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After The Moon: A Study Of Governmental Agency Decline And Nasa

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AFTER THE MOON: A STUDY OF GOVERNMENTAL AGENCY DECLINE AND NASA

by

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ABSTRACT

The concept of decline has variously been applied to businesses, organizations, groups, and government (Levine 1978; Lorange and Nelson 1987; Whetten 1980). The term decline has also been used to describe various government agencies such as NASA. It is the theory put forth presently that decline in its traditional form in the literature does not apply to government agencies. Decline has been previously characterized as a time of decreasing or restricted resources, conflict, a decrease in innovativeness, a decrease in organizational size, a decrease in income or profits, and an organization's inability to adapt (Cameron, Whetten, and Kim; Weitzel and Jonsson). These characteristics, however, are not applicable to individual government agencies; an agency's tasks, form, and functions are usually set and defined through legislation, its budget is tied to the budget of the rest of the US government, and policy is usually generated at the top. Because of these pitfalls, I propose a new model of operations at the government level: the government agency decline model. This model posits that an agency's operations are in constant flux depending on the nature of the US economy at any given time and a number of other variables. Pursuant to this, I propose that there is a strong relationship between budget, agency performance, and power; more money in an agency's accounts contributes to bettering their performance, better performance leads to more power, which can lead to an increased budget. Therefore this cycle can begin and be interrupted at the money stage depending on the state of the American economy.

Findings show that there are relationships between economy, budgets, performance, and power leading to an enhanced explanation of NASA's yearly budget. Recommendations

for further research include examining a wider array of government agencies and developing better ways to measure power.

To Josh, for all of your help, patience, and love.

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CHAPTER 1: INTRODUCTION

What do you do after you have been to the Moon? This question has plagued not only astronauts but NASA as it has attempted to adjust to life without a Cold War rationale for influxes of large amounts of money. With landing on the Moon often considered the high point in a precarious NASA history, accomplishments afterward may seemingly be characterized as a decline in the functions of NASA. The time period following the Apollo moon landings has been variously described as NASA's eclipse or decline, but what is decline?[1] What does decline mean? Or rather, how do you top the moon?

Human beings, organizations, systems, and companies are not expected to run and operate at their highest standards at all times. People get sick, systems run slowly, and companies may not run as efficiently as they used to. Having an agency, organization, corporation, or company running at its highest potential for any amount of time is an incredible endeavor that takes significant inputs of innovation, funds, and resources. In some instances, changes in these inputs and thus that organization's performance may be considered a decline in whatever sense that the phrase is used.

Yet, it is here that a difference between public (or government) and private arises- if a private organization experiences decline, it is generally said to have fewer resources, lower profits, a lack of innovativeness and/or long-term planning, more turnover among employees, and a growing rigidity in the organization.[2] In public or governmental organizations, budgets are generally dependent on overall government budgeting and the tasks assigned to organizations and how they go about them are often regulated by an

agency's enabling legislation and a myriad of other rules and statutes. The problem thus encountered is how to reconcile the idea of decline with the inherent characteristics of a governmental agency.

The primary focus of this investigation is an examination of organizational decline relevant to politicized government agencies, specifically NASA. Because of the nature of governmental agencies, the idea of organizational decline as it is presented in the literature, I hypothesize, is irrelevant to government organizations; therefore I propose a model of governmental agency decline (GAD) in which an agency's operations are in constant flux depending on the nature of the US economy at any given time and a number of other variables. Pursuant to this, I propose that there is a strong relationship between budget, agency performance, and power; more money in an agency's accounts contributes to bettering their performance, better performance leads to more power, which can lead to an increased budget. Therefore this cycle can begin and be interrupted at the money stage depending on the state of the American economy.

There is perhaps no better agency to examine in regards to this problem than the National Aeronautics and Space Administration (NASA). Its history of publicly identifiable programs, pursuits, challenges and failures makes it quite vulnerable to declarations of decline. The first flight of the reusable space shuttle and the successful Mars rovers were publicly accessible events that exhibited what makes NASA great; at the same time, the disasters *Challenger* and *Columbia* were public tragedies that signify NASA's failures. While the public may not always observe the successes and failures of the Departments of Agriculture or Treasury, they can readily see whether NASA launches made it into space or shuttles made it home.

This is not to say that the analysis done here would not or could not apply to other government agencies; the very nature of NASA that their achievements, their outputs, are readily available to be examined, put it in a unique position compared to other agencies to be studied. One could certainly trace the performance of the US Geological Survey and identify changes, whether positive or negative, in its performance, but NASA offers us a rare chance at examining an agency that is charged with highly technical tasks and must protect human life to the best of its ability at the same time.

NASA at its heart is a government organization that does not exist in a vacuum, unlike the environment in which its members at times operate. Budgetary politics, election year ploys, and changes in political environments can and do affect NASA and the way in which it operates. The challenges that politics puts on NASA only complicate its missions and actions. It is this interplay between government and NASA that explanation is sought for here.

Who or What is NASA?

Variously, in the first pages of this examination, NASA has been referred to as a government organization, a public agency, and a group that has readily identifiable missions, successes, and failures. One of the key concepts that must be identified here at the outset is what NASA is, how it operates, and perhaps even why it operates as it does. To be sure, a large organization is almost always made up of smaller component parts and people; it is easy enough to state that the sum of the parts equals the whole but how do those component parts influence the whole? While Downs and Wilson provide rudimentary mechanisms to explain this in the form of their theories on bureaucracy, it

should be sufficient here to identify NASA as an organization with a particular culture or way of doing things.[3]

But the culture is only the way NASA goes about doing things, how does it decide what it does in the first place? NASA is the primary arm of the US federal government for executing US space policy and as such, ends are often decided for it with the means being left to NASA. Is it the president, the Congress, or some combination of those actors that decide what NASA will do? This topic will be addressed in chapter two, but it is important to note, as Krasner does, that whether the agency has the ability to decide for itself what to do is still a function of presidential policy.[4] Even when the president is not setting specific policy, "some policy options are never presented;" in this sense, how does NASA decide what options to present and what options to argue for?[5]

NASA decision-making is very much a result of its culture in that the missions they strive to achieve and push for are missions that have been in their blood from the beginning- human spaceflight. No matter the resources at their disposal, "the agency agenda has been consistent (albeit tactically flexible) while the external agenda often changes rapidly in different directions."[6] Therefore, the major policy decisions, while being generally acceptable at the presidential level, are usually formed and argued for strongly by NASA leaders as a result of their history and culture.

Plan of Study

It is the hypothesis here that the idea of decline as presented in the literature and all too often used by others to characterize NASA is irrelevant; characteristics such as increasing bureaucracy and competition, and decreasing innovativeness and profits/income are characteristics that do not apply only to government agencies but

rather government as a whole. In order to examine this idea, this study will proceed in three phases: a critical review of decline as presented in the literature, an examination of the history of NASA between 1970 and 2005, and an explanation of the governmental agency decline model, and a test of that model using NASA as a case study.

Governmental Agency Decline

It would be very easy to declare that NASA has declined and perhaps, in certain cases, one could say that is has declined. There are two questions that need to be answered, however. One, what is decline? Decline has been conceptualized in a variety of ways as shown in table 1.1. Not all of these can equally be applied to government organizations as will be examined shortly. The question left to be answered, then, is what characteristics explain or demonstrate governmental agency decline.

Table 0-1: Characteristics of Organizational Decline

Characteristics	Sources
Increasing conflict internally	Cameron, Whetten, and Kim 1987
Increasing rigidity	Cameron, Whetten, and Kim 1987
Decreasing morale	Cameron, Whetten, and Kim 1987
Lack of innovation	Cameron, Whetten, and Kim 1987
Elimination of slack resources	Cameron, Whetten, and Kim 1987
Concern with survival	Weitzel and Jonsson 1989
Inability to adapt	Weitzel and Jonsson 1989
Decreasing sales	Weitzel and Jonsson 1989
Decreasing profits	Weitzel and Jonsson 1989
Increasing competition	Weitzel and Jonsson 1989
Decreasing capacity for innovation	McCurdy 1991
Decreasing flexibility	McCurdy 1991
Decreasing number or excess of personnel	Whetten 1980; Lorange and Nelson 1987
Decreasing demand for services	Whetten 1980
Lack of clear goals	Lorange and Nelson 1987
Loss of effective communication	Lorange and Nelson 1987
Outdated structure	Lorange and Nelson 1987

Many researchers are already familiar with the work of Downs with his theory of organizational life cycles and Wilson's writings on bureaucracy. In general, both of these theories identify cycles through which government agencies and organizations go through with Downs focusing primarily on the beginnings of an agency. As will be discussed in chapter two, neither Downs nor Wilson's descriptions of bureaucracy hold up under examination. What I believe will be found in the course of an examination of the decline literature, is that the idea of decline as traditionally presented by authors such as Cameron, Whetten, and Kim and Weitzel and Jonsson are not applicable to government agencies which leads to the second question that needs to be addressed: if the traditional idea of organizational decline is not applicable, what is? The model thus put forth, governmental agency decline (or GAD), is designed to address the inability of the decline literature to apply to government. In dismissing the idea of a total decline, this model posits that government operations or an agency's operations are continually in flux dependent partially on the state of the national economy. A visual representation of this model appears in figure 1-1.

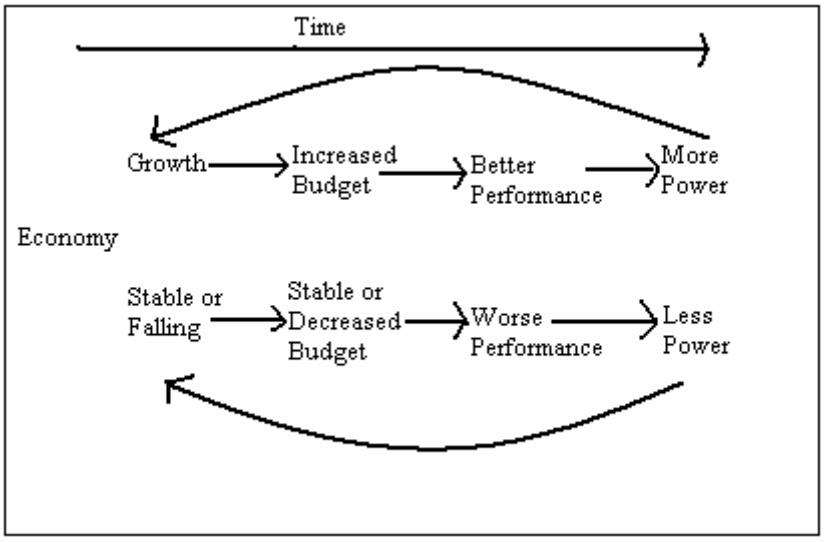

Figure 0-1: A Model of Governmental Agency Decline

In this model, which assumes that actors act rationally, an increase in an agency's budget allows it to funnel more money into operations, safety, and new programs increasing the agency's overall performance. As an agency's performance increases and it is seen by others in government as doing a better job, the agency's power and influence with others in the government thus increases (for our purposes here, power is defined as the ability of person or subject A to get what they want from person or subject B; this is discussed more fully in chapter four). This power and influence often translates into more money in the next budgetary cycle and so goes the model. It is very important, however, to note that this cycle is started at and can be interrupted at the budgetary or money position. If the Congress simply does not have the money to give to agencies for whatever variety of reasons, no amount of agency lobbying will be able to overcome that.

Conversely, though, what happens if the national economy improves but the agency does not have sufficient amounts of power to acquire what it would like from Congress? Certain scenarios can be imagined where, either the leadership of an agency or an agency's actions have received serious rebukes from the Congress; for instance, the current Congress was involved in a debate concerning the now former Attorney General, Alberto Gonzalez and his leadership of the Department of Justice. But, for agencies in or out of favor with the Congress, minor controversies or successes do not necessarily equal increases or decreases in budgets. Wildavsky puts forth the idea of "fair share" in his work on the congressional budgeting process explaining that, through the years, an idea of how much money an agency is budgeted is solidified in the minds of representatives.[7] While Wildavsky dos not address the idea of governmental decline, his explanation of fair share within the budgeting process helps to explain why agency budgets remain fairly

stable whether representatives and senators are fans of particular agencies and departments or not.

NASA's History

While the histories of the Space Age and NASA have been written ad nauseum, it is the aim of this paper to look at the years following the moon landing with a specific focus on the interplay between NASA and the rest of the government. I find that this exposition is needed for two interrelated reasons which will be discussed in turn: one, those scholars who have criticized NASA's performance and track record have focused only on specific instances and not the entirety of NASA's history; two, there only seems to be concern among academics with NASA's intragovernmental relations when major programs are up for debate.

If the *Challenger* accident had not occurred in 1986, would the space shuttle decision and design process been put under the microscope so soon? Would there have been any need in examining NASA's culture and its role in the accident? While hypothetical questions are hardly, if ever, answered, examining this problem from that standpoint is helpful. All too often, people are not spurred to action unless a major accident or disaster occurs; this "Pearl Harbor" effect has occurred all too often in recent history- September 11th, the federal response, or lack thereof, to natural disasters, *Challenger* and *Columbia*. In the wake of both shuttle accidents, authors have come out of the woodworks explaining how NASA has done wrong and should be abolished. Garwin writes, "The Challenger disaster has revealed in the primary NASA program bad design, bad management, and inadequate oversight."[8] Murray, again in the wake of *Challenger*, criticized the lack of debate concerning NASA's programs[9] and more

recently Klerkx contends that *Columbia*'s accident has allowed NASA to keep human spaceflight out of the private sectors' hands.[10] The point is, however, that none of these authors have noted the achievements that NASA has made, instead criticizing NASA for only one event.

I am not saying that these criticisms are unfair; indeed, serious errors and miscalculations were made not only in the shuttle disasters but also in lost science missions such as the Mars Polar Lander and the Mars Climate Orbiter. This increased criticism also leads to the second hole in the NASA literature- when concentration on NASA has increased, then more analyses on NASA's interactions with the rest of the government are also examined. Just like the authors who have funneled criticism at NASA in the wake of disaster, in order to examine the ups and downs of NASA between 1970 and 2005, we must also fill in the holes between accidents and increased attention. Government interactions do not only happen right before or immediately after a critical period of time; they occur all the time.

Disasters should not be the only impetus for increased examination of anything, be it FEMA, NASA, or homeland security. What is needed in the analysis of decline is a baseline from against which to compare NASA's successes and failures over time. Seeing the gaps in the literature between the major milestones of NASA such as the shuttle and ISS decisions and *Challenger* and *Columbia*, a major part of this study will look at completing an analysis of NASA between crises and major decisions.

Conclusion

There is much ground to be covered in this study, but I believe these are questions worth taking the time to answer. In examining what decline means to government and

the agencies that make it up, we can endeavor to understand how agencies operate and how government operates. Further insights into the nature of government operations help to shed light on what goes on behind the scenes. Further, if a more accurate description of decline as applied to government agencies can be achieved, perhaps new insights into NASA can also be found. Additionally, While Downs and Wilson focus specifically on agencies, neither incorporates larger influences into their models of agency operations. The work presented here aims to expand the work to include larger factors including power, economic conditions, and budgets.

It would be a monumental task for anyone to decide what to do once your life's dream has been achieved. NASA was born out of a Cold War desire to beat the Soviet Union in the Space Race and eventually to the moon. Its goal thus achieved, what do you do? Anything that is not the moon could certainly be seen as a letdown for NASA; continually going into low-Earth orbit is certainly not as exciting as venturing out beyond the atmosphere into deep space. Andrew Smith tells an intriguing story in his book *Moondust* of what happened to those twelve astronauts, those twelve men, who between the years of 1969 and 1972 ventured to the moon. He writes of the various twists and turns that many of these men took in their lives once they had to adjust to life after the moon. But what happened to NASA? What happened to the agency once it fulfilled its task? NASA has not gone away, yet has continued to fly despite setbacks in the form of *Challenger* and *Columbia*. My mission here is to find out what happened to NASA and hopefully to explain why.

[1] Kay, W.D. (2005). *Defining NASA: The Historical Debate Over the Agency's Mission.* Albany, NY: State University of New York Press: 87, 94.
[2] Cameron, Kim S., Whetten, David A., & Kim, Myung U. (1987). Organizational dysfunctions of decline. *Academy of Management Journal*. *30*: 126, 127.
[3] McCurdy, Howard E. (1993). Inside NASA: High Technology and Organizational Change in the US Space Program. Baltimore, MD: Johns Hopkins UP: 4.
[4] Krasner, Stephen D. (1972). Are bureaucracies important? (Or Allison Wonderland). *Foreign Policy*. 7, 159-179: 168.
[5] Krasner, Stephen D. (1972). Are bureaucracies important? (Or Allison Wonderland). *Foreign Policy*. 7, 159-179: 168.
[6] Handberg, Roger (2003). Reinventing NASA: Human Spaceflight, Bureaucracy, and Politics. Westport, CT: Praeger: 205.
[7] Wildavsky, Aaron (1984). *The Politics of the Budgetary Process*. Boston: Little, Brown and Company: 17.
[8] Garwin, Richard L. (1987).National security space policy. *International Security*. *11*: 172.
[9] Murray, Bruce (1987)."Born anew" versus "born again". *International Security*. *11*: 180.
[10] Klerkx, Greg (2005). Lost in Space: The Fall of NASA and the Dream of a New Space Age. New York, NY: Vintage Books: 113.

CHAPTER 2: BUREAUCRACY, BUDGETING AND DECLINE IN GOVERNMENT

When considering how NASA operates or has operated, the last thing we can imagine is that it operates in a vacuum. There exist a number of different and varying political pressures, organizational issues, and financial matters. For NASA, organizing and putting into motion technical missions of the highest degree of difficulty could be considered hard enough; but to put humans safely into space within specific budget and political constraints is even more difficult.

Scholars have put forth various theories and explanations of bureaucracy, budgeting, and decline within government, some of which will be explored here. In order to explore how and why NASA has operated as it has between 1970 and 2005 the analysis requires a serious look at existing theories on these subjects. In this chapter, I will explore the existing literature on bureaucracy, budgeting, and organizational decline in turn.

Bureaucracy

The first question that needs to be answered concerning this topic is what exactly bureaucracy is. At times, it seems like a buzzword to be bandied about, criticizing the government in some way, shape, or form. But in reality, the bureaucracy encompasses integral parts of the government, if not the government in its entirety. In fact, Merriam-Webster defines "bureaucracy" as all of the characteristics previously discussed; bureaucracy can be "a body of nonelective government officials," "government characterized by specialization of functions, adherence to fixed rules, and a hierarchy of authority," or "a system of administration marked by officialism, red tape, and proliferation."[1] Bureaucracy can be both beneficial and negative all at the same time

then. It provides a system of objective and reliable organization that allows the government to continue to operate but this same reliance on stable organizational patterns may not respond well and/or quickly to new issues or situations.

The explosive growth that the US government experienced during the New Deal period is reflected in the growing amount of literature throughout the 1950s and 1960s that deals exclusively with bureaucracy and organizational politics. Anthony Downs's 1967 book *Inside Bureaucracy* is perhaps one of the best examples of this new niche in scholarly studies. While Downs intends "to develop a useful theory of bureaucratic decisionmaking," he explicates a theory of life cycles of bureaus which is of interest here.[2] I will briefly outline his life cycle theory and examine its application and limits to agencies such as NASA.

Downs's Life Cycle of Bureaus

Downs begins by postulating four different types of ways that bureaus come into being: (1) coming from Max Weber, "the routinization of charisma;" (2) a bureau that is created purposefully for a specific reason out of various groups; (3) "a new bureau can split off from an existing bureau"; and (4) a bureau may come into being through what Downs calls "'entrepreneurship' if a group of men promoting a particular policy gains enough support to establish and operate a large nonmarket organization devoted to that policy."[3] In all of these cases, however, people are enthusiastic about it and its creation, people who are "zealots" and "advocates", essentially dominate the new bureaus.[4]

In turn, these zealots and advocates push for distinct functions for their bureau to carry out and the autonomy to do so as they see fit. It is like walking a tightrope, however, for these new functionaries, as they strive for independence, they also must

cultivate support for their activities in people who would continue to support their operations. In the case of government operations, new bureaus must continually struggle for the support of those in Congress who would continue to support their operations in the form of funding. It is interesting though, that this would play a part in Downs's life cycle theory. Because the creation of new government agencies can be quite contentious at times, establishing a new agency or department often requires an enormous amount of start-up funding and requirements, new organizational patterns, and exercise of political power. One would assume, then, that this new agency, simply by being established would overcome this initial struggle for external support.

A quite recent example of this phenomenon can be found in the creation of the Department of Homeland Security following the September 11th terrorist attacks. Various proponents argued for consolidating various agencies and new ones underneath a brand new Department of Homeland Security (DHS) stating that a new department would centralize homeland security operations rather than having them scattershot throughout the government. Thus, the DHS would be able to secure a greater amount of control through its creation and would have more authority to carry out operations that would attempt to safeguard the homeland. Yet, still others argued that creation of the DHS would create more bureaucratic barriers and needlessly expand government.

Downs does attempt to address this pitfall yet ultimately dismisses it saying that "initial external sources of support are usually weak, scattered, and not accustomed to relations with the bureau" so the bureau still must seek out sources of support, a constituency.[5] Once these sources of supports have been found, the bureau or agency generally undergoes a rapid growth to meet what Downs calls its "initial survival

threshold."[6] This threshold represents a point at which the bureau has become sufficiently useful and old enough to establish regular relations with its clientele.[7]

This rapid growth is certainly not the only state in which bureaus operate; Downs theorizes that both "The major causes of both growth and decline in bureaus are rooted in exogenous factors in their environment. As society develops over time, certain social functions grow in prominence and others decline."[8] These outside environmental factors are not the only determinants of how an agency behaves though, according to Downs; the make up, or type, of employees that operate within the agency also affects what the agency does and how they do it. In other words, "if most of the officials occupying key positions in a bureau are of one type (that is, conservers, climbers, and so on), then the bureau and its behavior will be *dominated* by the traits typical of that type."[9] This idea thus assumes two things: one, that agency behavior reflects the behavior of a core group of individuals, and two, that the type of people that occupy those core positions are affected by the state of the agency.

