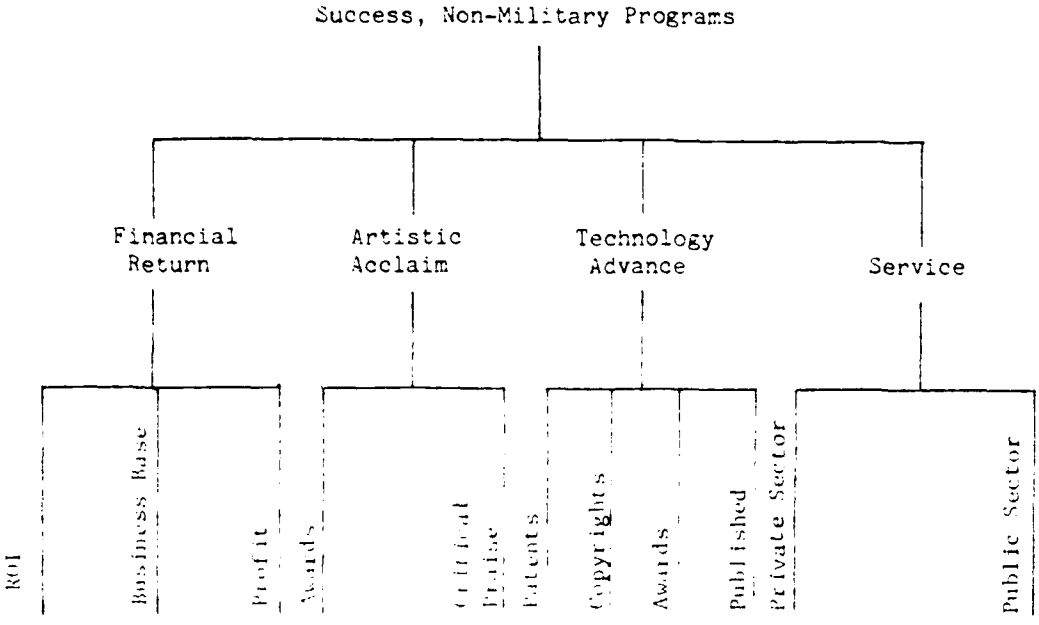
The failure of "Heaven's Gate" was not simply that it came in 3½ times over budget, but that it did not succeed in any of the three measures of success. An expected outcome of the "Heaven's Gate" experience, reports one recent article (2:26), is that in the future the directors will be held accountable for their budgets. If so, the interesting question which then comes to mind is: Would "Heaven's Gate" have been a success if it had come in on schedule for $11.6 million? If the same product had resulted (no financial return, artistic acclaim, or awards), the answer certainly seems to be <u>No</u>. The producer (closest equivalent to program manager) who turns out a "turkey" fails, no matter how close to the CSP goals he/she comes.

c. Project vs Product Emphasis. Although the case examples suggest that product success is paramount, there was some information in the reviewed literature which provided techniques for project management. Success was, in one instance, implied as the development of a system (or product) of the highest technical quality, developed at the lowest cost possible, in the shortest possible time. Assuredly, this would be an ideal situation.

Other sources suggested that the manager was responsible for defining the objectives, the standards of success, then the tasks by which the objectives were to be achieved. No insight was given to what success meant; instead, causes for success were listed. These causes were well discussed: program definition, careful planning, and adequate control.

d. Overall Observations. Literature on "How to Succeed" revealed little insight on how to define Program Management success. This seemed to be self-obvious; it was what the organization decided it should be. Project management techniques to meet CSP goals were described, and effective (or successful) management was discussed in terms of "how to" rather than "what is." The consensus position seemed to be that project (i.e., activity) success, while important, mattered much less than how well the product fared.

A top level success classification for non-military programs follows:



B. Success in the Defense (Military) Sector

1. Secondary Research. An important source of information concerning success in systems program management was from secondary sources. The purpose was to search the defense (military) related literature to determine how success is defined, discussed, or suggested. This search complemented the primary research because both secondary and primary research information came from the same population group: defense program management experts. The research investigated:

Published literature. Information in this category tended to be polished and sanctioned, reflecting an officially approved aura.

Unpublished literature. This information, though not as refined, reflected more of how the process really works as opposed to how it is supposed to work.

a. Research locations.

The literature search was conducted at the sources listed in III.A.1 (above) as well as:

Air Force Association Headquarters (Periodicals)
Unpublished student reports at:
Defense Systems Management College
Industrial College of the Armed Forces
National War College

b. Research findings:

(1) Program Management is Important. There is no doubt that program management is important in the defense environment. Program management has synonyms: project or systems management. The previous "program equals project plus product" definition used in the non-military area finds no counterpart here. Most writings use the terms program, project, and systems as equivalents when describing program management. This may be

important in defining success, because though used interchangeably, the terms program and system are not the same if the system means the resulting defense weapon system. Air Force program management is defined (AFSCP 600-3) as "The process whereby a single manager is responsible for planning, organizing, coordinating, directing, and controlling the combined efforts of Air Force contractors and participating organizations in accomplishing program/project objectives." Successful program management accomplishes program/project objectives to deploy a system. These program objectives are different from the program's product or system objectives.

(2) Definitions of Success are Rare. The literature contains many works on how success in program management is to be achieved through organization, technique, or managerial qualities. Usually the definition of success is absent with no reason being given for the omission. Two authors recognized a need to consider the meaning of success, but settled with:

"...If a successful program manager is one who managed a successful program, then a precise quantification of a successful program becomes important. Unfortunately, in most instances there is no standard for comparision; for no two programs are sufficiently alike in span, in time, or in content to permit direct comparison. Simply stated, a successful program is one that did not fail (2.20)."

"I will not attempt to define what a successful program manager is..." (2.7).

A recent report published by Air Force Systems Command (2.1) acknowledged that if the objective is to have a successful program, then a logical question is to ask what standards or measurements determine whether a program is successful. Besides meeting CSP goals, ten characteristics were suggested:

Recognized need
Management commitment
One individual responsible with authority

Sound technical foundation
Risk management
Comprehensive and dynamic planning
Good contractors with recent experience
Realistic requirements and schedules
A firm baseline with traceability
Capability available when needed

Only the last characteristic--capability available when needed--is an effect or output of a program. The other nine characteristics represent causes or inputs. One very precise definition of success was found in a paper (2.10) describing the Maverick AGM-65 program:

"Among indications of the program's success were the attainment by Hughes of all maximum positive performance incentives, the program receipt of the prestigious Daedalian Award and the attainment of a total of four stars by three former Air Force Maverick SPO Directors."

A description of the F-15 program (2.3) contained an inclusive goal for success: To build the best, on time, and within budget. This perspective places capability of the resulting product ahead of meeting the project goals in importance. Taking this perspective one step further was the former Director Defense Research and Engineering, Malcolm R. Currie. In prepared remarks to students at the Defense Systems Management College (2.8), Dr. Currie acknowledged the importance of adequate program definition and of using cost as a valid engineering design requirement, but concluded with his belief that "There's only one final judgment on the quality of a program. That is how well the defense system works in the field when it is needed."

(3) Success is Usually Equated with Meeting Program Objectives. Program management, by definition, is a process to accomplish program/project objectives. Little wonder, then, that most authors equate successful program management with attaining objectives. The question becomes: What are the program objectives?

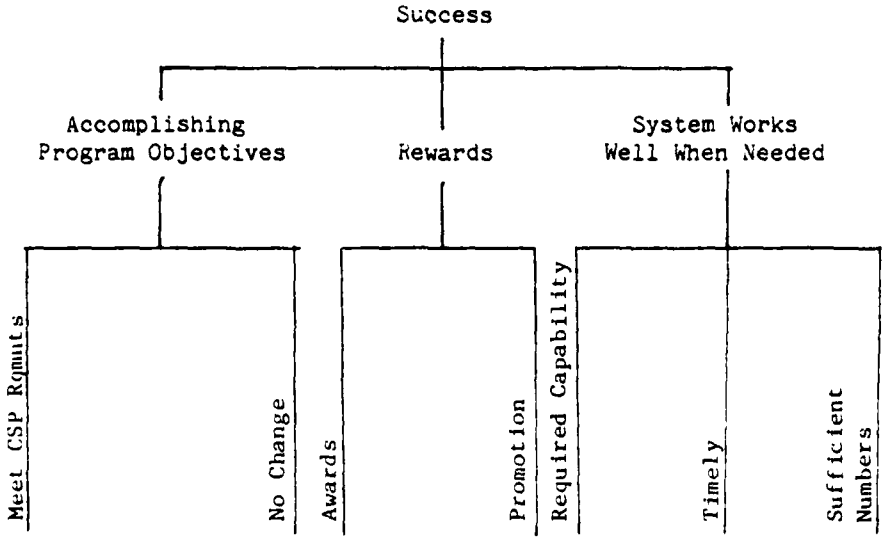
It is important to remember, when considering the derivation of program objectives, that program management for defense systems occurs in the military. Hence, all officers are bound by oath to do their utmost to achieve prompt and successful completion of the mission, and the mission is defined and assigned by military superiors. Basic program objectives become those which are established in the charter. In 1961, the then Secretary of the Air Force wrote (2.27) that "Discipline in defense procurement means the same thing that it does in combat--prompt response to orders...." In 1969, the commander of AFSC said (2.14): "...the System Program Director's job is management of a program. It is not to buy the best equipment that can be defined as the program development proceeds; it is to buy what has been approved, within the costs that have been established." This notion of defining program objectives to the program manager continues to the present, as described in October 1979 (2.5): Once clear and well-defined cost, schedule, and performance baselines are established, program directors cannot change them without a formal authorizing document.

In addition to the fact that program objectives are directed down the chain of command, and thus become the goals to which program activities are directed, DSP goals tend to be the objectives. These DSP objectives retain widespread use because they can be measured. Military managers lack the profit motive and other easily quantifiable measures of success of the resulting system (or product) (2.23). "Results in cost, schedule, and performance have been the standard measures of success in all our methods of managing defense systems acquisition. Such results are indeed the tell tale yardsticks.... They direct attention to a quantitative scale of success in terms of money, time, and engineering units" (2.24). It is easy to conclude that program objectives mean to most military program managers those DSP goals which can and will be measured by their military superiors within the acquisition community.

(4) Change is to be avoided. Today's AFSC program managers operate with a policy that DSP baselines, once established, can be changed only by formal direction. Weapon systems contracts and the pricing system tend to be based on the assumption that there will be no change (2.1),

Design change requirements may be equated (2.15) with problems which are the "seeds of overruns and degraded capability." An early study of the F-15 program success (2.22) gave the philosophy "Assuming that the job of defining goals and implementing them into lean specifications is complete, there should be no need for changes.... Once a program baseline is established, changes, while often tempting, should be resisted." The avoidance of change leads to more detailed definitions of program plans, which in turn leads toward airtight contracts and responsibility agreements in which the contractors and Government seem more concerned with protecting themselves from each other than in obtaining optimum systems within the constraints of time and the budget (2.9). If change is to be avoided, then, stability is desirable; it becomes a key (or perhaps a definition) of program success.

(5) Top Level Classification for Military Programs: This classification has been suggested through the secondary research:



2. Primary Research. The primary research instrument was a survey questionnaire (Appendix 2) mailed to the survey population listed in Appendix 1.

a. Information concerning the questionnaire.

(1) Population. The survey population was selected based on the following factors:

(a) Respondents had to be in decision-making positions with a broad view of the defense acquisition process.

(b) The number of desired responses was 50-60. The answer population was 110, and a 67% response rate from personnel of the proven responsibility of this group appeared reasonable.

(c) The orientation of the population was predominately that of the Program Manager because the Study Team believed that the Program Manager would have the clearest and most deeply held opinion of the definition of system program success.

(NOTE: Population respondents were furnished the Study Team Leader's name and telephone number if any additional dialogue was desired.)

(2) Questionnaire Structure. The questionnaire (Appendix 2) was composed of five parts. Respondents were requested to complete each part in turn, not returning to completed parts. This instruction was to avoid biasing responses to Parts I-III, because Part IV contained ten factors which could have been interpreted as the "answers" to what is system program success. The following list and matrix describe the research intent of each questionnaire part:

(a) Part I. Subjective, unstructured response.

Purposes:

1 Require respondents to consider the overall question of system program management success.

2 Define system program management success.

3 Substantiate/refute Hypotheses I and II.

(b) Part II. Requirement for specific choice of most successful programs, with reasons.

Purposes:

1 List attributes of successful system programs.

2 Identify programs felt to be successful.

3 Substantiate/refute Hypothesis I.

(c) Part III. Requirement for specific choice of least successful programs, with reasons.

Purposes:

1 List attributes of unsuccessful system programs (a method of negatively defining what is success).

2 Identify programs felt to not be successful.

(d) Part IV. Forced ranking of factors which define system program success.

Purpose: Substantiate/refute Hypothesis II.

(e) Part V. Selection and query of reasons for system program success.

Purpose: Input for Phase II of study.

Research Objectives	Questionnaire Part No. I	II	III	IV	V
1. Define system program management success	X	X	X*		
2. Substantiate/refute Hypotheses I and/or II	X	X		X	
3. List programs felt to be successful		X			X
4. Identify reasons for program success					X

*In negative terms

MATRIX: Research Objectives vs. Questionnaire Part.

---

(3) Effectiveness of questionnaire as research instrument.

(a) Response. As of 13 February 1970 (final date to allow inclusion within report), 38 questionnaires had been received. Of the 72 questionnaires mailed, four were returned because the addressee was listed as "deceased." Hence, there were 38 of a possible 68 who responded, for a response rate of 55.9% or 56%. While this rate is above the 50% rate normally expected from mailed questionnaires, it is below the 67% desired during the establishment of research methodology for this study.

(b) Industry involvement. Responses were received from [illegible] of the 11 civilian program managers from [illegible] companies who, according to the overall response rate, [illegible]

ment at the Defense Systems Management College, in a recent paper "The Interface Between the DOD Manager, the OSD Policy Maker and the Acquisition Researcher - A Study of Management by Compulsion," stated his belief that "Most acquisition research fails to take the industrial view into account...." The response results from this study indicate that industry involvement may not improve. Reasons for the lower involvement could include:

1 One respondent: "It's corporate policy to not respond to these type surveys. They have to be answered through the corporation headquarters."

