AFIT/GLM/LSY/92S-5

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NASA AND LOGISTICS—A MATCH FOR THE 21st CENTURY

THESIS

STEPHAN P. BRADY, CAPTAIN, USAF

JAY R. JENNINGS, CAPTAIN, USAF

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A MATCH FOR THE 21st CENTURY

THESIS

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the Degree of

Master of Science in Logistics Management

Stephan P. Brady, B.A.

Captain, USAF

Jay R. Jennings, B.S.

Captain, USAF

September 1992

Preface

This thesis has been an exciting adventure that we will not soon forget. Although we came into it with a baseline knowledge of strategy theory, we were able to greatly expand our understanding beyond the confines of what we needed to accomplish our previous jobs in the Air Force. Chapter Two is but a slice of what we uncovered, distilled by design to give the reader the theoretical and practical background required to understand and benefit from the thesis. And, although this preliminary research was enlightening, it was just the beginning.

The next step in our research process brought us into the world of NASA. We poured over massive amounts of documentation to help us better understand the organization and its people. We interviewed some of the most highly skilled, and admired, people in government service today. These interviews proved to be invaluable in our final analysis, allowing us to capture the essence of the organization and its strategy processes.

Out of that analysis came the recommendations we offer in Chapter Five. Much thought and discussion over the course of this thesis went into their formation. It is our sincere hope that they will be accepted and implemented by NASA's decision makers to help it continue to grow and flourish into the 21st century as the world's foremost leading-edge technology pioneer.

We wish to gratefully acknowledge our thesis advisors, Professor Brett Andrews and Major Jake Simons, for their patience and wisdom in helping us put together a thesis which may actually "make a difference." Of course, this thesis would not have been possible without the help, understanding, and funding of our sponsors at HQ NASA. We would like to thank those at HQ NASA, and the centers, who welcomed us DoD "outsiders," took time out of their busy schedules to introduce us to NASA, and answered our questions with the utmost honesty and candor. Thanks are also extended to Professor Herbert Smith from Western Maryland College for his assistance in developing the survey tools used. We are further indebted to our strategy mentor, Major Wayne Stone of the Air Force Institute of Technology, for his many contributions to this endeavor.

Last, but certainly not least, we would like thank our families. To Steve's family—Jenni, Stephanie, Heather, and Matthew and to Jay's family—Wendy, Christopher, and Joshua: Only your strength and love has allowed us to endure, and for that, we are truly thankful.

Steve Brady Jay Jennings

Table of Contents

Page

List of Figures

List of Tables

Abstract

This research evaluated current NASA organizational and logistical strategy processes to compare them with current academic theory and make recommendations to improve the processes. Various strategy theories were explored, resulting in a model synthesizing the various elements. The organizational, cultural, and political environment surrounding NASA was studied. Personal interviews were conducted and various NASA strategic plans and other documents were analyzed. From these activities emerged six recommendations: 1. Create a formal strategy process for NASA logistics (and NASA), 2. Tie logistics strategies directly to organizational strategies/goals, 3. Get logisticians from different functions/programs/centers to crossflow information, 4. Identify redundancies in logistics functions at centers and consolidate where possible, 5. Change the culture and tradition of NASA by infusing trained logisticians, and 6. Evaluate each program not in terms of the program itself but in terms of the goal for that program.

NASA AND LOGISTICS--

A MATCH FOR THE 21st CENTURY

I. An Introduction

Problem Overview

- Apollo 11 and Neil Armstrong setting foot on the Moon
- Voyager silently passing by the majestic beauty of Jupiter
- The Space Shuttle Challenger exploding on national TV

When one thinks of NASA, visions of America's most stunning successes, and most graphic failures, almost immediately spring to mind. Each of these vaunts our nation's ability to triumph over nature and to overcome obstacles through technology. NASA faces new challenges in the 90's, many of which cannot be overcome through sheer technological innovation, but additionally require "logistics" to achieve success. This is brought on by a shift in focus, transitioning from manned missions that go up and come down within relatively short time periods, to missions that will go up and stay up. Maintaining a permanent, and possibly manned, presence in space will require not only dollars and research, but also a solid plan for ensuring full operability throughout the projected life of the systems (Motley and Craig, 1991: 2,3).

NASA was born during the height of the Cold War era. Congress established NASA with the National Aeronautics and Space Act of 1958. Because it drives the overarching strategic direction for NASA, the Act is included as Appendix A to this study. The Act served to establish the mission of the organization and specified that NASA should "contribute materially to one or more of the following objectives" (U. S. Congress, 1958:1):

> (1) The expansion of human knowledge of the Earth and of phenomena in the atmosphere and space;
>
> (2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;
>
> (3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;
>
> (4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;
>
> (5) The preservation of the role of the United Sates as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;
>
> (6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;
>
> (7) Cooperation by the United States with other nations and groups of nations in work done pursuant to the Act and the peaceful application of the results thereof; and
>
> (8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment. (U. S. Congress, 1958:2)

These national objectives for the civil space program were distilled by the Advisory Committee On the Future of the U.S. Space Program into "imperatives" (NASA, 1990:23). These "imperatives" include sustaining our heritage through education and exploration, maintaining our technological advantage as a world leader, and enhancing the quality of life for the peoples of the world (NASA, 1990:23). NASA has taken these three goals and formulated three objectives for the organization. In them they seek to achieve the national goals through mission oriented programs, pure research, and "spin-offs" of technological developments (NASA, 1990:24; Asker and Covault, 1992:180).

From these organizational objectives NASA develops specific programs. These programs, which seek to fulfill NASA's goals and objectives, will require not only development of new technologies, but also a logistics structure that can sustain their operations. These goals, objectives, and programs, taken together comprise NASA's strategic direction.

Specific Problem. A new thinking is driving NASA strategic planning. NASA's new systems are functioning more and more as platforms for scientific research while maintaining the traditional role of the systems yielding useful science themselves. As such, the systems are shifting from expendable, one-shot items to reusable, sustainable assets. In addition, NASA is now thinking of the lifespan of systems in terms of years, and decades, in space. Supporting such systems and operations will require on-orbit maintenance, and constant (and consistent) resupply (Sutton, 1991). Even older systems, such as the

satellite Solar Maximum (*Solar Max*), are being repaired on-orbit rather than replaced (Bilstein, 1989:133). In recognition of the increasing role logistics must play, NASA's logistics community now perceives a need to develop logistics strategies that will guide the organization down the path of logistics self-support. In that light, we have been asked by NASA/JI to evaluate the current organizational and logistical strategic processes to compare them with current academic theory and make recommendations to improve the processes, if applicable.

Investigative Questions.

1. What is the current academic and professional thought concerning the strategy process?

In order to fully evaluate the strategic process at NASA, it will be necessary to establish the proper intellectual framework. This framework for understanding the strategic process must include extensive research into both academic and professional thought to balance theory with practice, ivory tower idealism with brick-laying realism.

2. What are the relationships between NASA's organizational goals, objectives, and strategies at various levels of the organizational structure?

The strategy process occurs at all levels of an organization (Higgins, 1985:94). When developing (or analyzing) a strategy at the lower echelons it is essential to review the strategies at the higher levels. While some strategies have been

noted above, it is imperative that we fully explore the range of strategies, goals and objectives that NASA has established to secure an adequate logistics strategy. The goals, objectives, and strategies will not be explicitly stated in this thesis, but they will be reviewed to determine the relationships that form the strategic direction of NASA.

3. How are NASA's various strategies formulated, disseminated, implemented, monitored, and controlled?

Strategies work best when they are known. The ability of an organization to "get the word out" concerning the direction will inevitably improve their ability to effectively meet the goals and their organizational strategies. Strategies that either are not implemented, or are implemented inappropriately, are as ineffective as no strategy at all. Only strategies implemented fully and within the context in which they were formulated can be expected to guide an organization to meet its goals. Feedback and control are essential elements to ensure proper and continued implementation of the strategies, as well as to provide means of evaluating the strategies themselves. Determining what feedback mechanisms exist in NASA is the first step in analyzing the adequacy of these mechanisms of control.

A full understanding of the strategy process at NASA (both past and present) should provide insight into the corporate management and culture, and will assist in identifying both those actions that function well, and those that are dysfunctional. Any recommendations that can be made must either be within the existing framework, or include a change to that framework. Either way, the

current processes must be known and understood before they can be effectively evaluated and potentially changed.

4. What are the implications of the NASA strategic process for logistics strategies?

This question is central to our study and ties all of the previous questions together in focusing on NASA logistics. With strategy theory and the NASA strategy process laid out, we can now look at how these relate to and affect logistics at NASA, specifically examining what the NASA perception of logistics is and what drives logistics (and logisticians) at NASA.

5. What, if any, recommendations can be made that will affect a positive change in the NASA strategy process as it relates to logistics?

The answer to this question calls on all we may learn about strategy process theory, the NASA strategy process, and NASA logistics. Although this question appears somewhat leading or biased in that it may seem we expect to have to make recommendations for some sort of improvements at NASA, this is not the case. Conduct of this study will be accomplished in the strictest academic demeanor, without premeditated conclusions. However, it must be noted that this research would not have been requested by our sponsors if it were not for their perceived need for improvement. This calls on us to not only guard against the biases we bring into this research effort, but also to guard against those biases we may be exposed to in the prosecution of this study.

Scope

This study is a literature review of strategy theory, a case study of NASA strategic plans, and a field study of NASA Headquarters and several centers. Data gathering to answer the investigative questions will involve both primary and secondary data sources. We intend to use personal interviews as our primary data source, to capture the thoughts of the decision players.[1] Our secondary sources will include academic texts, journal articles, official NASA documents and open media sources that will function not only as additional sources of information to answer our investigative questions, but will allow for a cross check of information gleaned during the interviews.

The Research Process

The first step in this study will be the use of secondary sources of data concerning the strategy process to gain an understanding of the latest theoretical underpinnings of research in this area. These sources include the writings of academic theoreticians and actual practitioners to provide a balance between the two. This preliminary step will set the theoretical basis for the remaining research effort, and help the researchers better understand the strategic environment specifically at NASA. In addition, we shall examine writings that highlight the similarities and differences that exist between business strategy processes and those in government, or public, agencies.

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[1] We have elected to use the phrase "Decision Players" to refer to those in management who affect the strategic decisions. We see decision makers as a subset of this group, consisting of the individuals who actually make the decisions concerning strategic direction.

Following this, we shall conduct a literature search through NASA documents (and outside sources, if available) to determine NASA's goals, objectives, and strategies and how they fit together.

The final step in the data gathering process will be to go to NASA Headquarters and the various space centers to conduct personal interviews with key personnel responsible for strategy and/or logistics. These interviews will assist in answering how the various levels of the organization receive their strategic guidance from higher headquarters and to determine the process by which these strategies are formulated, implemented, monitored and controlled.

Interview responses will be evaluated using qualitative analysis techniques. The outcome of this analysis will be compared with the information contained in current theory and summarized in the Literature Review, Chapter Two, to identify logistics strategy implications and ways NASA might improve their strategic planning process and the products of that process.

Limitations

All data collected, and conclusions reached, are limited in application to the specific NASA organizations. It is our hope that the methodology and models used should be generally applicable to the study of non-profit organizations. Additional limitations will be identified while the research continues, as we learn more about the various qualitative analysis methods and as we actually begin to gather data. These additional limitations will be

addressed in Chapter Two and Chapter Four, outlining the potential effects they had on our research.

Researcher Bias

It has been obvious from the genesis of this thesis that the researchers' background in the Air Force may lead to a study biased toward findings and recommendations that would impose an Air Force or Department of Defense (DoD) framework onto NASA. Even the perception of a bias toward the Air Force way of doing business would render this thesis useless to those it is meant to serve, namely NASA personnel. Knowing this, the researchers have done their best to shed their DoD frame of reference for a purely academic one and keep a conscious vigil against allowing past DoD "truths" to influence their present research.

Because this thesis involves two researchers with very different academic, professional, and personal backgrounds, it has already been apparent that attempts to interject individual biases will be difficult. At the start of the thesis, a verbal agreement was made between the researchers that binds each to ensure that any perceived attempts at entering bias into the research will be challenged and objectively discussed. This agreement has helped, and will continue to help, buffer this research effort from individual bias and to focus objectively on the relevant aspects of the data and its relationship to theory.

Looking Ahead

In Chapter Two we shall review the literature concerning current thinking surrounding the strategy process. Additionally we shall develop composite definitions of the key terms, strategy and logistics. Various strategic models will be explored with the intent of developing a model for use in our own research.

Chapter Three will more completely explore the avenues we shall use to answer the investigative questions previously discussed. Chapter Four will relate our application of the processes and techniques used in data gathering and analysis, and will discuss the findings. Finally, Chapter Five contains our recommendations and conclusions which we believe to be solidly based on the data collected and interpreted using generally accepted analytical techniques.

II. Literature Review

Overview

Before we can discuss the strategy process followed at NASA, both in the organization and for logistics, it will be necessary to accomplish several fundamental steps. First, some key words must be operationally defined. Additionally, the theory behind the current academic and professional understanding of the strategy process should be fully explored. This exploration must look at all areas of the process, and its environment. Finally, various models of the strategy process need to be identified to provide a solid reference point from which our study of NASA can progress.

Definitions

A plethora of definitions for logistics are put forth in the literature. Most of them revolve around the concepts of distribution, marketing, materials management, supply, or warehousing (Stock and Lambert, 1987:6). For business, one of the most widely accepted definitions was delineated by the Council of Logistics Management in 1986:

> the process of planning, implementing and controlling the efficient, cost-effective flow and storage of raw materials, in-process inventory, finished goods, and related information from point-of-origin to point-of-consumption for the purpose of conforming to customer requirements. (Stock and Lambert, 1987:7)

The Department of Defense (DoD) definition of logistics is much broader, encompassing not only the flow of goods concept of the Council's definition, but

also including such elements as maintenance (both of equipment and facilities), aeromedical evacuation, and the "acquisition or furnishing of services," like food services or billeting (National Defense University, 1991:I-21).

The definition of logistics used by NASA combines elements from both the Council definition and the DoD definition, adding yet other elements which NASA sees as vital to supporting their unique operations:

> the art and science of management, engineering, and technical activities concerned with determining requirements, design, and supplying and maintaining resources to support objectives, plans and operations. (NASA, 1991:1-2)

Note that this definition includes engineering and "technical activities" which are the underpinnings of NASA's overall operations (NASA, 1990:8). This definition will be used throughout the remainder of this study as the frame of reference from which logistics strategies are realized in NASA.

Strategy

There are various definitions of strategy put forward in the literature. James B. Quinn (in Mintzberg and Quinn) offers one of the most exhaustive definitions in the literature today:

> A **strategy** is the *pattern* or *plan* that *integrates* an organization's *major* goals, policies, and action sequences into a *cohesive* whole. A well formulated strategy helps to *marshall* and *allocate* an organization's resources into a *unique and viable posture* based on its relative *internal competencies* and *shortcomings*, anticipated *changes in the environment*, and contingent moves by *intelligent opponents*. (Mintzberg and Quinn, 1991:4) (Emphasis is that of the original author)

Along with this definition, both Higgins and Quinn emphasize the components of strategy. According to Quinn, a strategy consists of goals, policies, programs, and strategic decisions (Mintzberg and Quinn, 1991:6). Higgins includes these basic points, and expands on them in developing a strategy process model (Higgins, 1985:8). Higgins' model is further explored in this chapter (page 16).

In addition to this definition, it is important to note that strategy occurs at all levels. In fact, at times the only difference between strategy and tactics is "the perception of the leader. What appears to be a 'tactic' to the chief executive officer (or general) may be a 'strategy' to the marketing head (or lieutenant)" (Mintzberg and Quinn, 1991:6). From this point then we can say that strategies are the goals, policies, programs and strategic decisions that direct the actions of an organization, or sub-organization.