Downs continues on to describe only one of these implicit ideas, that the type of people that make up the core of an agency is affected by the state of the agency itself. Rapid organizational growth, he theorizes, leads to an increase in opportunities and promotions particularly for those "climbers" who are interested in such opportunities.[10] Climbers are more inclined to pursue innovation and thus in rapidly growing new agencies, more innovation-focused climbers occupy the higher ranks.[11] Soon though, "growth acceleration… runs into serious obstacles."[12] Downs provides some examples of what could cause the growth to slow down and eventually stop: the social function of the agency decreases in relative importance compared to the importance it engendered at

its creation, other bureaus become increasingly competitive, the agency finds difficulty in continuing to produce good results, and conflicts among the climbers who increasingly populate the agency over internal politics redirects their attention from the activities of the agency.[13] In any case, the agency begins to experience declining growth and in turn this lower growth rate influences different operations in the bureau.

As the agency begins to slow down its growth, Downs writes that the climbers who once occupied the top positions will recognize this and transfer, or jump, to other bureaus.[14] In turn, "those who have reached high positions in the bureau will lose hope of climbing much higher, and will tend to become conservers instead of climbers" and the agency will become more conservative in character.[15] But again, this assumption hinges on taking for granted that the type pf people occupying key positions depends on external factors that influence the growth rate of an agency and that the agency is truly reflective of the behavior of certain individuals, neither of which Downs fully explores.

That an agency's culture, its way of doing things, is inherently affected by a certain group of peoples is something that a wide variety of scholars rebut. Kay writes that, in reference to NASA, "the agency's long range goals, priorities, timetables, and even to some degree its method of operation (as with any major public organization) are shaped by a number of complex factors, including the bureaucratic, budgetary, legislative, electoral, and other political processes of the US federal government, as well as the demands of a wide variety of outside interest groups."[16] McCurdy, whose article relating Downs's life cycle theory and NASA we will address shortly, argues that it was experience that taught NASA to become more conservative, particularly its experience with failures.[17]

Aside from scholars who have studied NASA in particular, other authors who focus on organizational studies often advocate a varying point of view. Lorange and Nelson argue that "With economic success," rather than decreasing growth rates, "a change in emphasis from innovation to tightened administration tends to create an increasingly rigid culture."[18] Wilson has a problem with viewing an organization as having a certain culture to begin with since this presumption assumes that "an organization will have *a* culture; many, perhaps most, will have several cultures."[19] Without explaining exactly how or why a small number of individuals control how the agency operates, Downs's argument simply may not hold up.

Downs goes on to identify possible ways in which the age of a bureau may affect its performance. Bureaus may perform their tasks better with more experience, they "develop more formalized rule systems covering more and more of the possible situations they are likely to encounter," bureaus may focus more on survival rather than fulfilling their "social functions," and the number of administrators rises.[20] While the first two of these characterizations have been acknowledged and examined by scholars such as McCurdy and Wilson, the second characteristic, a focus on survival, seems counterintuitive. Once an agency has reached its survival threshold, as described by Downs, the support and base of constituents is fairly guaranteed. The question then becomes, why would the agency shift focus to survival rather than its stated goals and missions? Downs gives us a clue in drawing in the influence of the growing number of administrators in the agency- while never saying so, the assumption is that these administrators are conservers in nature which would lead the agency to act conservatively to ensure its survival.[21] But again, we are led back to the original assumption that an

agency's behavior reflects the behavior of a select group of people. One other question is pulled from this discussion, however, and that is why should an agency, who is already fairly ensured of its survival, worry about it?

Downs's argument is summed up quite easily: a new agency is created, it experiences rapid growth until it reaches a certain age, maturity, and survival threshold, growth begins to slow down and the types of people that comprise the agency changes. In actually applying this theory, however, the questions are more numerous. McCurdy attempts to test the life cycle theory against NASA and finds that "the development of the US civilian space program followed the pattern predicted by the life-cycle theory" in that it had rapidly expanded and then declined.[22] McCurdy bases this claim on employment statistics citing an aging NASA workforce and a lower turnover rate.[23] The assumption is that the make up of employees becomes more stable over time, climbers (in Downs's terminology) depart, and the workforce becomes more conservative. But again, does the make up of a core group of employees affect the overall behavior of the agency?

Another question that McCurdy seeks to answer is whether there has been an increase in bureaucracy in NASA. Using survey data from NASA employees, McCurdy finds that among those who worked for NASA during the Apollo program into the 1980s, 95% either strongly agreed or agreed with the statement "The amount of paperwork has increased substantially since I came to work for NASA."[24] But is increased paperwork and bureaucracy such a bad thing? There is wide agreement that as an agency ages, its procedures become more stable and formalized, which would perhaps increase paperwork and bureaucracy, but there is little agreement as to whether this is an all-around bad thing. Having a paper trail and predictable operations could be considered

positives in the government sphere. Knowing how a procedure goes and knowing that that procedure will be the same each and every time it is used could also be argued to be beneficial.

The third question that McCurdy looked to tackle is the question of conservatism. McCurdy writes that "In the 1988 survey, agency professionals agreed that 'at the management level, NASA is dominated by people who are cautious and inclined to avoid risks.'"[25] This gives us a hint that Downs does not provide as to the mechanism through which the personality of a small group of people affects the behavior of the agency as a whole; conservative leaders and project managers who are less inclined to take on risks, may not pursue new and engaging projects that are technically risky. Instead, they may wish to design proven systems and programs that are all but guaranteed to succeed. This may look good as an agency success, but it does not propel space exploration forward. As a result, these decisions could be termed conservative.

But what causes this conservatism? Downs proposes that it is the age of an agency and search for survival that encourages agency leaders to become more conservative. Klerkx echoes this in describing the decision to pursue the space shuttle as a decision that changed NASA from "an organization that would risk its future for an outrageous goal – bold and daring, worthy of sacrifice- to one that wanted more than anything else to simply survive."[26] But McCurdy in his later book on NASA, writes that, "Decreased tolerance for failure discouraged testing…. As political support for the space program diminished and the cost of test hardware increased, failure even on a test flight unleashed a barrage of criticism."[27] Thus the question becomes, do pressures to become more conservative come from within or without an agency? Do pressures to be

successful influence the agency and thus the core group of people? Or does the pressure to be successful and thus more conservative come from the people themselves? The data reported by McCurdy on the 1988 survey of NASA employees provides a few clues. McCurdy reports that NASA employees continued to "profess faith in the underlying norms of their original test and exploration culture" and "more agreed than did not that 'NASA employees are allowed to fail and learn from their mistakes.'"[28]

We are left with mixed conclusions, then, about this idea of a life-cycle of bureaus. The rapid expansion of bureaus is to be expected following their creation and at some point that growth has to stop. I have purposefully avoided characterizing this slower growth as decline because the questions concerning "decline" are just as many and the answers just as few. Increased bureaucracy is not necessarily a bad thing, and the mechanism through which a small number of people influence overall agency behavior is questionable. Nonetheless, Downs gives us a good starting point to continue the discussion of agency behavior.

Wilson and Bureaucracy

In a later examination of bureaucracy, James Wilson focuses on how bureaucracies operate and why they operate in the fashion that they do. Expanding on Downs's idea that agencies attempt to acquire sufficient autonomy to perform their tasks, Wilson describes what he calls the critical task. To begin with, the agency must decide upon what their critical task is, then there must be agreement within the agency as to what that task is. This sense of mission then leads the agency to acquire enough autonomy to perform the task in the way they see fit.[29] Wilson also takes the position

that people's actions and beliefs influence the overall behavior of the agency but expands it somewhat.

For Wilson, it is the whole of the lower and upper-level employees that agree upon the critical task at hand. As for the methods by which those tasks get accomplished, it is again an unspoken agreement among all involved. Wilson writes:

> When a government agency is created, it is not assembled out of people who are blanks slates on which the organization can write at will. Except for young employees getting their first jobs, the operators will have worked for other organizations, often other government agencies. Indeed, most new agencies are formed out of bits and pieces of old ones…. These people had learned certain ways of doing things. If a new agency has ambiguous goals, the employees' prior experiences will influence how its tasks get defined.[30]

In this way, a great number of employees influence how the agency operates rather than the personality of a select few. This egalitarian outlook has advantages over the Downs argument; it provides for the influence of a great many number of people, particularly at the lower level, rather than just a select few at the top, it recognizes that there are often a number of ways to go about doing things and that it is only through time and effort that an agreement results about the proper operation for that agency. Indeed, Wilson explicates this idea arguing that over time, certain definitions of the critical task grew in popularity and others waned.[31]

Wilson is very cautious concerning the topic of culture. As noted before, he chides the assumption of a single culture within an agency instead choosing to recognize that there could be a number of cultures within an agency. But, when a single culture does permeate throughout the agency, Wilson argues that the organization thus has a sense of mission.[32] Again, though, could it be possible for a number of different cultures have the same sense of missions? Taking NASA as an example, when it was created out

of the National Advisory Committee for Aeronautics (NACA), it was comprised of groups of employees from NACA and elsewhere. Each of these employees and groups of employees came with preconceived notions and a certain culture, a way of doing things.

Aside from this issue, however, Wilson goes on to discuss how this single culture and the mission get developed. With varying ideas and missions, it is often difficult to specify to the operators, the lower-level employees who actually carry out the task, what exactly they need to do and how to do it. Further, the small group of people at the top may have limited influence about how the task is accomplished as they are confined by "a variety of political and legal constraints."[33] But still, "sometimes an organization is endowed with a sense of mission despite ambiguous goals, personal predispositions, group pressures, and situational imperatives. This usually occurs during the formative experience of the organization, and experience shaped and interpreted by a founder who imposes his or her will on the first generation of operators in a way that profoundly affects succeeding generations."[34]

This sense of mission that, beyond all doubts eventually is adopted plays an important part in the shaping of an agency. If a task does not play an integral part in the mission, it may not be pursued to the same degree of voracity as other tasks and goals.[35] Further, tasks that do not approximate with the culture have less of a chance of being pursued because those tasks do not seem appropriate to the agency. For example, NASA was created primarily to win the space race against the Soviets and to eventually send humans into space. One mission that has been pushed on the agency in recent decades is the study of planet Earth; this task, however, is not something that is natural to the

majority of the agency. As such, the agency has resisted such exploration. The short-lived Mission to Planet Earth in the 1990s produced few missions.

How does one control the mission and the tasks? Is there any way that the mission and the culture can be changed? As will be examined in Chapter 3, the NASA culture has indeed changed over time, from one of a technical and engineering based culture, to one that focuses on results and success. What did this change result from? For NASA, it could be the focus on survival following Apollo. Forced to pursue a space shuttle for reasons of economy, NASA was pressured to achieve results and as such, the culture changed. In this example, then, the culture and mission changed as a result of changing pressures on the agency that could arguably have also come from within. Those within NASA perceived that their survival was at stake and thus relied on certain pronouncements of the space shuttle that they could not follow through on. This argument, though, could also be reversed. Because of the changing context outside of NASA, specifically the lessening focus on the space race and space operations, NASA had to change its method of operating. Instead of advocating large-scale, expensive human spaceflight missions, NASA adapted and pursued a program that it described as cost-effective and efficient. Most likely, the resulting space shuttle program was a combination of these two arguments, but perhaps we will never know for sure.

Similar to Downs's argument concerning increased conservatism in the agency, Wilson counters by saying that the resistance to innovation is not surprising. The creation of an agency is designed "in large part to replace the uncertain expectations and haphazard activities of voluntary endeavors with the stability and routine of organized relationships."[36] Thus, increasing conservatism and bureaucracy may not be such a bad

thing. Also, bureaucracy and conservatism could be seen as characteristic of government as a whole. Indeed, McCurdy notes that it is difficult to isolate the amount of bureaucracy as a result of aging and the amount of bureaucracy that could be attributed to the government as a whole.[37] Clearly, we cannot treat the agency as existing in a vacuum; we still must consider the rest of the government and its influence upon agencies.

Budgeting and Policy Making

Most executive agencies do not create their own policies nor do they generate and approve their own budgets; the executive and legislative branches play important roles in the life of any government agency and particularly NASA. In the previous chapter, a concerted attempt was made to examine the intergovernmental relations of NASA, specifically pertaining to the interaction between NASA, the Congress, and the president. Here, we will look at the literature concerning these interactions and the various theories concerning how and why things get done the way they are.

How Policy Gets Made

Anyone with a basic knowledge of how government works knows that generally, the president will set, or at least attempt to set, policy for the executive agencies. While what a policy may cost is kept in mind when designing and setting it, in the case of the US government, the trend has been for the policy to be set and then money budgeted by the Congress for it. Thus, we will first consider the genesis of policy and different methods for implementing it.

One of the greatest intersections between this policy-making topic and NASA is Paul Schulman's analysis of nonincremental policy making. Beginning with two different

versions of policy-making, Schulman examines incremental policy-making and the divisibility paradigm of policy-making, arguing that "these paradigms have deprived policy analysis and public administration of attention to a class of policy enterprises which fit into neither framework," nonincremental policy-making.[38] According to Schulman, there is a class of policies that cannot be made in small steps (incrementally) and must be made comprehensively (not divisibly).[39] Using, NASA, more specifically manned space exploration, as his main example, Schulman explores this class of nonincremental policies.

Throughout his study, Schulman identifies a number of characteristics that he believes are typical of nonincremental policies. The first of these is that "critical mass" points are inherent and required for the development of nonincremental policies.[40] Similar to Downs's critical survival threshold in that it requires a certain amount of support to ensure its continuance, these critical mass points represent the point at which political and resource commitments are available to support a given policy.[41] Schulman argues that the amount of public pressure that arose following the Soviet launch of Sputnik in 1957 and the political pressure to catch up to the Soviets amounted to this critical point. Indeed, as has been seen with major public policy innovations from the New Deal to the creation of the Department of Homeland Security, the creation of new agencies to affect new policy has come only after enough support has been acquired to create that agency.

Again, similar to the Downs argument, Schulman believes that once a nonincremental policy has been implemented, it expands greatly in order to overcome the "inertia, external resistance, or internal start-up problems."[42] There are two comments in

order here. From Schulman's own argument, he previously stated that it takes a great amount of public pressure and political support for a nonincremental policy to be successful; if that is the case, then the policy should not have to grow so much as to overcome initial resistance. If there was any amount of resistance, it might not have come into being in the first place. Two, this mirrors quite closely Downs's life cycle theory and its advancement of rapid growth for a young agency. Up to this point, in fact, there are very few differences between Schulman and Downs with the major one being that Schulman writes about the policy and Downs writes about the agency. Yet in the case of NASA, the agency was created to advocate the policy, which at the time was beating the Soviet Union in the space race.

Another Schulman argument that deserves to be discussed here is that of consolidation. Arguing that "The nonincremental policy requires an extensive consolidation because of the close interdependency of its component parts," Schulman posits that consolidation of various functionaries is important for the policy to be successful.[43] Schulman finds evidence of this in NASA in that the research and development projects of, for example, rocket boosters, computers, the manned vehicle, etc., all had to work together and be consolidated under one umbrella. Any organization will have subsidiaries that deal with their own details and programs, so this may not necessarily be characteristic of nonincremental policies. In addition, NASA was essentially created to take space operations away from the military and thus consolidate all operations under one civilian agency.[44]

Schulman further discusses the subject of decline in nonincremental policies, but we will save this discussion for later in this chapter. But what should be apparent from

this discussion of Schulman's argument is that the only real difference between it and earlier arguments, particularly Downs's, is that Schulman reserves his argument for policy while others focus on the agency. Yet for all the agencies and departments created, they are designed to fulfill specific policy needs, thus the question becomes, how do you separate the policy from the agency and the agency from the policy? Clearly, when Schulman talks about rapid expansion and consolidation, the policy itself does not do this, but the agency. Then these characteristics must be examples of nonincremental agency creation, which could arguably be every agency creation. Creating the Department of Homeland Security or the Tennessee Valley Authority are major actions, certainly nonincremental. If this is the case, then Schulman is simply stating the obvious.

In another interesting article published prior to the Schulman study, Krasner asks the question of whether bureaucracies are important in the foreign policy-making arena. While he focuses on the foreign policy apparatus, the conclusions he draws can still be applied here. Attempting to take the focus away from the bureaucracies and place it back in the hands of a single person who can control policy (the president), Krasner argues that:

> The President chooses most of the important players and sets the rules. He selects the men who head the large bureaucracies. These individuals must share his values…. The values which bureau chiefs assign to policy outcomes are not independent. They are related through a perspective shared with the President.[45]

Continuing along this line of reasoning, Krasner admits that the president is never confronted with all the options or all the information as a result of some bureaucratic posturing.[46] Those in the bureaucracy who are in charge of briefing the president and presenting options may choose to present the information in such a way that the president favors the bureaucratic preference. But, Krasner argues, if this is the case, then the

president is not paying very much attention to the agency and its current situation. "Presidential attention" on an agency "is a function of presidential values. The Chief Executive involved himself in those areas which he determines to be important."[47] Therefore, whether the bureaucracy is allowed to pursue policies of its own choosing or have policies enforced upon them are still a function of the values and beliefs of one person and not the many in the bureaucracy. Krasner's analysis thus makes policy-making a top-down affair; the president will either impose a policy or allow one to be imposed on him. Either way, it is a conscious decision in the executive branch of which policy is made and pursued.

There is evidence of both of these cases in the history of NASA. Beginning in the 1960s with Kennedy's moon landing goal, policy was enforced from the top-down. There have been many arguments and analyses putting forth the position that having their mission given to them from the president has set NASA up for many a failure.[48] Yet since the 1970s, NASA has made policy from the bottom-up; in pushing the bureaucratic desires, the president, the executive, has simply gone along because NASA and space exploration have simply not been one of the major priorities.

Yet, as a counterpoint to the Krasner argument, the Space Exploration Initiative (SEI) proposed by President George H.W. Bush in 1989 is an example of top-down policy-making that failed. Kay has remarked that "SEI appeared to present the agency with a larger purpose, a mission, that moved it out of the supporting roles it had been playing."[49] The initial assumption, then, is that this sort of policy would be favorable to the NASA bureaucracy. The non-existent nature of the program, however, would give us clues that favorable it was not. Following the announcement of SEI, NASA pursued a

90-day report examining the prospects and costs of SEI and eventually gave the program a price tag of billions of dollars.[50] A program with such a high price tag (given by NASA itself) was "dead on arrival" in Congress and gave some the belief that NASA intentionally killed the program to instead focus on the space shuttles and the space station.[51]

Nearly fifteen years following the announcement of SEI, President George W. Bush introduced the Vision for Space Exploration (VSE). And unlike the experience that his father had in 1989, the VSE seems to be moving along through development and into existence. After almost 35 years of either bottom-up or failed top-down policy-making, a policy that has been announced by the president for the space agency has chances of succeeding. But why now? The argument that NASA was weakened as an agency following *Columbia* may have some truth to it but in 1989, NASA was still picking up the pieces from *Challenger*. Some would argue that the spending on the war on terror during George W. Bush's tenure might have dimmed the prospects for a new space policy, yet that has not happened yet. George H.W. Bush did not have an active war that needed billions in funding and his policy was dismissed.

Perhaps the only clue that we might have to the acceptance of the VSE and not the SEI is the decade separating them. As discussed in chapter 2, the mid-1990s marked a turn around in public feeling for NASA and space exploration. With the outpouring of grief and the sad reaffirmation of the space program's existence, the timing was simply right for a new space policy.[52] Downs and/or Schulman may variously term this a critical point that would lead to a reinvigoration of the agency and a new agenda to follow.

So what conclusions can be made concerning policy-making specifically for NASA? Contrary to Schulman, nonincremental policies such as the space shuttle program or the space station are decided upon even without the appropriate amount of political and resource commitment that may be deemed necessary. And contrary to Krasner, the bureaucracy often has a say in presidential policy-making whether the president likes it or not. Perhaps the only conclusion that can be drawn is that policy-making is never absolute; it is not one thing or the other. Policy-making, again, is not done in a vacuum- a ringing theme throughout this chapter. Other factors must be considered when considering policy; presidential support will not cut it not will bureaucratic pressure. What that leads us to is the Congress and its power of the purse.

The Congress and Budgeting

For all of the pronouncements of wanting to cut spending and balance the budget, every year, the US budget seems to get larger and larger. From pork barrel spending to hurricane recovery and the war on terror, particularly now, the US budget seems to be a magnet for higher totals. Nothing can be done unless money for it is appropriated and approved of by the Congress; this makes an examination of budgeting incredibly important. When policies such as the Vision for Space Exploration or the space shuttle program is announced by the president, it must also be approved of by the Congress in the form of money and authorization. Indeed, Greenberg writes, "the politics of science is registered in money awarded or denied."[53]

In his classic study of the budgetary process, Aaron Wildavsky explores the process from both sides of the equation: those who request the money and those who authorize and appropriate it. What is of most concern here, however, is his theory of

"fair share." Fair share, according to Wildavsky, "reflects a convergence of expectations on roughly how much the agency is to receive in comparison to others."[54] This expectation, gathered from years of experience influences expectations and requests. Similarly, after a period of time, there also exists an agreement on an agency's "base," which is the expectation that the budget for the agency will continue at current levels.[55] Thus, the fair share and the base work in conjunction to provide the agency with an estimate of what it should expect in the budget for the coming year. But there can be disagreement over what each of these concepts will represent in any given year as current events may influence beliefs as to the value of the given agency and its actions.[56]

What Wildavsky explains, then, is that even though there is general agreement every year concerning what an agency will receive, a little wiggle room is left for any adjustments that might be deemed necessary. But how do you place a value on actions or policies? How does the Congress deem what is valuable and what is not? Some may argue that public opinion influences representatives and senators in the Congress and that they will perform according to public will. Gabriel Almond writes: "Popular opinion may be viewed as 'latent policy' and 'latent politics.' It not only indicates potential changes in public policy and the political elite, it is a most significant component of that public policy and must be understood and appreciated if a proper estimate of the meaning of that policy is to be made."[57] Thus, if the public feels compelled to support a particular program or policy, then it is likely that its budget may be raised in the coming year.