2 Reluctance to provide any information which may appear to be derogatory toward important customer (Air Force).

3 Indifference to any activity which will not lead to a financial return.

(c) Reaction to questionnaire. Four specific comments concerning the effectiveness of the survey questionnaire were received:

1 Telephone, 23 Jan 81, previous Vice Commander, AFSC: "The questionnaire could not allow me to express the frustrations which were encountered in trying to do the job, but not being allowed to by OSD and Air Staff people."

2 Telephone, 5 Feb 81, previous DCS/RD, Air Staff: "The questionnaire struck me as another search for the magic formula to program management. And there's not one."

3 Letter accompanying returned questionnaire, 22 Dec 80, previous SPD on two major ASD programs: "The questionnaire is provocative but I am of the opinion that there should be face-to-face dialog on such research. There are simply too many facets for examination by mail...."

4 Letter accompanying returned questionnaire, 2 Feb 81, from previous DDR&E: "In general, I feel that your questionnaire is far too simplified to yield any deep insights into the elements of success or failure in our acquisition process. I could suggest that in-depth personal interviews of very experienced people both in government and industry could, with effort (versus computerized statistics) lead to the insights that would be valuable to AF management. There are a great many factors (political, personal characteristics, role of in-house laboratories,---etc.) which are often the crucial areas, as distinguished from those simplified text-book factors (adequate definition of job, work breakdown, management to schedule and cost, etc.). The subtle factors are usually not openly discussed, but they are the one that usually are the key to success or failure of a program."

b. Findings of Primary Research.

(1) Data Presentation.

(a) Population. The total respondent population was, for analysis purposes, subdivided into the following groups based on their expected perspective of the system program management process:

Group Perspective	Identifier	Includes
User	A	OSD/PA&E HQ USAF/LE/XO
↑	B	HQ AFSC/CC HQ USAF/RD OSD/USDR&E
	C	HQ AFSC/CV [illegible]
	D	ASD/ESD/SAMSO/[illegible]
	E	USAF SPOs
↓	F	Civilian PMs
Program Office		

(b) Survey Results. All six of the population groups were represented by the returned questionnaires:

Group Identifier	Number of responses
A	5
B	3
C	5
D	2
E	15
F	3

Data extracted from the returned questionnaires are presented in the tables of Appendix 3. Reference is made to these tables in subsequent discussions of research findings:

Table I Classification of Success Criteria
Table II Importance of Success Criteria
Table III Examples of Success Descriptions
Table IV Part IV Scores by Population and Questions
Table V Assumed Responses Per Question by Population Group
Table VI Average Response Per Question by Population Group

(2) Results of survey to determine what is meant by system program management success.

(a) Evaluation of Survey Questionnaire. In evaluating the initial returned questionnaires, it became apparent that the Part I instruction was not totally clear nor would Part I be completely successful in determining the effects or attributes of successful system programs. There were two difficulties encountered:

1 First, the question "...please describe what you believe is meant by successful system program management" could be interpreted as either successful system-program-management, in which case the emphasis was on how effective and efficient the actual management process was. On the other hand, an interpretation of successful-system program-management put the focus on how well the actual system turned out. This dual interpretation was faced all through this study: Does success come from the system or the program?

2 Second, some respondents concentrated on the causes of success rather than the attributes. Examples of these type descriptions are:

"Keeping managers aware of problems..."
"Negotiating the right kind of contract."
"Timely and adequate funding."

Parts II and III of the questionnaire provided clearer and more succinct insights to what system program management success is perceived to be. By requiring the respondent to tell why a program was felt to be successful, a rather complete list of attributes was constructed.

(b) Results. Tables I, II, and III present the consolidated answer to what system program management success means.

1 Table I displays the Classification of Success Criteria. The element 1.2 "Program and personnel rewarded" was included based on the secondary research, but no one, even a respondent who had been awarded the Air Force Association Meritorious Award for Program Management on two occasions, listed rewards/awards as indications of program management success. It is important to note that this classification is not exhaustive. Cost, for example, under element 1.1.1 "Fulfilled DCP/PMP Cost/Schedule/Performance (CSP) Requirements" could have been subdivided into literally dozens of cost goals. The classification includes the elements mentioned as most important in language program managers understand. This classification of success criteria for a major acquisition program satisfied the Study Contract SOW requirement 3.4.1.4.

2 Table II builds on the classification of success criteria by showing, from the viewpoint of the questionnaire respondents, the importance of each third level success criterion. At the third level, the most important criterion was "System Was Capable." As mentioned in the previous paragraph, no importance was placed on "Program and Personnel Rewarded."

Element 1 "Accomplished Program Objectives," though of lesser importance with 3 "System Worked Well When Needed," revealed one interesting finding. Respondents believed that a program which "Maintained Program Stability" was of moderate importance. Element 1.2 "Maintained Program Stability" begs this question: Is program stability an attribute (effect) or a cause of successful system program management? The importance of program stability will be raised again later in the Section IV discussion of reasons for program success.

3 Table III lists success descriptors by criteria elements. The 92 descriptors were extracted from all the returned questionnaires. This table is an amplification of Table II.

4 Appendix 4 to this report contains several questionnaire Parts I which showed unusual perception of the question of what is success in program management. The reader is strongly encouraged to review Appendix 4.

(3) *Results to substantiate or refute Hypotheses I and II.*

Hypothesis I. System program success is defined in terms of (a) the program's record in meeting directed cost/schedule/performance (CSP) requirements, and (b) the program's system's ability to attain and maintain a military effectiveness.

Hypothesis II. The closer one is to the Program Office (in an organizational sense), the more likely it is that success will be defined in terms of meeting CSP requirements.

(a) Evaluation of Survey Questionnaire. The survey instrument was effective in meeting this research objective. Parts I and II of the questionnaire provided data for the first hypothesis; this resulted in the classification of success criteria. Part IV worked as designed to substantiate/refute Hypothesis II. Parts I and II were of little value in analyzing Hypothesis II because of the broad range of answers received.

(5) Results.

1 Hypothesis I was substantiated. As shown in Tables II and III, respondents divided the 92 descriptors between "Accomplished Program Objectives" (or "meeting directed CSP requirements") and "System Worked Well When Needed" (or "system's ability to attain and maintain a military effectiveness"). All descriptors could be categorized within these two broad elements; there were no other categories of success attributes mentioned.

2 Hypothesis II was not substantiated.

For analysis purposes, the factors which may describe system program success (Part IV of the Survey Questionnaire) were ordered on an assumed bias (or perspective) favored by the program office or user.

Factor:

d. c. i. f. h. e. b. j. a. g.

Program Office ← Perspective Biased Toward → User

Listed, the factor ranking would be:

Program Office Perspective →

d. Meets directed (Decision Coordinating Paper/Program Management Directive) requirements for Cost/Schedule/Performance/Supportability.

c. Clearly defines an acquisition strategy at program's outset and closely adheres to it throughout the life of the program.

i. Minimizes design changes throughout development and production/deployment.

f. Defines and attains affordability goals for each acquisition phase.

h. Incorporates the most current state-of-the-art technology in the system design.

e. Produces a system for which the operational requirement has been clearly established.

b. Integrates support and manpower concerns into the acquisition process such that system deployment is accomplished with minimum disruption to the operational force.

j. Meets an established Initial Operational Capability (IOC) date.

a. Minimizes the time from need identification to introduction into operational use.

g. Deploys a system with capability which is competitively effective against the threat during the system's projected life.

User Perspective

In Table IV, (App. 3) the Part IV Questions (i.e., factors) are arranged in order of expected perception, Program Office on left, User on right. The population groups are placed with Program Office orientation at the bottom, then User orientation at the top. Actual responses to the questionnaire Parts IV were then listed.

Table V (App. 3) displays an expected assumed response per question by population group if Hypothesis II was valid. A graphic description of this would be:

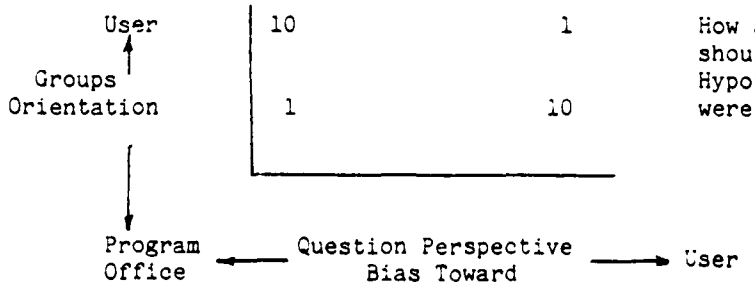


Table VI (App. 3) attempts to remove the heavy Air Force SPD orientation by averaging the Table I responses by population group. Here are some data results.

Relative importance of each question (factor) irrespective of population group:

Factor	d	c	i	f	h	e	b	j	a	g
Average of group average responses	4.27	4.57	7.3	6.26	7.93	3.97	4.93	7.83	5.33	2.1
Indicated ranking	3	4	8	7	10	2	5	9	6	1

Data from the Parts IV were analyzed and show that Hypothesis II is refuted.

Annex 1 to Appendix 3 displays the statistical analysis to refute Hypothesis II. If Hypothesis II were valid, a distribution of Part IV responses would be statistically equivalent to Table V. In Annex 1, the Null Hypothesis is that the means for groups A, C, and E and responses for factors d, h, and g are as shown in Table V. The statistical test shows conclusively that the assumed means are not within the true means.

Results from Annex 2 to Appendix 3 suggest that an alternate Hypothesis II may be correct: System program management success tends to be defined by similar terms, irrespective of organizational perspective. In this statistical analysis, an Analysis of Variances for One-Way Classification at a 5% significance level showed no reason to reject the hypothesis that the average response of factor "d" from Part IV was the same for every group. If further analysis verified the Alternative Hypo-

thesis II for all 10 factors, the data would show that the two most important factors from Part IV to describe success are:

Factor g. Deploys a system with capability which is competitively effective against the threat during the system's projected life.

Factor e. Produces a system for which the operational requirement has been clearly established; further,

the data would show that the two least important factors are:

Factor h. Incorporates the most current state-of-the-art technology in the system design.

Factor j. Meets an established Initial Operational Capability (IOC) date.

C. Observations Concerning Success Criteria.

This subsection generalizes the findings of Section III, Attributes of Success. Appendix 3, Table I "Classification of Success Criteria" lists all attributes of success suggested by the research study. Based on an analysis of all the data, these observations are offered:

1. Program management success is generally determined by product success, in the non-defense and defense (military) sectors.

2. Attention to system performance and system supportability is more important to long-lasting success than is attention to program cost and schedule.

3. A program whose system is usable and meets a need (whether or not the need was known at program initiation) will be considered more successful than one which meets unusable or unnecessary performance

requirements. This observation can be carried one step furtner to state that system program management success is more of a function of what impact the system had on the Air Force's military capability than on how well the technical performance goals were met. One respondent summarized this important point with the statement that a "Useful product is the savior of any program."

SECTION IV CAUSES OF SUCCESS

Overview. This section responds to Section C.4.2 of the SOW. There is no attempt to provide a functional "How To" check list on program management. The order of presentation is: a review of a broad classification of success causes, a discussion of successful Air Force system programs, a suggested list of the most important inputs (causes) to enhance system program management success, comments concerning Hypotheses III and IV, and some overall observations concerning success causes.

A. Classification of Causes for Success

Figure IV-1 presents the top level classification causes for system program success. This classification was developed from secondary research, experience of the study team, and results from the study questionnaires and investigative worksheets. Examples of each of the subelements are included in Table IV-1 located directly behind Figure IV-1. Every questionnaire and investigative worksheet example of success cause is covered by an element in the table.

(NOTE: Section IV-B begins following Table IV-1).

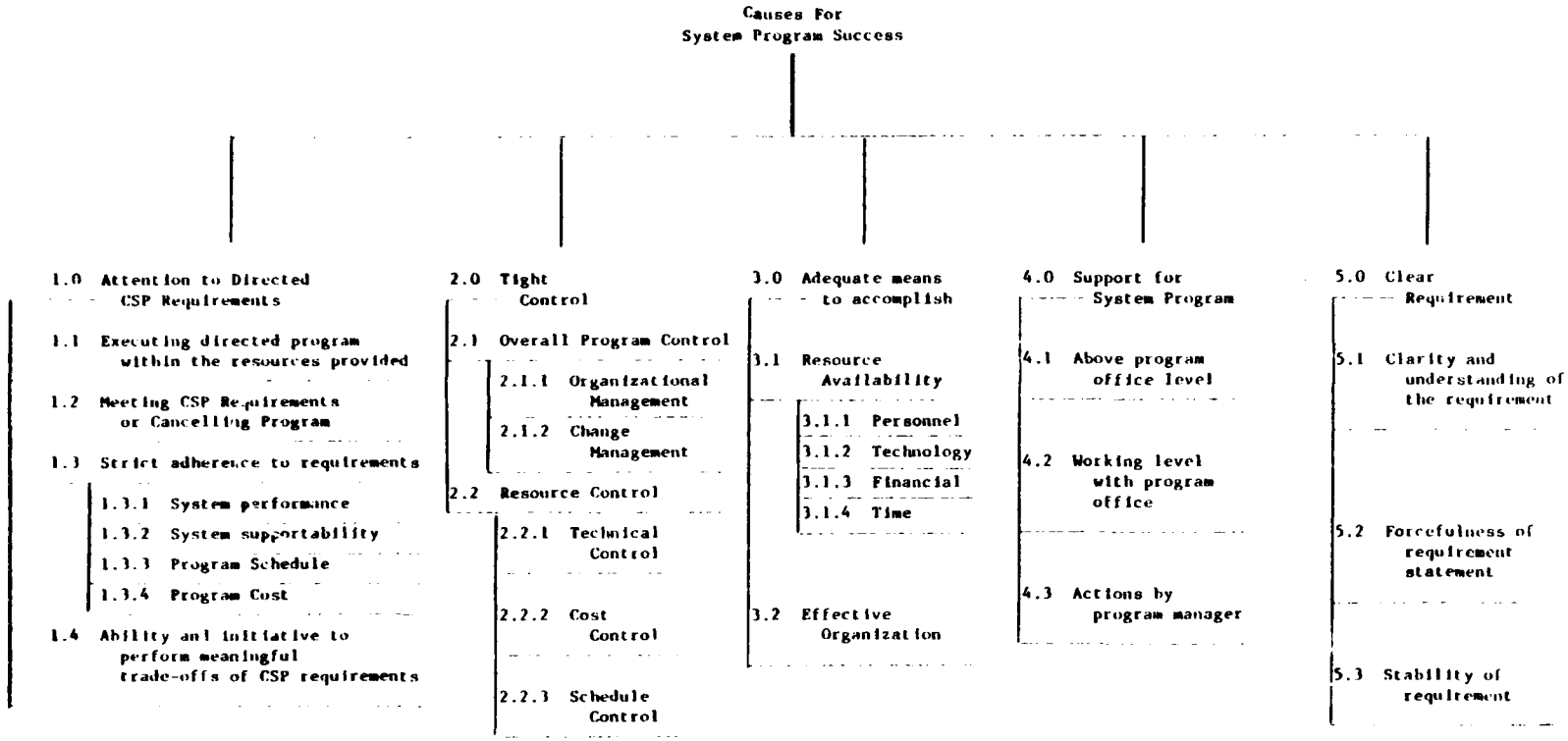


Figure IV-1 Classification of Causes

TABLE IV-'. EXAMPLES OF DESCRIPTORS
FOR CAUSES OR REASONS FOR
SYSTEM PROGRAM SUCCESS

'.0 Attention to Directed Cost/Schedule/Performance (CSP) Requirements.