Theory on Strategy

One of the more interesting concepts in strategy formulation is put forward by Mintzberg. He argues that there are four distinctly different types of strategy: deliberate, emergent, realized, and unrealized. Deliberate strategy is that strategy which was consciously derived and achieved the result intended. Emergent strategies are not the result of conscious decisions, but rather are strategies that develop as the time goes on, but which achieve the desired ends. Realized strategies are the net result of both deliberate and emergent strategies, whereas unrealized strategies are those intended strategies that fail to achieve the desired results. It is of note that an emergent strategy will

always achieve the desired results, since failure to do so would mean it wasn't an emergent strategy. (Mintzberg and Quinn, 1991:13)

According to Platts and Gregory, most formal formulation models are built using seven steps. These steps, which are tied most closely to the deliberate strategy, include: strategy identification, environment analysis, resource analysis, gap analysis, strategic alternatives, strategy evaluation and strategic choice (Platts and Gregory, 1990:7,8). Mintzberg counters with the argument that while this formal process may work well for a pure deliberate strategy, much strategy is formulated outside of a formal process, with outside pressures and the process of learning constantly affecting the strategy.

Strategy Process Models

As with the definitions for strategies, there are many strategy process models developed in the literature. It is interesting to note that viewing the strategy process as a process is relatively new. Much work has been done on the planning aspects with research into implementation and control gaining acceptance only recently (Lorange, 1982:3). There is a basic commonality among the models, with each author emphasizing differing aspects according to findings of their respective research. Several models will be presented here, and, because of their basic commonality, their differences will be delineated.

Chakravarthy and Lorange detail a five step strategy process (1991:4-6). The first three steps constitute the "strategic planning system." The first element of the strategic planning system is the setting of objectives by the top

executives of an organization. These objectives are broad in scope, and set the general direction which the organization will follow. Objectives take into account the organization's environment and "its strengths in dealing with [the environment]." Once objectives are set, the organization can then move on to the second step of the strategic planning system.

The second step is the development of strategies to meet the organizational objectives. This entails identifying programs that will ultimately meet the objectives. This step helps identify and draw together the resources required to accomplish the organization's programs. This step also establishes time-lines for the organization to meet in order to implement the strategies to meet the objectives. Since businesses generally measure resources in terms of dollars, it follows that some form of budget process would also be included in the system. That leads us to step three.

Step three of the strategy process, and the final step of the strategic planning system, is budgeting, which equates dollars to the resources required by the organization to implement its strategies. Chakravarthy and Lorange emphasize the importance of budgeting in their model, and it is unique in that it specifically identifies budgeting as an explicit step in the strategy process. Their justification for this is the fact that most for-profit organizations (for which the model was developed) use budgeted versus actual, and cost versus profit, to measure and control their progress and success in meeting organizational objectives, which brings us to the next step.

Step four of the strategy process is the "monitoring, control, and learning system." This is the method by which the organization measures not only its progress in meeting organizational objectives through dollar measures, but also in terms of the time-lines set for meeting the objectives. This system then feeds back into the strategic planning system to make necessary modifications to the strategies that are needed to keep the organization on track to meeting its objectives.

The final step in the process is the designing of "incentives and staffing systems." This is the system that sets rewards for managers who help to keep the organization on the strategic path to its objectives. The staffing portion of this system is used to evaluate the performance of the organization's managers in reaching objectives, possibly resulting in changes in management personnel if satisfactory progress toward organizational objectives is not realized.

Raimond and Eden offer their own version of the strategy process (1990:101). Their concept is similar to the previous model. However, Raimond and Eden emphasized a greater attention to the importance of people, especially the role of, and conflict between, the corporation's managers in the strategy process.

Higgins' model (1985:6-9) places the emphasis on the aspects of implementation. More specifically, he focuses on three major areas of implementation that are essential to the success of strategies: 1) organizing and assigning the strategies to appropriate organizational units, 2) an "implementation system" which ensures strategies are broken down into tasks

which these units may accomplish, and 3) identifying the leadership skills of managers and motivational requirements of workers needed to ensure the success (that is, the reaching of organizational objectives) of the organization.

Bungay and Goold stress the importance of identifying the organization's "key success factors as the most important step in the strategy process" (1991:35-37). These key success factors could include such elements as required customer service levels, choosing appropriate channels of distribution, or, in the case of NASA, staying on the cutting edge of technology (NASA, 1990:8).

Andrews, in Mintzberg and Quinn, presents one of the most comprehensive models in the literature today. His model portrays the "corporate strategy" as the fruit of the planning process, with formulation and implementation forming the roots and the stem from whence the strategy is born (1991:47). In developing his model, he incorporates the analysis of the environment and the capabilities of the organization. In addition, he discusses the role the organization itself will play in affecting the implementation of the strategy. Moskow supports this position (at least in planning) asserting that "the style of management and the structure of the organization are among the most important determinants" in the process (Moskow, 1978:3) It is this model that will serve as the foundation for our research.

Andrews argues that the structure of the organization, the leadership and power distribution, and the organization's culture will all affect its ability to effectively implement the strategy. This is further developed in numerous other

articles, specifically combining the various aspects of the organization into an organizational context. This context "is a type of situation wherein can be found particular structures, power relationships, processes, competitive settings, and so on" (Mintzberg and Quinn, 1991:601).

There are five contexts commonly identified in literature. These contexts are: the entrepreneurial, mature, diversified, professional, and innovation contexts. Each of these contexts combines the various aspects of the organization noted earlier. These various contexts are quite extensive, and to describe them in detail would require more space than is necessary for the scope of this work. Table 1 adequately summarizes the various differences between them. This thesis will use the information gleaned from

Table 1: Summary of the Five Organizational Contexts

CHARACTERISTIC	ENTREPENUERIAL	MATURE	PROFESSIONAL	DIVERSIFIED	INNOVATION
Specialization	Low	High functional	High social	High Functional	High Social
Formalization	Low	High	Low	High within Divisions	Low
Centralization	High	High	Low	Limited decentralization	Low
Environment	Simple and Dynamic	Simple and Stable	Complex and Stable	Simple and Stable	Complex and Dynamic
General structural classification	Organic	Mechanistic	Mechanistic	Mechanistic	Organic

(Robbins, 1992:305)

research into this area, and summarized in Table 1, to match the organization of NASA to an appropriate context. Following that, we will explain in detail the context chosen, and how it is appropriate (Mintzberg and Quinn, 1991:xviii, 601-807).

The Research Model

The strategy models discussed above can seem extremely complex and difficult to understand, especially to the person with limited knowledge of the strategy process and the organizational factors which impinge on it. For this research, we will draw on the basic elements contained in the models above (formulation, implementation, and control) as well as the organizational aspects described by Andrews (for instance, culture and power). In order to clarify the synthesized model we will use, we designed the graphical representation at Figure 1. The strategy process is depicted in the figure as a three-step process, flowing from formulation down to control and feedback. Feedback and control assure that the strategy, as formulated, is being properly implemented according to "the plan". This also alerts management when it may be time to reformulate the strategy due to changes within and outside the organization. The plan itself, the product of the formulation step, should explain the strategy in terms of the definition of strategy discussed earlier. In addition, it should outline the remaining steps in the strategy process to provide a strategic roadmap for the organization. Organizational context surrounds the strategy process, affecting the products of formulation (the strategic plan) and the way in

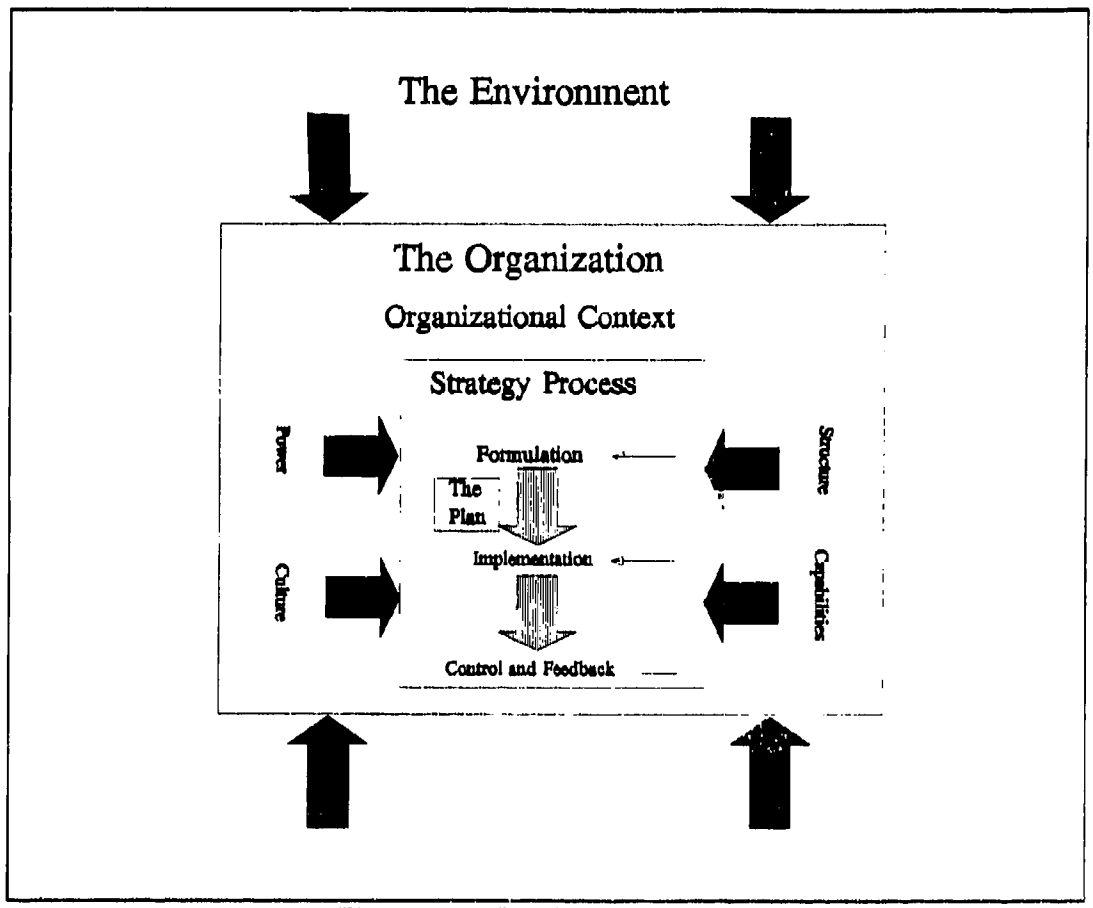

Figure 1. The Strategy Model

which each step is executed. The environment (defined as everything external to the organization) impacts, to varying degrees, the whole organization and may affect the state of or changes in strategic direction (strategy formulation) or organizational context.

Our hope is that this representation will assist the reader as much as it has us in focusing on the essentials of the strategy model. Thus, this model sets the theoretical foundation on which our research is based.

Strategy and the Government Agency

Much of the research done in the strategic process focuses on the private (or business) sector. It was necessary for the researchers to bear in mind that since business and government do not function identically, the models identified above might be inappropriate. It was therefore necessary to research this consideration to ensure the validity of the balance of the thesis. Several fundamental differences in the goals and motivations of these two different types of organizations were identified, most obviously differences in the control and direction of the two (businesses usually have a fairly limited number of individuals providing strategic direction while government agencies receive direction from various branches of government) and the purpose of the organization (private firms seek a profit, while public firms meet policy objectives) (Moskow, 1978:38,39).

Despite these differences, among others, we concluded to operate on the premise that the process of determining an organization's strategy or direction is not significantly different for either type of organization. Determining an organization's goals and objectives, developing a course of action, and ensuring the successful implementation of the process are elements of sound management common to both private and public pursuits. Many public administration texts are devoted to not only policy development (strategic

planning)[2] but to effective program implementation and program review and evaluation methods (Bardach, 1984:5; Lynn. 1987:134-181).

The primary area of concern remaining in looking at a governmental agency would seem to be the political arena. In the private sector, a firm can develop a plan and stay the course, seeing the plan to its completion. In the public sector, decisions are made within the constraints of fiscal year funding and the vagaries of the political climate. Given this, it can be difficult to establish a long-term direction, especially if administrations change or control of the legislature shifts. This can be especially critical if the catalyst for change is a political appointee (Preston, 1984:166-169).

Summary

This chapter has explored the definitions of logistics and strategy as represented in the literature today. It has further attempted to explain some of the theory behind strategy formulation and implementation, including the types--deliberate, emergent, realized, and unrealized--and levels of strategies. Finally, several strategy process models were discussed, and their differences explored. The model put forward by Andrews was selected as the foundation for our research; however, the basic premises common to all models will add substance to our research framework. Therefore, all the concepts presented in

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[2]As an aside, we have looked closely at the strategic process as a governmental activity. It is often seen as a new concept, brought in from the private sector. We would argue that the process has existed all along, but has been labeled "Public Policy" rather than strategy. In fact, many definitions of Public Policy closely parallel the definitions of strategy used here (Lynn, 1987:161).

this chapter serve as the theoretical underpinnings for the remainder of this study.

III. Research Methodology

Overview

In this Chapter we more completely explore the avenues used to answer the investigative questions previously discussed. This chapter specifies the various methods used to answer all five investigative questions as presented in Chapter One. Various techniques of qualitative analysis are discussed as well in the context of the analysis conducted. Further, validity of the survey instrument used and of the overall study are discussed.

Methodology Overview

This study combines three research methodologies to answer the investigative questions identified in Chapter One. The first methodology was a review and compilation of the current theories on strategy and the strategy process. The results of this process, summarized in Chapter Two, answered the first investigative question and will be used as a framework for the remaining portion of the research effort. The second methodology is the case study, which involves an analysis of NASA strategic plans and will contribute to the answering of investigative questions two through four. The field study involving personal interviews will be the last methodology used. The analysis of field data will reinforce the case study already accomplished and capture the organizational issues which may affect NASA logistics strategies and the

strategy process, thus completing the data needed to fully answer investigative questions two through four. The results of the previous methodologies will finally be used to answer investigative question number five. In this last portion of the study, the researchers will use a holistic approach somewhat like that of an evaluative case study (Merriam, 1988:28), immersing themselves in the data, findings, and theory, in order to provide the necessary impetus to develop any recommendations deemed appropriate.

Case Study Analysis

Published NASA strategic plans will be analyzed for overall content as well as structure. The contents will be analyzed to answer investigative questions two and three. The structural analysis will determine if the plans contain the essential elements of a strategy and if the plans lay out a strategic roadmap for accomplishing implementation and feedback and control. The section titled *The Research Model* in Chapter Two synopsizes the theoretical basis for this analysis. The results of this analysis will be used to answer investigative question four as well as provide inputs for the eventual answering of investigative question five.

The Field Study

Personal interviews will be used primarily to capture the organizational behavior aspects of NASA's logistics strategies and strategy process, and to ascertain the efficacy of the overall strategy process. Exclusive use of observation of the behavior of NASA personnel or further examination of

documents will not yield the data needed to complete answering investigative questions two through four. We have identified personal interviews as the best means of getting the data required since concepts like organizational culture or the distribution of power—which impact strategies and the strategy process—and strategy acceptance and implementation by individuals are not normally documented and are either not observable or only observable over long periods of intense contact with the organization (Merriam, 1988: 72). Time limitations on this study definitely eliminate observation as a main method of gathering the needed data. However, observation will still be used to enhance and enrich the data gathered through the interview process.

Sampling. Because of the qualitative nature of this study, rigorous sampling techniques and computation of sample size are not required (Merriam, 1988:47-48; Miles and Huberman, 1984:36-37). We will endeavor to conduct as many interviews as time permits. The population consists of those people overseeing functions consistent with the definition of logistics as used in this study. This population spans the entire organization of NASA, including its headquarters and all geographically dispersed locations. Because strategy is dealt with at the executive level, the sample for the personal interviews will include department, directorate, branch, or unit heads. In addition, although contractor personnel are a large and pervasive force within NASA, they will be expressly excluded from being interviewed because they are not NASA employees. Contractors' strategic foci are toward their companies and are generally based on what they have been hired to do for NASA.