This concept raises two questions: one, what is the mechanism by which public opinion influences congress and two, the validity of public opinion and the measure of public opinion. In considering the first question, we must also consider whether public

opinion influences leaders at all. Jacobs cites quantitative research that finds public opinion has a significant effect on policy-making yet Jacobs with Lawrence, Shapiro, and Smith write that the public's "influence on substantive policy decisions of individual members is quite modest."[58] Using a survey of "congressional participants," Jacobs, Lawrence, Shapiro, and Smith found that though surveys were paid attention to, they did not influence congressmen and women quite as much as would be expected for two reasons: one, perceptions of unreliable surveys and two, "insistence on following their own convictions."[59]

Addressing the second question, while surveys can be great tools for scholars and leaders alike, there are many recognized limits to them. They may not be completely representative of the targeted population or the wording may influence reactions and answers. Indeed, numbers can be made to appear however one would like them to appear. Knowing these limits to survey data can certainly impede one's usage of the knowledge. If the survey is not representational of the district the congress member represents, then what is the point of using the knowledge the survey offers?

Years of slow economic growth, fewer dollars being taken in as taxes, and defense needs can put a great strain on the yearly budget. For instance, in recent years, the US Congress has had to authorize and appropriate billions of dollars for Hurricane Katrina recovery and the war on terrorism. With such pressing needs, the discretionary budget can often become strained. As a result, those funded from discretionary accounts such as NASA begin to feel the pinch. Thus, while "space exploration is supported as an ideal… when forced to choose between supporting space and some other social priority,

the public's choice is usually to support the other priority as more socially necessary."[60] It is also generally the Congress's choice as well.

Decline

Wilson and Schulman both focused on it and as previously discussed, many of the characteristics associated with it, do not fit in the government sphere. Decline and what is meant by decline is something that is often neglected throughout the literature on NASA. A throwaway term, many use it simply to describe the categorization that NASA is not the agency that it used to be. The problem lies, however, in not properly defining the term so that its meaning may be at best ambiguous and at worst ill-informed. This discussion will proceed as follows: first, a review of Downs's, McCurdy's, and Schulman's conceptualization of decline and second, an examination of the characteristics of define listed in chapter one and reprinted here.

The Theorists

Downs's examines decline from the point of view of his life-cycle theory. As the agency becomes older, it is less capable of being innovative and dynamic. As the agency ages, its standard operating procedures become hardened, its period of rapid growth is tempered, and the employee make-up changes. Bureaucracy, the endless paper and pencil pushing, increases, and changes are harder to make. Downs takes this transition to be a normal result of age that may damage the agency. Yet in government, paperwork and bureaucracy are hallmarks of the established bureaucracy. A paper trail and standard operating procedures are the norm so as to ensure fairness and prevent corruption. Agencies are created to make operations more standard and predictable so is conservative really all that bad?

To relate this to NASA, certainly, the agency has changed from its early days. Any new agency needs to rapidly expand to create offices and workspaces and employees to run the agency. At some point growth will inevitably level off and that is not necessarily bad. A smaller workforce may mean greater efficiency or be a symptom of falling budget levels for whatever reason. It seems clear from the analysis of NASA's history in chapter two that NASA did indeed become more conservative following the 1960s, but it has also attempted to be innovative in recent times, signified by its acceptance of the Vision for Space Exploration. While Downs admits that some rejuvenation may be possible for an agency if it undergoes significant periods of growth, NASA is not going through such a period yet it is taking on new activities.

Related to Downs, McCurdy takes a similar viewpoint on what decline is to mean. In answering the questions of whether NASA has experience more bureaucracy and/or conservatism, McCurdy accepts Downs definition of decline: an increasingly conservative organization characterized by more bureaucracy and conservatism. While McCurdy's analysis may have been relevant in the early 1990s when his piece was written, in light of recent events, it may not be so anymore. Increased budgetary pressure overall has not led to the Congress rejecting the VSE and conservatism has not led to NASA rejecting it either. Without an influx of growth, NASA seems to be pursuing a radical new program under tough budget conditions. None of this situation seems to mesh well with either Downs or McCurdy.

When Schulman discusses decline, he discusses it in the performance sense or in other words, that their *performance* has declined. This varies from the previous definition of decline in that for Downs and McCurdy the *agency* declined. Thus, does

declining performance equal a declining agency? Clearly, what the agency does, how it performs, is essential to an overall evaluation of agency itself, therefore it must be considered in conjunction with other factors. Schulman makes a point to note the "exodus" of personnel from the space program from the 1960s, which left the agency with a deficit of "imaginative and capable personnel."[61] As discussed above, this draws parallels to Downs's life-cycle theory and makes it all the more evident that Schulman is analyzing relatively the same thing as Downs.

The point that Schulman attempts to make in this discussion of decline, however, is that "These space exploration declines- in public support, appropriations, personnel, morale, organizational structure and performance- all illustrate the fundamental instability inherent all the nonincremental policy enterprise."[62] Schulman tries to make the argument that the support surrounding nonincremental policies fluctuates. If the support fell so dramatically, though, then why was the space shuttle approved of as a follow-on program? Indeed, public support for the space agency has been remarkably consistent over time (though certainly not deep and only as a second tier concern) and NASA has continued to have money authorized and appropriated for its use.[63] While already concluding that Downs and Schulman are discussing essentially the same thing, it should also be clear by this point that Schulman is not describing nonincremental policies as a whole, but simply the decision to go to the moon. The incredible circumstances surrounding the moon landing decision including Cold War politics, the launch of Sputnik, and domestic political concerns are unique characteristics perhaps endemic to that one period in history. Thus, for Schulman's argument to be more persuasive, we

would need to be provided with a greater range and variety of examples of nonincremental policies.

One other author that has focused on decline specifically in government agencies is Charles H. Levine. Levine theorizes four causes of what he calls "public organization decline:" political vulnerability, problem depletion, organizational atrophy, and environmental atrophy.[64] Levine writes "No organization is immune from these problems and no organization is likely to be afflicted by them all at once, but a heavy dose of some of these breakdowns in combination can contribute to an organization's decline and even death."[65] Levine identifies these causes in order to explicate management schemes that can attempt to reduce or smooth the supposed decline; Levine's focus is on managing the organizational change but his four identified causes can be examined for insights applicable here.

Interestingly enough, when examining political vulnerability, Levine believes that age is the best predictor of this characteristic. He writes that "Contrary to biological reasoning, aged organizations are more flexible than young organizations and therefore rarely die or even shrink much."[66] This argument is quite different from the ones that we have examined previously and the only argument he uses to back up this proposition is that over time, organizations have learned different adaptive abilities. From the evidence examined previously, I must disagree with Levine. As the organization gets older, it becomes more established, more situated, firming up its constituency and engraining its procedures into institutional memory. Therefore, one would think that as the organization ages, its political vulnerability would decrease. While NASA's ability to survive catastrophes and falling budgets may provide evidence for Levine's argument,

NASA's flexibility has been in the details and not the major objective. The main goal has always been human spaceflight with merely the means being flexible over time.

Moving on to Levine's second characteristic, problem depletion, this one seems a bit more plausible. Levine posits that this is the "most familiar" problem for government organizations; once the political definition of an agency's mission has run its course or through a cycle (such as natural disasters or defense), the organization has no more problems to deal with in the interim.[67] What reason do the organizations that deal with cyclical problems have to exist in the meantime? Common sense would tell us that they must prepare and re-supply themselves in between missions or federal disasters. For example, FEMA in between major disaster declarations in which their help is requested and/or required must restock, plan, and reexamine what happened in the last event. In this way, they continue to be prepared for any possible contingency. Since no one knows when or where FEMA or the military may be needed, they do not cease to exist in the meantime. Problem depletion therefore does not necessarily equal a decline or organizational change as Levine argues.

Organizational atrophy most closely resembles the characteristics we will examine next. Among the list of "management failures" that Levine uses are: weak oversight, internal atrophy, stifled dissent and upward communication, continuous reorganization, lack of self-evaluating, and authority with vague responsibility.[68] Any one of these could be argued to be characteristics influenced by the government as a whole and inapplicable to any individual agency. For example, weak oversight would be the fault of the Congress, not of the agency itself. Continuous reorganization will usually

only happen at the behest of those who oversee agencies after they have identified problems with the agency.

The final cause of government decline that Levine identifies is environmental atrophy. Levine says that this occurs "when the capacity of the environment to support the public organization at prevailing levels of activity erodes."[69] While not examining this idea much further than giving some examples, Levine argues that this lack of resources can significantly reduce what the organization can do, which is only logical. And as will be explained in the next chapter, is the change in resources that I argue is the main cause of organizational change.

Levine's main focus is not on the causes of decline however, but how to manage for those periods. What Levine neglects, though, is the influence of the rest of the government on how the agency manages. If an agency can foresee a period of cutbacks, then without the requisite funds, they may have problems in performing their duties. With political pressure coming from both executive and legislative branches, the agency may be forced to do more with less, which causes problems of its own. The agency only has so much leeway to do as they please, a constraint that plays as much into how the agency is run as what caused it in the first place.

The Characteristics

In chapter one, the characteristics presented in the following table were briefly discussed as not being applicable to government agencies. Here, I will go further in depth about each of these characteristics, which could be described as characteristic of the decline literature as a whole.

Table 0-1: Characteristics of Organizational Decline

Characteristics	Sources
Increasing conflict	Cameron, Whetten, and Kim 1987
Increasing rigidity	Cameron, Whetten, and Kim 1987
Decreasing morale	Cameron, Whetten, and Kim 1987
Lack of innovation	Cameron, Whetten, and Kim 1987
Elimination of slack resources	Cameron, Whetten, and Kim 1987
Concern with survival	Weitzel and Jonsson 1989
Inability to adapt	Weitzel and Jonsson 1989
Decreasing sales	Weitzel and Jonsson 1989
Decreasing profits	Weitzel and Jonsson 1989
Increasing competition	Weitzel and Jonsson 1989
Decreasing capacity for innovation	McCurdy 1991
Decreasing flexibility	McCurdy 1991
Decreasing number or excess of personnel	Whetten 1980; Lorange and Nelson 1987
Decreasing demand for services	Whetten 1980
Lack of clear goals	Lorange and Nelson 1987
Loss of effective communication	Lorange and Nelson 1987
Outdated structure	Lorange and Nelson 1987

These characteristics can ideally be divided into two different categories, ones that NASA or the individual agency may or may not have control over directly, and ones that have to do with the rest of the government. To aid in this analysis, I will employ this designation.

Government Responsibility

Cameron, Whetten, and Kim succinctly summarize the characteristics of decline as presented in the literature as such: "Increases in conflict, secrecy, scapegoating, self-protective behaviors, rigidity, and turnover and decreases in morale, innovativeness, participation, and long-term planning are among the common problems associated with decline."[70] As suitable a place to begin with as any, many of these characteristics are simply not applicable to government operations. Conflict, when it occurs over policy, often happens at the top (in the executive branch) and only over the most controversial

policies. Conflict within an agency, though, may be little to none once the agency has established itself. From what we have seen previously, government agencies settle into this repetitive functioning replete with standard operating procedures that are designed to reduce conflict.

Secrecy and scapegoating may be considered by some to be an epidemic among the government as a whole. Does the entire government decline then? Secrecy in the foreign policy or domestic security apparatus may be absolutely essential. Laws such as the Freedom of Information Act ensure that public records are available. When talking about people in particular, if something wrong has been done, there is generally a "fall guy" identified that takes the blame for failed policies. This occurs within government at a startling pace. But again, does this mean that government as a whole declines? Most likely, the answer to that question is a no.

NASA certainly cannot be blamed for a lack of innovation. While they are utilizing thirty plus year old technology now on the space shuttle, NASA has upgraded to use newer technology on the shuttle and develop new space technologies depending on its budget. One of the problems that one runs into though, is whether the technology keeps a pace with the times. If NASA is not innovative enough it could be that the technology has not changed rapidly enough to allow for it. If technology development is slow, then it is certainly not NASA's fault and thus not significant of a decline. The same could be said to be true for any government research and development agency such as the National Institutes of Health. Technological change needs to be considered and lack of not blamed on respective agencies.

Cameron, Whetten, and Kim also identify an "elimination of slack resources like contingency accounts, reserves, or new projects" as symptomatic of decline.[71] This at times may not be at the agency's choosing; the Congress may well dictate what accounts get cut, changed, or rolled back. When talking about a government agency, the context in which it operates must be taken into account and this is one of those times. Criticisms of the number of field centers that NASA possesses are abundant at times with repeated cries of redundant operations. Yet these field centers are in no danger of being cut. Once established, the chances of an agency being dismantled or a field center dissolved are incredibly slim. Simply by being a government agency, survival is all but guaranteed.

Finally, lack of long-term planning and flexibility is identified as a part of decline. The essence of NASA's operations requires long-term planning and in any case, that long-term planning, the policy-making, is contingent on the executive and the legislative branches. In many cases it is difficult for either branch to pursue long-term planning, even in the case of NASA. The budget is never guaranteed every year and circumstances may develop that prohibit funding agencies at the level that would be required. While having a long-term budget guaranteed would be nice and beneficial, but as discussed in chapter two and here in chapter three, it is often difficult to do such.

Agency Responsibility

While they are fewer in number than the characteristics that are affected by the government as a whole, the following characteristics can often be controlled by the agency at hand. It should be kept in mind, however, that the government as a whole may still affect an agency in these matters.

Higher personnel turnover is an interesting case. In the 1960s, when NASA was, by most standards, considered to be at the height of its performance, turnover was quite high. If we go by this characteristic then, NASA in the 1960s would be undergoing a decline. In actuality, turnover has decreased throughout the decades in NASA at the same time pronouncements of decline have risen.

Decreasing morale is another characteristic Cameron, Whetten, and Kim identify. While I know of no comprehensive, government wide survey of satisfaction with employment, the data provided by McCurdy's study of NASA employees in the early 1990s provide us with some evidence. But again, enthusiasm for the job may not necessarily be requisite for a successful agency.

Decreasing sales, profits, and demand for services, and increasing competition, have little to no applicability for government agencies at all. The bulk, if not all, of them are run to provide public services, which do not incur costs. As such, no profits and/or sales are unable to be tracked. Often times, these agencies are the only agencies that provide a public good or service and experience no competition for them. In particular relation to NASA, other space agencies both public and private can provide some sort of competition for launch services but generally, government agencies do not experience competition for services.

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CHAPTER 3: A BRIEF HISTORY OF NASA, 1970-2005

As noted previously, this brief review of NASA history is designed to fill two holes in the literature: NASA's performance and intergovernmental relations beyond the big decisions and disasters. As such, I will play special attention to these topics in each of the following sections. I have divided, for ease of discussion, this 35-year period into seven distinct time periods: (1) post-Apollo and the Shuttle decision, (2) Shuttle development and early operations, (3) post-*Challenger*, (4) planning for and implementing the International Space Station, (5) the 1990s, (6) post-*Columbia*, and (7) Constellation.

Post-Apollo and the Shuttle Decision

In order to put the shuttle decision in its proper context, we must go back to the mid-1960s, before the Apollo program had even gotten off the ground and before the moon was even within reach. In 1964, President Lyndon Johnson asked NASA for recommendations as to what the future of America in space should be once the Apollo program was over.[1] Unfortunately for NASA, in the race to the moon, it had yet to concern themselves with any sort of follow-on program or mechanism for planning one- a criticism that might be seen to haunt the agency to this day.[2] The irony is that at that time, in 1964, NASA was seen as one of the most progressive, future-forward agencies involved in the government; yet this same organization neglected to address its future beyond the current program. With all resources focused squarely on the task at hand, it appeared difficult for the agency to see anything beyond it.

While the lack of planning for the future continued, the planning for Apollo continued on. When *Apollo 11* reached the moon in July 1969, public enthusiasm for the

program was already falling; the percent of people who believed that space funding should be decreased increased dramatically from 5% of the public in 1968 to 56% of the public in 1975.[3] This created a problem for NASA which, without any sort of follow on program, would lose all reason for existence. A cascade of other problems evolved from this very question of survival: thousands of civil servants employed by NASA depended on it, an industry full of aerospace companies that had been mobilized to support Apollo were now left without any contracts, and NASA, above all, wanted to "maintain its bureaucracy and its primacy as a technological organization."[4] The problem that was foreseen by one of the earliest supporters of spaceflight, Lyndon Johnson, had come home to roost before the echoes of the cheers for *Apollo 11* had even ended.

In response to this looming crisis, Vice President Spiro Agnew and his Space Task Group released a report in the summer of 1969 concerning future NASA programs. While this report put forward numerous proposals for the future, the group could not agree on a single approach that would recommend itself on its merits.[5] This inconclusive report was actually a sign of what really was occurring: no one knew what the space program should do now that it had beaten the Soviets to the moon and won the so-called Space Race.

NASA's bureaucratic drive pushed for survival; survival in turn meant that it would continue to receive the type and amount of funding that it had received for the previous decade. For NASA, this meant coming up with some type of program involving human spaceflight, which would require a large amount of funds. But NASA's drive for survival did not mesh well with the outside political environment. Public support for the program dwindled following the moon landings and the Vietnam War was eating up

more and more of the national budget. Without the willingness of the Congress to fund and without the money to fund as noted above, NASA would not be able to get what they absolutely wanted- a brand new program that would provide the funding it was accustomed to. To counter this, NASA attempted to "rekindle public support" for an "expansive and expensive" human spaceflight program.[6]

Aside from questions concerning funding and public support, there existed very real questions concerning the need for the US to remain in space. Logsdon writes that "In 1971, as the debate over whether to approve the space shuttle reached its climax, NASA Administrator James Fletcher argued to the White House that 'for the US not be in space, while others do have men in space, is unthinkable, and it is a position which America cannot accept.'"[7] But some questioned the very need to have humans in space at all, something that continues to be relevant today.[8] James Van Allen, the very Van Allen who discovered radiation belts surrounding the Earth wrote that "Almost all of the space program's important advances in scientific knowledge have been accomplished by hundreds of robotic spacecraft" without the presence of humans.[9]

NASA certainly has pursued a number of scientific missions, but at its core, the pursuit of human spaceflight has colored NASA's ambitions for its future.[10] As such, NASA, sensing the political situation, pushed the space shuttle as a suitable follow-on program that would cost approximately $5.2 billon "less than an expendable alternative for performing the same mission."[11] NASA claimed that the shuttle would accomplish two main objectives: reduce the cost of spaceflight and "provide a future capability designed to support a wide range of scientific, defense, and commercial use."[12] Extolling

its virtues of cost-effectiveness and reusability, NASA claimed that the shuttle would be a workhorse that would eventually pay for itself.[13]

The biggest justification that NASA used for a new program, and in particular the space shuttle, was that it would be very economical.[14] This judgment would in turn be supported by a number of factors including a high number of flights by the shuttle and cost-savings that a reusable system would garner over an expendable launch system.[15] The shuttle would be able to perform a variety of functions in low-Earth orbit including retrieving and repairing satellites and scientific experiments and launching defense and commercial payloads. This increased focus on the economic advantages and a wide variety of uses highlights the changing times. While Apollo did not have to be seen as an economic or technological benefit, a new program would; a variety of activities for the shuttle to perform would also give the program a wider base of constituencies and thus a wider base of support. No longer could NASA rely on public opinion to spur it on or the space race to give it an edge in the budgetary process.

From all of these constraints, emerged the space shuttle option- a reusable fleet of space vehicles that would provide cheap and reliable access to space for commercial and scientific programs. Emerging from Agnew's Space Task Group and NASA leadership, the space shuttle seemed to be the only feasible option for NASA. The space shuttle would attempt to satisfy the requirements of a number of constituencies that would fill the void of support left by falling public opinion. It could perform commercial operations such as retrieving, repairing, and releasing satellites and performing valuable commercial zero-g manufacturing experiments. The DOD would also be able to use the

shuttles to perform military operations. And science would be aided in the capabilities of the shuttle to perform and release long-term experiments in space.

Of course, the decision to support the shuttle was a very political decision- Nixon "did not wish to go down in history as the president who ended the era of man in space" but this political decision had very real political consequences.[16] Yet, the Vietnam War was consuming more and more of the national budget and attention with the space program falling from public favor at the same time. Without due consideration of the ultimate goals that the country wished to use NASA to achieve, the space shuttle decision would set the stage for the next thirty-five years. Logsdon traces the basic failure of national space policy to this shuttle decision: "The reality that national space policy did not bring ambitions and resources into balance in the 1970s, nor in the subsequent two decades, is the basic policy failure."[17]

This decision has also led NASA to unduly place all its efforts on the space shuttle, pushing it to operational status in the 1980s and pushing to keep the program going in the 1990s.[18] Logsdon is not the only one to fault this decision for many of the events that would happen years later. The Columbia Accident Investigation Board also blamed the "compromises hammered out by the White House and NASA headquarters" for turning NASA into "more of a business, with schedules, production pressures, deadlines, and cost efficiency goals elevated to the level of technical innovation and safety goals."[19]

Performance

There is no doubt that NASA lived up to expectations in landing twelve men on the moon and returning them home safely. Indeed, up until the *Apollo 1* fire, there were

no questions concerning NASA's performance. Even in the beginning of the 1970s, these questions had yet to be raised. Yet there are serious questions as to why NASA pushed the shuttle as hard as it did. Greenberg, in his study of science and politics, offers one explanation.