1.1 Executing directed program within the resources provided.

A. Bringing system into inventory, on schedule, within cost estimates, and meeting specifications--the classical definition.

B. Meeting the requirements of cost, schedule, and performance is the objective.

C. Living up to promises made to OSD through the DCP process and to the Congress through the SAR process.

D. Meeting cost-effective (not "Letter of the Spec") performance requirements.

'.2 Meeting CSP requirements or cancelling program.

A. If product cannot meet all CSP goals and objectives "(they are <u>never</u> requirements)," either stop program or sensibly relax goals until a useful product can be realized.

B. Program is cancelled if it becomes clear that the costs exceed the benefits.

C. Do not drag a program out. Develop in the shortest time possible or cancel.

D. Operational performance objectives demonstrated during test/evaluation.

1.3 Strict adherence to CSP requirements in following:

1.3.1 Adherence to system performance.

1.3.2 Adherence to system supportability.

1.3.3 Adherence to program schedule.

1.3.4 Adherence to program cost.

1.4 Ability and initiative to perform meaningful trade-offs of CSP requirements.

A. Ability to balance resources against significant underlying requirements while neutralizing the impact of trivial requirements.

B. Knowing which of the CSP requirements really is the most important and making trade-offs accordingly.

2.0 Ability and success in maintaining tight control.

2.1 Overall program control.

2.1.1 Organizational management.

A. Comprehensive and dynamic planning.

B. Firm baselines with traceability.

C. Risk management is understood and performed.

D. When problems involving cost, schedule and quality surface, they are acted on promptly.

E. The program manager (PM) is decisive.

F. Getting all functional areas to work together as a team.

G. The PM does not get involved in the day-to-day details.

H. Contractor must have a good management system.

(TABLE IV-1 Continued)

I. Contractor is given authority and responsibility to the top.

J. Electing an acquisition strategy which preserves as reasonable.

K. Adequate planning and budgeting.

L. A sound business contract.

M. Early establishment of baseline.

N. An acquisition strategy based on the requirements of the user.

O. Contract and [illegible].

2.3.2 Change management.

A. Ability to control changes.

B. Effective contract change system.

C. Well documented [illegible].

D. Maintain firm requirements, but if changes be necessary then recognize and fund.

2.4 Resource control.

2.4.1 Technical control.

A. Translation of user's operational specifications to design criteria fully within state-of-the-art.

B. Correct early definition of the technical baseline.

C. Carefully define the system to be developed.

D. Designing a system to meet the operational requirement without gold-plating it.

E. Avoiding technical embellishments.

F. Don't increase performance beyond state-of-the-art.

G. Early definition of the technical solution.

TABLE [illegible]

2.2.2 Cost Control.

A. Negotiating a contract that protects the taxpayer's interest.
B. Development of realistic life cycle cost data.
C. Properly using life cycle cost as a guiding factor.
D. Cost and schedule relationships established.
E. Accurate cost estimates.

2.2.3 Schedule control.

A. Development of a realistic schedule.
B. Following a consistent, well-developed set of milestones.
C. Meeting the schedule milestones.

3.0 Adequacy of means to accomplish program objectives.

3.1 Resource availability.

3.1.1 Personnel availability.

A. Select highly qualified people to manage the program.
B. Program support provided either through project or matrix organization.
C. Personnel continuity maintained.
D. Good experienced people put in charge.
E. Good SPO team.

3.1.2 Technology availability.

A. Technology is well in hand.
B. Technology allows production "surge" or "mobilization."

C. Using available technology.

D. Testing components prior to project development.

E. Small step forward.

3.1.3 Financial availability.

A. Funding is consistent.

B. Assure adequate funding for work to be performed.

3.1.4 Time availability.

Realistic schedules which are compatible with the system requirements.

3.2 Effective organization.

A. The SPO demonstrates excellence.

B. Establishment of a management team with responsibilities.

C. Selecting proficient contractors with recent similar experience.

D. Selecting responsible contractor with best chance of meeting program requirements.

E. The contractor demonstrates excellence.

F. Good contractor management.

G. Aggressive management engagement with contractor.

H. User is integral part of SPO.

4.0 Support for the system program.

4.1 Support above the program office level.

Be sure system has adequate support at the top in this order of importance:

(TABLE IV-1 Continued)

HQ USAF
OSD
Congress

4.2 Support at working level of the program office.

A. Continued management commitment by government and industry over life span to develop, produce, and deploy the system.

B. Disciplined participative management between developer, logistics manager, user, contractor, and headquarters.

C. Interaction with training, logistics and operational commands, and industry so that when the system becomes operational it fulfills a significant role.

4.3 Actions by the program manager (PM).

A. PM is aggressive in selling and explaining the program and progress.

B. PM is straightforward in program assessment and acknowledges problems.

C. Diplomacy.

D. Keep program visibility low.

5.0 Existence of clear requirements.

5.1 Clarity and understanding of the requirement.

A. Clearly stated, fully justified and realistically attainable operational specifications that accurately relate the user's needs for fulfilling his role in supporting national objectives.

B. Clearly articulated mission requirements. They are readily understood.

(TABLE IV-1 Continued)

C. The PM is sure there is a need for the system.

D. Realistic and technically supportable requirements.

E. The time (need date) requirement for the system is apparent.

F. Requirements well defined.

5.2 Forcefulness of the requirement statement.

A. The need is recognized by the organizations whose support is necessary.

B. The requirements are firm and quantified.

C. The ROC/SONS is validated.

D. The MENS is approved.

E. Meeting the requirement will complement other system's effectiveness.

5.3 Stability of requirements.

A. Stable program.

B. Make sure user knows what's needed at the beginning.

B. Determination of Successful Programs

To determine which Air Force system programs were to be ranked in the top success classes, the following inputs were required:

(1) List of all USAF major programs which have experienced a DSARC III (or equivalent) milestone from 1 July 1965 through 30 April 1980. Table IV-2 separates the 40 major programs into 22 to be evaluated; and 18 to not be evaluated with reasons.

(2) Investigative worksheet (See Appendix 5) with elements of success criteria and input parameters.

(3) Results from the Phase II investigation of all programs on the population list. These results, listed in Appendix 6, represent the study investigator's subjective evaluation of each program's strength in meeting the attributes of success and of demonstrating causes of success.

Based on the above inputs, the ranking in Table IV-3 represents the findings of the study team. Qualification statements beside each program amplify reasons for its rating in the "Most" or "Moderately Successful" classes.

TABLE IV-2 PROGRAM POPULATION

Programs To Be Included

1. A-7
2. A-10
3. Air Force Satellite Communications System (AFSATCOM)
4. Air Launched Cruise Missile (ALCM)
5. B-1 (Advanced Manned Strategic Aircraft, AMSA)
6. C-5A
7. C-141
8. DOD Space Transportation System
9. Defense Satellite Communications Systems (DSCS) I and II
10. E-3A (Airborne Warning and Control System, AWACS)
11. E-4 (Advanced Airborne National Command Post, AABNCP)
12. EF-111A
13. F-5 E/F (International Fighter Aircraft, IFA)
14. F-15
15. F-16
16. F/RF/FB-111
17. Gunship
18. KC-10A (Advanced Tanker/Cargo Aircraft, ATCA)
19. Maverick
20. Minuteman II and III
21. NAVSTAR Global Positioning System
22. Short Range Attack Missile (SRAM)

Programs Not To Be Included

	Name	Rationale
1.	Advanced Ballistic Re-Entry System (ABRES)	A "conglomerate" program of continuing developments/improvements of subsystems.
2.	ATC Radar Beacon IFF Mark XII System (AIMS)	Not a system but a family of equipment.
3.	Advanced Medium STOL Transport (AMST)	Program cancelled prior to DSARC II.
4.	Aero-Propulsion Systems Test Facility (ASTF)	Not a defense system, but more of a real estate project.
5.	C-141 Stretch	Really a modification program.
6.	DOD COMSAT	Now called DSCS.
7.	Drone/Remotely Piloted Vehicle	Not one system, but many programs.
8.	Defense Support Program (DSP)	Not one defense system.
9.	F/RF-4	First production contract (F-4C) signed in 1962.
10.	Ground Launched Cruise Missile (GLCM)	Not in Production/Deployment.
11.	Pave Strike	Accelerated development/production of selected systems (not one system program).
12.	Precision Action Link (PAL)	Too old; essentially a space technology program.
13.	Precision Location Strike System (PLSS)	DSARC III scheduled 1985.
14.	Program 647 (CLASSIFIED)	No data available.
15.	Sabres (Self Aligning Boost Re-Entry)	Too old; a space technology program.
16.	Space Defense System (SDS)	Too classified; not deployed.

(TABLE IV-2 Continued)

17. Simulators	Not one system, but many separate programs.
18. Titan III	A program to develop/produce versatile boosters for space exploration purposes. Titan II, the weapon system, was in production before 1965.

(TABLE IV-2 Continued)

Program	Success Criteria Score	Comments
C-1-1	9.2	o Combined NATC/AFSC testing was outstanding. o Vietnam war caused urgent requirement. o Significant step forward in capability and technology.
Maverick	9.1*	o Great military utility. o User knew how to use system because of extensive testing. o Vietnam and Mid-east wars caused urgency.
F-5 E/F	8.8	o High reliability and adaptability. o Succeeded despite lack of USAF interest.
F-16	8.2	o Prototype testing showed user what system could do before FSD began. o Succeeded though no definite USAF requirement.
E-3A	8.2*	o Prototype test showed tremendous military utility. o Emphasized use of proven components.
Gunship	8.1*	o Interest and utility rose then waned with SEA conflict.
F-15	7.8*	o Engine's reliability and supportability degraded from a superior program.
SRAM	7.7*	o Early technical problems impacted cost/schedule.
A-7	7.5*	o Air Force reluctant to accept system from Navy.
A-10	7.4	o Current success of program obscures early AF resistance. o Became embroiled in roles and missions arguments.
KC-10	7.3	o Because user is not sure how to use, program subject to funding uncertainty.

*Scores were adjusted upward if significant program awards were noted.

TABLE IV-3 PROGRAMS BY SUCCESS CATEGORIES

TABLE IV-3 PROGRAMS BY SUCCESS CATEGORIES

Most Successful		Least Successful	
Program	No. Responses	Program	No. Responses
F-15	13	C-5A	21
C-141	9	F/RF/FB-111	16
F-16	8	B-1	9
MM II & III	6	DOD STS	4
F-5E/F	7	PLSS	4
Maverick	6	Drone/RPV	3
Gunship	5	E-4	3
A-10	5	AMST	2
F/RF-4	5	EF-111A	2
A-7	4	F-15	2
B-1	4	GLCM	2
Titan III	3	SDS	2
E-3A	2	Simulators	2
NAVSTAR GPS	2	AFSATCOM	1
SRAM	2	ALCM	1
ABRES	1	KC-10A	1
AFSATCOM	1	MM II	1
ALCM	1	Titan III	1
AMST	1		
DSP	1		
E-4	1		
EF-111A	1		
F/RF/FB-111	1		
KC-10A	1		
Prog 647	1		

TABLE IV-4 MAJOR PROGRAMS FELT MOST AND LEAST SUCCESSFUL

C. Comparison of Successful Program Rankings

1. Requirement

Study Task II-E required that the programs in the top two Success Classes be compared with the "list of programs felt to be successful" from Task I-E. Significant anomalies were to be identified and discussed.

2. Criteria and Assumptions

For this comparison, the following assumptions and criteria were used to identify "anomalies":

a. The program ranking obtained through application of the success criteria (i.e., Table IV-3) is considered the baseline for comparison.

b. Programs rated in the top 11 of baseline ranking, but not in the top 11 of major programs felt most successful (see Table IV-4) were considered anomalies.

c. Programs mentioned three or more times as "most successful" (Table IV-4) but not included in the top two classes through use of success criteria were considered anomalies.

3. Discussion of "Anomalies"

a. High in Ranked Success But Low in Perceived Success

(1) E-3A. It can be speculated that this successful program was underrated because of its relative newness and complexity of mission. Also, though very effective, the E-3A cannot be generally regarded as "exciting."

(2) SRAM. This program suffered early adverse publicity, and deployed a weapon system which, though very effective as a deterrent, received little publicity.

(3) KC-10A. This program is very new, with the system yet to be deployed. Due to the very nature of the program, respondents may have felt that the minimum technical challenge removed much program management difficulty.

b. Felt to be High Though Not Ranked High Using Success Criteria

(1) Titan III. Respondents possibly were rating the entire Titan (I, II, and III) family which deployed a key element in the United States' nuclear deterrence. For this study, however, the Titan III was not rated using the success criteria because of Titan III's main use as a space booster.