The Interview Instrument. We developed the survey at Appendix B to use in the personal interviews. The questions are grouped by category where each category is designed to elicit responses to generate data to support and supplement the results of the case study discussed above. The theoretical foundation for each category emerges from the discussion of strategy models and theory in Chapter Two (refer to Figure 1 in Chapter Two). The first category, "Personal and Introductory Questions," is designed to gather data which contribute to the organizational context in which the strategy process is embedded. They also serve to build rapport with the interviewee and set the stage for the rest of the interview. The next category, "Program Level," is designed to address the organizational dynamics of NASA including formal and informal channels of communications, perceived constraints, and interoffice rivalries. The third category, "Office Level," seeks to ascertain the amount and kind of input the interviewee's office gets from its customer. This is the kind of input that the interviewee's office may use to develop formal written strategies or may be the seeds of the organization's emergent strategies. We purposely do not ask if these inputs are used for strategy formulation, so we may discover any emergent strategies the interviewee may not be aware of and to see if any explicitly stated strategies elicited later in the interview match customer desires. The "Strategy" category addresses directly the existence and impact of published NASA strategies and the formal strategy process. The next category, "Power," is designed to elicit the interviewee's perception of the relationship between formal power (based on an individual's position and grade) and the

distribution of informal power (based on, for example, an individual's personality, contacts, or political clout) and its impact on the interviewee's organization. The "Logistics Strategy" category seeks to determine if any formal logistics strategies exist, how they are derived and how resources (specifically money) are attached to them. Additionally, we ask explicitly where the interviewee's office gets its goals and objectives. This data will be used in later analysis to see if responses here regarding goal formation match perceived customer desires. This category also helps find whether there is any formal or informal, explicit or implicit, logistics strategies within and across functional or program organizations. The final category, "Logistics Communications," addresses communications as well as perceived and desired organizational structure and focus of control.

The second portion of the instrument, the "Written Response" portion, will be given to the interviewee at the start of the interview. Its purpose is twofold: one, to get the interviewee involved in the interview process by allowing them some freedom to express themselves on paper and two, to give us richer data in the form of graphic images.

Procedure. Our sponsors at HQ NASA agreed to assist in setting up trips to various centers to conduct interviews. They will coordinate with the organizations to be visited and will arrange for local sponsorship so as to ease our initial contact with, and acceptance by, personnel in the various offices we wish to visit.

We will interview respondents as a team, with both interviewers taking notes. In this way, we hope to cross-check the information and identify areas of misunderstanding or confusion on the part of the interviewers. This will allow time to return to the respondent and clarify any issues in a timely manner. As stated above, the second portion of the survey will be provided to the interviewee to allow for inputs from them during the course of the interview. Interaction in this way will provide another avenue of data gathering, encourage the respondent to explore various aspects of the question, and provide the respondent with a greater sense of involvement in the process.

Because the topic we are dealing with may tend to be sensitive in that some responses could be viewed negatively by an interviewee's superiors, we will use control numbers to track each interview. The front cover of the instrument is the only document that associates names with control numbers. These cover pages will be removed from the instrument at the completion of each interview and secured by the researchers to avoid compromise. In this way, we hope to elicit the most frank and honest responses possible. Additionally, tape recording of interviews and source identification of direct quotes taken from interviews will not be used.

Data Analysis Methodology. There are several methods available for qualitatively analyzing interview data. At one extreme, one can merely immerse oneself in the data, reading through it, discussing it, pondering it, and, coupled with one's knowledge of theory, derive conclusions (Merriam, 1988:131). At the other extreme is the word counting, pseudo-quantitative approach of content

analysis, where one picks key words, counts their occurrence in the responses, and bases conclusions on the number of times these words appear given the number of interviews performed (Emory and Cooper, 1991:458). We decided to use an analysis technique somewhere in between.

Our method is based on methods found in Miles and Huberman (1984). The first step in the process involves building matrices in which the response data will be displayed. Because "there are no fixed canons for constructing a matrix," we have developed our matrix design because it was an intuitively appealing way to view and analyze the data (Miles and Huberman, 1984:211).

We will build a matrix for each category of the survey (for example, "Strategy"). Questions will be listed along the top of the matrix, respondents along the left side. Each square of the matrix will be filled in with the respective responses taken from the field notes on each survey. Analysis will ultimately consist of immersion in the data, but this immersion will be on a category by category, question by question basis, rather than trying to interpret all the data holistically at the outset.

After the data is entered into the matrices, the iterative process of analysis will begin. The initial analysis will be done independently by each researcher. First, we will examine each column (that is, each question) for first impressions. As we continue to read through each question and category, we will look for patterns, themes, plausibility, and generally try to make some theoretical coherence out of the data presented (Miles and Huberman,

1991:217-230). Each researcher will record his conclusions based on this iterative process prior to a joint analysis session.

With conclusions in hand, the researchers will then compare the results of their independent analyses. If differences exist between the conclusions, reference to the field notes and theoretical writings, as well as frank discussion of the reasoning behind the interpretation of the data should result in a consensus between the researchers. If differences still exist, they will be explicitly stated in the findings of this study.

Overall Validity of the Study

Validity Issues. The purpose for having such a qualitative analysis is to capture the greatest amount of knowledge from the interviewee rather than limiting them to a few select responses. According to Miles and Huberman, this places the emphasis for analysis on construct and contextual validity, "where qualitative studies can be especially strong" (1984:43).

Construct validity refers to the research tool's ability to measure abstract characteristics "for which no empirical validation seems possible" (Emory, 1991:182). The measuring of decision makers' perceptions concerning the strategy process fits neatly into this category Given this, it is essential that the theories we seek to test are properly explored through the use of our measurement instrument. In addition to ensuring that we accurately measure the theoretical constructs on which our research is based we must also ensure that the comments we receive are understood within the context in which they

were given. Nearly everyone has had some experience with someone quoting them "out of context." Therefore it should be intuitively obvious that analysis without understanding the context would severely undermine the value of the research (Cowser, 1991: 37).

Content validity was also of concern in the development of our interview instrument. Content validity measures the "degree to which the content of the items [in the instrument] represent the universe of all relevant items under study" (Emory and Cooper, 1991:184). Since content validity is determined judgementally, we decided to attack it from not one, but two fronts using generally accepted techniques (Emory and Cooper, 180-181).

First, both researchers did extensive reading in the area of strategy (the bibliography of this study accounts for perhaps 20 percent of the readings done in preparation for this study). This theoretical knowledge coupled with years of first-hand experience in strategic logistics planning for the United States Air Force was brought to bear when constructing the instrument to assure the topic of concern was adequately covered.

The second avenue used to assure content validity was the counsel of experts in the areas of strategy and instrument design. Dr. Herbert Smith, Professor of Political Science at Western Maryland College, Major (Dr.) Wayne Stone, Assistant Professor of Behavior and Management at the Air Force Institute of Technology, and Capt Bruce Cowser (through his thesis referenced in the bibliography of this study), all contributed their expertise prior to instrument development as well as during and after. Their inputs were

invaluable in the development of a sound, valid instrument that would elicit the data we need.

Internal Validity. Internal validity relates to "how one's findings match reality" (Merriam, 1988:166). Merriam discusses six techniques available to the researcher to improve internal validity (169-170). Of the six, five will be used in this study and will be explained below. The only technique not used, long-term observation, will not be used because of time constraints on this study. The first technique, triangulation, will be used extensively in this study. Triangulation involves using multiple researchers, data sources, or methods to help cross-check and verify findings and conclusions. This study will use multiple researchers in the data gathering process as well as the data analysis process. Multiple data sources will also be used in the form of written material and interview responses. Additionally, use of multiple methods, as outlined previously in this chapter, is also planned.

The second technique we will use to improve internal validity is "member checks." Member checks involve "taking the data and interpretations back to the people from whom they were derived and asking them if the results are plausible." This will be done mostly while the researchers are still in the field, however, because of the limited time available for conducting the field study. Therefore, this technique will be of limited value.

Third, we have used peer examination to ensure our instrument will elicit the data we need to answer our investigative questions. Additionally, we will discuss our conclusions with those already consulted in instrument

development, as well as with our thesis advisors and other experienced logisticians (as required) to assure the conclusions are based soundly on the data collected.

The fourth technique we will use is "participatory modes of research" wherein we will involve our sponsors at HQ NASA throughout the research process. They have already been heavily involved up front in identifying the specific problem this research endeavors to solve. They were also involved, to a lesser extent, in instrument development to assure the questions asked were answerable given the current political climate at NASA (even though interviewee anonymity has been assured).

Identifying our biases is the fifth technique we have used to assure internal validity. This was addressed in Chapter One. We will continue to strive to relate and interpret the data while minimizing any biases we may have had going into this study. The two researcher concept will assist in moderating any attempt by one or the other of the researchers to interject that bias into the study.

We must mention one final thing concerning the validity of the recommendations that come out of this research. The theoretical models presented in this study and used in the analysis of NASA are descriptive, not prescriptive. The descriptive model merely represents an interpretation of the preponderance of cases in the real world. Descriptive models are very good at providing understanding as to what elements make up a particular process; however, the elements represented may not be appropriate or desired in all

instances. Therefore, there is a danger that the recommendations may not actually represent the best course for improvement for NASA. We will (based on our experience, current practice and theory, and knowledge of the NASA organization) endeavor only to forward those recommendations which we believe will have a positive effect on NASA's strategy process.

External Validity. Although the theories related in Chapter Two are applicable across the spectrum of organizations, this study will not be generally applicable to other organizations because of its case study methodology. However, it is our hope that the findings of this study could be used by public organizations with similar strategy processes and organizational context.

IV. Analysis and Findings

Overview

Following the review of the academic and professional literature, the next steps (in compliance with the methodology previously discussed) were to review NASA literature and then conduct interviews. This chapter discusses the various issues that came to play in the process, including access to data and sources for interviews. We assess the various NASA strategic plans, discuss the information gleaned from the surveys and interviews, and assess various aspects of the NASA organization with particular emphasis on the strategic processes. Finally, the affects of NASA's strategy process on NASA logistics planning are discussed.

Information Gathering

In the course of this thesis, we made numerous trips, gathered reams of papers, and discussed a wide range of issues with a variety of people at many levels of NASA organizational responsibility. Some of what we gathered proved directly useful, some was of less obvious value, but all provided a valuable indoctrination into the NASA culture.

Our trips included two visits to the Space Station Freedom program office in Reston, Virginia, two visits to Goddard Space Flight Center in Greenbelt, Maryland, and several trips to visit our sponsors at NASA

Headquarters (including one visit to meet with the Society of Logistics Engineers (SOLE) Space Committee) In addition, NASA arranged, and funded, two trips: one to Johnson Space Center in Houston, Texas, and the other (partially funded) to Kennedy Space Center at Cape Canaveral, Florida. These trips occurred over a span of 6 months, with the first introductory trip to the Washington, D.C. area in mid-December, 1991, and the last trip to Kennedy in mid-June, 1992. As noted earlier, NASA funded two trips (one with assistance from the Air Force Institute of Technology) with the remaining trips funded exclusively by the researchers.

Originally, our sponsors at HQ NASA agreed to assist in setting up trips to various centers to conduct interviews. They intended to coordinate with the organization to be visited and arrange for local sponsorship to ease our initial contact of and acceptance by personnel in the various offices we were to visit. While this was accomplished in the visits to Goddard, Johnson and Kennedy, the level of support received from the centers varied greatly. We found that in some cases our local sponsors were at such a level in the organization that they were unable (or unwilling) because of local customs and protocol to arrange for meetings with the higher levels of management necessary for our research.

In such cases, we began networking through the various contacts we were provided, reviewing the organizational charts of the centers, and establishing interviews on our own. This technique allowed us the academic freedom to seek our sources in accordance with our expressed methodology,

and hopefully will dispel any concerns that our sponsor might have intentionally channeled us to reach a predisposed conclusion.

Analysis of Strategic Plans, Processes, and Organizational Context

Overview. This portion of the study addresses investigative questions two and three and develops the essence of NASA's strategy process. Our analysis flows from the strategy model presented in the latter part of Chapter Two. To begin with, we collected and examined published NASA strategic plans from various levels of the organization. Our purpose was to see whether these documents existed and, if so, whether they related in a hierarchical fashion (the strategic plans at higher levels in the organization drove those at the lower levels). Also, we sought to ascertain whether these plans contained the "normal" elements one would expect to see in a strategic plan, for example, explicit goals and objectives, implementation instructions, and strategic control (control and feedback) mechanisms or measures.

In addition to looking at the plans themselves, the interviews we conducted during the field study portion of our research gave us an understanding of how well accepted the plans were at various levels of the organization. It was obvious after two or three interviews that, because of the depth of discussion of each question asked, certain future and follow-up questions in the survey were answered through the answer to the currently asked question. In these cases, the interviewers simply marked through and did not ask questions, as they came to these questions in the course of the

survey, that were not applicable or were already answered. This technique not only helped the flow of the interviews, but also avoided aggravating respondents by not asking redundant questions. Additionally, as much as possible through the interviews when future questions were answered through the current question, these answers were noted under the appropriate questions. However, because this was not always possible for every question, the field notes were examined thoroughly during the analysis to assure no data was lost.

Analysis. Analysis of the data obtained proceeded as set out in the methodology described in Chapter Three. The culmination of the analysis involved a long session in which the researchers met in a classroom at the Air Force Institute of Technology and entered the interview data in matrices on a blackboard. This facilitated not only the viewing of the data by both researchers simultaneously, but also allowed for an environment in which the thoughts and ideas of each researcher could be easily written on the board, reviewed, discussed, and "tweaked" until satisfactory to both.

As detailed in the methodology chapter, each matrix represented one aspect of the strategy model presented in Chapter Two. Each column in a matrix was titled with a question from the interview instrument corresponding to the portion of the model the matrix addressed (for example, power). Each row represented responses from one interviewee. The results were recorded in the form of an elaborate and detailed outline. The findings in this chapter and the recommendations contained in Chapter Five were taken directly from that

outline, and expanded and elaborated with additional information and quotes from both the data and theory.

As discussed, this study used two main sources of data: published NASA strategic plans and interviews. Because the plans analyzed were, in total, too voluminous to reproduce here (in excess of 200 pages), they are listed in the bibliography for easy reference. Additionally, due to the potential sensitivity of the data gathered in the interviews, that raw data is not included in this report either. Even though we very carefully guarded the anonymity of the people we interviewed, we found that the raw data (in the form of filed notes on each survey) could, in most cases, be easily traced back to a respondent because of the nature and contents of the responses. That is why some quotes used in this chapter have been carefully sanitized by the researchers to keep the quote in context while avoiding revelation of the source. If requested, the raw data from this study may be made available to other researchers at the discretion of the researchers and our sponsors at NASA. However, in fulfillment of our promise of anonymity this data will not be released if the researchers perceive that it may be used, personally or professionally, against any of the respondents.

Findings

Strategic Plans and Processes. The majority of the offices we contacted either had no strategic plan or were currently drafting a plan but had no idea when it might be released. However, we were able to find the following plans:

Vision 21: The NASA Strategic Plan; NASA Supply and Equipment Management Strategic Plan; Kennedy Space Center Strategic Plan; Goddard Space Flight Center Strategic Plan; Johnson Space Center Strategic Plan; NASA Space Station Freedom Strategic Plan; Shuttle Logistics Strategic Plan.