> In a profession built on numeracy and dedicated to accuracy, what accounts for these topsy-turvy misstatements of fact? The complaints and the mangling of financial data without doubt reflected actual distress, principally of a localized nature: the number of money-seeking scientists was growing faster than the money. Lacking any real political power… science employed desperate appeals, in which precision took second place to propaganda.[20]

NASA wanted its future, it wanted to survive, and thus it needed guaranteed funding, which would come in the form of a human spaceflight program. While this might not be so much a question of performance of an individual program, NASA's pushing of the shuttle using reasons that would turn out to be untrue is indicative of the organization's performance. It should be noted, though, that the technology involved in constructing and designing the shuttle was entirely new; predictions of cost effectiveness and reusability may have been believed within NASA. Actions to cut cost through the early phases of construction may have been believed to have no effect on the eventual capabilities of the shuttle. But the overall effect of new technology and budget constructions led to a program that did not live up to its promises.

NASA should certainly not be singled out for pushing a program that it believed in; many other agencies and organizations are cheerleaders of plans that they believe are good or could be successful. But rather than engage in a debate concerning space's proper place in US politics and policy, NASA took the easy way out. Knowing the political environment in which it operated, NASA compromised; rather than recommend a program that would truly lead to innovation and success such as continuation of the X

program that led to the development of the X-15, NASA pushed a program that would get it money and contracts in the short term.

Immediately following the decision to proceed with the space shuttle program, criticisms of the cost analysis that NASA used to support it began to appear. The General Accounting Office (GAO, now known as the Government Accountability Office) produced two reports at the request of Senator Walter Mondale analyzing the cost-benefit analysis that NASA had produced. In both of these reports, the GAO was highly critical of the pronouncements of economic viability and the shuttle's advantages over other programs.[21] This criticism and suspicion of NASA's own reports highlights the changing times that the agency was going through with respect to relations with the legislative and executive branches. In the 1960s, all it took was presidential support and congressional appropriations without any good justifications for what NASA would undertake. Now, Congress did not even trust NASA's own word for the shuttle's advantages and were openly showing suspicion.

Though it was certainly worried, was NASA's concern for its survival actually irrational? As has been demonstrated by so many government agencies, once they have been brought into existence, they very rarely ever get shut down. This would mean that NASA's concern for survival existed either because it wrongly perceived that the agency was on the chopping block or it simply wanted to maintain the current budget. As we have seen, Nixon would not have ended human spaceflight for a variety of political reasons including his own legacy and the America's standing in the world at large. Even though the Space Race had been won, the standing still had to be maintained. One could then conclude that NASA was not so much concerned with its survival, as survival was

all but guaranteed, but maintaining the funding levels that they had become accustomed to as human spaceflight was not necessarily guaranteed.

Intragovernmental Relations

NASA's compromises are clear examples of how NASA negotiated its political environment. Recognizing the increased funding that the Vietnam War was drawing and the fall in public opinion, NASA decided to recommend the shuttle, which it believed would be cost-effective and the minimum that would be required to keep the US in space. With the fall in public support for the program and the success of the US in the space race, those in Congress did not feel the same amount of pressure from constituents at home in the early 1970s for continued US involvement in space as they did in the late 1950s after the launch of Sputnik by the Soviet Union.

In negotiating the pitfalls of legislative and executive relations, NASA decided to take the road that would get the most support, regardless of whether it was the right road or not. With supporters in the aerospace, defense, and commercial industries, NASA did not have to rely on public opinion and in turn their representatives' support in the Congress. While it would ultimately have to be Congress that would appropriate the money for the program, the pressure from industry would replace the pressure from the folks at home. Recognizing this political shift, NASA exploited the supposed wide variety of tasks that the shuttle would be able to perform and its economy.

The Lost Promises of the STS: Shuttle Development and Early Operations

Once the decision to proceed with the space shuttle program had been made, progress continued into the developmental phases. The program was not even three years old when problems began to creep up. In a report from the GAO in 1975, NASA was

already experiencing delays of up to a year, rising costs, and falling budgets.[22] Just a year later, in 1976, another GAO report identified continuing issues with the program including increased development time, less testing, and falling contingency reserves for the agency.[23]

As the development problems increased, the economic justifications for the program became increasingly uncertain. The same 1976 GAO report indicated that for the economic justifications to be valid, NASA would require a stable budget of $3.3 billion in 1972 dollars.[24] A relatively stable and predictable budget level is never a guarantee for any government agency and this unpredictability coupled with higher development costs and lower expectations for the shuttle combined together to put in doubt the original economic justification for the shuttle and put the program at higher risk.[25]

What is also interesting about the shuttle justification and developmental phase is the participation of the Department of Defense (DOD). The DOD had committed (over the objections of the Air Force) to using the shuttle for all of its military payloads once the shuttle had reached operational status and proven all of its capabilities.[26] Among the reasons stated for this reliance include: reduced launch costs, improved payload reliability, and phase-out of expendable launch vehicles and their various launch complexes.[27] While dependence on the shuttle would no doubt be cost-effective for the military, it is only cost-effective if and when the shuttle reaches its performance and operational goals. Further, there was no guarantee of a specific number of payloads from the DOD and those that would be required would need to get into geosynchronous orbit from the low-Earth orbit achieved by the shuttle.

The requirement of geosynchronous orbit would either require an additional booster on shuttle that would allow it to reach the higher orbit or what would be termed a "space tug." This space tug would provide an additional reusable propulsion system that could place payloads in the higher orbit. By 1976, the space tug had been delayed until late 1985, which would leave the military with a gap of approximately 4-5 years until which payloads could be placed in a higher orbit.[28]

Additionally, DOD's reliance on the space shuttle would lead to a major consequence that would be unseen until *Challenger* in 1986. With the shuttle reaching operational status, the military's stock of expendable launch vehicles was being phased out. When the shuttle *Challenger* exploded 51 seconds into its mission, it meant a temporary stop in all shuttle launches until the cause of failure could be determined and changes made to the program. This effectively left the DOD with no launch options of its payloads for some time. As we will see further down, the DOD would abandon its commitment to the shuttle program following *Challenger* highly damaging the already fragile program.

Another aspect of DOD participation was the possibility of the military buying two orbiters that would be refurbished from testing status. The purchase would ensure the military a platform from which to launch its payloads but it also brings to light many questions concerning military involvement in a civilian agency. Indeed, these questions have haunted NASA before there even was a NASA. Dwight Eisenhower's concerns about military control of a space program eventually led him to conclude that a civilian agency would be the most appropriate venue to pursue space exploration. But as we have seen, with NASA's needs of a wide constituency base, it was almost forced to view the

DOD as a partner in human spaceflight from the beginning. With the defense industry and the DOD behind it, NASA hoped to make up for lost popular support in the Congress.

Table 0-1: Space Shuttle Projected versus Actual

Space Shuttle Features	Projected	Actual
Shuttle Design, Development, Test, and Evaluation	$5.15 billion	$5.67 billion
Number of Orbiters	5	4
Production Cost of Orbiters	$1 billion	$2.64 billion
Number of Flights, through 1990	581	38 plus 5 test flights
Cost per Flight	$10.45 million	$750 million

All budget figures in 1971 dollars
Sources: GAO: Space Transportation System, February 1975, pg. 2
NASA Historical Data Book Vol. 5, pg. 260
NASA Historical Data Book Vol. 3, tables 2-24, 2-29
Space.com. <http://www.space.com/news/shuttle_cost_050211.html>.

In 1982, the space shuttle officially became operational. It was not without its problems, however. Only two orbiters were in use, per flight costs were still highly over budget, and turn-around times for orbiters between flights were astronomical compared to the original planned estimate. For example, in 1983, five fully operational flights were planned at a cost of $266 million each and projected turn-around times by the 26th flight was expected to be 888 man-hours as compared to NASA's goal of 160 hours.[29] This combination of higher cost per flight and fewer flights would put into doubt the original projections of the project just as it had become operational.

With the shuttle pushed to operational status, the question also arose of who would operate the space shuttle program. Since Project Mercury, the original human spaceflight program, NASA had always had the responsibility to develop and operate

manned spaceflight missions. Yet the human spaceflight programs of the 1960s never had as their stated goals, low-cost and reliable human spaceflight. If sending humans into space was to be made reliable and operational, the question arose as to whether NASA, an agency focused primarily on research and development, should operate it.[30]

As demonstrated by *Challenger* and *Columbia*, the job of putting humans into space using the shuttle will never be made into the reliable system that many had hoped for. Placing responsibility for systems like weather satellites, COMSAT (a communications satellite system) and LANDSAT does make operational sense but these systems do not involve placing human lives at risk. Even though a system is operational does not mean that the risk is 100% gone.

Performance

Again, NASA experienced a number of performance issues in the late 1970s and early 1980s. These issues were not so much evident in specific programs living or not living up to their goals, but overall agency operations. Two major problems will be addressed here: NASA cost-estimates and early shuttle capabilities. These two issues are intertwined, but will be examined in turn.

NASA's cost-estimates for the shuttle program beginning with their initial estimates in 1971 were shown to be grossly off track. In each of the GAO reports on the shuttle that I have examined, the GAO consistently criticizes NASA's cost-estimating and budgeting processes. In its 1976 report on the shuttle program's progress, the GAO reported that NASA had failed to include in-house development costs for the shuttle and its components, "changes in the shuttle's development plan have reduced the probability of meeting cost and performance goals," and "the innovative design and refurbishment

techniques which account for much of the projected payload savings are controversial issues."[31] It appears from the report's findings that NASA left some costs of development out so as to make the projected cost of the program appear lower. Again, we face the question of whether NASA did this simply to survive or to increase its yearly budget intake. Clearly, not including all applicable costs in the program's cost, can work both ways for NASA. By making the total cost appear lower, the program looks more attractive and more economical. But, as actual costs have shown, by intentionally keeping the projected budget lower, NASA left less room for error in the development phase.

This intentional lowering of projected costs not only left NASA little room for technical problems but also led to cutting the shuttle's capabilities. The GAO noted that this led to two questions: one, will the goals initially set for the shuttle be met and two, "how much development can be eliminated and still keep a viable program."[32] The same report went on to criticize this approach of deletion of program elements by stating: "In addition, past experience with major civil and defense acquisitions has shown that NASA's development approach can lead to costly retrofit or redesign at a later date or to deploying systems that cannot adequately fulfill their intended role."[33]

The situation foreseen by the GAO in 1976 eventually came to pass once the shuttle became operational in 1982. The true cost of the design deletions would be seen in the increased costs per launch and fewer launches. It is interesting to contemplate what might have happened had NASA included all possible costs in its original estimates and included all planned elements of the system. Perhaps the shuttle might have met its original stated goals after all or been cancelled because of the huge costs.

Intragovernmental Relations

In the years comprising the development, testing, and operations of the space shuttle, the number of GAO reports concerning the agency increased to a high of ten in 1977 (for a complete content analysis of GAO reports concerning NASA between 1970 and 2005, see Appendix I). This increased interest on the part of the Congress, whose members routinely request these reports, demonstrates the increased oversight that NASA was experiencing. Unlike the 1960s when NASA had a fairly wide range of freedom to conduct its operations without much oversight and with a blank check signed by Congress, the newest generation of human spaceflight experienced much more congressional oversight.

With less pressure from constituents at home, the Congress did not have as much pressure to completely fund a space program. Between 1972 and 1982, the General Social Survey found that 74% of people asked about the amount of money being spent on the space program responded that it was "about right" or "too much."[34] The 1970s actually saw the cooperation of the US and the Soviet Union in space in the form of the Apollo-Soyuz test program. The space race and its money was over and NASA was now experiencing what most government agencies experience- the normal budgetary process. What is interesting about the 1970s, however, is the lack of involvement in the space program by the executive branch, namely the president. Once Nixon had made the decision to go with the space shuttle, the presidents of that decade had very little to do with the program. While NASA worked with the Office of Management and Budget (an executive agency) on various budgets, direct involvement with the Oval Office was very little.

Challenger

The long simmering doubts about the abilities of the space shuttle would come to a sudden head on January 28, 1986. Just moments into its flight, the shuttle *Challenger* disintegrated when an o-ring in one of its boosters failed bringing the shuttle program to a halt. While the faulty o-ring would eventually be deemed the cause of the disaster, the accident review board examining *Challenger* and other analysts would find many more systemic problems that had led up to it.

Once declared fully operational, the space shuttle program was still not meeting the benchmarks that had been set out for it. As discussed above, the low-cost estimates and even lower budgets had led to disastrous cuts from the program and an orbiter that did not have all the features promised. Because of this, turn-around time for the orbiters in between missions did not get anywhere near the target of 160-hours that would have made possible the 25+ plus flights a year that would in turn have made the program economical. This combination of problems would place much pressure on NASA to push the shuttles more to meet their performance targets.

Among the pressures felt by NASA was a push to get more shuttle flights in with less money, with better results; quicker, better, cheaper. In this sense, NASA was forced to operate more like a business with deadlines and budgets rather than the research and development agency it was designed to be. Once again, the consequences of NASA's actions in the 1970s caught up with them. The Rogers Commission, the board that investigated the *Challenger* accident, stated that costs of individual shuttle components were the primary consideration used by NASA to select contractors for the program.[35] The implicit suggestion made by the commission, then, is that NASA sacrificed safety for

cost in the early stages of the program, which is consistent with what has already been described.

In short, NASA's own actions, or lack thereof, in support of the belief that the shuttle would make human spaceflight more reliable and cost-effective were a major cause of *Challenger*. The Rogers Commission noted the increased acceleration of shuttle flights with less resources available to crew and support staff as a critical cause of the accident.[36] NASA had set the standards for the shuttle program so high that in the end, it did not have the requisite resources to achieve those standards. Why were these standards set so unrealistically high? Clearly, part of the explanation is that the shuttle represented new and untested technology and without knowledge of what exactly it could do, the shuttle flight estimates were optimistic. But perhaps there is a more political aspect to this explanation; NASA needed to show the Congress a program that would make economical sense and the only way to do that was to set the flight standard incredibly high. Of course, the individual blame for *Challenger* is not relegated solely to this decision, but as the Rogers Commission explained, it was an accident with a history.

A major criticism that was made in the wake of *Challenger*, and also after *Columbia*, was that NASA's own culture played a role in the incident. When speaking of culture, it is considered the way that the agency does things.[37] In McCurdy's history of NASA culture *Inside NASA*, this change in the way that NASA operates is detailed from the 1960s through the 1990s. In short, what has been shown is that NASA's technical culture with its deference to engineers and the engineering culture had been greatly worn away with age. In the early NASA, "the normalization of risk, the acceptance of failure and the anticipation of trouble led to an atmosphere in which these things could be

discussed openly. NASA's ability to handle risk required open discussions in which mid-level managers and engineers felt unrestrained in voicing warnings and dissent."[38] With age, NASA began to formalize its operations and increase the level of bureaucratization, institutionalizing methods and procedures for various occurrences thus stifling this early atmosphere of cooperation and acceptance of all the aspects of the challenge of sending humans into space. The Columbia Accident Investigation Board sums this problem up nicely showing that the lesson was not fully learned: "NASA's Apollo-era research and development culture and its prized deference to the technical expertise of its working engineers was overridden in the space shuttle era by 'bureaucratic accountability'- an allegiance to hierarchy, procedure, and following the chain of command. Prior to *Challenger*, the can-do culture was a result not just of years of apparently successful launches, but of the cultural belief that the shuttle program's many structures, rigorous procedures, and detailed system of rules were responsible for those successes" and failures. [39]

It was not only this formal bureaucracy that contributed to change in NASA culture but also the failures it had experienced including the Apollo 1 fire. In response to various failures, NASA became more conservative, "more concerned with not making mistakes, and less tolerant of intuitive decisions."[40] Agencies such as NASA that are funded with discretionary money by the US Congress cannot afford to be seen as a failing agency either; in that case, they risk losing the very funding that could make them successful.[41] With NASA already taking on the criticism that the shuttle had failed to live up to expectations, the pressure was on to get the shuttle operating more effectively

and more efficiently. As a result, concerns about the o-ring that caused the death of the seven crewmembers were stifled.

Challenger also led to some very practical effects for NASA and the space community as a whole. Because the Department of Defense was to have relied upon the shuttle for all of its launching needs, plans had been drawn up by NASA and the DOD to effectively shut down the production of expendable launch vehicles (ELVs) which could have, posed a threat as a cheaper launch alternative to the shuttle. With the temporary grounding of the orbiter fleet until *Challenger* was fully investigated, the DOD was left with no launch options for its payloads. Thus, the decision was made to keep ELVs in service as a launch option for the military and private companies. This effectively meant the end of DOD participation in the shuttle program as it never purchased the two orbiters that it had all but committed to.

So it was that *Challenger* confirmed the growing suspicions that the shuttle would not and could not live up to its promises. Why stick with the program then? At the time, there were calls for the program to be ended but the big aerospace companies with their lobbying power, actually pushed the Congress to give NASA more funds with which to build another orbiter to replace *Challenger*. It was also at this time that the International Space Station (called Space Station Freedom then) was in early development. The space station would eventually need to be hauled into space piece by piece by the space shuttle, which would not only give the shuttle a purpose but also enable Americans to have a space station comparable to the Soviet Union's Mir.

More abstractly, however, the US has established a tradition of surviving disaster and coming back from it. Following the Apollo 1 fire, the race to the moon did not stop,

but continued on. The same thing has happened following *Challenger* and *Columbia*. In the wake of disasters, Americans exhibit this determination to continue no matter the costs and do it better than the last time. President Ronald Reagan, who was to have given his State of the Union address the night of the *Challenger* accident, addressed the nation instead that night. His words are instructive:

> The future doesn't belong to the fainthearted; it belongs to the brave. The Challenger crew was pulling us into the future, and we'll continue to follow them…. We'll continue our quest in space. There will be more shuttle flights and more shuttle crews and, yes, more volunteers, more civilians, and more teachers in space. Nothing ends here; our hopes and our journeys continue.[42]

President George W. Bush echoed these same sentiments following the *Columbia* accident in 2003 but it is interesting to note that, while perhaps not the main cause of continuing on with the shuttle program following *Challenger*, that this sentiment of "going on with the mission" and "continuing on" might have played a small role.

Performance

Clearly, *Challenger* was not the high point of NASA's performance record. In the wake of the accident, the first major criticisms of NASA's performance began to creep up, however. Calls for NASA to be restructured or the space program to be ended completely were roundly heard. The consequences of NASA's decisions in the shuttle development phase were bound out to their conclusion.

If any good was to have come out of this, it was perhaps the lowering of shuttle standards to more realistic expectations. By this time, no one in government or NASA was seeing the program through rose-colored glasses; flights per year were never going to meet the goal of 25, shuttle refurbishment between flights was going to take longer, and the program was going to cost more and need more resources. In bringing the standards

for the program into a more realistic light, *Challenger* not only highlighted problems of performance for NASA but also lowered future standards for performance.

Intragovernmental Relations

In 1967 following the launch pad fire of Apollo 1 during routine testing, NASA was allowed with very little interference to conduct their own investigation into the accident. That was not the case following *Challenger*. President Reagan established a commission, formally entitled the Presidential Commission on the Space Shuttle *Challenger* Accident, better known as the Rogers Commission, to investigate the causes of the break up of *Challenger*. The commission identified the mechanical failure, the o-ring that directly caused the accident but also spent four chapters examining contributing causes to *Challenger*. As discussed above, they criticized the very decision-making processes that allowed *Challenger* to launch stating, "If the decision makers had known all of the facts, it is highly unlikely that they would have decided to launch."[43]

That NASA was not allowed to conduct its own investigation is the obvious sign of the times that demonstrated NASA's fallen stance in respect to governmental relations. Clearly, if NASA could not be trusted to live up to the standards that had been set for the shuttle program to begin with, it could not be trusted to fully investigate what had went wrong. Further, NASA would not have been in a position to identify and critique the very decision-making processes and policies that the Rogers Commission identified as contributing to the accident. While having this criticism leveled at them certainly could not have been comfortable, it could have saved lives in the end by allowing NASA to change these dangerous processes.

The International Space Station

Even before *Challenger* and the concerns that it raised, NASA was pushing for a new program, fresh on the heels of declaring the shuttle operational. A space station, originating in the 1969 task force report, in low-Earth orbit that would be serviced by the shuttle was argued to be the next step in America's space program. Nominally argued for since the 1950s, many people inside NASA, and out, believed that a space station would be a stepping-stone to going back to the moon and onto other worlds. But NASA, sensing that releasing satellites into space would not give the shuttle enough to do, pushed the space station to give the shuttle something to do.[44] In fact, the space station became the next logical step.[45]

Putting a continuous American human presence into space also gave NASA a chance to regain the popular support that was once again viewing space flight as a routine and normal operation.[46] Indeed, NASA's own pronouncements that it could make regular, routine access to space for humans into a cost-efficient affair came to work against NASA. Following the initial spectacular launches of the space shuttle, public attention to the program waned; perhaps if NASA could launch another program, another spectacle, it could continue to draw the public's attention to its activities.

Of course, giving the shuttle something to do and regaining public attention were not the only reasons that NASA pushed the space station. The Soviet Union had placed a series of space stations into orbit beginning in the 1970s and was preparing to launch its most successful space station, Mir. Though the Cold War did not give NASA as big of a rationale to pursue big expensive projects as it did in the 1960s, the space station still came to be "defined by its political rationale."[47] If the Soviets were doing it, then the US

had to do it as well. Ironically, however, the former Soviet Union would come to play an important part in the eventual International Space Station.