(2) B-1. This program presented one of the clearest examples of the differences between program management and system program management success. Evidence exists showing the excellence and accomplishments of the program director and his staff because of results in terms of technical achievement and real cost control. The program, like the B-70, [illegible] AMST, failed the acid test: no usable systems were deployed [illegible]. Perhaps with a different political and fiscal climate [illegible] been (or may yet be) a successful program.

[illegible] not rated using the success criteria because of [illegible].

[illegible] Minuteman II & III. If rated separately, Minuteman III [illegible] the success criteria. The development delays and [illegible] among the rating assessed by this study. [illegible] Minuteman has more to the [illegible] that in

terms of military effectiveness, no other Air Force weapon system has ever had more importance than Minuteman because of its deterrent value.

D. Correlation and Importance of Causes

Of the listed causes for success (Figure IV- [illegible] Table IV-[illegible]), certain of the input parameters appear to be more important than others in achieving program success. The purpose of this sub-section is to identify and give evidence for selection of the more important causes of success.

1. Selection Methods. Three methods were used to identify the more important causes of success:

a. Factors Associated With Successful Programs. Part V of the study questionnaire asked each respondent to identify "each factor you believe was a major contributor" to program success. Table IV-5 lists each factor and shows its frequency of response.

b. Use of the Investigative Worksheet. Table IV-6 displays the results of Appendix B simplified to a scheme of plus, check, and minus grading for the top 11 programs. On the bottom of the table the individual input subfactors are consolidated on the basis of number of pluses (best), checks (next best), and minuses (degrading).

c. Correlation of Success Criteria Scores (Per Program) with Average for Each Input Parameter. The Table IV-1 success scores were correlated with the Appendix B input parameter averages.

2. Causes of Success Considered Important. From each selection method, the most important causes of system program management success are identified in the following sets in order of importance.

a. From Table IV-6:

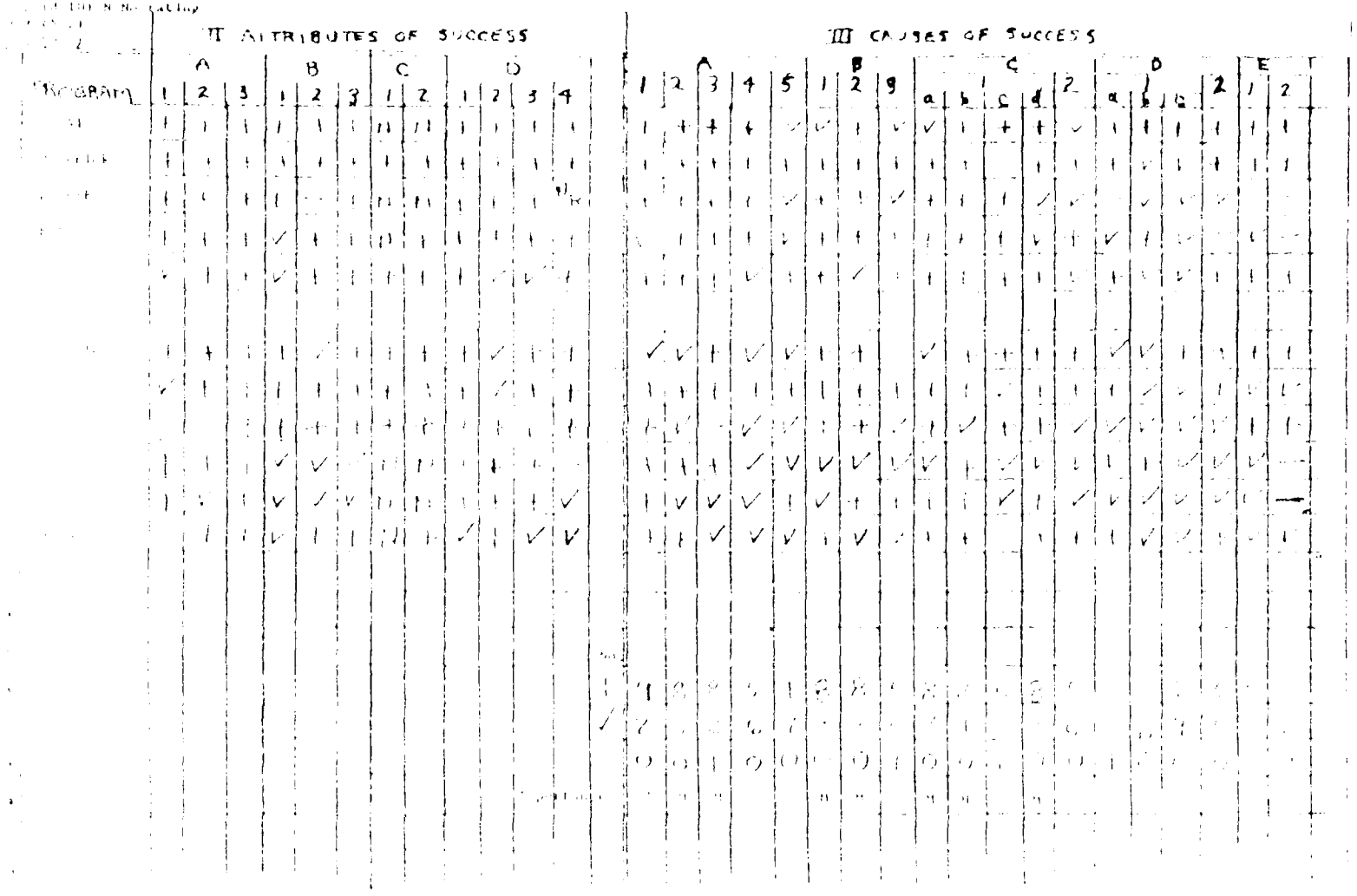
(1) Strict adherence to system performance.

(2) Funding was consistent.

TABLE IV-5 IMPORTANCE OF FACTORS CONTRIBUTING TO SUCCESS

Importance Standard	Standards Responses
Low	0-20
Some	21-39
Moderate	40-59
High	60+

	Factors Contributing to Success (From Questionnaire Part V		Frequency of Response	Relative Importance
[illegible]	a.	ROC/SCNS Validated	24	Some
[illegible]	b.	DCP Alternative Defended	[illegible]	Low
[illegible]	c.	MENS Accepted	[illegible]	Low
	d.	Responsiveness to Threat	63	High
	e.	Priority Time Urgency	40	Moderate
	f.	Complement to Other Systems	33	Some
[illegible]	a.	Congress	46	Moderate
[illegible]	b.	OSD	50	Moderate
System	c.	HQ USAF	64	High
From:	d.	USN or US Army	13	Low
	e.	Political Pressure	24	Some
	f.	Unity of Effort (AF, OSD, Cong)	48	Moderate
Means to Accomplish	a.	Funding was Consistent	73	High
	b.	Contractor Demonstrated Excellence	60	High
	c.	SPO Demonstrated Excellence	59	Moderate
	d.	PEM Excellence	20	Low
Critical Program Decision/Actions Outside SPO	a.	OSD	45	Moderate
	b.	HQ USAF	49	Moderate
	c.	HQ AFSC or Dev. Center	30	Some
	d.	CMD	11	Low
Strict Adherence to:	a.	Program Cost	50	Moderate
	b.	Program Schedule	57	Moderate
	c.	System Performance	74	Highest
	d.	System Supportability	51	Moderate
Other	a.	High Security Classification	4	Low
	b.	Application of New Technology	20	Low
	c.	Other:		
		(1) Wartime exigency	2	Low
		(2) Reasonable goals	2	Low
		(3) Multinational Involvement	2	Low
		(4) Variety of Use	1	Low


II ATTRIBUTES OF SUCCESS
A
B
C
D
III CAUSES OF SUCCESS
A
B
C
D
E

(3) The system was supported by HQ USAF.

(4) The requirement was responsive to the threat.

(5) The contractor demonstrated excellence.

b. From Investigative Worksheet results, Table IV-6:

(1) Availability of Technology.

(2) Adherence to system performance requirements.

(3) Adherence to system supportability requirements.

(4) Continuity and authority of PM.

(5) Emphasis on change management.

(6) Availability of program office personnel.

(7) Availability of time (for development).

c. From a correlation analysis, output success scores (Table IV-3) with input parameter averages (Appendix 6):

(1) Input parameter 2 "Ability and success in maintaining tight control," r = .76.

(2) Input parameter 4 "Support for the system program," r = .64.

(3) Input parameter 1 "Attention to directed CSP requirements," r = .57.

(4) Input parameter 3 "Adequacy of means to accomplish program objectives," r = .42.

(5) Input parameter 5 "Existence of clear requirement," r = .37.

(NOTE: Analysis showed there was no satisfactory multiple linear regression expression which would define the relationship between the five input parameters and results of the eleven top programs.)

B. Hypotheses III and IV

1. Hypothesis III: System program success is impeded because the Program Manager is disciplined to meet Cost/Schedule/Performance (CSP

requirements and to resist changes which may be necessary to ensure long term military effectiveness of the system. This factor causes the acquisition management process to focus on the program objectives instead of the defense weapon system objectives.

a. Supporting evidence.

(1) Long term AFSC policy has insisted that SPOs undertake no performance baseline change without appropriate authority.

(2) Program review processes cover Technical Characteristics, give minimal attention to threat and threat projection, and have no provision for reporting on the system's expected military utility.

(3) Program objectives (in terms of CSP) are visible and easy to quantify; system objectives (in terms of military utility) are much more difficult to reduce to simple measures of effectiveness.

b. Refuting evidence.

(1) Respondents to the survey questionnaire indicated that "Strict adherence to system performance" was the most important factor for programs felt to be successful.

(2) The consensus leading attribute of program success was "Deploys a system with capability which is competitively effective against the threat during the system's projected life."

(3) The analysis of causes of success for the [illegible] most successful programs (Table IV-6) indicated "Adherence to program cost" to be among the lower of the causes in importance.

c. Judgement. Hypothesis III cannot be substantiated. The data from successful programs and from knowledgeable program managers indi-

viduals indicate that system (or product) success overshadows adherence to CSP requirements, and if system's effectiveness results require that the technical performance baseline be changed, then the SPD is obligated to work for such a change. Program stability is desired, but no evidence shows that stability is more important than expected system performance.

2. Hypothesis IV: The most important determinant of system program success is the clarity and understanding of the intended military mission.

a. Discussion. The analysis method to substantiate this hypothesis was to consider each system program which was included in the two top success classes (Table IV-3). If each successful program had a clear and easily understood military mission, the hypothesis would be supported.

Program	Easily Understood Military Mission	Selected Comments
1. C-141	Yes	"More truck than limousine, more mule than race horse."
2. Maverick	Yes	Kills tanks.
3. F-5E/F	Yes	Support Nixon doctrine.
4. F-16	Yes	Low-mix air-to-air.
5. E-3A	No	Effective system for complex mission.
6. Gunship	Yes	Hamlet defense and truck killer.
7. F-15	Yes	World's best air-to-air.
8. SRAM	Yes	Assist bomber penetrator.
9. A-7	Yes	Close air support.
10. A-10	Yes	Close air support to kill tanks.
11. KC-10	No	Tanker, cargo, or ???

Note that two of the programs do not fit the criterion of easily understood military mission. Additional evidence tending to refute Hypothesis IV comes from the investigative worksheet results (see Table IV-6): "Availability of Technology" seemed to be the most important input sub-parameter.

b. Judgement. Hypothesis IV cannot be substantiated. This judgement is based on qualitative analysis rather than statistical results.

F. Overall Observations Concerning Causes of Success.

From the sub-section IV-E(above) sets of success causes, it is difficult to substantiate the existence of a definitive ranking of success causes. There are, however, reasons to believe that these observations are valid:

1. Availability of technology, and strict adherence to system performance should be considered the highest priority causes. As evidence for this observation, consider the methods used by these successful programs to assure that the needed technology was in hand and that the user understood the expected military utility of the system:

a. C-141: Extensive operator testing concurrent with early production/deployment. System shortcomings were detected and corrected.

b. Maverick: Extensive systems testing with operator involvement.

c. F-5E/F:

(1) Follow-on from a mature system.

(2) Prototype demonstrated technology.

d. F-16: Prototype demonstrated technology.

e. E-3:

(1) Extensive involvement in prototype testing showed operator what the system could do.

(2) Selected sub-systems were well-proven prior to integration.

f. Gunship:

(1) Extensive operator involvement during prototype evaluation showed tremendous utility of system.

(2) Relied mostly on off-the-shelf components.

g. A-7: Follow-on from a mature system.

h. A-10:

(1) Prototype demonstrated technology.

(2) Only after considerable operator testing did operational concept and utility evolve.

i. KC-10: Modification of a mature system.

2. Input parameter 5.0, "Existence of clear requirements," appears to be the least reliable indication of program success. Historical data shows that four of the successful programs were virtually forced upon the Air Force: F-5E/F, F-16, A-7, and A-10. Even with the apparent success of these programs, the Air Force currently does not have a clear use for the F-5E/F (other than a specialized "aggressor training" role) nor the A-7.

Certain of the programs have appeared more successful than others because urgent requirements arose which they could meet (e.g., in the SEA conflict: C-141, A-7, and Gunship; and in the Middle East conflicts:

Maverick, E-3A). Hence, the conditions of history sometime allow certain systems to excel, while others (Minuteman and SRAM) are effective in a totally opposite, yet unspectacular manner: not having to be used because of their success as deterrents.

3. System success (hence program success) tends to be measured in terms of how well the following seemingly straightforward questions can be answered in the affirmative:

a. Does the user understand what to do with the system to obtain military utility?

b. Does the system work well?

Included within these questions are the considerations of operational concept, doctrine, and military utility; as well as capability, reliability, and adaptability.

A credible case could be made that the demise of the AMST, B-1, and B-70 programs resulted in a large part because these two questions could not be answered satisfactorily. If the user can perceive a definite and important use for the system, the chances for program completion are high. Without this clear-cut understanding of what significant role the system will fill, the program can expect failure, just as the B-70 failed: "The ultimate cause of failure, shared by two administrations, was that the B-70 could not do a useful job." (19, p.9).