These plans can be divided into four major groups: Administration-wide, center specific, programmatic, and functional. On the surface, this would lead one to conclude that a hierarchical planning process exists, and that each lower level plan was developed to directly support the higher level plans. However, this does not appear to be the case. The plans were all developed relatively simultaneously, and contain no references to other plans. Further investigation through both the formal survey interviews and informal background interviews confirmed that the strategic plans were developed independently. One notable exception was the *Shuttle Logistics Strategic Plan*. Even though it did not specifically state so, our interviews indicated this plan, which was developed to directly support the Space Shuttle, was written to dovetail with the Kennedy Space Center plan. It is interesting to note that this plan was not written to support the Space Shuttle Operations Strategic Plan, since such a plan has yet to be written.

We found a wide variation in the quality of the plans. In general, however, the plans were largely compilations of vague or abstract objectives; what one interviewee termed "pie in the sky" and "grandiose." Although implementation of the plans was often mentioned, the plans offered little in the way of explanation as to how implementation would be achieved. Additionally,

the plans lacked a strategic control mechanism through which the organization could measure its progress toward the delineated objectives.

We found one noteworthy exception to the generalizations above: *The NASA Space Station Freedom Strategic Plan*. This plan was a text book example of a fully developed, highly detailed strategic plan. It very clearly outlined the objectives of the Space Station Freedom program and how they fit into and supported objectives at higher levels in the organization, all the way up to the national level. The implementation portion included a list of offices and their responsibilities and tied in overall resource requirements. Strategic control was realized through a timeline, identifying significant program milestones as well as carefully delineating lines of authority in program management.

Writing and publishing a strategic plan is one thing, but effectively communicating the vision and realizing it is another. This aspect of the strategic process is perhaps the toughest, and least glorious. Perhaps Geis and Kuhn described it best:

> Making strategies work is nitty-gritty grimy work. No quick kills here. What counts? Brilliant flashes of genius take a weak second place to steady, consistent plodding. Strategy implementation and control may lack the creative explosiveness of strategy formulation and the cool elegance of strategy evaluation, but never forget that implementation and control are the essence of corporate success. No active ivory towers here (all are boarded up and empty). Strategic implementation and control is real-world nuts and bolts. Problems and persistence. Battlefield mud. (Geis and Kuhn, 1987:188)

Given this view of the trenches, how successful is NASA at transitioning from the "ivory tower" to the "battlefield mud?" Is the vision getting out? Are the troops following?

This may come as no surprise to people familiar with planning, but the researchers found the message is getting out and few are willing to listen. During the course of our interviews we actively sought the opinions of the various managers concerning several aspects of the strategy process, and specifically the various plans affecting their organization. Quite frequently the responses received showed a disregard for the plans. In fact, when one person interviewed was asked about the impact of the NASA strategic plan on his organization he referred to it as a "glossy magazine" and stated that he looks instead for signs and signals from the political environment. This response was echoed time and again with responses such as "I've seen it," "I'm sure it must have passed through here" or "it's on the wall over there." In practice, research showed a small number of staffers would develop a plan, coordinate it through the highest levels of the organization, and then release it. Interview responses suggest the plans were ignored because they were perceived as just capturing on paper, after the fact, what was already being done or because those who would implement the plan felt no ownership of the plan or the process which created it.

Very few people acknowledged having read any plan, and even those people consistently perceived the plans had no effect. The only instances when actions were said to match the plan were when, according to one source,

the plan was so full of "motherhood and apple pie" that it would be almost impossible not to comply. Even the extremely well written Space Station Freedom Strategic Plan has been received with little fanfare. Everyone in the program received a copy but our data suggests no one has read it or spoken about it.

There are signs that this may be changing. Since the initial interviews, Mr. Goldin has taken the helm as the NASA Administrator. Many of the interviews afterwards showed a strong wind of change throughout the organization and a greater willingness to support a strategic process that more actively seeks the involvement NASA managers.

Why might people be more willing now than before to seek strategic direction? To answer this, one must compare previous practices with Goldin's process. Interview responses showed previous practices involved a top down, directive approach. Of course, as already discussed, these plans provided no mechanism for implementation or control. This, added with the organizational context of NASA (discussed next), in retrospect, doomed such plans to failure.

Organizational Context. Our research has shown that NASA fits most closely the professional organizational context. This context is seen most often in an organization with a highly technical staff (such as engineers or doctors and nurses) working in a collegial atmosphere. Control is largely decentralized and decisions are built upon consensus (Mintzberg and Quinn, 1991:704-717). This context tends to "sharply circumscribe the capacity of central administrators to manage the professionals in the ways of conventional

bureaucracy—through direct supervision and the designation of internal standards" (Mintzberg and Quinn, 1991:712). Compounding the problem of direction and control is that NASA is rather unique for a professional context in that, by their very nature, such professional organizations are usually limited to small geographic areas. NASA's nationwide dispersement and a strong tradition of autonomous centers further hinder any attempts to steer the bureaucratic ship.

A preponderance of the interviews supported this classification of organizational context. Many also felt that it was a time for a change in NASA's culture and organizational context. Unfortunately, conventional wisdom held that NASA is a mature bureaucracy, and as such is unable to change more than incrementally. In fact, several interviews were punctuated by the phrases "during Apollo we..." or "I have been here since the Apollo program, and..." Given such bureaucratic entrenchment, change seemed to some to be impossible.

Surprisingly, Mr. Goldin appears able to affect change without restructuring the culture, at least initially. His approach is perceived to take advantage of the collegial atmosphere, making everyone feel they have a part in driving the strategic direction of NASA. Although nothing really tangible in the way of a strategic plan has come as yet from this new management philosophy, the ground-swell of support from NASA managers is evident.

Power and the Culture. The perceived distribution of power at NASA plays an important role in shaping the way strategic direction is accepted. We

found that power is not distributed from the top down, as the numerous NASA organizational charts we acquired might suggest. In this study, power distribution was viewed from two levels: the center level and the overall NASA level.

At the center level, power is distributed by program or function. For example, at Kennedy Space Center, the person perceived as having the most power was not the Center Director, but rather the Space Shuttle Program Director (who, according to organizational charts, works for the Center Director). Two reasons are seen for this: First, even though program budgets flow through the Center Director, he has no control over the resulting funds. Second, the NASA-wide perception that the Space Shuttle program is the "premiere program" in NASA adds greatly to the status of the job of the director of the program, effectively increasing his power in the organization.

At the overall NASA level, power is distributed in much the same way. In the past, the NASA Administrator has not held a predominantly strong position. At best, one can say that the position has been at a level equal to the Center Directors, and often equal with some of the Administrator's own Assistant Administrators. This is due in large part to the influence exerted from the political arena. Historically, Congress has maintained an open communication line with the various centers to ensure their districts are well represented. This direct involvement in the operation of the Centers tends to elevate the desires of the various programs, while limiting the influence an Administrator may exert on the strategic direction of the organization.

On top of the informal, political power structure is laid the National Space Council. This council, under the direction of Vice President Quayle, is providing a sense of strategic direction ensuring the perspectives of the White House are adequately represented. This council is widely regarded as having precipitated the replacement of Admiral Truly as the Administrator (Doherty, 1992).

There are signs that the weakness of the Administrator may also be changing. with the arrival of Administrator Goldin. He has received wide support from all levels of NASA in his effort to provide a vision and direction. He is perceived to be charting a course through the turbulent waters of a shrinking government budget, calling on everyone to do things faster, cheaper, and better. These three standards, along with his effort to build consensus, seem to effectively overcome the limitations traditionally inherent in his position.

Implications for Logistics

In answering investigative questions two and three, we examined NASA strategies at various levels and the strategic planning environments that spawned them. With this information in hand, we will now address investigative question four and to see how overall strategic planning affects logistics and logistics planning.

Given the sparse, but varied, nature of the strategy processes at NASA, coupled with the initiative fostered by Mr. Goldin to forge a greater unity of purpose, it seems only appropriate that the logistics functions would be expected to participate in the strategic process. This participation could be

through providing inputs to the strategic planning activities of both their parent organizations and their own organizations. There are isolated instances where logistics organizations have taken the lead to create strategic plans. Examples include the various functional activities from NASA Headquarters (such as supply and equipment management and transportation) and the Space Shuttle Logistics Strategic Plan from Kennedy Space Center. However, as noted previously, these plans tend to be separate and distinct. In terms of a strategic process, it is necessary to look at who is currently doing logistics, what it is they are doing, and what other organizational aspects impact the ability of logistics to support NASA operations.

Who Does Logistics. As stated previously, logistics means different things to different people. At times logisticians find it difficult to define, and even more difficult to categorize who actually is performing logistics activities. This is true in NASA as well. We found many people from various functional areas that are performing what would be considered by many (both in and out of government) as true logistics activities. Unfortunately, in NASA these activities are classified as "operations" in direct support of flight, or are seen as pure engineering activities. Time and again when talking to senior staff at the centers we were reminded that they do not know much about logistics "because we rely on others to track spare parts." This narrow definition of logistics is most prevalent among the older generation of NASA employees, quite often those at the top of the organization influencing NASA's strategic process.

Additiona[illegible] views seem to be perpetuated through narrow hiring practices. According to many of those interviewed, NASA has sought to attract a highly educated work force through the use of ratings to provide promotion opportunities for the engineers. This rating system has worked to exclude trained logisticians from joining NASA since promotion opportunities are limited, and has encouraged the practice of placing engineers into logistics positions for which they are not trained. To compound this problem, there are people in such positions who view logistics as a lesser discipline, and therefore have not sought any further education related to the performance of their jobs. One of the most interesting comments during an interview with a senior member of a Space Station work package team reflected this contempt for logistics. When asked what formal training was received in logistics, this person noted that none was required because "I am an...engineer." The engineer-only logistics workforce was also justified because of the perception that non-engineer logisticians would not be able to comprehend matters arising with the "cutting edge of technology" used in NASA. This engineer-only view has produced a form of "in-breeding" that hinders the introduction of new ideas from outside the engineering discipline. Interview responses seem to indicate that most view NASA logistics functions as somehow separate and unique from logistics as done elsewhere. This view is held despite the fact that most of the NASA logistics activities that we observed or were told about are performed routinely in many segments of government and private business.

This is not to say that NASA does not have good logisticians, or that logistics is not being performed. There are a number of dedicated people working at every center to see that new systems are reliable, that they can be maintained, and supported over the long-term. Time and again logisticians have worked to infuse these concepts of logistics into the design and acquisition phase of new programs, including the Space Shuttle and currently the design for Space Station Freedom.

As is often the case with government programs, what is actually budgeted rarely matches what is appropriated by Congress. In such instances, these reduced budgets are Congress' response to perceived waste, and in other instances they may be a reflection of the priority Congress places on that program in light of the many governmental issues competing for resources. Either way, it becomes necessary to reduce fiscal year costs, and when this decision is required, the "axe" will fall on those expenses that impact the "out years" in an effort to field a system. One highly placed individual summed it up by saying that, to the program managers, it is most important to get a system up and flying, and maintainability and operability issues often get cut to secure a system's acquisition, resulting in increased resource needs during the lifetime of the system. The data suggests also that the exclusive use of engineers in logistics positions on programs has resulted in little effort to affect system designs to address supportability and maintainability issues. The perception in NASA is that any problems encountered in the "-ilities" after a system is fielded can be overcome through sustaining engineering.

Congress has had other influences on the Space Program as well. In Space Station Freedom, Congress has specified many of the technical details. These details exceed the traditional role of establishing a time-line for meeting objectives, and setting spending limits. For example, Congress stipulated "that Freedom should provide a total of 75 kilowatts of power, 30 kilowatts of which should be dedicated to users." (NASA, 1992:4)[3] In addition to this documented case, we learned of several other anecdotal instances during the interviews. Some selected quotes form this composite response:

> Specific cases are in the paper daily but include the ACRV [Assured Crew Return Vehicle]. Presumably no money to fund the requirement and yet last year in the budget process it became a REQUIREMENT if the station program was to continue. Ironically, after we made it a program design requirement, the Congress, during the Truly—GAO audit, questioned whether we were adequately funded to develop a return vehicle...
>
> Earlier in the program there was a Flight Telerobotic Servicer being developed by GSFC [Goddard Space Flight Center]. It was originally not in the program and in order to get the Maryland support that was necessary to get the Station through the House and Senate it became part of the Station Program.

Constraints, Resources, and the Budget Process

Given NASA's tightening budget constraints, it comes as no surprise that every person we spoke with identified lack of money/funds as their greatest

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[3] In all fairness, another source has told us that this may not be as disastrous as it seems. Apparently it was an attempt by Congress during the restructuring of the Space Station Freedom program to counter decisions by engineers to limit the power available to users to provide funds for fielding hardware.

constraint. This constraint was identified at all levels of the agency, in all types of operations. However, when subjects were pressed for examples of how operations could be improved if this constraint were loosened, only one of those asked could provide an example. Because of the lack of responses, and the need to understand the resource allocation process as a means of control, we began asking people how money is allocated. None were readily able to respond. Although every person contacted manages an office where funds are controlled and expended, only a limited number of those interviewed seemed to understand the budget process. These responses suggest that people seem to feel they need more money, but are unaware of the methods available to seek those resources. This seems to support the conclusion reached in the *Report of the Advisory Committee on the Future of the U.S Space Program* that "the research community must understand and appreciate, as well as participate in, the planning and budgetary process" if the civil space program is to continue receiving a suitable level of funding (NASA, 1990:25)

Conclusion

This chapter has discussed the application of the methodology as set forth in Chapter Three. We first outlined what actually happened in pursuit of our research, including the process we used to gain access to the NASA personnel we needed to interview for the field study portion of this study. We then detailed the data analysis process we followed to yield our findings.

The findings enumerated in this chapter included an evaluation of the structure NASA's existing strategic plans, their relationships to each other, and the process through which they were born. We then focused on the NASA organization. Discussions of organizational context, power, and culture punctuated our findings, since these aspects of the NASA organization were found to have a profound effect on the strategy process in NASA. Finally, we related what we found out about the NASA organization and strategy process to address the implications of these findings for logistics in NASA. Our intent was to describe what we found in order to paint a picture of the realities of NASA. In the next chapter, we offer some recommendations, based on our picture of NASA, that will aid NASA and its logisticians to follow a path to excellence through strategy.

V. Recommendations and Conclusion

Our look into NASA's strategic processes and logistics operations has provided us the opportunity to meet a number of highly skilled professionals, who we perceived to be truly dedicated to the missions they support. As mentioned in the previous chapter, we found that much of NASA's direction today is based on past successes. Even so, the successes of the past cannot be viewed as a prescription for the future to the extent that the changing national and global climate requires a fundamental re-evaluation of NASA operations. This is the approach currently being followed by Mr. Goldin, and it is our opinion that the recommendations put forward in this thesis will match very closely with the direction currently pursued through his efforts (Asker and Covault, 1992,29).

Recommendations

Recommendation 1. Create a formal strategy process for logistics (and NASA).

As we have noted, there currently is no organized approach to the strategy process. The plans that exist are disjointed, with little relationship to the goals and objectives of another. The techniques currently used by Administrator Goldin may be appropriate at other levels in the organization to help get people involved in developing a strategy process that works for NASA.

Whatever approach is to be followed, it needs to be supported from the highest levels of the agency, perhaps even through inclusion in the agency's Strategic Plan. In addition, it should account for the organizational context in which NASA finds itself, and either works within the culture, or seeks to change the culture. Developing a process that fails to take context into account, could doom (yet another) plan to failure. Fitting the process to the culture will also assist in ensuring the process produces not just a plan, but an organization committed to achieving explicit, well-defined and accepted goals. This by its nature demands that the process include a strong implementation phase, dedicated to ensuring the successful meeting of the goal, through a rigorous feedback and control process.

Recommendation 2. Tie logistics strategies directly to organizational strategies/goals.

It should be clear that an organization devoted to providing support should define themselves by the nature of the support required. This does not mean simply providing "supply" or "transportation" support, but needs to include other specific issues. Such issues could include customer response time (based on what the *customer* determines that to be), determining the needs of the user and seeking to meet those needs, and ensuring that sub-optimization at lower levels does not occur, thereby creating competing goals and objectives.