In order to get approval for such an expansive project, NASA would have to take the plans to the president, Ronald Reagan. A Cold Warrior, Reagan was also concerned about the economics of the program, particularly coming off of the non-economical space shuttle program. NASA in turn convinced Reagan of the space station's commercial possibilities- zero-gravity manufacturing, the promise of the new drugs developed in lower gravity, and other possible commercial ventures. Klerkx recounts that "When Reagan approved the project now known as the International Space Station, commerce- if not outright profit- was high on the list of his motivations for doing so; in fact, had NASA not convinced Reagan that industrial suitors interested in lucrative microgravity research and manufacturing could eventually turn the station into a for-profit enterprise, it probably wouldn't have been built."[48] Greenberg seems to confirm this by arguing "Reagan began his presidency with announced plans to reduce the government's civilian budget, including research, by substantial amounts."[49] That we should see Reagan go ahead and endorse an expensive space project after announcing his intention to cut the budget demonstrates the apparent strength of the economic arguments that NASA used in justifying the space station and Reagan's enthusiasm for space overall.

When Reagan finally approved the space station known as Freedom, the long process of development and design began. Much like the space shuttle, various designs and options were examined all while the costs of the program skyrocketed- a total of seven project redesigns with a reduced budget to just over a billion dollars.[50] With NASA suffering from the aftermath of *Challenger* and repeated budget cuts to the space station

budget, it would be 1988 until a "final" design of the space station would be approved. This final design would be short-lived however, as a confluence of events came together to change the future of Space Station Freedom.

In 1990, the space station was found to be too heavy and too complicated to construct.[51] With it costing more and more money and the budget for the space station continually underestimated by NASA, the program became dangerously close to being cut altogether by the Congress. The Congress would hold a vote in 1993 on whether to continue the program- it came within one vote of being shut down.[52] Thus NASA was forced to come up with an incredibly scaled down project that eliminated many of the science aspects of the original space station that still cost more than what was expected.

At the same time, the former Soviet Union was falling apart and concerns began to be raised about their space program and their scientists. With no guarantee of income or a job, there was a danger that these scientists would go on to work with groups or countries and give them valuable knowledge concerning nuclear weapons. As a result, the US invited Russia to become a major partner in the International Space Station (ISS) thus ensuring their scientists jobs and their economy money. The space station that had originally begun as a counter to the Soviet Union's Mir now had the cooperation of Russia with much of the original rationale for the space station disappearing.

Performance

Once again, NASA's performance has come into question not because of failing to reach performance objectives but because of what they did to get approval for their projects. Some may proclaim NASA has literally lied to not only the president but also the Congress in order to get the space station approved, but perhaps it was more of a

question of good intentions with bad results. NASA personnel may have truly believed that the space station could be designed and constructed with a relatively small budget and that it would eventually turn a profit, but the experience with the space shuttle should have been a lesson. Technology does not often grow at the pace that other people want it to grow at and, as had been learned with other government acquisition projects, as stated before, the budgets are often higher than projected.

Certainly, the budget that was continually lowered by the Congress for the space station project played a role in the constant redesigns that consequently cost more. On the other hand, however, if NASA had given an estimate that was higher for the space station that could have been closer to the actual cost, the program might never have gotten off the ground. To NASA's credit, it was between a rock and the rest of the government; NASA needed to give the space shuttle something else to do and wanted to continue its presence in space. Human spaceflight was what brought the largest percentage of money into the agency and by continually flying humans into space, NASA could guarantee itself a certain amount of money every year. Beside the conscious decision to remain in low-Earth orbit with the space shuttle and the space station, some within NASA thought that the space station could serve as a middle ground between Earth and the rest of our solar system- it would eventually turn into a jumping off point for missions to Mars. But good intentions often have bad outcomes as the space station and the space shuttle have shown.

That NASA did not learn from its mistakes is an example of two characteristics of NASA: it is hardheaded, determined to get its own way, it pursues a specific vision of its own, and is willing to use its power, but also that the agency strove to continue a human

presence in space and follow the ideal of continuing discoveries and journeys into space. It is this "real" and "ideal" NASA that many have often commented about, including renowned physicist Freeman Dyson.[53] The ideal NASA still holds on to the dreams of moving further and further out into space but the real NASA is still destined to remain in low-Earth orbit because of its emphasis on survival and greater budgets. The tension between these two ideals remains and perhaps a winning side will never be decided upon.

Intragovernmental Relations

There are two highlights of NASA's intergovernmental relations during this period: getting presidential approval for the space station program and increasing congressional oversight over the program. In the course of persuading Reagan to approve the space station, NASA utilized a number of reasons including: commercial applications, the Cold War, and that it was the next logical step. When NASA referred to the space station as the next logical step, they were really saying that now that we have a space shuttle, it needs to do something (build a space station) and that that space station would serve as a way station for further exploration. Reagan, being perhaps the consummate Cold Warrior, accepted these rationales and NASA explanations and approved the program in 1984.

That NASA could convince Reagan to support the program using almost the same rationales as they used for the space shuttle program is intriguing. Obviously NASA claims that the shuttle could be cost-efficient, reliable, and provide routine access into space were coming to naught at that time. How could Reagan trust NASA with another multi-billion dollar program that it claimed would be economical and provide constant US access in space? This event provides an unmistakable indication of the amount of

power that NASA still wielded even though the space shuttle program was underperforming compared to its stated objectives.

But not all in government were convinced by NASA's claims for the space station. Just as we saw in the late 1970s, the number of General Accounting Office (GAO) reports concerning NASA increased from just two in 1986 to 38 in 1992 at the height of the discussions concerning the space station. Congress was certainly utilizing their oversight powers and not just in investigating the agency either. A number of votes were held in the early 1990s concerning the future of the program with the closest the program came to being killed being one vote. The amount of oversight that Congress took with the space station, however, Greenberg finds to be the norm- the program was constantly criticized and chastised yet still survived.[54]

The 1990s: A Reemergence of Space, a Reemergence of NASA

While the events of the 1960s did not truly play themselves out all over again in the 1990s, the memories were brought back out in the form of popular culture. The 1990s became the first decade since the existence of NASA that brought no new major human spaceflight program. Instead, the International Space Station finally got off the ground and the space shuttle inched closer to achieving its goal of at least, reliable access to space.

The 1990s began with the replacement shuttle *Endeavour* coming into service following the *Challenger* disaster. *Endeavour* was approved in 1987 as a replacement for the lost orbiter and was built at a cost of over $2 billion dollars. Marking the end of a long recovery period from NASA's first loss of a crew during an actual mission, *Endeavour* flew its first flight in 1992.

Another significant characteristic of the decade for NASA was the long and stable leadership of Dan Goldin as administrator of NASA. Pioneering the "faster, better, cheaper" trend that had been evident for some time now, Goldin made extensive personnel cuts, reduced the time spent designing new science missions, and lowered budget estimates submitted to the Congress.[55] Goldin serveed as NASA administrator through a total of three presidential administrations, from 1992-2001.

It was not only stable leadership, the space shuttle program's recovery from *Challenger*, and the headway made with the International Space Station that led to a greater awareness of NASA and its programs during the 1990s. Nor was it a big presidential announcement of a new space program. The release of the film "Apollo 13" in 1995 and the HBO miniseries "From the Earth to the Moon" in 1998 marked a new interest in the space program. In his study of public opinion and NASA, Launius found that "These images from popular culture, coupled with real world accomplishments in spaceflight, work together to create powerful visions affecting the public consciousness."[56] Launius found that until 1995, public opinion polls concluded that a majority of the American public favored robotic space exploration over human exploration of space.[57] He traces the change to not only the ensuing Mir/Shuttle missions, but to the release of "Apollo 13" and other "near-term science fiction films."[58]

Along with the film "Apollo 13," two other movies released in the 1990s served to reignite public interest in the space program: "Armageddon" and "Deep Impact," both released in 1998. "Armageddon," a film in which a fictitious asteroid is on a collision course with Earth is notable for the significant involvement of NASA both in real life and in the movie. In the movie, NASA is clearly portrayed throughout as the agency that

spearheads the effort to blow the asteroid up so that it does not hit the Earth. NASA provides a new class of shuttle for the mission and trains the crews for the mission; Billy Bob Thornton plays a NASA mission manager with a critical role on Earth during the mission. NASA also participated in the filming of the movie with giving technical advice (though the film is still technically inaccurate).

"Deep Impact" does not have the focus on NASA that "Armageddon" has. The film's subplot involves a crew sent to the comet that is due to hit the Earth, but the major plotlines have more to do with the effects on individual people on Earth knowing that a comet is on its way to destroy their home and possibly their lives. The combination of these two movies, however, served to stimulate an interest in Near Earth Objects (NEOs) that could possibly collide with the Earth and NASA's efforts to stop them. While NASA does have an NEO program, it has recently been decried as utterly under funded.

Real life events also helped to heighten public interest in the program. On July 4, 1997, the first successful Mars rover landed on the red planet and beamed pictures back to Earth. Taking place on America's Independence Day, *Sojourner* was released by the Mars Pathfinder and provided stunning pictures of Mars that had never been seen before. Following the success of *Sojourner*, two more rovers would be sent to Mars in 2003 that would be equally successful. With the combination of sometimes fantastic and sometimes partially truthful docudramas and the successful Mars missions, the percent of people who believed NASA's performance to be either excellent or good rose from 46% in July 1990 to a decade high of 76% in November 1998.[59]

But successes notwithstanding, NASA's scientific exploration of Mars would indeed suffer from some very public disasters. The Mars Climate Orbiter was destroyed

as it attempted to enter into orbit around Mars in 1998. The orbiter suffered its fatal error because of a measurement mix-up by contractor Lockheed Martin. Coming closely on the heels of the successful *Sojourner* mission, most had expected this mission to be equally successful; with such high hopes for success, its failure was all the more deafening.

Aside from the science mission failures, the human spaceflight program seemed to have gotten its pitfalls behind them. After years of delays on the part of both America and Russia, the first module of the ISS was placed into orbit in 1998. Following the addition of two more modules, the beginning of a continual human presence on the ISS began in 2000. Giving the Russians "a steady paycheck" for their involvement in the ISS also seemed to be helping the recovering Russia.[60] Yet at the same time, some within NASA were concerned with Russia's continuing operations on the space station *Mir*.[61] Russia's attempt at creating modules for the ISS and continuing operations on *Mir* was delaying the ISS and continually infuriating America and the other partners in the project. As a result, NASA pressured the Russians to deorbit *Mir* so that they could focus on the ISS. A very political decision indeed, some wondered whether NASA felt that its ISS was threatened by having another space station nearby already. Why spend all this money on designing, building, and constructing in orbit a brand new space station when one was already there? Nevertheless, by the end of the 1990s, routine human spaceflight seemed all the more reliable and had a purpose- construct the International Space Station.

Performance

Of all the time periods examined here, it could be argued that during the 1990s, NASA's performance increased greatly. With no major mishaps or deaths and no new

scandals over under priced programs, NASA seemed to be well on its way to "faster, better, cheaper." Indeed, the number of reports concerning NASA during the 1990s continually dropped throughout the decade to a low of seven in 1998. Public opinion was warming back up to the program and many thought that the worst was behind them.

But all is never as well as it initially appears and the same is true of NASA. During the 1990s, NASA attempted developing several vehicles that eventually replaced the space shuttle yet none of these programs ever came to fruition. The GAO acknowledged this saying that "Despite many successes in the exploration of space, such as landing the Pathfinder and Exploration Rovers on Mars, NASA has had difficulty bringing a number of projects to completion, including several efforts to build a second generation reusable human spaceflight vehicle to replace the space shuttle."[62] Part of the problem with these programs is that, outside of the International Space Station, the future goals and requirements for US human spaceflight was unknown and had never really been debated; thus, it was unclear "what kind of 'post-Shuttle' vehicle to develop."[63] While not a failure of a major program, the failure of NASA to be able to develop the next generation of space transportation system after the shuttle had been in operation almost twenty years could be considered a failure of planning.

Intragovernmental Relations

With no new human spaceflight program during the 1990s, then-President Bill Clinton really had very little interaction with the space agency. In contrast, however, relations with the Congress were improving. Dan Goldin's focus on cutting the budget and streamlining the agency and imposed congressional budget ceilings on the International Space Station helped to keep budget costs for the space station under

control. And with no one under any illusion that the space shuttle would be economical, budget quarrels over that program were few and far between. NASA even played a critical foreign policy role following the break-up of the Soviet Union, giving the Russians funding and something to do. As mentioned previously, the number of reports concerning the space program generated by the GAO consistently fell throughout the decade and increased public interest in the agency helped to alleviate support problems in the Congress.

While the number of GAO reports on NASA did indeed decrease, the GAO's criticism of the agency did not. Beginning in 1990, the GAO "identified NASA's contract management as a high-risk area."[64] NASA's cost-estimating procedures, though a problem since the 1970s, became a major problem for them in the 1990s. The GAO derided NASA not only for terrible cost-estimates but also for the bad program management that stemmed from that.

Columbia

The progress that NASA made through the 1990s with respect to the space shuttle and International Space Station programs was not destined to last into the new millennium. On February 1, 2003, returning from a two-week flight to the International Space Station, disintegrated over Texas upon reentry. The eventual technical fault was found to be a foam strike on the left wing during lift-off from the Kennedy Space Center in Florida. While some within NASA were concerned about possible damage from the debris strike, the concerns were eventually waved off.

Similar to the aftermath of *Challenger*, the accident put the shuttle fleet on an immediate grounding and sent the space agency scrambling to find the cause. And just

like *Challenger*, many of the causes would be found within NASA itself. The Columbia Accident Investigation Board, or CAIB, was the counterpart to the Rogers Commission for *Columbia*. It found that, in addition to the technical flaws and "In response to White House and Congressional mandates, NASA leaders took actions that created systematic organizational flaws at the time of *Challenger* that were also present for *Columbia*."[65]

For many, these "flaws" are questions of culture, or rather NASA's way of operating. The same questions that arose following *Challenger* crept up in *Columbia's* wake. Over 15 years had passed between the two accidents, yet NASA was still pushing a tight schedule of launches due to the construction of the ISS. Following years of delays, progress was finally being consistently made on getting the ISS into orbit and constructed. As a result, the shuttle launch schedule was pushed to its breaking point. The GAO noted that "Columbia's safety was compromised in part by the shuttle program's fluctuating priorities and arbitrary schedule pressures to achieve certain space station milestones."[66] This comment is noteworthy since the fact that the shuttle launch schedule was deemed to be "arbitrary" reinforces the blame that should be placed on NASA. In 1986, NASA was pushing the shuttle in order to demonstrate that it achieved the cost efficiency benefits that had been proclaimed yet since then, those claims have been proven wholly false. Therefore, in 2003, the shuttle schedule was completely arbitrary; knowing that it would never be cost-effective, NASA personnel could have taken the time to ensure safety and a reliable orbiter yet they were continually be pushed to get the space station constructed to the point of neglecting the possibility of increased safety in the form of a shuttle replacement.

Similar to the Rogers Commission's finding of blame in NASA's culture, the CAIB found that "NASA's culture of bureaucratic accountability emphasized chain of command, procedure, following the rules, and going by the book. While rules and procedures were essential for coordination, they had an unintended negative effect. Allegiance to hierarchy and procedure had replace deference to NASA engineers' technical expertise."[67] This very familiar conclusion leads to an eerie train of thought- had the lessons concerning culture and safety been fully implemented following *Challenger*, could *Columbia* have been avoided? Perhaps time had eroded the value of the lessons; as we get further and further away from 1986, people get more and more confident in those same systems and procedures. Lessons get lost, memories become fuzzy, and accidents happen.

Columbia not only led to questions of culture but also to the topic of the aging shuttles. While various programs, most notably the DC-X and X-33 programs, had been trying to develop replacements for the space shuttle, most went over budget and/or were cancelled for various reasons. The promising X-33 program was cancelled in 2001 in deference to the new Space Launch Initiative, which would in turn be cancelled just prior to *Columbia.*[68] Questions concerning what to do with the shuttle had lingered for years; by 2000, the technology was already almost 25 years old. But the same question that was not asked following Apollo was still not being asked at the beginning of the 21st century- what does America want out of its space program? Without answers to that very fundamental questions, appropriate programs cannot be designed and pursued. Again, CAIB found this question to be very elemental- without answers as to what the nation wants, NASA is not funded properly and thus strives "to do too much with too little."[69]

These familiar echoes of *Challenger* turned into deafening roars following *Columbia*. And like the aftermath in 1986, the push to continue exploration of space had been heard from not only the president, but the congress as well. That NASA had a future was all but written in stone, but what would that future hold?

Performance

Clearly, *Columbia* was not NASA's best moment. While the criticisms levied following *Challenger* were quite direct and alarming, that NASA allowed the same problems to creep up once again is inexcusable. Ultimately, the crew of *Columbia* died not of first mistakes, but of second, third, and fourth ones. However, in NASA's defense, the same technical mishap, falling foam from the shuttle's external tank, that doomed *Columbia* was an event that had been seen in prior shuttle launches with no ill effect. With history showing that the orbiter could sustain hits from this foam, it could be argued that nothing out of the ordinary be feared.

Yet there is evidence, provided very extensively in the report of the Columbia Accident Investigation Board, that concerns about the falling foam were particularly more virulent following the launch of this particular flight. Because the size of the foam and the speed it was traveling at were so great, a number of engineers were concerned. When the problem was taken up the chain of command, however, it was quickly stifled and offers from the military to get high resolution images of the orbiter were declined. True, had the foam strike been found to be deadly while the crew was still in orbit, there was probably very little they could do to fix their spacecraft. The possibilities and their consequences are far too varied to be considered here, but it is safe to say that the saying "better safe than sorry" was not listened to.

What is commendable on NASA's part was their reaction to *Columbia* in comparison to *Challenger*. Following the accident in 1986, many had criticized NASA of withholding information and not being completely forthright with the country and investigators. That mistake was not made again in 2003; NASA immediately endorsed the appointment of an independent board and made itself available for all inquiries.

Intragovernmental Relations

Following *Columbia*, NASA as an organization, as noted above, was more forthcoming about its actions to the media and to the rest of the government. The accident indeed brought new attention to NASA and the nation's space policy. Questions of the need for a new program or a new orbiter arose. And while a few calls for the abandonment of NASA altogether were heard, there were not nearly as many as in 1986.

The Future: Project Constellation

Nearly one year after the destruction of *Columbia*, President George W. Bush announced a new plan for NASA, the Vision for Space Exploration (VSE). The VSE provides for the retirement of the space shuttle by 2010, the development of a new human-rated space vehicle, the Crew Exploration Vehicle, and a return to the moon by 2020. The plan also provides for the development of a new lifter, the Ares, with enough power to propel the CEV out of Earth orbit. The Ares would be the first new class of heavy lifter since the Saturn V of the Apollo era.

The crux of this new project, which would generally require large influxes of new money into the NASA budget, is the retirement of the space shuttle, which would free up the requisite money. But there are still questions regarding the "long-term funding outlook": the GAO found that "the agency [NASA] will have to keep the program

compelling for both Congress and potential international partners, in terms of the activities that will be conducted as part of the lunar program, in order for the program to be sustainable in the long run."[70] Thus, NASA will continue to find itself in the same position of the past three decades, that is, continually justifying a program that costs hundreds of millions, if not billions of dollars, with perhaps little of valuable scientific returns guaranteed.

Since this section concerns the future of NASA programs, I will not examine issues regarding intergovernmental relations and performance as above. Instead, I will look at some of the lessons that NASA has, hopefully, learned from, and how it may apply to Project Constellation. These questions include: cost-estimating and budget processes, bureaucracy versus technology, and questions of what a proper space policy for the United States would look like and consist of.

One of the biggest problems with both the space shuttle and space station programs was the ill-informed cost-estimation and budget processes. These low-cost estimates and claims of economy eventually lead to unreasonable expectations, which in turn were not met. Combined with this, when the will is not in the Congress to continue funding projects like this at the level which is required, budgets get cut and capabilities are then cut from the program. In sum, the combination of these two problems lead to a snowball effect; low cost-estimates lead to unreasonable expectation of economy, capabilities get cut, the Congress cuts funds, and even more capabilities are gone. What is left, then, is a program like the space shuttle, which does not live up to its original expectations in the least.

The lesson that NASA should draw from this is that the theory of low cost-estimates garners support in the Congress hardly ever proves right. The best course of action would be to completely open with the Congress and the country as to the level of monetary support that is going to be required for a project such as Constellation. If the executive and legislative programs still support it after a full evaluation of the costs involved, then there is a greater chance that it will be funded adequately. Yet even this does not always prove true. In the current appropriations cycle, NASA's budget is projected to be cut; that cut in turn could lead to serious consequences for Constellation, perhaps similar to what has been seen with the shuttle and the International Space Station. So what does NASA do when its stuck between a rock and a hard place?

Among the many rocks that NASA is caught between are also rocks named bureaucracy and technology. Both the Rogers Commission following *Challenger* and the Columbia Accident Investigation Board found that contributing causes to the respective accidents included the tendency for bureaucrats to prevail over technocrats. In other words, the assumption that the bureaucratic channels, procedures, and hierarchies would catch any significant problems influenced those in the agency to ignore falling foam or destructive o-rings.

This bureaucratic tendency also led to a push for launches; in *Challenger*'s case, it was a push to get more shuttles up in less time and in *Columbia's* case (while the shuttle *Columbia* itself did not go to the ISS), it was a push to get the International Space Station constructed and completed. While Project Constellation may not experience the same kinds of pressures as the space shuttle has, it certainly will experience some. With retirement of the space shuttle in 2010, there is a projected four year gap in American

human spaceflight capability- the CEV, Orion, is not scheduled to be online until 2014. Thus, Project Constellation will face pressures to get Orion developed and built as quickly as possible to keep the gap between it and the shuttle small. Where a gap between vehicles might have been acceptable in the past, one program in particular makes it quite unsavory now: the International Space Station. With American needs for personnel and supplies on the ISS and no space shuttle to get them there, the US will have to depend on Russia for flights to and from the ISS.[71]

Dependence on Russia leads to the third problem that NASA and the rest of the government will have in developing Project Constellation, what is the proper role of space policy in American society. That this question has never been truly thought though should be apparent by now; the desires of NASA to continue human spaceflight at the level it is used to have never been properly reconciled to the requirements of greater US policy.