SECTION V SOME IMPACTS OF FINDINGS ON AIR FORCE SYSTEM PROGRAM MANAGEMENT

A. Introduction. The findings of this study suggested certain issues which the study team, based on its experience and judgement, believes should be the subjects for further investigation. Each topic involves an aspect of organizational effectiveness which helps to determine the overall success of Air Force system program management. The discussion of these issues becomes the foundation for the Recommendations for Additional Research found later in this report (see page 75).

B. Issue #1. Importance of Military Utility.

Question. Assuming that the ability of a system to perform a significant military mission is one of the most important determinants of system program management success, what methods are used within the program office and by the acquisition management review process to estimate, measure, and control military utility?

Discussion. The concept of the Mission Area Analysis (MAA) is a method to relate system performance to mission effectiveness. MAA output can either lead to an approved Mission Element Need Statement (MENS) or serve as an annual revalidation of the system's eventual worth. The MAA process misses the point of this issue, however. Within the project office and acquisition review process there is a need for a method to relate the system's planned military utility to the program's cost/schedule/performance/supportability (C/S/P/S) requirements. Some technique employing a capability/threat ratio may be appropriate. The important point is that the program manager must have the ability to relate and demonstrate the impact of C/S/P/S changes to military utility. Experience indicates that such techniques lack widespread use.

C. Issue #2. Experience of Program Manager.

Question. "Adherence to system performance" was initially one of the top causes for system [illegible]

be logical to believe that the program manager (decision maker) must have a thorough understanding of the intended system use. What, then, will be the effects of severely restricted entry of personnel with operational experience into the program management career field because of continual operational personnel shortages?

Discussion. A reasonable conclusion of this study is that because the military program manager, like the non-military program manager, must strive for product success, knowledge of the system's (product's) intended use is vital in program definition, planning, and control. To be successful, a program manager must above all else be able to thoroughly articulate the system's end use; with this understanding, programmatic structure and decisions can be properly defined and defended through every level of the acquisition organization.

As the entry of O-3/O-4 operationally experienced personnel into AFSC decreases, how will program managers be developed? Program management is a complex process, and a program manager must have a reasonable amount of experience in making the acquisition process work to be effective as a O-5/O-6 level manager. In raising this particular issue, the study team recognizes that the proper specialty mix in AFSC program management has been a continuing concern of Air Force personnel managers. The issue, however, is exacerbated by the study's findings of how important the program manager's operational knowledge and understanding is to the success of the program.

D. Issue #3. Requirements Process.

Question. Given the relatively low correlation between successful programs and "the existence of clear requirements" (see section IV-D for details), are there correctable deficiencies within the Air Force requirements process which impede system program management success?

Discussion. The requirements process, central to a program's beginning ("What's needed?") and eventual deployment ("Does the system meet the requirement?"), has been reviewed on numerous occasions. Because this study found that 4 of the 11 most successful programs occurred in the absence of clear requirements, and because at least three programs (E-4, EF-111A, and PLSS) were reported by respondents to have unclear or unrealistic requirements, there is reason to believe that the requirements process remains flawed.

One clue to the success of many of the top-rated programs seems to be the high degree of user involvement in the detailed system design. This "Try Before Buy" approach seems to be quite useful because the user must invariably and inevitably take the time and effort to balance system performance, employment concept, and operational doctrine. Without having the opportunity to gain first-hand use in the system's capabilities, the user does not nor cannot know what performance the system really needs to do the job. Hence, "requirements" are sometimes unrealistic and/or unnecessary.

The value of full-scale system prototypes to demonstrate technology achievement and to enhance cost realism, while important, may overlook perhaps the biggest benefit: it allows the user to determine if the intended (or perhaps another unintended) military mission can be satisfactorily and affordably accomplished by the system. Any new look at the Air Force requirements process should acknowledge the effect that prototype evaluations have had on the success of the F-16, E-3A, A-10, and F-5E/F programs.

CONCLUSIONS

A. Study Methodology

1. Use of the mailed questionnaire provided fewer data responses than expected.

2. Involvement of industry in acquisition research, while desirable, is restricted by factors such as corporate policy, fear of alienating a current/potential customer, or lack of financial incentive to participate.

B. Success in System Program Management

1. Little effort is made in management literature to define success in program management. Success is used to mean fulfilling the objectives of the organization.

2. In the private, non-military sector, program success usually is equated with product success. The basic method of evaluating a program is the size of the financial return from the resulting product. Hence, program managers are very knowledgeable of and sensitive to the expected product use.

3. Within the Air Force environment, program management is described by AFSCP 800-3 as a process of completing program objectives. Some authors suggest that these objectives are passed down to the program manager as his/her "mission."

4. Hypothesis I, "System program success is defined in terms of (a) the program's record in meeting directed cost/schedule/performance (CSP) requirements, and (b) the program's system's ability to attain and maintain a military effectiveness," was substantiated. The respondents believed that a system program is judged to be a success on the basis of how well the following criteria, in order of importance, have been met:

a. The system was operationally capable.
b. The program met its cost/schedule/performance objectives.
c. The program maintained stability of program requirements.
d. Deployment of the system was timely.
e. There were sufficient numbers of the system to be militarily significant.
f. The program and personnel received awards or promotions.

5. Hypothesis II, "The closer one is to the Program Office (in an organizational sense), the more likely it is that success will be defined in terms of meeting CSP requirements, " was not substantiated. The two most important factors, irrespective of organizational perspective, appear to be (a) Deploying a capable system and (b) Producing a system for which the operational requirement has been clearly established.

6. The five major Air Force system programs felt by respondents to be the most successful during the period 1965-1980 were:

a. F-15
b. C-141
c. F-16
d. Minuteman II and III
e. F-5E/F

7. All causes of success were classified under these five main input parameters:

a. Attention to directed CSP requirements.
b. Ability to maintain tight control.
c. Adequacy of means to accomplish program objectives.
d. Support for the system program.
e. Existence of clear requirements.

8. Using the success criteria developed in Phase I, the most successful Air Force programs of those evaluated in the 1965-1980 period were determined to be:

Most Successful	Moderately Successful
C-141	Gunship
AGM-65 Maverick	F-15
F-5E/E	SRAM
F-16	A-7
E-3A	A-10
	KC-10

9. Hypothesis III, "System program success is impeded because the Program Manager is disciplined to meet CSP requirements and to resist changes which may be necessary to ensure long term military effectiveness of the system," was not substantiated. Collected data indicated that the desire for system effectiveness exceeded that for adherence to CSP requirements.

10. Hypothesis IV, "The most important determinant of system program success is the clarity and understanding of the intended mission," could not be substantiated. One input sub-parameter, "Availability of Technology," appeared to have the most importance.

11. The highest priority causes of system program success are availability of technology and strict adherence to system performance. A review of the most successful programs revealed various methods to enhance these causes:

a. Prototype to demonstrate technology.
b. Extensive operator input in testing.
c. Use of off-the-shelf components.
d. Follow-on from a mature system.
e. Modification of a mature system.

12. System program success tends to be measured in terms of how affirmative and strong the answers are to the following questions:

a. Does the user understand what to do with the system to obtain military utility?

b. Does the system work well?

RECOMMENDATIONS

A. Study Methodology

If the technique of mailing survey questionnaires is to be used on future research studies, expect a 25-35% response rate. Plan on alternative means to obtain primary research data to ensure adequate coverage of all population viewpoints.

B. Success in System Program Management

Inform the Air Force program management community of the classifications of success attributes and most significant causes to aid in developing, refining, and implementing acquisition strategies. Some suggested techniques to transmit the results of this study include:

1. Prepare and submit an article to professional publications such as "Concepts" (The Journal of Defense Systems Acquisition Management, Defense Systems Management College) or "Air University Review."

2. Brief the results of the study and furnish final reports to the acquisition management faculties of Defense Systems Management College and Air Force Institute of Technology.

3. Brief the results of the study and furnish final reports to the Acquisition Policy offices of HQ USAF (RDCS) and HQ AFSC (SDD).

4. Present the findings at symposia such as the annual Acquisition Research Symposium co-sponsored by the Department of Defense and Federal Acquisition Institute.

C. Additional Research

1. Determine methods which may be used within the program office and by the acquisition management review process to estimate, measure, and control military utility for an overall system.

2. Analyze the effects and possible corrective actions concerning the increasingly restricted entry of operationally experienced personnel into the acquisition management career field because of personnel shortages.

3. Review the Air Force requirements process to recommend better methods for developing/deploying systems with significant military utility.

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Program	Date
a. A-7	30 Jun 75
b. A-10	30 Jun 79
c. ALCM	31 Dec 79
d. B-1	30 Sep 77
e. C-5	30 Sep 73
f. DSCS II	30 Jun 70
g. E-3A	31 Dec 79

h.	E-4A	31 Dec 79
i.	EF-111A	30 Dec 79
j.	F-5E/F	31 Mar 76
k.	F-15	31 Dec 79
l.	F-16	31 Dec 79
m.	F/RF/FB-111	30 Jun 75
n.	Maverick	30 Sep 76
o.	MM II & III	31 Dec 77
p.	SRAM	31 Dec 73

3.17 KC-10 Command Management Review, 30 Jun 76.

APPENDICES:

1. Survey Population List

2. Survey Questionnaire

3. Survey Results

4. Selected Parts I

5. Investigative Worksheet

6. Phase II Results

SURVEY POPULATION LIST

AIR FORCE SYSTEM COMMAND (AFSC) COMMANDERS (1965-80)

Gen. Bernard A. Schriever
Gen. James Ferguson
Gen. George S. Brown
Gen. Samuel C. Phillips
Gen. William J. Evans
Gen. Lew Allen, Jr.
Gen. Alton D. Slay

AFSC VICE COMMANDERS (1965-80)

Lt. Gen. W. Austin Davis
Lt. Gen. Charles H. Terhune, Jr.
Lt. Gen. John W. O'Neill
Lt. Gen. Edmund F. O'Connor
Lt. Gen. John B. Hudson
Lt. Gen. Robert T. Marsh
Lt. Gen. Robert C. Mathis
Lt. Gen. George H. Sylvester

AERONAUTICAL SYSTEMS DIVISION (ASD) COMMANDERS (1965-80)

Maj. Gen. Charles H. Terhune
Maj. Gen. Harry E. Goldsworthy
Maj. Gen. Lee V. Gossick
Lt. Gen. James T. Stewart
Lt. Gen. George H. Sylvester
Lt. Gen. Lawrence A. Skantze

SPACE AND MISSILE SYSTEMS ORGANIZATION (SAMSO) COMMANDERS (1965-80)

Maj. Gen. Ben I. Funk
Brig. Gen. Paul T. Cooper
Lt. Gen. John W. O'Neill
Lt. Gen. Samuel C. Phillips
Lt. Gen. Kenneth W. Schultz
Lt. Gen. Thomas W. Morgan
Lt. Gen. Richard C. Henry

ELECTRONIC SYSTEMS DIVISION (ESD) COMMANDERS (1965-80)

Maj. Gen. John W. O'Neill
Maj. Gen. John B. Bestic
Maj. Gen. Joseph J. Cody, Jr.
Maj. Gen. Albert B. Chiely, Jr.
Maj. Gen. Benjamin W. Bellis
Lt. Gen. Wilbur L. Creech
Lt. Gen. Robert T. Marsh

DEPUTY CHIEF OF STAFF/RESEARCH DEVELOPMENT & ACQUISITION (DCS/RD&A) (1965-80)

Lt. Gen. Kelly H. Burke
Lt. Gen. Thomas P. Stafford
Lt. Gen. Alton D. Slay
Lt. Gen. William J. Evans
Lt. Gen. Otto J. Glasser
Lt. Gen. Marvin L. McNickle
d Lt. Gen. Joseph R. Holzapple
Lt. Gen. James Ferguson

DEPUTY CHIEF OF STAFF/OPERATIONS PLANS AND READINESS (DCS/OP&R) (1965-80)

Lt. Gen. Charles A. Gabriel
Lt. Gen. Andrew B. Anderson
Lt. Gen. John W. Pauly
Lt. Gen. Robert E. Huyser
Lt. Gen. Joseph G. Wilson
Lt. Gen. Russell E. Dougherty
Lt. Gen. Lucius D. Clay, Jr.
Lt. Gen. Keith K. Compton
d Lt. Gen. William H. Blanchard

DEPUTY CHIEF OF STAFF/LOGISTICS AND ENGINEERING (DCS/LE) (1965-80)

Lt. Gen. B.M. Minter
Lt. Gen. John R. Kelly
Lt. Gen. Thomas M. Ryan
Lt. Gen. Robert E. Hails
Lt. Gen. William W. Snavely
Lt. Gen. Harry E. Goldsworthy
Lt. Gen. Robert C. Ruegg
i Lt. Gen. Thomas P. Gerrity

OSD/DDR&E

Dr. W.J. Perry
Dr. M. Currie
Dr. John Foster

OSD/PA&E

Dr. Russell Murray
Mr. Leonard Sullivan, Jr.
Mr. Alan Enthoven

ASD(C)

Mr. J.R. Quetsch
Mr. F.P. Wacker
Mr. T.E. Clary
Mr. R.C. Moot
Mr. R.C. Anthony

I. REPRESENTING ASD

Program

A-10
F-15
F-16
EF-111A
F-5E/F
ALCM
F-111
AGM-65
KC-10A
C-141

II. REPRESENTING ESD

Program

AFSATCOM	Ja[illegible]
E-3A	Ma[illegible]
E-4	Co[illegible]
Combat Theater Comm.	LTC [illegible]
JSS	LTC [illegible]
JTIDS	Co[illegible]
SACDIN	Lt[illegible]
TACSI	[illegible]
TACLORAN	[illegible]
OASIS	[illegible]

III. REPRESENTING SAMSO (Now SD)

Program

ABRES	Co[illegible]
AFSATCOM	[illegible]
DSP	[illegible]
DOD Space Trans Sys	[illegible]
Minuteman	[illegible]
SABRE	
DSCS II & III	
NAVSTAR GPS	
SDS	
Expendable LV	

Survey Questionnaire
To Support
Air Force Business Research Management Center (AFBRMC)
Study of Successful System Program Management

Conducted by

Advanced Technology, Inc.
Contract F33615-80-C-5184

Instructions:

1. This is a five-part questionnaire. To prevent biasing your response to Parts I-III, please complete each part in turn, and do not return to any part you have completed.