Recommendation 3. Get logisticians from different functions/programs/centers to crossflow information.

We saw several instances where several similar, nearly identical projects were underway, both between centers and inside them. These duplicated efforts were, in a large part, suggestive of Plato's Man in the Cave, not ever quite sure of what the world outside is doing, but not wishing to find out either, lest the comfort of the current reality be shattered (Ebenstein, 1969:57-61).

In all our interviews, we found that the one thing everyone saw was some need to centralize logistics. Of course, they also fully supported the decentralized form of management currently enjoyed in NASA. It is then necessary, if one wishes to work within the current culture, to develop some means of achieving the one without disrupting the other. Results of the research showed the only avenues used by people in NASA to share ideas between programs and functions is membership in the Society of Logistics Engineers (SOLE). While this is a worthy organization it is no substitute for a healthy agency-wide program of exchange. One useful avenue to achieve such a cross-flow would be the establishment of an agency-wide newsletter. This newsletter could be devoted to seeking out innovations in the various areas. Of course, it should include not only the tradition "institutional" logistics but also include a section dedicated to improving program acquisition logistics operations.

Another useful idea would be the development of a "logistician exchange program" taking logisticians from one functional area and transferring them temporarily to another functional area. This could be extremely useful if one were to take logisticians from the design teams, operational areas, "institutional"

logistics offices and cross utilize them to grow a broader, more capable logistics cadre.

One final idea would be to consolidate the logistics functions at each center under an Assistant Director for Logistics (logistics is used here as defined in Chapter Two). This assistant director would then be responsible for matrixing out logisticians to various programs under development, as well as maintaining the institutional functions currently seen as logistics.

Recommendation 4. Identify redundancies in logistics functions at centers and consolidate where possible.

This recommendation goes hand-in-hand with Recommendation 3. We saw that not only were logisticians failing to talk with each other and exchange ideas, but in many cases they duplicate simple logistics activities at the same center. This appeared to be precipitated by an "NIH" (not invented here) attitude. For example, at Kennedy Space Center, each directorate had their own organization to acquire and distribute office supplies such as paper and pens. This duplication was also evident in the fact that each center (and sometimes even different programs at the same center) use different inventory management systems.

Another example is the variety of "standards" used for Integrated Logistics Support and Logistics Support Analysis on the various systems. One respondent said it best when he said NASA needed to stop redesigning logistics frameworks from the ground up. He felt they should concentrate on the objective rather than on the tools.

Again, this recommendation flies in the face of NASA's organizational context. The tendency toward multiple, identical, independently managed functions and the NIH mindset are replete throughout NASA. Nonetheless, with shrinking budgets and a new administrator who wants 30% cuts NASA-wide, eliminating these redundancies may be just the gesture needed to secure Congressional support for other visionary programs. If logisticians are going to convince program managers that logistics can save them money, it would be wise to "start at home."

Recommendation 5. Change the culture and tradition of NASA by infusing trained logisticians.

The tradition and culture of NASA has seen it through these many years. Unfortunately it is now perceived by many at NASA as hindering further progress. Two senior individuals interviewed noted the fact that one of the greatest impediments to progress at their center is tradition. One way of making a small, but significant dent in tradition would be to re-evaluate the AST (Aerospace Technician) rating required for logisticians. This position hinders the ability of NASA to recruit, and promote, trained logisticians, and is defended by long-time NASA (engineer) employees with an almost religious fanaticism. This would also allow NASA to free many of their best minds to use their unique skills, rather than devote time to tasks for which they are not trained.

Recommendation 6. Each program should be evaluated not in terms of the program itself but in terms of the goal for that program.

When programs are forced to re-examine their course, often due to budget cuts or congressional mandates, the engineers turn toward the best way to keep what they are working on. Instead, they need to revisit the original purpose of the program. As discussed in Chapter Two, a program is an activity that moves an organization toward the goal or objective that the program was selected to achieve. NASA losing sight of the strategic direction of the Space Station Freedom program, and the goals it was supposed to achieve, is what led to congressional intervention concerning the station's power supply. The focus had changed from providing users with a platform in space to providing a platform in space. The difference is subtle, but essential.

In Conclusion...

This chapter presented several recommendations which are based on the findings of this thesis. The findings were derived from our research into the theory and application of strategy and the strategy process coupled with the analysis of data obtained in the course of this thesis. This coupling of theory and data came about through the methodology put forth in Chapter Three. Two primary methodologies were used: the case study and the field study. The first methodology, the case study, involved obtaining as many NASA strategic plans as possible and analyzing them for content and structure. For the second methodology, the field study, we relied on personal interviews with NASA employees, and to a lesser extent on observation of the sites we visited, to complete the strategic picture of NASA both from an overall NASA perspective

and from the perspective of logistics operations and the logistician. Our recommendations flowed from taking a holistic view of NASA, making an objective assessment based on its strategy and logistics planning processes in light of the current thinking of strategy and logistics academicians and practitioners. It is the researchers' opinion that use of these recommendations will have a beneficial impact on NASA if used administration wide. However, at the very least, it is our hope that NASA logisticians will use these recommendations to make incremental improvements in their own operations, allowing them to better fulfill their mission of supporting NASA into the 21st century and beyond.

NATIONAL AERONAUTICS AND SPACE ACT OF 1958, AS AMENDED

AN ACT

To provide for research into problems of flight within and outside the earth's atmosphere, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I-SHORT TITLE, DECLARATION OF POLICY, AND DEFINITIONS

SHORT TITLE

Sec. 101. This Act may be cited as the "National Aeronautics and Space Act of 1958."

DECLARATION OF POLICY AND PURPOSE

Sec. 102. (a) The Congress hereby declares that it is the policy of the United States that activities in space should be devoted to peaceful purposes for the benefit of all mankind.

(b) The Congress declares that the general welfare and security of the United States require that adequate provision be made for aeronautical and space activities. The Congress further declares that such activities shall be the responsibility of, and shall be directed by, a civilian agency exercising control over aeronautical and space activities sponsored by the United States, except that activities peculiar to or primarily associated with the development of weapons systems, military operations, or the defense of the United States (including the research and development necessary to make effective provision for the defense of the United States) shall be the responsibility of, and shall be directed by, the Department of Defense; and that determination as to which such agency has responsibility for and direction of any such activity shall be made by the President in conformity with section 201(e).

(c) The Congress declares that the general welfare of the United States requires that the National Aeronautics and Space Administration (as established by title II of this Act) seek and encourage to the maximum extent possible the fullest commercial use of space. [1]

(d) The aeronautical and space activities of the United States shall be conducted so as to contribute materially to one or more of the following objectives:

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[1]Subsection (c) was added by the "National Aeronautics and Space Administration Authorization Act, 1985," Public Law 98-361, July 16, 1984, section 110(a) (98 Stat. 426) and required a relettering of the subsequent subsections.

(1) The expansion of human knowledge of the Earth and[2] of phenomena in the atmosphere and space;

(2) The improvement of the usefulness, performance, speed, safety, and efficiency of aeronautical and space vehicles;

(3) The development and operation of vehicles capable of carrying instruments, equipment, supplies, and living organisms through space;

(4) The establishment of long-range studies of the potential benefits to be gained from, the opportunities for, and the problems involved in the utilization of aeronautical and space activities for peaceful and scientific purposes;

(5) The preservation of the role of the United States as a leader in aeronautical and space science and technology and in the application thereof to the conduct of peaceful activities within and outside the atmosphere;

(6) The making available to agencies directly concerned with national defense of discoveries that have military value or significance, and the furnishing by such agencies, to the civilian agency established to direct and control nonmilitary aeronautical and space activities, of information as to discoveries which have value or significance to that agency;

(7) Cooperation by the United States with other nations and groups of nations in work done pursuant to this Act and in the peaceful application of the results thereof; and

(8) The most effective utilization of the scientific and engineering resources of the United States, with close cooperation among all interested agencies of the United States in order to avoid unnecessary duplication of effort, facilities, and equipment.

(e) The Congress declares that the general welfare of the United States requires that the unique competence in scientific and engineering systems of the National Aeronautics and Space Administration also be directed toward ground propulsion systems research and development. Such development shall be conducted so as to contribute to the objectives of developing energy- and petroleum-conserving ground propulsion systems and of minimizing the environmental degradation caused by such systems.[3]

(f) The Congress declares that the general welfare of the United States requires that the unique competence in scientific and engineering systems of the National Aeronautics and

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[2]The clause, "of the Earth and" was added by the "National Aeronautics and Space Administration Authorization Act, 1985," Public Law 98-361, July 16, 1984, section 110(b) (98 Stat. 426).

[3]This subsection was added by the "Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976," Public Law 94- 413, September 17, 1976, section 15, (90 Stat. 1270) and was subsection (d) before the new subsection (c) was added by the "NASA Authorization Act, 1985."

Space Administration also be directed toward the development of advanced automobile propulsion systems. Such development shall be conducted so as to contribute to the achievement of the purposes set forth in section 302(b) of the Automotive Propulsion Research and Development Act of 1978.[4]

(g) The Congress declares that the general welfare of the United States requires that the unique competence of the National Aeronautics and Space Administration in science and engineering systems be directed to assisting in bioengineering research, development, and demonstration programs designed to alleviate and minimize the effects of disability.[5]

(h) It is the purpose of this Act to carry out and effectuate the policies declared in subsections (a), (b), (c), (d), (e), (f), and (g).

DEFINITIONS

Sec. 103. As used in this Act—

(1) the term "aeronautical and space activities" means (A) research into, and the solution of, problems of flight within and outside the Earth's atmosphere; (B) the development, construction, testing, and operation for research purposes of aeronautical and space vehicles; (C) the operation of a space transportation system including the Space Shuttle, upper stages, space platforms, and related equipment;[6] and (D) such other activities as may be required for the exploration of space; and

(2) the term "aeronautical and space vehicles" means aircraft, missiles, satellites, and other space vehicles, manned and unmanned, together with related equipment, devices, components, and parts.

TITLE II--COORDINATION OF AERONAUTICAL AND SPACE ACTIVITIES

NATIONAL AERONAUTICS AND SPACE COUNCIL

[Sec. 201. (a)

There is hereby established, in the Executive Office of the President, the National

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[4]This subsection was added by the "Department of Energy Act of 1978--Civilian Applications", Public Law 95-238, February 25, 1978, section 311 (92 Stat. 47) and was subsection (e) before the new subsection (c) required relettering.

[5]This subsection was added by the "National Aeronautics and Space Administration Authorization Act, 1979," Public Law 95-401, September 30, 1978, section 7 (92 Stat. 860) and was subsection (f) before the new subsection (c) required relettering and redesignated old subsection (g) as subsection (h).

[6]Subsection (C) was added by the "National Aeronautics and Space Administration Authorization Act, 1984," Public Law 98-52, July 15, 1983, section 108 (97 Stat. 285).

Aeronautics and Space Council...][7]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Sec. 202.[8]

(a) There is hereby established the National Aeronautics and Space Administration

(hereinafter called the "Administration"). The Administration shall be headed by an Administrator, who shall be appointed from civilian life by the President by and with the advice and consent of the Senate. Under the supervision and direction of the President, the Administrator shall be responsible for the exercise of all powers and the discharge of all duties of the Administration, and shall have authority and control over all personnel and activities thereof.

(b) There shall be in the Administration a Deputy Administrator, who shall be appointed from civilian life by the President by and with the advice and consent of the Senate and shall perform such duties and exercise such powers as the Administrator may prescribe. The Deputy Administrator shall act for, and exercise the powers of, the Administrator during his absence or disability.

(c) The Administrator and the Deputy Administrator shall not engage in any other business, vocation, or employment while serving as such.

FUNCTIONS OF THE ADMINISTRATION

Sec. 203.

(a) The Administration, in order to carry out the purpose of this Act, shall—

(1) plan, direct, and conduct aeronautical and space activities;

(2) arrange for participation by the scientific community in planning scientific measurements and observations to be made through use of aeronautical and space vehicles, and conduct or arrange for the conduct of such measurements and observations; and

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[7]Reorganization Plan No. 1 of 1973, 38 Federal Register 9579, April 18, 1973 (87 Stat. 1089), abolished the National Aeronautics and Space Council together with its functions, effective July 1, 1973.

[8]The Federal Executive Salary Act of 1964, Public Law 88-426, August 14, 1964, section 305 (12), (78 Stat. 423), repealed the language in section 202 (72 Stat. 429) fixing the compensation of the Administrator and Deputy Administrator at per annum rates of $22,500 and $21,500 respectively. In lieu thereof, the positions of Administrator and Deputy Administrator were placed in level II and level III, respectively, of the Federal Executive Salary Schedule. In addition, the Federal Executive Salary Act of 1964 placed 10 other NASA positions in designated levels of the Federal Executive Salary Schedule (78 Stat. 416, as amended. 5 U.S.C. 5311-5317). See Appendix A, sec. II, 1, at p. 26 of the October 1983 version of the "National Aeronautics and Space Act of 1958, as Amended, and Related Legislation."

(3) provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.

(b) (1) The Administration shall, to the extent of appropriated funds, initiate, support, and carry out such research, development, demonstration, and other related activities in ground propulsion technologies as are provided for in sections 4 through 10 of the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976.[9]

(2) The Administration shall initiate, support, and carry out such research, development, demonstrations, and other related activities in solar heating and cooling technologies (to the extent that funds are appropriated therefor) as are provided for in sections 5, 6, and 9 of the Solar Heating and Cooling Demonstration Act of 1974[10]

(c) In the performance of its functions the Administration is authorized—

(1) to make, promulgate, issue, rescind, and amend rules and regulations governing the manner of its operations and the exercise of the powers vested in it by law;

(2) to appoint and fix the compensation of such officers and employees as may be necessary to carry out such functions. Such officers and employees shall be appointed in accordance with the civil-service laws and their compensation fixed in accordance with the Classification Act of 1949, except that (A) to the extent the Administrator deems such action necessary to the discharge of his responsibilities, he may appoint not more than four hundred and twenty-five of the scientific, engineering, and administrative personnel of the Administration without regard to such laws, and may fix the compensation of such personnel not in excess of the highest rate of grade 18 of the General Schedule of the Classification Act of 1949, as amended and[11] (B) to the extent the Administrator deems such action necessary to recruit specially qualified scientific and engineering talent, he may establish the entrance grade for scientific and engineering personnel without previous service in the Federal Government at a level up to two grades higher than the grade provided for such

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[9]The "Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976," Public Law 94-413, September 17, 1976, section 15 (90 Stat. 1270) added this new subsection. Subsections b (1) and (2) were relettered by the "National Aeronautics and Space Administration Authorization Act, 1979," Public Law 95-401, September 30, 1978, section 6 (92 Stat. 860), to correct a misiettering which resulted from the enactment of Public Law 94-413.

[10]The "Solar Heating and Cooling Demonstration Act of 1974," Public Law 93-409, September 3, 1974, section 4 (88 Stat. 1070), added this new subsection. See Appendix A, sec. VIII, 1 at p. 86 of the October 1983 version of the "National Aeronautics and Space Act of 1958, as Amended, and Related Legislation."