Conclusion

NASA has endured almost 50 years of a long and winding existence during which NASA has been fearful, to say the least, of losing budgetary and monetary footing. Its performance has suffered and rebounded, it has seen new programs come and go, and has pushed it own agenda to much success. The question that we are left with is thus, if NASA has suffered so many defeats and pitfalls, why does it continue to have the support of the rest of the government in bestowing new multi-billion dollar programs? If NASA was really doing that badly, would they continue to get the funds that they do? Is there some kind of cycle waiting to be discovered here? These questions will continue to be examined and probed in the following chapter.

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CHAPTER 4: GOVERNMENT AGENCY DECLINE MODEL WITH NASA AS A CASE STUDY

A Model of Governmental Agency Decline

If decline as presented in the literature is not applicable to the government, then what is? The main argument presented here is that in government, there is no such thing as decline. Rather, agencies and organizations are constantly in flux, or rather, their operations change according to political and fiscal resources, which in turn depend on overall economic performance (Figure 4-1). Thus, the three major indicators to be examined are money, performance, and power.

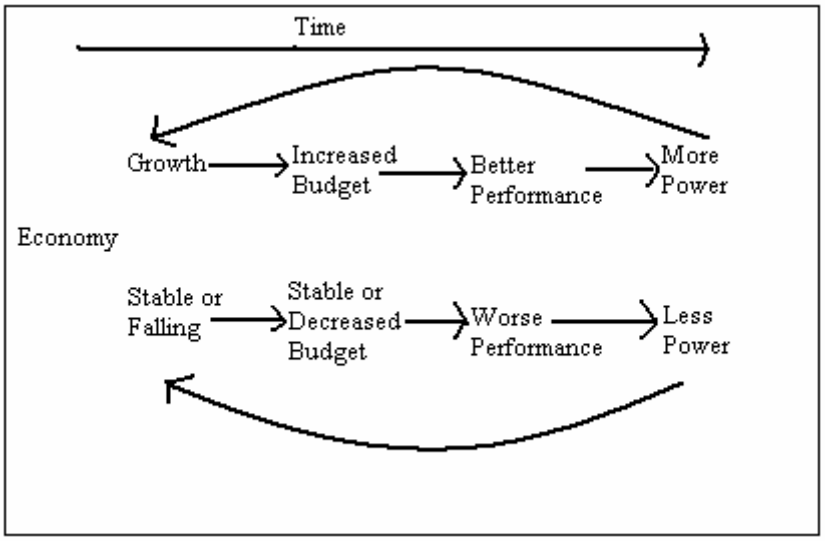

Figure 0-1: Governmental Agency Decline

In this chapter, I will present this model and its component parts. It must be kept in mind, however, that this is simply a model for analysis of government agencies. The variables that are established for a study of NASA may not necessarily be the same that could be established for the Department of State or FEMA. It is not possible to specify

generalized performance targets for all agencies as they each perform different activities and fulfill different duties.

One other constraint to this model is that it does not cover the initial stages of an agency. As predicted by Downs's life cycle theory, new agencies often undergo rapid development and expansion and as such must mesh the different cultures of previous organizations so that the new one can develop. These new agencies also have an enormous amount of political support that has supported their creation in the first place and as such, their power and ability to get money and resources are likely dramatically out of sync with their future budgets. NASA can even be seen as an example of this in what is often called the Apollo paradigm or the Apollo legacy. In its first decade in existence, NASA was provided with an abundance of funds and support; the argument whether this was because it was a new agency or because of Cold War political realities do not really matter here. The point is, what NASA experienced in its first decade became much different than what it experienced in the 35 years since.

I will examine each of the three indicators in turn and then put forth the specific variables I will be using in regards to NASA.

Budget

Greenberg puts it succinctly "the politics of science is registered in money awarded or denied."[1] The hinge of this model and the point at which it can begin or be interrupted is money. Money is the ultimate resource that allows an agency to perform its tasks. Without adequate funding, some things may not get done, some things may not get done well, or people are laid off. Generally though, the agency is expected to continue its tasks at the same level (or better), just with less resources and funding.

The budgeting process is the method through which agencies request funds, get funds approved, and then receive and spend them. It is not the agency or organization itself that decides how much an organization should get, any number of people and organizations influence the budget process through the executive branch to the legislative. This political process, then, as identified by Wildavsky and others, impacts the amounts of money that a given organization will receive. Of course, this is not the only restraint in the budgeting process- environmental factors certainly affect political calculations. For example, the current budget deficit or the amount of taxes received (and thus the amount of money that the legislature has to work with) can all affect the budget. Natural disasters and defense needs can also play a role.

The differences between agencies funded through discretionary funds and mandatory outlays also play a major role. Hence, we must distinguish between discretionary and mandatory. Mandatory outlays include those monies, which are required by law or statute to be spent each and every year regardless of political, economic, or environmental factors. Items like Social Security, Medicare, other entitlement programs, and interest owed on debts are included in this category, which, in 2006 took up 62% of the entire US budget.[2] Because these outlays are considered mandatory, only so much of the rest of the budget is left to fund not only other government agencies, but also the Department of Defense and the military.

It must be noted that the defense budget comes from the discretionary part of the budget. In 2005, the defense budget made up 51% of the discretionary budget, therefore, what was already limited, becomes limited even further.[3] Because of the nature of the military and the need for them to be prepared for possible conflicts and to fight in current

ones, the military budget is often what is required by the Defense Department, and not what is appropriated by the Congress. Some within the Congress may feel as if, politically, their only choice is to fully fund the military so as to protect the US. Therefore, although the military budget comes from the discretionary pot, oftentimes, it is not discretionary in the least.

The source of NASA's budget are these discretionary funds. Perhaps Caspar Weinberger, as an aide to Nixon represented NASA's situation best when he wrote in a memo to Nixon: "The real reason for sharp reductions in the NASA budget is that NASA is entirely in the 28% of the budget that is controllable. In short we cut it because it is cuttable, not because it is doing a bad job or an unnecessary one."[4] The point of this discussion then, is the importance of recognizing not only the amount of the funding, but the source. NASA's funding must be examined with an eye towards discretionary funding; it cannot be compared to programs that are legislatively required to be funded.

In order to examine this money aspect of the model, one must first look at the actual budget levels of the agency. However, this is not the only exercise that could be or should be done. Comparing the budgets of one agency to others will help to gain an overall picture of what funding situation was present in any given year. Did a number of agencies lose funding, was it just a handful, or only one? If NASA was the only agency to gain or lose funding, then we have just learned something else. But again, the discretionary nature of the budget must be taken into account and comparisons cannot be made across agencies not within the discretionary arena.

A number of exercises can be done regarding the NASA budget and the entire US budget, specifically encompassing comparisons that can enlighten us as to NASA's

stance in regards to the rest of the government. While the percent of the total budget that is directed towards NASA is generally very tiny, we can look not only at that figure, but also NASA's percent of the discretionary pie.

A large part of the comparison however, will encompass comparisons between NASA's budgets and the budgets of other agencies. Taking into account the discretionary source and the types of tasks that the agencies perform, I have chosen two agencies to compare NASA against: the National Science Foundation and the National Institutes of Health. Both of these agencies participate in research (and development activities in the case of the NIH), which make them appropriate foils against which to compare NASA. It is possible to track, over time, the percent of the total US budget and the discretionary budget each of these agencies received and compare NASA to them.

Performance

Within the performance aspect it is not possible to simply construct certain performance standards for NASA or any other government agency and apply them to projects that were not designed to be measured against these ad hoc standards. Not even within the traditional decline literature itself, do we find constructed measures of performance.[5] Therefore these measures must be individually constructed for each agency that is to be studied.

The emphasis on performance in the government has not always existed. In 1993, the Government Performance and Results Act (GPRA) was enacted which required yearly performance reports from federal agencies.[6] These reports, though, were not required until 1997.[7] Additionally, scholars have found these reports to be "works in progress" and Beryl has described the requirements as a "tangled set of expectations."[8]

Criticism of the act has also come in the shape of one of the restrictions within this model. Implementing a government wide system of accountability is admirable, but can it truly be done? Is it fair to apply the same standards to agencies that perform widely varying functions?

Because the GPRA has only been in use for ten years, it does not give much information concerning NASA for the bulk of the period being studied. Performance reports put out by the agency in question must also be critically examined; since these reports influence thinking concerning the agency, they are more likely to be less critical of the agency in question. While painting the situation in a good light benefits the agency, it does not benefit the scholar studying the agency. As such, judgment concerning the use of GPRA reports and other performance reports published by government agencies must be left to the scholar utilizing the model to study a particular agency.

The challenge within performance thus becomes creating indicators of performance that do not unfairly measure programs against standards which they were not designed to live up to. These standards must be created for each agency being evaluated within this model and cannot simply be put forth here.

NASA not only deals with human spaceflight but also with science missions. It would be wrong to weigh both of these types of missions similarly; when NASA launches a rocket with a satellite or science mission onboard, human life is usually not risked. But when the space shuttle lifts off with up to seven people onboard, the danger and the standards for avoiding disasters are much higher. Therefore, when considering

performance, human missions will be separated out from robotic and/or scientific launches.

The total number of launches including human, science, and missions which NASA has solely provided launch services is a base statistic that will be used in this analysis. The number of successful launches (as designated by NASA) is tracked through which the success rate of launches in any given year is calculated. Further, the number of science missions launched in a year will be used to examine performance. For the human spaceflight program, the number of human flights per year will be utilized. From data provided by the archive of shuttle missions published on NASA's Kennedy Space Center website, I have calculated the number of delay days per year that the space shuttles have experienced. This figure is calculated from the date of the original planned launch and when the launch actually occurred. The statistic, however, that will be primarily used is the percent of on-time human flights per year.

As has been noted before and used previously, reports generated by the Government Accountability Office (GAO) provide a political measure of indicating NASA's performance. Since these reports are written usually on the request of a legislator, the number gives a clue as to the amount of oversight that NASA could be experiencing. Increased oversight is most likely to come when agencies are experiencing times of trouble or low performance. Further, the criticisms found in these reports are often directed towards NASA operations and help to inform the analysis.

Power

Power is an inherently difficult concept to define and measure. White contends that "Power is not a physical thing;" if power is not something physical, it may be seen as

completely unquantifiable.[9] Part of the problem of power is conceptualization; what exactly we are defining, what a definition of power should include, and what this conceptualization should clarify are all bones of contention.[10] Pluralist theories of power such as those presented by Robert Dahl contend that power is seen only through the actions that cause something to happen. More specifically, power is exercised when person A does some action B to cause another person C to act like A wants them to. There are problems with this conception, however. Any person can act and thus create an observable action- it is the result of that action that shows power or influence. Therefore, we may be able to see a form of power in the resulting action but person A can have power even if he or she does nothing with it.

It is not so much the question of whether NASA has power, by virtue of being a government agency we can say that it does, but how much of it do they have and how they exercise it. So what does power *mean* with respect to NASA? Ball writes that the concept of power is likely to be ambiguous separate from its context therefore "Its meaning *is* its use, the ways in which it is used."[11] With respect to NASA, its place in government, and its missions, NASA's exercise of power within government is its ability to get what the agency wants or to persuade others to go along with NASA's wishes. In order to guide my examination of NASA's power, I will employ the following conceptualization of power: the ability to persuade, convince, or influence person or agency C to do what person or agency A wants them to do. While some, such as James Webb, believed that "it was up to the government to tell NASA what to do," what we have seen throughout the history of NASA is their pursuit of what they deem to be the most necessary for survival reasons or otherwise.[12]

An example of this exercise of power of persuasion comes following the introduction of the space shuttle in 1981. NASA needed something to do with the shuttle and the justification for having it was thus found in a space station.[13] In order to get approval for a space station, NASA officials needed to convince the Reagan administration of the usefulness of such a project. Klerkx writes that "had NASA not convinced Reagan that industrial suitors interested in lucrative microgravity research and manufacturing could eventually turn the station into a for-profit enterprise, it probably wouldn't have been built."[14] This has obviously not occurred with the operation of either the space shuttle or the International Space Station but can be seen as an example of NASA pursuing (and getting) what it wants- thus using power.

A number of ways to measure power must be considered here. As has been argued before in chapter three, public opinion may influence representatives and their actions with the logic being that if the public supports program, than their representatives should support it to. But as Jacobs, Lawrence, Shapiro and Smith found, the influence of public opinion to be weak and lower than originally thought mostly because of the methodological questions surrounding polling.[15]

Additionally, the only consistent measure of public opinion regarding NASA is provided by the General Social Survey approximately every two years in their question: "Are we spending too much, too little, or about the right amount on the space exploration program?"[16] Asking whether the amount of money we are spending on space exploration does not equate very well to how much power NASA holds with the general public; rather, this seems to be a better expression of how the public believes the agency is performing.

Recognizing the limits to conceptualizations of power and thus how to measure it, the qualitative analysis presented in chapter two and expanded upon below will provide greater context to the question of power. From this qualitative analysis, I aim to identify points in time where NASA has held more or less power as seen by its actions and their outcomes.

NASA as a Case Study

The work laid out here and in the previous chapters has lent itself well to a continuing analysis using quantitative methods. As such, in testing the model, I will treat it as four separate hypotheses: one, US economic performance affects NASA's budget; two, NASA's budget affects its performance; three, NASA's performance enhances its power; and four, NASA's power enhances its budgetary gains.

Hypothesis One: Economic Performance and Budgets

As a gauge of US economic performance, I have chosen to use the gross domestic product (GDP) over the 35-year period in question. As such, my initial tests including examining for correlations among GDP, NASA's budget (and the budget broken down into its scientific and human spaceflight components), the US discretionary budget, the total US budget, and the budgets of the National Science Foundation (NSF) and the National Institutes of Health (NIH).

As demonstrated in Table A-1 (see Appendix One for all data tables referred to in this chapter), all of the relationships are significant. What is the most interesting to note, however, is that the correlation with the lowest Pearson value (besides the correlation associated with the subdivision of NASA's budget) is GDP and NASA's total budget. This suggests that there is something other than the influence of national economic

performance involved in the relationship. This fits well with the government agency decline model (GAD), which suggests that an agency's power also influences its budgetary gains. That hypothesis is tested further down.

An additional component of the model suggests that a time lag should be present; in other words, the GDP in one year more strongly affects the budget in a later year. I have hypothesized that there is a two to three year time lag present within the model but I have tested for time lags of one to five years (table A-2).

Two items of importance should be noticed here. One, while all the correlations remain significant, it becomes less important for NASA over time. The same is true of the total and discretionary US budget, although these figures still remain higher than the NASA correlations. Two, the Pearson figures for NSF and NIH grow over time. This suggests that these budgets are continually growing over time whether due to GDP or other factors. One explanation could be that the importance of these agencies has grown over time and thus, so have their budgets. What is important to the analysis here, is that of NSF and NIH as comparisons to NASA are quite appropriate as they act as baselines from which to examine the rise and fall in NASA's budget.

In order to extend the analysis, I also performed a regression analysis testing the relationship between GDP and the various budget variables. Table A-3 confirms the findings of table A-1; the relationships are all significant though the effect that GDP has on the different budgets varies. Compared to the R-square of the total US Budget, the discretionary budget, and the budgets of NSF and NIH, GDP has the lowest effect on the NASA budget with an R-square of .877. This continues to suggest that something else is at work in influencing the yearly budget that NASA receives.

To further examine the effect of time of GDP's relationship to budget, I used regression analyses with time effects for the total US budget, NASA's budget, and the NSF and NIH budgets. Table A- 4 presents the effect that time has on the relationship between GDP and the total US budget. One should note the R-square values decrease over three years very slightly and then rise by a small degree in the last two years. Comparatively, the R-square values in table A-5 for GDP and NASA over time actually decrease from .876 in an analysis with a one-year time lag to .840 in an analysis with a five-year time lag. This is simply more evidence for there being another variable influencing NASA's budget.

The only regression that does not produce significant relationships is that of the NSF budget over time, though the R-square value does increase over the five years. The only value that fails to show significance is that of the constant; the beta value for the independent is significant. Since the analysis of the NIH budget in table A-7 shows significance for all values in all five years, it may be possible to conclude that this result is spurious. The correlation values over time are similar and the R-squares increase for NSF and NIH over time as well, contributing to the conclusion that it is indeed spurious.

Hypothesis Two: Budgets and Performance

The next step in the analysis is to examine the effects that budgets have on an agency's performance. It is hypothesized that as budgets rise, so will performance. Because NASA's performance is predicated mostly on two major programs, the human spaceflight and science programs, these factors will be examined both together and separate. Like the previous hypothesis, I have begun the examination with a look at the

correlations between the NASA budget and the various performance variables (table A-8).

It is interesting that there is a slight negative correlation between the NASA budget and total launches in a year. This demonstrates that there may need to be time between the implementation of a budget and the number of total launches, as hypothesized by the time lag. Further, there is a stronger correlation among budget and performance factors involving human spaceflight rather than science missions. The vast majority of the agency's resources are dedicated to human spaceflight, as shown in chapter three, and as such these results should be expected. NASA has dedicated an overwhelming amount of effort into the human spaceflight program because it has historically been considered more important and shown to draw more funds.

The correlation is also significant between NASA budget and the number of GAO reports. GAO reports may be a better overall indicator of NASA performance as they examine many facets of the agency. Since the variables consisting of launch data focus merely on one small aspect of NASA's performance, the correlation between budget and GAO reports should be considered a more valid indicator of performance.

Again, however, the effect of time must be considered. Table A-9 reports the correlations between NASA budget and various performance variables with one, two, three, four, and five-year time lags. With significant results shown in bold, one can see that the same pattern exhibited above, that of significant relationships between budget and human spaceflight performance indicators and GAO reports, continues with the time lags. Though the effect becomes less pronounced through the years, this again shows that the most significant relationships to be found are within the GAO reports and human

spaceflight performance. Another reason that could contribute to this could be the sheer visibility of the human spaceflight program. While the various science missions and other launches are not as well publicized, when the space shuttle is launched, people know. Since this part of the program is the most visible, it requires the most amount of money to be successful. NASA would certainly not want to appear unsuccessful when it launches humans into space as it repeatedly puts human lives at risk.

Since the relationship between the NASA budget and human spaceflight performance has been shown to be fairly strong, it is only natural to look at the relationship between only the human spaceflight portion of NASA's budget to performance. Those correlations, with time effects, are shown in table A-10. Once again, there is a rather strong relationship between the manned spaceflight budget and the number of human flights per year. Though the relationship does decrease as the time lag increases, it still remains significant through a time lag of four years.

When the same approach is taken with the science budget to science mission performance, less stringent results are found. The only significant correlation within table A-11 is that of the science budget to science missions with a time lag of one year (though it should be noted that it is on the very cusp of significance). Once again and confirming the suspicions of many researchers, it appears as if the science portion of NASA is superfluous or secondary to the main goal of putting humans into space.

To continue the analysis, I performed regression analyses of the relationships that the above correlations found to be significant. These analyses can be found in tables A-12 through A-18. Very few of the analyses show significant relationships; in most cases, only one of the beta coefficients exhibit it. In fact, there are only two of the regression

equations that show significance for all variables, NASA budget and total launches in the same year and the science budget to science missions with a one-year time lag. This again confirms the result in table A-11, in which science missions are affected the most by the science budget in the year before. It is also evident in table A-18 that the R-square value increases with that one-year time effect to .151 from .057 with no time effect. In other words, the science budget contributes approximately 15% to explaining the number of science missions in the following year.

Both the correlation and regression results deserve some scrutiny, however. For most of the science missions that NASA pursues, years of planning, development, and construction are involved, with usually more than one year required. Therefore, in this area above all others, one would expect the time effect to be more pronounced. On the other hand, the number of years required for satellite production has been decreasing; the lead-time though for NASA science missions, has not yet decreased to the point that we should expect the results gotten here.

Hypothesis Three: Performance and Power

With few quantitative methods of measuring power, the researcher is generally led to examine the nature of power with qualitative analysis. Since an extensive review of NASA's history was examined in chapter three, I find no need to repeat it here. Rather, drawing from the analysis of that chapter, the aim here is to identify periods of time in which NASA wielded power, particularly the power of persuasion; since it is almost impossible to come to a solid conclusion as to whether one has power or not, the utilization of it implies that an agency had to have had power in order to use it. Following the rough outline of major programs and timelines used in chapter two, here I

will consider five possible points in time in which NASA could have utilized power: the shuttle decision, the International Space Station, post-*Challenger*, the late 1990s, and post-*Columbia*.

The Shuttle Decision

The decision to go ahead with the Space Transportation System (STS) in the 1970s was not always ensured though continuation of the human spaceflight was all but. NASA Administrator James Fletcher argued to the White House that the US essentially needed to be in space and Nixon did not want to be the president who ended American human spaceflight.[17] Thus the question becomes whether the space shuttle decision was NASA flexing its political power to get what it wanted (a big, brand new human spaceflight program) or political inertia that required the US to remain in space.

Considering that NASA's creation was essentially the result of Cold War politics, as the Soviet Union continued to send humans into space and begin an incredibly successful series of space stations, an argument could be made that the US could simply not entertain the thought of ending human spaceflight. On the other hand, with President Nixon in office and his pursuit of détente with the Soviet Union, an argument could also be made that the US did not have to continue sending humans into space in order to compete with the Soviet Union. In fact, the Apollo-Soyuz tests of the 1970s would be demonstrations of US-USSR cooperation in space, rather than competition.

Further considerations come in the form of the Vietnam War. With more and more money being required for defense, NASA had already seen the last few flights of Apollo cut. Partially the consequence of increasing demands for money in other spheres, this decision also came as a consequence of decreasing public support for the endeavor.