2. Kindly use the enclosed envelope to send us your completed questionnaire.

3. Do you desire a copy of the study report which will be based, in part, on your response? Yes_____ No_____

4. If you have questions concerning the questionnaire or study, or if you wish to provide additional comments, please call Mr. Frederick B. Wynn, 703-521-9220.

PRIVACY ACT STATEMENT

In accordance with Paragraph 8, AFR 12-35, Air Force Privacy Act Program, the following information about this survey is provided:

a. Authority: Federal Statute Title 10, USC Section 80-12 Secretary of the Air Force: Powers and Duties, Delegations by.

b. Principal purpose: This survey is being conducted to seek a meaning of success across all programs and ways in which future programs can be made successful.

c. Routine use: Survey data will be compiled and analyzed as a data base for research into determining criteria for successful acquisition programs.

d. Participation in this survey is entirely voluntary.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

USAF Survey Control Number 81-11

Part I. To whatever depth you fe
successful system program ma

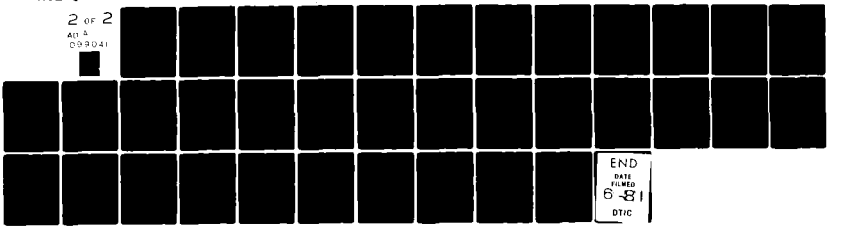
Part II. From the list of major programs attached to this questionnaire, select three you believe were/are most successful, and comment why.

a. Program _____
Successful because:

b. Program _____
Successful because:

c. Program _____
Successful because:

AD-A099 041 ADVANCED TECHNOLOGY INC ARLINGTON VA F/G 5/1
AN ANALYSIS OF SUCCESS IN SYSTEMS PROGRAM MANAGEMENT.(U)
FEB 81 F B WYNN F33615-80-C-5184
UNCLASSIFIED NL



Part III. From the list of major programs attached to this questionnaire, select three you believe to be <u>least</u> successful, and comment why.

a. Program_____
Least successful because:

b. Program_____
Least successful because:

c. Program _____
Least successful because:

Part IV. Column A lists factors which may partially define system program success. Please select those factors from most to least important and rank them in Column B (1 is most important, 2 is second most important, . . . , 10 is least important).

	COLUMN A. "A SUCCESSFUL SYSTEM PROGRAM IS ONE WHICH: . . ."	COLUMN B. IMPORTANCE OF EACH FACTOR
a.	Minimizes the time from need identification to introduction into operational use.	_____
b.	Integrates support and manpower concerns into the acquisition process such that system deployment is accomplished with minimum disruption to the operational force.	_____
c.	Clearly defines an acquisition strategy at program's outset and closely adheres to it throughout the life of the program.	_____
d.	Meets directed (Decision Coordinating Paper/Program Management Directive) requirements for Cost/Schedule/ Performance/Supportability.	_____
e.	Produces a system for which the operational requirement has been clearly established.	_____
f.	Defines and attains affordability goals for each acquisition phase.	_____
g.	Deploys a system with capability which is competitively effective against the threat during the system's projected life.	_____
h.	Incorporates the most current state-of-the-art technology in the system design.	_____
i.	Minimizes design changes throughout development and production/deployment.	_____
j.	Meets an established Initial Operational Capability (IOC) date.	_____

MAJOR AIR FORCE SYSTEM PROGRAMS

System programs are defined as "major" and included on this list by meeting any of the following criteria for the 1965-1980 period:

1. Selected Acquisition Report (SAR) program
2. Designated Systems Management Group (DSMG) program
3. Program Assessment Review/Secretary of the Air Force Program Review (PAR/SPR) program.

A-7
A-10
Advanced Ballistic Re-Entry System (ABRES)
Air Force Satellite Communications System (AFSATCOM)
ATC Radar Beacon IFF Mark XII System (AIMS)
Air Launched Cruise Missile (ALCM)
Advanced Medium STOL Transport (AMST)
Aero-Propulsion Systems Test Facility (ASTF)
B-1 (Advanced Manned Strategic Aircraft, AMSA)
C-5A
C-141
C-141 Stretch
DOD COMSAT
DOD Space Transportation System
Drone/Remotely Piloted Vehicle
Defense Satellite Communications System (DSCS) I and II
Defense Support Program (DSP)
E-3A (Airborne Warning and Control System, AWACS)
E-4 (Advanced Airborne National Command Post, AABNCP)
EF-111A
F/RF-4
F-5 E/F (International Fighter Aircraft, IFA)
F-15
F-16
F/RF/FB-111
Ground Launched Cruise Missile (GLCM)
Gunship
KC-10A (Advanced Tanker/Cargo Aircraft, ATCA)
Maverick
Minuteman II and III
NAVSTAR Global Positioning System
Precision Action Link (PAL)
Pave Strike
Precision Location Strike System (PLSS)
Program 647 (CLASSIFIED)
Sabres (Self Aligning Boost Re-Entry)
Space Defense System (SDS)
Simulators
Short Range Attack Missile (SRAM)
Titan III

Attachment to Survey Questionnaire

APPENDIX 3

SURVEY RESULTS

TABLE I. CLASSIFICATION OF SUCCESS CRITERIA

Successful System Program

1. Accomplished Program Objectives
   - 1.1 Met Cost/Schedule/Performance (CSP) Requirements
     - 1.1.1 Fulfilled DCP/PMD CSP Requirements
     - 1.1.2 (Industry Viewpoint) Met contract requirements
     - 1.1.3 Completed well planned Test/Eval program
     - 1.1.4 Provided good "audit trail"
   - 1.2 Maintained Program Stability
     - 1.2.1 Well defined program
     - 1.2.2 Performance requirements constrained
     - 1.2.3 Changes minimized
     - 1.2.4 Risks minimized
     - 1.2.5 Risk continually assessed and controlled
     - 1.2.6 Program schedule "sacred," unvarying
   - 1.3 Cancelled program when obvious that system would not satisfy military mission.
2. Program and Personnel Rewarded
   - 2.1 Program and/or personnel received awards
   - 2.2 Personnel promoted
3. System Worked Well When Needed
   - 3.1 System was capable
     - 3.1.1 Met user needs
       - 3.1.1.1 High operational utility
       - 3.1.1.2 High operational supportability
     - 3.1.2 Good design
       - 3.1.2.1 System worked well
       - 3.1.2.2 System adaptable to new uses
       - 3.1.2.3 Real trade-offs were made
     - 3.1.3 Contractor available to support system
   - 3.2 System deployment was timely
     - 3.2.1 Development time was shortest possible
     - 3.2.2 System equipment provided before need date
   - 3.3 System numbers were sufficient

TABLE II. IMPORTANCE OF SUCCESS CRITERIA

Criteria (to third level)		Total Responses	Importance
Successful System Program		92	N/A
1. Accomplished Program Objectives		42	High
1.1	Met CSP Requirements	25	Moderate
1.2	Maintained Program Stability	16	Moderate
1.3	Cancelled program when obvious system would not satisfy military mission	1	Some
2. Program Personnel Rewarded		0	None
2.1	Received Awards	0	None
2.2	Personnel Promoted	0	None
3. System Worked Well When Needed		50	Highest (of 2nd Level)
3.1	System Was Capable	42	Highest (of 3rd Level)
3.2	Deployment Was Timely	7	Some
3.3	System Numbers Sufficient	1	Some

Importance Standards:

Standards	Responses
None	0
Some	1-15
Moderate	16-30
High	30+

TABLE III. EXAMPLES OF SUCCESS DESCRIPTORS

Successful System Program

1. Accomplished Program Objectives

1.1 Met CSP Requirements

1.1.1 Fulfilled DCP/PMD CSP Requirements

1. Executing directed program to meet CSP Requirements
2. PM satisfies CSP
3. Management delivered what it promised
4. Completed program by IOC within CSP
5. Delivering system within specified Schedule and Performance
6. Lives up to DCP promises made to OSD
7. Met both operational and cost objectives
8. Minimal cost to bring system into inventory
9. From SPD's perspective: Meet CSP Requirements
10. Survey factor IV.d.
11. Survey factor IV.f.
12. Ultimate in successful management is producing to schedule and performance within cost.
13. Cost/schedule met.
14. Costs were not excessive.

1.1.2 (Industry viewpoint) Met contract requirements

1. Met contractual CSP requirements
2. Equitable contract
3. Satisfaction of buyer and seller
4. Operational system that meets customer's requirements
5. Contract meets profit objectives
6. Excels over competition
7. Minimizes unrewarded investment

1.1.3 Completed well planned Test/Eval program

1. Followed well-designed T&E program
2. Test programs validate hardware

1.1.4 Provided good "audit trail"

Program allows a good "audit trail"

1.2 Maintained Program Stability

1.2.1 Well defined program

1. Had one basic requirement
2. The program was initially well defined

1.2.2 Performance requirements constrained

1. Stable requirements base
2. Performance requirements were kept constant

1.2.3 Changes minimized

1. Air Force was sold on original requirements
2. Miminum changes through production
3. Requirements remained firm
4. The requirements didn't change
5. Survey factor IV.c.
6. Survey factor IV.i.

1.2.4 Risks minimized

1. Only tried what could be done
2. State-of-the-art program
3. Program only completed if CSP goals possible
4. Reducing objectives/goals until useful product realized

1.2.5 Risk continually assessed and controlled

Continuing risk assessment and control

1.2.6 Program schedule "sacred," unvarying

Relatively firm, unvarying schedule

1.3 Cancelled program when obvious that system would not satisfy military mission

2. Program and personnel rewarded

2.1 Program and/or personnel received awards

2.2 Personnel promoted

3. System Worked Well When Needed

3.1 System was Capable

3.1.1 Met user Needs

1. Meets the user's needs

2. Meets/exceeds the user's requirements
3. Reliable and maintainable hardware
4. Continued essential deterrence
5. Met urgent operational needs with reasonable costs
6. Survey factor IV.g.
7. Achievement of usable weapon system despite environment in which program is undertaken
8. Optimum system performance
9. Quantum jump in air superiority
10. Unifying force
11. Significant improvement over predecessor
12. Recognition of capability by users
13. Effective weapon

3.1.1.1 High operational utility

1. Providing system which satisfies need
2. Demonstrated operational utility
3. Fulfilled major operational need
4. Affordable capability to satisfy need
5. Satisfied a real need
6. Insure system is combat capable
7. Program of national importance
8. Survey factor IV.h.
9. Survey factor IV.e.

3.1.1.2 High operational supportability

1. Demonstrated operational supportability
2. Survey factor IV.b.
3. Depot capability at IOC

3.1.2 Good design

1. Well defined system design
2. Excellent engineering system design
3. Straightforward engineering design
4. Good design
5. Recognition of great advancement in state-of-the-art

6. Develop from state-of-the-art technology

3.1.2.1 System worked well

It (the system) works

3.1.2.2 System adaptable to new uses

1. Design adaptable to changing needs
2. Retained built-in flexibility
3. Capable of growth
4. Provide for appropriate growth
5. Designed in adaptability

3.1.2.3 Real trade-offs were made

1. Ability to balance requirements against resources
2. Enable real (as opposed to predetermined) trade studies
3. Achieving best compromises

3.1.3 Contractor available to support system

1. Contractor was covered for total system support
2. Provide continuing support

3.2 System Deployment Was Timely

3.2.1 Development Time was shortest possible

1. Shortest possible time for development (don't drag out)
2. Survey factor IV.a.
3. Timely deployment of much needed system capability
4. Quick response to urgent needs

3.2.2 System equipment provided before need date

1. Equipment provided before need date
2. Put system into use in reasonable time
3. Survey factor IV.j

3.3 System Numbers Were Sufficient

Produced useful systems at cost to allow enough to be bought

Population Group Identifier	Part IV Question									
	d	c	i	f	n	e	[illegible]	j	[illegible]	[illegible]
Type A	8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
OSD (PA&E)	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	2	[illegible]	7	[illegible]
	5	[illegible]		10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
HQ USAF/LE/XO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]		[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Type B	4	7	3	[illegible]	[illegible]	[illegible]	5	10	4	[illegible]
HQ AFSC/CC	3	[illegible]	7	[illegible]	[illegible]	[illegible]	4	6	[illegible]	[illegible]
HQ USAF/RD	5	[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	2
OSD/USDR&E										
Type C	2	[illegible]	[illegible]	[illegible]	10	5	3	[illegible]	3	[illegible]
	4	5	5	[illegible]	[illegible]	[illegible]	2	8	[illegible]	[illegible]
HQ AFSC/CV	[illegible]	[illegible]	[illegible]	10	[illegible]		[illegible]	5	2	[illegible]
OSD(C)	6	[illegible]	9	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]
	2	3	5	[illegible]	[illegible]	[illegible]	7	10	[illegible]	[illegible]
Type D	4	3	10	5	[illegible]	[illegible]	7	9	[illegible]	[illegible]
ASD/ESD/SAMSO	3	4	8	[illegible]	[illegible]	[illegible]	5	10	6	2
CC										
	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5	7	[illegible]	[illegible]
Type E	9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	10	8	[illegible]
	7	[illegible]	5	[illegible]	[illegible]	[illegible]	3	10	[illegible]	[illegible]
USAF SPDs	3	5	[illegible]	5	10	2	[illegible]	9	4	[illegible]
	9	6	6	[illegible]	10	[illegible]	4	5	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]	[illegible]	8	6	[illegible]
	5	4	10	[illegible]	9	[illegible]	6	8	[illegible]	2
	5	6	8	7	[illegible]	[illegible]	2	10	3	[illegible]
	4	3	[illegible]	[illegible]	10	[illegible]	[illegible]	[illegible]	2	[illegible]
	2	2	5	[illegible]	[illegible]	10	3	[illegible]	[illegible]	7
	2	3	[illegible]	5	[illegible]	[illegible]	4	10	6	[illegible]
	9	2	7	[illegible]	10	[illegible]	[illegible]	5	[illegible]	2
	3	1	[illegible]	2	10	[illegible]	5	[illegible]	8	[illegible]
	2	3	5	4	[illegible]	[illegible]	[illegible]	[illegible]	10	[illegible]
	1	2	[illegible]	4	[illegible]	10	[illegible]	6	3	[illegible]
	5	4	5	6	10	1	7	9	3	2
Type F	2	[illegible]	5	4	[illegible]	10	3	5	3	[illegible]
	4	8	[illegible]	9	10	5	2	6	3	[illegible]
Civilian PMs	7	6	[illegible]	5	[illegible]	[illegible]	[illegible]	8	3	[illegible]
	7	6	[illegible]	[illegible]	10	[illegible]	2	[illegible]	3	[illegible]