[11]Section 414(a)(2) of the "Civil Service Reform Act of 1978," Public Law 95-454, October 13, 1978 (92 Stat. 1177) terminated the authority of any agency (other than pursuant to 5 U.S.C. 3104--see Appendix A, Sec. II, 3 at p. 26 of the October 1983 version of the "National Aeronautics and Space Act of 1958, as Amended, and Related Legislation") to establish scientific or professional positions outside the General Schedule. NASA has taken the position that this Act did not repeal NASA's authority.

personnel under the General Schedule established by the Classification Act of 1949, and fix their compensation accordingly;

(3) to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain laboratories, research and testing sites and facilities, aeronautical and space vehicles, quarters and related accommodations for employees and dependents of employees of the Administration, and such other real and personal property (including patents), or any interest therein, as the Administration deems necessary within and outside the continental United States; to acquire by lease or otherwise, through the Administrator of General Services, buildings or parts of buildings in the District of Columbia for the use of the Administration for a period not to exceed ten years without regard to the Act of March 3, 1877 (40 U.S.C. 34);[12] to lease to others such real and personal property; to sell and otherwise dispose of real and personal property (including patents and rights thereunder) in accordance with the provisions of the Federal Property and Administrative Services Act of 1949, as amended (40 U.S.C. 471 et seq.); and to provide by contract or otherwise for cafeterias and other necessary facilities for the welfare of employees of the Administration at its installations and purchase and maintain equipment therefor;

(4) to accept unconditional gifts or donations of services, money, or property, real, personal, or mixed , tangible or intangible;.

(5) without regard to section 3648 of the Revised Statutes, as amended (31 U.S.C. 529), to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary in the conduct of its work and on such terms as it may deem appropriate, with any agency or instrumentality of the United States, or with any State, Territory, or possession, or with any political subdivision thereof, or with any person, firm, association, corporation, or educational institution. To the maximum extent practicable and consistent with the accomplishment of the purposes of this Act, such contracts, leases, agreements, and other trans actions shall be allocated by the Administrator in a manner which will enable small-business concerns to participate equitably and proportionately in the conduct of the work of the Administration;

(6) to use, with their consent, the services, equipment, personnel, and facilities of Federal and other agencies with or without reimbursement, and on a similar basis to cooperate with other public and private agencies and instrumentalities in the use of services, equipment, and facilities. Each department and agency of the Federal Government shall cooperate fully with the Administration in making its services, equipment, personnel, and facilities

[12] 40 U.S.C. 34 provides that "no contract shall be made for the rent of any building...to be used for the purposes of the Government in the District of Columbia, until an appropriation therefor shall have been made in terms by Congress..." The authority of NASA to lease buildings in the District of Columbia was added to section 203(c)(3) by Public Law 86-20, May 13, 1959 (73 Stat. 21), to remedy the peculiar situation at that time where the agency had the money but no authority, and GSA had the authority but no money, to provide the agency with its own office space.

available to the Administration, and any such department or agency is authorized, notwithstanding any other provision of law, to transfer to or to receive from the Administration, without reimbursement, aeronautical and space vehicles, and supplies and equipment other than administrative supplies or equipment;

(7) to appoint such advisory committees as may be appropriate for purposes of consultation and advice to the Administration in the performance of its functions;

(8) to establish within the Administration such offices and procedures as may be appropriate to provide for the greatest possible coordination of its activities under this Act with related scientific and other activities being carried on by other public and private agencies and organizations;

(9) to obtain services as authorized by section 3109 of title 5, United States Code, but at rates for individuals not to exceed the per diem rate equivalent to the rate for GS-18;[13]

(10) when determined by the Administrator to be necessary, and subject to such security investigations as he may determine to be appropriate, to employ aliens without regard to statutory provisions prohibiting payment of compensation to aliens;

(11) to provide by concession, without regard to section 321 of the Act of June 30, 1932 (47 Stat. 412; 40 U.S.C. 303b), on such terms as the Administrator may deem to be appropriate and to be necessary to protect the concessioner against loss of his investment in property (but not anticipated profits) resulting from the Administration's discretionary acts and decisions, for the construction, maintenance, and operation of all manner of facilities and equipment for visitors to the several installations of the Administration and, in connection therewith, to provide services incident to the dissemination of information concerning its activities to such visitors, without charge or with a reasonable charge therefor (with this authority being in addition to any other authority which the Administration may have to provide facilities, equipment, and services for visitors to its installations). A concession agreement under this paragraph may be negotiated with any qualified proposer following due consideration of all proposals received after reasonable public notice of the intention to contract. The concessioner shall be afforded a reasonable opportunity to make a profit commensurate with the capital invested and the obligations assumed, and the consideration paid by him for the concession shall be based on the probable value of such opportunity and not on maximizing revenue to the United States. Each concession agreement shall specify the manner in which the concessioner's records are to be maintained, and shall provide for access to any such records by the Administration and the

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[13]Previous language authorizing pay not to exceed $100 per diem was amended to read as stated above by the "National Aeronautics and Space Administration Authorization Act, 1975." Public Law 22, 1974, section 6 (88 Stat. 243).

Comptroller General of the United States for a period of five years after the close of the business year to which such records relate. A concessioner may be accorded a possessory interest, consisting of all incidents of ownership except legal title (which shall vest in the United States), in any structure, fixture, or improvement he constructs or locates upon land owned by the United States; and, with the approval of the Administration, such possessory interest may be assigned, transferred, encumbered, or relinquished by him, and, unless otherwise provided by contract, shall not be extinguished by the expiration or other termination of the concession and may not be taken for public use without just compensation;[14]

(12) with the approval of the President, to enter into cooperative agreements under which members of the Army, Navy, Air Force, and Marine Corps may be detailed by the appropriate Secretary for services in the performance of functions under this Act to the same extent as that to which they might be lawfully assigned in the Department of Defense;

(13)(A) to consider, ascertain, adjust, determine, settle, and pay, on behalf of the United States, in full satisfaction thereof, any claim for $25,000[15] or less against the United States for bodily injury, death, or damage to or loss of real or personal property resulting from the conduct of the Administration's functions as specified in subsection (a) of this section where such claim is presented to the Administration in writing within two years after the accident or incident out of which the claim arises; and (B) if the Administration considers that a claim in excess of $25,000 is meritorious and would otherwise be covered by this paragraph, to report the facts and circumstances thereof to the Comptroller General as provided in 31 U.S.C. 1304[16]

[14] Repealed.[17]

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[14]The "National Aeronautics and Space Administration Authorization Act, 1974," Public Law 93-74, July 23, 1973, section 6(87 Stat. 174) added paragraph 11. Previously, title IV, section 402 (a)(34) of the Dual Compensation Act (Public Law 88-448, August 19, 1964, 78 Stat. 495) repealed the original section 203 (b)(11), (72 Stat. 431), which had authorized NASA "to employ retired commissioned officers of the armed forces of the United States and compensate them at the rate..."

[15]The "National Aeronautics and Space Administration Authorization Act, 1980," Public Law 96-48, August 8, 1979, section 6(a), (93 Stat. 348) substituted "$25,000" for "$5,000" each place it appeared.

[16]This section was amended by the Supplemental Appropriations Act of 1978, Sec. 201 of Public Law 95-240. NASA, like other Federal agencies, can settle claims under the Federal Tort Claims Act as amended (28 U.S.C. 2671-2680).

[17]The "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970," Public Law 91-646, January 2, 1971, section 220(a)(2), (84 Stat. 1903), repealed section 203(b)(14) which had dealt with relocation assistance and had been added by the "National Aeronautics and Space Administration Authorization Act, 1963," Public Law 87-585, August 14, 1962, section 6 (76 Stat. 384)

17 Sec. 204. [Civilian-Military Liaison Committee] abolished[18]

INTERNATIONAL COOPERATION

Sec. 205. The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to this Act, and in the peaceful application of the results thereof, pursuant to agreements made by the President with the advice and consent of the Senate.[19]

REPORTS TO CONGRESS

Sec. 206. (a) The President shall transmit to the Congress in January of each year a report, which shall include (1) a comprehensive description of the programmed activities and the accomplishments of all agencies of the United States in the field of aeronautics and space activities during the preceding calendar year, and (2) an evaluation of such activities and accomplishments in terms of the attainment of, or the failure to attain, the objectives described in section 102(c) of this Act.*

(b) Any report made under this section shall contain such recommendations for additional legislation as the Administrator or the President may consider necessary or desirable for the attainment of the objectives described in section 102(c) of this Act.* (c) No information which has been classified for reasons of national security shall be included in any report made under this section, unless such information has been declassified by, or pursuant to authorization given by, the President.[20]

[*All references to 102(c) should read 102(d).]

DISPOSAL OF EXCESS LAND

Sec. 207. Notwithstanding provisions of this or any other law, the Administration may not report to a disposal agency as excess to the needs of the Administration any land having an estimated value in excess of $50,000 which is owned by the United States and under the jurisdiction and control of the Administration, unless (A) a period of thirty days has passed after the receipt by the Speaker and the Committee on Science and Astronautics of the House of

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[18]This section has been omitted since the Committee was abolished and its functions, together with the function of its chairman and other officers, were transferred to the President by Reorganization Plan No. 4 of 1965, effective July 27, 1965 (30 Federal Register 9253, July 28, 1965, 79 Stat. 1319).

[19]President Eisenhower, upon the signing of the National Aeronautics and Space Act of 1958, singled out and made the following statement about section 205: "I regard this section merely as recognizing that international treaties may be made in this field, and as not precluding, in appropriate cases, less formal arrangements for cooperation. To construe the section otherwise would raise substantial constitutional questions."

[20]The "National Aeronautics and Space Administration Authorization Act, 1972," Public Law 92-68, August 6, 1971, section 7 (85 Stat. 177), repealed the original subsection (a) of section 206 and relettered the remaining subsections (b), (c) and (d) as (a), (b) and (c).

Representatives and the President and the Committee on Aeronautics and Spaces Sciences of the Senate[21] of a report by the Administrator or his designee containing a full and complete statement of the action proposed to be taken and the facts and circumstances relied upon in support of such action, or (B) each such committee before the expiration of such period has transmitted to the Administrator written notice to the effect that such committee has no objection to the proposed action.[22]

DONATIONS FOR SPACE SHUTTLE ORBITER[23]

Sec. 208. (a) The Administrator may accept gifts and donations of services, money, and real, personal, tangible, and intangible property, and use such gifts and donations for the construction of a space shuttle orbiter.

(b) (1) The authority of the Administrator to accept gifts or donations pursuant to subsection (a) of this section shall terminate five years after the date of the enactment of this section.

(2) All gifts and donations accepted by the Administrator pursuant to subsection (a) of this section which are not needed for construction of a space shuttle orbiter shall be used by the Administrator for an appropriate purpose-- (A) in tribute to the dedicated crew of the space shuttle Challenger; and (B) in furtherance of the exploration of space.

(c) The name of a space shuttle orbiter constructed in whole or in part with gifts or donations whose acceptance and use are authorized by sub section (a) of this section shall be selected by the Administrator from among suggestions submitted by students in elementary and secondary schools.

TITLE III—MISCELLANEOUS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Sec. 301. (a) The National Advisory Committee for Aeronautics, on the effective date of this section, shall cease to exist. On such date all functions, powers, duties, and obligations, and all

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[21]The "Committee Reform Amendments of 1974" (October 8 1974), changed the name of the Committee on Science and Astronautics of the House of Representatives to the Committee on Science and Technology. The Committee on Aeronautical and Space Sciences of the Senate was abolished and its jurisdiction transferred to the new Committee on Commerce, Science and Transportation, especially the Subcommittee on Science, Technology and Space thereof, by the "Committee System Reorganization Amendments of 1977" (February 2, 1977).

[22]The "National Aeronautics and Space Administration Authorization Act, 1974," Public Law 93-74, July 23, 1973, section 7 (87 Stat. 175), added section 207. Clause (B) is now unconstitutional under the Supreme Court's legislative veto decision, "Immigration and Naturalization Service v. Chadha," 462 U.S. 919, 103 S Ct. 2764 (1983), 51 USLW 4907.

[23] The "National Aeronautics and Space Administration Authorization Act of 1988," Public Law 100-147, October 30, 1987 (101 Stat. 860).

real and personal property, personnel (other than members of the Committee), funds and records of that organization, shall be transferred to the Administration.

(b) Section 2302 of title 10 of the United States Code is amended by striking out "or the Executive Secretary of the National Advisory Committee for Aeronautics." and inserting in lieu thereof "or the Administrator of the National Aeronautics and Space Administration."; and section 2303 of such title 10 is amended by striking out "of the National Advisory Committee for Aeronautics." and inserting in lieu thereof "The National Aeronautics and Space Administration."

(c) The first section of the Act of August 26, 1950 (5 U.S.C. 22-1),[24] is amended by striking out "the Director, National Advisory Committee for Aeronautics" and inserting in lieu thereof "the Administrator of the National Aeronautics and Space Administration", and by striking out "or National Advisory Committee for Aeronautics" and inserting in lieu thereof "or National Aeronautics and Space Administration".

(d) The Unitary Wind Tunnel Plan Act of 1949 (50 U.S.C. 511-515) is amended (1) by striking out "The National Advisory Committee for Aeronautics (hereinafter referred to as the 'Committee')" and inserting in lieu thereof "The Administrator of the National Aeronautics and Space Administration (hereinafter referred to as the 'Administrator')"; (2) by striking out "Committee" or "Committee's" wherever they appear and inserting in lieu thereof "Administrator" and "Administrator's", respectively; and (3) by striking out "its" wherever it appears and inserting in lieu thereof "his."

(e) This section shall take effect ninety days after the date of the enactment of this Act, or on any earlier date on which the Administrator shall determine, and announce by proclamation published in the Federal Register, that the Administration has been organized and is prepared to discharge the duties and exercise the powers conferred upon it by this Act.[25]

TRANSFER OF RELATED FUNCTIONS

Sec. 302. (a) Subject to the provisions of this section, the President, for a period of four years after the date of enactment of this Act, may transfer to the Administration any functions (including powers, duties, activities, facilities, and parts of functions) of any other department or agency of the United States or of any officer or organizational entity thereof, which relate primarily to the functions, powers, and duties of the Administration as prescribed by section 203 of this Act. In connection with any such transfer, the President may, under this section or other

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[24]The Act of August 26, 1950, was enacted to "protect the national security of the United States by permitting the summary suspension of employment of civilian officers and employees of government." That Act was amended several times and then replaced by 5 U.S.C. 3571, 5594, 7312, 7501(c), 7512(c), and 7532. 5 U.S.C. 5594 was repealed by section 1(34)(B) of Public Law 90-83, September 11, 1967 (81 Stat. 201).

[25]Effective close of business September 30, 1958, by virtue of proclamation of September 25, 1958 (23 Federal Register 7595, September 30, 1958).

applicable authority, provide for appropriate transfers of records, property, civilian personnel, and funds.[26]

(b) Whenever any such transfer is made before January 1, 1959, the President shall transmit to the Speaker of the House of Representatives and the President pro tempore of the Senate a full and complete report concerning the nature and effect of such transfer.

(c) After December 31, 1958, no transfer shall be made under this section until

(1) a full and complete report concerning the nature and effect of such proposed transfer has been transmitted by the President to the Congress, and

(2) the first period of sixty calendar days of regular session of the Congress following the date of receipt of such report by the Congress has expired without the adoption by the Congress of a concurrent resolution stating that the Congress does not favor such transfer.[27]

ACCESS TO INFORMATION

Sec. 303. Information obtained or developed by the Administrator in the performance of his functions under this Act shall be made available for public inspection; except (A) information authorized or required by Federal statute to be withheld, and (B) information classified to protect the national security: Provided, That nothing in this Act shall authorize the withholding of information by the Administrator from the duly authorized committees of the Congress.

SECURITY

Sec. 304. (a) The Administrator shall establish such security requirements, restrictions, and safeguards as he deems necessary in the interest of the national security. The Administrator may arrange with the Office of Personnel Management for the conduct of such security or other personnel investigations of the Administration's officers, employees, and consultants, and its contractors and subcontractors and their officers and employees, actual or prospective, as he deems appropriate; and if any such investigation develops any data reflecting that the individual who is the subject thereof is of questionable loyalty the matter shall be referred to the Federal Bureau of Investigation for the conduct of a full field investigation, the results of which shall be furnished to the Administrator.