Now that NASA had gotten to the moon and completed Kennedy's mission, why continue going back? Considering all of these caveats, perhaps the decision to continue with the shuttle program was not so much a consequence of NASA's power, but of political inertia mixed with some persuasion. Nixon did not want to end the program but the public did not want to see a massive influx of funds into a new program. NASA was this able to persuade Nixon that the shuttle would serve as the appropriate middle ground as a program that would not cost much and in the end be economically viable.

The International Space Station

Following a decade of shuttle development that consistently ran over costs and provided a set of orbiters that did not live up to expectations, NASA set out to gain presidential approval for Space Station Freedom from Ronald Reagan. Billed as the next logical step, NASA wanted to pursue a space station project to give the space shuttle something to do.[18] In order to convince an economically minded Reagan that the space station would be a project worth pursuing, NASA pushed the economic possibilities of the space station, particularly science and manufacturing prospects in low gravity.

What reason did Reagan have, though, to believe NASA about its claims for a space station when its claims concerning the space shuttle had all but proven untrue? Unlike the space shuttle decision, there was no inertial reason for beginning a space station project; humans were continuing to fly into space in the space shuttle and the Cold War seemed to be coming to an end. Reagan had initially pledged to cut the budget as well- giving approval to a project with a large price tag certainly did not fit in well with that pledge.[19] Unlike the space shuttle decision, getting Reagan to approve the space station is clearly an example of NASA's ability to persuade. With no reason to believe

NASA's estimates and project prospects aside from its word, NASA pushed (with support from the aerospace industry as well) to get the space station project started. Not only would it continue to give its skilled workforce a highly technical project to work on, it would also continue generating contracts for big aerospace companies, and give the space shuttle something to do besides releasing satellites and conducting science experiments.

Post-Challenger

The loss of the shuttle *Challenger* was certainly a blow to NASA's prestige if not its power. The question, rather, focuses on the aftermath and increased funding for NASA so that it could construct a replacement orbiter. According to Wildavsky's fair share thesis, the amount of funding for an agency or department should have nothing to do with its performance good or bad, rather its associated with an expectation gathered over years of how much the agency should get.[20] Contrary to this hypothesis, though. NASA experienced an increase in their budget beginning in 1988 for a replacement orbiter.

But why build a replacement? Clearly, the shuttle had not lived up to the hype and expectations that NASA had set for it in the 1970s. The Department of Defense did not purchase the expected two orbiters and *Challenger* had shown the continued need for expendable launch vehicle options. But like the justification for the space station, the need for another orbiter quickly turns into a rather circular argument. The space station was needed to give the shuttle something to do and now another orbiter was needed to complete the space station that was already proving difficult to design and costly.

Determining what portion of the leverage used to wrangle funding for another orbiter was from the aerospace industry that wanted continued contracts worth hundreds of millions of dollars and what was from NASA proves rather difficult. NASA's standing was indeed diminished not only by *Challenger* and the dim prospects for the shuttle's operations but also by its not being fully forthcoming in the immediate aftermath of *Challenger*. What can be known for sure, however, is that it was no less than an exercise of power that increased NASA's funding for the purposes of constructing the orbiter *Endeavour*.

George Bush's Space Exploration Initiative

In the late 1980s, NASA was just beginning to recover from the loss of *Columbia*, send shuttles back into orbit and begin to see plans for a space station partially finalized. With the election of George Bush to the presidency, NASA would also see a new program which had the possibility of reinvigorating the program: the Space Exploration Initiative (SEI). Announced by the first President Bush on July 20, 1989 on the steps of the Smithsonian Air and Space Museum, the plan called for building of the new space station, a return to the moon, and eventually voyages to Mars.[21] A quick 90-day study of the plan by NASA into the resources it would require showed the program to be a commitment of at least $500 billion; much more than the Congress, the President, or the country would allow to be spent.[22]

While the initiation of a new program would be expected to infuse NASA with a new sense of mission and purpose, the SEI proposal did nothing of the sort. In fact, Kay claims the proposal "seemed to hit the country with a resounding thud."[23] With NASA's history of forming project proposals in an economically favorable light, the price tag of

half a trillion dollars seems to be quite out of character. Yet in light of the *Challenger* disaster which had the potential of ending the space shuttle program altogether, NASA was not quite ready to give up on the space shuttles.

Some analysts have claimed that NASA priced the SEI at such a high level on purpose claiming that, "Having just won a reprieve in a bread-and-butter program [the space shuttle], NASA may well have viewed SEI as a threat to business as usual, just as normalcy was being reestablished."[24] By setting the price so high, NASA knew that the program would never be supported and it would not have to end the space shuttle program any time soon; because of the 90-day study, the Congress and other supports became quite "hostile" to SEI and the program eventually died out.[25]

If the explanation that NASA intentionally killed SEI is accepted, then it is possible to see NASA's use of power. In this case, the agency used its power of information to create a plan with a price tag so astronomical that it knew the plan would never be implemented. Thus NASA's power can be interpreted as having increased over the time period between *Challenger* and the end of the decade allowing it to end a presidential initiative that would have given it an influx of new money but would have put a stop to NASA's signature program, the space shuttle.

The Late 1990s

With no outright event to demonstrate NASA's usage of power in the second half of the 1990s, the inference of power is completely subjective. There was no big new program yet there were no big new disasters either. With popular culture bringing space back to the forefront and the popular Mars rover beaming back spectacular images, NASA saw its presence in the public sphere rise through the late 1990s. As reported by

Launius, beginning in the mid-1990s, the public's ratings of the job being done by NASA rose, from approximately 36% of the public approving of NASA's performance in 1990 to a high of approximately 55% in 1996.[26]

Whether public opinion directly influences and changes political support for a program is a question discussed previously, but suffice it to say here that the connection is not clear at all. In fact, during this time period, NASA's budget rose slightly and then leveled off, if not declined. Certainly, the fact that no major disaster detracted from NASA's performance influenced some perception of the agency that it was doing better in the public. But does this feeling translate to the political environment in which NASA has to operate? The evidence is less clear. With no huge spike in NASA's budget, which if you take Greenberg's assertion that the politics of science is played out in money, one could assume that business as usual and program inertia took over through this time period. A sense of complacency took over, with the agency and the rest of the government content with the progress and pace. The International Space Station was looking to be up in orbit shortly and the number of space shuttle missions plateaued at seven or eight missions a year.

But years of reliable performance can also serve to increase an agency or department's reputation as a reliable provider of services. Nevertheless, with no outright action to pinpoint and identify as an example of NASA's usage of its power, it is difficult to say that it even built up power through the rather reliable '90s.

Post-Columbia

Unlike the aftermath of *Challenger*, NASA proactively communicated with the press and the public as to the status of the investigation. The accident, which some have

argued could have been prevented, did result, though, in a different, yet similar operating atmosphere for NASA. In 1986 and 1987, NASA argued for, and got, increased funding for the purposes of building a replacement orbiter. In 2003 and 2004, NASA got not just a new orbiter but a brand new human spaceflight program. The question thus becomes that in the face of tragedy and failure, what is the impetus to give a supposedly declining organization more money and a new program to undertake?

Since this idea has already been explored in chapter two, the focus should be on NASA's usage of power in the aftermath of *Columbia.* Like *Challenger,* the agency was badly damaged and highly criticized for its culture, performance, and actions leading up to the accident. But for all its pitfalls, NASA was able to push for a new program. While the accident brought home the fact to NASA that they needed to come up with a replacement for the shuttle, election year politics also come into play in the decision to approve Constellation. Up for reelection in 2004 with two wars, President George W. Bush, announced his Vision for Space Exploration in January 2004, only ten months prior to the November election. Yet some have questioned and even doubted Bush's confidence in the program. As governor of Texas, he never visited the Johnson Space Center, home of the manned program and mission control. Further, since announcing the program, he has not made many efforts to support it and increase funding. In fact, most of the funds for Constellation come from the savings that will be acquired in retiring the space shuttle.

Columbia vividly drove home the point that the shuttle needed to be replaced. Seeing an opportunity to push a multi-billion dollar program that would provide jobs in major election states like Texas, Florida, and Alabama, whether NASA's power actually

influenced Bush's decision or the power of politics did is the question. With NASA's power clearly diminished by *Columbia*, one has to suspect that it was election year ploys more than NASA power that played a role in the decision.

Tracing Power Over Time

So how does any of this relate to being able to trace NASA's power over time to provide a useful comparison to the other indicators? From this analysis, it is apparent that in the least, NASA's power has risen and fallen over time. In figure 4-1, I have plotted my summary of NASA's power using a scale of one to ten with one being the least power and ten being the most power. Taking from the analysis presented in this chapter and chapter three, I believe it can safely be surmised that even if the numbers are different, that the pattern of NASA's power is similar to what appears in figure 4-2.

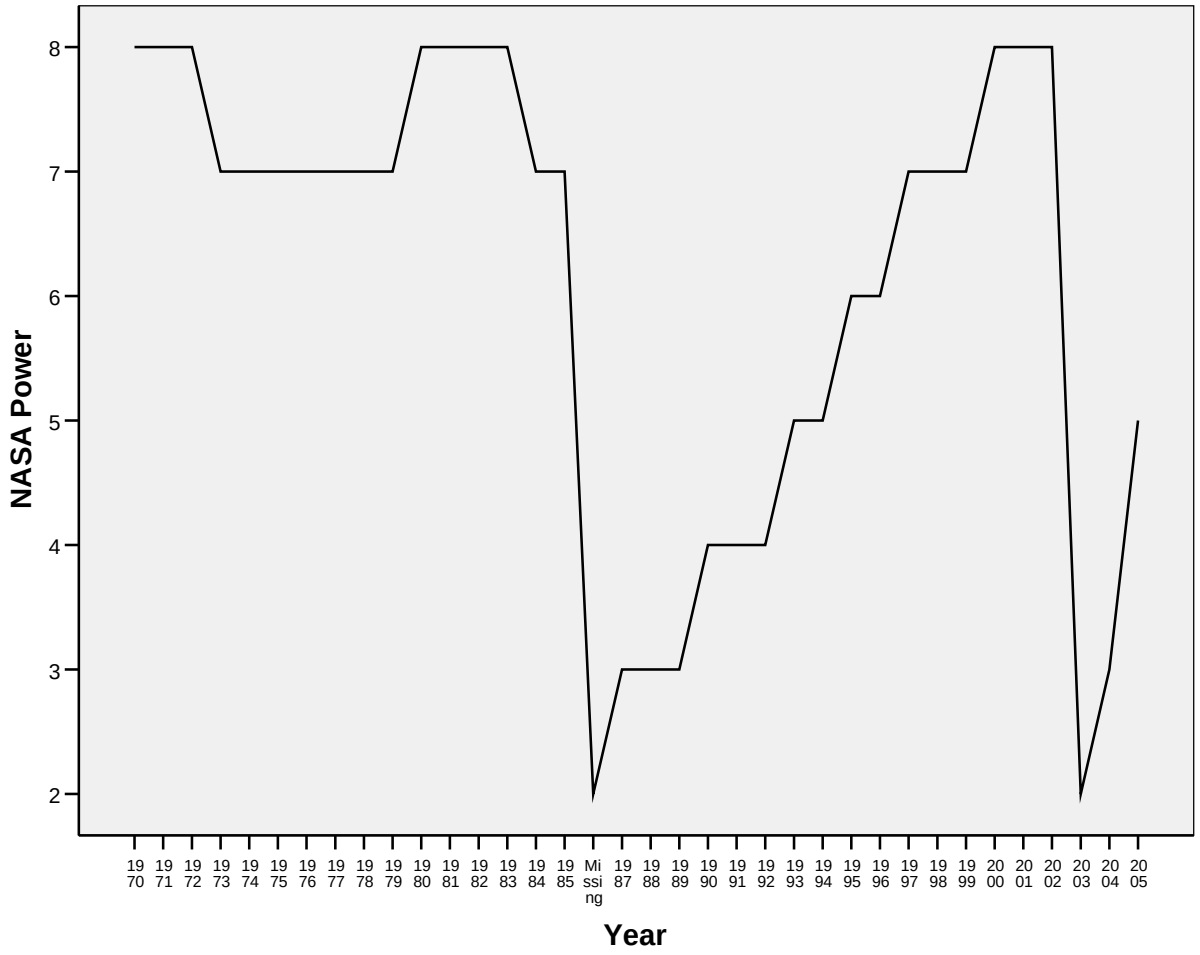

Figure 0-2: NASA's Power Over Time

The usefulness of the data being presented in this manner is that this line chart can be placed onto line charts depicting NASA's budget and performance over the years, as has been done in figure 4-3. In order to gauge performance, in this chart, I used the number of GAO reports but inverted it. In other words, if NASA had five reports written about it in one year and ten in the next that would mean that their performance had worsened. If those numbers were placed on the chart as they are, however, it would

appear as if their performance had actually improved. By inverting the numbers so that they appear as -5 and -10, a line graph would show the decrease in performance.

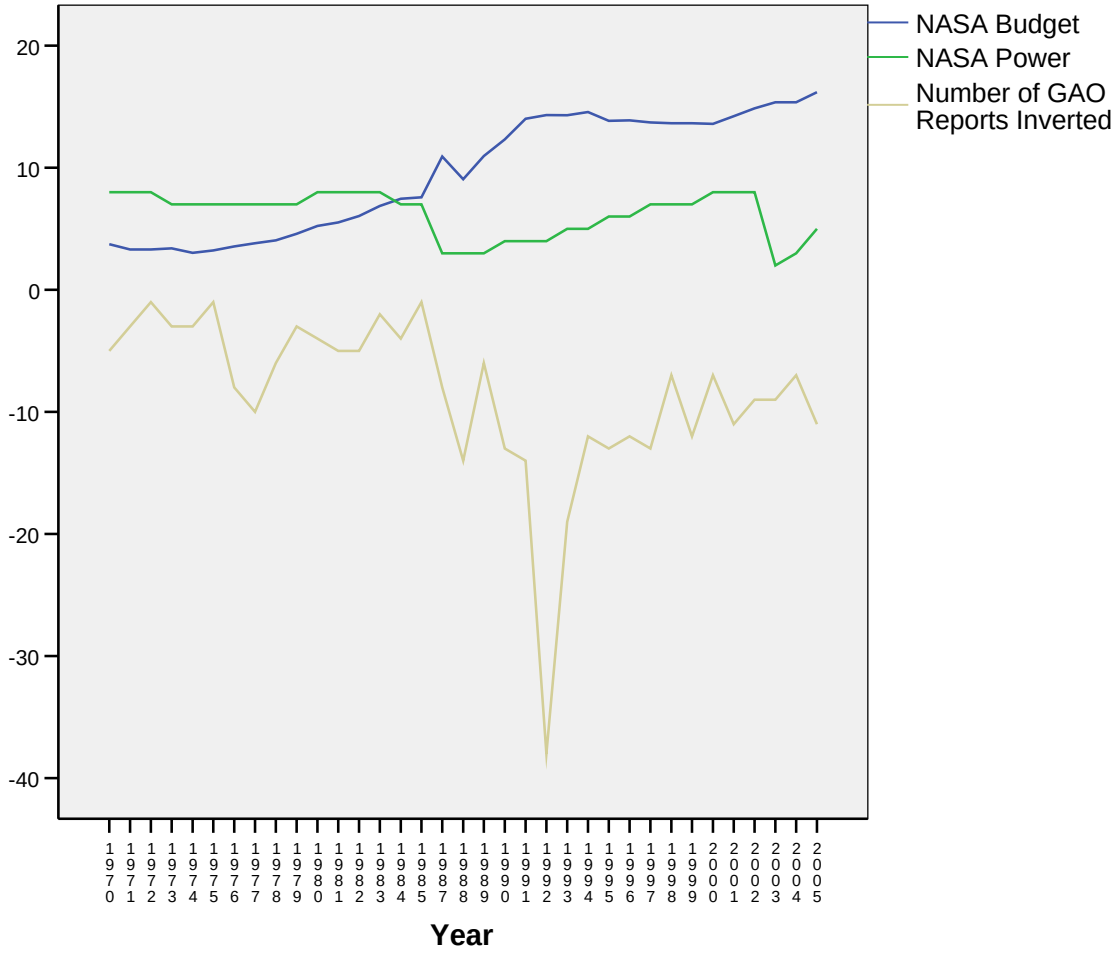

Figure 0-3: NASA Budget, Performance, and Power

To continue the analysis from this chart, it would be best to break it into different time periods from which to analyze the relationship between budgets, performance, and power. From 1970 to about 1985, while performance buoyed up and down, it remained relatively stable along with the budget and power. In fact, through 1985, NASA's power remained relatively unchanged and the budget increased. The various numbers of GAO reports which reflect NASA's performance at the time are attributable to reports on the

status of the space transportation system, or the space shuttle. Between 1986 and 1990, however, two contradictory things are apparent. One, according to the GAD model, we would expect the budget to decrease before decrease performance. The budget, though, continued to rise peaking in 1987 with the funding to build the *Challenger* replacement. Second, performance decreases only after power does and again, according to our model, we should see power decrease only after performance does.

Yet there is a very good methodological reason to explain these contradictory conclusions. While it is assumed that performance affects power and not the other way around, the measures of power and performance do not accurately reflect the reality of the situation. The subjective measure of power immediately reflects circumstances of any given year (for example, 1986), but the measure being used for performance, that is, the number of GAO reports, has an inherent time lag in it. It takes time to write reports; the immediacy of performance is not accurately shown, then, by this measure. While other indicators of performance could be used in the above graph, none of the other performance variables used in this analysis have shown significance. We become stuck between a rock and a hard place, then, with respect to the contradictory conclusions.

Nevertheless, figure 4-3 still allows us to draw some significant conclusions, particularly in the 1990s. As NASA's power steadily rose, so did their budget. The agency performance also improved during the '90s, going from a high of 38 reports in 1992 to a low of seven in 1998, a level which had not been seen for almost a decade. Without better real-time indicators of performance, however, it would not be appropriate to draw more significant conclusions beyond speculating about the pattern of data.

Hypothesis Four: Power and Budgets

Without quantitative measures of power, it is difficult to quantitatively analyze the connection between power and budgets. As such, I will instead examine the relationship between NASA budget and the rough measurement of power provided in the above charts. Because of the tentative nature of the power measurement, however, we must regard any results as potentially spurious.

In a correlation analysis presented in table A-19, a negative relationship is found between NASA's power and its budget with the relationship becoming strongest and most significant when a five year time lag is included (at five years, Pearson=-0.571, sig.=0.001). While the method of measuring power can not be seen as very reliable, the results suggest that power does not have a strong positive influence on budgets.

Completing the cycle, we can include the rough estimation of power in a linear regression with GDP to examine the effect these two variables combined have on budgets; table A-20 presents these results. Compared to the effect that only GDP has on predicting NASA's budget, our predictive power increases by as much as 10%. Including a time effect of three years, power and GDP work together to help explain up to 96% of NASA's budget compared to 86.1% using just GDP. Thus while power alone does not have a strong effect on NASA's budget, power in conjunction with GDP, as predicted by the model, does.

Conclusion

While leaving a complete discussion of results to the next chapter, the major finding in this analysis is that something more than simply economic performance is involved in determining the yearly NASA budget. Further, there does seem to be some

sort of relationship between the NASA budget and the human spaceflight program with no major correlations being found within the scientific program.

Measures of power leave something to be desired, as quantitative indicators of how much power one holds, has, or uses are elusive if not impossible to develop. Yet, we can clearly see that NASA's power has risen and fallen between 1970-2005 and can be somewhat projected onto a line graph to match with indicators of the other categories.

Finally, we do see some interaction of power and GDP in the influence of NASA's budget, particularly after some period of time has elapsed. We will examine the significance of this finding in the next chapter.

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[3] Historical Budget Tables, OMB
[4] From *Exploring the Unknown Volume I*. ed. John M. Logsdon, Washington, D.C.: NASA, 1995: 547.
[5] For Cameron, Whetten, and Kim, performance is deduced from the twelve dysfunctional consequences of decline. They take items such as centralization and long term planning to be indicators of performance but their indicators ignore the characteristics of governmental organization that often require highly centralized planning, a resistance to change, and fragmented pluralism. See: Cameron, Kim S., Whetten, David A., & Kim, Myung U. (1987). Organizational dysfunctions of decline. *Academy of Management Journal*. *30*: 128.
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CHAPTER 5: DISCUSSION OF RESULTS AND CONCLUSION

Nearly forty years after the US first went to the moon, what has happened to the agency that put them there? From declarations of an agency in decline to accidents that might prove the claim to more funding and new programs, what is to explain the rise and fall of NASA's outputs through the years? In chapter one, the claim that a new conception of decline in government was needed was put forward and in the previous chapters I hope to have proven that. Here, I will discuss the meaning of the data in chapter four and its effects on the government agency decline model. I will then examine prospects for further research and conclude the discussion.

Discussion of Results

In chapter four, statistical tests and their results were presented to test the government agency decline model. The first conclusion that can be reached from that data is that overall national economic performance does greatly influence budget levels. Interestingly enough, and pursuant to the GAD model, the effect that GDP has on NASA's budget is less than the effect that it has on the US budget, the discretionary budget or the budgets of the NSF and NIH. As a result, there seems to be something else influencing NASA's budget. This conclusion is contrary to Wildavsky's idea of "fair share" in that there is not simply a consensus approach to agency budgeting at the federal level, but other considerations, predominantly economic, are important. To be fair to Wildavsky, however, no large scale study examining legislators' attitudes towards agency budgeting. It is quite possible that this idea of fair share is connected to the economy such that legislators' attitudes could be included as an intervening variable.

The next hypothesis that was tested was that an agency's budget affects its performance. A slight negative correlation was found between NASA's budget and the total number of launches per year, suggesting that some time is needed for the budget changes to affect the number of launches. Reflecting the proportion of the entire NASA budget that manned spaceflight encompasses, there were stronger relationships among budget and performance factors measuring performance of the human spaceflight program.