TABLE IV. PART IV SCORES BY POPULATION AND QUESTION

Group Identifier	d	c	i	f	h	e	b	j	a	g
A	10	9	8	7	6	5	4	3	2	1
B	9	8	7	6	6	5	5	4	3	2
C	6	6	6	6	6	5	5	5	4	4
D	4	4	5	5	5	6	6	6	6	6
E	2	3	4	5	5	6	6	7	8	9
F	1	2	3	4	5	6	7	8	9	10

TABLE V. ASSUMED RESPONSES PER QUESTION BY POPULATION GROUP (Assumed if Hypothesis II is valid)

Group Identifier	d	c	i	f	h	e	b	j	a	g
A	5.8	5.2	6.8	6.2	8.0	3.0	4.2	7.6	5.4	2.8
B	4.3	4.3	6.7	6.7	6.3	3.0	5.3	8.0	7.3	1.7
C	3.0	5.2	7.0	7.0	8.0	6.6	5.2	8.4	3.0	1.8
D	3.5	3.5	9	6	7.5	1.5	6	9.5	7	1.5
E	4.0	4.2	6.1	5.3	8.6	5.1	5.3	7.7	5.1	3.0
F	5.0	5.0	8.2	6.4	9.2	4.6	3.6	5.8	4.2	1.8

TABLE VI. AVERAGE RESPONSE PER QUESTION BY POPULATION GROUP

Annex 1 to Appendix 3 : Statistical Analysis #1

Test for Hypothesis II.

Using Groups A, C, E

Questions d, h, g

Assume normal distribution, Student "t", degrees of freedom = 29, to compare two means.

Ho : $\mu_{Ad} = 10$ $\mu_{Ah} = 6$ $\mu_{Ag} = 1$
$\mu_{Cd} = 6$ $\mu_{Ch} = 6$ $\mu_{Cg} = 9$
$\mu_{Ed} = 2$ $\mu_{Eh} = 5$ $\mu_{Eg} = 9$

Use five per cent level test

$n_A = 5$

$n_C = 5$

$n_E = 15$

S_i^2	d	h	g
A	4.29	4.5	3.36
C	4.0	6.5	1.53
E	8.5	2.385	6.35

$\bar{X}_i$	d	h	g
A	5.8	8.0	2.8
C	3.0	8.0	1.8
E	4.0	8.6	3.0

$$\bar{X}_i - t_{.025}\frac{S_i}{\sqrt{n_i}} \leq \mu_i \leq \bar{X}_i + t_{.025}\frac{S_i}{\sqrt{n_i}}$$

True values, 95% confidence	Ho	Accept or Reject
$3.99 \leq \mu_{Ad} \leq 7.61$	10	Reject
$6.25 \leq \mu_{Ah} \leq 9.75$	6	Reject
$.25 \leq \mu_{Ag} \leq 5.35$	1	Accept
$1.15 \leq \mu_{Cd} \leq 4.85$	6	Reject
$5.76 \leq \mu_{Ch} \leq 10.00$ (upper limit of values)	6	Accept
$.45 \leq \mu_{Cg} \leq 3.15$	4	Reject

True values, 95% confidence	Ho	Accept or Reject
$3.07 \leq \mu Ed \leq 4.93$	2	Reject
$7.97 \leq \mu Eh \leq 9.23$	5	Reject
$1.73 \leq \mu Eg \leq 4.27$	9	Reject

Annex 2 to Appendix 3:

Statistical Analysis No. 2 - All groups respond similarly.

Using an Analysis of Variance for One-Way Classification

Ref: Wine, R. Lowell "Statistics for Scientists and Engineers," Prentice-Hall Inc., 1964, pp. 312-315

Objective: Select question IV "d," analyze to determine if means of the groups are significantly the same.

Data Available:

Groups	A	B	C	D	E	F
Samples	5	3	5	2	15	5

Analysis Method: To increase the significance of the test, Combine Groups into Three Blocks:

Block:	I	II	III
Groups:	(A+B)	(C+D)	(E+F)

Hence, Null Hypothesis is

$$Ho = \mu_I = \mu_{II} = \mu_{III}$$

Significance level $\alpha = 0.05$

Statistic $F > F_{.05}(2,32) = 3.30$ if $\frac{Sm^2}{Se^2} > F_{.05}$, reject

$$Sm^2 = \frac{\sum_{i=1}^{3} \sum_{j=1}^{8,7,20} \left(\bar{x}i. - \bar{\bar{x}}i\right)^2}{b-1}$$

$$Se^2 = \frac{\sum_{i=1}^{3} \sum_{j=1}^{8,7,20} \left(xij - \bar{x}i.\right)^2}{n_1 + n_2 + n_3 - 3}$$

$Sm^2 = 1.144$

$Se^2 = 6.57$

$\frac{Sm^2}{Se^2} = .174 < 3.30$

∴ There is reason to believe that Ho is true.

b = 3

a=7

Samples \ Blocks	I	II	III
1	8	2	3
2	6	4	9
3	5	1	7
4	1	6	3
5	9	2	9
6	4	4	1
7	3	3	5
8	6		5
9			4
10			2
11			2
12			9
13			3
14			2
15			1
16			5
17			2
18			4
19			7
20			7
n=	8	7	20
Ti=	42	22	90
$\bar{X}i$=	5.25	3.14	4.5
$ai=\bar{\bar{X}}i - \bar{X}i$	.95	-1.15	.20

T..= 154

$\bar{\bar{X}}i$ = 4.30

SELECTED PARTS I
FROM SURVEY QUESTIONNAIRE

Introduction. Part I of the Survey Questionnaire was purposely structured to be open-ended, allowing the respondent to address "success" from a wide range of views. Data from all questionnaires, including Parts I, formed the basis for the final report of this study. Some of the Part I responses, however, showed so much insight that they are repeated in this appendix almost verbatim.

Comment. Most Parts I described success in terms of either the "classical definition": Bringing the system into the inventory, on schedule, within cost estimates, and meeting specifications; or from a user's perspective: That management process which provides to the operational forces a system which satisfies a true operational need.

Responses which expand on these themes follow, listed generally on the basis of some significant viewpoint:

a. Working definition from a SPD.

b. Acquisition strategy based on system (not necessarily program) requirements.

c. Characteristics of a successfully managed system program.

d. The contractor.

e. "Micro" program management (what the SPD can control) vs. "Macro" (what the SPD cannot control).

f. OSD

g. Importance of the environment and factors beyond the control of the SPD.

h. Making certain the system works.

i. Plea from a user.

A. Working definition from an SPD.

"Successful program management will have existed if the following conditions are met.

1. System capabilities provided the using command are equal to or greater than those specified in the requirements documents.

2. The costs are within 5% of the estimates in real dollars for total program. (1-2% in annual estimates).

3. The IOC is within 6 months to a year of the need date.

4. The necessary support equipment and facilities are available at IOC and included in the cost estimates.

It is possible that successful management will lead to termination of a program if the above conditions cannot be met due to funding constraints, threat changes, and user gold plating requirements."

B. Acquisition strategy based on system (not necessarily program) requirements.

"Successful system program management is the ability of a manager to take the requirements of the user (customer) and then define a program/strategy to design, develop, test and deploy that system and have it meet the requirements...those requirements must remain constant (but) if there are changes, the cost and schedule impacts must be recognized and funded without prejudice to the program."

C. Characteristics of a successfully managed system program.

"A successfully managed system program consists of a number of diverse characteristics. These would include:

a. Early establishment of an 'accepted' Requirements Base Line. This often, in my experience, did not exist until a Program Manager was assigned. There is a need to coalesce the often loose objectives into a meaningful requirement that ultimately can become an unambiguous contracted work statement and well defined specification.

b. The objectives must be articulated to the user, AFLC, and the Air Staff, to achieve energetic and total Air Force support - early.

c. Establishment of an early and realistic cost Base Line.

d. Clearly articulated to DOD and Congress to obtain their support.

e. A sound business contract which subsequently cannot be second-guessed by antagonistic critics.

f. Once the program development and production milestones are established, it is essential that each be met.

g. Whenever 'outside' interference (OSD or Congress reprogramming) causes adjustments, these should be avoided, and when unavoidable, they should be recorded with clearly articulated impact statements. The 'interferer' should be identified and held responsible.

h. Operational performance objectives should be demonstrated during test evaluation.

i. Development and production costs should coincide with original estimates. This is more difficult with double-digit inflation, but inflation impacts should be isolated.

j. Original I.O.C. dates should be achieved.

Achieve these - and the program will be successful!"

D. The contractor.

"- Test programs meet objectives and validate hardware.

- Development costs are close to estimates.

- Development schedule is achieved.

- Production cost is consistent with earlier estimates.

- Program must be perceived by OSD and Congress as being 'highly successful' and bring credit to The Service.

- The system meets technical requirements.

- The system is satisfactory to the user.

- RAM characteristics are acceptable.

- Contractor interfaces are responsive to Government factors.

- Effective support is sustained at least within the military and at DOD.

- Meets profit objectives.

- Utilizes resources effectively.

- Minimizes unrewarded investment.

- Excels over the competition.

- Shows understanding of and meets Government 'special' objectives (i.e., any not overtly stated in program documents)."

E. "Micro" program management (what the SPD <u>can</u> control) vs. "Macro" (what the SPD <u>cannot</u> control).

"Let me begin by establishing my terms of reference for system program management. In my judgment there is 'micro' program management (System Program Office level) and there is 'macro' program management (the whole schmeer for lowliest enlisted or civil servant participant to the Congress and even the Executive Department if they involve themselves). It is my opinion that to achieve (the purpose of) this research you only want to look at 'macro' program management. So I will devote myself to that. And I think I know of what I speak. I was a System Program Director and I succumbed to the 'micro' idea that the SPD is responsible for everything. But in retrospect I realize that some of my frequent frustrations resulted because I was saddled with things over which I had no control. So the 'micro' view is terribly fallacious because it covers only a fraction of the pivotal decision-making life span of the program.

In contrast, 'macro' system program management covers every phase of the system from a conceptual cradle to the post operational salvage grave. Every participating agency having a responsible role to play must play the role well and in a timely manner. No Program Director could have overcome the dual burden of controversial concept and controversial selection of the ... contractor for the TFX; these errors were made in the Senior Air Staff and at the Sec Def level. No Program Director could have overcome the burdens of unrealistic requirements, total package procurement management and ... his 'supporting Air Staff'; these errors were imposed above the SPO level. No Program Director could foresee, least of all overcome, the decision of a ... President in cancelling a B-1 Program that was apparently developing satisfactorily. None of these are within the sphere of SPD control but each dramatically influenced the programs in question.

It is with this 'micro-macro' differentiation in mind that I suggest successful system program management consists of all of the following as a minimum:

a. Clearly stated, fully justified and realistically attainable operational specifications that accurately relate the user's needs for fulfilling his role in supporting national objectives.

b. Translation of the user's operational specifications into design criteria and technical specifications fully within demonstrable state of the art.

c. Development of a realistic schedule for acquisition, development testing, production, training, and logistics support.

d. Development of realistic life cycle cost data to accurately reflect the development, production, operational, and support costs of the system.

e. Disciplined participative management in full cooperation between the Air Force Program Office, the AFLC Support Manager, the Contractor and others as necessary.

f. Effective support and representation of the program by AFSC, AFLC, USAF, and OSD staffs at all levels.

g. Support of the Congress to include timely approvals and appropriations of requested funding.

Successful integration of these essential elements with myriad others, both predictable and unpredictable, will produce the desired synergistic effect - the 'bottom line' criteria for succesful system program management. The 'bottom line' is: Meet the program schedule within estimated/budgeted costs with a system that meets or exceeds the user's technical requirements and is fully supportable in the operations, training and logistics support senses."

F. OSD.

"Successful system program management produces a product generally within the bounds of the various parameters established for it at the outset. In other words, it lives up to the promises made to OSD thru the DCP process, and to the Congress through the SAR process. These 'promises' are essentially informal 'contracts' by which the credibility of the performer can be judged.

If the product cannot in fact meet all the goals and objectives (they are never requirements), then successful system program management must either stop the program, or sensibly reduce the goals until a useful product can be realized. Such relaxation of goals must be balanced between cost, performance, maintainability, and schedules -- with none being considered 'sacred'.

Successful system program management, in a more administrative sense, provides a useful and intelligible record of its progress towards its goals -- providing an 'audit trail' which not only demonstrates its own achievement, but provides information which may improve estimates and projections for future programs.

Successful system program management should persist through the useful life of any major program, making possible the updating and improving of performance and the reduction of both production and maintenance (and training) costs. Good management can considerably extend both the useful life and the total production quantities of most types of systems, as well as possibly making them attractive for foreign transfer/sale.

Program management would also be more successful if it considers the potential need to 'surge' or 'mobilize' the production of either complete systems or the spares and related consumables associated with higher operational tempos or combat situations. I would acknowledge, however, that if such capabilities are not stated as goals, then the manager may be hard pressed to make sensible judgments on his own.