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[26]Transfers pursuant to sec. 302 have been: Executive Order 10783, October 1, 1958, transferring from the Department of Defense the Project VANGUARD and other projects of Advanced Research Projects Agency and of Department of the Air Force relating to space activities; Executive Order 10793, December 3, 1958, transferring from Department of the Army the Jet Propulsion Laboratory (near Pasadena, California); Transfer Plan, delivered to Congress January 14, 1960 effective March 15, 1960, transferring from the Department of Defense the activities of development and research of space vehicle systems and specifically the Development Operations Division of the Army Ballistic Missile Agency (near Huntsville, Alabama).

[27]Clause (2) is unconstitutional under the Supreme Court's legislative veto decision "Immigration and Naturalization Service v. Chadha," 462 U.S. 919, 103 S. Ct. 2764 (1983), 51 USLW 4907.

(b) The Atomic Energy Commission[28] may authorize any of its employees, or employees of any contractor, prospective contractor, licensee, or prospective licensee of the Atomic Energy Commission or any other person authorized to have access to Restricted Data by the Atomic Energy Commission under subsection 145b, of the Atomic Energy Act of 1954 (42 U.S.C. 2165(b)), to permit any member, officer, or employee of the Council, or the Administrator, or any officer, employee, member of an advisory committee, contractor, subcontractor, or officer or employee of a contractor or subcontractor of the Administration, to have access to Restricted Data relating to aeronautical and space activities which is required in the performance of his duties and so certified by the Council or the Administrator, as the case may be, but only if

(1) the Council or Administrator or designee thereof has determined, in accordance with the established personnel security procedures and standards of the Council or Administration, that permitting such individual to have access to such Restricted Data will not endanger the common defense and security, and

(2) the Council or Administrator or designee thereof finds that the established personnel and other security procedures and standards of the Council or Administration are adequate and in reasonable conformity to the standards established by the Atomic Energy Commission under section 145 of the Atomic Energy Act of 1954 (42 U.S.C. 2165). Any individual granted access to such Restricted Data pursuant to this subsection may exchange such Data with any individual who (A) is an officer or employee of the Department of Defense, or any department or agency thereof, or a member of the armed forces, or a contractor or subcontractor of any such department, agency, or armed force, or an officer or employee of any such contractor or subcontractor, and (B) has been authorized to have access to Restricted Data under the provisions of section 143 of the Atomic Energy Act of 1954 (42 U.S.C. 2163).

(c) Chapter 37 of title 18 of the United States Code (entitled Espionage and Censorship) is amended by--

(1) adding at the end thereof the following new section:

"§799. Violation of regulations of National Aeronautics and Space Administration."

"Whoever willfully shall violate, attempt to violate, or conspire to violate any regulation or order promulgated by the Administrator of the National Aeronautics and Space Administration for the protection or security of any laboratory, station, base or other facility, or part thereof, or any aircraft, missile, spacecraft, or similar vehicle, or part thereof, or other property or equipment in the custody of the Administration, or any real or personal property or equipment in the custody of any contractor under any contract with the Administration or any subcontractor of any such contractor, shall be fined not more than $5,000, or imprisoned not more than one year, or both."

(2) adding at the end of the sectional analysis thereof the following new item:

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[28]The Atomic Energy Commission was abolished and all functions were transferred to the Administrator of the Energy Research and Development Administration (ERDA) (unless otherwise specifically provided) by Public Law 93-438, title I, section 104, Oct 11, 1974 (88 Stat. 1273). ERDA was terminated and its functions transferred to the Secretary of Energy (unless otherwise specifically provided) by Public Law 95-91, title III, section 301, (91 Stat. 577), and title VII, section 703, (91 Stat. 606), August 4, 1977

§"799. Violation of regulations of National Aeronautics and Space Administration."

(d) Section 1114 of title 18 of the United States Code is amended by inserting immediately before "while engaged in the performance of his official duties" the following: "or any officer or employee of the National Aeronautics and Space Administration directed to guard and protect property of the United States under the administration and control of the National Aeronautics and Space Administration,".

(e) The Administrator may direct such of the officers and employees of the Administration as he deems necessary in the public interest, to carry firearms while in the conduct of their official duties. The Administrator may also authorize such of those employees of the contractors and subcontractors of the Administration engaged in the protection of property owned by United States and located at facilities owned by or contracted to the United States as he deems necessary in the public interest, to carry firearms while in the conduct of their official duties.

PROPERTY RIGHTS IN INVENTIONS

Sec. 305. (a) Whenever any invention is made in the performance of any work under any contract of the Administration, and the Administrator determines that—

> (1) the person who made the invention was employed or assigned to perform research, development, or exploration work and the invention is related to the work he was employed or assigned to perform, or that it was within the scope of his employment duties, whether or not it was made during working hours, or with a contribution by the Government of the use of Government facilities, equipment, materials, allocated funds, information proprietary to the Government, or services of Government employees during working hours; or
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> (2) the person who made the invention was not employed or assigned to perform research, development, or exploration work, but the invention is nevertheless related to the contract, or to the work or duties he was employed or assigned to perform, and was made during working hours, or with a contribution from the Government of the sort referred to in clause (1),

such invention shall be the exclusive property of the United States, and if such invention is patentable a patent therefor shall be issued to the United States upon application made by the Administrator, unless the Administrator waives all or any part of the rights of the United States to such invention in conformity with the provisions of subsection (f) of this section.

(b) Each contract entered into by the Administrator with any party for the performance of any work shall contain effective provisions under which such party shall furnish promptly to the Administrator a written report containing full and complete technical information concerning any invention, discovery, improvement, or innovation which may be made in the performance of any such work.

(c) No patent may be issued to any applicant other than the Administrator for any invention which appears to the Commissioner of Patents to have significant utility in the conduct of aeronautical and space activities unless the applicant files with the Commissioner, with the application or within thirty days after request therefor by the Commissioner, a written statement executed under oath setting forth the full facts concerning the circumstances under which such invention was made and stating the relationship (if any) of such invention to the performance of any work under any contract of the Administration. Copies of each such statement and the application to which it relates shall be transmitted forthwith by the Commissioner to the Administrator.

(d) Upon any application as to which any such statement has been transmitted to the Administrator, the Commissioner may, if the invention is patentable, issue a patent to the applicant unless the Administrator, within ninety days after receipt of such application and statement, requests that such patent be issued to him on behalf of the United States. If, within such time, the Administrator files such a request with the Commissioner, the Commissioner shall transmit notice thereof to the applicant, and shall issue such patent to the Administrator unless the applicant within thirty days after receipt of such notice requests a hearing before a Board of Patent Interferences on the question whether the Administrator is entitled under this section to receive such patent. The Board may hear and determine, in accordance with rules and procedures established for interference cases, the question so presented, and its determination shall be subject to appeal by the applicant or by the Administrator to the United States Court of Appeals for the Federal Circuit[29] in accordance with procedures governing appeals from decisions of the Board of Patent Interferences in other proceedings.

(e) Whenever any patent has been issued to any applicant in conformity with subsection (d), and the Administrator thereafter has reason to believe that the statement filed by the applicant in connection therewith contained any false representation of any material fact, the Administrator within five years after the date of issuance of such patent may file with the Commissioner a request for the transfer to the Administrator of title to such patent on the records of the Commissioner. Notice of any such request shall be transmitted by the Commissioner to the owner of record of such patent, and title to such patent shall be so transferred to the Administrator unless within thirty days after receipt of such notice such owner of record requests a hearing before a Board of Patent Interferences on the question whether any such false representation was contained in such statement. Such question shall be heard and determined, and determination thereof shall be subject to review, in the manner prescribed by subsection (d) for questions arising thereunder. No request made by the Administrator under this subsection for the transfer of title to any patent, and no prosecution for the violation of any criminal statute, shall be barred by any failure of the Administrator to make a request under subsection (d) for the issuance of such patent to him, or by any notice previously given by the Administrator stating that he had no objection to the issuance of such patent to the applicant therefor.

(f) Under such regulations in conformity with this subsection as the Administrator shall prescribe, he may waive all or any part of the rights of the United States under this section with respect to any invention or class of inventions made or which may be made by any person or class of persons in the performance of any work required by any contract of the Administration

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[29]The "Federal Courts Improvement Act of 1982," Public Law 97-164, April 2, 1982, Title I, section 162(3), (96 Stat. 49) substituted "United States Courts of Appeals for the Federal Circuit" for "Court of Customs and Patent Appeals."

if the Administrator determines that the interests of the United States will be served thereby. Any such waiver may be made upon such terms and under such conditions as the Administrator shall determine to be required for the protection of the interests of the United States. Each such waiver made with respect to any invention shall be subject to the reservation by the Administrator of an irrevocable, nonexclusive, nontransferable, royalty-free license for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States. Each proposal for any waiver under this subsection shall be referred to an Inventions and Contribution Board which shall be established by the Administrator within the Administration. Such Board shall accord to each interested party an opportunity for hearing, and shall transmit to the Administrator its findings of fact with respect to such proposal and its recommendations for action to be taken with respect thereto.

[(g)] deleted[30]

(h) The Administrator is authorized to take all suitable and necessary steps to protect any invention or discovery to which he has title, and to require that contractors or persons who retain title to inventions or discoveries under this section protect the inventions or discoveries to which the Administration has or may acquire a license of use.

(i) The Administration shall be considered a defense agency of the United States for the purpose of chapter 17 of title 35 of the United States Code.

(j) As used in this section—

(1) the term "person" means any individual, partnership, corporation, association, institution, or other entity;

(2) the term "contract" means any actual or proposed contract, agreement, understanding, or other arrangement, and includes any assignment, substitution of parties, or subcontract executed or entered into thereunder; and

(3) the term "made", when used in relation to any invention, means the conception or first actual reduction to practice of such invention.

(k) Any object intended for launch, launched, or assembled in outer space shall be considered a vehicle for purpose of section 272 of title 35, United States Code [35 U.S.C. 272].[31]

(l) The use or manufacture of any patented invention incorporated in a space vehicle launched by the United States Government for a person other than the United States shall not be considered to be a use or manufacture by or for the United States within the meaning of section

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[30]The "Small Business and University Patent Procedures Act," Public Law 96-517, December 12, 1980, section 7(b), (94 Stat. 3027) deleted subsection (g) which authorized the Administrator to promulgate regulations for the granting of licenses for NASA patents. Section 8(f) of the Act provided that such deletion was effective on July 1, 1981.

[31]The "National Aeronautics and Space Administration Authorization Act, 1982," Public Law 97-96, December 21, 1981, section 7 (95 Stat. 1210) added this subsection

1498(a) of title 28, United States Code (28 U.S.C. 1498(a)) unless the Administration gives an express authorization or consent for such use or manufacture.[32]

CONTRIBUTIONS AWARDS

Sec. 306. (a) Subject to the provisions of this section, the Administrator is authorized, upon his own initiative or upon application of any person, to make a monetary award, in such amount and upon such terms as he shall determine to be warranted, to any person (as defined by section 305) for any scientific or technical contribution to the Administration which is determined by the Administrator to have significant value in the conduct of aeronautical and space activities. Each application made for any such award shall be referred to the Inventions and Contributions Board established under section 305 of this Act. Such Board shall accord to each such applicant an opportunity for hearing upon such application, and shall transmit to the Administrator its recommendation as to the terms of the award, if any, to be made to such applicant for such contribution. In determining the terms and conditions of any award the Administrator shall take into account—

(1) the value of the contribution to the United States;

(2) the aggregate amount of sums which have been expended by the applicant for the development of such contribution;

(3) the amount of any compensation (other than salary received for services rendered as an officer or employee of the Government) previously received by the applicant for or on account of the use of such contribution by the United States; and

(4) such other factors as the Administrator shall determine to be material.

(b) If more than one applicant under subsection (a) claims an interest in the same contribution, the Administrator shall ascertain and determine the respective interests of such applicants, and shall apportion any award to be made with respect to such contribution among such applicants in such proportions as he shall determine to be equitable. No award may be made under subsection (a) with respect to any contribution—Apportionment of award.

(1) unless the applicant surrenders, by such means as the Administrator shall determine to be effective, all claims which such applicant may have to receive any compensation (other than the award made under this section) for the use of such contribution or any element thereof at any time by or on behalf of United States, or by or on behalf of any foreign government pursuant to any treaty or agreement with the United States, within the United States or at any other place;

(2) in any amount exceeding $100,000, unless the Administrator has transmitted to the appropriate committees of the Congress a full and complete

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[32]Idem.

report concerning the amount and terms of, and the basis for, such proposed award, and thirty calendar days of regular session of the Congress have expired after receipt of such report by such committees.

DEFENSE OF CERTAIN MALPRACTICE AND NEGLIGENCE SUITS

Sec. 307. (a) The remedy against the United States provided by sections 1346(b) and 2672 of title 28, United States Code, for damages for personal injury, including death, caused by the negligent or wrongful act or omission of any physician, dentist, nurse, pharmacist, or paramedical or other supporting personnel (including medical and dental technicians, nursing assistants, and therapists) of the Administration in the performance of medical, dental, or related health care functions (including clinical studies and investigations) while acting within the scope of his duties or employment therein or therefor shall hereafter be exclusive of any other civil action or proceeding by reason of the same subject matter against such physician, dentist, nurse, pharmacist, or paramedical or other supporting personnel (or the estate of such person) whose act or omission gave rise to such action or proceeding.

(b) The Attorney General shall defend any civil action or proceeding brought in any court against any person referred to in subsection (a) of this section (or the estate of such person) for any such injury. Any such person against whom such civil action or proceeding is brought shall deliver within such time after date of service or knowledge of service as determined by the Attorney General, all process served upon such person or an attested true copy thereof to such person's immediate superior or to whomever was designated by the Administrator to receive such papers and such person shall promptly furnish copies of the pleading and process therein to the United States Attorney for the district embracing the place wherein the proceeding is brought to the Attorney General and to the Administrator.

(c) Upon a certification by the Attorney General that any person described in subsection (a) was acting in the scope of such person's duties or employment at the time of the incident out of which the suit arose, any such civil action or proceeding commenced in a State court shall be removed without bond at any time before trial by the Attorney General to the district court of the United States of the district and division embracing the place wherein it is pending and the proceeding deemed a tort action brought against the United States under the provisions of title 28, United States Code, and all references thereto. Should a United States district court determine on a hearing on a motion to remand held before a trial on the merits that the case so removed is one in which a remedy by suit within the meaning of subsection (a) of this section is not available against the United States, the case shall be remanded to the State court.

(d) The Attorney General may compromise or settle any claim asserted in such civil action or proceeding in the manner provided in section 2677 of title 28, United States Code, and with the same effect.

(e) For purposes of this section, the provisions of section 2680(h) of title 28, United States Code, shall not apply to any cause of action arising out of a negligent or wrongful act or omission in the performance of medical, dental, or related health care functions (including clinical studies and investigations).

(f) The Administrator or his designee may, to the extent that the Administrator or his designee deem appropriate, hold harmless or provide liability insurance for any person described in subsection (a) for damages for personal injury, including death, caused by such person's negligent or wrongful act or omission in the performance of medical, dental, or related health care functions (including clinical studies and investigations) while acting within the scope of such person's duties if such person is assigned to a foreign country or detailed for service with other than a Federal department, agency, or instrumentality or if the circumstances are such as are likely to preclude the remedies of third persons against the United States described in section 2679(b) of title 28, United States Code, for such damage or injury.[33]

INSURANCE AND INDEMNIFICATION[34]

Sec. 308. (a) The Administration is authorized on such terms and to the extent it may deem appropriate to provide liability insurance for any user of a space vehicle to compensate all or a portion of claims by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle. Appropriations available to the Administration may be used to acquire such insurance, but such appropriations shall be reimbursed to the maximum extent practicable by the users under reimbursement policies established pursuant to section 203(c) of this Act (42 USCS 2473(c)).