What is also apparent within this concept is the delineation of very public performance indicators and public indicators relegated to the governmental sphere only. Launches of satellites and shuttles are quite visible to the general public while indicators of performance such as the number and nature of GAO reports, while public, is not widely paid attention to outside of the government. Which of the performance indicators to use, public or semi-public, is a problem that largely depends on the next aspect of the GAD model, specifically whether power is public or governmental in nature.

The next aspect of the model to be tested was that performance affects power. The qualitative analysis clearly shows that NASA's power has been flexible, certain points in time can be identified where NASA has clearly used its power demonstrating that it has it. Using a rudimentary measure of power based on this analysis, a negative correlation was found between power and NASA's budget suggesting that as power went up, the agency's budget fell. While acknowledging that a better measure of power is needed since the results could be spurious, the result is contrary to what was expected.

Finally, the last hypothesis examined was that an agency's power affects their budget and that overall economic performance is also a factor in that determination.

Even though power seemed to have a negative influence on NASA's budget, a regression analysis with power and GDP as independent variables and NASA budget as the dependent demonstrated that the relationship is quite significant and highly explanatory. In the same year and including time effects of one to five years, power and GDP working together help to explain NASA's budget more than GDP alone with the relationship becoming stronger and more significant in years three and four.

Thus far, the analysis has garnered mixed results for the GAD model but another important aspect is that there should be a time lag between all of these indicators; that there should be some period of time between when economic performance affects budget, another period of time between a budget's effect on performance, and so on. These time lag effects were also tested for. GDP had the strongest effect on budget in the same year for almost all of the cases examined. The only exception to that were the cases of the NSF and NIH, signaling that their budgets increased no matter the GDP. This also confirms their choices as appropriate baselines from which to examine the budget of NASA. That other scientific agencies experienced constant and consistent increases in their budget and NASA did not effectively means that something else was affecting the budget of NASA.

Similar to the finding that the strongest relationship between budget and performance was to be found among performance indicators relating to human spaceflight, time lag effects were also found between NASA budget and human spaceflight performance. While the relationships are significant, the strength of them does decrease over time again showing that the strongest relationship occurs in the same year. When examining the science portion of NASA's budget and science missions, a

relationship was found with a one-year time lag. On the verge of significance (significance= .050), this signals that among science missions we should expect some sort of time lag as it takes years of planning and development for science missions to actually occur.

Although power on its own was shown to have the opposite effect than what was predicted, when the variable is used in regression analyses, it enhances the relationship particularly after three years. While this is the effect that was predicted, that the previous hypotheses do not have a significant time effect leads to the question of whether the results are spurious either for power and GDP's effect on budget or for hypotheses one and two or time effects only need to be included in the model for the power to budget stage. This is a question that cannot be resolved here; the measure of power being utilized might be the problem which of course would have to wait to be resolved until a more reliable indicator of power can be discovered. Logically, however, a time effect would most likely be needed between budgets and performance; money does not flow directly into projects but must go through mission directorates and be approved for specific purposes. While there is a slight suggestion that the time lag is present, more research is needed.

This brings the discussion to a question of what it means for the GAD model. There is some data reinforcing the model. Some other piece of data does need to be included so as to enhance the relationship between economic performance and NASA's budget. Human spaceflight performance is indeed helped by the budget reflecting the focus on human spaceflight by the agency, the rest of the government, and the public. What clearly needs to be reconsidered within the model is the use of a time lag.

Particularly within the relationships between economic performance and budgets and budgets and performance, the primary effect declines over time. There still may be some use for it, however, when examining the other end of the model and the effect that power and GDP jointly have on a budget.

Limitations of GAD and Ideas for Further Research

The application of the GAD model to NASA is all well and good, but what about its applications to other agencies? In the data analysis, the budgets of the National Science Foundation and the National Institutes of Health all rose over time, regardless of the GDP. This would suggest that no matter their performance or the relative amount of power they held, their budget would still rise; thus, GAD may not be applicable to them. It seems that what NASA has or lacks (relatively speaking) compared to the NSF and NIH is the duty to operate in a highly politicized environment. As much as one would like to, in government, it is quite impossible to forget about the politics of the situation and the politics of the environment in which you work. A strong argument could be made that the NSF and NIH make relatively apolitical contributions to people's lives. NASA, on the other hand, was created essentially to carry out a political task and it continues to operate as such.

Downs's work on the bureaucracy focuses closely on the initial growth stages of an agency; this is noticeably absent from the model. GAD serves to extend the Downs analysis and as such can only be applied to agencies that are beyond these initial stages. In this case, I have joined NASA eleven years into its existence. Arguably, this time frame could be difference dependent on which agency the model is being applied to.

The benefit of the GAD model is that it includes as explanatory factors all those variables, which operate in political environments: power, overall economic performance, budgets, and performance. Because of this, the agencies and departments that it may apply best to are agencies created out of or for political purposes. The Tennessee Valley Authority and the Department of Homeland Security are past and present examples of this. GAD may not adequately describe agencies that are created to fulfill specific apolitical or nominally political purposes such as the Internal Revenue Service, the Social Security Administration or the Department of Health and Human Services.

Related to this, I explicitly call GAD a model and not a theory; I do not believe it would be appropriate or possible to develop specific indicators of particularly performance that could be used across a variety of government agencies. Depending on the agency and the nature of its operations, performance standards need to be created and tailored to the specific agency. A broad outline of a theory could be designed to say that economic factors affect a agency's (political in nature) budget, which in turn affects performance and then affects power which then helps to explain that agency's budget. Including all of these explanatory factors is a net positive gain over prior descriptions of government decline and agency growth.

Clearly, more research is needed before the conclusion that the GAD model accurately describes political agencies is reached. Further research is varied and could include applications of the model to other agencies, perhaps the Department of Homeland Security or the NIH as a control. Development of more accurate indicators of power would also help to enhance the analysis.

Conclusion

The government agency decline model is a good first step in examining what affects an agency's outputs and inputs and in turn, its operations. By including many (if not all) of the political factors into a single model, it can eventually help to predict budget levels and help performance by knowing the effects that funding has on it. Clearly, further refining is needed, but good progress has been made here in showing the explanatory power of the model.

What must have gone through the minds of the twelve men who walked on the moon as they prepared to say goodbye to it? Knowing that nothing in their lives would probably be like the moment they were experiencing right then, the collective minds of NASA were probably wondering the same thing. Nothing is ever going to be like the moon, for the moon walkers or for NASA. What has probably spurned so much discussion of whether NASA is or was in a decline or not was the fact that nothing they could do besides landing a human on Mars was ever going to be anything like landing humans on the moon.

Perhaps what is needed for NASA is the realization that while nothing will ever be like what has been done before, the opportunity for still greater things lies ahead. Though NASA operates within a politically charged environment that affects nearly everything that it does or tries to do, understanding the mechanism through which politics operates can help them and us understand why it is so difficult to get funding for such big ideas. For other agencies that must operate within similar limitations and the scholars who study them, having a model that can explain the fluxes agencies experience is helpful. Decline in government is not really decline unless the agency disappears. And since most agencies can be assured of their continued existence, I do not believe that the

idea of decline as applied to individual agencies is useful. If an agency is declining, most times, it is because of nothing that they have done or can control; it has to be related back to the environment at large and in this case that environment is national politics.

Memories of the moon landing may be fading now, but expectations of what NASA can do and will do have the prospect of rising; a declining agency would not be able to claim that. The challenge is in convincing the public and the rest of the government (through the mechanism of acquiring power) that greater things can and will be done and are happening now. Tom Hanks as astronaut Jim Lovell in the movie "Apollo 13" says, "Imagine if Christopher Columbus came back from the New World and no one returned in his footsteps." Even though the moon landings of the 1960s and 1970s are over, there is always continued exploration, no matter the form, to look forward to.

APPENDIX A: DATA TABLES

Table 0-1: Correlations of GDP to Budget Variables

		GDP
Total US Budget	Pearson Correlation Significance	.994 .000
NASA Budget	Pearson Correlation Significance	.937 .000
NASA Manned Budget	Pearson Correlation Significance	.941 .000
NASA Science Budget	Pearson Correlation Significance	.805 .000
Discretionary Budget	Pearson Correlation Significance	.971 .000
NSF Budget	Pearson Correlation Significance	.985 .000
NIH Budget	Pearson Correlation Significance	.962 .000

Table 0-2: Correlations of GDP to Budget Variables with Time Effects

		One Year	Two Years	Three Years	Four Years	Five Years
NASA Budget	Pearson Sig.	.936 .000	.933 .000	.928 .000	.921 .000	.916 .000
Total US Budget	Pearson Sig.	.994 .000	.993 .000	.993 .000	.993 .000	.993 .000
Discretionary Budget	Pearson Sig.	.969 .000	.966 .000	.965 .000	.964 .000	.962 .000
NSF Budget	Pearson Sig.	.985 .000	.985 .000	.987 .000	.989 .000	.990 .000
NIH Budget	Pearson Sig.	.961 .000	.963 .000	.965 .000	.967 .000	.966 .000

Table 0-3: Regression Analysis of GDP to Budget

Dependent Variable	B Constant B GDP	Significance	R-Square
Total US Budget	65.812 .192	.006 .000	.989
NASA Budget	2.412 .001	.000 .000	.877
Human NASA Budget	2.120 .001	.000 .000	.886
Science NASA Budget	.292 .0000914	.000 .000	.648
Discretionary	87.961 .064	.000 .000	.944
NSF	-.174 .000	.030 .000	.971
NIH	-.003 .00000229	.000 .000	.925

Table 0-4: Regression Analysis of GDP to Total US Budget with Time Effects

Time Lag of Budget	B Constant B GDP	Significance	R- Square
One Year	92.927 .199	.000 .000	.987
Two Years	125.538 .206	.000 .000	.986
Three Years	163.620 .211	.000 .000	.985
Four Years	204.864 .217	.000 .000	.986
Five Years	247.377 .222	.000 .000	.986

Table 0-5: Regression Analysis of GDP to NASA Budget with Time Effects

Time Lag of Budget	B Constant B GDP	Significance	R- Square
One Year	2.537 .001	.000 .000	.876
Two Years	2.757 .001	.000 .000	.870
Three Years	3.046 .001	.000 .000	.861
Four Years	3.368 .001	.000 .000	.849
Five Years	3.744 .002	.000 .000	.840

Table 0-6: Regression Analysis of GDP to NSF Budget with Time Effects

Time Lag of Budget	B Constant B GDP	Significance	R- Square
One Year	-.150 .000	.072 .000	.969
Two Years	-.123 .000	-.136 .000	.971
Three Years	-.091 .000	.240 .000	.975
Four Years	-.054 .000	.454 .000	.978
Five Years	-.022 .001	.759 .000	.980

Table 0-7: Regression Analysis of GDP to NIH Budget with Time Effects

Time Lag of Budget	B Constant B GDP	Significance	R- Square
One Year	-.003 2.40 E-006	.000 .000	.924
Two Years	-.003 2.53 E-006	.000 .000	.927
Three Years	-.003 2.65 E-006	.000 .000	.932
Four Years	-.003 2.78 E-006	.000 .000	.934
Five Years	-.003 2.92 E-006	.001 .000	.934

Table 0-8: Correlations of NASA Budget to Performance Panel

		NASA Budget
Total Launches	Pearson Correlation Significance	**-.343** **.040**
Number of Successful Launches	Pearson Correlation Significance	-.280 .098
Success Rate in Total Launches	Pearson Correlation Significance	.313 .063
Number of Science Missions	Pearson Correlation Significance	.275 .166
Number of Human Flights	Pearson Correlation Significance	**.625** **.000**
Percent of On Time Human Flights	Pearson Correlation Significance	**.453** **.006**
Number of GAO Reports	Pearson Correlation Significance	**.602** **.000**

*Significant results in bold

Table 0-9: Correlations of Budget to Performance Panel with Time Effects

		One Year	Two Years	Three Years	Four Years	Five Years
Total Launches	Pearson Sig.	-.207 .240	-.134 .456	-.140 .446	-.119 .525	-.091 .631
Success Rate	Pearson Sig.	.323 .063	.316 .074	.307 .087	.308 .092	.289 .122
Science Missions	Pearson Sig.	.271 .180	.246 .236	.248 .242	.276 .202	.308 .164
Human Missions	Pearson Sig.	**.591** **.000**	**.550** **.001**	**.490** **.004**	**.434** **.015**	.340 .066
On Time Flights	Pearson Sig.	**.374** **.029**	**.344** **.050**	.315 .080	.299 .103	.219 .245
GAO Reports	Pearson Sig.	**.524** **.001**	**.480** **.005**	**.406** **.021**	**.412** **.021**	.298 .109

*Significant results in bold

Table 0-10: Correlations of Manned Budget to Human Spaceflight Performance with Time Effects

		Same Year	One Year	Two Years	Three Years	Four Years	Five Years
Human Flights	Pearson Sig.	**.616** **.000**	**.582** **.000**	**.541** **.001**	**.486** **.005**	**.435** **.014**	.342 .064
Percent On Time	Pearson Sig.	**.449** **.006**	**.374** **.029**	.341 .052	.310 .084	.293 .110	.215 .253

*Significant results in bold

Table 0-11: Correlations of Science Budget to Science Mission Performance with Time Effects

		Same Year	One Year	Two Years	Three Years	Four Years	Five Years
Total Flights	Pearson	-.320	-.149	-.042	-.080	-.075	-.127
	Sig.	.057	.400	.818	.663	.689	.503
Success Rate	Pearson	.213	.297	.334	.325	.279	.238
	Sig.	.212	.088	.057	.070	.128	.205
Science Missions	Pearson	.240	**.389**	.339	.342	.302	.332
	Sig.	.229	**.050**	.097	.102	.161	.131

*Significant results in bold

Table 0-12: Regression Analysis of NASA Budget to Total Launches with Time Effects

Time	B Constant B NASA Budget	Significance	R-Square
Same Year	35.951 -.756	.000 .040	.118
One Year	31.489 -.422	.000 .240	.043
Two Year	29.589 -.270	.000 .456	.018
Three Year	29.676 -.288	.000 .446	.020
Four Year	29.211 -.251	.000 .525	.014
Five Year	28.318 -.193	.000 .631	.008

Table 0-13: Regression Analysis of NASA Budget to Total Human Flights with Time Effects

Time	B Constant B NASA Budget	Significance	R-Square
Same Year	-.635 .401	.489 .000	.390
One Year	-.183 .388	.849 .000	.349
Two Year	.201 .365	.841 .001	.302
Three Year	.704 .327	.504 .004	.240
Four Year	1.193 .290	.276 .015	.189
Five Year	1.904 .226	.100 .066	.115

Table 0-14: Regression Analysis of NASA Budget to Percent On Time Human Flights with Time Effects

Time	B Constant B NASA Budget	Significance	R-Square
Same Year	-2.372 3.741	.860 .006	.205
One Year	5.918 3.197	.682 .029	.140
Two Year	9.377 2.996	.527 .050	.119
Three Year	12.977 2.777	.394 .080	.099
Four Year	15.638 2.664	.313 .103	.089
Five Year	23.236 1.965	.149 .245	.048

Table 0-15: Regression Analysis of NASA Budget to Number of GAO Reports with Time Effects

Time	B Constant B NASA Budget	Significance	R-Square
Same Year	.011 .872	.996 .000	.363
One Year	1.466 .785	.528 .001	.275
Two Year	2.368 .726	.238 .005	.230
Three Year	3.577 .624	.165 .021	.165
Four Year	3.734 .641	.152 .021	.170
Five Year	5.608 .464	.043 .109	.089

Table 0-16: Regression Analysis of Human Spaceflight Budget to Number of Human Flights with Time Effects

Time	B Constant B Human Spaceflight Budget	Significance	R-Square
Same Year			
One Year	-.107 .415	.912 .000	.339
Two Year	.269 .390	.789 .001	.293
Three Year	.738 .354	.484 .005	.236
Four Year	1.192 .318	.276 .014	.189
Five Year	1.892 .249	.101 .064	.117

Table 0-17: Regression Analysis of Human Spaceflight Budget to Percent of On Time Human Flights with Time Effects

Time	B Constant B Human Spaceflight Budget	Significance	R-Square
Same Year			
One Year	6.081 3.472	.672 .029	.140
Two Year	9.794 3.225	.508 .052	.116
Three Year	13.372 2.990	.379 .084	.096
Four Year	16.105 2.860	.299 .110	.086
Five Year	23.501 2.120	.145 .253	.046

Table 0-18: Regression Analysis of Science Budget to Number of Science Missions with Time Effects

Time	B Constant B Science Budget	Significance	R-Square
Same Year	2.458 .956	.002 .229	.057
One Year	2.033 1.518	.007 .050	.151
Two Year	2.239 1.333	.005 .097	.115
Three Year	2.206 1.379	.008 .102	.117
Four Year	2.376 1.237	.008 .161	.091
Five Year	2.278 1.383	.012 .131	.110

Table 0-19: Correlations Between NASA Power and NASA Budget

Length of Time Effect	Pearson Correlation	Significance
None- Same Year	-0.464	0.004
One Year	-0.499	0.002
Two Years	-0.466	0.005
Three Years	-0.456	0.008
Four Years	-0.515	0.003
Five Years	-0.571	0.001

Table 0-20: Regression Analysis: GDP and Power's Effect on NASA Budget

Length of Time Effect	B Constant B Power B GDP	Significance	R-Square
None- Same Year	5.178 -0.386 0.001	0.000 0.010 0.000	0.900
One Year	6.116 -0.498 0.001	0.000 0.001 0.000	0.915
Two Years	6.767 -0.569 0.001	0.000 0.000 0.000	0.922
Three Years	8.502 -0.802 0.001	0.000 0.000 0.000	0.960
Four Years	8.883 -0.790 0.001	0.000 0.000 0.000	0.946
Five Years	9.128 -0.748 0.001	0.000 0.000 0.000	0.927

APPENDIX B: ANALYSIS OF GAO REPORTS

	Costs	Manage-ment	ISS	STS	Contracts	Finances	Science	Transpor-tation	Informat-ion Technolo-	National Security	Total
1970		2									2
1971					2	1					3
1972				1							1
1973				1	1	1					3
1974				1		1	1				3
1975		1									1
1976		5		1			2				8
1977		1		2		3	4				10
1978		1		2	1	2					6
1979		1			1	1					3
1980		1			1	1	1				4
1981				3		1	1				5
1982		1		2		2					5
1983				1	1						2
1984		2				2					4
1985						1					1
1986				2							2
1987			1	1	1	2	1		2		8
1988		1		5		5	1	1	1		14
1989				1		1	3		1		6
1990		2		1	1	2	1	1	4	1	13
1991		2	2	2	1	1	3	1	2		14
1992	1	2	7	3	6	6	10	3			38
1993		3	2	4	3		4	2	1		19
1994			3	2	5		1			1	12
1995		3	1	2		1	4			2	13
1996		3	1	1	1	1	2	1	2		12
1997		3	4	1	2	1	1			1	13
1998		1	2		2		1			1	7
1999		2	5		2			2	1		12
2000		1	3	2					1		7
2001		4	3	1		1		2			11
2002	1	3	1	2	1	1					9
2003		2	1	1		5					9
2004	2			1		1	3				7
2005	1	1		3	1	4	1				11

APPENDIX C: VARIABLES AND SOURCES

Indicator/Variable	Format	Source
Budget		
GDP		OMB Historical Data Tables http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf
US Budget	Billions of Dollars	OMB Historical Data Tables http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf
Discretionary Budget	Billions of Dollars	OMB Historical Data Tables http://www.whitehouse.gov/omb/budget/fy2008/pdf/hist.pdf
NASA Budget	Billions of Dollars	Aeronautics and Space Report of the President, Fiscal Year 2005
Human Spaceflight Budget	Billions of Dollars	Aeronautics and Space Report of the President, Fiscal Year 2005
Science Budget	Billions of Dollars	Aeronautics and Space Report of the President, Fiscal Year 2005
NSF Budget	Billions of Dollars	OMB Historical Data Tables
NIH Budget	Billions of Dollars	The NIH Almanac http://www.nih.gov/about/almanac/index.html
Performance		
Total Launches	Number of Launches per Year	Aeronautics and Space Report of the President, Fiscal Year 2005
Science Missions	Number of Science Missions Launched per Year	http://science.hq.nasa.gov/
Number of Successful Launches	Number of Successful Launches per Year	Aeronautics and Space Report of the President, Fiscal Year 2005
Number of Failed Launches	Number of Failed Launches per Year	Aeronautics and Space Report of the President, Fiscal Year 2005
Success Rate	Success Rate of Launches per Year	Calculated from data in the Aeronautics and Space Report of the President, Fiscal Year 2005
Failure Rate	Failure Rate of Launches per Year	Calculated from data in the Aeronautics and Space Report of the President, Fiscal Year 2005
Number of Human	Number of	NASA Shuttle Mission Archives

Flights	Human Flights per Year	http://www.nasa.gov/mission_pages/shuttle/shuttlemissions/list_main.html
Total Delay Days	Total Days per Year Human Flights Delayed	Calculated from data in Shuttle Mission Archives
Number of Flights Delayed	Number of Human Flights per Year Delayed	Calculated from data in Shuttle Mission Archives
Average Delay in Days	Average Delay of Human Flights per Year	Calculated from data in Shuttle Mission Archives
Percent of Flights Delayed	Percent of Human Flights Experiencing a Delay per Year	Calculated from data in Shuttle Mission Archives
Percent of Flights Launched On Time	Percent of Human Flights Launched On Time per Year	Calculated from data in Shuttle Mission Archives
Number of GAO Reports	Number of GAO Reports Written Concerning NASA per Year	Calculated from a Search of GAO Reports Published Between 1970 and 2005

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