By my definitions, successful system program management may or may not lead to a very useful product in retrospect. If the established program objectives turn out to be inappropriate, that can hardly be blamed on the *system program management* <u>*unless*</u> *they were party* to the formulation of unrealistic initial objectives."

G. Importance of the environment and factors beyond the control of the SPD.

"The basic principles of successful program management are not secret. You can find no end of repetitive studies covering the same ground. The problem comes in the application of those principles in an environment where so many elements essential to program success are beyond the control of the program manager. The AF has a long history of success in managing system acquisitions; then in the last 15-20 years the advances in technology, plus inflation, multiplied acquisition costs several times so that cost rather than operational requirement has become the dominant factor. Then too, McNamara ushered in a new era under which the OSD staff sought to change the world of system management and suddenly we had too many managers, most of whom didn't understand the process, and program stability became a thing of the past. (Kissinger in his book 'White House Years' comments on McNamara. 'His eager young associates hid their moral convic-

tions behind a seemingly objective method of analysis which obscured that their questions too often pre-determined the answers and that these answers led to a long term stagnation of our military technology.').

The greatest contribution to program management would come with acceptance as fact that (1) we can never predict with precision the problems to be encountered and the costs to be incurred in developing and producing something that has never been built before, and (2) that if we delay production until all technical advancements are proven we will produce obsolesence. If a capability is vital to our national defense, we must afford it. Such concepts as 'Design to Cost' not only are utter nonsense, they are dangerous.

There is a difference between program success and successful program management. Management is but one element in program success, although a very important one. Inadequate funding by Congress can ruin a program, even if the management is excellent. Many other factors can bias results. The C-5A will never be classified as a successful program but, in my opinion, the AF management was good. (To come to this conclusion I exclude from the grading of management the decision to procure under the Total Package Procurement Concept which was forced on AF program managers. TPPC precluded prudent management actions which could have balanced poor contractor performance and benefited the program.) Inflation has had a severe impact on program success in recent years but this should not be a measure of management success since projected inflation rates are provided by the Executive Branch and reflect that built-in optimism.

In a broad sense, the ultimate in program success is to meet performance specifications on schedule and within cost projections. In the real world, the success of program management is measured against how close the managers come to meeting those three goals in their current order of priority; that is, which is most important at that time, achieving performance specifications, meeting an IOC or staying close to budgetary limits. The Minuteman I program was considered a success because it came in on or ahead of schedule and met operational requirements--the priority objectives at that time. Placed in a different era with unpredicted inflation

and an emphasis on cost, the verdict might have been quite different. When cost is dominant, the manager's flexibility is limited. He can't buy performance or improved IOCs."

H. Making certain that the system works.

"Successful program management means more than guiding a hardware program over the hurdles to get a favorable production decision. It means fielding a system that can perform its combat role when and where required. Successful program management means 'designing-in' the operational performance (range, speed, accuracy, etc.) and logistics supportability from the very first day the program is conceived. It means establishing the traditional cost, performance and schedule criteria for success plus a relatively new and equally important criterion - logistics supportability. Progress toward goals for reliability, maintainability, readiness, manpower, and operating and support costs provide the benchmarks for measuring the success of this criterion..."

I. Pleas from a user.

"Without trying to write a treatise on the subject of acquisition management, a task for which I am not at all qualified, I'll offer a thought or two from the perspective of an operator and maintainer.

Firstly, I believe we tend to over-specify our requirements in terms of design and performance characteristics. In so doing, we sometimes push the contractor away from taking his best shot by preempting it with something less. In my view we could be better served by describing our requirements more in terms of the mission(s) to be satisfied and encouraging the contractor to innovate to include the use of commercially proven designs where practical.

Secondly, I feel very strongly about reliability and maintainability. Nothing is so frustrating as trying to operate in combat with a weapon system that requires too much TLC (Tender Love and Care) by highly qualified technicians--we never have enough of them. I don't believe we end up

with these kinds of systems solely because we insist on high levels of performance. Too often, in my view, it's because we do not economically motivate the contractor to design in good maintainability and reliability. This is a well-recognized principle represented by the mission of AFLC's Acquisition Logistics Division but too often given lip service and honored only in the breach. We have to make it worth the contractor's effort up front ... to design in reliability, use high quality components and keep the field level maintenance man's task firmly in mind."

For Contract F33615-80-C-5184

STUDY: ANALYSIS OF SUCCESS IN SYSTEMS PROGRAM MANAGEMENT

Investigative Worksheet for _____ Program

I. General Data:

Date of investigation _____
Location of investigation _____
Investigator _____
Data Source _____

II. Attributes of Success. From the data source, indicate numerically in this section the degree to which success criteria were met.

A. Accomplishment of Cost/Schedule/Performance (CSP) Requirements.

1. Success in meeting cost requirements:

0_____10
Low High

Evidence/Comments:

2. Success in meeting schedule requirements:

0_____10
Low High

Evidence/Comments:

3. Success in meeting performance requirements:

0 _____ 10
Low High

Evidence/Comments:

B. Maintaining of Program Stability

1. Clarity in defining program objectives:

0 _____ 10
Low High

Evidence/Comments:

2. Success in minimizing changes:

0 _____ 10
Low High

Evidence/Comments:

3. Success in recognizing/managing risk:

0 _____ 10
Low High

Evidence/Comments:

C. Rewards to Program Personnel

1. Indications that program/personnel won awards:

0 _____ 10
Low High

Evidence/Comments:

2. Indications that program personnel were promoted as a result of program accomplishments:

0_____10
Low High

Evidence/Comments:

D. How Well System Worked When Needed

1. Indications that system met user's operational needs:

0_____10
Low High

Evidence/Comments:

2. Indications that system was supportable:

0_____10
Low High

Evidence/Comments:

3. Indications that deployment was timely (e.g., met IOC):

0_____10
Low High

Evidence/Comments:

4. Indications that sufficient numbers of system were deployed:

0_____10
Low High

Evidence/Comments:

III. Cause of Success. From the data sources, indicate numerically the degree to which input parameters were met.

A. Input parameter 1.0: Attention to Directed CSP Requirements

1. Adherence to system performance requirements:

0_____10
Low High

Evidence/Comments:

2. Adherence to system supportability requirements:

0_____10
Low High

Evidence/Comments:

3. Adherence to program schedule:

0_____10
Low High

Evidence/Comments:

4. Adherence to program cost:

0_____10
Low High

Evidence/Comments:

5. Indications of meaningful CSP trade-offs:

0_____10
Low High

Evidence/Comments:

B. Input parameter 2.0: Ability and success in maintaining tight control.

1. Continuity and authority of PM:

0_____10
Low High

Evidence/Comments:

2. Emphasis on change control management:

0_____10
Low High

Evidence/Comments:

3. Evidence that CSP control techniques were used (C/SCSC, TPM, CPM, etc.):

0 _____ 10
Low High

Evidence/Comments:

C. Input parameters 3.0: Adequacy of means to accomplish program objectives.

1. Availability of resources:

a. Personnel:

0 _____ 10
Low High

b. Technology:

0 _____ 10
Low High

c. Finances (Funding):

0 _____ 10
Low High

d. Time:

0 _____ 10
Low High

Evidence/Comments:

2. Evidence of SPO Capability/Excellence:

0 _____ 10
Low High

Evidence/Comments:

D. Input parameter 4.0: Support for the system program.

1. Support above program office:

a. HQ USAF:

0 _____ 10
Low High

b. OSD:

0 _____ 10
Low High

c. Congress:

0 _____ 10
Low High

Evidence/Comments:

2. Support at working level of SPO (with logistics manager, user, contractor, and headquarters):

0 _____ 10
Low High

Evidence/Comments:

E. Input parameter 5.0: Existence of clear requirements.

1. Clarity and understanding of the requirement:

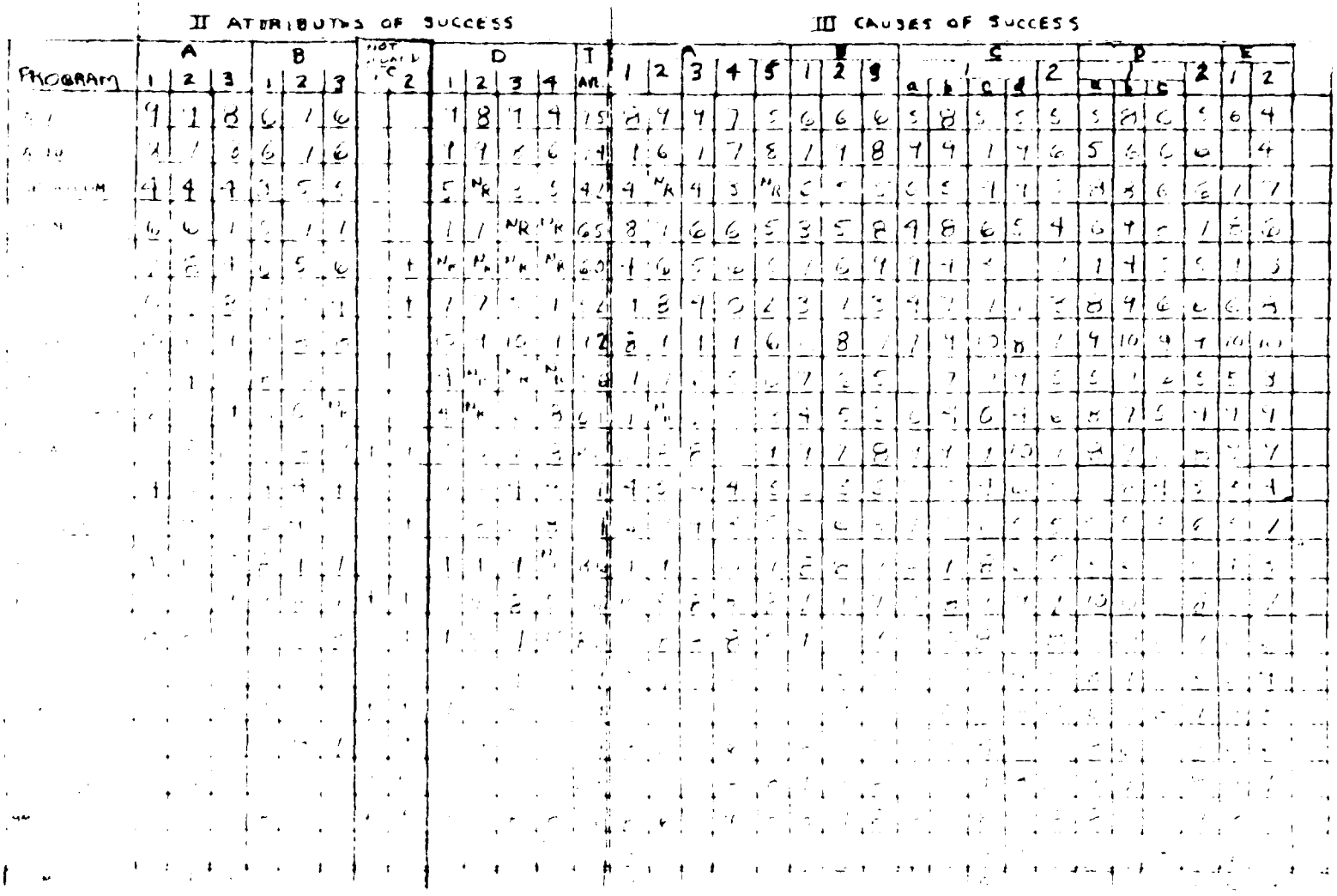
0 _____ 10
Low High

Evidence/Comments:

2. Forcefulness of the requirement statement (need recognized and approved):

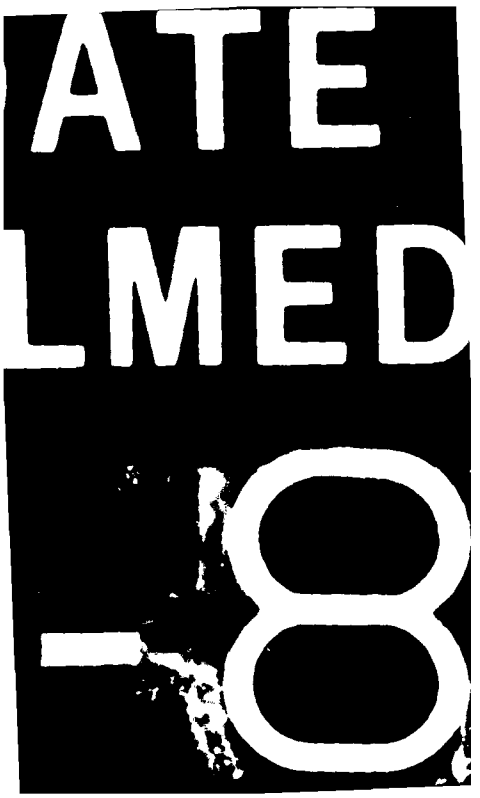
0 _____ 10
Low High

Evidence/Comments:


II ATTRIBUTES OF SUCCESS
III CAUSES OF SUCCESS
PROGRAM
A
B
C
D
T
E

Abbreviations and Acronyms

AFLC	Air Force Logistics Command
AFSC	Air Force Systems Command
ASD	Aeronautical Systems Division
ASD(--)	Assistant Secretary of Defense for --
AU	Air University
CMD	Contract Management Division
DCP	Decision Coordiating Paper
DDC	Defense Documentation Center
DLSIE	Defense Logistic Support Information Exchange
DTIC	Defense Technical Information Center
ESD	Electronic Systems Division
JCS	Joint Chiefs of Staff
MENS	Mission Element Need Statement
OSD	Office of Secretary of Defense
PEM	Program Element Monitor
PM	Program Manager
PMD	Program Management Directive
ROC	Required Operational Capability
SAFA.	Secretary of the Air Force, Acquisition and Logistics
SAMSO	Space and Missile Systems Organization (now Space Division and Ballistic Missile Office)
SMS	Senior Master Sergeant
SONS	Statement(s) of Operational Need
SOW	Statement of Work
SPD	System Program Director
SPO	System Program Office
STOL	Short Takeoff and Landing
TFX	Tactical Fighter, Experimental (became F-111)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