(b) Under such regulations in conformity with this section as the Administrator shall prescribe taking into account the availability, cost and terms of liability insurance, any agreement between the Administration and a user of a space vehicle may provide that the United States will indemnify the user against claims (including reasonable expenses of litigation or settlement) by third parties for death, bodily injury, or loss of or damage to property resulting from activities carried on in connection with the launch, operations or recovery of the space vehicle, but only to the extent that such claims are not compensated by liability insurance of the user: Provided, That such indemnification may be limited to claims resulting from other than the actual negligence or willful misconduct of the user. Indemnification of user.

(c) An agreement made under subsection (b) that provides indemnification must also provide for—

(1) notice to the United States of any claim or suit against the user for the death, bodily injury, or loss of or damage to the property; and

(2) control of or assistance in the defense by the United States, at its election, of that suit or claim.

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[33]A law, "Medical Malpractice--Actions Against U.S.," Public Law 94- 464, October 8, 1976, section 3 (90 Stat. 1988), added this new section 307 and redesignated old section 307 as section 308.

[34]The "National Aeronautics and Space Administration Authorization Act, 1980," Public Law 96-48, August 8, 1979, section 6(b), (93 Stat. 348) added new section 308 and redesignated old section 308 as section 309. Section 6(c) of that act provided that the amendment would be effective October 1, 1979.

(d) No payment may be made under subsection (b) unless the Administrator or his designee certifies that the amount is just and reasonable.

(e) Upon the approval by the Administrator, payments under subsection (b) may be made, at the Administrator's election, either from funds available for research and development not otherwise obligated or from funds appropriated for such payments.

(f) As used in this section—

(1) the term "space vehicle" means an object intended for launch, launched or assembled in outer space, including the Space Shuttle and other components of a space transportation system, together with related equipment, devices, components and parts;

(2) the term "user" includes anyone who enters into an agreement with the Administration for use of all or a portion of a space vehicle, who owns or provides property to be flown on a space vehicle, or who employs a person to be flown on a space vehicle; and

(3) the term "third party" means any person who may institute a claim against a user for death, bodily injury or loss of or damage to property.

APPROPRIATIONS[35]

Sec. 309. (a) There are hereby authorized to be appropriated such sums as may be necessary to carry out this Act, except that nothing in this Act shall authorize the appropriation of any amount for (1) the acquisition or condemnation of any real property, or (2) any other item of a capital nature (such as plant or facility acquisition, construction, or expansion) which exceeds $250,000. Sums appropriated pursuant to this subsection for the construction of facilities, or for research and development activities, shall remain available until expended.

(b) Any funds appropriated for the construction of facilities may be used for emergency repairs of existing facilities when such existing facilities are made inoperative by major breakdown, accident, or other circumstances and such repairs are deemed by the Administrator to be of greater urgency than the construction of new facilities.

(c) Notwithstanding any other provision of law, the authorization of any appropriation to the Administration shall expire (unless an earlier expiration is specifically provided) at the close of the third fiscal year following the fiscal year in which the authorization was enacted, to the extent that such appropriation has not theretofore actually been made.[36]

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[35] For other laws affecting NASA's appropriations, see section I of Appendix A of the October 1983 version of the "National Aeronautics and Space Act of 1958, as Amended, and Related Legislation."

[36] Subsection (c) of section 309 was added by section 6 of the "National Aeronautics and Space Administration Authorization Act, 1963," Public Law 88-113, September 6, 1963 (77 Stat. 144); note that section 309 in the original Space Act was section 307. Public Law 94-464 (see footnote 33) changed it to section 308. Public Law 96-48 (see footnote 34) changed it to section 309.

MISUSE OF AGENCY NAME AND INITIALS

Sec. 310. (a) No person (as defined by section 305) may

(1) knowingly use the words 'National Aeronautics and Space Administration' or the letters 'NASA', or a combination, variation, or colorable imitation of those words or letters either alone or in combination with other words or letters, as a firm or business name in a manner reasonably calculated to convey the impression that such firm or business has some connection with, endorsement of or authorization from, the National Aeronautics and Space Administration which does not, in fact, exist; or

(2) knowingly use those words or letters or any combination, variation, or colorable imitation thereof either alone or in combination with other words or letters in connection with any product or service being offered or made available to the public in a manner reasonably calculated to convey the impression that such product or service has the authorization, support, sponsorship, or endorsement of, or the development, use, or manufacture by or on behalf of the National Aeronautics and Space Administration which does not, in fact, exist.

(b) Whenever it appears to the Attorney General that any person is engaged in an act or practice which constitutes or will constitute conduct prohibited by subsection (a), the Attorney General may initiate a civil proceeding in a district court of the United States to enjoin such act or practice.[37]

CONTRACTS REGARDING EXPENDABLE LAUNCH VEHICLES [38]

Sec. 311. (a) The Administrator may enter into contracts for expendable launch vehicle services that are for periods in excess of the period for which funds are otherwise available for obligation, provide for the payment for contingent liability which may accrue in excess of available appropriations in the event the Government for its convenience terminates such contracts, and provide for advance payments reasonably related to launch vehicle and related equipment, fabrication, and acquisition costs, if any such contract limits the amount of the payments that the Federal Government is allowed to make under such contract to amounts provided in advance in appropriation Acts. Such contracts may be limited to sources within the United States when the Administrator determines that such limitation is in the public interest.

(b) If funds are not available to continue any such contract, the contract shall be terminated for the convenience of the Government, and the costs of such contract shall be paid from appropriations originally available for performance of the contract, from other, unobligated

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[37]This subsection was added by section 107 of the "National Aeronautics and Space Administration Authorization Act, 1984," Public Law 98-52, July 15, 1983 (97 Stat. 284).

[38]The "National Aeronautics and Space Administration Authorization Act, 1988," Public Law 100-147, October 30, 1987 (101 Stat. 860).

appropriations currently available for the procurement of launch services, or from funds appropriated for such payments.

TITLE IV - UPPER ATMOSPHERIC RESEARCH[39]

PURPOSE AND POLICY

Sec. 401. (a) The purpose of this title is to authorize and direct the Administration to develop and carry out a comprehensive program of research, technology, and monitoring of the phenomena of the upper atmosphere so as to provide for an understanding of and to maintain the chemical and physical integrity of the Earth's upper atmosphere.

(b) The Congress declares that is the policy of the United States to undertake an immediate and appropriate research, technology, and monitoring program that will provide for understanding the physics and chemistry of the Earth's upper atmosphere.

DEFINITIONS

Sec. 402. For the purpose of this title the term "upper atmosphere" means that portion of the Earth's sensible atmosphere above the troposphere.

PROGRAM AUTHORIZED

Sec. 403. (a) In order to carry out the purposes of this title the Administration in cooperation with other Federal agencies, shall initiate and carry out a program of research, technology, monitoring, and other appropriate activities directed to understand the physics and chemistry of the upper atmosphere.

(b) In carrying out the provisions of this title the Administration shall—

(1) arrange for participation by the scientific and engineering community, of both the Nation's industrial organizations and institutions of higher education, in planning and carrying out appropriate research, in developing necessary technology and in making necessary observations and measurements;

(2) provide, by way of grant, contract, scholarships or other arrangements, to the maximum extent practicable and consistent with other laws, for the widest practicable and appropriate participation of the scientific and engineering community in the program authorized by this title; and

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[39] This title was added by section 8 of the "National Aeronautics and Space Administration Authorization Act, 1976," Public Law 94-39, June 19, 1975 (89 Stat. 222).

(3) make all results of the program authorized by this title available to the appropriate regulatory agencies and provide for the widest practicable dissemination of such results.

INTERNATIONAL COOPERATION

Sec. 404. In carrying out the provisions of this title, the Administration, subject to the direction of the President and after consultation with the Secretary of State, shall make every effort to enlist the support and cooperation of appropriate scientists and engineers of other countries and international organizations.

Survey Sheet

Air Force Institute of Technology
Thesis Research

Conducted By:
Captain Steve Brady
Captain Jay Jennings

Name: _____
Title: _____
Date Interviewed: _____
Phone #: _____
Address: _____
Control #: _____

Personal and Introductory Questions

Please share a bit of your past with us: What is your professional background, schooling?

How many years have you been with NASA? And how many years have you been working Logistics issues?

What training have you received in logistics functions?

- Also, what training did you initially recetraining did you initially receive in NASA logis operations?

What do you most enjoy in your job? What do you least enjoy?

Control #:_____

Program Level

Could you please chart for us the major interactions between your logistics organization and the other organizations in your program.

What is the biggest constraint on your program today?

What is the most important force driving your program?

What do you perceive to be the premier program at NASA today?

What is the end product of your program/project?

Control #:_____

What value does the end product carry, and for whom?
(Responses may be categorized into systems, knowledge, process,etc)

Who is the "Customer" for your program?

Control #:_____

Office Level

What would you define to be the "product" of your office?

Who is the ultimate customer of your product?

How are your customers desires made known to you?

Where is the customer located now?

Where will the customer be located during the operation of the program/project?

How can the customer be reached if you have questions?

How can the customer reach you if they have questions?

Control #:_____

What coordination exists between you and others like you from different programs?

What coordination exists between you and others like you from different centers working on the **same** program?

Control #:_____

Strategy

How familiar are you with the NASA Strategic Plan?

- With your own center's strategic plan?

What influence does your organization have on development of the strategic plan?

How does the strategic plan affect your organization?

What happens when something deviates from plan?

What happens when you have a conflict?

Control #:_____

Power

What requirements do you have that are keeping you from doing your job?

Put yourself in a list of who is powerful in your organization:

Could you please chart for us the way you perceive power to be distributed at this center.

Which center has the most access to resources?

If you could change one aspect of the logistics organization, what would it be?

Control #:_____

Logistics Strategy

Does a comprehensive logistics strategic plan exist?

- If not, how do we establish goals and objectives for logistics?

- If so, what influence did you have on the plan?

-- How does it affect your organization?

Where does your office get its goals and objectives?

- What are they (and are they written down?)

Control #:_____

How are resources (specifically, money) tied to these goals and objectives?

Is there a shared value set for people working logistics issues inside your program?

Is there a shared value set between people working logistics issues in your program and other programs?

Control #:_____

Logistics Communications

What form of "cross-talk" communications exist between you and other logisticians?

- How frequent are these communications?

- Would you please diagram the general communications patterns, or outline some of the more important forms of exchange.

- Would you categorize these as formal or informal channels of communications?

- What sort of information is exchanged in these flows.

Control #:_____

If another center were to direct how logistics should be developed on your portion of a shared program, how would you respond?

- How would your boss respond?

- How high a level of coordination would ultimately be required?

What logistics initiatives would you like to see implemented across NASA?

Control #:_____

Survey Sheet

Written Response Questionnaire

Air Force Institute of Technology
Thesis Research

Conducted By:
Captain Steve Brady
Captain Jay Jennings

Name: _____
Title: _____
Date Interviewed: _____
Phone #: _____
Address: _____
Control #: _____

Control #:_____

Could you please chart for us the major interactions between your logistics organization and the other organizations in your program.

Control #:_____

Put yourself in a list of who is powerful in your organization:

Control #:_____

Could you please chart for us the way you perceive power to be distributed at this center.

Control #:_____

- Would you please diagram the general communications patterns, or outline some of the more important forms of exchange.

Control #:_____

Variable Description	Sliding Scale		
Nature of Goal Setting	Bottom Up	Mixed Mode	Top-Down
Linkage Between Plans and Budget	Very Loose	Loose-tight	Very Tight
Role of the Planner	Catalyst	Mixed	Strategist
Frequency of Monitoring Strategic Plans	Infreq. (One yr or More)	Modest (qrtrly)	Very Freq
Nature of Organizational/Management Control NASA	Centralized		De-centralized
Personal Preference for Nature of Organizational/Management Control NASA	Centralized		De-centralized

Control #:_____

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Vita: Captain Stephan P. Brady

Captain Stephan P. Brady was born in Houston, Texas on 31 October, 1963. He attended Damascus High School, in Damascus, Maryland, graduating in June of 1981. While in high school he pursued a variety of interests including agriculture, photography, music, and political involvement. He received a Bachelor of Arts degree in Political Science from Western Maryland College in May of 1985 and was commissioned into the United States Air Force on 24 May 1985. Upon entering active duty in the Air Force, Steve was selected as one of a few second lieutenants to enter the Logistics Plans career field. He was first assigned to the historic 509th Bombardment Wing at Pease AFB, New Hamshire, holding numerous positions, including chief of the plans and programs branch and the mobility branch, and ultimately serving as the Officer-in-Charge, Logistics Plans Division. Steve was then assigned to Grand Forks AFB, North Dakota, as the Chief, Logistics Plans Division. There he deployed the B-1B and KC-135R in their first conventional, bare-base deployment and was instrumental in basing the KC-135R at Cairo-West, Egypt, during DESERT SHIELD. These efforts led to his selection as Eighth Air Force Outstanding Logistics Manager for 1990. Captain Brady is currently a Master's Degree candidate in the School of Logistics and Acquisition Management, Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

Permanent Address: 9214 Lawnview Ln

Laurel, MD 20708

Vita: Captain Jay R. Jennings

Captain Jay R. Jennings was born in Portland, Oregon on November 30, 1959. Attending Jackson High School in Portland, he was involved in music, science, and numerous sports, including football and baseball. He graduated with High Honors in 1978 and went on to Portland State University, combining his studies in music, biology, chemistry, math, and computer science with a number of exploratory careers, including musician, emergency medical technician and high school science teacher and football coach. He graduated in 1984 with a Bachelor of Science degree in Science. He was commissioned in February 1985 through the Air Force Officer Training School, becoming one of a handful of second lieutenants in the Logistics Plans career field. An Honor Graduate of the logistics plans school, he was assigned as Chief of Logistics, 2953rd Combat Logistics Support Squadron, Tinker AFB, Oklahoma. In 1988, he was transferred to the 616th Military Airlift Group, Elmendorf AFB, Alaska, as the Chief, Logistics Plans, later assuming the position of Assistant Director of Resources. His accomplishments as the Military Airlift Command (MAC) logistics planner in the Alaskan theater earned him the honor of MAC Logistics Plans and Programs Junior Manager of the Year for 1989. Captain Jennings is currently a Master's degree candidate in the School of Logistics and Acquisition Management, Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

Permanent Address: 9204 SW 8th Dr.

Portland, OR 97219

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	September, 1992	Master's Thesis

4. TITLE AND SUBTITLE
NASA AND LOGISTICS—A MATCH FOR THE 21st CENTURY

5. FUNDING NUMBERS

6. AUTHOR(S)
Stephan P. Brady, Capt, USAF
Jay R. Jennings, Capt, USAF

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Air Force Institute of Technology, WPAFB OH 45433-6583

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/GLM/LSY/92S-5

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)
NASA/JI
NASA Headquarters
Washington, D.C. 20546

10. SPONSORING MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION / AVAILABILITY STATEMENT
Approved for Public Release; distribution unlimited

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

This research evaluated current NASA organizational and logistical strategy processes to compare them with current academic theory and make recommendations to improve the processes. Various strategy theories were explored, resulting in a model synthesizing the various elements. The organizational, cultural, and political environment surrounding NASA was studied. Personal interviews were conducted and various NASA strategic plans and other documents were analyzed. From these activities emerged six recommendations: 1. Create a formal strategy process for NASA logistics (and NASA), 2. Tie logistics strategies directly to organizational strategies/goals, 3. Get logisticians from different functions/programs/centers to crossflow information, 4. Identify redundancies in logistics functions at centers and consolidate where possible, 5. Change the culture and tradition of NASA by infusing trained logisticians, and 6. Evaluate each program not in terms of the program itself but in terms of the goal for that program.

14. SUBJECT TERMS	15. NUMBER OF PAGES
Logistics Management, Strategy, Organization Theory, Public Administration	118
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

AFIT Control Number AFIT/GLM/LSY/92S-5

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